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

FORM 10-Q

(Mark One)

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

For the quarterly period ended September 30, 2019

OR

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

For the transition period from to

Commission File Number: 001-38052

TOCAGEN INC.

(Exact name of registrant as specified in its charter)

Delaware	**26 - 1243872**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification Number)**
4242 Campus Point Court, Suite 500, San Diego, CA	**92121**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code: (858) 412-8400

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, par value $0.001 per share	TOCA	The Nasdaq Global Select Market

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

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

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

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

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

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

As of November 1, 2019, the registrant had 23,897,771 shares of common stock, par value $0.001 per share, outstanding.

TOCAGEN INC.
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PART I - FINANCIAL INFORMATION

Item 1. Financial Statements.

TOCAGEN INC.
CONDENSED BALANCE SHEETS
(in thousands, except share and par value data)

	September 30, 2019 (unaudited)	December 31, 2018
ASSETS		
Current assets:		
Cash and cash equivalents	$ 25,580	$ 40,813
Marketable securities	29,762	55,273
Prepaid expenses and other current assets	4,201	1,662
Total current assets	59,543	97,748
Property and equipment, net	3,604	3,973
Operating lease right-of-use asset	7,597	—
Other assets	5	1,360
Total assets	$ 70,749	$ 103,081
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 2,293	$ 3,404
Accrued liabilities	11,601	13,094
Notes payable, current portion	27,843	—
Deferred license revenue	9	36
Total current liabilities	41,746	16,534
Operating lease liability, net of current portion	9,122	—
Notes payable, net of current portion	—	26,201
Deferred rent, net of current portion	—	2,201
Other long term liabilities	81	—
Total liabilities	50,949	44,936
Commitments and contingencies		
Stockholders' equity:		
Common stock, $0.001 par value; 200,000,000 shares authorized at September 30, 2019 and December 31, 2018; 23,897,711 and 23,000,151 shares issued and outstanding at September 30, 2019 and December 31, 2018, respectively	23	23
Additional paid-in capital	288,551	274,029
Accumulated deficit	(268,817)	(215,884)
Accumulated other comprehensive income (loss)	43	(23)
Total stockholders' equity	19,800	58,145
Total liabilities and stockholders' equity	$ 70,749	$ 103,081

See accompanying notes to these unaudited condensed financial statements.

TOCAGEN INC.
CONDENSED STATEMENTS OF OPERATIONS AND COMPREHENSIVE LOSS
(in thousands, except share and per share data)

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
	(unaudited)		(unaudited)	
License revenue	$ 9	$ 18,009	$ 27	$ 18,027
Operating expenses				
Research and development	13,295	12,262	37,703	35,461
General and administrative	3,837	4,320	13,133	9,311
Total operating expenses	17,132	16,582	50,836	44,772
(Loss) Income from operations	(17,123)	1,427	(50,809)	(26,745)
Other income (expense), net				
Interest income	361	441	1,367	1,087
Interest expense	(1,973)	(742)	(3,490)	(2,184)
Total other expense, net	(1,612)	(301)	(2,123)	(1,097)
(Loss) Income before income taxes	(18,735)	1,126	(52,932)	(27,842)
Income tax expense	—	(1,509)	(1)	(1,510)
Net loss	$ (18,735)	$ (383)	$ (52,933)	$ (29,352)
Other comprehensive loss:				
Net unrealized (loss) gain on investments	(13)	31	66	11
Comprehensive loss	$ (18,748)	$ (352)	$ (52,867)	$ (29,341)
Net loss per common share, basic and diluted	$ (0.78)	$ (0.02)	$ (2.25)	$ (1.47)
Weighted-average number of common shares outstanding, basic and diluted	23,897,243	19,951,262	23,540,222	19,926,662

See accompanying notes to these unaudited condensed financial statements.

TOCAGEN INC.
CONDENSED STATEMENTS OF CHANGES IN STOCKHOLDERS' EQUITY
(in thousands, except share data)
Unaudited

	For the Three Months ended September 30, 2019					
	Common Stock		Additional Paid-In Capital	Accumulated Deficit	Accumulated Other Comprehensive Income (Loss)	Total Stockholders' Equity
	Shares	Amount				
Balance at June 30, 2019	23,895,742	$ 23	$ 286,489	$ (250,082)	$ 56	$ 36,486
Exercise of stock options	434	—	—	—	—	—
Issuance of common stock, net of offering costs	1,535	—	9	—	—	9
Stock-based compensation	—	—	2,053	—	—	2,053
Other comprehensive loss	—	—	—	—	(13)	(13)
Net loss	—	—	—	(18,735)	—	(18,735)
Balance at September 30, 2019	23,897,711	$ 23	$ 288,551	$ (268,817)	$ 43	$ 19,800

	For the Nine Months ended September 30, 2019					
	Common Stock		Additional Paid-In Capital	Accumulated Deficit	Accumulated Other Comprehensive Income (Loss)	Total Stockholders' Equity
	Shares	Amount				
Balance at December 31, 2018	23,000,151	$ 23	$ 274,029	$ (215,884)	$ (23)	$ 58,145
Exercise of stock options	69,697	—	252	—	—	252
Issuance of common stock pursuant to employee stock purchase plan	67,774	—	298	—	—	298
Issuance of common stock, net of offering costs	760,089	—	7,575	—	—	7,575
Stock-based compensation	—	—	6,397	—	—	6,397
Other comprehensive income	—	—	—	—	66	66
Net loss	—	—	—	(52,933)	—	(52,933)
Balance at September 30, 2019	23,897,711	$ 23	$ 288,551	$ (268,817)	$ 43	$ 19,800

	For the Three Months ended September 30, 2018					
	Common Stock		Additional Paid-In Capital	Accumulated Deficit	Accumulated Other Comprehensive Income (Loss)	Total Stockholders' Equity
	Shares	Amount				
Balance at June 30, 2018	19,951,158	$ 20	$ 242,021	$ (195,898)	$ (54)	$ 46,089
Exercise of stock options	1,851	—	3	—	—	3
Stock-based compensation	—	—	1,927	—	—	1,927
Other comprehensive income	—	—	—	—	31	31
Net loss	—	—	—	(383)	—	(383)
Balance at September 30, 2018	19,953,009	$ 20	$ 243,951	$ (196,281)	$ (23)	$ 47,667

	For the Nine Months ended September 30, 2018					
	Common Stock		Additional Paid-In Capital	Accumulated Deficit	Accumulated Other Comprehensive Income (Loss)	Total Stockholders' Equity
	Shares	Amount				
Balance at December 31, 2017	19,882,551	$ 20	$ 238,025	$ (166,929)	$ (34)	$ 71,082
Exercise of stock options	35,093	—	37	—	—	37
Issuance of common stock pursuant to employee stock purchase plan	35,365	—	290	—	—	290
Stock-based compensation	—	—	5,120	—	—	5,120
Issuance of common stock warrants	—	—	479	—	—	479
Other comprehensive income	—	—	—	—	11	11
Net loss	—	—	—	(29,352)	—	(29,352)
Balance at September 30, 2018	19,953,009	$ 20	$ 243,951	$ (196,281)	$ (23)	$ 47,667

See accompanying notes to these unaudited condensed financial statements.

TOCAGEN INC.
CONDENSED STATEMENTS OF CASH FLOWS
(in thousands)

	Nine Months Ended September 30,	
	2019	**2018**
	(unaudited)	
OPERATING ACTIVITIES		
Net loss	$ (52,933)	$ (29,352)
Adjustments to reconcile net loss to net cash used in operating activities		
Stock-based compensation	6,397	5,120
Depreciation	657	421
Noncash interest expense	1,641	1,016
Amortization of premium (discount) on investments, net	102	(114)
Changes in operating assets and liabilities:		
Prepaid expenses and other assets	(611)	(3,780)
Accounts payable	(983)	2,367
Accrued liabilities	(3,049)	1,062
Deferred license revenue	(27)	(27)
Other	280	761
Net cash used in operating activities	(48,526)	(22,526)
INVESTING ACTIVITIES		
Proceeds from the sale/maturity of marketable securities	76,638	49,186
Purchases of marketable securities	(51,163)	(52,636)
Purchases of property and equipment	(428)	(1,496)
Net cash provided by (used in) investing activities	25,047	(4,946)
FINANCING ACTIVITIES		
Proceeds from issuance of common stock	550	327
Proceeds from offering of common stock, net of issuance costs	7,696	—
Proceeds from issuance of notes payable, net of issuance costs	—	26,325
Cash paid on extinguishment of debt	—	(8,631)
Principal payments on notes payable	—	(3,000)
Net cash provided by financing activities	8,246	15,021
Net decrease in cash and cash equivalents	(15,233)	(12,451)
Cash and cash equivalents, beginning of period	40,813	35,933
Cash and cash equivalents, end of period	$ 25,580	$ 23,482
SUPPLEMENTAL DISCLOSURE OF CASH FLOW INFORMATION		
Cash paid for interest	$ 1,856	$ 1,013
NONCASH INVESTING AND FINANCING ACTIVITIES		
Property and equipment purchases included in accounts payable and accrued liabilities	$ 37	$ 506
Tenant improvement allowance	$ -	$ 1,243
Fair value of common stock warrants issued in connection with notes payable	$ -	$ 479

See accompanying notes to these unaudited condensed financial statements.

1. Organization and Basis of Presentation

Tocagen Inc. (Tocagen or the Company) is a clinical-stage, cancer-selective gene therapy company focused on developing first-in-class, broadly-applicable product candidates designed to activate a patient's immune system against their own cancer. The Company's cancer-selective gene therapy platform is built on retroviral replicating vectors which are designed to selectively deliver therapeutic genes into the DNA of cancer cells. Tocagen's gene therapy approach is designed to fight cancer through immunotherapeutic mechanisms of action without the autoimmune toxicities commonly experienced with other immunotherapies. The Company views its operations and manages its business in one operating segment.

From inception through September 30, 2019, the Company has devoted substantially all of its efforts to developing its gene therapy platform and its lead product candidate, Toca 511 & Toca FC, as well as raising capital and building its infrastructure. The Company has not generated revenues from its principal operations.

The accompanying unaudited condensed financial statements have been prepared in accordance with U.S. generally accepted accounting principles (GAAP) for interim financial information and the instructions to Form 10-Q and Article 10 of Regulation S-X. Accordingly, these financial statements do not include all of the information and footnotes required by GAAP for complete financial statements. In management's opinion, the accompanying financial statements reflect all adjustments, consisting of normal recurring adjustments, considered necessary for a fair presentation of the results for the interim periods presented. Interim financial results are not necessarily indicative of results anticipated for the full year. These unaudited condensed financial statements should be read in conjunction with the audited financial statements and footnotes included in the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2018, from which the balance sheet information herein was derived.

Liquidity

The accompanying financial statements have been prepared on a basis which assumes the Company is a going concern, and do not include any adjustments to reflect the possible future effects on the recoverability and classification of assets or the amounts and classifications of liabilities that may result from any uncertainty related to the Company's ability to continue as a going concern. The Company has experienced net losses and negative cash flows from operating activities since its inception. As of September 30, 2019, the Company had an accumulated deficit of $268.8 million and working capital of $17.8 million available to fund future operations.

Based on the Company's operating plans, cash, cash equivalents and marketable securities may not be sufficient to fund operations for the next 12 months. As a result, there is substantial doubt about the Company's ability to continue as a going concern. All amounts due under the Term Loans (see note 5) have been classified as a current liability as of September 30, 2019 due to the considerations discussed above and the assessment that a material adverse change clause under the Term Loans is not within the Company's control. On October 31, 2019, the Company entered into an amendment (the Second Amendment) to its Amended and Restated Loan and Security Agreement with the two lenders, dated May 18, 2018, which was further amended on August 3, 2018 (the Loan Agreement), and made a prepayment of $23.3 million, which amount was used to prepay i) a portion equal to $21.5 million of the outstanding principal of the Term Loans plus all accrued and unpaid interest thereon through the prepayment date, ii) prorated portion of the final payment with respect to the portion of such Term Loans being prepaid, plus iii) all outstanding lenders' expenses as of the date of the Second Amendment (see note 9). The Company has not been notified of an event of default by the lenders as of the date of the filing of this Form 10-Q.

The Company will seek to fund its losses from operations and capital needs through debt and equity financing, or through collaborations or partnerships with other entities which may not be available on a timely basis on terms acceptable to the Company, or at all. If the Company is unable to raise additional capital when required or on acceptable terms, the Company may be required to scale back or discontinue the advancement of product candidates, further reduce headcount, reorganize, merge with another entity, file for bankruptcy, or cease operations.

As of September 30, 2019, the Company had cash, cash equivalents and marketable securities of $55.3 million.

Use of Estimates

The Company's financial statements are prepared in accordance with GAAP, which requires management to make estimates and assumptions that affect the reported amounts of assets, liabilities, revenue and expenses and the disclosure of contingent assets and liabilities in the financial statements and accompanying notes. Significant estimates in the Company's financial statements relate to clinical trial accruals, the valuation of equity awards, and the development period used for license revenue recognition. Estimates are

periodically reviewed in light of changes in circumstances, facts and experience. Actual results may differ from these estimates under different assumptions or conditions.

2. Summary of Significant Accounting Policies

Clinical Trial Accruals

Expenses related to clinical studies are based on estimates of the services received and efforts expended pursuant to the Company's contract arrangements. The financial terms of these agreements are subject to negotiation, vary from contract to contract and may result in uneven payment flows. There may be instances in which payments made to the Company's service providers will temporarily exceed the level of services provided and result in a prepayment of the clinical expense. Payments under some of these contracts depend on factors such as the successful enrollment of patients, site initiation and the completion of clinical milestones. The Company makes estimates of its accrued expenses as of each balance sheet date in its financial statements based on facts and circumstances known at that time. In accruing service fees, the Company estimates the time period over which services will be performed and the level of effort to be expended in each period. If the actual timing of the performance of services or the level of effort varies from its estimate, the Company adjusts the accrual or prepaid expense balance accordingly. Historically, the Company's estimated accrued liabilities have materially approximated actual expense incurred.

Revenue Recognition

Revenue generally consists of license revenue with upfront payments and development milestones considered probable of achievement.

Revenue is recognized when control of the promised goods or services is transferred to the Company's customers in an amount that reflects the consideration the Company expects to receive from its customers in exchange for those goods and services. This process involves identifying the contract with a customer, determining the performance obligations in the contract, determining the transaction price, allocating the contract price to the distinct performance obligations in the contract, and recognizing revenue when or as the Company satisfies the performance obligation(s).

At contract inception, the Company assesses the goods and services promised within each contract and assesses whether each promised good or service is distinct and determines that those are performance obligations. A performance obligation is considered distinct from other obligations in a contract when it provides a benefit to the customer either on its own or together with other resources that are readily available to the customer and is separately identified in the contract. The Company considers factors such as the research, manufacturing and commercialization capabilities of the collaboration partner and the availability of the associated expertise in the general marketplace. The Company considers a performance obligation satisfied once the Company has transferred control of a good or service to the customer, meaning the customer has the ability to use and obtain the benefit of the good or service. The Company recognizes revenue for satisfied performance obligations only when the Company determines there are no uncertainties regarding payment terms or transfer of control.

Collaborative Arrangements

The Company enters into collaborative arrangements with partners that may include payment to the Company of one or more of the following: (i) license fees; (ii) payments related to the achievement of developmental, regulatory, or commercial milestones; and (iii) royalties on net sales of licensed products. Where a portion of non-refundable upfront fees or other payments received are allocated to continuing performance obligations under the terms of a collaborative arrangement, they are recorded as contract liabilities and recognized as revenue when (or as) the underlying performance obligation is satisfied.

As part of the accounting for these arrangements, the Company must develop estimates and assumptions that require judgment to determine the underlying stand-alone selling price for each performance obligation which determines how the transaction price is allocated among the performance obligation(s). The stand-alone selling price may include items such as forecasted revenues, development timelines, discount rates, and probabilities of technical and regulatory success. The Company evaluates each performance obligation to determine if it can be satisfied at a point in time or over time. In addition, variable consideration must be evaluated to determine if it is constrained and, therefore, excluded from the transaction price.

License Fees

If a license to the Company's intellectual property is determined to be distinct from the other performance obligations identified in the arrangement, the Company recognizes revenues from non-refundable, upfront fees allocated to the license when the license is transferred to the licensee and the licensee is able to use and benefit from the license. For licenses that are bundled with 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 for purposes of recognizing revenue. The Company evaluates the measure of progress each reporting period and, if

necessary, adjusts the measure of performance and related revenue recognition. Any such adjustments are recorded on a cumulative catch-up basis, which would affect license, collaboration or other revenues and earnings in the period of adjustment.

Milestone Payments

At the inception of each arrangement that includes milestone payments (variable consideration), the Company evaluates whether the milestones are considered probable of being reached and estimates the amount to be included in the transaction price. If it is probable that a milestone event would occur at the inception of the arrangement, the associated milestone value is included in the transaction price. Milestone payments that are not within the Company's control, such as regulatory approvals, are generally not considered probable of being achieved until those approvals are received. The transaction price is then allocated to each performance obligation on a relative stand-alone selling price basis, for which the Company recognizes revenue as or when the performance obligations under the contract are satisfied. At the end of each reporting period, the Company evaluates the probability of achievement of such milestones and any related constraint(s), and if necessary, may adjust the Company's estimate of the overall transaction price. Any such adjustments are recorded on a cumulative catch-up basis, which would affect license, collaboration or other revenues and earnings in the period of adjustment.

Royalties

For arrangements that include sales-based royalties, including milestone payments based on the level of sales, and for which 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 royalty revenue resulting from its collaborative arrangements.

Stock-Based Compensation

Stock-based compensation expense represents the cost of the grant date fair value of stock awards, including stock options, and stock purchase rights granted to employees and members of the Company's board of directors. For awards with time-based vesting provisions, the Company estimates the fair value of stock options on the date of grant using the Black-Scholes option pricing model and recognizes the expense over the requisite service period of the awards, which is generally the vesting period, on a straight-line basis. For awards with performance-based vesting provisions, the Company estimates the fair value of stock option grants on the date of grant, or the date when all of the terms of the grant have been agreed to, if later, and recognizes the expense based on the probability of the occurrence of the individual milestones at each reporting period. The expense is recognized over the implicit service period that commences once management believes the performance criteria are probable of being met. For purchase rights, the Company estimates the fair value of the purchase as of the plan enrollment date and recognizes expense on a straight-line basis over the applicable offering period. The Company accounts for forfeitures when they occur and reverses any compensation cost previously recognized for awards for which the requisite service has not been completed, in the period that the award is forfeited.

Net Loss Per Share

Basic and diluted net loss per common share for the periods presented is computed by dividing net loss by the weighted-average number of common shares outstanding during the respective periods, without consideration of common stock equivalents as they are anti-dilutive. Common stock equivalents that could potentially dilute earnings in the future are comprised of options to purchase shares of common stock outstanding under the Company's equity incentive plan and warrants for the purchase of shares of common stock. For all periods presented, there is no difference in the number of shares used to calculate basic and diluted shares outstanding due to the Company's net loss position.

Common stock equivalents from potentially dilutive securities that are not included in the calculation of diluted net loss per share, because to do so would be anti-dilutive, are as follows:

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Common stock options	4,395,696	3,637,502	4,395,696	3,637,502
Common stock warrants	66,514	67,238	66,514	67,238
Total	4,462,210	3,704,740	4,462,210	3,704,740

Recently Adopted Accounting Pronouncements

In February 2016, the Financial Accounting Standards Board (FASB) issued Accounting Standards Update (ASU) 2016-02, *Leases (Topic 842)*. The new standard is aimed at making leasing activities more transparent and comparable. Under the new guidance, lessees are required to recognize substantially all leases on their balance sheet as a lease liability, which is a lessee's obligation to make lease payments arising from a lease, measured on a discounted basis and a right-of-use asset, which is an asset that represents the lessee's right to use, or control the use of, a specified asset for the lease term. The Company adopted Topic 842 on January 1, 2019 using the modified retrospective approach with a cumulative-effect adjustment as of January 1, 2019. The Company recognized a right-of-use asset and a lease liability on the condensed balance sheet for the discounted value of future lease payments from the date of adoption. The impact on the condensed balance sheet as of the date of adoption was as follows (in thousands):

	ASC 840 January 1, 2019	ASC 842 January 1, 2019	Impact of Adoption
Balance Sheet			
Accrued liabilities	$ 154	$ 645	$ 491
Deferred rent, net of current portion	2,201	—	(2,201)
Operating lease right-of-use asset	—	8,060	8,060
Operating lease liability, net of current portion	—	9,770	9,770

Operating lease assets and liabilities were recorded in the Company's condensed balance sheet as of September 30, 2019 (in thousands):

	September 30, 2019
Operating lease right-of-use asset	$ 7,597
Accrued liabilities	876
Operating lease liability, net of current portion	9,122

In June 2018, the FASB issued ASU 2018-07, *Compensation- Stock Compensation (Topic 718), Improvements to Nonemployee Share-Based Payment Accounting*. This new standard is intended to simplify aspects of share-based compensation issued to non-employees by aligning the accounting for share-based payment awards issued to employees and non-employees as it relates to the measurement date and impact of performance conditions. The new standard became effective January 1, 2019 and did not have a material impact to the overall financial statements of the Company.

3. Fair Value of Financial Instruments

Fair Values of Assets Measured on a Recurring Basis

The following tables summarize the Company's assets that require fair value measurements on a recurring basis and their respective input levels based on the fair value hierarchy (in thousands):

		Fair Value Measurements at End of Period Using:		
	Total	Quoted Market Prices for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
September 30, 2019				
Cash equivalents:				
Commercial paper	$ 2,494	$ —	$ 2,494	$ —
	$ 2,494	$ —	$ 2,494	$ —
Marketable securities:				
Corporate debt securities	$ 11,687	$ —	$ 11,687	$ —
Commercial paper	12,478	—	12,478	—
Asset-backed securities	5,597	—	5,597	—
	$ 29,762	$ —	$ 29,762	$ —

	Total	Fair Value Measurements at End of Period Using: Quoted Market Prices for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
December 31, 2018				
Cash equivalents:				
Corporate debt securities	$ 4,783	$ —	$ 4,783	$ —
Commercial paper	1,987	—	1,987	—
	$ 6,770	$ —	$ 6,770	$ —
Marketable securities:				
Corporate debt securities	$ 16,301	$ —	$ 16,301	$ —
Commercial paper	24,576	—	24,576	—
U.S. treasury securities	1,997	1,997	—	—
Asset-backed securities	12,399	—	12,399	—
	$ 55,273	$ 1,997	$ 53,276	$ —

Marketable Securities. For fair values determined by Level 1 inputs, which utilize quoted prices in active markets for identical assets, the level of judgment required to estimate fair value is relatively low. The fair values of investments in U.S. treasury securities were determined using Level 1 inputs.

Fair values determined by Level 2 inputs, which utilize data points that are observable such as quoted prices, interest rates and yield curves, require the exercise of judgment and use of estimates, that if changed, could significantly affect the Company's financial position and results of operations. Investments in corporate debt securities, commercial paper and asset-backed securities are valued using Level 2 inputs. Level 2 securities are initially valued at the transaction price and subsequently valued and reported utilizing inputs other than quoted prices that are observable either directly or indirectly, such as quotes from third-party pricing vendors.

There were no transfers in or out of Level 1 or Level 2 investments during the nine months ended September 30, 2019 or 2018.

At September 30, 2019 and December 31, 2018, the Company had investments in money market funds of $20.1 million and $30.9 million, respectively, that were measured at fair value using the net asset value per share (or its equivalent) that have not been classified in the fair value hierarchy. The funds invest primarily in U.S. government securities. Refer to Note 4 for information regarding the Company's investments.

Fair Values of Other Financial Instruments

The carrying amounts of certain of the Company's financial instruments, including cash and accounts payable, approximate their respective fair values due to their short-term nature. The carrying amount of the Company's notes payable of $27.8 million at September 30, 2019 approximated their fair value as the terms of the notes are consistent with the market terms of transactions with similar profiles as of such date (Level 2 inputs).

4. Certain Financial Statement Caption Information

Marketable Securities

The following is a summary of the Company's marketable securities (in thousands):

	Maturity (in years)	Amortized Cost	Unrealized Gain	Unrealized Loss	Fair Value
September 30, 2019					
Corporate debt securities	1 or less	$ 7,494	$ 11	$ —	$ 7,505
Corporate debt securities	>1 and <5	4,169	13	—	4,182
Commercial paper	1 or less	12,469	9	—	12,478
Asset-backed securities	1 or less	4,838	9	—	4,847
Asset-backed securities	>1 and <5	749	1	—	750
		$ 29,719	$ 43	$ —	$ 29,762
December 31, 2018					
Corporate debt securities	1 or less	$ 10,013	$ 1	$ (4)	$ 10,010
Corporate debt securities	>1 and <5	6,293	2	(4)	6,291
Commercial paper	1 or less	24,584	—	(8)	24,576
U.S. treasury securities	1 or less	1,997	—	—	1,997
Asset-backed securities	1 or less	10,612	—	(8)	10,604
Asset-backed securities	>1 and <5	1,797	—	(2)	1,795
		$ 55,296	$ 3	$ (26)	$ 55,273

The Company has classified all of its available-for-sale investment securities, including those with maturity greater than one year, as current assets on the balance sheet based on the highly liquid nature of these investment securities and because these investment securities are considered available for use in current operations.

There were no impairments considered other-than-temporary during the periods presented, as it is management's intention and ability to hold the securities until a recovery of the cost basis or recovery of fair value. Gross realized gains and losses on sales of marketable securities were immaterial for all periods presented.

Accrued Liabilities

Accrued liabilities are comprised of (in thousands):

	September 30, 2019	December 31, 2018
Clinical trial expenses	$ 3,636	$ 4,535
Payroll and other employee-related expenses	1526	2,840
Contract manufacturing services	3,349	3,411
Current lease liability	876	—
Professional fees	245	474
Interest payable	198	205
Other	1,771	1,629
Total accrued liabilities	$ 11,601	$ 13,094

5. Notes Payable

Loan Agreement

On October 30, 2015, the Company entered into a Loan and Security Agreement (Prior Loan Agreement) with two lenders whereby it borrowed $18.0 million (the Initial Loans). Balances under the Prior Loan Agreement were due in monthly principal and interest payments, with final maturity of the Initial Loans in May 2019. Each Initial Loan included a final payment fee of 7.95% of the original principal amount due upon maturity.

On May 18, 2018, the Company entered into the Loan Agreement, which was further amended on August 3, 2018, pursuant to which the lenders agreed to lend the Company $26.5 million as term loans (the Term Loans). Of the total proceeds, $8.6 million was applied to the repayment of outstanding principal, interest and final payment owed pursuant to the Initial Loans.

The Company evaluated the Loan Agreement in accordance with ASC Topic 470, which requires assessment of whether the modification is considered a substantial modification, in which case the modification would be accounted for as a debt extinguishment. Based on the Company's evaluation, the Loan Agreement was considered substantial and therefore the unamortized discount associated with the Prior Loan Agreement was written off through interest expense and the principal balance of the Prior Loan Agreement was written off.

The Term Loans will mature on December 1, 2022 (the Maturity Date) and the Company will have interest-only payments through January 1, 2020, followed by 36 equal monthly payments of principal and interest.

The Term Loans bear interest at a floating per annum rate equal to the greater of (i) 8.50% and (ii) the sum of (a) the prime rate reported in the Wall Street Journal on the last business day of the month that immediately proceeds the month in which the interest will accrue, plus (b) 3.75%. The Company will be required to make a final payment of 7.95% of the principal amount of the Term Loans payable on the earlier of (i) the Maturity Date, (ii) the acceleration of any Term Loans, or (iii) the prepayment of the Term Loans. On October 31, 2019, the Company entered into the Second Amendment and made a prepayment of $23.3 million, which amount was used to prepay i) a portion equal to $21.5 million of the outstanding principal of the Term Loans plus all accrued and unpaid interest thereon through the prepayment date, ii) prorated portion of the final payment with respect to the portion of such Term Loans being prepaid, plus iii) all outstanding lenders' expenses as of the date of the Second Amendment (see note 9).

In conjunction with the Loan Agreement, the Company has issued the lenders warrants exercisable for 56,578 shares of common stock (the Warrants). The Warrants are exercisable in whole or in part, immediately, and have a per share exercise price of $9.35. The Warrants will terminate on the earlier of May 18, 2028 or the closing of a certain merger or consolidation transaction. The Company recorded the Warrants as a debt discount, which is a contra-liability against debt, and is amortizing the balance over the life of the underlying debt. The offset to the contra-liability is recorded as additional paid in capital in the Company's balance sheet as the Warrants were determined to be an equity instrument. The Company determined the fair value of the Warrants at the date of issuance was $0.5 million using the Black-Scholes option pricing model based on significant unobservable inputs (Level 3) with an expected term of 10 years, volatility of 85.6%, risk free rate of 3.1% and expected dividend of 0%.

The costs incurred to issue the Term Loans of $0.1 million were deferred and are included in the discount to the carrying value of the Term Loans in the accompanying balance sheet. The deferred costs and the final payment fee are amortized to interest expense over the expected term of the Term Loans using the effective interest method with an effective interest rate of 10.7%.

The aggregate carrying amounts of the Term Loans are comprised of the following (in thousands):

	September 30, 2019	December 31, 2018
Principal	$ 26,450	$ 26,450
Add: accreted liability for final payment fee	1,821	276
Less: unamortized discount	(428)	(525)
	$ 27,843	$ 26,201

The Term Loans are secured by substantially all of the Company's assets other than its intellectual property, except rights to payment from the sale, licensing or disposition of such intellectual property. In connection with the Second Amendment on October 31, 2019, the Company agreed to grant a security interest in the Company's intellectual property as additional collateral to secure the Term Loans for the ratable benefit of the lenders.

The Company is also required to maintain its primary operating accounts at all times with one of the lenders. The Loan Agreement contains customary conditions of borrowing, events of default and covenants, including covenants that restrict the Company's ability to dispose of assets, merge with or acquire other entities, incur indebtedness and make distributions to holders of its capital stock. Should an event of default occur, including the occurrence of a material adverse change, the Company could be liable for immediate repayment of all obligations under the Loan Agreement. As of September 30, 2019, the Company was in compliance with the covenants contained in the Loan Agreement.

Based on the Company's operating plans, cash, cash equivalents and marketable securities may not be sufficient to fund operations for the next 12 months. As a result, there is substantial doubt about the Company's ability to continue as a going concern. All amounts due under the Term Loans have been classified as a current liability on the condensed balance sheets.

Future maturities of the Term Loans, including the final payment fee, as of September 30, 2019 are as follows (in thousands):

	September 30, 2019
Year ending December 31, 2019	—
Year ending December 31, 2020	8,817
Year ending December 31, 2021	8,817
Year ending December 31, 2022	10,919
	28,553
Unaccreted balance for final payment fee on Loans	(282)
Unamortized discounts	(428)
	$ 27,843

Subsequent to the Company's Second Amendment, its future payments under the Term Loans are 36 equal monthly payments of principal and interest, beginning January 1, 2020 and will mature on December 1, 2022. An exit fee of 7.95% of the outstanding principal of $5.0 million will be due upon maturity.

6. Stockholders' Equity

In November 2018, the Company entered into an Equity Distribution Agreement (the Sales Agreement) with an outside placement agent (the Placement Agent) to sell shares of the Company's common stock with aggregate gross proceeds of up to $30.0 million, from time to time, through an "at-the-market" equity distribution program under which the Placement Agent will act as sales agent. Under the Sales Agreement, the Company will set the parameters for the sale of shares, including the number of shares to be issued, the time period during which sales are requested to be made, limitation on the number of shares that may be sold, and any minimum price below which sales may not be made. The Sales Agreement provides that the Placement Agent will be entitled to compensation for its services in an amount equal to up to 3.0% of the gross proceeds from the sales of shares sold through the Placement Agent under the Sales Agreement. The Company has no obligation to sell any shares under the Sales Agreement, and may at any time suspend solicitation and offers under the Sales Agreement.

During the three and nine months ended September 30, 2019, the Company sold 1,535 shares and 760,089 shares of its common stock under the Sales Agreement, respectively. The sales were made at a weighted average price of $6.02 for the three months ended September 30, 2019 and $10.41 for the nine months ended September 30, 2019. The Company received net proceeds of less than $0.1 million during the three months ended September 30, 2019 and net proceeds of $7.7 million during the nine months ended September 30, 2019. The Company may sell up to an additional $22.1 million in shares of the Company's common stock under the Sales Agreement.

Common Stock Reserved for Future Issuance

Common stock reserved for future issuance as of September 30, 2019 is as follows:

Issued and Outstanding:	
Stock options	4,395,696
Warrants for common stock	66,514
Shares reserved for issuance under the 2017 Employee Stock Purchase Plan	488,405
Shares reserved for future award grants	482,523
Total	5,433,138

The following table summarizes the allocation of the Company's non-cash stock-based compensation expense for all stock awards during the three and nine months ended September 30, 2019 and 2018 (in thousands):

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Research and development	$ 901	$ 842	$ 2,635	$ 2,377
General and administrative	1,152	1,085	3,762	2,743
Total	$ 2,053	$ 1,927	$ 6,397	$ 5,120

The Company has not recognized non-cash stock-based compensation expense for outstanding options to purchase 188,651 shares of common stock with performance-based vesting provisions after its evaluation that the occurrence of the individual milestones is not probable as of September 30, 2019.

7. Collaborative Arrangements

ApolloBio License

On April 18, 2018, the Company entered into a License Agreement (the License Agreement) with Beijing Apollo Venus Biomedical Technology Limited and ApolloBio Corp. (collectively, ApolloBio), which became effective in July 2018, pursuant to which the Company granted to ApolloBio an exclusive license to develop and commercialize Toca 511 & Toca FC within the greater China region, including mainland China, Hong Kong, Macao and Taiwan (the Licensed Territory).

The Company is eligible to receive up to an aggregate $111.0 million, less withholding and other taxes, upon the achievement of specified development and commercial milestones. The Company completed its planned enrollment of 380 patients in the Toca 5 clinical trial in 2018 and earned a $2.0 million development milestone payment. The Company is also eligible for low double-digit tiered royalty payments based on annual net sales of licensed products in the Licensed Territory, subject to reduction under specified circumstances. ApolloBio will be responsible for all development and commercialization costs in the Licensed Territory. Future payments by ApolloBio are subject to the People's Republic of China (PRC) currency exchange approval and may be subject to other approvals by PRC authorities.

Under the License Agreement, the Company has received net proceeds of $15.2 million which is comprised of a $16.0 million up-front payment and a $2.0 million development milestone payment less $1.7 million in foreign income taxes and $1.1 million in certain foreign non-income taxes.

Unless earlier terminated, the License Agreement will expire upon the expiration of the last-to-expire royalty term for any and all licensed products, which royalty term is, with respect to a licensed product in a particular region (*i.e.*, mainland China, Hong Kong, Macao and Taiwan) of the Licensed Territory (each, a Region), the latest of (i) 10 years after the first commercial sale of such licensed product in such Region, (ii) the expiration of all regulatory exclusivity as to such licensed product in such Region and (iii) the date of expiration of the last valid patent claim covering such licensed product in such Region. Either party may terminate the License Agreement upon a material breach by the other party that remains uncured following 60 days (or, with respect to any payment breach, 10 days) after the date of written notice of such breach. ApolloBio may terminate the License Agreement at any time by providing 90 days' prior written notice to the Company. In addition, the Company may terminate the License Agreement upon written notice to ApolloBio under specified circumstances if ApolloBio challenges the licensed patent rights.

Under ASU 2014-09, *Revenue from Contracts with Customers (Topic 606)*, the Company evaluated the terms of the License Agreement and the transfer of intellectual property rights (the license) was identified as the only performance obligation as of the inception of the License Agreement. The Company determined that the transaction price under the License Agreement was comprised solely of the $16.0 million upfront payment. The future potential development and commercial milestone payments were not included in the transaction price as they were determined to be fully constrained. As part of the evaluation of the development and commercial milestone constraint, the Company determined that the achievement of such milestones is contingent upon success in future clinical trials and regulatory approvals, each of which was uncertain at the inception of the License Agreement. The Company will re-evaluate the transaction price each quarter or as uncertain events are resolved or other changes in circumstances occur. Future potential development and commercial milestone amounts would be recognized as revenue, if unconstrained. Any reimbursable program costs are recognized proportionately with the performance of the underlying services and are accounted for as a reduction to research and development expense and are excluded from the transaction price.

The entire $16.0 million transaction price was allocated to the license performance obligation. The license was delivered in connection with the execution of the License Agreement and the performance obligation was fully satisfied in 2018 (transfer of intellectual property). Additionally, the Company earned a $2.0 million development milestone payment in 2018 upon completion of the planned enrollment of 380 patients in the Toca 5 clinical trial.

8. Commitments

The Company leases its office and laboratory space located in San Diego, California, for its corporate headquarters and research facility under an operating lease agreement (the Lease). The Lease commenced in March 2018. The term of the Lease is eight years and the Company has one option to extend the Lease for a period of five additional years. In connection with the inception of the Lease, the Company was provided and fully utilized a tenant improvement allowance of $1.2 million. The Lease provides for an abatement of a portion of the lease payments for the first nine months of the lease term and includes escalation clauses in the future. The Company excluded the extension option in its calculation of present value of lease payments as it is not reasonably certain to be exercised. The Company's lease payment consists primarily of fixed rental payments for the right to use the underlying leased assets over the lease term as well as payments for common-area maintenance and administrative services.

Operating lease right-of-use asset and liability on the Company's condensed balance sheets represent the present value of our remaining lease payments over the remaining lease term. The Company does not allocate lease payments to non-lease components; therefore, fixed payments for common-area maintenance and administrative services are included in its operating lease right-of-use asset and liability. The future undiscounted cash flows for the Company's lease are consistent with those disclosed in its Form 10-K for the fiscal year ended December 31, 2018. The Company uses its incremental borrowing rate of 10.9% to calculate the present value of lease payments, as the implicit rate in its lease is not readily determinable.

9. Subsequent Events

Corporate Restructuring

In October 2019, the Company implemented a corporate restructuring to extend the Company's resources. In connection with the restructuring, the Company committed to a reduction in its total workforce by approximately 65%, to approximately 30 employees. The restructuring was approved by the Company's Board of Directors on October 1, 2019. The Company estimates that it will incur a one-time personnel-related restructuring charge of approximately $1.0 million for employee severance and other related termination benefits. Payments are expected to be paid by December 31, 2019.

Loan Amendment

On October 31, 2019, the Company entered into the Second Amendment with its lenders. Pursuant to the terms of the Second Amendment, the lenders (i) agreed to waive any prepayment fee otherwise applicable to a prepayment of the Term Loans in connection with any prepayment of the Term Loans on or after the date of the Second Amendment, (ii) consent to the sale of certain specified equipment, so long as the net cash proceeds from the sale of such assets are used to repay the Term Loans, and (iii) release their lien on the specified equipment upon the closing of any such sale. Under the Second Amendment, the Company has also agreed to grant a security interest in the Company's intellectual property as additional collateral to secure the Term Loans for the ratable benefit of the lenders.

In connection with the Second Amendment, the Company made a prepayment of $23.3 million, which amount was used to prepay i) a portion equal to $21.5 million of the outstanding principal of the Term Loans plus all accrued and unpaid interest thereon through the prepayment date, ii) prorated portion of the final payment with respect to the portion of such Term Loans being repaid, plus iii) all outstanding lenders expenses as of the date of the Second Amendment.

The pro-rated portion of the final payment with respect to the portion of such Term Loans repaid in October 2019 were recorded as notes payable, current portion in the accompanying condensed balance sheet as of September 30, 2019.

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 financial statements and related notes included in this Quarterly Report on Form 10-Q and the audited financial statements and notes thereto as of and for the year ended December 31, 2018 and the related Management's Discussion and Analysis of Financial Condition and Results of Operations contained in our Annual Report on Form 10-K filed with the Securities and Exchange Commission, or SEC, on February 27, 2019, or Annual Report on Form 10-K. Unless the context requires otherwise, references in this Quarterly Report on Form 10-Q to "we," "us," and "our" refer to Tocagen Inc.

Forward-Looking Statements

The information in this discussion contains forward-looking statements and information within the meaning 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, or the Exchange Act, which are subject to the "safe harbor" created by those sections. These forward-looking statements include, but are not limited to, statements concerning our strategy, future operations, future financial position, future revenues, projected costs, prospects and plans and objectives of management. The words "anticipates," "believes," "could," "estimates," "expects," "intends," "may," "plans," "projects," "will," "would" and similar expressions are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words. We may not actually achieve the plans, intentions, or expectations disclosed in our forward-looking statements and 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 that we make. These forward-looking statements involve risks and uncertainties that could cause our actual results to differ materially from those in the forward-looking statements, including, without limitation, the risks set forth in Part II, Item 1A, "Risk Factors" in this Quarterly Report on Form 10-Q and in our other filings with the SEC. The forward-looking statements are applicable only as of the date on which they are made, and we do not assume any obligation to update any forward-looking statements.

Overview

We are a clinical-stage, cancer-selective gene therapy company focused on developing first-in-class, broadly-applicable product candidates designed to activate a patient's immune system against their own cancer. Our cancer-selective gene therapy platform is built on retroviral replicating vectors, which are designed to selectively deliver therapeutic genes into the DNA of cancer cells. Our gene therapy approach is designed to fight cancer through immunotherapeutic mechanisms of action without the autoimmune toxicities commonly experienced with other immunotherapies.

We are developing our lead product candidate, Toca 511 (vocimagene amiretrorepvec) & Toca FC (extended-release flucytosine), initially for the treatment of recurrent high grade glioma, or HGG, a brain cancer with limited treatment options, low survival rates and, therefore, a significant unmet medical need. We conducted a randomized, controlled Phase 3 clinical trial (Toca 5) of Toca 511 & Toca FC in patients with recurrent HGG, which was designed to serve as a registrational trial. At the final analysis, the trial missed the primary endpoint of overall survival compared to the standard of care treatment (11.1 months median compared to 12.2 months, HR=1.06, p=0.6154). In addition, all secondary endpoints showed no meaningful difference between the arms of the trial. The safety, tolerability and adverse event profile of Toca 511 & Toca FC was as expected for this patient population.

In February 2017, the U.S. Food and Drug Administration, or FDA, granted Toca 511 & Toca FC Breakthrough Therapy Designation for the treatment of patients with recurrent HGG and in June 2017 the European Medicines Agency, or EMA, granted Toca 511 Priority Medicines, or PRIME, Designation for the treatment of patients with HGG. Breakthrough Therapy Designation indicates that preliminary clinical evidence demonstrates the drug may have substantial improvement on one or more clinically significant endpoints over available therapy. PRIME Designation indicates that there is a potential to benefit patients with unmet medical needs based on early clinical data. We also have Fast Track Designation (which may lead to priority review of new products that treat serious diseases or conditions and demonstrate the potential to address an unmet medical need) from the FDA for Toca 511 & Toca FC for the treatment of recurrent HGG. We also received Orphan-Drug Designation from the FDA for the treatment of malignant glioma in addition to glioblastoma multiforme. Orphan-Drug Designation is a designation for a product that treats a rare disease or condition and which, if the product receives the first FDA approval for that disease or condition, may result in a period of regulatory exclusivity, subject to some exceptions. The Committee for Orphan Medicinal Products of the EMA has designated both flucytosine and vocimagene amiretrorepvec as orphan medicinal products indicated for the treatment of glioma. The EMA provides several benefits to drug developers for developing drugs for orphan diseases.

In April 2018, we entered into a license agreement, or ApolloBio License Agreement, with Beijing Apollo Venus Biomedical Technology Limited and ApolloBio Corp., or collectively ApolloBio, which became effective in July 2018, pursuant to which we granted to ApolloBio an exclusive license to develop and commercialize Toca 511 & Toca FC within the greater China region, including mainland China, Hong Kong, Macao and Taiwan, or the Licensed Territory. Under the ApolloBio License Agreement, we received an aggregate upfront payment of $16.0 million and we are eligible to receive up to a total of $111.0 million upon achievement of specified development and commercial milestones. In addition, we are also eligible for low double-digit tiered royalty payments based on annual net sales of licensed products in the Licensed Territory, subject to reduction under specified circumstances. We have earned $2.0 million in development milestones as of September 30, 2019.

We do not have any products approved for sale and have not generated any revenue from product sales. Since our inception in August 2007, we have devoted substantially all of our efforts to developing our gene therapy platform and our lead product candidate, Toca 511 & Toca FC. We have never been profitable and have incurred significant operating losses in each year since our inception. We had an accumulated deficit of $268.8 million as of September 30, 2019. Substantially all of our net losses resulted from costs incurred in connection with our research, preclinical, clinical, product, regulatory and business development activities, as well as raising capital and building our infrastructure.

To fund further operations, we will need to raise additional capital. Accordingly, we will seek to fund our operations through equity and/or debt financings or through collaborations or partnerships with other entities which may not be available on a timely basis on terms acceptable by us, or at all. If we are unable to raise additional capital when required or on acceptable terms, we may be required to scale back or discontinue the advancement of product candidates, further reduce headcount, reorganize, merge with another entity, file for bankruptcy, or cease operations. In addition, subject to limited exceptions, our Loan Agreement (as defined below) also prohibits us from incurring indebtedness without the prior written consent of the lenders. Our failure to raise capital or enter into such other arrangements as and when needed would have a negative impact on our financial condition and our ability to develop our product candidates.

Financial Operations Overview

Revenue

We currently have no products approved for sale and have not generated any revenues from the sale of products. We have not submitted any product candidate for regulatory approval.

We expect that any future revenue we generate will fluctuate from quarter to quarter and year to year as a result of the timing and amount of license fees, milestone and other payments, and the amount and timing of payments that we receive upon the sale of our products, to the extent any are successfully commercialized. If we fail to complete the development of our product candidates in a timely manner or obtain regulatory approval of them, our ability to generate future revenue, and our results of operations and financial position, would be materially adversely affected.

Research and Development Expenses

Research and development expenses consist primarily of salaries and related expenses for personnel, including non-cash stock-based compensation costs, preclinical costs, clinical trial costs, costs related to acquiring and manufacturing clinical trial materials, contract services, facilities costs, overhead costs and depreciation. These activities also include research and development related to our gene therapy platform development. All research and development costs are expensed as incurred.

We cannot determine with certainty the duration and completion costs of the current or future clinical trials of our product candidates, or if, when or to what extent we will generate revenues from the commercialization and sale of any of our product candidates that obtain regulatory approval. We may never succeed in achieving regulatory approval for any of our product candidates. The duration, costs and timing of clinical trials and development of our product candidates will depend on a variety of factors, including:

- per patient trial costs;
- the number of patients that participate in the trials;
- the number of sites included in the trials;
- the countries in which the trials are conducted;
- the length of time required to enroll eligible patients;
- the drop-out or discontinuation rates of patients;

- the potential for additional safety monitoring or other clinical trials requested by regulatory agencies;
- significant and changing government regulation; and
- the timing and receipt of any regulatory approvals.

A change in the outcome of any of these variables with respect to the development of a product candidate could mean a significant change in the costs and timing associated with the development of that product candidate. For example, if the FDA or another regulatory authority were to require us to conduct clinical trials beyond those that we currently anticipate will be required for the completion of clinical development of a product candidate or if we experience significant delays in enrollment in any of our clinical trials, we could be required to expend significant additional financial resources and time on the completion of clinical development. In addition, the probability of success for each product candidate will depend on numerous factors, including competition, manufacturing capability and commercial viability. We will determine which programs to pursue and how much to fund each program in response to the scientific and clinical success of each product candidate, as well as an assessment of each product candidate's commercial potential.

The following table sets forth our research and development expense by project for the three and nine months ended September 30, 2019 and 2018 (in thousands):

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Toca 511 & Toca FC	$ 12,841	$ 10,947	$ 36,266	$ 32,343
Vector technology	454	1,315	1,437	3,118
Total	$ 13,295	$ 12,262	$ 37,703	$ 35,461

We expect our research and development expenses to decrease for the foreseeable future as we scale back our expenses to preserve our cash position.

General and Administrative Expenses

General and administrative expenses consist primarily of salaries and related expenses for personnel, including non-cash stock-based compensation costs and travel expenses for our employees in executive, operational, finance and business development functions. Other general and administrative expenses include facility-related costs, consulting fees, information technology, insurance, professional fees for accounting and legal services, expenses associated with obtaining and maintaining patents, expenses related to commercial readiness activities and costs associated with being a public company.

We anticipate continued expenses related to audit, legal, regulatory and tax-related services associated with maintaining compliance with exchange listing and SEC requirements, director and officer insurance premiums and costs associated with being a public company.

Interest Income

Interest income consists primarily of interest income earned on cash, cash equivalents and marketable securities.

Interest Expense

Interest expense consists primarily of stated interest and the amortization of related debt issuance costs incurred on the outstanding principal amount of our borrowings under our notes payable.

Critical Accounting Policies and Significant Judgments and Estimates

There have been no significant changes to our critical accounting policies since December 31, 2018 besides the adoption of ASU No. 2016-02, *Leases (Topic 842)*, which amended the existing accounting standards for leases. For a description of critical accounting policies that affect our significant judgments and estimates used in the preparation of our unaudited condensed financial statements, refer to Item 7 "Management's Discussion and Analysis of Financial Condition and Results of Operations" and Note 2 to our audited financial statements contained in our Annual Report on Form 10-K and Note 2 to our unaudited condensed financial statements contained in this Quarterly Report on Form 10-Q.

Recent Accounting Pronouncements

We have reviewed all recently issued standards and have determined that other than as disclosed in Note 2 to our unaudited condensed financial statements included herein, such standards will not have a material impact on our financial statements or do not otherwise apply to our operations.

Results of Operations

Comparison of the Three and Nine Months Ended September 30, 2019 and 2018

The following table summarizes our results of operations for the three and nine months ended September 30, 2019 and 2018 (in thousands):

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
License revenue	$ 9	$ 18,009	$ 27	$ 18,027
Research and development expenses	13,295	12,262	37,703	35,461
General and administrative expenses	3,837	4,320	13,133	9,311
Interest income	361	441	1,367	1,087
Interest expense	(1,973)	(742)	(3,490)	(2,184)

License revenue License revenue was less than $0.1 million for the three and nine months ended September 30, 2019, compared to $18.0 million for the three and nine months ended September 30, 2018. The license revenue recognized in the periods presented for 2018 relate to an upfront payment and milestones earned under our license agreement with ApolloBio.

Research and development expenses Research and development expenses were $13.3 million and $37.7 million for the three and nine months ended September 30, 2019, respectively, compared to $12.3 million and $35.5 million for the three and nine months ended September 30, 2018, respectively. The increase of $1.0 million for the three months ended September 30, 2019 compared to the same period in 2018 was primarily related to increases in manufacturing costs of $3.3 million offset by a reduction in clinical development expenses of $2.3 million due to the Toca 5 trial nearing completion. The increase of $2.2 million for the nine months ended September 30, 2019 compared to the same period in 2018 was primarily due to an increase in manufacturing costs of $4.2 million and personnel related costs of $1.5 million offset by a reduction in clinical development expenses of $4.9 million due to the Toca 5 trial nearing completion.

General and administrative expenses General and administrative expenses were $3.8 million and $13.1 million for the three and nine months ended September 30, 2019, respectively, compared to $4.3 million and $9.3 million for the three and nine months ended September 30, 2018, respectively. The decrease of $0.5 million for the three months ended September 30, 2019 compared to the same period in 2018 was primarily related to foreign non-income tax expense of $1.0 million in 2018 offset by increased external services related to commercial readiness activities of $0.7 million. The $3.8 million increase for the nine months ended September 30, 2019 compared to the same period in 2018 was due to increased personnel related costs of $1.2 million and external services related to commercial readiness activities of $2.5 million. Based on our clinical trial results, commercial readiness activities have paused.

Interest income Interest income was $0.4 million and $1.4 million for the three and nine months ended September 30, 2019, respectively, compared to $0.4 million and $1.1 million for the three and nine months ended September 30, 2018, respectively. The increase of $0.3 million for the nine months ended September 30, 2019 was primarily due to earning interest at higher rates during 2019 compared to 2018.

Interest expense Interest expense was $2.0 million and $3.5 million for the three and nine months ended September 30, 2019, respectively, compared to $0.7 million and $2.2 million for the three and nine months ended September 30, 2018, respectively. We entered into an amended loan agreement in May 2018. Interest expense increased for the three and nine months ended September 30, 2019 due to an increase of $1.2 million related to accretion of our prorated portion of the final payment for our term loan prepayment made in October 2019.

Liquidity and Capital Resources

We have incurred significant losses and cumulative negative cash flows from operations since our inception. As of September 30, 2019, we had an accumulated deficit of $268.8 million and we anticipate that we will continue to incur losses.

Based on our operating plans, cash, cash equivalents and marketable securities may not be sufficient to fund operations for the next 12 months. As a result, there is substantial doubt about our ability to continue as a going concern. All amounts due under the Term Loans (as defined below) have been classified as a current liability as of September 30, 2019 due to the assessment that a material adverse change clause under the Term Loans is not within our control. On October 31, 2019, we entered into an amendment, or the Second Amendment, to our Loan Agreement and made a prepayment of $23.3 million, which amount was used to prepay i) a portion equal to $21.5 million of the outstanding principal of the Term Loans plus all accrued and unpaid interest thereon through the prepayment date, ii) prorated portion of the final payment with respect to the portion of such Term Loans being prepaid, plus iii) all outstanding lenders' expenses as of the date of the Second Amendment. We have not been notified of an event of default by the Lender as of the date of the filing of this Form 10-Q.

If we are unable to maintain sufficient financial resources, our business, financial condition and results of operations will be materially and adversely affected. There can be no assurances that we will be able to obtain the needed financing on acceptable terms or at all. Additionally, equity or debt financings may have a dilutive effect on the holdings of our existing stockholders. These factors raise substantial doubt about our ability to continue as a going concern. We may be required to scale back or discontinue the advancement of product candidates, further reduce headcount, reorganize, merge with another entity, file for bankruptcy, or cease operations.

Since inception through September 30, 2019, we have funded our operations primarily through the private placement of our convertible preferred stock, our public offerings of our common stock, term loans, the issuance of convertible promissory notes and upfront and milestone payments under our license and collaboration agreements.

The loans under our amended and restated loan and security agreement with two lenders, dated May 18, 2018, as amended, or the Loan Agreement, are secured by substantially all of our assets other than our intellectual property (except rights to payment from the sale, licensing of disposition of such intellectual property). In connection with the Second Amendment on October 31, 2019, we agreed to grant a security interest in our intellectual property as additional collateral to secure the Term Loans for the ratable benefit of the lenders. As of September 30, 2019, the outstanding principal amount under the Loan Agreement was $26.5 million. Balances under the Loan Agreement accrue interest at the prime rate plus 3.75%, subject to a floor of 8.50%. The interest rate as of September 30, 2019 was 9.25%. The loans under the Loan Agreement, or Term Loans, mature in December 2022 with interest only payments through January 1, 2020 followed by 36 monthly payments of principal and interest. The Loan Agreement contains customary conditions of borrowing, events of default and covenants, including covenants that restrict our ability to dispose of assets, merge with or acquire other entities, incur indebtedness and make distributions to holders of our capital stock. Should an event of default occur, including the occurrence of a material adverse change, we could be liable for immediate repayment of all obligations under the Loan Agreement.

As of September 30, 2019, we had $55.3 million in cash, cash equivalents and marketable securities. Our available cash and marketable securities are invested in accordance with our investment policy, primarily with a view to preserve principal and maintain liquidity.

Cash Flows

The following table sets forth the primary sources and uses of cash for the nine months ended September 30, 2019 and 2018 (in thousands):

	Nine Months Ended September 30,	
	2019	**2018**
Net cash (used in) provided by:		
Operating activities	$ (48,526)	$ (22,526)
Investing activities	25,047	(4,946)
Financing activities	8,246	15,021
Net decrease in cash and cash equivalents	$ (15,233)	$ (12,451)

Operating Activities Net cash used in operating activities was $48.5 million and $22.5 million for the nine months ended September 30, 2019 and 2018, respectively. The increase in net cash used in operating activities was primarily attributable to an increase in net loss of $23.6 million due to $18.0 million in revenue under our ApolloBio collaboration being recognized in the nine months ended September 30, 2018 and changes in working capital resulting in net cash used in operating activities of $4.4 million for the nine months ended September 30, 2019 compared to net cash provided by operating activities of $0.4 million for the nine months ended September 30, 2018 as a result of the timing of manufacturing payments.

Investing Activities Net cash provided by investing activities was $25.0 million for the nine months ended September 30, 2019 and net cash used in investing activities was $4.9 million for the nine months ended September 30, 2018. Net cash provided by and used in investing activities for the periods presented primarily relate to the net of purchases, sales and maturities of marketable securities used to fund our operations and purchases of property and equipment. We invest cash in excess of our immediate operating requirements in a way that maturity is staggered and designed to optimize our return on investments, while satisfying our liquidity needs.

Financing activities Net cash provided by financing activities was $8.2 million and $15.0 million for the nine months ended September 30, 2019 and 2018, respectively. The decrease in cash provided by financing activities for the nine months ended September 30, 2019 was primarily related to net proceeds from our Loan Agreement of $26.3 million offset by cash paid on extinguishment of our prior loan and security agreement of $8.6 million in May 2018. Net cash provided by financing activities for the nine months ended September 30, 2019 was primarily related to net proceeds of $7.7 million received under our Equity Distribution Agreement with Citigroup Global Markets Inc., or the ATM facility.

Funding Requirements

Our primary uses of capital are, and we expect will continue to be, compensation and related expenses for personnel, third-party clinical research and development services, manufacturing expenses, laboratory expenses, regulatory expenses, marketing, and general and administrative expenses. Based on our operating plans, cash, cash equivalents and marketable securities may not be sufficient to fund operations for the next 12 months. As a result, there is substantial doubt about our ability to continue as a going concern. All amounts due under the Term Loans have been classified as a current liability as of September 30, 2019 due to the assessment that a material adverse change clause under the Term Loans is not within our control. On October 31, 2019, we entered into the Second Amendment and made a prepayment of $23.3 million, which amount was used to prepay (A) a portion equal to $21.5 million of the outstanding principal of the Term Loans plus all accrued and unpaid interest thereon through the prepayment date, ii) prorated portion of the final payment with respect to the portion of such Term Loans being prepaid, plus iii) all outstanding lenders' expenses as of the date of the Second Amendment. We have not been notified of an event of default by the Lender as of the date of the filing of this Form 10-Q.

The successful development of any product candidate is highly uncertain. As such, at this time, we cannot reasonably estimate or know the nature, timing and costs of the efforts that will be necessary to complete the development of our current and future product candidates. We are also unable to predict when, if ever, material net cash inflows will commence from the sale of product candidates. This is due to the numerous risks and uncertainties associated with gene therapy product development, including the uncertainty of:

- the progress, timing, costs and results of development for our product candidates;
- the outcome, timing and cost of regulatory approvals by the FDA and comparable foreign regulatory authorities, including the potential for the FDA or comparable foreign regulatory authorities to require that we perform more studies than those that we currently expect;
- the ability of our product candidates to progress through clinical development successfully;
- the cost of filing, prosecuting, defending and enforcing any patent claims and other intellectual property rights;
- arrangements with third-party service providers and manufacturers;
- our need and ability to hire additional personnel;
- our need to implement additional infrastructure and internal systems;
- the effect of competing technological and market developments; and
- the cost of establishing sales, marketing and distribution capabilities for any products for which we may receive regulatory approval.

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 and timing associated with the development of that product candidate.

Until we can generate a sufficient amount of revenue from our products, if ever, we expect to finance future cash needs through equity and/or debt financings. We may also consider new collaborations or selectively partnering our technology or programs. Other than our ATM facility, we do not have any committed external source of funds. Additional capital may not be available on reasonable terms, if at all. Subject to limited exceptions, our Loan Agreement also prohibits us from incurring indebtedness without the prior written consent of the lenders. If we are unable to raise additional capital in sufficient amounts or on terms acceptable to us, we may

have to significantly delay, scale back or discontinue the development of one or more of our product candidates. If we raise additional funds through the issuance of additional equity or debt securities, it could result in dilution to our existing stockholders and increased fixed payment obligations, and these securities may have rights senior to those of our common stock. If we incur indebtedness, we could become subject to covenants that would restrict our operations and potentially impair our competitiveness, such as limitations on our ability to incur additional debt, limitations on our ability to acquire, sell or license intellectual property rights and other operating restrictions that could adversely impact our ability to conduct our business. Any of these events could significantly harm our business, financial condition and prospects.

Off-Balance Sheet Arrangements

As of September 30, 2019, we did not have any off-balance sheet arrangements as defined in the rules and regulations of the SEC.

Item 3. Quantitative and Qualitative Disclosures About Market Risk.

The primary objective of our investment activities is to preserve our capital to fund our operations. We also seek to maximize income from our investments without assuming significant risk. To achieve our objectives, we maintain a portfolio of cash equivalents and investments in securities of high credit quality. As of September 30, 2019, we had cash, cash equivalents and marketable securities of $55.3 million. A significant portion of our investments may be subject to interest rate risk and could fall in value if market interest rates increase. However, because our investments are primarily short-term in duration, we believe that our exposure to interest rate risk is not significant and a 1% movement in market interest rates would not have a significant impact on the total value of our portfolio. We actively monitor changes in interest rates.

We also have interest rate exposure as a result of our Loan Agreement. As of September 30, 2019, the outstanding principal amount under the Loan Agreement was $26.5 million. The term loan bears interest at a floating per annum rate equal to the greater of (i) 8.50% and (ii) the sum of (a) the prime rate reported in the Wall Street Journal on the last business day of the month that immediately proceeds the month in which the interest will accrue, plus (b) 3.75%. Changes in the U.S. Dollar prime rate may therefore affect our interest expense associated with the term loan.

If a 10% change in interest rates were to have occurred on September 30, 2019, this change would not have had a material effect on our interest expense as of that date.

Item 4. Controls and Procedures.

Disclosure Controls and Procedures

In evaluating the disclosure controls and procedures, management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving the desired control objectives, and management is required to apply its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Our management, with the participation of our Chief Executive Officer and our Chief Financial Officer, evaluated the effectiveness of our disclosure controls and procedures as of the end of the period covered by this Quarterly Report on Form 10-Q. Based on that evaluation, our Chief Executive Officer and our Chief Financial Officer concluded that our disclosure controls and procedures were effective, at the reasonable assurance level, as of the end of the period covered by this Quarterly Report on Form 10-Q to ensure that information we are required to disclose in reports that we file or submit under the Exchange Act (1) is recorded, processed, summarized and reported within the time periods specified in SEC rules and forms, and (2) is accumulated and communicated to management, including our Chief Executive Officer and our Chief Financial Officer, as appropriate to allow timely decisions regarding required disclosure.

Changes in Internal Control Over Financial Reporting

There have been no changes in our internal control over financial reporting during our most recent fiscal quarter ended September 30, 2019 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

None.

Item 1A. Risk Factors

You should carefully consider the following risk factors, as well as the other information in this report, before deciding whether to purchase, hold or sell shares of our common stock. The occurrence of any of the following risks could harm our business, financial condition, results of operations and/or growth prospects or cause our actual results to differ materially from those contained in forward-looking statements we have made in this report and those we may make from time to time. You should consider all of the factors described in this section as well as the other information in our Annual Report on Form 10-K including our audited financial statements and the related notes and "Management's Discussion and Analysis of Financial Condition and Results of Operations" when evaluating our business. The risk factors set forth below that are marked with an asterisk (*) contain changes to the similarly titled risk factors included in Item 1A of our Annual Report on Form 10-K. If any of the following risks actually occurs, our business, financial condition, results of operations and future growth prospects would likely be materially and adversely affected. In these circumstances, the market price of our common stock would likely decline and you may lose all or part of your investments. Additional risks and uncertainties not presently known to us or that we currently deem immaterial also may impair our business operations.

Risks related to our business and industry

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

Developing gene therapy products is expensive. As of September 30, 2019, our cash, cash equivalents and marketable securities were $55.3 million. Based on our operating plans, cash, cash equivalents and marketable securities may not be sufficient to fund operations for the next 12 months. As a result, there is substantial doubt about our ability to continue as a going concern. In November 2018, we entered into an Equity Distribution Agreement with Citigroup Global Markets Inc., or Citigroup, pursuant to which we may sell and issue shares of our common stock having an aggregate offering price of up to $30.0 million from time to time through Citigroup, as our sales agent, or the ATM facility. Through September 30, 2019, we have sold 760,089 shares of common stock under our ATM facility and received net proceeds of $7.7 million. Other than our ATM facility, we do not have any committed external source of funds. We may also consider new collaborations or selectively partner our technology or programs. In any event, we will require additional capital to obtain regulatory approval for, and to commercialize, our product candidates. Raising funds in the current economic environment may present additional challenges.

We cannot guarantee that future financing will be available in sufficient amounts or on terms acceptable to us, if at all. Subject to limited exceptions, our amended and restated loan and security agreement, or Loan Agreement, also prohibits us from incurring indebtedness without the prior written consent of the lenders. Moreover, the terms of any financing may adversely affect the holdings or the rights of our stockholders and the issuance of additional securities, whether equity or debt, by us, or the possibility of such issuance, may cause the market price of our shares to decline. The sale of additional equity or convertible securities would dilute all of our stockholders. The incurrence of indebtedness would result in increased fixed payment obligations and we may be required to agree to certain restrictive covenants, such as limitations on our ability to incur additional debt, limitations on our ability to acquire, sell or license intellectual property rights and other operating restrictions that could adversely impact our ability to conduct our business. We could also be required to seek funds through arrangements with collaborative partners or otherwise at an earlier stage than otherwise would be desirable and we may be required to relinquish rights to some of our technologies or product candidates or otherwise agree to terms unfavorable to us, any of which may have a material adverse effect on our business, operating results and prospects.

If we are unable to raise additional capital when required or on acceptable terms, we may be required to scale back or discontinue the advancement of product candidates, further reduce headcount, reorganize, merge with another entity, file for bankruptcy, or cease operations.

We have incurred significant losses since our inception and anticipate that we will continue to incur significant losses for the foreseeable future.*

We are not profitable and have incurred net losses in each year since our inception in 2007, including net losses of $49.0 million for the year ended December 31, 2018 and $52.9 million for the nine months ended September 30, 2019. As of September 30, 2019, we had an accumulated deficit of $268.8 million.

We have devoted most of our financial resources to research and development, including our clinical, preclinical and platform development activities. To date, we have financed our operations primarily through the private placement of our convertible preferred stock, public offerings of our common stock, term loans, the issuance of convertible promissory notes and upfront and milestone payments under our license and collaboration agreements. We expect to continue to incur operating losses for the foreseeable future. The amount of our future net losses will depend, in part, on the rate of our future expenditures and our ability to generate revenue. We conducted a randomized, controlled Phase 3 clinical trial (Toca 5) of Toca 511 & Toca FC in patients with recurrent HGG, which was designed to serve as a registrational trial. We received the data from this trial in September 2019. At the final analysis, the trial missed the primary endpoint of overall survival compared to the standard of care treatment (11.1 months median compared to 12.2 months, HR=1.06, p=0.6154). In addition, all secondary endpoints showed no meaningful difference between the arms of the trial. It will be several years, if ever, before we have a product candidate ready for regulatory approval and commercialization. Even if we or our strategic partners succeed in obtaining regulatory approval and commercializing one or more of our product candidates, we will continue to incur substantial research and development and other expenditures to develop and market additional product candidates. We may encounter unforeseen expenses, difficulties, complications, delays and other unknown factors that may adversely affect our business. The size of our future net losses will depend, in part, on the rate of future growth of our expenses and our ability to generate revenue. Our prior losses and expected future losses have had and will continue to have an adverse effect on our stockholders' equity and working capital.

Failure to successfully develop and obtain approval of our lead product candidate, Toca 511 & Toca FC, or our other future product candidates could adversely affect our future success.*

Our business and future success is substantially dependent on our ability to obtain regulatory approval of and then successfully commercialize our lead product candidate, Toca 511 & Toca FC which is in clinical development. All of our product candidates, including Toca 511 & Toca FC, will require additional clinical and nonclinical development, regulatory review and approval in one or more jurisdictions, substantial investment, access to sufficient pre-commercial and commercial manufacturing capacity and significant marketing efforts before we can generate any revenue from product sales. In addition, because Toca 511 & Toca FC is our most advanced product candidate, and because all of our other future product candidates will likely be based on similar technology, if Toca 511 & Toca FC encounters safety or efficacy problems, developmental delays, regulatory issues or other problems, our development plans and business for our other product candidates would be significantly harmed.

We conducted a randomized, controlled Phase 3 clinical trial (Toca 5) of Toca 511 & Toca FC in patients with recurrent HGG, which was designed to serve as a registrational trial. The final analysis from this trial was disclosed in September 2019. At the final analysis, the trial missed the primary endpoint of overall survival compared to the standard of care treatment (11.1 months median compared to 12.2 months, HR=1.06, p=0.6154). In addition, all secondary endpoints showed no meaningful difference between the arms of the trial. The safety, tolerability and adverse event profile of Toca 511 & Toca FC was as expected for this patient population.

Immunotherapy, gene therapy and biopharmaceutical product development is a highly speculative undertaking and involves a substantial degree of uncertainty. We have never generated any revenue from product sales and may never be profitable.*

Since our inception in August 2007, we have devoted most of our efforts to developing our gene therapy platform and our lead product candidate, Toca 511 & Toca FC. We have not completed development of any products. Our ability to generate revenue and achieve profitability depends in large part on our ability, alone or with partners, to successfully complete the development of, obtain the necessary regulatory approvals for, and commercialize product candidates. We do not anticipate generating revenues from sales of products for the foreseeable future. Our ability to generate future revenues from product sales depends heavily on our success in:

- completing clinical trials through all phases of clinical development of our current and future product candidates;
- seeking and obtaining marketing approvals for product candidates that successfully complete clinical trials;
- launching and commercializing product candidates for which we obtain marketing approval with a partner or, if launched independently, successfully establishing a sales force, marketing and distribution infrastructure;
- obtaining coverage and adequate reimbursement for commercialized products from third-party payors;
- identifying and developing new product candidates;
- progressing our preclinical programs into human clinical trials;
- establishing and maintaining supply and manufacturing relationships with third parties;
- maintaining, protecting, expanding and enforcing our intellectual property; and
- attracting, hiring and retaining qualified personnel.

Because of the numerous risks and uncertainties associated with gene therapy product development, we are unable to predict the timing or amount of increased expenses or when we will be able to achieve or maintain profitability, if ever. In addition, our expenses could increase beyond expectations if we are required by the U.S. Food and Drug Administration, or FDA, or foreign regulatory agencies, to perform studies and clinical trials in addition to those that we currently anticipate or if there are any delays in the development of any of our product candidates. If one or more of the product candidates that we develop is approved for commercial sale, we anticipate incurring significant costs associated with commercializing such product candidates. 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, which may not be available to us on favorable terms, if at all. Even 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 depress the value of our company and could impair our ability to raise capital, expand our business, maintain our research and development efforts, diversify our product offerings or even continue our operations. A decline in the value of our company could also cause stockholders to lose all or part of their investment.

Our gene therapy product candidates are based on novel technology, which makes it difficult to predict the time and cost of product candidate development.*

We have concentrated our product research and development efforts on our gene therapy platform, and our future success depends on the successful development of this therapeutic approach. There can be no assurance that any development problems we experience in the future related to our gene therapy platform will not cause significant delays or unanticipated costs, or that such development problems can be solved. We may also experience delays in developing a sustainable, reproducible and scalable manufacturing process or transferring that process to commercial partners, or developing or validating product release assays in a timely manner, which may prevent us from completing our clinical trials or commercializing our products on a timely or profitable basis, if at all.

In addition, the clinical trial requirements of the FDA, the European Medicines Agency, or EMA, and other regulatory agencies 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 potential products. The regulatory approval process for novel product candidates such as ours can be more expensive and take longer than for other, better known or extensively studied pharmaceutical or other product candidates. The limited precedent for gene therapy approvals makes it difficult to determine how long it will take or how much it will cost to obtain regulatory approvals for our product candidates in the United States, Europe or other territories.

Regulatory requirements governing gene therapy products have changed frequently and may continue to change in the future. Gene therapy clinical trials conducted at institutions that receive funding for recombinant DNA research from the U.S. National Institutes of Health, or the NIH, are also subject to review by the institution's institutional biosafety committees, or IBC, in addition to the institution's institutional review board, or IRB, to assess the safety of the study before a clinical trial can begin. We have received from time to time questions from the FDA regarding investigational new drug application, or IND, submissions and clinical protocols for Toca 511 & Toca FC. We believe that we have adequately addressed these questions, some of which have caused, in the past, some delays in our clinical trials. Although the FDA decides whether individual gene therapy protocols may proceed, the IRB and IBC review process can impede the initiation of a clinical trial, even if the FDA has reviewed the study and approved its initiation. Conversely, the FDA can put an IND on a partial or complete clinical hold even if the IRB and IBC have provided a favorable review. Our trials have, in the past, been put on hold for reasons including suspected serious adverse events, which resulted in delays of our trials. In addition, adverse developments in clinical trials of gene therapy products conducted by others may cause the FDA or other regulatory bodies to change the requirements for performing studies or for obtaining approval of any of our product candidates.

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 our 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. Delay or failure to obtain, or unexpected costs in obtaining, the regulatory approval necessary to bring a potential product to market could decrease our ability to generate sufficient revenue to maintain our business.

We expect to continue to rely on third parties to distribute, manufacture and perform release testing for our vectors, product candidates and other key materials and if such third parties do not carry out their contractual duties or meet expected deadlines, we may not be able to obtain regulatory approvals for our product candidates.

We intend to continue to rely on third-party contract manufacturing organizations, or CMOs, to produce our vectors, product candidates and other key materials and on third-party contract testing organizations, or CTOs, for the establishment and performance of validated product release assays, but we have not entered into commercial supply agreements with any such CMOs or CTOs. Additionally, any CMO may not have experience or availability to produce adequate product candidates at commercial levels and may

not achieve the necessary regulatory approvals or produce our vectors and products at the quality, quantities, locations and timing needed to support commercialization. We may change our manufacturing process from the current defined media process to a different defined media process, or from its current equipment to different equipment, or our cell line or vector and there can be no guarantee that the regulatory authorities will approve this new process in a timely manner, or ever. Also, as a consequence of a manufacturing change, there may be a requirement to do more preclinical safety or efficacy studies, develop new manufacturing and release assays and/or repeat all or part of the ascending dose safety study in animals or humans. Regulatory requirements ultimately imposed could adversely affect our ability to test, manufacture or market products.

We have not yet secured manufacturing capabilities for commercial quantities of our viral vector but we intend to rely on third-party manufacturers for commercialization. We may be unable to negotiate binding agreements with our manufacturers to support our commercialization activities at commercially reasonable terms.

No manufacturer we know of currently has the direct experience or the demonstrated ability to produce our vectors and product candidates at reasonable commercial levels or under full commercial requirements. We have developed in-house, a more scalable manufacturing process for Toca 511, which we have transferred to one or more CMOs. We may run into technical or scientific issues related to manufacturing or development that we may be unable to resolve in a timely manner or with available funds. Further, we have not completed the characterization and validation activities necessary for commercial and regulatory approvals. If our manufacturing and testing partners do not satisfy such regulatory requirements, our commercialization efforts may be harmed.

Similarly, we currently have limited manufacturers of the active pharmaceutical ingredient for Toca FC and final drug product. We also rely on outside contractors to perform validated release testing for Toca FC. Currently we have not fully validated production of the drug product, Toca FC.

Even if we have developed manufacturing processes for Toca 511 & Toca FC and successfully implement them at third-party manufacturers, if such third-party manufacturers are unable to produce viral vectors and our product candidates in the necessary quantities, or in compliance with current good manufacturing practices, or cGMP, or in compliance with pertinent regulatory requirements, and within our planned time frame and cost parameters, the development and sales of our products, if approved, may be materially harmed. The facilities used by our contract manufacturers to manufacture our product candidates must be approved by the FDA pursuant to inspections that will be conducted after we submit our biologics license application, or BLA, to the FDA. We do not directly control the manufacturing process of, and are completely dependent on, our contract manufacturing partners for compliance with cGMPs for the manufacture of our product candidates. If our contract manufacturers cannot successfully manufacture material that conforms to our specifications and the strict regulatory requirements of the FDA or others, they will not be able to secure and/or maintain regulatory approval for their manufacturing facilities. In addition, we have no control over the ability of our contract manufacturers to maintain adequate quality control, quality assurance and qualified personnel. If the FDA or a comparable foreign regulatory authority does not approve these facilities for the manufacture of our product candidates or if it withdraws any such approval in the future, we may need to find alternative manufacturing facilities, which would significantly impact our ability to develop, obtain regulatory approval for or market our product candidates, if approved. In addition, any failure to achieve and maintain compliance with these laws, regulations and standards could subject us to the risk that we may have to suspend the manufacturing of our product candidates or that obtained approvals could be revoked, which would adversely affect our business and reputation.

In addition, any significant disruption in our supplier relationships could harm our business. We source key materials, devices and equipment from third parties, either directly through agreements with suppliers or indirectly through our manufacturers who have agreements with suppliers. There are a small number of suppliers for certain key materials, equipment, software and components that are used to manufacture our product candidates. Such suppliers may not sell these key materials to our manufacturers at the times or quantities we need them or on commercially reasonable terms. We may not have any control over the process, quality or timing of the acquisition of these key materials by our manufacturers.

We also expect to rely on other third parties to store and distribute our vectors and products for our clinical trials. Any performance failure on the part of our distributors could delay clinical development or marketing approval of our product candidates or commercialization of our products, if approved, producing additional losses and depriving us of potential product revenue.

The FDA regulatory approval process is lengthy and time-consuming, and we may experience significant delays in the clinical development and regulatory approval of our product candidates. If we are ultimately unable to obtain regulatory approval for our product candidates, our business will be substantially harmed.

The time required to obtain approval by the FDA and comparable foreign authorities is unpredictable but typically takes many years following the commencement of clinical trials and depends upon numerous factors, including the substantial discretion of the regulatory authorities. In addition, approval policies, regulations or the type and amount of clinical data necessary to gain approval may change during the course of a product candidate's clinical development and may vary among jurisdictions. We have not obtained

regulatory approval for any product candidate and it is possible that none of our existing product candidates or any product candidates we may seek to develop in the future will ever obtain regulatory approval.

We have not previously submitted a BLA to the FDA, or similar approval filings to comparable foreign authorities. A BLA must include extensive preclinical and clinical data and supporting information to establish the product candidate's safety, purity and potency for each desired indication. The BLA must also include significant information regarding the chemistry, manufacturing and controls for the product. Clinical testing is expensive, time-consuming and uncertain as to outcome. We have experienced in the past delays in the commencement and completion of our clinical trials. We cannot guarantee that any clinical trials will be conducted as planned or completed on schedule, if at all. A failure of one or more clinical trials can occur at any stage of testing. In addition to challenges related to patient enrollment, other events that may prevent successful or timely completion of clinical development include:

- the availability of financial resources to commence and complete our planned clinical trials;
- delays in reaching a consensus with clinical investigators on study design;
- delays in reaching a consensus with regulatory agencies on study design or approval from regulatory authorities to commence a trial;
- reaching agreement on acceptable terms with prospective clinical trial sites, the terms of which can be subject to extensive negotiation and may vary significantly among different clinical trial sites;
- delays in obtaining required IRB and/or biologic safety committee approval at each clinical trial site;
- imposition of a clinical hold by regulatory agencies, after an inspection of our clinical trial operations or study sites, or otherwise;
- failure by our contract research organizations, or CROs, other third parties or us to adhere to clinical trial requirements;
- failure to perform in accordance with the FDA's good clinical practices, or GCP, or applicable regulatory guidelines in other countries;
- failure to adequately acquire, preserve and quality assure clinical trial data;
- delays in the testing, validation, manufacturing and delivery of our product candidates to the clinical sites;
- inadequate shipping or storage of our products, resulting in loss of activity;
- delays in having patients complete participation in a study or return for post-treatment follow-up;
- clinical trial sites dropping out of a study;
- changes in legislation or regulatory requirements and guidance that require amending or submitting new clinical protocols; and
- technical equipment and/or operating room supply limitations at a clinical trial site.

We could also encounter delays if physicians encounter unresolved ethical issues associated with enrolling patients in clinical trials of our product candidates in lieu of prescribing existing treatments that have established safety and efficacy profiles. Further, a clinical trial may be suspended or terminated by us, the IRBs for the institutions in which such clinical trials are being conducted, the Data Safety Monitoring Committee for such clinical trial, the FDA or other regulatory authorities due to a number of factors, including failure to conduct the clinical trial in accordance with regulatory requirements or our clinical protocols, inspection of the clinical trial operations or clinical trial site by the FDA or other regulatory authorities resulting in the imposition of a clinical hold, unforeseen safety issues or adverse side effects, failure to demonstrate a benefit from using a product candidate, changes in governmental regulations or administrative actions or lack of adequate funding to continue the clinical trial. If we experience termination of, or delays in the completion of, any clinical trial of our product candidates, the commercial prospects for our product candidates will be harmed, and our ability to generate product revenue will be delayed. In addition, any delays in completing our clinical trials will increase our costs, slow down our product development and approval process and jeopardize our ability to commence product sales and generate revenue.

Any inability to successfully complete preclinical and clinical development could result in additional costs to us or impair our ability to generate revenues from product sales, regulatory and commercialization milestones and royalties. 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 could also shorten any periods during which we may have patent protection rights to commercialize our product candidates or allow our competitors to bring products into clinical trials or to market before we

do, which could impair our ability to successfully commercialize our product candidates and may harm our business and results of operations.

Our clinical trials may fail to demonstrate safety and efficacy and any of our product candidates could be associated with undesirable side effects or other properties, which would prevent or delay regulatory approval and commercialization.*

Before obtaining marketing approval from regulatory authorities for the sale of our product candidates, we or our strategic partner must conduct extensive clinical trials to demonstrate the safety and efficacy of the product candidates in humans. Failure can occur at any time during a clinical trial process. The results of preclinical studies and early clinical trials of our product candidates may not be predictive of the results of later-stage clinical trials. There is typically an extremely high rate of attrition from the failure of product candidates proceeding through clinical trials. Product candidates in later stages of clinical trials may fail to show the desired safety and efficacy profile despite having progressed through preclinical testing and initial clinical trials. Most product candidates that commence clinical trials are never approved as products.

In addition, from time to time, we may publish interim, "top-line," initial, or preliminary data from our clinical studies. Interim data from clinical trials are subject to the risk that one or more of the clinical outcomes may materially change as patient enrollment continues and more patient data becomes available. Preliminary, initial, or "top-line" data also remain subject to audit and verification procedures that may result in the final data being materially different from the preliminary data we previously published. As a result, interim, "top-line", initial, and preliminary data should be viewed with caution until the final data are available. Adverse changes between preliminary, initial, "top-line" or interim data and final data could significantly harm our business prospects. Patients treated with our product candidates may also be undergoing surgical, radiation and chemotherapy treatments, which can cause side effects or adverse events that are unrelated to our product candidate, but may still impact the success of our clinical trials. Additionally, our product candidates could potentially cause other adverse events that have not yet been predicted. The inclusion of critically ill patients in our or our partner's clinical trials may result in deaths or other adverse medical events due to other therapies or medications that such patients may be using or due to the gravity of such patients' illnesses. Patients who will be administered Toca 511 & Toca FC in the high grade glioma, or HGG, clinical trials are seriously or terminally ill and some of them may have immune impairment related to their treatment with temozolomide and dexamethasone. It is expected that some of the patients will die or experience major clinical events such as strokes, hydrocephalus, infections, brain swelling and pulmonary emboli either during the course of our or our partner's clinical trials or after such trials, which has occurred in the past. In some patients with evidence of drug activity from Toca 511 & Toca FC, new lesions have been observed, some of which continue to grow even with continued Toca FC treatment.

It is possible that our retroviral replicating vector, or RRV, product candidates will spread to healthy tissues and result in unknown side effects, and that any anticipated or unanticipated side effects may occur at doses required to achieve clinically relevant efficacy, which could prohibit or delay commercialization of our product candidates. Alternatively, our RRV product candidates might not spread rapidly enough through the tumor or transfer sufficient genetic material to the tumor to demonstrate efficacy sufficient for regulatory approval. In preclinical studies in rodent models, we observed that our vectors do not initially infect tumors in some locations as well as they infect tumors in other locations, which may limit treatment with our future product candidates to a limited number of cancer locations. Further, it is possible that the RRV might not spread fast enough through the brain cancer to have a beneficial effect or that the virus might not be able to reach certain parts of the tumor due to prior surgical removal of contiguous cancer tissue or from scarring resulting from surgery, chemotherapy, radiation or spontaneous tumor necrosis (cell death) or due to mechanical limitations such as the inability to insert the needle accurately into tissue bearing the tumor; the inability to push enough RRV volume into a tumor; the rapid diffusion of RRV from the injection site due to high intratumor pressure or due to the communication with the ventricular space, external cerebral spinal fluid or the entry into veins; or the inability to insert the needle into the tumor without damaging vital brain structures. It is possible that the cancers which we seek to treat with our product candidates will be or become resistant to infection with the virus or become resistant to the 5-FU (5-fluorouracil) produced from Toca FC, due to mutation within the cancer cells genes or due to mutation of Toca 511, including loss of the therapeutic gene, cytosine deaminase.

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

- be delayed in obtaining marketing approval for our product candidates, if at all;
- obtain approval for indications or patient populations that are not as broad as intended or desired;
- obtain approval with labeling that includes significant use or distribution restrictions or safety warnings;
- be subject to changes with the way the product is administered;
- be required to perform additional clinical trials to support approval or be subject to additional post-marketing testing requirements;

- have regulatory authorities withdraw their approval of the product or impose restrictions on its distribution in the form of a modified Risk Evaluation and Mitigation Strategy, or REMS;
- be subject to product liability or other litigation claims; or
- experience damage to our reputation.

In third-party clinical trials involving other viral vectors for gene therapy, some patients experienced serious adverse events, including the development of leukemia due to vector-related insertional oncogenesis and death. If our vectors demonstrate a similar effect, we may be required to halt or delay clinical development of our product candidates.

Existing data on the safety and efficacy of gene therapy is very limited and sometimes include historically poor clinical efficacy of previous non-replicating gene therapy products. In addition, there have been publicized safety issues associated with previous gene therapy products in third-party clinical trials, including patient deaths. The results of preclinical and clinical trials performed for our product candidates do not definitively predict safety or efficacy in humans. Possible serious side effects of other viral vector-based gene therapy therapies in general include uncontrolled viral infections and the development of cancer, particularly lymphoma or leukemia.

A significant risk in any gene therapy product based on viral vectors that integrate into the host genome at measurable frequencies is that the vector will insert near cancer-linked oncogenes leading to uncontrolled clonal proliferation of mature cancer cells in the patient. A potential clinical concern for gene therapy using retroviral vectors has been the possibility of insertional mutagenesis by the vectors, leading to malignant transformation of transduced cells (i.e., cancer). Because our replicating retroviruses produce viral antigens, these foreign proteins could serve as a target for immune activation against virally-infected cells and inflammation, which is not a feature of non-replicating retroviral vectors. In addition, we have not, and do not plan to, treat patients with severe immunodeficiency with our product candidates. Further, with our lead product candidate, Toca FC kills the virally-infected cells and presents the antigens. We believe that we have not observed oncogenesis in the patients treated in our clinical trials to date for these reasons. Our future product candidates are also designed to activate the immune system against virally-infected cells.

It is possible Toca 511 may spread to non-tumor tissue. We have detected transient and low levels of viral sequences in the saliva of several patients. The risk of insertional mutagenesis or oncogenesis remains a significant concern for gene therapy, and we cannot provide any assurance that it will not occur in any of our current, planned or future clinical trials. There is also the potential risk of delayed adverse events following exposure to gene therapy products due to persistent biological activity of the genetic material or other components of products used to carry the genetic material. If any such adverse events occur, further advancement of our clinical trials could be halted or delayed, which would have a material adverse effect on our business and operations.

We may not be successful in our efforts to identify or discover additional product candidates from our gene therapy platform.

The success of our business depends primarily upon our ability to identify, develop and commercialize products based on our gene therapy platform. Although our Toca 511 & Toca FC product candidate is currently in clinical development, our research programs may fail to identify other potential product candidates for clinical development. Our research methodology may be unsuccessful in identifying potential product candidates, or our potential product candidates may be shown to have harmful side effects or may have other characteristics that may make the products unmarketable or unlikely to receive marketing approval. If any of these events occur, we may be forced to abandon our development efforts for a program or programs, which would have a material adverse effect on our business and could potentially cause us to cease operations.

We rely, and 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, it may harm our business.*

We rely on CROs and clinical trial sites to ensure our clinical trials are conducted properly and on time. While we have agreements governing their activities, we may have limited influence over their actual performance. We control only certain aspects of our CROs' activities. Nevertheless, we are responsible for ensuring that each of our clinical trials is conducted in accordance with the applicable protocol, legal, regulatory and scientific standards, and our reliance on the CROs does not relieve us of our regulatory responsibilities.

We and our CROs are required to comply with the GCPs for conducting, recording, auditing and reporting the results of clinical trials 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. The FDA enforces these GCPs through periodic inspections of study sponsors, principal investigators and clinical trial sites. If we or our CROs 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. Upon inspection, the FDA may determine that our clinical trials did not comply with GCPs. In addition, our clinical trials will require a sufficient number of test subjects to evaluate the safety and effectiveness of our product candidates. Accordingly, if our CROs 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.

Our CROs are not our employees, and we are not able to directly monitor whether or not they devote sufficient time and resources to our clinical and nonclinical programs. These CROs 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 CROs 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 their 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 would be harmed, our costs could increase and our ability to generate revenues could be delayed.

We may have difficulty enrolling patients in our clinical trials, which could delay or prevent development of our product candidates.*

Identifying and qualifying patients to participate in clinical trials of our product candidates is critical to our success. The timing of our clinical trials depends on the speed at which we can recruit patients to participate in testing our product candidates. We have experienced delays in some of our clinical trials in the past due to difficulties with enrollment and we may experience similar delays in the future. If patients are unwilling to participate in our clinical trials because of negative publicity from adverse events in the industry or in the trials for other third party product candidates, or for other reasons, including competitive clinical trials for similar patient populations, the timeline for recruiting patients, conducting studies and obtaining regulatory approval of potential products may be delayed. These delays could result in increased costs, delays in advancing our product development, delays in testing the effectiveness of our technology or termination of the clinical trials altogether.

We or our clinical trial sites may not be able to identify, recruit and enroll a sufficient number of patients, or those with the required or desired characteristics in a clinical trial, to complete our clinical trials in a timely manner. Patient enrollment is affected by factors including:

- severity of the disease under investigation;
- design of the clinical trial protocol, including the fact that certain of our clinical trials are randomized to current treatments;
- size of the patient population;
- eligibility criteria for the clinical trial in question;
- perceived risks and benefits of the product candidate under study;
- general level of excitement for the treatment approach;
- comments on social media;
- proximity and availability of clinical trial sites for prospective patients;
- availability of competing therapies and clinical trials;
- efforts to facilitate timely enrollment in clinical trials;
- patient referral practices of physicians; and
- ability to monitor patients adequately during and after treatment.

The eligibility criteria of our clinical trials will limit the pool of available trial participants. Additionally, the process of finding and diagnosing patients may prove costly. Finally, our treatment necessitates that the patient be near one of our clinical trial sites, since periodic follow-up visits at the clinical trial site are contemplated in the protocols.

We currently plan to seek initial marketing approval in the United States and subsequently other pharmaceutical markets. We may not be able to initiate or continue clinical trials if we cannot enroll a sufficient number of eligible patients to participate in the clinical trials required by the FDA, the EMA or other regulatory agencies. 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 CROs and physicians;
- different standards for the conduct of clinical trials;

- our inability to locate qualified local consultants, physicians and partners; and
- the potential burden of complying with a variety of foreign laws, medical standards and regulatory requirements, including the regulation of pharmaceutical and biotechnology products and treatments.

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 clinical trials, any of which would have an adverse effect on our business.

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

Because we rely on third parties to manufacture our vectors and our product candidates, and because we collaborate with various organizations and academic institutions on the advancement of our gene therapy platform, we must, at times, share trade secrets with them. We seek to protect our proprietary technology in part by entering into confidentiality agreements and, if applicable, material transfer agreements, collaborative research agreements, consulting agreements or other similar agreements with our manufacturers, collaborators, advisors, employees and consultants prior to beginning research or disclosing proprietary information. These agreements typically limit the rights of the third parties to use or disclose our confidential information, such as trade secrets. Despite the contractual provisions employed when working with third parties, the need to share trade secrets and other confidential information increases the risk that such trade secrets become known by our competitors, are inadvertently incorporated into the technology of others, are used inappropriately to create new inventions or are disclosed or used in violation of these agreements. Given that our proprietary position is based, in part, on our know-how and trade secrets, a competitor's discovery of our trade secrets or other unauthorized use or disclosure would impair our competitive position and may have a material adverse effect on our business.

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

We are dependent on ApolloBio to develop and commercialize Toca 511 & Toca FC within the greater China region, including mainland China, Hong Kong, Macao and Taiwan. Failure of ApolloBio or any other third parties to successfully develop and commercialize Toca 511 & Toca FC in the applicable jurisdictions could have a material adverse effect on our business.

We have granted ApolloBio an exclusive license to develop and commercialize Toca 511 & Toca FC within the greater China region, including mainland China, Hong Kong, Macao and Taiwan. We have limited contractual rights to force ApolloBio to invest significantly in the development and commercialization of Toca 511 & Toca FC.

In the event that ApolloBio or any other third party with any future development and commercialization rights to any of our product candidates fails to adequately develop and commercialize those product candidates because they lack adequate financial or other resources, decide to focus on other initiatives or otherwise, our ability to successfully develop and commercialize our product candidates in the applicable jurisdictions would be limited, which would adversely affect our business, financial condition, results of operations and prospects. In addition, our license agreement with ApolloBio may be terminated by either party upon a material breach by the other party that remains uncured following 60 days (or, with respect to any payment breach, 10 days) after the date of written notice of such breach, may be terminated by ApolloBio at any time by providing us 90 days' prior written notice and may be terminated by us upon written notice to ApolloBio under specified circumstances if ApolloBio challenges the licensed patent rights. If we or ApolloBio terminate our license agreement, our ability to develop and commercialize Toca 511 & Toca FC within the greater China region, including mainland China, Hong Kong, Macao and Taiwan, would be materially harmed.

Any adverse developments that occur during any clinical trials conducted by ApolloBio may affect our ability to obtain regulatory approval or commercialize Toca 511 & Toca FC.

ApolloBio retains the rights to develop and commercialize Toca 511 & Toca FC in the greater China region, including mainland China, Hong Kong, Macao and Taiwan. If serious adverse events occur during any clinical trials ApolloBio decides to conduct with respect to Toca 511 & Toca FC, the FDA and other regulatory authorities may delay, limit or deny approval of Toca 511 & Toca FC or require us to conduct additional clinical trials as a condition to marketing approval, which would increase our costs. If we receive FDA approval for Toca 511 & Toca FC and a new and serious safety issue is identified in connection with clinical trials conducted by ApolloBio, the FDA and other regulatory authorities may withdraw their approval of the product or otherwise restrict our ability to market and sell our product. In addition, treating physicians may be less willing to administer our product due to concerns over such adverse events, which would limit our ability to commercialize Toca 511 & Toca FC. ApolloBio is not currently conducting any clinical trials of Toca 511 & Toca FC.

We face intense competition and rapid technological change and the possibility that our competitors may develop therapies that are more advanced or effective than ours, which may adversely affect our financial condition and our ability to successfully commercialize our product candidates.

We are engaged in developing gene therapies and cancer immunotherapies, which are rapidly evolving and fiercely competitive fields. A wide variety of institutions in the United States and internationally, including major multinational pharmaceutical companies, specialty biotechnology companies, academic research departments and public and private institutions, are actively developing potentially competitive technology and products. We face substantial competition from biotechnology and pharmaceutical companies developing products in immunotherapy and our initial proposed indication. Our competitors generally fall into the following categories: companies developing checkpoint inhibitors; companies developing immunotherapies; companies aimed at stimulating immune responses; companies developing CAR and TCR T cells; companies developing oncolytic virus-based technology; and companies with a focus on HGG.

Many of our competitors have substantially greater financial, technical and other resources, such as larger research and development staff and experienced marketing and manufacturing organizations. Accordingly, our competitors may be more successful than us in obtaining approval for treatments and achieving widespread market acceptance, rendering our treatments obsolete or non-competitive. These companies also compete with us in recruiting and retaining qualified scientific and management personnel, establishing clinical trial sites and patient registration for clinical trials and acquiring technologies complementary to, or necessary for, our programs. Smaller or early-stage companies may also prove to be significant competitors, particularly through collaborative arrangements with large and established companies.

If these competitors develop and commercialize more effective, safer or less toxic products than us or if they obtain regulatory approval before us in key geographies, our commercial opportunities could be substantially limited. In addition, adverse clinical outcomes or similar events at gene therapy companies in the past have adversely affected other companies in this field and could also do so in the future at our company.

Even if we obtain regulatory approval of our product candidates, the products may not gain market acceptance among physicians, patients, hospitals, cancer treatment centers, third-party payors and others in the medical community.

Ethical, social and legal concerns about gene therapy and genetic research could result in additional regulations restricting or prohibiting the products and processes we may use. Even with the requisite approvals, the commercial success of our product candidates will depend in part on the medical community, patients, and third-party payors accepting gene therapy products in general, and our product candidates in particular, as medically useful, cost-effective and safe. Any product that we bring to the market may not gain market acceptance by physicians, patients, third-party payors and others in the medical community. 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 these product candidates, if approved for commercial sale, will depend on a number of factors, including:

- the clinical indications for which our product candidates are approved;
- physicians, hospitals, cancer treatment centers and patients considering our product candidates as a safe and effective treatment;
- the potential and perceived advantages of our product candidates over alternative treatments;
- the prevalence and severity of any side effects;
- product labeling or product insert requirements of the FDA or other regulatory authorities;
- limitations or warnings contained in the labeling approved by the FDA;

- the timing of market introduction of our product candidates as well as competitive products;
- the pricing and cost-effectiveness of our product candidates as well as the cost of treatment in relation to alternative treatments;
- the availability of favorable coverage and adequate reimbursement by third-party payors and government authorities;
- the willingness of patients to pay out-of-pocket in the absence of coverage or adequate reimbursement by third-party payors, including government authorities;
- the willingness, ability and availability of healthcare providers that can comply with the transportation, handling, and temperature-controlled storage requirements associated with our product candidates;
- relative convenience and ease of administration, including as compared to alternative treatments and competitive therapies; and
- the effectiveness of our sales and marketing efforts.

Even if a potential product displays a favorable efficacy and safety profile in preclinical and clinical trials, market acceptance of the product will not be known until after it is launched. Our efforts to educate the medical community and third-party payors on the benefits of the product candidates may require significant resources and may never be successful. Such efforts to educate the marketplace may require more resources than are required by the conventional technologies marketed by our competitors and may be restricted by the allowed label.

We are highly dependent on our key personnel, and if we are not successful in attracting and retaining highly qualified personnel, we may not be able to successfully implement our business strategy.

Our ability to compete in the highly competitive biotechnology and pharmaceutical industries depends upon our ability to attract and retain highly qualified managerial, scientific and medical personnel. We are highly dependent on our management, scientific and medical personnel. The loss of the services of any of our executive officers, other key employees and other scientific and medical advisors, and our inability to find suitable replacements, could result in delays in product development and harm our business.

To induce valuable employees to remain at our company, in addition to salary and cash incentives, we have provided stock options that vest over time. The value to employees of stock options that vest over time may be significantly affected by movements in our stock price that are beyond our control and may at any time be insufficient to counteract more lucrative offers from other companies. Despite our efforts to retain them, valuable employees and members of our management, scientific and development teams may terminate their employment with us at any time, with or without notice. We do not maintain “key man” insurance policies on the lives of any of our executive officers or other employees. Our success also depends on our ability to continue to attract, retain and motivate highly skilled scientific and medical personnel.

We may use our financial and human resources to pursue a particular research program or product candidate and fail to capitalize on programs or product candidates that may be more profitable or for which there is a greater likelihood of success.

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 resource allocation decisions may cause us to fail to capitalize on viable commercial products or profitable market opportunities. Our spending on current and future research and development programs for product candidates may not yield any commercially viable products. If we do not accurately evaluate the commercial potential or target market for a particular product candidate, we may relinquish valuable rights to that product candidate through strategic collaboration, licensing or other royalty arrangements in cases in which it would have been more advantageous for us to retain sole development and commercialization rights to such product candidate, or 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.

We currently have a limited marketing and sales organization. If we are unable to expand our marketing and sales capabilities or enter into agreements with third parties to market and sell our product candidates, we may not be able to generate product revenue.*

We currently have limited sales, marketing and distribution capabilities. At the appropriate time, if ever, we would build a commercial infrastructure which would require significant capital expenditures, management resources and time. ApolloBio retains the rights to develop and commercialize Toca 511 & Toca FC in the greater China region, including mainland China, Hong Kong, Macao and Taiwan. We may build our own commercial infrastructure in other territories or consider additional opportunities to enter into out-licensing or co-promotion agreements with other pharmaceutical or biotechnology companies to develop and/or

commercialize our product candidates outside the United States. We will have to compete with other pharmaceutical and biotechnology companies to recruit, hire, train and retain marketing and sales personnel.

If we are unable or decide not to expand our internal sales, marketing and distribution capabilities, we will pursue collaborative arrangements regarding the sales and marketing of our products, however, there can be no assurance that we will be able to establish or maintain such collaborative arrangements, or if we are able to do so, that they will have effective sales forces. Any revenue we receive will depend upon the efforts of such third parties, which may not be successful. We may have little or no control over the marketing and sales efforts of such third parties, and our revenue from product sales may be lower than if we had commercialized our product candidates ourselves. We also face competition in our search for third parties to assist us with the sales and marketing efforts of our product candidates.

There can be no assurance that we will be able to develop in-house sales and distribution capabilities or establish or maintain relationships with third-party collaborators to commercialize any product in the United States or elsewhere.

A variety of risks associated with marketing our product candidates internationally could materially adversely affect our business.

We plan to seek regulatory approval of our product candidates outside of the United States and, accordingly, we expect that we will be subject to additional risks related to operating in foreign countries if we obtain the necessary approvals, including:

- differing regulatory requirements and reimbursement regimes in foreign countries;
- unexpected changes in tariffs, trade barriers, price and exchange controls and other 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 taxes, including withholding of payroll taxes;
- foreign currency fluctuations, which could result in increased operating expenses and reduced revenue, and other obligations incident to doing business in another country;
- difficulties staffing and managing foreign operations;
- workforce uncertainty in countries where labor unrest is more common than in the United States;
- potential liability under the Foreign Corrupt Practices Act of 1977 or comparable foreign regulations;
- challenges enforcing our contractual and intellectual property rights, especially in those foreign countries that do not respect and protect intellectual property rights to the same extent as the United States;
- production shortages resulting from any events affecting raw material supply or manufacturing capabilities abroad; and
- business interruptions resulting from geo-political actions, including war and terrorism.

These and other risks associated with our international operations may materially adversely affect our ability to attain or maintain profitable operations.

The terms of our Loan Agreement place restrictions on our operating and financial flexibility.

In May 2018, we entered into a Loan Agreement with Oxford Finance LLC and Silicon Valley Bank, as amended in August 2018, which is secured by substantially all of our assets other than our intellectual property (except rights to payment from the sale, licensing or disposition of such intellectual property). In connection with the Second Amendment on October 31, 2019, we agreed to grant a security interest in our intellectual property as additional collateral to secure the Term Loans for the ratable benefit of the lenders. We borrowed $26.5 million upon execution of the Loan Agreement. Approximately $8.6 million of the proceeds received was used to repay the outstanding principal, interest and final payment fees owed under our prior loan and security agreement.

The Loan Agreement includes affirmative and negative covenants applicable to us and any subsidiaries we create in the future. The affirmative covenants include, among others, covenants requiring us to maintain our legal existence and governmental approvals, deliver certain financial reports, maintain insurance coverage, and subject all of our deposit accounts, securities accounts, commodity accounts or any other bank accounts, to a control agreement in favor of Oxford Finance LLC. The negative covenants include, among others, restrictions on us transferring collateral, incurring additional indebtedness, engaging in mergers or acquisitions, paying dividends in cash or making other distributions, making investments, creating liens, selling assets, and suffering a change in control, in each case subject to certain exceptions.

The Loan Agreement also includes events of default, the occurrence and continuation of which provide Oxford Finance LLC, as collateral agent, with the right to exercise remedies against us and the collateral securing the loans under the Loan Agreement, including foreclosure against our properties securing the Loan Agreement, including our cash, potentially requiring us to renegotiate our agreement on terms less favorable to us or to immediately cease operations. These events of default include, among other things, our failure to pay any amounts due under the Loan Agreement, a breach of covenants under the Loan Agreement, our insolvency, impairment in the perfection or priority of each lender's security interest in the collateral, the occurrence of any default under certain other indebtedness in an amount greater than $250,000, our failure to obtain or maintain material governmental approvals, and a final judgment against us of at least $250,000. Further, if we are liquidated, the lenders' right to repayment would be senior to the rights of the holders of our common stock to receive any proceeds from the liquidation. The lenders could declare a default upon the occurrence of any event that they interpret as a material adverse change as defined under the Loan Agreement, thereby requiring us to repay the loan immediately or to attempt to reverse the declaration of default through negotiation or litigation. Any declaration by the lenders of an event of default could significantly harm our business and prospects and could cause the price of our common stock to decline.

If product liability lawsuits are brought against us, we may incur substantial liabilities and may be required to limit commercialization of our product candidates.

We face an inherent risk of product liability as a result of the clinical testing of our product candidates and will face an even greater risk if we commercialize any products. For example, we may be sued if our product candidates cause or are perceived to cause injury or are found to be otherwise unsuitable during clinical testing, manufacturing, marketing or sale. Any such product liability claims may include allegations of defects in manufacturing, defects in design, a failure to warn of dangers inherent in the product, negligence, strict liability or a breach of warranties. Claims could also be asserted under state consumer protection acts. If we cannot successfully defend ourselves against product liability claims, we may incur substantial liabilities or be required to limit commercialization of our product candidates. Even successful defense would require significant financial and management resources. Regardless of the merits or eventual outcome, liability claims may result in:

- decreased demand for our product candidates;
- injury to our reputation;
- withdrawal of clinical trial participants;
- initiation of investigations by regulators;
- costs to defend the related litigation;
- a diversion of management's time and our resources;
- substantial monetary awards to clinical trial participants or patients;
- product recalls, withdrawals or labeling, marketing or promotional restrictions;
- exhaustion of any available insurance and our capital resources;
- loss of revenue;
- the inability to commercialize any product candidate; and
- a decline in our share price.

Our inability to obtain sufficient product liability insurance at an acceptable cost to protect against potential product liability claims could prevent or inhibit the commercialization of any products we develop, alone or with corporate collaborators. We currently carry $5 million of product liability insurance covering our clinical trials. Although we maintain such insurance, our insurance policies may have various exclusions, and we may be subject to a product liability claim for which we have no coverage. We may have to pay any amounts awarded by a court or negotiated in a settlement that exceed our coverage limitations or that are not covered by our insurance, and we may not have, or be able to obtain, sufficient capital to pay such amounts. Even if our agreements with any future corporate collaborators entitle us to indemnification against losses, such indemnification may not be available or adequate should any claim arise.

Negative public opinion and increased regulatory scrutiny of gene therapy and genetic research may damage public perception of our product candidates or adversely affect our ability to conduct our business or obtain regulatory approvals for our product candidates.

Public perception may be influenced by claims that gene therapy is unsafe, and gene therapy may not gain the acceptance of the public or the medical community. In particular, our success will depend upon physicians specializing in the treatment of those diseases that our product candidates target prescribing treatments that involve the use of our product candidates in lieu of, or in addition to,

existing treatments with which they are already familiar with and for which greater clinical data may be available. More restrictive government regulations or negative public opinion would have a negative effect on our business or financial condition and may delay or impair the development and commercialization of our product candidates or demand for any products we may develop. Adverse events in our clinical trials, even if not ultimately attributable to our product candidates, and the resulting publicity could lead to increased governmental regulation, unfavorable public perception, potential regulatory delays in the testing or approval of our potential product candidates, stricter labeling requirements for those product candidates that are approved and a decrease in demand for any such product candidates. Concern about environmental spread of our product, whether real or anticipated, may hinder the commercialization of our products.

Our internal computer systems, or those used by our CROs, SaaS providers, contractors or consultants, may fail or suffer security breaches.

Despite the implementation of security measures, our internal computer systems and those of our CROs, SaaS providers, contractors and consultants are vulnerable to damage from computer viruses and unauthorized access. While we have not experienced any such material system failure or security breach to date, if such an event were to occur and cause interruptions in our operations, it could result in a material disruption of our development programs and our business operations. For example, the loss of clinical trial data from completed or future clinical trials could result in delays in our regulatory approval efforts and significantly increase our costs to recover or reproduce the data. To the extent that any disruption or security breach were to result in a loss of, or damage to, our data or applications, or inappropriate disclosure of confidential or proprietary information, we could incur liability, and the further development and commercialization of our product candidates could be delayed.

Our business could be negatively impacted by cyber security threats.

In the ordinary course of our business, we use our data centers and our networks to store and access our proprietary business information. We face various cyber security threats, including cyber security attacks to our information technology infrastructure and attempts by others to gain access to our proprietary or sensitive information. The procedures and controls we use to monitor these threats and mitigate our exposure may not be sufficient to prevent cyber security incidents. The result of these incidents could include disrupted operations, lost opportunities, misstated financial data, liability for stolen assets or information, increased costs arising from the implementation of additional security protective measures, litigation and reputational damage. Any remedial costs or other liabilities related to cyber security incidents may not be fully insured or indemnified by other means.

Business disruptions could seriously harm our future revenue and financial condition and increase our costs and expenses.

Our operations, and those of our CROs, contractors and consultants, could be subject to power shortages, telecommunications failures, wildfires, water shortages, floods, earthquakes, hurricanes, typhoons, fires, extreme weather conditions, medical epidemics and other natural or man-made disasters or business interruptions for which we are predominantly self-insured. The occurrence of any of these business disruptions could seriously harm our operations and financial condition and increase our costs and expenses. Our ability to obtain clinical supplies of our product candidates could be disrupted if the operations of our contract manufacturers or cell line storage facilities are affected by a man-made or natural disaster or other business interruption.

Risks related to government regulation

The FDA may disagree with our regulatory plans, and we may fail to obtain regulatory approval of our product candidates.*

Following receipt of Breakthrough Therapy Designation from the FDA, we redesigned our Phase 2/3 clinical trial of Toca 511 & Toca FC for the treatment of recurrent HGG to a single Phase 3 trial design and have included the 187 patients that were previously enrolled in the Phase 2/3 trial in the total of approximately 380 patients enrolled in the redesigned trial. The general approach for FDA approval of a new biologic or drug is to require dispositive data from two adequate and well-controlled Phase 3 clinical trials of the biologic or drug in the relevant patient population. The redesigned Phase 3 trial, which we refer to as Toca 5, upon final analysis, missed the primary endpoint of overall survival compared to the standard of care treatment (11.1 months median compared to 12.2 months, HR=1.06, p=0.6154). In addition, all secondary endpoints showed no meaningful difference between the arms of the trial. We are currently evaluating the next steps for the development of Toca 511 & Toca FC, including whether additional clinical trials are advisable, either alone or with a partner.

In addition, we believe that it is likely that there may be a regulatory requirement for one or more diagnostic assays to monitor treatment, especially for the presence of Toca 511 & Toca FC or their components or derivatives. We plan to meet with the FDA to discuss the development of such assays, and it is possible that the FDA may require a separate regulatory approval for such assays contemporaneously with the approval of Toca 511 & Toca FC.

Our clinical trials results may not support approval. In addition, Toca 511 & Toca FC and our other product candidates could fail to receive regulatory approval for many reasons, including the following:

- the FDA or comparable foreign regulatory authorities may disagree with the design or implementation of our clinical trials, including clinical endpoints;
- the results of clinical trials may not meet the level of statistical significance required by the FDA or comparable foreign regulatory authorities for approval;
- as evident by the results from Toca 5,we may be unable to demonstrate that our product candidates' clinical and other benefits outweigh their safety risks or are better than recently produced safety or efficacy data for other products;
- we may encounter serious and unexpected adverse events during clinical trials that render our products unsafe for use in humans;
- the FDA or comparable foreign regulatory authorities may disagree with our interpretation of data from preclinical studies or clinical trials;
- the data collected from clinical trials of our product candidates may not be sufficient to the satisfaction of the FDA or comparable foreign regulatory authorities to support the submission of a BLA or other comparable submission in foreign jurisdictions or to obtain regulatory approval in the United States or elsewhere;
- the FDA or comparable foreign regulatory authorities may fail to approve our manufacturing processes and/or facilities of third-party manufacturers with which we contract for clinical and commercial supplies; and
- the approval policies or regulations of the FDA or comparable foreign regulatory authorities may significantly change in a manner rendering our clinical data insufficient for approval.

Obtaining and maintaining regulatory approval of our product candidates in one jurisdiction does not mean that we will be successful in obtaining regulatory approval of our product candidates in other jurisdictions.

Obtaining and maintaining regulatory approval of our product candidates in one jurisdiction does not guarantee that we will be able to obtain or maintain regulatory approval in any other jurisdiction, while a failure or delay in obtaining regulatory approval in one jurisdiction may have a negative effect on the regulatory approval process in others. For example, even if the FDA grants marketing approval of a product candidate, comparable regulatory authorities in foreign jurisdictions must also approve the manufacturing, marketing and promotion of the product candidate in those countries. Approval procedures vary among jurisdictions and can involve requirements and administrative review periods different from, and greater than, those in the United States, including additional preclinical studies or clinical trials. Studies and clinical trials conducted in one jurisdiction or study group may not be accepted by regulatory authorities in other jurisdictions. In many jurisdictions outside the United States, a product candidate must be approved for reimbursement before it can be approved for sale in that jurisdiction. In some cases, the price that we intend to charge for our products is also subject to approval.

We may also submit marketing applications in other countries. Regulatory authorities in jurisdictions outside of the United States have requirements for approval of product candidates with which we must comply prior to marketing in those jurisdictions. 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 products in certain countries. If we fail to comply with the regulatory requirements in international markets and/or receive applicable marketing approvals, our target market will be reduced and our ability to realize the full market potential of our product candidates will be harmed.

Additional time may be required to obtain regulatory approval for Toca 511 & Toca FC because it is a combination product.

We believe our Toca 511 & Toca FC product candidate is regulated as a drug/biologic combination product, which will require coordination within the FDA and similar foreign regulatory agencies for review of their biologic and drug components and potentially one or more diagnostic assays to monitor treatment. Although the FDA and similar foreign regulatory agencies have systems in place for the review and approval of combination products such as ours, we may experience delays in the development and commercialization of our product candidates due to regulatory timing constraints and uncertainties in the product development and approval process.

Even if we receive regulatory approval of our product candidates, we will be subject to ongoing regulatory obligations and continued regulatory review, which may result in significant additional expense, and we may be subject to penalties and/or withdrawal of product approval if we fail to comply with regulatory requirements or experience unanticipated problems with our product candidates.*

Any regulatory approvals that we receive for our product candidates will require surveillance to monitor the safety and efficacy of the product candidate. Specifically, we believe that it is likely that there may be a regulatory requirement for one or more diagnostic

assays to monitor treatment, especially for the presence of Toca 511 or Toca FC or their components or derivatives. We plan to meet with the FDA to discuss the development of such assays, and it is possible that the FDA may require a separate regulatory approval for such assays. Further, each vector containing a particular gene could be regulated as a separate biologic depending on its intended use and FDA policy. The FDA may also require a REMS, in order to approve our product candidates, which could entail requirements for a medication guide, physician communication plans or additional elements to ensure safe use, such as restricted distribution methods, patient registries and other risk minimization tools. In addition, if the FDA or a comparable foreign regulatory authority approves our product candidates, the manufacturing processes, labeling, packaging, distribution, adverse event reporting, storage, advertising, promotion, import, export and record keeping for our product candidates will be subject to extensive and ongoing regulatory requirements. These requirements include, among other things, submissions of safety and other post-marketing information and reports, registration, as well as continued compliance with cGMPs for manufacturing and GCPs for any clinical trials that we conduct post-approval. Later discovery of previously unknown problems with our product candidates, including adverse events of unanticipated severity or frequency, or with our third-party manufacturers or manufacturing processes, or failure to comply with regulatory requirements, may result in, among other things:

- restrictions on the marketing or manufacturing of our product candidates, withdrawal of the product from the market, or voluntary or mandatory product recalls;
- fines, warning letters or holds on clinical trials;
- refusal by the FDA to approve pending applications or supplements to approved applications filed by us or suspension or revocation of license approvals;
- suspension or termination of manufacturing at one or more manufacturing facilities;
- product seizure or detention, or refusal to permit the import or export of our product candidates; and
- injunctions or the imposition of civil or criminal penalties.

Moreover, the FDA strictly regulates the promotional claims that may be made about drug and biologic products. In particular, a product may not be promoted for uses that are not approved by the FDA as reflected in the product's approved labeling. However, companies may share truthful and not misleading information that is otherwise consistent with a product's FDA approved labeling. The FDA and other agencies actively enforce the laws and regulations prohibiting the promotion of off-label uses, and a company that is found to have improperly promoted off-label uses may be subject to significant civil, criminal and administrative penalties.

The FDA's and other regulatory authorities' policies 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.

We have Orphan-Drug Designation for Toca 511 & Toca FC for the treatment of malignant glioma in addition to glioblastoma multiforme, or GBM, but we may be unable to maintain the benefits associated with Orphan-Drug Designation, including potential eligibility for any future market exclusivity.

Under the Orphan-Drug Act, the FDA may grant orphan designation to a drug or biologic intended to treat a rare disease or condition, which is defined as one occurring in a patient population of fewer than 200,000 in the United States, or a patient population greater than 200,000 in the United States for which there is no reasonable expectation that the cost of developing and making available in the United States a drug or biologic for a disease or condition will be recovered from sales in the United States for that drug or biologic. In the United States, Orphan-Drug Designation entitles a party to financial incentives such as opportunities for grant funding towards clinical trial costs, tax advantages and user-fee waivers. In addition, if a product that has Orphan-Drug Designation subsequently receives the first FDA approval for the disease for which it has such designation, the product is entitled to orphan product exclusivity, which means that the FDA may not approve any other applications to market the same biologic for the same indication for seven years, except in limited circumstances, such as a showing of clinical superiority to the product with orphan drug exclusivity or where the manufacturer is unable to assure sufficient product quantity.

Toca 511 & Toca FC has Orphan-Drug Designation in the United States for the treatment of malignant glioma in addition to GBM, and in the European Union for the treatment of glioma. We are currently developing this product candidate for the treatment of recurrent HGG, which is a subset of malignant glioma. Exclusive marketing rights in the United States may be limited if we seek approval for an indication broader than the orphan designated indication and may be lost if the FDA later determines that the request for designation was materially defective or if the manufacturer is unable to assure sufficient quantities of the product to meet the needs of patients with the rare disease or condition. Further, even if we obtain orphan drug exclusivity for a product, that exclusivity may not effectively protect the product from competition because different products with different active moieties can be approved for the same condition. Even after an orphan product is approved, the FDA can subsequently approve the same product with the same active moiety for the same condition if the FDA concludes that the later product is safer, more effective or makes a major contribution to patient care. Orphan-Drug Designation neither shortens the development time or regulatory review time of a drug or biologic nor gives

the drug or biologic any advantage in the regulatory review or approval process. In addition, while we may seek orphan designation for other product candidates, we may never receive such designations.

A Fast Track Designation or Breakthrough Therapy Designation by the FDA or Priority Medicines, or PRIME, Designation by the EMA, may not actually lead to a faster development or regulatory review or approval process.

If a product candidate is intended for the treatment of a serious or life-threatening condition and demonstrates the potential to address unmet medical needs for this condition, the drug sponsor may apply for FDA Fast Track Designation. Similarly, Breakthrough Therapy Designation may be granted by the FDA, or PRIME Designation may be granted by the EMA, to product candidates for serious conditions that have preliminary clinical evidence indicating the product candidate may offer substantial improvement over available therapy. The FDA and EMA have broad discretion whether or not to grant these designations, and even if we believe a particular product candidate is eligible for these designations, we cannot assure you that the FDA or EMA would decide to grant them. We have been granted Fast Track Designation and Breakthrough Therapy Designation for our Toca 511 & Toca FC product candidate for the treatment of recurrent HGG and PRIME Designation for Toca 511 in HGG, but this is no assurance we will receive these designations for any future product candidates. Further, even though we have received these designations for Toca 511 & Toca FC, we may not experience a faster development process, review or approval compared to conventional FDA or EMA procedures. The FDA or EMA may withdraw these designations if it believes that they are no longer supported by data from our clinical development program.

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

We currently have relationships with a limited number of suppliers for the manufacturing of our viral vectors and product candidates. Each supplier may require licenses to manufacture such components if such processes are not owned by the supplier or in the public domain and we may be unable to transfer or sublicense the intellectual property rights we may have or later obtain with respect to such activities.

All entities involved in the preparation of therapeutics for clinical trials or commercial sale, including our existing contract manufacturers for our product candidates, are subject to extensive regulation. Components of a finished therapeutic product approved for commercial sale or used in late-stage clinical trials must be manufactured in accordance with cGMP. These regulations govern manufacturing processes and procedures (including record keeping) and the implementation and operation of quality systems to control and assure the quality of investigational products and products approved for sale. Poor control of production processes can lead to the introduction of adventitious agents or other contaminants, or to inadvertent changes in the properties or stability of our product candidates that may not be detectable in final product testing. We or our contract manufacturers must supply all necessary documentation in support of a BLA on a timely basis and must adhere to the FDA's good laboratory practices and cGMP regulations enforced by the FDA through its facilities inspection program. Some of our contract manufacturers have limited experience in production of commercially-approved products and therefore may have not obtained the requisite FDA approvals to do so. Our facilities and quality systems and the facilities and quality systems of some or all of our third-party contractors must pass a pre-approval inspection for compliance with the applicable regulations as a condition of regulatory approval of our product candidates or any of our other potential products. In addition, the regulatory authorities may, at any time, audit or inspect a manufacturing facility involved with the preparation of our product candidates or our other potential products or the associated quality systems for compliance with the regulations applicable to the activities being conducted. If these facilities do not pass a pre-approval plant inspection, FDA approval of the products may not be granted.

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

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

Additionally, if supply from one approved manufacturer is interrupted, there could be a significant disruption in commercial supply. An alternative manufacturer would need to be qualified through a BLA supplement which could result in further delay. The regulatory agencies may also require additional studies if a new manufacturer is relied upon for commercial production. Switching manufacturers may involve substantial costs and is likely to result in a delay in our desired clinical and commercial timelines.

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

Our Toca 511 & Toca FC product may face competition sooner than anticipated, if approved.

The Biologics Price Competition and Innovation Act, or BPCIA, created an abbreviated approval pathway for biological products that are biosimilar to or interchangeable with an FDA-licensed reference biological product. Under the BPCIA, an application for a biosimilar product may not be submitted to the FDA until four years following the date that the reference product was first licensed by the FDA. In addition, the approval of a biosimilar product may not be made effective by the FDA until 12 years from the date on which the reference product was first licensed. During this 12-year period of exclusivity, another company may still market a competing version of the reference product if the FDA approves a full BLA for the competing product containing the sponsor's own preclinical data and data from adequate and well-controlled clinical trials to demonstrate the safety, purity and potency of its product.

We believe that any of our product candidates approved as a biological product under a BLA should qualify for the 12-year period of exclusivity. However, there is a risk that this exclusivity could be shortened due to congressional action or otherwise, or that the FDA will not consider our product candidates to be reference products for competing products, potentially creating the opportunity for competition sooner than anticipated. Other aspects of the BPCIA, some of which may impact the BPCIA exclusivity provisions, have also been the subject of recent litigation. Moreover, the extent to which a biosimilar, once approved, will be substituted for any one of our reference products in a way that is similar to traditional generic substitution for non-biological products is not yet clear, and will depend on a number of marketplace and regulatory factors that are still developing.

We may be subject, directly or indirectly, to federal, state, local and foreign healthcare fraud and abuse laws, false claims laws, privacy laws and other applicable healthcare laws, and the failure to comply with such laws could result in substantial penalties. Our employees, independent contractors, consultants, principal investigators, CROs, commercial partners and vendors may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements.*

We are exposed to the risk of fraud, misconduct or other illegal activity by our employees, independent contractors, consultants, principal investigators, CROs, commercial partners and vendors. Misconduct by these parties could include intentional, reckless and/or negligent conduct that fails to: comply with the laws of the FDA and other similar foreign regulatory bodies; provide true, complete and accurate information to the FDA and other similar foreign regulatory bodies; comply with manufacturing standards we have established; comply with federal and state data privacy, security, fraud and abuse and other healthcare laws and regulations in the United States and similar foreign fraudulent misconduct laws; or report financial information or data accurately or to disclose unauthorized activities to us.

In addition, our current and future operations are subject to regulation under such laws, and if we obtain FDA approval for any of our product candidates and begin commercializing those products in the United States, our potential exposure under such laws would increase significantly, along with our costs associated with compliance with such laws. These laws may impact, among other things, our current activities with principal investigators and research patients, as well as proposed and future sales, marketing and education programs. In particular, the promotion, sales and marketing of healthcare items and services, as well as certain business arrangements in the healthcare industry, are subject to extensive laws and regulations intended to prevent fraud, misconduct, kickbacks, self-dealing and other abusive practices. These laws and regulations may restrict or prohibit a wide range of pricing, discounting, marketing and promotion, including off-label promotion of our products, structuring of commission(s), certain customer incentive programs and other business arrangements generally. Activities subject to these laws also involve the improper use or misrepresentation of information obtained in the course of patient recruitment for clinical trials, creating fraudulent data in our preclinical studies or clinical trials or illegal misappropriation of drug product, which could result in regulatory sanctions and cause serious harm to our reputation. The laws that may affect our ability to operate include, but are not limited to:

- the federal Anti-Kickback Statute, which prohibits, among other things, individuals 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, lease, order or recommendation of, any good, facility, item or service for which payment may be made, in whole or in part, under a federal healthcare program, such as the Medicare and Medicaid programs. A person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;

- federal civil and criminal false claims laws and civil monetary penalty laws, including the federal civil False Claims Act, which can be enforced by individuals on behalf of the government through civil whistleblower or *qui tam* actions, which impose criminal and civil penalties on individuals and entities for, among other things, knowingly presenting, or causing to be presented, claims for payment or approval from Medicare, Medicaid, or other federal healthcare programs that are false, fictitious or fraudulent, or knowingly making, using or causing to be made or used, a false statement to avoid, decrease or conceal an obligation to pay money to the federal government. In addition, the government may assert that a claim including items and services resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the federal civil False Claims Act;
- the federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, which imposes criminal and civil liability for, among other things, knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program or obtain, by means of false or fraudulent pretenses, representations, or promises, any of the money or property owned by, or under the custody or control of, any healthcare benefit program, regardless of the payor (e.g., public or private), willfully obstructing a criminal investigation of a healthcare offense, and knowingly and willfully falsifying, concealing or covering up by any trick or device a material fact or making any materially false, fictitious or fraudulent statements in connection with the delivery of, or payment for, healthcare benefits, items or services relating to healthcare matters. Similar to the federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;
- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act, or HITECH, and their respective implementing regulations, which impose requirements on certain covered healthcare providers, health plans, and healthcare clearinghouses, as well as their respective business associates that perform services for them that involve the creation, use, maintenance or disclosure of, individually identifiable health information, relating to the privacy, security and transmission of individually identifiable health information without appropriate authorization;
- the federal physician payment transparency requirements, sometimes referred to as the "Physician Payments Sunshine Act," created under the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act, collectively the Affordable Care Act, and its implementing regulations, which require 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 certain exceptions) to report annually to the Centers for Medicare and Medicaid Services, or CMS, information related to payments or other transfers of value made to physicians (defined to include doctors, dentists, optometrists, podiatrists and chiropractors) and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members;
- the U.S. Federal Food, Drug and Cosmetic Act, or FD&C Act, which prohibits, among other things, the adulteration or misbranding of drugs and medical devices; and
- federal consumer protection and unfair competition laws, which broadly regulate marketplace activities and activities that potentially harm consumers.

Additionally, we are subject to state, local and foreign equivalents of each of the healthcare fraud and abuse laws described above, among others, some of which may be broader in scope and may apply regardless of the payor. We may also be subject to state, local and foreign 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 or otherwise restrict payments that may be made to healthcare providers; to report information related to payments and other transfers of value to healthcare providers or entities, or marketing expenditures; report certain information regarding drug pricing; and require registration of pharmaceutical sales representatives. We may also be subject to 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 often are not preempted by HIPAA, thus complicating compliance efforts.

In the European Union, the General Data Protection Regulation (2016/679), or GDPR, applies to any organization established in the European Union, and in some cases to activities of organizations that are not established in the European Union. The GDPR, which is wide-ranging in scope, imposes several requirements relating to control over personal data by individuals to whom personal data relates, the information that an organization must provide to individuals, the documentation an organization must maintain, the security and confidentiality of personal data, data breach notification and the use of third party processors in connection with the processing of personal data. The GDPR also imposes strict rules on the transfer of personal data out of the European Union to the United States, provides an enforcement authority, and authorizes fines of up to 20 million Euros or up to 4% of an organization's annual global turnover, whichever is greater, for non-compliance. Additionally, the California Consumer Privacy Act, or CCPA, goes into effect on January 1, 2020. The CCPA creates new individual privacy rights for consumers (as that word is broadly defined in the law) and places increased privacy and security obligations on many organizations that handle the personal data of consumers or households. When the CCPA becomes effective, it will require covered companies to provide new disclosures to California

consumers, provide a new right for consumers to opt-out of certain sales of personal information, and provide a new cause of action for data breaches in some cases. The California Attorney General is expected to issue regulations regarding the CCPA later this year. Several amendments have been proposed in the California legislature that would modify the CCPA before it goes into effect, but it remains unclear what, if any, modifications may be made to this legislation. As currently written, the CCPA will likely impact our business activities and exemplifies the vulnerability of our business to not only cyber threats but also the evolving regulatory environment related to personal data and protected health information.

It is not always possible to identify and deter employee misconduct, and the precautions we take to detect and prevent inappropriate conduct may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to be in compliance with such laws or regulations. We are also subject to the risk that a person or government could allege such fraud or other misconduct, even if none occurred. Efforts to ensure that our business arrangements will comply with applicable healthcare laws and regulations will involve substantial costs. It is possible that governmental and enforcement authorities will conclude that our business practices may not comply with current or future statutes, regulations or case law interpreting applicable fraud and abuse or other healthcare laws and regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, including the imposition of civil, criminal and administrative penalties, damages, disgorgement, monetary fines, possible exclusion from participation in Medicare, Medicaid and other federal healthcare programs, contractual damages, reputational harm, diminished profits and future earnings, imprisonment, additional reporting obligations and oversight if we become subject to a corporate integrity agreement or other agreement to resolve allegations of non-compliance with these laws, and curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and our results of operations. In addition, the approval and commercialization of any of our product candidates outside the United States will also likely subject us to foreign equivalents of the healthcare laws mentioned above, among other foreign laws.

Coverage and reimbursement may be limited or unavailable in certain market segments for our product candidates, if approved, which could make it difficult for us to sell our product candidates profitably.

Successful sales of our product candidates, if approved, depend on the availability of coverage and adequate reimbursement from third-party payors such as government authorities, including Medicare and Medicaid, private health insurers, and health maintenance organizations. Because our product candidates represent new approaches to the treatment of cancer, we cannot be sure that coverage and reimbursement will be available for, or accurately estimate the potential revenue from, our product candidates.

Patients who are provided medical treatment for their conditions generally rely on third-party payors to reimburse all or part of the costs associated with their treatment. Coverage and adequate reimbursement from governmental healthcare programs, such as Medicare and Medicaid, and commercial payors are critical to new product acceptance.

Third-party payors decide which drugs and treatments they will cover and the amount of reimbursement. Coverage and reimbursement by a third-party payor may depend upon a number of factors, including, but not limited to, 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;
- cost-effective; and
- neither experimental nor investigational.

In the United States, no uniform policy of coverage and reimbursement for products exists among third-party payors, and coverage and reimbursement for products can differ significantly from payor to payor. As a result, obtaining coverage and reimbursement approval of a product from a government or other third-party payor is a time-consuming and costly process that could require us to provide to each payor supporting scientific, clinical and cost-effectiveness data for the use of our products and to justify the level of coverage and reimbursement relative to other therapies, with no assurance that coverage and adequate reimbursement will be obtained. Third party payors may also have difficulty in determining the appropriate coverage of our product candidates, if approved, due to the fact that they are combination products that include a small molecule drug. To the extent there are any delays in determining such coverage or inadequate coverage and reimbursement for all aspects of our combination therapies, it would adversely affect the market acceptance, demand and use of our product candidates.

A number of gene therapy products have been approved recently by the FDA. Although CMS subsequently approved a method of coverage and reimbursement for certain gene therapy products, it is difficult to predict how CMS may decide to cover and

reimburse our product candidates, if approved. Often private payors follow the coverage and reimbursement decisions of the Medicare program, but also have their own methods and approval process. Therefore, coverage and reimbursement for can differ significantly from payor to payor and approval by one payor does not guarantee approval by another. Further, third-party payors' coverage and reimbursement determinations are subject to change. Any denial in coverage or reduction in reimbursement from Medicare or other government programs may result in a similar denial or reduction in payments from private payors, which may adversely affect our future profitability.

We intend to seek approval to market our product candidates in both the United States and in selected foreign jurisdictions. If we obtain approval in one or more foreign jurisdictions for our product candidates, we will be subject to rules and regulations in those jurisdictions. In some foreign countries, particularly those in the European Union, the pricing of biologics is subject to governmental control and other market regulations which could put pressure on the pricing and usage of our product candidates. In these countries, pricing negotiations with governmental authorities can take considerable time after obtaining marketing approval of a product candidate. In addition, market acceptance and sales of our product candidates will depend significantly on the availability of coverage and adequate reimbursement from third-party payors for our product candidates and may be affected by existing and future health care reform measures.

Healthcare legislative reform measures may have a material adverse effect on our business and results of operations.*

Third-party payors, whether domestic or foreign, or governmental or commercial, are developing increasingly sophisticated methods of controlling healthcare costs. In both the United States and certain foreign jurisdictions, there have been a number of legislative and regulatory changes to the health care system that could impact our ability to sell our products profitably. In particular, in 2010, the Affordable Care Act was enacted in the United States. The Affordable Care Act and its implementing regulations, among other things, subjected biological products to potential competition by lower-cost biosimilars, revised the methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for certain drugs and biologics, including our product candidates, that are inhaled, infused, instilled, implanted or injected, increased the minimum Medicaid rebates owed by most manufacturers under the Medicaid Drug Rebate Program, extended the Medicaid Drug Rebate program to utilization of prescriptions of individuals enrolled in Medicaid managed care organizations, subjected manufacturers to new annual fees and taxes for certain branded prescription drugs, and provided incentives to programs that increase the federal government's comparative effectiveness research.

Since its enactment, there have been judicial, Congressional and political challenges to certain aspects of the Affordable Care Act, as well as recent efforts by the Trump administration to repeal or replace certain aspects of the Affordable Care Act. Since January 2017, President Trump has signed two Executive Orders and other directives designed to delay the implementation of certain provisions of the Affordable Care Act or otherwise circumvent some of the requirements for health insurance mandated by the Affordable Care Act. Concurrently, Congress has considered legislation that would repeal or repeal and replace all or part of the Affordable Care Act. While Congress has not passed comprehensive repeal legislation, two bills affecting the implementation of certain taxes under the Affordable Care Act have been signed into law. On December 22, 2017, President Trump signed into law new federal tax legislation, informally titled the Tax Cuts and Jobs Act, or Tax Act, which includes a provision that repealed, effective January 1, 2019, the tax-based shared responsibility payment imposed by the Affordable Care Act on certain individuals who fail to maintain qualifying health coverage for all or part of a year that is commonly referred to as the "individual mandate". On January 22, 2018, President Trump signed a continuing resolution on appropriations for fiscal year 2018 that delayed the implementation of certain Affordable Care Act-mandated fees, including the so-called "Cadillac" tax on certain high cost employer-sponsored insurance plans, the annual fee imposed on certain health insurance providers based on market share, and the medical device excise tax on non-exempt medical devices. The Bipartisan Budget Act of 2018, or the BBA, among other things, amended the Affordable Care Act, effective January 1, 2019, to close the coverage gap in most Medicare Part D drug plans, commonly referred to as the "donut hole". In July 2018, CMS published a final rule permitting further collections and payments to and from certain Affordable Care Act qualified health plans and health insurance issuers under the Affordable Care Act risk adjustment program in response to the outcome of federal district court litigation regarding the method CMS uses to determine this risk adjustment. On December 14, 2018, a U.S. District Court Judge in Texas ruled that the Affordable Care Act is unconstitutional in its entirety because the "individual mandate" was repealed by Congress as part of the Tax Act. While such U.S. District Court Judge, as well as the Trump administration and CMS, have stated that the ruling will have no immediate effect pending appeal of the decision, it is unclear how this decision, subsequent appeals, and other efforts to repeal and replace the Affordable Care Act will impact the Affordable Care Act and our business.

In addition, other legislative changes have been proposed and adopted in the United States since the Affordable Care Act was enacted. In August 2011, the Budget Control Act of 2011, among other things, created measures for spending reductions by Congress. A Joint Select Committee on Deficit Reduction, tasked with recommending a targeted deficit reduction of at least $1.2 trillion for the years 2013 through 2021, was unable to reach required goals, thereby triggering the legislation's automatic reduction to several government programs. This includes aggregate reductions of Medicare payments to providers up to 2% per fiscal year, which went into effect on April 1, 2013 and, due to subsequent legislation, including the BBA, will stay in effect through 2027 unless Congressional action is taken. In January 2013, President Obama signed into law the American Taxpayer Relief Act of 2012, which,

among other things, reduced Medicare payments to several providers, including hospitals, imaging centers and cancer treatment centers, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. Moreover, payment methodologies including payment for any companion diagnostics may be subject to changes in healthcare legislation and regulatory initiatives. For example, CMS began bundling the Medicare payments for certain laboratory tests ordered while a patient received services in a hospital outpatient setting and, beginning in 2018, CMS has begun paying for clinical laboratory services based on a weighted-average of reported prices that private payors, Medicare Advantage plans and Medicaid Managed Care plans pay for laboratory services.

Further recently, there has been heightened governmental scrutiny over the manner in which drug manufacturers set prices for their marketed products, which has resulted in several Congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to product pricing, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drug products. At the federal level, the Trump administration's budget proposal for fiscal year 2019 contains further product price control measures that could be enacted during the 2019 budget process or in other future legislation, including, for example, measures to permit Medicare Part D plans to negotiate the price of certain products under Medicare Part B, to allow some states to negotiate product prices under Medicaid, and to eliminate cost sharing for generic products for low-income patients. Further, the Trump administration released a "Blueprint", or plan, to lower drug prices and reduce out of pocket costs of drugs that contains additional proposals to increase drug manufacturer competition, increase the negotiating power of certain federal healthcare programs, incentivize manufacturers to lower the list price of their products, and reduce the out of pocket costs of drug products paid by consumers. The United States Department of Health and Human Services, or HHS, has already started the process of soliciting feedback on some of these measures and are implementing others under its existing authority. While some of these and other proposed measures will require additional authorization to become effective, Congress and the Trump administration have each indicated that it will continue to seek new legislative and/or administrative measures to control drug costs. At the state level, legislatures are increasingly 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.

Further, on May 30, 2018, the Trickett Wendler, Frank Mongiello, Jordan McLinn, and Matthew Bellina Right to Try Act of 2017, or Right to Try Act, was signed into law. The law, among other things, provides a federal framework for certain patients to access certain investigational new drug products that have completed a Phase I clinical trial and that are undergoing investigation for FDA approval. Under certain circumstances, eligible patients can seek treatment without enrolling in clinical trials and without obtaining FDA permission under the FDA expanded access program. There is no obligation for a drug manufacturer to make its drug products available to eligible patients as a result of the Right to Try Act.

There have been, and likely will continue to be, legislative and regulatory proposals at the foreign, federal and state levels directed at broadening the availability of healthcare and containing or lowering the cost of healthcare. We cannot predict the initiatives that may be adopted in the future. The continuing efforts of the government, insurance companies, managed care organizations and other payors of healthcare services to contain or reduce costs of healthcare and/or impose price controls may adversely affect:

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

Due to the novel nature of our technology and the small size of our initial target patient populations, we face uncertainty related to pricing and reimbursement for these product candidates.

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

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

Our research and development, manufacturing processes, clinical trials and products may involve the controlled use of hazardous materials, chemicals, viruses and various radioactive compounds. Specifically, if our products or product candidates spread from human or companion pet patients to other people or pets, these other individuals or pets (such as the immune suppressed or the very young), might be more sensitive to the product or product candidate than the patient and may experience an adverse reaction. We are subject to federal, state and local laws and regulations governing the use, manufacture, storage, handling and disposal of such materials and certain waste products, including numerous environmental, health and safety laws and regulations, such as those governing laboratory procedures and the handling, use, storage, treatment and disposal of hazardous materials and wastes. Our operations involve the use of hazardous and flammable materials, including chemicals and biological materials. Our operations also produce hazardous waste products. We generally contract with third parties for the disposal of these materials and wastes. We cannot eliminate the risk of contamination or injury from these materials. In the event of contamination or injury resulting from our use of hazardous materials, we could be held liable for any resulting damages, and any liability could exceed our resources. We also could incur significant costs associated with civil or criminal fines and penalties.

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

Risks related to our intellectual property

If we are unable to protect our intellectual property rights or if our intellectual property rights are inadequate for our technology and product candidates, our competitive position could be harmed.

Our commercial success will depend in part on our ability to obtain and maintain patent and other intellectual property protection in the United States and other countries with respect to our proprietary technology and products. We rely on trade secret, patent, copyright and trademark laws, and confidentiality, licensing and other agreements with employees and third parties, all of which offer only limited protection. We seek to protect our proprietary position by filing and prosecuting patent applications in the United States and abroad related to our novel technologies and products that are important to our business.

The patent positions of biotechnology and pharmaceutical companies generally are highly uncertain, involve complex legal and factual questions and have in recent years been the subject of much litigation. As a result, the issuance, scope, validity, enforceability and commercial value of our patents, including those patent rights licensed to us by third parties, are highly uncertain. The steps we or our licensors have taken to protect our proprietary rights may not be adequate to preclude misappropriation of our proprietary information or infringement of our intellectual property rights, both inside and outside of the United States. Further, the examination process may require us or our licensors to narrow the claims for our pending patent applications, which may limit the scope of patent protection that may be obtained if these applications issue. The rights already granted under any of our currently issued patents or those licensed to us and those that may be granted under future issued patents may not provide us with the proprietary protection or competitive advantages we are seeking. If we or our licensors are unable to obtain and maintain patent protection for our technology and products, or if the scope of the patent protection obtained is not sufficient, our competitors could develop and commercialize technology and products similar or superior to ours, and our ability to successfully commercialize our technology and products may be adversely affected. It is also possible that we or our licensors will fail to identify patentable aspects of inventions made in the course of our development and commercialization activities before it is too late to obtain patent protection on them. It is also possible that as research and development progresses, the direction of our intellectual property strategy and patent portfolio will change, resulting in strategic business decisions to allow certain patents or patent applications to be abandoned or lapse.

With respect to patent rights, we do not know whether any of the pending patent applications for any of our compounds or biologic products will result in the issuance of patents that effectively protect our technology or products, or if any of our issued patents or if any of our or our licensors' issued patents will effectively prevent others from commercializing competitive technologies and products. 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 not at all, until they are issued as a patent. Therefore, we cannot be certain that we or our licensors were the first to make the inventions claimed in our owned or licensed patents or pending patent applications, or that we or our licensors were the first to file for patent protection of such inventions.

Our pending applications cannot be enforced against third parties practicing the technology claimed in such applications unless and until a patent issues from such applications. Because the issuance of a patent is not conclusive as to its inventorship, scope, validity or enforceability, issued patents that we own or have licensed from third parties may be challenged in the courts or patent offices in the United States and abroad. Such challenges may result in the loss of patent protection, the narrowing of claims in such patents or the invalidity or unenforceability of such patents, 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 for our technology and products. Protecting against the unauthorized use of our or our licensor's patented technology, trademarks and other intellectual property rights is expensive, difficult and may in some cases not be possible. In some cases, it may be difficult or impossible to detect third-party infringement or misappropriation of our intellectual property rights, even in relation to issued patent claims, and proving any such infringement may be even more difficult.

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

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

Third parties have asserted, and in the future may assert, that we are employing their proprietary technology without authorization. There may be third-party patents or patent applications with claims to materials, formulations, methods of manufacture or methods for treatment related to the use or manufacture of our product candidates. Because patent applications can take many years to issue, there may be currently pending patent applications which may later result in issued patents that our product candidates may infringe. In addition, third parties may obtain patents in the future and claim that use of our technologies infringes upon these patents. If any third-party patents were held by a court of competent jurisdiction to cover the manufacturing process of any of our product candidates, or any final product itself, the holders of any such patents may be able to block our ability to commercialize such product candidate unless we obtained a license under the applicable patents, or until such patents expire.

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

Parties making claims against us may obtain injunctive or other equitable relief, which could effectively block our ability to further develop and commercialize one or more of our product candidates. Defense of these claims, regardless of their merit, may involve substantial litigation expense and would be a substantial diversion of employee resources from our business. In the event of a successful claim of infringement against us, we may have to pay substantial damages, including treble damages and attorneys' fees for willful infringement, pay royalties, redesign our infringing products or obtain one or more licenses from third parties, which may be impossible or require substantial time and monetary expenditure.

We may not be successful in obtaining or maintaining necessary rights to gene therapy product components and processes for our development pipeline through acquisitions and in-licenses.

Presently we believe that we have rights to the intellectual property, through licenses from third parties and under patents that we own, to develop our gene therapy product candidates. Because our programs may involve additional product candidates that may require the use of proprietary rights held by third parties, the growth of our business may depend in part on our ability to acquire, in-license or use these proprietary rights. In addition, our product candidates may require specific formulations to work effectively and efficiently and these rights may be held by others. We may be unable to acquire or in-license any compositions, methods of use, processes or other third-party intellectual property rights from third parties that we identify. The licensing and acquisition of third-party intellectual property rights is a competitive area, and a number of more established companies are also pursuing 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, cash resources and greater clinical 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. If we are unable to successfully obtain rights to required third-party intellectual property rights, our business, financial condition and prospects for growth could suffer.

If we fail to comply with our obligations in the agreement under which we license intellectual property rights from the University of Southern California, or USC, or otherwise experience disruptions to our business relationships with USC or other future licensors, we could lose license rights that are important to our business.

In October 2007, we entered into a license agreement with USC pursuant to which we received a worldwide, exclusive license to, among other things, manufacture and market products utilizing certain inventions that are critical to our business. We expect to enter into additional license agreements in the future. Our existing license agreement imposes, and we expect that future license agreements will impose, various diligence, milestone payment, royalty and other obligations on us. If we fail to comply with our obligations under these 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 market products covered by the license.

We may need to obtain licenses from third parties to advance our research or allow commercialization of our product candidates, and we have done so from time to time. We may fail to obtain any of these licenses at a reasonable cost or on reasonable terms, if at all. In that event, we may be required to expend significant time and resources to develop or license replacement technology. 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. We cannot provide any assurances that third-party patents do not exist which might be enforced against our current product candidates or future products, resulting in either an injunction prohibiting our sales, or, with respect to our sales, an obligation on our part to pay royalties and/or other forms of compensation to third parties.

In certain cases, patent prosecution of our licensed technology may be controlled solely by the licensor. If our licensors fail to obtain and maintain patent or other protection for the proprietary intellectual property we license from them, we could lose our rights to the intellectual property or our exclusivity with respect to those rights, and our competitors could market competing products using the intellectual property. In certain cases, we control the prosecution of patents resulting from licensed technology. In the event we breach any of our obligations related to such prosecution, we may incur significant liability to our licensing partners. Licensing of intellectual property is of critical importance to our business and involves complex legal, business and scientific issues and is complicated by the rapid pace of scientific discovery in our industry. 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 ownership of inventions and know-how resulting from the joint 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.

We may be involved in lawsuits to protect or enforce our patents or the patents of our licensors, which could be expensive, time-consuming and unsuccessful.

Competitors may infringe our patents or the patents of our licensors. To counter infringement or unauthorized use, we may be required to file infringement claims, which can be expensive and time-consuming. In addition, in an infringement proceeding, a court may decide that a patent of ours or our licensors is not valid, is unenforceable and/or is not infringed, or may refuse to stop the other party from using the technology at issue on the grounds that our patents do not cover the technology in question. An adverse result in any litigation or defense proceedings could put one or more of our patents at risk of being invalidated or interpreted narrowly and could put our patent applications at risk of not issuing.

Interference or derivation proceedings provoked by third parties or brought by us may be necessary to determine the priority of inventions with respect to our patents or patent applications or those of our licensors. An unfavorable outcome could require us to cease using the related technology or to attempt to license rights to it from the prevailing party. Our business could be harmed if the prevailing party does not offer us a license on commercially reasonable terms. Our defense of litigation, interference or derivation proceedings may fail and, even if successful, may result in substantial costs and distract our management and other employees. We may not be able to prevent, alone or with our licensors, misappropriation of our intellectual property rights, particularly in countries where the laws may not protect those rights as fully as in the United States.

Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation. There could also 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 material adverse effect on the price of our common stock.

Obtaining and maintaining our patent protection depends on compliance with various procedural, document submission, fee payment and other requirements imposed by governmental 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 governmental fees on patents and/or applications will be due to be paid to the U.S. PTO and various governmental patent agencies outside of the United States in several stages over the lifetime of the patents and/or applications. We employ an outside firm and rely on our outside counsel to pay these fees due to non-U.S. patent agencies. The U.S. PTO and various non-U.S. governmental patent agencies require compliance with a number of 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 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. However, there are situations 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. In such an event, our competitors might be able to enter the market and this circumstance would have a material adverse effect on our business.

Issued patents covering our product candidates could be found invalid or unenforceable if challenged in court.

If we, USC or one of our future licensing partners initiated legal proceedings against a third party to enforce a patent covering one of our product candidates, the defendant could counterclaim that the patent covering our product candidate is invalid and/or unenforceable. In patent litigation in the United States, defendant counterclaims alleging invalidity and/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 or non-enablement. Grounds for an unenforceability assertion could be an allegation that someone connected with prosecution of the patent withheld relevant information from the U.S. PTO, or made a misleading statement, during prosecution. Third parties may also raise similar claims before administrative bodies in the United States or abroad, even outside the context of litigation. Such mechanisms include re-examination, post grant review and equivalent proceedings in foreign jurisdictions (e.g., opposition proceedings). Such proceedings could result in revocation or amendment to our patents in such a way that they no longer cover our product candidates. The outcome following legal assertions of invalidity and unenforceability is unpredictable. With respect to the validity question, for example, we cannot be certain that there is no invalidating prior art, of which we and the patent examiner were unaware during prosecution. If a defendant were to prevail on a legal assertion of invalidity and/or unenforceability, we would lose at least part, and perhaps all, of the patent protection on our product candidates. Such a loss of patent protection would have a material adverse impact on our business.

We may be subject to claims that our employees, consultants or independent contractors have wrongfully used or disclosed confidential information of third parties or that our employees have wrongfully used or disclosed alleged trade secrets of their former employers.

We employ individuals who were previously employed at universities or other biotechnology or pharmaceutical companies, including our competitors or potential competitors. Although we try to ensure that our employees, consultants and independent contractors do not use the proprietary information or know-how of others in their work for us, we may be subject to claims that we or our employees, consultants or independent contractors have inadvertently or otherwise used or disclosed intellectual property, including trade secrets or other proprietary information, of any of our employee's former employer or other third parties. 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, which could adversely impact our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees.

We may be subject to claims challenging the inventorship or ownership of our patents and other intellectual property.

We may be subject to claims that former employees, collaborators or other third parties have an ownership interest in our patents or other intellectual property. We may have potential ownership disputes arising, for example, from conflicting obligations of consultants, collaborators or others who are involved in developing our product candidates. Litigation may be necessary to defend against these and other claims challenging inventorship or ownership. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights, such as exclusive ownership of, or right to use, valuable intellectual property. Such an outcome could have a material adverse effect on our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees.

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

As is the case with other biotechnology companies, our success is heavily dependent on intellectual property, particularly patents. Obtaining and enforcing patents in the biotechnology industry involve both technological and legal complexity, and therefore obtaining and enforcing biotechnology patents is costly, time-consuming and inherently uncertain. In addition, the United States has recently enacted and is currently implementing wide-ranging patent reform legislation. Recent U.S. Supreme Court rulings have narrowed the scope of patent protection available in certain circumstances and weakened the rights of patent owners in certain situations. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents, once obtained. Depending on decisions by the U.S. Congress, the federal courts and the U.S. PTO, the laws and regulations governing patents could change in unpredictable ways that would weaken our ability to obtain new patents or to enforce our existing patents and patents that we might obtain in the future.

We have not yet registered trademarks for a commercial trade name for Toca 511 & Toca FC, and failure to secure such registrations could adversely affect our business.

We have not yet developed a proprietary name for our products nor registered trademarks for a commercial trade name for Toca 511 & Toca FC. During trademark registration proceedings, we may receive rejections. Although we would be given an opportunity to respond to those rejections, we may be unable to overcome such rejections. In addition, in the U.S. PTO and in comparable agencies in many foreign jurisdictions, third parties are given an opportunity to oppose pending trademark applications and to seek to cancel registered trademarks. Opposition or cancellation proceedings may be filed against our trademarks, and our trademarks may not survive such proceedings. Moreover, any name we propose to use with our product candidates in the United States must be approved by the FDA, regardless of whether we have registered it, or applied to register it, as a trademark. The FDA typically conducts a review of proposed product names, including an evaluation of potential for confusion with other product names. If the FDA objects to any of our proposed proprietary product names, we may be required to expend significant additional resources in an effort to identify a suitable substitute name that would qualify under applicable trademark laws, not infringe the existing rights of third parties and be acceptable to the FDA.

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

Filing, prosecuting and defending patents on product candidates in all countries throughout the world would be prohibitively expensive, and our intellectual property rights in some countries outside the United States can 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, which could make it difficult for us to stop the infringement of our patents or marketing of competing products in violation of our proprietary rights generally. Proceedings to enforce our patent rights 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.

Risks related to ownership of our common stock

If we fail to satisfy applicable listing standards, our common stock may be delisted from the Nasdaq Global Select Market.*

On October 28, 2019, we received a letter from the Listing Qualifications Staff of the Nasdaq Stock Market LLC, or Nasdaq, notifying us that the closing bid price of our common stock had been below $1.00 per share for 30 consecutive business days and that we were therefore not in compliance with the minimum bid price requirement for continued listing on The Nasdaq Global Select Market, as required by Nasdaq Listing Rule 5550(a)(2). Nasdaq stated in its October 28, 2019 letter that, in accordance with Nasdaq Listing 5810(c)(3)(A), we have a grace period of 180 calendar days, or until April 27, 2020, to regain compliance with the minimum closing bid price requirement for continued listing. We will regain compliance if our closing bid price is at or above $1.00 for at least 10 consecutive business days anytime during the 180-day grace period.

There is no guarantee that we will be able to regain compliance with the Nasdaq minimum bid price requirement, which could result in Nasdaq taking steps to delist our common stock. Delisting from The Nasdaq Global Select Market could adversely affect our ability to raise additional financing through the public or private sale of equity securities, would significantly affect the ability of investors to trade our securities and would negatively affect the value and liquidity of our common stock. Delisting could also have other negative results, including the potential loss of confidence by employees, the loss of institutional investor interest and fewer business development opportunities. If our common stock is delisted by The Nasdaq Global Select Market, the price of our common stock may decline, and although our common stock may be eligible to trade on the OTC Bulletin Board, another over-the-counter quotation system, or on the pink sheets, an investor may find it more difficult to dispose of their common stock or obtain accurate quotations as to the market value of our common stock. Further, if we are delisted, we would incur additional costs under state blue sky laws in connection with any sales of our securities. These requirements could severely limit the market liquidity of our common stock and the ability of our shareholders to sell our common stock in the secondary market.

The market price of our common stock may be highly volatile, and you could lose all or part of your investment.

The market price of our common stock is likely to be volatile. Our stock price could be subject to wide fluctuations in response to a variety of factors, including the following:

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

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

Unstable market and economic conditions may have serious adverse consequences on our business, financial condition and stock price.

From time to time, global credit and financial markets have experienced extreme volatility and disruptions, including severely diminished liquidity and credit availability, declines in consumer confidence, declines in economic growth, increases in unemployment rates and uncertainty about economic stability. Our general business strategy may be adversely affected by any such economic downturn, volatile business environment and continued unpredictable and unstable market conditions. If the equity and credit markets deteriorate it may make any necessary debt or equity financing more difficult to complete, more costly, and more dilutive. Failure to secure any necessary financing in a timely manner and on favorable terms could have a material adverse effect on our growth strategy, financial performance and stock price and could require us to delay or abandon clinical development plans. In addition, there is a risk that one or more of our current service providers, manufacturers and other partners may not survive an economic down-turn, which could directly affect our ability to attain our operating goals on schedule and on budget.

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

We have never declared or paid any cash dividends on our common stock. We currently anticipate that we will retain future earnings for the development, operation and expansion of our business and do not anticipate declaring or paying any cash dividends for the foreseeable future, including due to limitations that are currently imposed by our Loan Agreement. Any return to stockholders will therefore be limited to the appreciation of their stock.

We are an emerging growth company, and we cannot be certain if the reduced reporting requirements applicable to emerging growth companies will make our common stock less attractive to investors.

We are an emerging growth company, as defined in the Jumpstart Our Business Startups Act, or JOBS Act. For as long as we continue to be an emerging growth company, we may take advantage of exemptions from various reporting requirements that are applicable to other public companies that are not emerging growth companies, including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002, as amended, or the Sarbanes-Oxley Act, reduced disclosure obligations regarding executive compensation in our periodic reports and proxy statements and exemptions from the requirements of holding nonbinding advisory votes on executive compensation and stockholder approval of any golden parachute payments not previously approved. We could be an emerging growth company for up to five years following the year in which we completed our initial public offering, although circumstances could cause us to lose that status earlier. We will remain an emerging growth company until the earlier of (1) the last day of the fiscal year (a) following the fifth anniversary of the completion of our initial public offering (i.e. December 31, 2022), (b) in which we have total annual gross revenue of at least $1.07 billion or (c) in which we are deemed to be a large accelerated filer, which requires the market value of our common stock that is held by non-affiliates to exceed $700 million as of the prior June 30th, and (2) the date on which we have issued more than $1 billion in non-convertible debt during the prior three-year period.

Even after we no longer qualify as an emerging growth company, 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 including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act and reduced disclosure obligations regarding executive compensation in our periodic reports and proxy statements. We cannot predict if investors will find our common stock less attractive because we may rely on 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.

Under the JOBS Act, emerging growth companies can also delay adopting new or revised accounting standards until such time as those standards apply to private companies. We have irrevocably elected not to avail ourselves of this exemption from new or revised accounting standards and, therefore, will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies. As a result, changes in rules of U.S. generally accepted accounting principles or their interpretation, the adoption of new guidance or the application of existing guidance to changes in our business could significantly affect our financial position and results of operations.

We will incur significant increased costs as a result of operating as a public company, and our management will be required to devote substantial time to existing and new compliance initiatives.

As a public company, we incur significant legal, accounting and other expenses that we did not incur as a private company. We are subject to the reporting requirements of the Securities Exchange Act of 1934, as amended, or the Exchange Act, which require, among other things, that we file with the SEC annual, quarterly and current reports with respect to our business and financial condition. In addition, the Sarbanes-Oxley Act, as well as rules subsequently adopted by the SEC and the Nasdaq Global Select Market to implement provisions of the Sarbanes-Oxley Act, impose significant requirements on public companies, including requiring establishment and maintenance of effective disclosure and financial controls and changes in corporate governance practices. Further, in July 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act, or the Dodd-Frank Act, was enacted. There are

significant corporate governance and executive compensation related provisions in the Dodd-Frank Act that require the SEC to adopt additional rules and regulations in these areas such as "say on pay" and proxy access. Recent legislation permits emerging growth companies to implement many of these requirements over a longer period and up to five years from the pricing of our initial public offering. We intend to take advantage of this legislation but cannot guarantee that we will not be required to implement these requirements sooner than budgeted or planned and thereby incur unexpected expenses. Stockholder activism, the current political environment and the current level of government intervention and regulatory reform may lead to substantial new regulations and disclosure obligations, which may lead to additional compliance costs and impact the manner in which we operate our business in ways we cannot currently anticipate.

We expect the rules and regulations applicable to public companies to continue to result in substantial legal and financial compliance costs and to make some activities more time-consuming and costly. If these requirements divert the attention of our management and personnel from other business concerns, they could have a material adverse effect on our business, financial condition and results of operations. These costs could decrease our net income or increase our net loss, and may require us to reduce costs in other areas of our business or increase the prices of our products or services. For example, these rules and regulations could make it more difficult and more expensive for us to obtain director and officer liability insurance and we may be required to incur substantial costs to maintain the same or similar coverage. We cannot predict or estimate the amount or timing of additional costs we may incur to respond to these requirements. The impact of these requirements could also make it more difficult for us to attract and retain qualified persons to serve on our board of directors, our board committees or as executive officers.

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

If our existing stockholders sell, or indicate an intention to sell, substantial amounts of our common stock in the public market, the market price of our common stock could decline. We had 23,897,771 shares of common stock outstanding as of November 1, 2019. We are unable to predict the effect that sales may have on the prevailing market price of our common stock.

Sales of our common stock by current stockholders may make it more difficult for us to sell equity or equity-related securities in the future at a time and price that we deem reasonable or appropriate, and make it more difficult for other stockholders to sell shares of our common stock. In addition, as of September 30, 2019, 4,945,457 shares of common stock that are either subject to outstanding options, reserved for future issuance under our equity incentive plans or subject to outstanding warrants 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. If these additional shares of common stock are sold, or if it is perceived that they will be sold, in the public market, the market price of our common stock could decline.

Future sales and issuances of our common stock or rights to purchase common stock, including pursuant to our equity incentive plans, could result in additional dilution of the percentage ownership of our stockholders and could cause our stock price to fall.*

Additional capital will be needed in the future to continue our planned operations. To the extent we raise additional capital by issuing equity securities, our stockholders may experience substantial dilution. We may sell common stock, convertible securities or other equity securities in one or more transactions at prices and in a manner we determine from time to time. If we sell common stock, convertible securities or other equity securities in more than one transaction, investors may be materially diluted by subsequent sales. These sales may also result in material dilution to our existing stockholders, and new investors could gain rights superior to our existing stockholders.

In November 2018, we entered into the ATM facility with Citigroup, pursuant to which we may sell and issue shares of our common stock having an aggregate offering price of up to $30.0 million from time to time through Citigroup, as our sales agent. As of September 30, 2019, we sold 760,089 shares of our common stock under the ATM facility and received net proceeds of $7.7 million.

Pursuant to our 2017 Equity Incentive Plan, or 2017 Plan, our management is authorized to grant stock options to our employees, directors and consultants. The number of shares of our common stock reserved for issuance under our 2017 Plan will automatically increase on January 1 of each year through and including January 1, 2027, by 4% of the total number of shares of our capital stock outstanding on December 31 of the preceding calendar year, or a lesser number of shares determined by our board of directors. Additionally, the number of shares of our common stock reserved for issuance under our 2017 Employee Stock Purchase Plan, or the ESPP, will automatically increase on January 1 of each year through and including January 1, 2027, by the lesser of 1% of the total number of shares of our capital stock outstanding on December 31 of the preceding calendar year, 300,000 shares or a lesser number of shares determined by our board of directors. Unless our board of directors elects not to increase the number of shares available for future grant each year under the 2017 Plan and the ESPP, our stockholders may experience additional dilution, which could cause our stock price to fall.

We have broad discretion in the use of working capital and may not use it effectively.*

Our management will have broad discretion in the application of working capital, and stockholders do not have the opportunity to assess whether working capital is being used appropriately. Because of the number and variability of factors that will determine our use of our working capital, its ultimate use may vary substantially from its currently intended use. Management might not apply working capital in ways that ultimately increase stockholder value. Failure by us to apply working capital effectively could harm our business. Pending its use, we may invest our working capital in short-term, investment-grade, interest-bearing securities. These investments may not yield a favorable return to our stockholders. If we do not invest or apply our working capital in ways that enhance stockholder value, we may fail to achieve expected financial results, which could cause our stock price to decline.

Changes in tax laws or regulations that are applied adversely to us or our customers may have a material adverse effect on our business, cash flow, financial condition or results of operations.*

New income, sales, use or other tax laws, statutes, rules, regulations or ordinances could be enacted at any time, which could affect the tax treatment of our domestic and foreign earnings. Any new taxes could adversely affect our domestic and international business operations, and our business and financial performance. Further, existing tax laws, statutes, rules, regulations or ordinances could be interpreted, changed, modified or applied adversely to us. For example, on December 22, 2017, U.S. federal income tax legislation was signed into law (H.R. 1, "An Act to provide for reconciliation pursuant to titles II and V of the concurrent resolution on the budget for fiscal year 2018"), informally titled the Tax Cuts and Jobs Act, or Tax Act, that significantly revised the Internal Revenue Code of 1986, as amended, or IRC. The Tax Act, among other things, contained 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 interest expense to 30% of adjusted taxable income, except for certain small businesses, limitation of the deduction for net operating losses generated in taxable years beginning after December 31, 2017, to 80% of current year taxable income, elimination of most carrybacks of net operating losses arising in taxable years ending after December 31, 2017, 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 modification or repeal of many business deductions and credits, including reduction of the business tax credit for certain clinical testing expenses incurred in the testing of certain drugs for rare diseases or conditions. We urge our stockholders to consult with their legal and tax advisors with respect to the Tax Act and the potential tax consequences of investing in or holding our common stock.

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

The trading market for our common stock will depend in part on the research and reports that securities or industry analysts publish about us or our business. If one or more of the analysts who covers us downgrades our stock or publishes inaccurate or unfavorable research about our business, our stock price may decline. If one or more of these analysts ceases coverage of our company or fails to publish reports on us regularly, demand for our stock could decrease, which might cause our stock price and trading volume to decline.

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

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

- permit our board of directors to issue up to 10,000,000 shares of preferred stock, with any rights, preferences and privileges as they may designate (including the right to approve an acquisition or other change in our control);
- provide that the authorized number of directors may be changed only by resolution of the board of directors;
- provide that the board of directors or any individual director may only be removed with cause and the affirmative vote of the holders of at least 66-2/3% of the voting power of all of our then outstanding common stock;
- provide that all vacancies, including newly created directorships, may, except as otherwise required by law, be filled by the affirmative vote of a majority of directors then in office, even if less than a quorum;
- divide our board of directors into three classes;
- require that any action to be taken by our stockholders must be effected at a duly called annual or special meeting of stockholders and not be taken by written consent;
- provide that stockholders seeking to present proposals before a meeting of stockholders or to nominate candidates for election as directors at a meeting of stockholders must provide notice in writing in a timely manner and also specify requirements as to the form and content of a stockholder's notice;

- do not provide for cumulative voting rights (therefore allowing the holders of a majority of the shares of common stock entitled to vote in any election of directors to elect all of the directors standing for election, if they should so choose);
- provide that special meetings of our stockholders may be called only by the chairman of the board, our Chief Executive Officer or by the board of directors pursuant to a resolution adopted by a majority of the total number of authorized directors; and
- provide that 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 or officers to us or our stockholders, (iii) any action asserting a claim against us arising pursuant to any provision of the Delaware General Corporation Law or our certificate of incorporation or bylaws, or (iv) any action asserting a claim against us governed by the internal affairs doctrine (these choice of forum provisions do not apply to suits brought to enforce a duty or liability created by the Securities Act, the Exchange Act, or any other claim for which the federal courts have exclusive jurisdiction).

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

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

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

Our amended and restated certificate of incorporation and amended and restated bylaws provide that the Court of Chancery of the State of Delaware is the sole and exclusive forum for substantially all disputes between us and 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 and amended and restated bylaws provide that the Court of Chancery of the State of Delaware is the sole and exclusive forum for (i) any derivative action or proceeding brought on our behalf; (ii) any action asserting a breach of fiduciary duty owed by any of our directors, officers or other employees to us or our stockholders; (iii) any action asserting a claim against us or any of our directors, officers or other employees arising pursuant to the Delaware General Corporation Law, our amended and restated certificate of incorporation or our amended and restated bylaws; or (iv) any action asserting a claim against us or any of our directors, officers or other employees that is governed by the internal affairs doctrine; *provided*, that these choice of forum provisions do not apply to suits brought to enforce a duty or liability created by the Securities Act, the Exchange Act, or any other claim for which the federal courts have exclusive jurisdiction. The choice of forum provision may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers or other employees, which may discourage such lawsuits against us and our directors, officers and other employees. Alternatively, if a court were to find the choice of forum provision contained in our amended and restated certificate of incorporation and amended and restated bylaws to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving such action in other jurisdictions, which could adversely affect our business and financial condition.

Because we have an even number of members of our board of directors, deadlocks may occur in our board of directors' decision-making process, which may delay or prevent critical decisions from being made.*

Since we have an even number of directors, deadlocks may occur when such directors disagree on a particular decision or course of action. Our amended and restated certificate of incorporation and amended and restated bylaws do not contain any mechanisms for resolving potential deadlocks. While our directors are under a duty to act in the best interest of our company, any deadlocks may impede the further development of our business in that such deadlocks may delay or prevent critical decisions regarding our business.

Item 6. Exhibits

The following exhibits are filed as part of this Quarterly Report on Form 10-Q.

Exhibit Number	Description of Exhibit
3.1	Amended and Restated Certificate of Incorporation of the Registrant, incorporated by reference to Exhibit 3.1 of the Registrant's Current Report on Form 8-K filed on April 19, 2017.
3.2	Amended and Restated Bylaws of the Registrant, incorporated by reference to Exhibit 3.2 of the Registrant's Current Report on Form 8-K filed on April 19, 2017.
4.1	Form of Common Stock Certificate of the Registrant, incorporated by reference to Exhibit 4.1 of the Registrant's Registration Statement on Form S-1 (File No. 333-216574), as amended, originally filed with the Securities and Exchange Commission on March 9, 2017.
4.2†	Research and Development Grant Agreement, dated June 5, 2013, by and between the Registrant and Voices Against Brain Cancer, incorporated by reference to Exhibit 4.3 of the Registrant's Registration Statement on Form S-1 (File No. 333-216574), as amended, originally filed with the Securities and Exchange Commission on March 9, 2017.
4.3	Warrant to Purchase Stock, dated October 30, 2015, issued to Oxford Finance LLC, incorporated by reference to Exhibit 4.4 of the Registrant's Registration Statement on Form S-1 (File No. 333-216574), as amended, originally filed with the Securities and Exchange Commission on March 9, 2017.
4.4	Warrant to Purchase Stock, dated October 30, 2015, issued to Silicon Valley Bank, incorporated by reference to Exhibit 4.5 of the Registrant's Registration Statement on Form S-1 (File No. 333-216574), as amended, originally filed with the Securities and Exchange Commission on March 9, 2017.
4.5	Warrant to Purchase Stock, dated May 18, 2018, issued to Oxford Finance LLC, incorporated by reference to Exhibit 4.6 of the Registrant's Quarterly Report on Form 10-Q filed on August 9, 2018.
4.6	Warrant to Purchase Stock, dated May 18, 2018, issued to Oxford Finance LLC, incorporated by reference to Exhibit 4.7 of the Registrant's Quarterly Report on Form 10-Q filed on August 9, 2018.
4.7	Warrant to Purchase Stock, dated May 18, 2018, issued to Oxford Finance LLC, incorporated by reference to Exhibit 4.8 of the Registrant's Quarterly Report on Form 10-Q filed on August 9, 2018.
4.8	Warrant to Purchase Stock, dated May 18, 2018, issued to Silicon Valley Bank, incorporated by reference to Exhibit 4.9 of the Registrant's Quarterly Report on Form 10-Q filed on August 9, 2018.
10.1*	Consent and Second Amendment to Amended and Restated Loan and Security Agreement, dated October 31, 2019, by and among the Registrant, Oxford Finance LLC and Silicon Valley Bank.
31.1*	Certification of Principal Executive Officer pursuant to Rule13a-14(a) and Rule 15d-14(a) of the Securities Exchange Act, as amended.
31.2*	Certification of Principal Financial Officer pursuant to Rule13a-14(a) and Rule 15d-14(a) of the Securities Exchange Act, as amended.
32.1*	Certification of Principal Executive Officer and Principal Financial Officer pursuant to Rule 13a-14(b) or 15d-14(b) of the Securities Exchange Act, as amended, and 18 U.S.C. Section 1350.
101.INS*	XBRL Instance Document.
101.SCH*	XBRL Taxonomy Extension Schema Document.
101.CAL*	XBRL Taxonomy Extension Calculation Linkbase Document.
101.DEF*	XBRL Taxonomy Extension Definition Linkbase Document.
101.LAB*	XBRL Taxonomy Extension Label Linkbase Document.
101.PRE*	XBRL Taxonomy Extension Presentation Linkbase Document.

* Filed herewith.

† Confidential treatment has been granted with respect to certain portions of this exhibit. Omitted portions have been filed separately with the Securities and Exchange Commission.

SIGNATURES

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

Date: November 12, 2019

TOCAGEN INC.

By: /s/ MARTIN J. DUVALL
Martin J. Duvall
Chief Executive Officer
(Principal Executive Officer)

By: /s/ MARK FOLETTA
Mark Foletta
Chief Financial Officer
(Principal Financial Officer)

Exhibit 10.1

CONSENT AND SECOND AMENDMENT TO AMENDED AND RESTATED LOAN AND SECURITY AGREEMENT

THIS CONSENT AND SECOND AMENDMENT TO AMENDED AND RESTATED LOAN AND SECURITY AGREEMENT (this "**Amendment**") is entered into as of October 31, 2019 (the "**Second Amendment Date**"), by and among OXFORD FINANCE LLC, a Delaware limited liability company with an office located at 133 North Fairfax Street, Alexandria, Virginia 22314, as collateral agent (in its individual capacity, "**Oxford**"; and in its capacity as collateral agent, "**Collateral Agent**"), the Lenders listed on Schedule 1.1 of the Loan Agreement (as defined below) or otherwise party thereto from time to time including Oxford in its capacity as a Lender and SILICON VALLEY BANK, a California corporation with an office located at 3003 Tasman Drive, Santa Clara, CA 95054 ("**Bank**" or "**SVB**") (each a "**Lender**" and collectively, the "**Lenders**"), and TOCAGEN INC., a Delaware corporation with offices located at 4242 Campus Point Ct., Suite 500, San Diego, CA 92121 ("**Borrower**").

WHEREAS, Collateral Agent, Borrower and the Lenders party to the Loan Agreement from time to time have entered into that certain Amended and Restated Loan and Security Agreement, dated as of May 18, 2018 (as amended, supplemented or otherwise modified from time to time, the "**Loan Agreement**") pursuant to which the Lenders have provided to Borrower certain loans in accordance with the terms and conditions thereof;

WHEREAS, Borrower has requested that Collateral Agent and the Lenders make certain revisions to the Loan Agreement, including, among other things, (i) not requiring the payment of the Prepayment Fee in connection with the prepayment of Twenty-One Million Four Hundred Fifty Thousand Dollars ($21,450,000) of the principal portion of the Obligations to be made on the date hereof, or in connection with any prepayment in connection with the sale of the Released Equipment (as defined below), or any other prepayment of the Obligations after the Second Amendment Date, in each case, which Borrower is otherwise obligated to do under the terms of the Loan Agreement, and (ii) consenting to the sale of certain Equipment and furniture set forth on Schedule 1 hereto (the "**Released Equipment**"), so long as the net cash proceeds from the sale of the Released Equipment are used to repay the Obligations, and in connection therewith terminate and release any and all Liens arising under the Loan Documents over the Released Equipment. In exchange for the agreement of the Lenders and the Collateral Agent to (i) not require the payment of the Prepayment Fee in connection with the prepayment of a portion of the Obligations to be made on the date hereof, and (ii) consent to the sale of the Released Equipment, and to compensate the Lenders and the Collateral Agent for the loss of (i) the Prepayment Fee in connection with the prepayment of a portion of the Obligations to be made on the date hereof, any prepayment in connection with the sale of the Released Equipment or any other prepayment of the Obligations after the Second Amendment Date, and (ii) the security interest in the Released Equipment, the Borrower has agreed to grant to the Lenders and the Collateral Agent a new security interest in Borrower's Intellectual Property, all as more fully set forth herein;

WHEREAS, although the Lenders and Collateral Agent are under no obligation to do so, the Lenders and Collateral Agent have agreed to (i) not require the payment of the Prepayment Fee in connection with the prepayment of a portion of the Obligations to be made on the date hereof, any prepayment in connection with the sale of the Released Equipment and any other prepayment of the Obligations after the Second Amendment Date, and (ii) consent to the sale of the Released Equipment so long as the net cash proceeds from the sale of the Released Equipment are used to repay the Obligations, but only to the extent, in accordance with the terms, subject to the conditions and in reliance upon the representations and warranties set forth below; and

WHEREAS, in connection with the foregoing, Borrower, the Lenders and Collateral Agent desire to amend certain provisions of the Loan Agreement, but only to the extent, in accordance with the terms, subject to the conditions and in reliance upon the representations and warranties set forth below;

NOW, THEREFORE, in consideration of the promises, covenants and agreements contained herein, and other good and valuable consideration, the receipt and adequacy of which are hereby acknowledged, Borrower, the Lenders and Collateral Agent hereby agree as follows:

1. Capitalized terms used herein but not otherwise defined shall have the respective meanings given to them in the Loan Agreement.

2. Notwithstanding the terms of the Loan Documents to the contrary, Collateral Agent and the Lenders (i) hereby agree that any Prepayment Fee due with respect to prepayment Twenty-One Million Four Hundred Fifty Thousand Dollars ($21,450,000) of the principal portion of the Obligations to be made on the date hereof shall not be due and owing as a result of such prepayments of principal, and each shall be deemed waived by Collateral Agent and the Lenders, (ii) hereby consent to the sale of the Released Equipment, so long as the proceeds from the sale of such assets are used to repay the Obligations, and (ii) upon the closing of the sale of the Released Equipment, release all Liens with respect to the Released Equipment under the Loan Agreement. The foregoing release shall take effect automatically, and without the need for further action by any Person, immediately upon the closing for the sale of the Released Equipment.

3. Section 2.2(d) of the Loan Agreement is hereby amended and restated as follows:

"(d) Permitted Prepayment of Term Loans.

(i) Borrower shall have the option to prepay all, but not less than all, of the Term Loans advanced by the Lenders under this Agreement, provided Borrower (i) provides written notice to Collateral Agent of its election to prepay the Term Loans at least ten (10) days prior to such prepayment, and (ii) pays to the Lenders on the date of such prepayment, payable to each Lender in accordance with its respective Pro Rata Share, an amount equal to the sum of (A) all outstanding principal of the Term Loans plus accrued and unpaid interest thereon through the prepayment date, (B) the Final Payment, (C) the Prepayment Fee, plus (D) all other Obligations that are due and payable, including Lenders' Expenses and interest at the Default Rate with respect to any past due amounts.

(ii) Notwithstanding anything herein to the contrary, on the Second Amendment Date, Borrower shall paydown a portion of the Term Loans in an amount equal to Twenty-Three Million Three Hundred Sixteen Thousand Eight Hundred Ninety-Four and 74/100 Dollars ($23,316,894.74), payable to each Lender in accordance with its respective Pro Rata Share, which amount shall be used to prepay (A) a portion equal to Twenty-One Million Four Hundred Fifty Thousand Dollars ($21,450,000) of the outstanding principal of the Term Loans plus all accrued and unpaid interest thereon through the prepayment date, (B) the Final Payment with respect to the portion of such Term Loans being prepaid, plus (C) all outstanding Lenders' Expenses as of the Second Amendment Date.

(iii) Notwithstanding anything herein to the contrary, after the Second Amendment Date, Borrower may paydown portions of the Term Loans in amounts equal to not less than Five Hundred Thousand Dollars ($500,000), or to the extent such prepayment is made as a result of a sale of Released Equipment (as defined in that certain Second Amendment and Consent to Loan and Security Agreement dated as of the Second Amendment Date, by and among Borrower, Agent and Lenders, shall pay down the Term Loans in amounts equal to the net cash proceeds received by Borrower from such sale, in each case, payable to each Lender in accordance with its respective Pro Rata Share, which amount shall be used to prepay (A) all or a portion of the outstanding principal of the Term Loans plus all accrued and unpaid interest thereon through the prepayment date, (B) the Final Payment with respect to the portion of such Term Loans being prepaid, plus (C) all outstanding Lenders' Expenses as of the prepayment date. For the purpose of clarity, any such partial prepayment shall be applied pro-rata to all outstanding amounts under the Term Loans and shall be applied pro-rata within each Term Loan tranche to reduce amortization payments under Section 2.2(b) on a pro-rata basis."

4. Section 5.2(d) of the Loan Agreement is hereby amended and restated as follows:

"(d) Borrower and each of its Subsidiaries is the sole owner of the Intellectual Property each respectively purports to own, free and clear of all Liens other than Permitted Liens. (i) Each of Borrower's and its Subsidiaries' Patents is valid and enforceable and no part of Borrower's or its Subsidiaries' Intellectual

Property has been judged invalid or unenforceable, in whole or in part, and (ii) to the best of Borrower's knowledge, no claim has been made that any part of the Intellectual Property or any practice by Borrower or its Subsidiaries violates the rights of any third party except to the extent such claim could not reasonably be expected to have a Material Adverse Change. Except as noted on the Perfection Certificates or as notified in writing to Collateral Agent, neither Borrower nor any of its Subsidiaries is a party to, nor is bound by, any material license or other material agreement with respect to which Borrower or such Subsidiary is the licensee that (i) prohibits or otherwise restricts Borrower or its Subsidiaries from granting a security interest in Borrower's or such Subsidiaries' interest in such material license or material agreement or any other property, or (ii) for which a default under or termination of could interfere with Collateral Agent's or any Lender's right to sell any Collateral. Borrower shall provide written notice to Collateral Agent and each Lender within ten (10) days of Borrower or any of its Subsidiaries entering into or becoming bound by any license or agreement with respect to which Borrower or any Subsidiary is the licensee (other than over-the-counter software that is commercially available to the public."

5. Section 6.2(a)(vii) of the Loan Agreement is hereby amended and restated in its entirety as follows:

"(vii) prompt notice of (A) any material change in the composition of the Intellectual Property, (B) the registration of any copyright, including any subsequent ownership right of Borrower or any of its Subsidiaries in or to any copyright, patent or trademark, including a copy of any such registration, and (C) any event that could reasonably be expected to materially and adversely affect the value of the Intellectual Property;"

6. Section 6.7 of the Loan Agreement is hereby amended and restated in its entirety as follows:

"**6.7 Protection of Intellectual Property.** Borrower and each of its Subsidiaries shall: (a) use commercially reasonable efforts to protect, defend and maintain the validity and enforceability of its Intellectual Property that is material to Borrower's business; (b) promptly advise Collateral Agent in writing of material infringement by a third party of its Intellectual Property; and (c) not allow any Intellectual Property material to Borrower's business to be abandoned, forfeited or dedicated to the public without Collateral Agent's prior written consent. If Borrower or any of its Subsidiaries (i) obtains any patent, registered trademark or servicemark, registered copyright, registered mask work, or any pending application for any of the foregoing, whether as owner, licensee or otherwise, or (ii) applies for any patent or the registration of any trademark or servicemark, then Borrower or such Subsidiary shall substantially contemporaneously provide written notice thereof to Collateral Agent and each Lender and shall execute such intellectual property security agreements and other documents and take such other actions as Collateral Agent shall reasonably request in its good faith business judgment to perfect and maintain a first priority perfected security interest in favor of Collateral Agent, for the ratable benefit of the Lenders, in such property. If Borrower or any of its Subsidiaries decides to register any copyrights or mask works in the United States Copyright Office, Borrower or such Subsidiary shall: (x) provide Collateral Agent and each Lender with at least fifteen (15) days prior written notice of Borrower's or such Subsidiary's intent to register such copyrights or mask works together with a copy of the application it intends to file with the United States Copyright Office (excluding exhibits thereto); (y) execute an intellectual property security agreement and such other documents and take such other actions as Collateral Agent may reasonably request in its good faith business judgment to perfect and maintain a first priority perfected security interest in favor of Collateral Agent, for the ratable benefit of the Lenders, in the copyrights or mask works intended to be registered with the United States Copyright Office; and (z) record such intellectual property security agreement with the United States Copyright Office contemporaneously with filing the copyright or mask work application(s) with the United States Copyright Office. Borrower or such Subsidiary shall promptly provide to Collateral Agent and each Lender with evidence of the recording of the intellectual property security agreement necessary for Collateral Agent to perfect and maintain a first priority perfected security interest in such property."

7. Section 13.1 of the Loan Agreement is hereby amended by amending and restating the following definitions therein as follows:

"**Loan Documents**" are, collectively, this Agreement, the Warrants, the Perfection Certificates, each Compliance Certificate, each Disbursement Letter, each Loan Payment/Advance Request Form and any Bank

Services Agreement, the Post Closing Letter, the IP Agreement, any subordination agreements, any note, or notes or guaranties executed by Borrower or any other Person, and any other pre-sent or future agreement entered into by Borrower, any Guarantor or any other Person for the benefit of the Lenders and Collateral Agent in connection with this Agreement; all as amended, restated, or other-wise modified.

8. Section 13.1 of the Loan Agreement is hereby further amended by adding the following definitions thereto in alphabetical order:

"**Second Amendment Date**" is October 31, 2019.

"**IP Agreement**" is that certain Intellectual Property Security Agreement entered into by and between Borrower and Collateral Agent dated as of the Second Amendment Date, as such may be amended from time to time.

9. Exhibit A to the Loan Agreement is hereby amended and restated in its entirety, without novation, as set forth on Exhibit A hereto.

10. Borrower hereby represents and warrants that a complete and accurate list of its Intellectual Property as of the Second Amendment Date is attached hereto as Exhibit B.

11. Borrower hereby reaffirms the security interest granted by Borrower previously in Section 4.1 of the Loan Agreement with respect to the Collateral and, as additional security for the repayment and performance in full of all of the Obligations, and to partially compensate Collateral Agent and the Lenders for the additional risk Collateral Agent and the Lenders are incurring by entering into this Amendment instead of exercising remedies available to Collateral Agent now, hereby grants Collateral Agent, for the ratable benefit of the Lenders a continuing security interest in, and pledges to Collateral Agent, for the ratable benefit of the Lenders, such part of the Collateral (including, without limitation, the Intellectual Property (whether or not listed on Exhibit B to this Amendment)) that was not pledged previously or in which security interest was not granted prior to the date hereof, wherever located, whether now owned or hereafter acquired or arising, and all proceeds and products thereof. Borrower agrees to promptly execute any and all documents Collateral Agent deems necessary to implement this grant of additional collateral. Furthermore, Borrower hereby authorizes Collateral Agent to file financing statements, amendments to financing statements or take any other action required to perfect Collateral Agent's security interests in the Collateral (as such term has been amended pursuant to this Amendment), without notice to Borrower, with all appropriate jurisdictions to perfect or protect Collateral Agent's interest or rights under the Loan Documents, including a notice that any disposition of the Collateral, except to the extent permitted by the terms of the Loan Documents, by Borrower, or any other Person, shall be deemed to violate the rights of Collateral Agent under the Code.

12. Limitation of Consent and Amendment.

    a. The consent set forth in Section 2 and the amendments set forth in Sections 3 through 9, above, are effective for the purposes set forth herein and shall be limited precisely as written and shall not be deemed to (i) be a consent to any amendment, waiver or modification of any other term or condition of any Loan Document, or (ii) otherwise prejudice any right or remedy which the Lenders, or obligation which Borrower, may now have or may have in the future under or in connection with any Loan Document.

    b. This Amendment shall be construed in connection with and as part of the Loan Documents and all terms, conditions, representations, warranties, covenants and agreements set forth in the Loan Documents, except as herein amended, are hereby ratified and confirmed and shall remain in full force and effect.

13. Release by Borrower.

    a. FOR GOOD AND VALUABLE CONSIDERATION, Borrower hereby forever relieves, releases, and discharges Collateral Agent and each Lender and their respective present or former employees,

officers, directors, agents, representatives, attorneys, and each of them, from any and all claims, debts, liabilities, demands, obligations, promises, acts, agreements, costs and expenses, actions and causes of action, of every type, kind, nature, description or character whatsoever, whether known or unknown, suspected or unsuspected, absolute or contingent, arising out of or in any manner whatsoever connected with or related to facts, circumstances, issues, controversies or claims existing or arising from the beginning of time through and including the date of execution of this Amendment solely to the extent such claims arise out of or are in any manner whatsoever connected with or related to the Loan Documents, the Recitals hereto, any instruments, agreements or documents executed in connection with any of the foregoing or the origination, negotiation, administration, servicing and/or enforcement of any of the foregoing (collectively "**Released Claims**").

b. In furtherance of this release, Borrower expressly acknowledges and waives any and all rights under Section 1542 of the California Civil Code, which provides as follows:

> "**A general release** does not extend to claims that the creditor or releasing party does not know or suspect to exist in his or her favor at the time of executing the release and that, if known by him or her, would have materially affected his or her settlement with the debtor or released party." (Emphasis added.)

c. By entering into this release, Borrower recognizes that no facts or representations are ever absolutely certain and it may hereafter discover facts in addition to or different from those which it presently knows or believes to be true, but that it is the intention of Borrower hereby to fully, finally and forever settle and release all matters, disputes and differences, known or unknown, suspected or unsuspected in respect of the Released Claims; accordingly, if Borrower should subsequently discover that any fact that it relied upon in entering into this release was untrue, or that any understanding of the facts was incorrect, Borrower shall not be entitled to set aside this release by reason thereof, regardless of any claim of mistake of fact or law or any other circumstances whatsoever. Borrower acknowledges that it is not relying upon and has not relied upon any representation or statement made by Bank with respect to the facts underlying this release or with regard to any of such party's rights or asserted rights.

d. This release may be pleaded as a full and complete defense and/or as a cross-complaint or counterclaim against any action, suit, or other proceeding that may be instituted, prosecuted or attempted in breach of this release. Borrower acknowledges that the release contained herein constitutes a material inducement to Collateral Agent and the Lenders to enter into this Amendment, and that Collateral Agent and the Lenders would not have done so but for Collateral Agent's and the Lenders' expectation that such release is valid and enforceable in all events.

e. Borrower hereby represents and warrants to Collateral Agent and the Lenders, and Collateral Agent and the Lenders are relying thereon, as follows:

i. Except as expressly stated in this Amendment, neither Collateral Agent, the Lenders nor any agent, employee or representative of any of them has made any statement or representation to Borrower regarding any fact relied upon by Borrower in entering into this Amendment.

ii. Borrower has made such investigation of the facts pertaining to this Amendment and all of the matters appertaining thereto, as it deems necessary.

iii. The terms of this Amendment are contractual and not a mere recital.

iv. This Amendment has been carefully read by Borrower, the contents hereof are known and understood by Borrower, and this Amendment is signed freely, and without duress, by Borrower.

v. Borrower represents and warrants that it is the sole and lawful owner of all right, title and interest in and to every claim and every other matter which it releases herein, and that it has not heretofore assigned or transferred, or purported to assign or transfer, to any person, firm or entity any claims or other matters herein released. Borrower shall indemnify Collateral Agent and the Lenders, defend and hold each harmless from and against all claims based upon or arising in connection with prior assignments or purported assignments or transfers of any claims or matters released herein.

14. To induce Collateral Agent and the Lenders to enter into this Amendment, Borrower hereby represents and warrants to Collateral Agent and the Lenders as follows:

a. Immediately after giving effect to this Amendment (i) the representations and warranties contained in the Loan Documents are true, accurate and complete in all material respects as of the date hereof (except to the extent such representations and warranties relate to an earlier date, in which case they are true and correct as of such date) and (ii) no Event of Default has occurred and is continuing;

b. Borrower has the power and due authority to execute and deliver this Amendment and to perform its obligations under the Loan Agreement, as amended by this Amendment;

c. The organizational documents of Borrower delivered to Collateral Agent on the Effective Date remain true, accurate and complete and have not been amended, supplemented or restated and are and continue to be in full force and effect;

d. The execution and delivery by Borrower of this Amendment and the performance by Borrower of its obligations under the Loan Agreement, as amended by this Amendment, do not and will not contravene (i) any law or regulation binding on or affecting Borrower, (ii) any contractual restriction with a Person binding on Borrower, (iii) any order, judgment or decree of any court or other governmental or public body or authority, or subdivision thereof, binding on Borrower, or (iv) the organizational documents of Borrower;

e. The execution and delivery by Borrower of this Amendment and the performance by Borrower of its obligations under the Loan Agreement, as amended by this Amendment, do not require any order, consent, approval, license, authorization or validation of, or filing, recording or registration with, or exemption by any governmental or public body or authority, or subdivision thereof, binding on Borrower, except as already has been obtained or made; and

f. This Amendment has been duly executed and delivered by Borrower and is the binding obligation of Borrower, enforceable against Borrower in accordance with its terms, except as such enforceability may be limited by bankruptcy, insolvency, reorganization, liquidation, moratorium or other similar laws of general application and equitable principles relating to or affecting creditors' rights.

15. Except as expressly set forth herein, the Loan Agreement shall continue in full force and effect without alteration or amendment. This Amendment and the Loan Documents represent the entire agreement about this subject matter and supersede prior negotiations or agreements.

16. This Amendment shall be deemed effective as of the First Amendment Date upon (a) the due execution and delivery to Collateral Agent of this Amendment by each party hereto, (b) the execution and delivery by Borrower of the IP Agreement, and (c) Borrower's payment of all Lenders' Expenses incurred through the date hereof, which may be debited (or ACH'd) from any of Borrower's accounts with the Lenders.

17. This Amendment may be executed in any number of counterparts, each of which shall be deemed an original, and all of which, taken together, shall constitute one and the same instrument.

18. This Amendment and the rights and obligations of the parties hereto shall be governed by and construed in accordance with the laws of the State of California.

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IN WITNESS WHEREOF, the parties hereto have caused this Consent and Second Amendment to Amended and Restated Loan and Security Agreement to be executed as of the date first set forth above.

BORROWER:

TOCAGEN INC.

By /s/ Martin J. Duvall
Name: Martin J. Duvall
Title: Chief Executive Officer

COLLATERAL AGENT AND LENDER:

OXFORD FINANCE LLC

By: /s/ Colette H. Featherly
Name: Colette H. Featherly
Title: Senior Vice President

LENDER:

SILICON VALLEY BANK

By: /s/ Kristine Rohmer
Name: Kristine Rohmer
Title: Vice President

SCHEDULE 1

List of Equipment and Furniture

EXHIBIT A

BORROWER: TOCAGEN INC.

Description of Collateral

The Collateral consists of all of Borrower's right, title and interest in and to the following personal property:

All goods, Accounts (including health-care receivables), Equipment, Inventory, contract rights or rights to payment of money, leases, license agreements, franchise agreements, General Intangibles (including all Intellectual Property), commercial tort claims, documents, instruments (including any promissory notes), chattel paper (whether tangible or electronic), cash, deposit accounts and other Collateral Accounts, all certificates of deposit, fixtures, letters of credit rights (whether or not the letter of credit is evidenced by a writing), securities, and all other investment property, supporting obligations, and financial assets, whether now owned or hereafter acquired, wherever located; and

All Borrower's Books relating to the foregoing, and any and all claims, rights and interests in any of the above and all substitutions for, additions, attachments, accessories, accessions and improvements to and replacements, products, proceeds and insurance proceeds of any or all of the foregoing.

Notwithstanding the foregoing, the Collateral does not include (i) any Equipment subject to a Lien described in clause (c) of the definition of "Permitted Liens" if the granting of a Lien in such Equipment is prohibited by or would constitute a default under the agreement governing such Equipment (but (A) only to the extent such prohibition is enforceable under applicable law and (B) other than to the extent that any such term would be rendered ineffective pursuant to Sections 9-406, 9-408 or 9-409 (or any other Section) of Division 9 of the Code); provided that upon the termination, lapsing or expiration of any such prohibition, such Equipment shall automatically be subject to the security interest granted in favor of Collateral Agent hereunder and become part of the "Collateral"; and (ii) any license or contract, in each case if the granting of a Lien in such license or contract is prohibited by or would constitute a default under the agreement governing such license or contract (but (A) only to the extent such prohibition is enforceable under applicable law and (B) other than to the extent that any such term would be rendered ineffective pursuant to Sections 9-406, 9-408 or 9-409 (or any other Section) of Division 9 of the Code); provided that upon the termination, lapsing or expiration of any such prohibition, such license or contract, as applicable, shall automatically be subject to the security interest granted in favor of Collateral Agent hereunder and become part of the "Collateral."

Pursuant to the terms of a certain negative pledge arrangement with Collateral Agent and the Lenders, Borrower has agreed not to encumber any of its Intellectual Property.

EXHIBIT B

Intellectual Property

Exhibit 31.1

CERTIFICATION

I, Martin J. Duvall, certify that:

1. I have reviewed this quarterly report on Form 10-Q of Tocagen Inc., a Delaware corporation (the "registrant");

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: November 12, 2019

/s/ MARTIN J. DUVALL

Martin J. Duvall
Chief Executive Officer
(Principal Executive Officer)

Exhibit 31.2

CERTIFICATION

I, Mark Foletta, certify that:

1. I have reviewed this quarterly report on Form 10-Q of Tocagen Inc., a Delaware corporation (the "registrant");

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: November 12, 2019

/s/ MARK FOLETTA

Mark Foletta
Chief Financial Officer
(Principal Financial Officer)

Exhibit 32.1

SECTION 1350 CERTIFICATION

Each of the undersigned, Martin J. Duvall, Chief Executive Officer of Tocagen Inc., a Delaware corporation (the "Company"), and Mark Foletta, Chief Financial Officer of the Company, do hereby certify, pursuant to 18 U.S.C. Section 1350 as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to the best of his knowledge (1) the quarterly report on Form 10-Q of the Company for the quarterly period ended September 30, 2019, as filed with the Securities and Exchange Commission on the date hereof (the "Report") and to which this Certification is attached as Exhibit 32.1, 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.

/s/ Martin J. Duvall
Name: Martin J. Duvall
Title: Chief Executive Officer (Principal Executive Officer)
Dated: November 12, 2019

/s/ Mark Foletta
Name: Mark Foletta
Title: Chief Financial Officer (Principal Financial Officer)
Dated: November 12, 2019

This certification accompanies and is being "furnished" with this Report, shall not be deemed "filed" by the Company for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, or otherwise subject to liability under that Section and shall not be deemed to be incorporated by reference into any filing of the Company under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, whether made before or after the date of this Report, irrespective of any general incorporation language contained in such filing. A signed original of this written statement required by Section 906, or other document authenticating, acknowledging, or otherwise adopting the signature that appears in typed form within the electronic version of this written statement required by Section 906, has been provided to the Company and will be retained by the Company and furnished to the Securities and Exchange Commission or its staff upon request.