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

FORM 10-Q

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

For the quarterly period ended 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: 001-35005

ASSEMBLY BIOSCIENCES, INC.
(Exact name of Registrant as specified in its charter)

Delaware	**20-8729264**
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
11711 N. Meridian St., Suite 310 **Carmel, Indiana** (Address of principal executive offices)	**46032** (zip code)

(833) 509-4583
(Registrant's telephone number, including area code)

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	ASMB	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, a smaller reporting company, or an emerging growth company. See definition of "large accelerated filer," "accelerated filer," "smaller reporting company" and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large Accelerated Filer	☒	Accelerated Filer	☐
Non-accelerated Filer	☐	Smaller Reporting Company	☐
Emerging growth company	☐		

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

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

As of November 4, 2019, there were 26,047,046 shares of the registrant's common stock outstanding.

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PART I - FINANCIAL INFORMATION
Item 1. Financial Statements

ASSEMBLY BIOSCIENCES, INC.
CONDENSED CONSOLIDATED BALANCE SHEETS
($ in thousands except for share and per share amounts)

	September 30, 2019 (Unaudited)	December 31, 2018
ASSETS		
Current assets		
Cash and cash equivalents	$ 24,867	$ 41,471
Marketable securities	132,070	176,609
Accounts receivable from collaboration	2,944	2,430
Prepaid expenses and other current assets	5,441	1,992
Total current assets	165,322	222,502
Property and equipment, net	1,931	557
Operating lease right-of-use assets	12,783	—
Other assets	1,671	3,348
Indefinite-lived intangible asset	29,000	29,000
Goodwill	12,638	12,638
Total assets	**$ 223,345**	**$ 268,045**
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities		
Accounts payable	$ 2,709	$ 3,693
Accrued expenses	9,430	9,679
Deferred revenue - short-term	6,151	5,100
Operating lease liabilities - short-term	3,208	—
Total current liabilities	21,498	18,472
Deferred rent	—	108
Deferred tax liabilities	3,251	3,252
Deferred revenue - long-term	32,268	35,560
Operating lease liabilities - long-term	9,839	—
Total liabilities	**66,856**	**57,392**
Commitments and contingencies		
Stockholders' equity		
Preferred stock, $0.001 par value; 5,000,000 shares authorized; no shares issued or outstanding	—	—
Common stock, $0.001 par value; 100,000,000 shares authorized as of September 30, 2019 and December 31, 2018; 25,872,723 and 25,495,425 shares issued and outstanding as of September 30, 2019 and December 31, 2018, respectively	26	25
Additional paid-in capital	569,005	552,762
Accumulated other comprehensive loss	(205)	(347)
Accumulated deficit	(412,337)	(341,787)
Total stockholders' equity	156,489	210,653
Total liabilities and stockholders' equity	**$ 223,345**	**$ 268,045**

See Accompanying Notes to Condensed Consolidated Financial Statements.

ASSEMBLY BIOSCIENCES, INC.
CONDENSED CONSOLIDATED STATEMENTS OF OPERATIONS AND COMPREHENSIVE LOSS
($ in thousands except for share and per share amounts)
(Unaudited)

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Collaboration revenue	$ 4,231	$ 4,286	$ 11,197	$ 11,069
Operating expenses:				
Research and development	21,736	19,109	63,141	51,490
General and administrative	8,488	7,752	22,085	25,992
Total operating expenses	30,224	26,861	85,226	77,482
Loss from operations	**(25,993)**	**(22,575)**	**(74,029)**	**(66,413)**
Other income (expenses)				
Interest and other income	983	1,116	3,441	2,015
Other income (expense), net	-	(82)	5	(232)
Total other income	983	1,034	3,446	1,783
Loss before income taxes	**(25,010)**	**(21,541)**	**(70,583)**	**(64,630)**
Income tax benefit	15	6	33	40
Net loss	**$ (24,995)**	**$ (21,535)**	**$ (70,550)**	**$ (64,590)**
Other comprehensive (loss) income				
Unrealized gain (loss) on marketable securities, net of tax	(18)	17	142	37
Comprehensive loss	**$ (25,013)**	**$ (21,518)**	**$ (70,408)**	**$ (64,553)**
Net loss per share, basic and diluted	$ (0.96)	$ (0.87)	$ (2.74)	$ (2.95)
Weighted average common shares outstanding, basic and diluted	25,912,568	24,878,413	25,765,414	21,900,943

See Accompanying Notes to Condensed Consolidated Financial Statements.

ASSEMBLY BIOSCIENCES, INC.
CONDENSED CONSOLIDATED STATEMENTS OF CASH FLOWS
($ in thousands)
(Unaudited)

	Nine Months Ended September 30,	
	2019	**2018**
Cash flows from operating activities		
Net loss	$ (70,550)	$ (64,590)
Adjustments to reconcile net loss to net cash used in operating activities:		
Depreciation and amortization	377	473
Stock-based compensation	14,049	21,678
Net accretion and amortization of investments in marketable securities	(1,503)	232
Non-cash rent expense	3,344	—
Deferred income tax benefit	(10)	(40)
Loss on disposal of fixed assets	102	—
Other	(5)	—
Changes in operating assets and liabilities:		
Accounts receivable from collaboration	(514)	(316)
Prepaid expenses and other current assets	(3,763)	(2,445)
Other assets	1,677	(611)
Accounts payable	(984)	863
Accrued expenses	(330)	378
Deferred revenue	(2,241)	(3,861)
Deferred rent	—	8
Operating lease liabilities	(3,188)	—
Net cash used in operating activities	(63,539)	(48,231)
Cash flows from investing activities		
Purchases of property and equipment	(1,539)	(129)
Purchases of marketable securities	(149,327)	(115,030)
Proceeds from maturities of marketable securities	166,911	41,921
Proceeds from sale of marketable securities	28,659	—
Net cash provided by (used in) investing activities	44,704	(73,238)
Cash flows from financing activities		
Proceeds from common stock sold, net of underwriters' discount and cost	-	155,425
Net proceeds from the issuance of common stock through equity plans	2,231	3,763
Net cash provided by financing activities	2,231	159,188
Net increase (decrease) in cash and cash equivalents	(16,604)	37,719
Cash and cash equivalents at the beginning of the period	41,471	82,033
Cash and cash equivalents at the end of the period	**$ 24,867**	**$ 119,752**

See Accompanying Notes to Condensed Consolidated Financial Statements.

ASSEMBLY BIOSCIENCES, INC.
CONDENSED CONSOLIDATED STATEMENTS OF CHANGES IN STOCKHOLDERS' EQUITY
($ in thousands except share amounts)
(Unaudited)

Three months ended September 30, 2019

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount				
Balance as of June 30, 2019	**25,646,783**	**26**	**562,210**	**(187)**	**(387,342)**	**174,707**
Issuance of common stock upon exercise of stock options	192,606	—	1,385	—	—	1,385
Issuance of shares of common stock for settlement of restricted stock units (RSUs)	33,334	—	—	—	—	—
Unrealized gain on marketable securities, net of tax	—	—	—	(18)	—	(18)
Stock-based compensation	—	—	5,410	—	—	5,410
Net loss	—	—	—	—	(24,995)	(24,995)
Balance as of September 30, 2019	**25,872,723**	**26**	**569,005**	**(205)**	**(412,337)**	**156,489**

Three months ended September 30, 2018

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount				
Balance as of June 30, 2018	**20,614,498**	**$ 21**	**383,543**	**(372)**	**(294,091)**	**89,101**
Proceeds from common stock sold, net of underwriters' discount and cost	4,600,000	4	155,421	—	—	155,425
Issuance of common stock upon exercise of stock options	244,686	—	419	—	—	419
Settlement of restricted stock units into common stock	938	—	—	—	—	—
Unrealized gain on marketable securities, net of tax	—	—	—	17	—	17
Stock-based compensation	—	—	6,006	—	—	6,006
Net loss	—	—	—	—	(21,535)	(21,535)
Balance as of September 30, 2018	**25,460,122**	**$ 25**	**545,389**	**(355)**	**(315,626)**	**229,433**

Nine months ended September 30, 2019

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount				
Balance as of December 31, 2018	**25,495,425**	**25**	**552,762**	**(347)**	**(341,787)**	**210,653**
Issuance of common stock upon exercise of stock options	243,481	—	1,716	—	—	1,716
Issuance of common stock under Employee Stock Purchase Plan (ESPP)	36,804	—	515	—	—	515
Issuance of shares of common stock for settlement of restricted stock units (RSUs)	97,013	1	(1)	—	—	—
Reclassification of stock-based awards from equity to accrued expenses	—	—	(4)	—	—	(4)
Unrealized gain on marketable securities, net of tax	—	—	—	142	—	142
Stock-based compensation	—	—	14,017	—	—	14,017
Net loss	—	—	—	—	(70,550)	(70,550)
Balance as of September 30, 2019	**25,872,723**	**26**	**569,005**	**(205)**	**(412,337)**	**156,489**

Nine months ended September 30, 2018

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount				
Balance as of December 31, 2017	**20,137,974**	**$ 20**	**364,528**	**(392)**	**(251,036)**	**113,120**
Proceeds from common stock sold, net of underwriters' discount and cost	4,600,000	4	155,421	—	—	155,425
Issuance of common stock upon exercise of stock options	721,210	1	3,762	—	—	3,763
Settlement of restricted stock units into common stock	938	—	—	—	—	—
Unrealized gain on marketable securities, net of tax	—	—	—	37	—	37
Stock-based compensation	—	—	21,678	—	—	21,678
Net loss	—	—	—	—	(64,590)	(64,590)
Balance as of September 30, 2018	**25,460,122**	**$ 25**	**545,389**	**(355)**	**(315,626)**	**229,433**

See Accompanying Notes to Condensed Consolidated Financial Statements

Note 1 - Nature of Business

Overview

Assembly Biosciences, Inc., together with its subsidiaries (Assembly or the Company), incorporated in Delaware in October 2005, is a clinical-stage biotechnology company developing innovative therapeutics targeting chronic hepatitis B virus (HBV) and diseases associated with the microbiome. The Company operates in one segment and is headquartered in Carmel, Indiana with operations in South San Francisco, California and Groton, Connecticut.

The Company's HBV-cure program is pursuing multiple drug candidates that inhibit the HBV lifecycle and block the generation of covalently closed circular DNA (cccDNA), with the aim of increasing the current low cure rates for patients with HBV. Assembly has discovered several novel core inhibitors, which are small molecules that directly target and allosterically modify the HBV core (HBc) protein.

The Company's Microbiome program consists of a fully integrated platform that includes a strain isolation, identification, characterization and function-based selection process, methods for strain purification and growth under conditions compliant with current Good Manufacturing Practice (cGMP) requirements, and a licensed patented delivery system, GEMICEL®, which is designed to allow for targeted oral delivery of live biologic and conventional therapies to the lower gastrointestinal (GI) tract. Using the Company's microbiome platform capabilities, the Company is exploring product candidates for multiple disease indications, including ulcerative colitis (UC), Crohn's disease and irritable bowel syndrome (IBS) with Allergan Pharmaceuticals International Limited (Allergan) in connection with its Research, Development, Collaboration and License Agreement (the Collaboration Agreement), as well as immune-mediated and metabolic disorders and oncology, which indications the Company will pursue either internally or in collaboration with other parties.

Liquidity

The Company has not derived any revenue from product sales to date and currently has no approved products. Once a product has been developed, it will need to be approved for sale by the U.S. Food and Drug Administration (FDA) or an applicable foreign regulatory agency. Since inception, the Company's operations have been financed primarily through the sale of equity securities, the proceeds from the exercise of warrants and stock options, the issuance of debt and an upfront payment related to the Collaboration Agreement. The Company has incurred losses from operations since inception and expects to continue to incur substantial losses for the next several years as it continues its product development efforts. Management believes the Company currently has sufficient funds to meet its operating requirements for at least the next twelve months following the date that these unaudited condensed consolidated interim financial statements are issued. If the Company cannot generate significant cash from its operations, it intends to obtain any additional funding it requires through strategic relationships, public or private equity or debt financings, grants or other arrangements. The Company cannot assure such funding will be available on reasonable terms, if at all.

If the Company is unable to generate enough revenue from the Collaboration Agreement when needed or to secure additional sources of funding and receive related full and timely collections of amounts due, it may be necessary to significantly reduce the current rate of spending through reductions in staff and delaying, scaling back, or stopping certain research and development programs, including more costly clinical trials.

Note 2 - Summary of Significant Accounting Policies and Recent Accounting Pronouncements

Basis of Presentation

The accompanying unaudited interim condensed consolidated financial statements include the accounts of the Company and its subsidiaries. All intercompany balances and transactions have been eliminated in consolidation.

The accompanying unaudited interim condensed consolidated financial statements have been prepared in accordance with the accounting principles generally accepted in the United States of America (U.S. GAAP) for interim financial information and pursuant to the instructions to Form 10-Q and Rule 10-01 of Regulation S-X of the U.S. Securities and Exchange Commission (SEC). In management's opinion, the unaudited interim condensed consolidated financial statements have been prepared on the same basis as the annual audited consolidated financial statements and include normal recurring adjustments necessary for the fair presentation of the Company's financial position and its results of operations and comprehensive loss and its cash flows for the periods presented. These statements do not include all disclosures required by U.S. GAAP and should be read in conjunction with the Company's audited consolidated financial statements and accompanying notes for the fiscal year ended December 31, 2018, which are contained in the Company's Annual Report on Form 10-K as filed with the SEC on February 28, 2019. The results for the three and nine months ended September 30, 2019 are not necessarily indicative of results to be expected for the entire year ending December 31, 2019 or future operating periods.

Use of Estimates

The preparation of the unaudited condensed consolidated financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that may affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and reported amounts of expenses during the reporting period. Actual results could differ from those estimates.

Significant estimates inherent in the preparation of the accompanying unaudited condensed consolidated financial statements include revenue recognition, clinical trial accruals, recoverability and useful lives (indefinite or finite) of intangible assets, assessment of impairment of goodwill, provisions for income taxes, amounts receivable and recognized as revenue under the Collaboration Agreement, measurement of operating lease liabilities, and the fair value of stock options, stock appreciation rights, and restricted stock units (RSUs) granted to employees, directors and consultants.

The Company's estimates could be affected by external conditions, including those unique to the Company and general economic conditions. It is reasonably possible that these external factors could have an effect on the Company's estimates and could cause actual results to differ from those estimates and assumptions.

Significant Accounting Policies

There have been no material changes to the Company's significant accounting policies from those described in the Company's Annual Report on Form 10-K for the year ended December 31, 2018, other than as set forth below.

Stock-Based Compensation

The Company expenses stock-based compensation to employees and Board members over the requisite service period based on the estimated grant-date fair value of the awards. Stock-based awards with graded-vesting schedules are recognized using the accelerated attribution method over the requisite service period for each separately vesting portion of the award.

Prior to the adoption of Accounting Standards Update (ASU) 2018-07 (ASU 2018-07) on January 1, 2019, the Company remeasured the fair value of the non-employee awards at each reporting period prior to vesting and finally at the vesting date of the award. Changes in the estimated fair value of these non-employee awards were recognized as compensation expense in the period of change. Subsequent to the adoption of ASU 2018-07, the Company recognizes non-employee compensation costs over the requisite service period based on a measurement of fair value for each stock award.

The Company estimates the fair value of stock option grants using the Black-Scholes option pricing model and the assumptions used in calculating the fair value of stock-based awards represent management's best estimates and involve inherent uncertainties and the application of management's judgment. Forfeitures are recognized when incurred.

The fair value of restricted stock units is determined based on the number of shares granted and the quoted market price of the Company's common stock on the date of grant. The fair value of restricted stock units with performance conditions deemed probable of being achieved and vesting are amortized to expense over the requisite service period using the accelerated attribution method of expense recognition.

Leases

All of the Company's leases are operating leases for facilities and equipment. Prior to January 1, 2019, the Company recognized related rent expense on a straight-line basis over the term of the lease. Incentives granted under the Company's facilities lease, including allowances for leasehold improvements and rent holidays, were recognized as reductions to rental expense on a straight-line basis over the term of the lease. Deferred rent consisted of the difference between cash payments and the rent expense recognized.

Subsequent to the adoption of the new leasing standard on January 1, 2019, the Company recognizes a lease asset for its right to use the underlying asset and a lease liability for the corresponding lease obligation. The Company determines whether an arrangement is or contains a lease at contract inception. Operating leases are included in operating lease right-of-use assets, operating lease liabilities - short-term, and operating lease liabilities - long-term in the Company's condensed consolidated balance sheet at September 30, 2019. Operating lease right-of-use assets and liabilities are recognized at the lease commencement date based on the present value of lease payments over the lease term. In determining the net present value of lease payments, the Company uses its incremental borrowing rate based on the information available at the lease commencement date. The incremental borrowing rate represents the interest rate the Company would incur at lease commencement to borrow an amount equal to the lease payments on a collateralized basis over the term of a lease. The Company considers a lease term to be the noncancelable period that it has the right to use the underlying asset, including any periods where it is reasonably assured the Company will exercise the option to extend the contract. Periods covered by an option to extend are included in the lease term if the lessor controls the exercise of that option.

The operating lease right-of-use assets also include any lease payments made and exclude lease incentives. Lease expense is recognized on a straight-line basis over the expected lease term. Variable lease expenses are recorded when incurred. The Company has elected not to separate lease and non-lease components for its leased assets and accounts for all lease and non-lease components of its agreements as a single lease component.

Net Loss per Share

Basic net loss per common share excludes dilution and is computed by dividing net loss by the weighted average number of common shares outstanding during the period. Diluted net loss per common share reflects the potential dilution that could occur if securities or other contracts to issue common stock were exercised or converted into common stock or resulted in the issuance of common stock that then shared in the earnings of the entity unless inclusion of such shares would be anti-dilutive. Since the Company has only incurred losses, basic and diluted net loss per share is the same.

Securities that could potentially dilute loss per share in the future that were not included in the computation of diluted loss per share are as follows:

	Nine Months Ended September 30,	
	2019	2018
Warrants to purchase common stock	15,296	15,296
Options to purchase common stock	5,462,773	4,422,194
Common stock subject to purchase under ESPP	17,018	10,198
Unvested RSUs	668,515	343,465
Total	6,163,602	4,791,153

A reconciliation of the numerators and the denominators of the basic and diluted net loss per common share computations is as follows (in thousands, except per share amounts):

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Numerator:				
Net loss (in thousands)	(24,995)	(21,535)	(70,550)	(64,590)
Denominator:				
Weighted average common shares outstanding for diluted net (loss) income per share	25,912,568	24,878,413	25,765,414	21,900,943
Net (loss) income per share:				
Basic	(0.96)	(0.87)	(2.74)	(2.95)
Diluted	(0.96)	(0.87)	(2.74)	(2.95)

Adoption of Recent Accounting Pronouncements

In February 2016, the Financial Accounting Standards Board (FASB) issued ASU 2016-02, *Leases* (ASU 2016-02). Under this standard, which applies to both lessors and lessees, lessees will be required to recognize all leases (except for short-term leases) as a lease liability, which is a lessee's obligation to make lease payments arising from a lease measured on a discounted basis, and as 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. Leases will be classified as either financing or operating, with classification affecting the pattern of expense recognition in the income statement. In January, July and December 2018 and March 2019, the FASB issued additional amendments to the new lease guidance related to transition and clarification.

The Company adopted ASU 2016-02 on January 1, 2019 using the modified retrospective approach and elected the package of practical expedients permitted under transition guidance, which allowed the Company to carry forward its historical assessments of: (1) whether contracts are or contain leases, (2) lease classification and (3) initial direct costs. The Company did not elect the use-of-hindsight practical expedient, which would require the Company to reassess the lease term of its leases based on all facts and circumstances through the effective date, and the Company did not elect the practical expedient pertaining to land easements as this is not applicable to the Company's current contract portfolio. The Company elected the post-transition practical expedient to not separate lease components from nonlease components for all existing lease classes. The Company also elected a policy of not recording leases on its condensed consolidated balance sheets when the leases have a term of 12 months or less and the Company is not reasonably certain to elect an option to purchase the leased asset.

The adoption of this standard resulted in the recognition of right of use (ROU) assets and lease liabilities of $13.8 million and $14.0 million, respectively, and the derecognition of the deferred rent balance of $0.1 million as of January 1, 2019. The adoption of the standard had no impact on the Company's condensed consolidated statements of operations and comprehensive loss or to its cash flows from or used in operating, financing, or investing activities on its condensed consolidated statements of cash flows. No cumulative-effect adjustment within accumulated deficit was required to be recorded as a result of adopting this standard.

On January 1, 2019, the Company adopted ASU 2018-02, *Income Statement - Reporting Comprehensive Income, (Topic 220): Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income,* which allows a reclassification from accumulated other comprehensive income to retained earnings for stranded tax effects resulting from the federal corporate income tax rate enacted under the Tax Cuts and Jobs Act (the Tax Act). The amount of the reclassification would be the difference between the historical corporate income tax rate and the Tax Act's 21% corporate income tax rate. The Company's adoption of this standard did not have a material impact on its condensed consolidated financial statements.

On January 1, 2019, the Company adopted ASU 2018-07, *Compensation-Stock Compensation (Topic 718): Improvements to Nonemployee Share-Based Payment Accounting* (ASU 2018-07), which simplifies several aspects of the accounting for nonemployee share-based payment transactions resulting from expanding the scope of Topic 718, *Compensation – Stock Compensation* to include share-based payment transactions for acquiring goods and services from nonemployees. The Company's adoption of this standard did not have a material impact on its condensed consolidated financial statements.

In August 2018, the SEC adopted amendments to certain disclosure requirements in Securities Act Release No. 33-10532, *Disclosure Update and Simplification*. The amendments became effective on November 5, 2018 and impact the Company's condensed consolidated financial statements through, among other things, the addition of a requirement to present a statement of stockholders' equity for interim periods. As a result of adopting this guidance, the Company is presenting comparative interim statements of stockholders' equity in this Quarterly Report on Form 10-Q for the quarters ended September 30, 2019 and 2018. Additionally, the guidance also simplified certain non-material disclosures in the Company's SEC filings.

Recent Accounting Pronouncements

In November 2018, the FASB issued ASU 2018-18, *Collaborative Arrangements (Topic 808): Clarifying the Interaction between Topic 808 and Topic 606*, which clarifies that certain transactions between collaborative arrangement participants should be accounted for as revenue under Topic 606 when the collaborative arrangement participant is a customer in the context of a unit of account. In those situations, all the guidance in Topic 606 should be applied, including recognition, measurement, presentation, and disclosure requirements. The standard adds unit-of-account guidance in Topic 808 to align with the guidance in Topic 606 (that is, a distinct good or service) when an entity is assessing whether the collaborative arrangement or a part of the arrangement is within the scope of Topic 606 and requires that in a transaction with a collaborative arrangement participant that is not directly related to sales to third parties, presenting the transaction together with revenue recognized under Topic 606 is precluded if the collaborative arrangement participant is not a customer. The standard is effective for interim and annual periods beginning after December 15, 2019, with early adoption permitted, including adoption in any interim period for public business entities for periods in which financial statements have not been issued. Amendments in the standard should be applied retrospectively to the date of initial application of Topic 606, but entities may elect to apply the amendments in Topic 808 retrospectively either to all contracts or only to contracts that are not completed at the date of initial application of Topic 606, and should disclose the election. An entity may also elect to apply the practical expedient for contract modifications that is permitted for entities using the modified retrospective transition method in Topic 606. The Company is currently assessing the impact of this standard on its condensed consolidated financial statements and related disclosures.

In August 2018, the FASB issued ASU 2018-13, *Fair Value Measurement (Topic 820): Disclosure Framework - Changes to the Disclosure Requirements for Fair Value Measurement*, which makes a number of changes meant to add, modify or remove certain disclosure requirements associated with the movement amongst or hierarchy associated with Level 1, Level 2 and Level 3 fair value measurements. This guidance is effective for fiscal years, and interim periods within those fiscal years, beginning after December 15, 2019. Early adoption is permitted upon issuance of the update. The Company does not expect the adoption of this guidance to have a material impact on its condensed consolidated financial statements and related disclosures.

In January 2017, the FASB issued ASU 2017-04, *Intangibles-Goodwill and Other (Topic 350): Simplifying the Test for Goodwill Impairment* (ASU 2017-04), which simplifies how an entity is required to test goodwill for impairment by eliminating Step 2 from the goodwill impairment test. Step 2 measures a goodwill impairment loss by comparing the implied fair value of a reporting unit's goodwill with the carrying amount of that goodwill. Under the amendments in ASU 2017-04, an entity should recognize an impairment charge for the amount by which the carrying amount of a reporting unit exceeds its fair value; however, the loss recognized should not exceed the total amount of goodwill allocated to that reporting unit. The updated guidance requires a prospective adoption. ASU 2017-04 is effective for fiscal years beginning after December 15, 2019, including interim periods within those fiscal years. Early adoption is permitted for goodwill impairment tests performed on testing dates after January 1, 2017. The Company is currently evaluating the timing and impact of adopting this new accounting standard on its condensed consolidated financial statements and related disclosures.

In June 2016, the FASB issued ASU 2016-13, *Financial Instruments - Credit Losses: Measurement of Credit Losses on Financial Instruments*, which requires that expected credit losses relating to financial assets measured on an amortized cost basis and available-for-sale debt securities be recorded through an allowance for credit losses. ASU 2016-13 limits the amount of credit losses to be recognized for available-for-sale debt securities to the amount by which carrying value exceeds fair value and also requires the reversal of previously recognized credit losses if fair value increases. In April 2019, the FASB issued ASU 2014-04, *Codification Improvements to Topic 326 Financial Instruments - Credit Losses, Topic 815, Derivatives and Hedging, and Topic 825, Financial Instruments*, which clarifies certain aspects of the accounting for credit losses, hedging activities and financial instruments. In May 2019, the FASB issued ASU 2019-05, *Financial Instruments - Credit Losses (Topic 326): Targeted Transition Relief*, which provides transition relief for entities adopting the Board’s credit losses standard. Specifically, ASU 2019-05 amends ASU 2016-13 to allow companies to irrevocably elect, upon adoption of ASU 2016-13, the fair value option for financial instruments that (1) were previously recorded at amortized cost and (2) are within the scope of the credit losses guidance in Accounting Standards Codification (ASC) 326-20, (3) are eligible for the fair value option under ASC 825-10, and (4) are not held-to-maturity debt securities. The new standard will be effective on January 1, 2020. Early adoption is available. The Company is currently evaluating the effect that the updated standard will have on its condensed consolidated financial statements and related disclosures.

Note 3 – Investments in Marketable Securities

The carrying amounts of cash equivalents and marketable securities approximate their fair value based upon quoted market prices. Certain of the Company’s financial instruments are not measured at fair value on a recurring basis, but are recorded at amounts that approximate their fair value due to their liquid or short-term nature, such as cash, accounts receivable, accounts payable, accrued expenses, lease liability-short term and deferred revenue-short term.

The Company uses the following three-level hierarchy that maximizes the use of observable inputs and minimizes the use of unobservable inputs to value its financial instruments:

Level 1: Observable inputs such as unadjusted quoted prices in active markets for identical instruments.

Level 2: Quoted prices for similar instruments that are directly or indirectly observable in the marketplace.

Level 3: Significant unobservable inputs that are supported by little or no market activity and that are financial instruments whose values are determined using pricing models, discounted cash flow methodologies, or similar techniques, as well as instruments for which the determination of fair value requires significant judgment or estimation.

Investments in marketable securities consisted of the following:

	September 30, 2019			
($ in thousands)	Amortized Cost	Gross Unrealized Gain (1)	Gross Unrealized Loss (1)	Fair Value
Short-term available-for-sale securities				
U.S. and foreign corporate debt securities	$ 34,111	$ 44	$ —	$ 34,155
Asset-backed securities	22,117	16	—	22,133
U.S. treasury securities	27,008	16	(6)	27,018
U.S. and foreign commercial paper	48,764	—	—	48,764
Total	$ 132,000	$ 76	$ (6)	$ 132,070

(1) Gross unrealized gain (loss) is pre-tax.

	December 31, 2018			
($ in thousands)	Amortized Cost	Gross Unrealized Gain (1)	Gross Unrealized Loss (1)	Fair Value
Short-term available-for-sale securities				
U.S. and foreign corporate debt securities	$ 73,251	$ —	$ (92)	$ 73,159
Asset-backed securities	28,450	—	(31)	28,419
U.S. treasury securities	19,898	—	(3)	19,895
U.S. and foreign commercial paper	55,136	—	—	55,136
Total	$ 176,735	$ —	$ (126)	$ 176,609

(1) Gross unrealized gain (loss) is pre-tax.

The contractual term to maturity of short-term marketable securities held by the Company as of September 30, 2019 is less than one year. There were no long-term marketable securities held by the Company as of September 30, 2019.

Realized gains and losses for the three and nine months ended September 30, 2019 and 2018 were not significant.

The following tables present the fair value of the Company's financial assets measured at fair value on a recurring basis:

	September 30, 2019			
($ in thousands)	Level 1	Level 2	Level 3	Fair Value
Cash equivalents				
Money market fund	$ 19,948	$ —	$ —	$ 19,948
Total cash equivalents	19,948	—	—	19,948
Short-term investments				
U.S. and foreign corporate debt securities	—	34,155	—	34,155
Asset-backed securities	—	22,133	—	22,133
U.S. treasury securities	—	27,018	—	27,018
U.S. and foreign commercial paper	—	48,764	—	48,764
Total short-term investments	—	132,070	—	132,070
Total assets measured at fair value	$ 19,948	$ 132,070	$ —	$ 152,018

	December 31, 2018			
($ in thousands)	Level 1	Level 2	Level 3	Fair Value
Cash equivalents				
Money market fund	$ 39,345	$ —	$ —	$ 39,345
Total cash equivalents	39,345	—	—	39,345
Short-term investments				
U.S. and foreign corporate debt securities	—	73,159	—	73,159
Asset-backed securities	—	28,419	—	28,419
U.S. treasury securities	—	19,895	—	19,895
U.S. and foreign commercial paper	—	55,136	—	55,136
Total short-term investments	—	176,609	—	176,609
Total assets measured at fair value	$ 39,345	$ 176,609	$ —	$ 215,954

The Company estimates the fair value of its U.S. and foreign corporate debt securities, asset-backed securities, U.S. treasury securities and U.S. and foreign commercial paper by taking into consideration valuations obtained from third-party pricing services. The pricing services utilize industry standard valuation models, including both income and market-based approaches, for which all significant inputs are observable, either directly or indirectly, to estimate fair value. These inputs include reported trades of and broker/dealer quotes on the same or similar securities, issuer credit spreads, benchmark securities, prepayment/default projections based on historical data, and other observable inputs.

There were no transfers between Level 1, Level 2 or Level 3 during the periods presented.

Note 4 - Property and Equipment, net

Property and equipment consist of the following:

($ in thousands)	Useful life (Years)	September 30, 2019	December 31, 2018
Computer hardware and software	3	$ —	$ 194
Lab equipment	3 to 5	230	407
Office equipment	7	699	70
Leasehold improvement	1 to 5	2,084	790
Total property, plant and equipment		3,013	1,461
Less: Accumulated depreciation and amortization		(1,082)	(1,057)
Construction in progress	N/A	—	153
Property, plant and equipment, net		$ 1,931	$ 557

Depreciation expense was approximately $0.1 million and $0.4 million for the three and nine months ended September 30, 2019, respectively and approximately $0.2 million and $0.5 million for the three and nine months ended September 30, 2018, respectively, and was recorded in both research and development expense and general and administrative expense in the unaudited condensed consolidated statements of operations and comprehensive loss.

Note 5 – Accrued Expenses

Accrued expenses consist of the following:

($ in thousands)	September 30, 2019	December 31, 2018
Accrued expenses:		
Accrued compensation	$ 4,042	$ 5,011
Accrued clinical trial expenses	4,321	3,561
Accrued professional fees and other	1,067	1,107
Total accrued expenses	$ 9,430	$ 9,679

Note 6 – Stock Plans and Stock-Based Compensation

Equity Incentive Plans

In May 2018, the Company's stockholders approved the Assembly Biosciences, Inc. 2018 Stock Incentive Plan (the 2018 Plan) pursuant to which the Company reserved 1,900,000 shares of its common stock for issuance in connection with equity incentive awards, and in May 2019, the Company's stockholders approved Amendment No. 1 (the Amendment) to the 2018 Plan to increase the number of shares reserved for issuance thereunder from 1,900,000 shares of common stock to 3,000,000. In May 2018, the Company's stockholders also approved the Assembly Biosciences, Inc. Employee Stock Purchase Plan (the 2018 ESPP), pursuant to which eligible employees can purchase an aggregate of up to 400,000 shares of the Company's common stock at the end of predetermined offering periods at 85% of the lower of the fair market value at the beginning or end of the offering period.

As of September 30, 2019, the Company had awards outstanding under the following shareholder-approved plans:

- 2010 Equity Incentive Plan (the 2010 Plan), which has been frozen;
- the Amended and Restated 2014 Stock Incentive Plan (the 2014 Plan); and
- the 2018 Plan.

Shares of common stock underlying awards that are forfeited under the 2010 Plan on or after June 2, 2016 will become available for issuance under the 2014 Plan. As of September 30, 2019, the Company also had awards outstanding under the Assembly Biosciences, Inc. 2017 Inducement Award Plan (the 2017 Plan) and the Assembly Biosciences, Inc. 2019 Inducement Award Plan (the 2019 Plan).

The Company issues new shares of common stock to settle options exercised and upon settlement of vested RSUs. The Company also issues new shares of common stock in connection with purchases of shares of common stock by eligible employees under the Company's 2018 ESPP.

Stock Plan Activity

Stock Options

A summary of the Company's option activity and related information for the nine months ended September 30, 2019 is as follows:

	Number of Shares	Weighted Average Exercise Price Per Share	Total Intrinsic Value (in thousands)
Outstanding as of December 31, 2018	4,637,145	$ 17.21	$ 48,179
Granted	1,418,350	15.74	—
Exercised	(243,481)	7.05	1,642
Forfeited	(346,741)	44.85	117
Expired	(2,500)	49.14	—
Outstanding as of September 30, 2019	5,462,773	$ 15.52	$ 9,000
Options vested and exercisable	3,278,755	$ 12.01	$ 8,656

Restricted Stock Units (RSUs)

A summary of the Company's RSUs and related information for the nine months ended September 30, 2019 is as follows:

	Number of RSU's	Weighted Average Grant Price
Outstanding as of December 31, 2018	568,005	$ 37.18
Granted	435,928	15.24
Vested and settled	(97,254)	45.05
Forfeited	(126,497)	24.41
Outstanding as of September 30, 2019	780,182 [(1)]	$ 26.01

(1) Includes 111,667 RSUs that have vested but are subject to deferred settlement.

As of September 30, 2019, RSUs outstanding include 45,000 RSUs granted in December 2017 and 100,000 RSUs granted in September 2019, each with performance-based conditions to executives of the Company. In the second quarter of 2019, 100,000 RSUs granted to a former officer were forfeited due to his departure. These RSUs had a grant date fair value of $2.4 million and were vesting over time but would have accelerated upon the achievement of certain performance-based conditions. The Company reversed the previously recognized expense of $0.4 million related to these forfeited awards upon the departure of the former officer.

As of September 30, 2019, the Company had unrecognized stock-based compensation expense related to all unvested RSUs of $10.2 million.

In May 2019, employees purchased 36,804 shares of common stock under the 2018 ESPP.

Valuation Assumptions

The fair value of the stock options granted or modified during the periods indicated was estimated using the Black-Scholes option pricing model, based on the following assumptions:

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2019	2018	2019	2018
Exercise price	$10.91 - $49.14	$38.88 - $41.25	$10.91 - $49.14	$38.88 - $57.53
Expected volatility	66.4% - 80.6%	76.0% - 84.5%	66.4% - 83.2%	76.0% - 86.1%
Risk-free rate	1.36% - 1.89%	2.75% - 2.94%	1.36% - 2.65%	2.56% - 2.94%
Expected term (years)	5.5 - 9.6	5.5 - 7.0	5.5 - 9.6	5.5 - 7.0
Dividend yield	0%	0%	0%	0%

The fair value of RSUs granted is determined based on the price of the Company's common stock on the date of grant.

Stock-Based Compensation Expense

The following table summarizes the components of total stock-based compensation expense included in the condensed consolidated statements of operations and comprehensive loss:

	Three Months Ended September 30,		Nine Months Ended September 30,	
($ in thousands)	2019	2018	2019	2018
Research and development	$ 2,464	$ 2,474	$ 8,309	$ 8,687
General and administrative	2,940	3,532	5,740 (1)	12,991
Total stock-based compensation expense	$ 5,404	$ 6,006	$ 14,049	$ 21,678

(1) Includes the reversal of previously recognized expense of $3.6 million related to forfeited awards resulting from the departure of one of our former officers during the period.

Note 7 - Collaboration Agreement

Allergan

In January 2017, the Company entered into the Collaboration Agreement with Allergan to develop and commercialize select microbiome gastrointestinal disease therapies. Pursuant to the Collaboration Agreement, the Company granted Allergan an exclusive worldwide license to certain of its intellectual property, including its intellectual property arising under the Collaboration Agreement, to develop and commercialize licensed compounds for UC, Crohn's disease, and two compounds for IBS. Allergan and the Company also agreed to collaborate on research and development activities with respect to the licensed compounds in accordance with a mutually agreed upon research and development plan. Per the terms of the Collaboration Agreement, Allergan can select backups and additional target indications to add to the licenses granted for additional consideration and also has the ability to enter into a contract manufacturing agreement with the Company for compound supply at cost plus an agreed upon margin. In addition, the Company will participate on a Joint Development Committee (JDC) and Joint Patent Committee (JPC). The Company provided to Allergan standard indemnification and protection of licensed intellectual property, which is part of assurance that the license meets the contract's specifications and is not an obligation to provide goods or services.

Allergan paid the Company an upfront non-refundable payment of $50.0 million, which was received in 2017. Additionally, the Company is eligible to receive variable consideration in the form of research and development cost reimbursements, up to approximately $631.0 million related to seven development milestones and up to approximately $2.14 billion related to 12 commercial development and sales milestones in connection with the successful development and commercialization of licensed compounds. In addition, the Company is eligible to receive tiered royalties at rates ranging from the mid-single digits to the mid-teens based on net sales.

Allergan and the Company have agreed to share research and development costs up to an aggregate of $75.0 million through proof-of-concept (POC) studies on a ⅔, ⅓ basis, respectively, and Allergan has agreed to assume all post-POC development costs. In the event any pre-POC development costs exceed $75.0 million in the aggregate, the Company may elect either (a) to fund ⅓ of such costs in excess of $75.0 million or (b) to allow Allergan to deduct from future development milestone payments ⅓ of the development costs funded by Allergan in excess of $75.0 million plus a premium of 25%. The Company has an option to co-promote the licensed programs in the U.S. and China, subject to certain conditions set forth in the Collaboration Agreement.

Allergan may terminate the Collaboration Agreement at any time upon 120 days' advance written notice to the Company. Unless terminated early, the Collaboration Agreement has a term that ends on the earlier of the (i) the period when POC studies have been completed and no further licensed compounds or licensed products are in development, and (ii) expiration of the last to exist valid claim covering the manufacture, use and sale of the licensed products. The Collaboration Agreement also contains customary provisions for termination by either party, including in the event of breach of the Collaboration Agreement, subject to cure. Upon termination for convenience, the licenses granted by the Company and its know-how all revert to the Company.

The Company concluded that Allergan is a customer and that the Collaboration Agreement is not subject to accounting literature on collaborative arrangements. This is because the Company granted to Allergan licenses to its intellectual property and research and development services, all of which are outputs of the Company's ongoing activities, in exchange for consideration. The Company identified the following material promises under the Collaboration Agreement: (1) transfer of licenses to intellectual property for the four initial indications, inclusive of the related technology know-how (Licenses) and (2) the obligation to perform research development services through POC (Development Services). The Company's participation on the JDC and JPC were considered to be immaterial in the context of the contract. The Company's co-promotion option was not considered to be a performance obligation. Allergan's selection of backups or additional target indications to add to the licenses granted for additional consideration and ability to enter into a contract manufacturing agreement with the Company for compound supply at cost plus an agreed upon margin were not considered to be performance obligations as the Company concluded the options were not offered at a discount that exceeds discounts available to other customers, and therefore were not material rights. The grant of additional licensing rights upon option exercises and contract manufacturing agreements will be accounted for as separate contracts when they occur.

The Company concluded the Licenses each were considered to be functional as they have significant standalone functionality and were capable of being distinct. However, the Company determined that each of the Licenses individually were not distinct from the Development Services within the context of the agreement. This is because Allergan is dependent on the Company to execute the Development Services, which it is uniquely able to perform, in order for Allergan to benefit from the Licenses. As such, the Company determined that it has four performance obligations under the Collaboration Agreement associated with the transfer of the four compound Licenses combined with the performance of the Development Services for each of the four compound indications. The Company determined that the four performance obligations will be performed over the duration of the contract, which began in February 2017 and ends upon completion of the Development Services. The Company originally estimated the completion of the Development Services to be in 2024. During the second quarter of 2019, the completion of the Development Services was extended to 2025 based on updated estimates of effort associated with the Company's and Allergan's development plans. This change in estimate did not have a material impact on the Company's revenue recognition. The Company is using a cost-based input method to measure proportional performance and to calculate the corresponding amount of revenue to recognize. The Company believes this is the best measure of progress because other measures do not reflect how the Company transfers its performance obligation to Allergan. In applying the cost-based input method of revenue recognition, the Company measures costs incurred relative to budgeted costs to fulfill the four performance obligations. These costs consist primarily of third-party contract costs and internal labor costs. Revenue will be recognized based on actual costs incurred as a percentage of total budgeted costs as the Company completes its performance obligations.

To allocate transaction price among the four performance obligations, the Company estimated their standalone selling price (SSP) using an income-based valuation approach for the estimated value a licensor of the compounds would receive considering the stage of the compounds' development. The Company believes that a change in the assumptions used to determine its best estimate of selling price for the four performance obligations would not have a significant effect on the allocation of consideration received to the four performance obligations.

The transaction price at the inception of the agreement and upon adoption of ASC 606 was limited to $50.0 million upfront payment. Of this amount, the Company allocated $12.5 million to each of the four performance obligations. Research and development cost reimbursement payments are included in the transaction price in the reporting period that the Company concludes that it is probable that recording revenue in the period will not result in a significant reversal in amounts recognized in future periods. The variable consideration related to the remaining development and commercialization milestone payments has not been included in the transaction price as these were fully constrained at September 30, 2019. As part of the Company's evaluation of the development and commercialization milestones constraint, the Company determined that the achievement of such milestones is contingent upon success in future clinical trials and regulatory approvals which are not within its control and uncertain at this stage. Any variable consideration related to sales-based milestones (including royalties) will be recognized when the related sales occur as they were determined to relate predominantly to the license granted to Allergan. The Company will re-evaluate the transaction price in each reporting period and as uncertain events are resolved or other changes in circumstances occur.

The Company did not incur any significant incremental costs of obtaining the Allergan contract.

For the nine months ended September 30, 2019 and 2018, the Company recognized approximately $11.2 million and $11.1 million, respectively, in revenue associated with the Collaboration Agreement. Short-term and long-term deferred revenue contract liabilities related to the Collaboration Agreement were approximately $6.2 million and approximately $32.3 million at September 30, 2019 and approximately $5.1 million and approximately $35.6 million at December 31, 2018.

On the unaudited condensed consolidated balance sheets, contract asset balances of approximately $2.9 million and approximately $2.4 million were recorded as accounts receivable from collaboration as of September 30, 2019 and December 31, 2018, respectively.

The following table presents changes in the Company's contract liabilities ($ in thousands):

	Balance at Beginning of Period	Additions	Deductions	Balance at End of Period
Nine Months Ended September 30, 2019				
Contract liabilities:				
Deferred revenue	$ 40,660	$ —	$ (2,241)	$ 38,419

	Balance at Beginning of Period	Additions	Deductions	Balance at End of Period
Nine Months Ended September 30, 2018				
Contract liabilities:				
Deferred revenue	$ 45,785	$ —	$ (3,861)	$ 41,924

	Three Months Ended September 30,		Nine Months Ended September 30,	
($ in thousands)	**2019**	**2018**	**2019**	**2018**
Collaboration revenue recognized in the period from				
Amounts included in deferred revenue at the beginning of the period	1,245	1,666	2,241	3,861
Performance obligations satisfied in previous period	—	—	—	—

Note 8 - Milestones and Research Agreements

HBV Research Agreement with Indiana University

Since September 2013, the Company has been party to an exclusive License Agreement dated September 3, 2013 with Indiana University Research and Technology Corporation (IURTC) from whom it has licensed aspects of the Company's HBV program held by IURTC. The license agreement requires the Company to make milestone payments based upon the successful accomplishment of clinical and regulatory milestones. The aggregate amount of all performance milestone payments under the IURTC license agreement, should all milestones through development be met, is approximately $0.8 million, with a portion related to the first performance milestone having been paid. The Company also is obligated to pay IURTC royalty payments based on net sales of the licensed technology. The Company is also obligated to pay diligence maintenance fees each year to the extent that the royalty, sublicensing, and milestone payments to IURTC are less than the diligence maintenance fee for that year. Amounts paid in the nine months ended September 30, 2019 and 2018 were insignificant.

Microbiome Targeted Colonic Delivery Platform

In November 2013, the Company entered into a License and Collaboration Agreement with Therabiome, LLC (Therabiome), for all intellectual property and know-how owned or controlled by Therabiome relating to the oral delivery of pharmaceutical drugs to specific sites in the intestine, using a pH sensitive controlled release capsule-in-capsule technology. The Company will be solely responsible for all research and development activities with respect to any product it develops under the license.

The Company must pay Therabiome clinical and regulatory milestones for each product or therapy advanced from the platform for U.S. regulatory milestones. The Company also must pay Therabiome lesser amounts for foreign regulatory milestones, which vary by country and region. The Company also must pay Therabiome royalties on annual net sales of a product in the low to mid-single digit percentages plus, once annual net sales exceed certain thresholds, a one-time cash payment upon reaching the thresholds.

Therabiome must pay the Company royalties on annual net sales of any product Therabiome is permitted to develop using the intellectual property in the low double to mid-double-digit percentages, depending on the level of development or involvement the Company had in the product.

Two regulatory milestones totaling $350,000 were determined to have occurred under this agreement and were paid during the nine months ended September 30, 2019. No amounts were accrued for this agreement as of and for the nine months ended September 30, 2018.

Note 9 - Leases

Operating Leases

The Company leases office space for corporate and administrative functions in Carmel, Indiana under a lease agreement that expires in August 2023. The Company leases office and laboratory space in South San Francisco, California under a sub-sublease that expires in December 2023. Prior to moving into the South San Francisco office and laboratory space in February 2019, the Company leased office and laboratory space in San Francisco, California, under a sublease that expired on February 28, 2019. The Company also leases office and laboratory space in Groton, Connecticut under a lease that expires in March 2020. The Company's China subsidiary leases office space in Shanghai that expires in May 2020 and rents lab space in Shanghai under a lease agreement that expires in December 2019. Additionally, the Company's China subsidiary leases office space in Beijing under a lease agreement that expires in December 2019. Certain lease contracts contain renewal clauses that the Company assesses on a case by case basis. The Company also leases certain laboratory equipment accounted for as operating leases. These equipment leases began to expire in 2017, with the final lease expiring in 2021.

When the Company cannot determine the implicit rate in its leasing arrangements, the Company uses its incremental borrowing rate as the discount rate when measuring operating lease liabilities. The incremental borrowing rate represents an estimate of the interest rate the Company would incur at lease commencement to borrow an amount equal to the lease payments on a collateralized basis over the term of a lease within a particular currency environment.

At September 30, 2019, the Company had operating lease liabilities of $13.0 million and right-of-use assets of $12.8 million, which were included in the condensed consolidated balance sheet.

The following summarizes quantitative information about the Company's operating leases:

($ in thousands)	**Three Months Ended September 30, 2019**	**Nine Months Ended September 30, 2019**
Lease cost		
Operating lease cost	$ 1,136	$ 3,344
Short-term lease cost	88	520
Variable lease cost	301	900
Total lease cost	$ 1,525	$ 4,764

($ in thousands)	**Three Months Ended September 30, 2019**	**Nine Months Ended September 30, 2019**
Operating cash flows from operating leases	$ 1,089	$ 3,188
Right-of-use assets exchanged for new operating lease liabilities	$ 928	$ 1,328

As of September 30, 2019, the weighted-average remaining lease term for operating leases was approximately 2.9 years and the weighted-average discount rate for operating leases was approximately 9.4%.

As of September 30, 2019, the maturities of the Company's operating lease liabilities were as follows (in thousands):

Three months ended December 31, 2019	$	4,361
Year Ended December 31, 2020		4,072
Year Ended December 31, 2021		3,532
Year Ended December 31, 2022		3,331
Year Ended December 31, 2023		806
Total		16,102
Less: present value discount		(3,055)
Operating lease liabilities	$	13,047

Operating lease costs were approximately $1.1 million and $3.3 million, for the three and nine months ended September 30, 2019, respectively and $0.8 million and $2.3 million for the three and nine months ended September 30, 2018, respectively.

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

The interim financial statements and this Management's Discussion and Analysis of Financial Condition and Results of Operations should be read in conjunction with the financial statements and notes thereto for the year ended December 31, 2018 and the related Management's Discussion and Analysis of Financial Condition and Results of Operations, both of which are contained in our Annual Report on Form 10-K for the fiscal year ended December 31, 2018 filed with the U.S. Securities and Exchange Commission on February 28, 2019 (2018 Annual Report). In addition to historical information, this discussion and analysis contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended and Section 21E of the Securities Exchange Act of 1934, as amended (the Exchange Act). These forward-looking statements are subject to risks and uncertainties, including those set forth under "Part I. Item 1A. Risk Factors" in our 2018 Annual Report, "Part II. Item 1A. Risk Factors" in this report, and elsewhere in this report, that could cause actual results to differ materially from historical results or anticipated results.

Overview

We are a clinical-stage biotechnology company developing innovative therapeutics targeting chronic hepatitis B virus (HBV) infection and diseases associated with the microbiome.

HBV-cure Program

Over 250 million people worldwide are chronically infected with HBV. Our HBV-cure program is pursuing multiple drug candidates that inhibit the HBV lifecycle and block the generation of covalently closed circular DNA (cccDNA), with the aim of increasing the current low cure rate for patients with HBV. We have discovered several novel core inhibitors, which are small molecules that directly target and allosterically modulate the HBV core (HBc) protein.

ABI-H0731

The lead product candidate from this program, ABI-H0731, is currently in an ongoing Phase 2a long-term open label combination study (Study 211) and has completed a Phase 1a/1b human clinical study in countries outside the United States. We have also completed an additional Phase 1a (ABI-H0731-102) pharmacokinetic (PK), safety and tolerability study of ABI-H0731 in healthy volunteers in the United States. In 2018, the U.S. Food and Drug Administration (FDA) granted Fast Track designation to ABI-H0731 for the treatment of patients with chronic HBV infection.

In July 2018, we commenced two Phase 2a combination studies for ABI-H0731, ABI-H0731-201 (Study 201) and ABI-H0731-202 (Study 202) at sites in the United States, Canada, Hong Kong, New Zealand and the United Kingdom. All subjects who completed treatment in Study 201 or Study 202 had the option to roll over into Study 211 and receive the combination of ABI-H0731 with ongoing standard of care nucleos(t)ide (Nuc) therapy. We expect that subjects in Study 211 will be treated for up to an additional year from the time of completion of their participation in either Study 201 or Study 202. Subjects in Study 211 who achieve a complete response, currently defined as viral DNA and RNA below limits of quantification, will begin a six-month treatment consolidation period and then have the opportunity to stop all treatment (ABI-H0731 and standard of care Nuc therapy) and be monitored for six or more months off therapy to assess whether combination therapy improves the rate of sustained viral responses. Final data from Studies 201 and 202 and interim results for Study 211 are expected in the fourth quarter of 2019.

Study 201 enrolled HBV patients whose viral load had already been suppressed on a standard of care Nuc therapy. Seventy-three patients were randomized 3:2 to receive either 300 mg of ABI-H0731 daily or placebo in addition to their continued Nuc therapy for 24 weeks. Study 201 compared the safety and tolerability of combination therapy with ABI-H0731, as well as evaluated HBV DNA and RNA levels and declines in HBV S antigen (HBsAg) and HBV e antigen (HBeAg), to those seen in patients on Nuc monotherapy.

Study 202 enrolled 25 HBeAg positive HBV patients who are naïve to Nuc treatment and randomized 1:1 to receive either 300 mg of ABI-H0731 daily or placebo in combination with standard of care entecavir (0.5 mg) for 24 weeks. Study 202 assessed the relative antiviral potency of combination therapy compared with entecavir alone. Endpoints included the speed and depth of viral suppression, as well as changes in biomarkers (HBsAg and HBeAg) and HBV RNA levels, and the safety and tolerability of ABI-H0731.

We presented interim safety and efficacy data from both Study 201 and Study 202 during a late-breaker oral session at The International Liver Congress™ (ILC), the Annual Meeting of the European Association for the Study of the Liver (EASL) in April 2019. The late-breaker abstract was also selected for inclusion in the "Best of ILC" presentation. The initial safety data suggest that ABI-H0731 in combination with Nuc therapy was well tolerated. Adverse events (AEs) were mild, infrequent, and evaluated as generally unrelated to treatment. There were no treatment-related discontinuations, no serious adverse events and no clinical AEs greater than Grade 2 observed. Lab abnormalities were mostly Grade 1, transient, and not thought to be related to the drug. The initial efficacy data suggest that combination therapy exhibited rapid and enhanced antiviral benefit in suppressing HBV DNA and RNA levels, with significant RNA reductions not observed with Nuc treatment alone. In treatment-naïve patients enrolled in Study 202, accelerated and significant declines in HBV DNA were observed starting as early as Week 2 of treatment. Reduction in residual viral DNA levels that persist on extended Nuc therapy to undetectable levels (<2-5 IU/mL) were only observed with combination therapy. We believe that complete suppression of viral replication will likely be required to cure HBV and that the initial efficacy data support the use of core inhibitors in HBV treatment regimens. If complete suppression of viral replication can be sustainably achieved, it is anticipated that this may lead to higher rates of "cure" defined as a sustained antiviral suppression of treatment (potentially with loss or diminution of viral antigens).

Final data from our completed Phase 1a (ABI-H0731-102) PK, safety and tolerability study and Phase 1b (ABI-H0731-101b) study showed antiviral activity observed across all patient cohorts. In the 300 mg dose cohort, the mean maximal declines from baseline were reported as ≥2.8* $\log_{10}$ IU/mL after 28 days, with ≥2.9 and 2.5* $\log_{10}$ IU/mL mean declines in HBeAg positive and negative patients, respectively. Maximal viral load declines of 3.6 to 4.0 $\log_{10}$ IU/mL were observed in HBeAg negative patients treated at all dose levels (100 mg to 400 mg). Mean RNA reductions observed in the 300 mg dose cohort were 2.3 $\log_{10}$ IU/mL over 28 days. The observed reductions in viral RNA levels are a distinguishing feature of this class of inhibitors compared to standard of care Nuc therapy.

Across all cohorts in the Phase 1a and Phase 1b studies, ABI-H0731 was generally well-tolerated. No serious adverse effects or dose-limiting toxicities were identified, and there was no pattern of treatment emergent clinical or laboratory abnormalities observed. With the exception of an isolated Grade 3 rash at the 400 mg dose that resolved with no intervention required other than treatment discontinuation, there were no other Grade 3 or Grade 4 AEs, and no other drug discontinuations have occurred in these studies.

ABI-H2158

ABI-H2158, our second product candidate in the HBV-cure program, is an internally discovered and developed drug product candidate that is chemically distinct from ABI-H0731 and in preclinical studies has demonstrated increased potency compared to HBI-0731, particularly related to prevention of cccDNA generation. In November 2018, we initiated a Phase 1a/1b dose-ranging clinical study of ABI-H2158 in New Zealand, to assess the safety, tolerability and PK of ABI-H2158 in healthy volunteers and then subsequently assess the safety, tolerability, PK and initial antiviral potency in non-cirrhotic patients with chronic HBV infection.

We presented final data from the Phase 1a portion of the Phase 1a/1b dose-ranging clinical study at EASL in April 2019. The Phase 1a study assessed safety, tolerability and PK in 48 healthy volunteers. ABI-H2158 was well tolerated following single and multiple ascending doses. There were no dose dependent treatment-emergent AEs and no pattern of clinical safety or laboratory abnormalities observed within or across any cohorts. Once daily administration is projected to result in trough liver concentrations in excess of the *in vitro* EC_{50} of 334 nM at which cccDNA establishment is inhibited to 50% of normal. We initiated the Phase 1b dose-ranging portion of this study in April 2019 to assess the safety, PK and antiviral activity of ABI-H2158 in patients with chronic HBV infection. Interim data from this study are expected to be presented in the fourth quarter of 2019. We expect to initiate a Phase 2a clinical study in 2020.

* Excludes one subject found to have pre-existing core inhibitor resistance substitutions at baseline.

ABI-H3733

ABI-H3733 is our third product candidate for the treatment of HBV and is currently undergoing Investigational New Drug (IND) enabling studies. ABI-H3733 exhibits a novel chemical scaffold separate from ABI-H0731 and ABI-H2158. We presented a preclinical profile of this candidate at EASL in April 2019. In preclinical studies, ABI-H3733 demonstrated potent inhibitory activity against multiple steps in the HBV infection cycle, particularly those relating to cccDNA generation. ABI-H3733 has shown favorable physical properties and PK profile in multiple species, along with a low drug-drug interaction potential. In preclinical mechanism of action studies, ABI-H3733 has shown enhanced potency in blocking encapsidation of pgRNA and disruption of pre-formed capsids as compared to our other product candidates, leading to premature disassembly during trafficking of rcDNA containing capsids to the nucleus during infection. ABI-H3733 inhibited cccDNA formation with an EC_{50} of 125 nM. ABI-H3733's enhanced potency and favorable preclinical results support advancement into Phase 1a studies, which we expect to initiate in the first quarter of 2020.

Other Product Candidates

We plan to conduct additional research and development to identify additional product candidates for our HBV-cure program.

Microbiome Program

Our Microbiome program consists of a fully integrated platform that includes a strain isolation, identification, characterization and function based selection process, methods for strain purification and growth under conditions compliant with Good Manufacturing Practice (cGMP) requirements, and a licensed patented delivery system that we call GEMICEL®, which is designed to allow for targeted oral delivery of live biologic and conventional therapies to the lower gastrointestinal (GI) tract. In connection with our Microbiome program, we filed an IND application in December 2018 for ABI-M201 (Ulcerative Colitis). In February 2019, we initiated a Phase 1b human clinical study for ABI-M201 in patients with mildly to moderately active ulcerative colitis to evaluate safety, efficacy and exploratory endpoints, and in June 2019, we initiated dosing of the first patient in this clinical study. Using our microbiome platform capabilities, we are also exploring additional product candidates for other disease indications, including Crohn's disease and irritable bowel syndrome in connection with the Collaboration Agreement (as defined below), as well as immune-mediated and inflammatory disorders and oncology, which indications we will pursue either internally or in collaboration with other collaborators.

On January 6, 2017, we entered into the Research, Development, Collaboration and License Agreement (the Collaboration Agreement) with Allergan to develop and commercialize select microbiome gastrointestinal programs. Pursuant to the terms of the Collaboration Agreement, in connection with the closing of the transaction in February 2017, Allergan paid us an upfront payment of $50.0 million. Additionally, we are eligible to receive up to approximately $631.0 million in payments related to seven development milestones and up to approximately $2.14 billion in payments related to 12 commercial development and sales milestones in connection with the successful development and commercialization of licensed compounds for up to six different indications. We have agreed with Allergan to share development costs up to an aggregate of $75.0 million through proof-of-concept (POC) studies on a ⅔, ⅓ basis, respectively, and Allergan has agreed to assume all post-POC development costs. Additionally, we have an option to co-promote the licensed programs in the United States and China, subject to certain conditions set forth in the Collaboration Agreement.

Operations

We currently have corporate and administrative offices in Carmel, Indiana, administrative offices and research laboratory space in South San Francisco, California and research, development and small-scale manufacturing activities in Groton, Connecticut. We also currently have an administrative office and research laboratory space in Shanghai, China and a regulatory office in Beijing, China.

Since our inception, we have had no revenue from product sales and have funded our operations principally through debt financings prior to our initial public offering in 2010 and through equity financings and collaborations since then. Our operations to date have been primarily limited to organizing and staffing our company, licensing our product candidates, discovering and developing our product candidates, establishing small-scale manufacturing capabilities for certain of our product candidates, maintaining and improving our patent portfolio and raising capital. We have generated significant losses to date, and we expect to continue to generate losses as we continue to develop our product candidates. As of September 30, 2019, we had an accumulated deficit of approximately $412.3 million. Because we do not generate revenue from any of our product candidates, our losses will continue as we further develop and seek regulatory approval for, and commercialize, our product candidates. As a result, our operating losses are likely to be substantial over the next several years as we continue the development of our product candidates and thereafter if none are approved or successfully launched. We are unable to predict the extent of any future losses or when we will become profitable, if at all.

Critical Accounting Policies and Significant Judgments and Estimates

Our management's discussion and analysis of our financial condition and results of operations are based on our condensed consolidated financial statements, which have been prepared in accordance with the accounting principles generally accepted in the United States (U.S. GAAP). The preparation of these financial statements requires us to make estimates and assumptions that affect the reported amounts of assets, liabilities, revenues, and expenses.

We evaluate our estimates and judgments, including those related to accrued expenses and stock-based compensation, on an ongoing basis. We base our estimates on historical experience and on various other factors that we believe are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying value of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

Our critical accounting policies and significant estimates are detailed in our 2018 Annual Report. Our critical accounting policies and significant estimates have not changed from those previously disclosed in our 2018 Annual Report, except for those accounting subjects discussed in the section of Note 2 to the unaudited condensed consolidated financial statements titled Adoption of Recent Accounting Pronouncements included in this Quarterly Report on Form 10-Q.

Results of Operations

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

Collaboration Revenue

For the three months ended September 30, 2019 and 2018, collaboration revenue was approximately $4.2 million and $4.3 million, respectively, which included the recognition of deferred revenue and reimbursements in each case incurred under the Collaboration Agreement. Revenue as compared to the same period in 2018 remained consistent as a result of increased reimbursement activities, offset by lower deferred revenue being recognized as a result of changes in our estimates of the performance period associated with our development activities under the Collaboration Agreement.

Research and Development Expense

Research and development expense, excluding stock-based compensation expense, was approximately $19.3 million for the three months ended September 30, 2019, an increase of approximately $2.7 million from approximately $16.6 million for the same period in 2018. The increase was primarily due to an increase of approximately $0.3 million in research expenses for our Microbiome program and an increase of approximately $2.3 million in research expenses for our HBV-cure program.

Stock-based compensation expense was approximately $2.5 million for each of the three months ended September 30, 2019 and 2018.

General and Administrative Expense

General and administrative expense consists primarily of salaries, consulting fees and other related costs, professional fees for legal services, accounting and tax services, insurance and travel expenses, as well as the stock-based compensation expense associated with equity awards to our employees, consultants, and directors.

General and administrative expense, excluding stock-based compensation expense, was approximately $5.5 million for the three months ended September 30, 2019, an increase of approximately $1.3 million from approximately $4.2 million for the same period in 2018. The increase was primarily due to an increase of approximately $0.6 million of employee related expenses, $0.3 million of rent expenses for our new office in South San Francisco, and $0.4 million of professional fees.

Stock-based compensation expense was approximately $2.9 million for the three months ended September 30, 2019, a decrease of $0.6 million from approximately $3.5 million for the same period in 2018.

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

Collaboration Revenue

For the nine months ended September 30, 2019 and 2018, collaboration revenue was approximately $11.2 million and $11.1 million, respectively, which included the recognition of deferred revenue and reimbursements in each case incurred under the Collaboration Agreement. Revenue as compared to the same period in 2018 remained consistent as a result of increased reimbursement activities, offset by lower deferred revenue being recognized as a result of changes in our estimates of the performance period associated with our development activities under the Collaboration Agreement.

Research and Development Expense

Research and development expense, excluding stock-based compensation expense, was approximately $54.8 million for the nine months ended September 30, 2019, an increase of approximately $12.0 million from approximately $42.8 million for the same period in 2018. The increase was primarily due to an increase of approximately $2.2 million in research expenses for our Microbiome program due to increased headcount and launching of Phase 1b human clinical study for ABI-M201 and an increase of approximately $9.8 million in research expenses for our HBV-cure program.

Stock-based compensation expense was approximately $8.3 million for the nine months ended September 30, 2019, a decrease of approximately $0.4 million from approximately $8.7 million for the same period in 2018.

General and Administrative Expense

General and administrative expense consists primarily of salaries, consulting fees and other related costs, professional fees for legal services, accounting and tax services, insurance and travel expenses, as well as the stock-based compensation expense associated with equity awards to our employees, consultants, and directors.

General and administrative expense, excluding stock-based compensation expense, was approximately $16.3 million for the nine months ended September 30, 2019, an increase of approximately $3.3 million from approximately $13.0 million for the same period in 2018. The increase was primarily due to an increase of approximately $0.6 million of professional fees, $1.8 million of employee related expenses, and $0.9 million of rent expenses for our new office in South San Francisco.

Stock-based compensation expense was approximately $5.7 million for the nine months ended September 30, 2019, a decrease of approximately $7.3 million from approximately $13.0 million for the same period in 2018. The decrease was primarily due to a $4.3 million one-time expense related to the departure and transition to consultant of one of our former officers in 2018 coupled with the reversal of previously recognized expense of $3.6 million related to forfeited awards resulting from the departure of one of our former officers in 2019.

Liquidity and Capital Resources

Sources of Liquidity

As a result of our significant research and development expenditures and the lack of any FDA-approved products to generate product sales revenue, we have not been profitable and have generated operating losses since we were incorporated in October 2005. We have funded our operations through September 30, 2019 principally through equity financing, raising an aggregate of approximately $412.8 million in net proceeds, and a strategic collaboration raising an aggregate of $50.0 million through an upfront payment.

Cash Flows for the Nine Months Ended September 30, 2019 and 2018

Net Cash from Operating Activities

Net cash used in operating activities was approximately $63.5 million for the nine months ended September 30, 2019. This was primarily due to a $70.6 million net loss, $1.5 million of accretion of discount of marketable securities and a decrease of $9.3 million of operating assets and liabilities, which were offset by a $14.0 million non-cash expense recorded for the stock-based compensation, $3.3 million of amortization of operating lease right-of-use assets and $0.4 million of depreciation and amortization expense.

Net cash used in operating activities was approximately $48.2 million for the nine months ended September 30, 2018. This was primarily due to a $64.6 million net loss and a decrease of $6.0 million of operating assets and liabilities, which were offset by a $21.7 million non-cash expense recorded for the stock-based compensation, $0.5 million of depreciation and amortization expense and approximately $0.2 million of realized loss from marketable securities.

Net Cash from Investing Activities

Net cash provided by investing activities for the nine months ended September 30, 2019 was $44.7 million due to $166.9 million of redemptions of marketable securities and $28.7 million of sale of marketable securities, which were partially offset by the purchase of approximately $149.3 million of marketable securities and $1.5 million of property and equipment.

Net cash used in investing activities for the nine months ended September 30, 2018 was approximately $73.2 million primarily due to the purchase of approximately $115.0 million of marketable securities and $0.1 million of fixed assets and construction in progress, which were offset by approximately $41.9 million of redemptions of marketable securities.

Net Cash from Financing Activities

Net cash provided by financing activities for the nine months ended September 30, 2019 was $2.2 million resulting from the exercise of stock options to purchase 243,481 shares of common stock and the issuance of 36,804 shares of common stock under the Assembly Biosciences, Inc. 2018 Employee Stock Purchase Plan.

Net cash provided by financing activities for the nine months ended September 30, 2018 was approximately $159.2 million resulting from the net proceeds of approximately $155.4 million from our public offering of 4,600,000 shares of common stock, including 600,000 shares of common stock purchased by the underwriters pursuant to their 30-day option to purchase additional shares, and approximately $3.8 million from the exercise of stock options to purchase 721,210 shares of common stock.

Funding Requirements

We expect our expenses to increase in connection with our ongoing activities, particularly as we continue the research, development and clinical studies of our product candidates and pursue our intellectual property strategy. Furthermore, we expect to continue to incur additional costs associated with operating as a public company. Accordingly, we will need to obtain substantial additional funding in connection with our continuing operations. If we are unable to raise capital when needed or on attractive terms, we would be forced to delay, reduce or eliminate our research and development programs or future commercialization efforts.

We monitor our cash needs and the status of the capital markets on a continuous basis. From time to time, we opportunistically raise capital and have done so numerous times since our initial public offering by issuing equity securities, most recently in July 2018. We intend to continue to raise capital when and as needed and at the time and in the manner most advantageous to us.

We expect that our existing cash, cash equivalents and marketable securities will enable us to fund our operating expenses and capital expenditure requirements for at least the next twelve months. Our future capital requirements will depend on many factors, including:

- the initiation, scope, progress, timing, results and costs of our ongoing drug discovery, nonclinical development, laboratory testing and clinical studies of our product candidates and any additional clinical studies we may conduct in the future;
- the extent to which we further acquire or in-license other product candidates and technologies;
- our ability to manufacture, and to contract with third parties to manufacture, adequate supplies of our product candidates for our clinical studies and any eventual commercialization;
- the costs, timing and outcome of regulatory review of our product candidates;
- the costs of preparing, filing and prosecuting patent applications in the United States and abroad, maintaining and enforcing our intellectual property rights and defending intellectual property-related claims; and
- our ability to establish and maintain collaborations on favorable terms, if at all.

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

Until such time, if ever, as we can generate substantial product revenues, we expect to finance our cash needs through a combination of equity offerings, debt financings, collaborations, strategic alliances and licensing arrangements. We do not have any committed external source of funds. To the extent that we raise additional capital through the sale of equity or convertible debt securities, the ownership interest of our stockholders will be diluted, and the terms of these securities may include liquidation or other preferences that adversely affect the rights of our common stockholders. Debt financing, if available, may involve agreements that include covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends.

If we raise funds through additional collaborations, strategic alliances or licensing arrangements with third parties, we may have to relinquish valuable rights to our technologies, future revenue streams, research programs or product candidates or to grant licenses on terms that may not be favorable to us. If we are unable to raise additional funds through equity or debt financings when needed, we may be required to delay, limit, reduce or terminate our product development or future commercialization efforts or grant rights to develop and market product candidates that we would otherwise prefer to develop and market ourselves.

Off-Balance Sheet Arrangements

None.

Contractual Obligations

There were no material changes in our commitments under contractual obligations as disclosed in our 2018 Annual Report.

Item 3. Quantitative and Qualitative Disclosures about Market Risk

There have been no material changes to our quantitative and qualitative disclosures about market risk as compared to the quantitative and qualitative disclosures about market risk described in our 2018 Annual Report.

Item 4. Controls and Procedures

Evaluation of Disclosure Controls and Procedures

We maintain a system of disclosure controls and procedures, as defined in Rules 13a-15(e) and 15d-15(e) of the Exchange Act, that is designed to provide reasonable assurance that information that is required to be disclosed in our reports filed pursuant to the Exchange Act, is accumulated and communicated to management in a timely manner. At the end of the period covered by this report, we carried out an evaluation, under the supervision and with the participation of our management, including our Chief Executive Officer and our Chief Financial Officer, of the effectiveness of the design and operation of our disclosure controls and procedures pursuant to Exchange Act Rules 13a-15(b) and 15d-15(b) as of the end of the period covered by this report. Based upon that evaluation, our Chief Executive Officer and Chief Financial Officer concluded that our disclosure controls and procedures as of the end of the period covered by this report were effective at the reasonable assurance level.

Changes in Internal Control over Financial Reporting

There were no changes in our internal control over financial reporting in the quarter ended September 30, 2019 that materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

PART II - OTHER INFORMATION

Item 1. Legal Proceedings

We are not a party to any material legal proceedings. In the future, we might from time to time become involved in litigation relating to claims arising from our ordinary course of business.

Item 1A. Risk Factors

This report contains forward-looking statements that involve risks and uncertainties. Our actual results could differ materially from those discussed in this report. Factors that could cause or contribute to these differences include, but are not limited to, those discussed below and elsewhere in this report and in any documents incorporated in this report by reference.

You should carefully consider the following risk factors, together with all other information in this report, including our financial statements and notes thereto, and in our other filings with the Securities and Exchange Commission. If any of the following risks, or other risks not presently known to us or that we currently believe to not be significant, develop into actual events, then our business, financial condition, results of operations or prospects could be materially adversely affected. If that happens, the market price of our common stock could decline, and stockholders may lose all or part of their investment.

Risks Related to Our Business

We have no approved products and currently are dependent on the future success of our HBV-cure and Microbiome programs.

To date, we have no approved products on the market and have generated no product revenues. Our prospects are substantially dependent on our ability to develop and commercialize our HBV and microbiome product candidates. Unless and until we receive approval from the FDA or other regulatory authorities for our product candidates, we cannot sell our product candidates and will not have product revenues. We will have to fund all of our operations and capital expenditures from cash on hand, any future securities offerings or debt financings and any fees we may generate from out-licensing, collaborations or other strategic arrangements. If we are unable to develop and commercialize any product candidates from our HBV-cure and Microbiome programs, we will be unable to generate revenues from the sale of products or build a sustainable or profitable business.

In addition, all of our product candidates are currently in early clinical development or in varying stages of nonclinical development and their risk of failure is high. The data supporting our drug discovery and nonclinical and clinical development programs are derived from either laboratory, nonclinical studies, Phase 1a/1b and initial Phase 2a clinical data. We cannot predict when or if any one of our product candidates will prove safe and effective in humans or will receive regulatory approval. The scientific evidence to support the feasibility of our product candidates and therapeutic approaches is limited, and many companies, some with more resources than we have, are and may be developing competitive product candidates. For these and other reasons, our drug discovery and development may not be successful, and we may not generate viable products or revenue.

We depend entirely on the success of product candidates from our HBV-cure program and our Microbiome program. We cannot be certain that we or our collaborators will be able to obtain regulatory approval for, or successfully commercialize, product candidates from either of our current programs or any other product candidates we may subsequently identify.

We and our collaborators are not permitted to market or promote any product candidates in the United States, Europe or other countries before we receive regulatory approval from the FDA or comparable foreign regulatory authorities, and we may never receive such regulatory approval for our current product candidates. We have not submitted a biologics license application (BLA) or new drug application (NDA) to the FDA or comparable applications to other regulatory authorities and do not expect to be in a position to do so in the foreseeable future.

All of our product candidates are currently in early clinical development or in varying stages of nonclinical development. It may be years before the larger, pivotal trials necessary to support regulatory approval of our product candidates are initiated, if ever. The clinical studies of our product candidates are, and the manufacturing and marketing of our product candidates will be, subject to extensive and rigorous review and regulation by numerous government authorities in the United States and in other countries where we intend to test and, if approved, market any product candidate. Before obtaining regulatory approvals for the commercial sale of any product candidate, we must successfully meet a number of critical developmental milestones, including:

- developing dosages that will be tolerated, safe and effective;
- reaching agreement with the FDA or comparable foreign regulatory authorities regarding the scope, design and data necessary to support regulatory approval for the product candidate;
- demonstrating through clinical studies that the product candidate is safe and effective in patients for the intended indication;
- determining the appropriate delivery mechanism;
- demonstrating that the product candidate formulation will be stable for commercially reasonable time periods; and
- completing the development and scale-up to permit manufacture of our product candidates in quantities sufficient to execute on our clinical development plans and, eventually, in commercial quantities and at acceptable prices.

The time necessary to achieve these developmental milestones for any individual product candidate is long and uncertain, and we may not successfully complete these milestones for our HBV and microbiome therapies or any other product candidates that we may develop. We have not yet completed and may never complete the development of any products. If we are unable to complete clinical development of our HBV or microbiome therapies, or any other product candidates that we may identify, we will be unable to generate revenue from the sale of products or build a sustainable or profitable business.

Nonclinical studies may not be representative of disease behavior in clinical studies. The outcomes of nonclinical testing and clinical studies are uncertain, and results of nonclinical studies and earlier clinical studies may not be predictive of future clinical study results.

The results of nonclinical studies may not be representative of disease behavior in a clinical setting and thus may not be predictive of the outcomes of our clinical studies. In addition, the results of nonclinical studies and early clinical studies of product candidates may not be predictive of the results of later-stage clinical studies, and the results of any study or trial for any of our product candidates may not be as favorable as the results for any prior studies or trials, if at all.

Nonclinical studies and clinical testing are expensive, can take many years to complete and their outcomes are highly uncertain. Failure can occur at any time during the nonclinical study and clinical study processes due to inadequate performance of a drug candidate or inadequate adherence by patients or investigators to clinical study protocols. Further, clinical studies might not provide statistically significant data supporting a product candidate’s safety and effectiveness to obtain the requisite regulatory approvals. In addition, there is a high failure rate for drugs and biologics proceeding through clinical studies. Our failure to replicate earlier positive results in later-stage clinical studies or otherwise demonstrate the required characteristics to support marketing approval for any of our product candidates would substantially harm our business, prospects, financial condition and results of operations.

Top-line or initial data may not accurately reflect the complete results of a particular study or trial.

We may publicly disclose top-line or initial data from time to time, which is based on a preliminary analysis of then-available efficacy, tolerability, PK and safety data, and the results and related findings and conclusions are subject to change following a more comprehensive review of the data related to the particular study or trial. We also make assumptions, estimates, calculations and conclusions as part of our analyses of data, and we may not have received or had the opportunity to evaluate fully and carefully all data. As a result, the top-line or initial results that we report may differ from future results of the same studies, or different conclusions or considerations may qualify such results, once additional data have been received and fully evaluated. Top-line data also remain subject to audit and verification procedures that may result in the final data being materially different from the initial or preliminary data we previously published. As a result, top-line and initial data should be viewed with caution until the final data are available.

Further, others, including regulatory agencies, may not accept or agree with our assumptions, estimates, calculations, conclusions or analyses or may interpret or weigh the importance of data differently, which could impact the value of the particular program, the approvability or commercialization of the particular drug candidate or biotherapeutic and our company in general. In addition, the information we may publicly disclose regarding a particular nonclinical or clinical study is based on what is typically extensive information, and you or others may not agree with what we determine is the material or otherwise appropriate information to include in our disclosure, and any information we determine not to disclose may ultimately be deemed significant with respect to future decisions, conclusions, views, activities or otherwise regarding a particular drug, drug candidate or our business. If the top-line or initial data that we report differ from actual results, or if others, including regulatory authorities, disagree with the conclusions reached, our ability to obtain approval for, and commercialize, our product candidates may be harmed or delayed, which could harm our business, financial condition, operating results or prospects.

Nonclinical and clinical testing required for our product candidates is expensive and time-consuming and may result in delays or may fail to demonstrate safety and efficacy for desired indications. Such delays or failures could delay or prevent our receipt of licensing, sales and/or milestone revenue.

Before we or any commercial partners can obtain FDA approval (or other foreign approvals) necessary to sell any of our product candidates, we must show through nonclinical studies and human testing in clinical studies that each potential product is safe and effective in humans. To meet these requirements, we must conduct extensive nonclinical testing and sufficient adequate and well-controlled clinical studies. Conducting clinical studies is a lengthy, time consuming, and expensive process. The length of time might vary substantially according to the type, complexity, novelty, and intended use of the product candidate, and often can be several years or more per trial. Delays associated with product candidates for which we are directly conducting nonclinical studies or clinical studies might cause us to incur additional operating expenses. The commencement and rate of completion of clinical studies might be delayed by many factors, including, for example:

- delays in reaching agreement with regulatory authorities on trial design;
- delays in reaching agreement on acceptable terms with prospective contract research organizations (CROs) and clinical study sites;
- failure to demonstrate efficacy during clinical studies;
- the emergence of unforeseen safety issues;
- inability to manufacture sufficient quantities of qualified materials under cGMP for use in clinical studies;
- slower than expected rates of patient recruitment;
- failure to recruit a sufficient number of eligible patients, which may be due to a number of reasons, including the size of the patient population, the proximity of patients to clinical sites, the eligibility criteria for the study, the design of the clinical study, and other potential drug candidates being studied;
- delays in having patients complete participation in a trial or return for post-treatment follow-up;

- delays caused by patients dropping out of a trial due to product side effects, disease progression or other reasons;
- clinical sites dropping out of a trial to the detriment of enrollment;
- modification of clinical study protocols;
- delays by our contract manufacturers to produce and deliver sufficient supply of clinical study materials;
- occurrence of adverse events associated with the product candidate that are viewed to outweigh its potential benefits;
- changes in regulatory requirements for clinical studies;
- delays, suspension, or termination of clinical studies by the institutional review board or ethics committee responsible for overseeing the study at a particular study site; and
- government, institutional review board, ethics committee, or other regulatory delays or clinical holds requiring suspension or termination of the trials.

We have used and intend to continue to rely on one or more CROs to conduct our nonclinical studies and clinical studies. We are highly dependent on these CROs to conduct our studies and trials in accordance with the requirements of the FDA, applicable local laws and good clinical and scientific practice. In the event the CROs fail to perform their duties in such a fashion, we may not be able to complete our clinical studies and may fail to obtain regulatory approval for any of our product candidates.

The failure of nonclinical studies and clinical studies to demonstrate safety and effectiveness of a product candidate for the desired indications could harm the development of that product candidate or other product candidates. This failure could cause us to abandon a product candidate and could delay development of other product candidates. Any delay in, or termination of, our nonclinical studies or clinical studies would delay the filing of our NDAs or BLAs with the FDA and, ultimately, our ability to commercialize our product candidates and generate product revenues. Any change in, or termination of, our clinical studies could materially harm our business, financial condition, and results of operations.

Any product candidates that we may discover and develop may cause undesirable side effects or have other properties that could delay or prevent their regulatory approval, limit the commercial profile of an approved label, or result in significant negative consequences following marketing approval, if any.

Many product candidates that initially showed promise in early stage testing have later been found to cause side effects that prevented their further development. Undesirable side effects caused by any product candidates that we may discover or develop, or safety, tolerability or toxicity issues that may occur in our nonclinical studies, clinical studies or in the future, could cause us or regulatory authorities to interrupt, restrict, delay, or halt clinical studies. Such results could also cause us to, or regulatory authorities to require us to, cease further development of our product candidates for any or all targeted indications. The drug-related side effects could affect patient recruitment or the ability of enrolled patients to complete the trial or result in potential product liability claims and could result in a more restrictive label or the delay or denial of regulatory approval by the FDA or other comparable foreign authorities. Any of these events could prevent us from achieving or maintaining market acceptance of the particular product candidate, if approved, and could significantly harm our business, prospects, financial condition and results of operations.

Additionally, if any of our product candidates receives marketing approval and we or others later identify undesirable or unacceptable side effects caused by these product candidates, a number of potentially significant negative consequences could result, including:

- regulatory authorities may withdraw approvals of such product and require us to take them off the market;
- regulatory authorities may require the addition of labeling statements, specific warnings, a contraindication or field alerts to physicians and pharmacies;

- regulatory authorities may require a medication guide outlining the risks of such side effects for distribution to patients, or that we implement a Risk Evaluation Mitigation Strategies (REMS) plan to ensure that the benefits of the product outweigh its risks;
- we may be required to change the way a product is administered, conduct additional clinical studies or change the labeling of a product;
- we may be subject to limitations on how we may promote the product;
- sales of the product may decrease significantly;
- we may be subject to litigation or product liability claims; and
- our reputation may suffer.

Any of these events could prevent us or any collaborators from achieving or maintaining market acceptance of our product candidates or could substantially increase commercialization costs and expenses, which in turn could delay or prevent us from generating significant revenue from the sale of our product candidates.

We have a limited operating history and a history of operating losses and expect to incur significant additional operating losses.

We merged with Assembly Pharmaceuticals, Inc. (Assembly Pharmaceuticals), a private company, in July 2014. We have only a limited operating history since the merger. Therefore, there is limited historical financial information upon which to base an evaluation of our performance. Our prospects must be considered in light of the uncertainties, risks, expenses, and difficulties frequently encountered by companies in their early stages of operations. We, and Assembly Pharmaceuticals prior to our merger, have generated losses since we began operations and as of September 30, 2019 and December 31, 2018, the combined company had an accumulated deficit of approximately $412.3 million and $341.8 million, respectively, and net losses of approximately $90.8 million, $42.8 million, and $44.3 million for the years ended December 31, 2018, 2017 and 2016, respectively. These net losses have had, and will continue to have, an adverse effect on our stockholders' equity and working capital. We expect to incur substantial additional losses over the next several years as we continue to pursue our research, development, nonclinical studies and clinical study activities. Further, since our initial public offering, we have incurred and will continue to incur as a public company significant additional legal, accounting and other expenses to which we were not subject to as a private company, including expenses related to our efforts in complying with the requirements of the Sarbanes-Oxley Act of 2002 (the Sarbanes-Oxley Act), the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 and other public company disclosure and corporate governance requirements and responding to requests of government regulators. The amount of future losses and when, if ever, we will achieve profitability are uncertain and will depend, in part, on the rate of increase in our expenses, our ability to generate revenues from the sale of products and our ability to raise additional capital. We have no products that have generated any commercial revenue, do not expect to generate revenues from the commercial sale of products unless and until our HBV or microbiome therapies or any other product candidate is approved by the FDA for sale, and we might never generate revenues from the sale of products.

We are not currently profitable and might never become profitable.

We have a history of losses and expect to incur significant operating and capital expenditures and resultant substantial losses and negative operating cash flow for the next several years and beyond if we do not successfully launch and commercialize any product candidates from our HBV-cure or Microbiome programs. We might never achieve or maintain profitability. We anticipate that our expenses will continue to be substantial in the foreseeable future as we:

- advance ABI-H0731 and ABI-H2158, our first and second HBV product candidate, respectively, through clinical development and conduct nonclinical studies and clinical studies with ABI-H3733, our third HBV product candidate;
- advance ABI-M201 (Ulcerative Colitis), our first candidate from our Microbiome program, through clinical development;

- continue to undertake research and development to identify potential additional product candidates in both our HBV-cure and Microbiome programs;
- seek regulatory approvals for our product candidates; and
- pursue our intellectual property strategy.

Because of the numerous risks and uncertainties associated with pharmaceutical product development, we are unable to accurately predict the timing or amount of increased expenses or when, or if, we will be able to achieve profitability. In addition, our expenses could increase if we are required by the FDA or comparable foreign regulatory authorities to perform studies or trials in addition to those currently expected, or if there are any delays in completing our clinical studies or the development of any of our product candidates.

As a result, we will need to generate significant revenues in order to achieve and maintain profitability. Our ability to generate revenue from the sale of products and achieve profitability will depend on, among other things:

- successful completion of research, nonclinical studies and clinical studies for our product candidates;
- obtaining necessary regulatory approvals from the FDA and comparable foreign regulatory authorities for our product candidates;
- maintaining patent protection for our products, methods, processes and technologies and/or obtaining regulatory exclusivity;
- establishing manufacturing, sales, and marketing arrangements internally and/or with third parties for any approved products; and
- raising sufficient funds to finance our activities, if and when needed.

We might not succeed at any of these undertakings. If we are unsuccessful at some or all of these undertakings, our business, prospects, and results of operations might be materially adversely affected.

We are an early stage company and might not be able to commercialize any product candidates.

We are an early stage company and have not demonstrated our ability to perform the functions necessary for the successful commercialization of any product candidates. The successful commercialization of any product candidates will require us to perform a variety of functions, including:

- continuing to undertake research and development and nonclinical studies and clinical studies;
- participating in regulatory approval processes;
- formulating and manufacturing products; and
- conducting sales, marketing and distribution activities.

We currently do not have the infrastructure to manufacture, market and sell our product candidates. If we partner with one or more third-party entities, those commercial partners may demand and receive rights to control product development and commercialization. As a result, these commercial partners may conduct these programs and activities more slowly or in a different manner than expected. If any of these events were to occur, the development of any product candidate could be significantly delayed, more expensive or less lucrative to us than anticipated, any of which would have a significant adverse effect on our business.

Our failure to commercialize successfully our product candidates would negatively impact the value of our company and could impair our ability to raise capital, expand our business, diversify our research and development pipeline, market our product candidates, if approved, or continue our operations.

Our development of product candidates is subject to risks and delays.

Our development of our product candidates is subject to the risks of failure and delay inherent in the development of new pharmaceutical products and products based on new technologies, including:

- delays in product development, nonclinical and clinical testing;
- unplanned expenditures in product development, nonclinical and clinical testing;
- failure of a product candidate to demonstrate acceptable safety and efficacy;
- failure to receive regulatory approvals;
- emergence of superior or equivalent products;
- inability to manufacture and sell on our own, or through others, product candidates on a commercial scale or at a financially viable cost; and
- failure to achieve market acceptance.

Because of these risks, our research and development efforts might not result in any commercially viable products. If we do not successfully complete a significant portion of these development efforts, obtain required regulatory approvals, and have commercial success with any approved products, our business, financial condition and results of operations will be materially harmed.

There are substantial risks inherent in attempting to commercialize new drugs and biologics, and, as a result, we may not be able to develop successfully products for commercial use.

Scientific research and development require significant amounts of capital and takes a long time to reach commercial viability, if it can be achieved at all. To date, our research and development projects have not produced commercially viable drugs or biologics and may never do so. During the research and development process, we may experience technological barriers that we may be unable to overcome. Further, certain underlying premises in our development programs are not fully proven.

Our HBV therapy research and development efforts involve therapeutics based on modulating forms of HBV core proteins with core inhibitors. The development of our core inhibitor technology is in early stages, and the commercial feasibility and acceptance of our core inhibitor technology is unknown. More specifically, the theory that treatment with core inhibitors may result in more rapid loss of covalently closed circular DNA (cccDNA) compared to conventional (standard of care) therapies is unproven. It is also unknown if the biomarkers assumed to be indicators of active cccDNA (such as serum surface antigen in HBV patients) will be meaningfully altered in patients on treatment with core inhibitors. Additionally, even if core inhibitor technology is successful at targeting the HBV core protein and treatment is successful at reducing cccDNA levels in HBV patients, it may not result in a commercially viable drug if there is not a corresponding medical benefit related to the underlying HBV infection.

Similarly, our Microbiome program is based on a novel therapeutic approach designed to treat disorders associated with the microbiome. To our knowledge, no companies have received regulatory approval for, or manufactured on a commercial scale, any microbiome-based therapeutics. Our microbiome therapy candidates are in nonclinical and early clinical development, and our GEMICEL® dual-targeted release capsule formulation is novel and has not yet shown to deliver successfully live bacteria in patients. The ability to deliver bacteria effectively and reliably to the GI tract is unproven, and, even if it can be proven, it may be difficult or impossible to provide the treatment economically. Because of these uncertainties, it is possible that no commercial products will be successfully developed. If we are unable to develop successfully commercial products, we will be unable to generate revenue from the sale of products or build a sustainable or profitable business.

A fast track designation by the FDA may not actually lead to a faster development or regulatory review or approval process.

We may seek fast track designation for some of our product candidates. If a drug or biologic is intended for the treatment of a serious or life-threatening condition and nonclinical or clinical data demonstrate the potential to address unmet medical needs for this condition, the drug or biologic sponsor may apply for FDA fast track designation. Fast track designation provides increased opportunities for sponsor meetings with the FDA during preclinical and clinical development, in addition to the potential for rolling review once a marketing application is filed. The FDA has broad discretion whether or not to grant this designation, and even if we believe a particular product candidate is eligible for this designation, we cannot assure you that the FDA would decide to grant it. In 2018, the FDA granted Fast Track designation to ABI-H0731 for the treatment of patients with chronic HBV infection. Even though we received fast track designation, we may not experience a faster development process, review or approval compared to conventional FDA procedures. Fast track designation does not assure ultimate approval by the FDA. The FDA may withdraw fast track designation if it believes that the designation is no longer supported by data from our product development program.

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

We may seek a breakthrough therapy designation for our product candidates. A breakthrough therapy is defined as a drug or biologic that is intended to treat a serious or life-threatening disease or condition, and preliminary clinical evidence indicates that the drug or biologic may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints. For drugs that have been designated as breakthrough therapies, interaction and communication between the FDA and the sponsor can help to identify the most efficient path for clinical development. Drugs designated as breakthrough therapies by the FDA may also be eligible for accelerated approval.

Designation as a breakthrough therapy is within the discretion of the FDA. Accordingly, even if we believe one of our product candidates meets the criteria for designation as a breakthrough therapy, the FDA may disagree and instead determine not to make such designation. In any event, the receipt of a breakthrough therapy designation for a product candidate may not result in a faster development process, review or approval compared to conventional FDA procedures and does not assure ultimate approval by the FDA. In addition, even if one or more of our product candidates qualify as breakthrough therapies, the FDA may later decide that the products no longer meet the conditions for qualification and rescind the designation.

We will need additional financing to complete the development of any product candidate and fund our activities in the future.

We anticipate that we will incur operating losses for the next several years as we continue to develop our HBV product candidates and our microbiome platform as well as initiate development of any other product candidates and will require substantial funds during that time to support our operations. We expect that our current resources will provide us with sufficient capital to fund our operations for at least the next twelve months. However, we might consume our available capital before that time if, for example, we are not efficient in managing our resources or if we encounter unforeseen costs, delays or other issues or if regulatory requirements change or if clinical study timelines are accelerated. If that happens, we may need additional financing to continue the development of our HBV and Microbiome product candidates, which we might seek and receive from the public financial markets, third-party commercial partners, private placements, debt financings and/or other sources. There is no assurance that we will be able to generate sufficient revenue from our Collaboration Agreement with Allergan or that we will be successful in raising any necessary additional capital on terms that are acceptable to us, or at all. If such events or other unforeseen circumstances occurred and we were unable to generate sufficient revenue or raise capital, we could be forced to delay, scale back or discontinue product development, sacrifice attractive business opportunities, cease operations entirely and sell or otherwise transfer all or substantially all of our remaining assets.

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

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

In addition, over the last several years, including most recently from December 22, 2018 to January 25, 2019, the U.S. government has shut down several times and certain regulatory agencies, such as the FDA and the SEC, have had to furlough critical FDA, SEC and other government employees and stop critical activities. If another prolonged government shutdown occurs, it could significantly impact the ability of the FDA to timely review and process our regulatory submissions or our ability to raise capital through the public financial markets, either of which could have a material adverse effect on our business.

We are substantially dependent on our Collaboration Agreement with Allergan, which may be terminated or may not be successful due to a number of factors, which could have a material adverse effect on our business and operating results.

In January 2017, we entered into the Collaboration Agreement for the development and commercialization of select microbiome gastrointestinal programs in ulcerative colitis, Crohn's disease and irritable bowel syndromes. Our collaboration with Allergan may be terminated, or may not be successful, due to a number of factors. In particular, Allergan may terminate the Collaboration Agreement for convenience at any time upon 120 days' advance written notice to us. The Collaboration Agreement also contains customary provisions for termination by either party, including in the event of breach of the Collaboration Agreement, subject to cure. In addition, if we are unable to identify product candidates for the licensed indications or we are unable to protect our products by obtaining and defending patents, the collaboration could fail. If the collaboration is unsuccessful for these or other reasons, or is otherwise terminated for any reason, we may not receive all or any of the research program funding, milestone payments or royalties under the agreement. In June 2019, Allergan and AbbVie Inc. (AbbVie) announced that the they had entered into a definitive transaction agreement under which AbbVie will acquire Allergan. Assuming the conditions to close are satisfied, the acquisition is expected to close in early 2020. We do not know what, if any, impact this transaction will have on the Collaboration Agreement. Any of the foregoing could result in a material adverse effect on our business, results of operations and prospects and would likely cause our stock price to decline.

We are dependent on a license relationship for each of our HBV-cure program and our Microbiome program.

Our license agreement with Indiana University Research and Technology Corporation (IURTC) from whom we have licensed ABI-H0731 and certain other HBV therapies, requires us to make milestone payments based upon the successful accomplishment of clinical and regulatory milestones related to ABI-H0731 and certain other HBV therapies. The aggregate amount of all performance milestone payments under the IURTC License Agreement, should all performance milestones through development be met, is $825,000, with a portion related to the first performance milestone having been paid. We also are obligated to pay IURTC royalty payments based on net sales of the licensed technology. We are also obligated to pay diligence maintenance fees ($75,000 to $100,000) each year to the extent that the royalty, sublicensing, and milestone payments to IURTC are less than the diligence maintenance fee for that year. Our license with Therabiome, LLC (Therabiome), from whom we have licensed our delivery platform of our Microbiome program, also requires us to pay regulatory and clinical milestones as well as royalty payments to Therabiome. If we breach any of these obligations, we could lose our rights to the targeted delivery mechanism of our Microbiome program. If we fail to comply with similar obligations to any other licensor, then that licensor would have the right to terminate the license, in which event we would not be able to commercialize drug candidates or technologies that were covered by the license. In addition, the milestone and other payments associated with licenses will make it less profitable for us to develop our drug candidates than if we owned the technology ourselves.

Corporate and academic collaborators might take actions to delay, prevent, or undermine the success of our product candidates.

Our operating and financial strategy for the development, nonclinical and clinical testing, manufacture, and commercialization of drug candidates heavily depends on collaborating with corporations, academic institutions, licensors, licensees, and other parties. However, there can be no assurance that we will successfully establish or maintain these collaborations. In addition, should a collaboration be terminated, replacement collaborators might not be available on attractive terms, or at all. The activities of any collaborator will not be within our control and might not be within our power to influence. There can be no assurance that any collaborator will perform its obligations to our satisfaction or at all, that we will derive any revenue or profits from these collaborations, or that any collaborator will not compete with us. If any collaboration is not successful, we might require substantially greater capital to undertake development and marketing of our proposed products and might not be able to develop and market these products effectively, if at all. In addition, a lack of development and marketing collaborations might lead to significant delays in introducing proposed products into certain markets and/or reduced sales of proposed products in such markets.

We rely on data provided by our collaborators and others that have not been independently verified and could prove to be false, misleading, or incomplete.

We rely on third-party vendors, scientists, investigators and collaborators to provide us with significant data and other information related to our projects, nonclinical studies and clinical studies, and our business. If these third parties provide inaccurate, misleading, or incomplete data, our business, prospects, and results of operations could be materially adversely affected.

Research, development and commercialization goals may not be achieved in the timeframes that we publicly estimate, which could have an adverse impact on our business and could cause our stock price to decline.

We set goals, and make public statements regarding our expectations, regarding the timing of certain accomplishments, developments and milestones under our research and development programs. The actual timing of these events can vary significantly due to a number of factors, including, without limitation, the amount of time, effort and resources committed to our programs by us and any collaborators and the uncertainties inherent in the clinical development and regulatory approval process. As a result, there can be no assurance that we or any collaborators will initiate or complete clinical development activities, make regulatory submissions or receive regulatory approvals as planned or that we or any collaborators will be able to adhere to our current schedule for the achievement of key milestones under any of our programs. If we or any collaborators fail to achieve one or more of the milestones as planned, our business could be materially adversely affected, and the price of our common stock could decline.

We lack suitable facilities for certain nonclinical and clinical testing and expect to rely on third parties to conduct some of our research and nonclinical testing and our clinical studies, and those third parties may not perform satisfactorily, including failing to meet deadlines for the completion of such research, testing or trials.

We do not have sufficient facilities to conduct all of our anticipated nonclinical and clinical testing. As a result, we expect to contract with third parties to conduct a significant portion of our nonclinical and clinical testing required for regulatory approval for our product candidates. We will be reliant on the services of third parties to conduct studies on our behalf. If we are unable to retain or continue with third parties for these purposes on acceptable terms, we may be unable to develop successfully our product candidates. In addition, any failures by third parties to perform adequately their responsibilities may delay the submission of our product candidates for regulatory approval, which would impair our financial condition and business prospects.

Our reliance on these third parties for research and development activities also reduces our control over these activities but will not relieve us of our responsibilities. For example, we are responsible for ensuring that each of our studies is conducted in accordance with the applicable protocol, legal and regulatory requirements and scientific standards, including, in the case of clinical studies, good clinical practices, and our reliance on third parties does not relieve us of our regulatory responsibilities. Furthermore, these third parties may also have relationships with other entities, some of which may be our competitors. In addition, these third parties are not our employees, and except for remedies available to us under our agreements with such third parties, we cannot control whether or not they devote

sufficient time and resources to our clinical and nonclinical programs. If these third parties do not successfully carry out their contractual duties or obligations or meet expected deadlines, if they need to be replaced or if the quality or accuracy of the clinical data they obtain is compromised due to the failure to adhere to our clinical protocols, regulatory requirements or for other reasons, our research, nonclinical studies or clinical studies may be extended, delayed or terminated and we may not be able to obtain, or may be delayed in obtaining, regulatory approvals for our product candidates. As a result, our results of operations and business prospects would be harmed, our costs could increase and our ability to generate revenues from the sale of products could be delayed.

We will need to either establish our own clinical and commercial manufacturing capabilities or rely on third parties to formulate and manufacture our product candidates, and we rely on third parties to manufacture products that we study in combination with our product candidates. Our use of third parties to manufacture these materials may increase the risk that we will not have sufficient quantities of our product candidates or other products, or necessary quantities of such materials on time or at an acceptable cost.

We currently rely on third-party manufacturers to supply the quantities of ABI-H0731, ABI-H2158 and ABI-H3733 used in our clinical and nonclinical studies and the drug substance for our Microbiome program. We currently manufacture our microbiome drug product for use in our planned nonclinical studies and early-stage clinical studies; however, we may require third-party manufacturers for subsequent clinical studies or other microbiome drug products. In addition, if any product candidate we might develop or acquire in the future receives FDA or other regulatory approval, we will need to either manufacture commercial quantities of the product on our own or rely on one or more third-party contractors to manufacture our products. The establishment of internal manufacturing capabilities is difficult and costly, and we may not be successful in doing so. If, for any reason, we are unable to establish our own manufacturing capabilities and we are unable to rely on any third-party sources we have identified to manufacture our product candidates, either for clinical studies or, at some future date, for commercial quantities, then we would need to identify and contract with additional or replacement third-party manufacturers to manufacture compounds, drug substance and drug products for nonclinical, clinical and commercial purposes. We might not be successful in identifying additional or replacement third-party manufacturers, or in negotiating acceptable terms with any that we do identify. If we are unable to establish and maintain manufacturing capacity either on our own or through third parties, the development and sales of our products and our financial performance will be materially and adversely affected.

In addition, before we or any of our collaborators can begin to commercially manufacture our product candidates, each manufacturing facility and process is subject to regulatory review. Manufacturing of drugs for clinical and commercial purposes must comply with the FDA's cGMPs and applicable non-U.S. regulatory requirements. The cGMP requirements govern compliance and documentation policies and procedures. Complying with cGMP and non-U.S. regulatory requirements will require that we expend time, money, and effort in production, recordkeeping, and compliance to assure that the product meets applicable specifications and other requirements. Any manufacturing facility must also pass a pre-approval inspection prior to FDA approval. Failure to pass a pre-approval inspection might significantly delay FDA approval of our product candidates. If we or any of our future collaborators fails to comply with these requirements with respect to the manufacture of any of our product candidates, regulatory action could limit the jurisdictions in which we are permitted to sell our products, if approved. As a result, our business, financial condition, and results of operations might be materially harmed.

We are exposed to the following risks with respect to the manufacture of our product candidates:

- If we are unable to establish our own manufacturing capabilities, we will need to identify manufacturers for commercial supply on acceptable terms, which we may not be able to do because the number of potential manufacturers is limited, and the FDA must evaluate any new or replacement contractor. This evaluation would generally require compliance inspections. In addition, a new manufacturer would have to be educated in, or develop substantially equivalent processes for, production of our products after receipt of FDA approval, if any.

- We or any third-party manufacturers with whom we contract might be unable to formulate and manufacture our product candidates in the volume and of the quality required to meet our clinical and, if approved, commercial needs in a timely manner.

- Any third-party manufacturers with whom we contract might not perform as agreed or might not remain in the contract manufacturing business for the time required to supply our clinical studies or to produce, store and successfully distribute our products.

- One or more of any third-party manufacturers with whom we contract could be foreign, which increases the risk of shipping delays and adds the risk of import restrictions.

- Drug manufacturers are subject to ongoing periodic unannounced inspection by the FDA and corresponding state agencies to ensure strict compliance with cGMP and other government regulations and corresponding foreign requirements. Any internal manufacturing facilities we establish may fail to comply, and we would not have complete control over any third-party manufacturers' compliance, with these regulations and requirements.

- We may be required to obtain additional intellectual property rights from third parties in order to manufacture our product candidates, and if any third-party manufacturer makes improvements in the manufacturing process for our product candidates, we might not own, or might have to share, the intellectual property rights to the innovation with our licensors.

- We may be required to share our trade secrets and know-how with third parties, thereby risking the misappropriation or disclosure of our intellectual property by or to third parties.

- If we contract with third-party manufacturers, we might compete with other companies for access to these manufacturers' facilities and might be subject to manufacturing delays if the manufacturers give other clients higher priority than us.

Each of these risks could delay our development efforts, nonclinical studies and clinical studies or the approval, if any, of our product candidates by the FDA or applicable non-U.S. regulatory authorities or the commercialization of our product candidates and could result in higher costs or deprive us of potential product revenues. As a result, our business, financial condition, and results of operations might be materially harmed.

If we or our collaborators cannot compete successfully for market share against other companies, we might not achieve sufficient product revenues and our business will suffer.

If our product candidates receive approval from the FDA or applicable non-U.S. regulatory authorities, they will compete with a number of existing and future drugs and biologics developed, manufactured and marketed by others. Existing or future competing drugs might provide greater therapeutic convenience or clinical or other benefits for a specific indication than our product candidates or might offer comparable performance at a lower cost. If our product candidates fail to capture and maintain market share, we might not achieve sufficient product revenues and our business will suffer.

We might compete against fully integrated pharmaceutical or biotechnology companies and smaller companies that are collaborating with larger pharmaceutical companies, academic institutions, government agencies and other public and private research organizations. Many of these competitors, either alone or together with their collaborative partners, operate larger research and development programs or have substantially greater financial resources than we do, as well as significantly greater experience in:

- developing drugs;

- undertaking nonclinical testing and human clinical studies;

- obtaining FDA and other regulatory approvals of drugs;

- formulating and manufacturing drugs; and

- launching, marketing and selling drugs.

We may not have or be able to obtain the same resources and experience as our competitors. If we are unable to perform these tasks effectively and efficiently, our results of operations might be materially adversely affected.

Developments by competitors might render our product candidates or technologies obsolete or non-competitive.

The pharmaceutical and biotechnology industries are intensely competitive. In addition, the clinical and commercial landscape for HBV, ulcerative colitis (UC), inflammatory bowel disease (IBD), including Crohn's disease, irritable bowel syndrome (IBS), immune-mediated and metabolic disorders and oncology is rapidly changing; we expect new data from commercial and clinical-stage products to continue to emerge. We compete with organizations that have existing treatments and that are or will be developing treatments for the indications that our product candidates target. If our competitors develop effective treatments for HBV, UC, IBD, IBS, immune-mediated and metabolic disorders and oncology or any other indication or field we might pursue, and successfully commercialize those treatments, our business and prospects might be materially harmed, due to intense competition in these markets.

Companies with microbiome products or core inhibitor products may produce negative clinical data, which will adversely affect public perception of our product candidates, and may negatively impact regulatory approval of, or demand for, our potential products.

Negative data from clinical trials using microbiome-based therapies (e.g., fecal transplant) or core inhibitors could negatively impact the perception of the therapeutic use of our microbiome or HBV-cure product candidates. This could negatively impact our ability to enroll patients in clinical trials. The clinical and commercial success of our potential products will depend in part on the public and clinical communities' acceptance of the use of oral live microbial biotherapeutic products (LBPs) and core inhibitor product candidates. Moreover, our success depends upon physicians prescribing, and their patients being willing to receive, treatments that involve the use of LBPs or core inhibitor product candidates we may develop in lieu of, or in addition to, existing treatments with which they are already familiar and for which greater clinical data may be available. Adverse events in our preclinical studies or clinical trials or those of our competitors or of academic researchers utilizing microbiome therapies or core inhibitor therapies, even if not ultimately attributable to our product candidates, and the resulting publicity could result in increased governmental regulation, unfavorable public perception, potential regulatory delays in the testing or approval of our potential product candidates, stricter labeling requirements for our product candidates that are approved, if any, and a decrease in demand for any such products.

Our product candidates under development in our Microbiome program will be subject to regulation as biologics. These candidates, and any other future product candidates for which we or our collaborators intend to seek approval as biologic products, may face competition sooner than anticipated.

The Affordable Care Act (ACA) includes a subtitle called the Biologics Price Competition and Innovation Act of 2009 (BPCIA), which 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 studies to demonstrate the safety, purity and potency of their product. The law is complex and is still being interpreted and implemented by the FDA. As a result, its ultimate impact, implementation, and meaning are subject to uncertainty. While it is uncertain when such processes intended to implement the BPCIA may be fully adopted by the FDA, any such processes could have a material adverse effect on the future commercial prospects for our biological products.

We believe that if product candidates from our Microbiome program are approved as biological products under a BLA, they 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 generic 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.

If we or our collaborators are not able to develop collaborative marketing relationships with licensees or partners, or create effective internal sales, marketing, and distribution capability, we might be unable to market our products successfully.

To market our product candidates, if approved, we will have to establish our own marketing and sales force or out-license our product candidates to, or collaborate with, larger firms with experience in marketing and selling pharmaceutical products. There can be no assurance that we will be able to successfully establish our own marketing capabilities or establish marketing, sales, or distribution relationships with third parties; that such relationships, if established, will be successful; or that we will be successful in gaining market acceptance for our product candidates. To the extent that we enter into any marketing, sales, or distribution arrangements with third parties, our product revenues will be lower than if we marketed and sold our products directly, and any revenues we receive will depend upon the efforts of such third parties. If we are unable to establish such third-party sales and marketing relationships, or choose not to do so, we will have to establish our own in-house capabilities. We, as a company, have no experience in marketing or selling pharmaceutical products and currently have no sales, marketing, or distribution infrastructure. To market any of our products directly, we would need to develop a marketing, sales, and distribution force that both has technical expertise and the ability to support a distribution capability. To establish our own marketing, sales, and distribution capacity would significantly increase our costs, and require substantial additional capital. In addition, there is intense competition for proficient sales and marketing personnel, and we might not be able to attract individuals who have the qualifications necessary to market, sell, and distribute our products. There can be no assurance that we will be able to establish internal marketing, sales, or distribution capabilities.

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

The commercial success of our products, if approved for marketing, will depend in part on the medical community, patients and third-party payors accepting our product candidates as effective and safe. 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 our products, if approved for marketing, will depend on a number of factors, including:

- the actual or perceived safety and efficacy of the products, and advantages over alternative treatments;
- the pricing and cost-effectiveness of our products relative to competing products or therapies, including generic drugs or biosimilars, if available;
- the labeling of any approved product;
- the prevalence and severity of any side effects, including any limitations or warnings contained in a product's approved labeling;
- the emergence, and timing of market introduction, of competitive products;
- the effectiveness of marketing and distribution efforts by us and our licensees and distributors, if any; and
- the availability of third-party insurance coverage or governmental reimbursement.

Even if a potential product displays a favorable efficacy and safety profile in nonclinical studies and clinical studies, market acceptance of the product will not be known until after it is launched. Any failure to achieve market acceptance for our product candidates will harm our business, results and financial condition.

If we lose key management or scientific personnel, cannot recruit qualified employees, directors, officers, or other significant personnel or experience increases in our compensation costs, our business might materially suffer.

Our President and Chief Executive Officer, Derek A. Small, resigned from his positions with the Company, effective August 6, 2019. Our future operations will depend in large part on the efforts of our new President and Chief Executive Officer, John G. McHutchison, A.O., M.D. In addition, we are highly dependent on the services of our executive officers and senior management team. Our employment agreements with our executive officers and senior management team members do not ensure their retention.

Furthermore, our future success also depends, in part, on our ability to identify, hire, and retain additional management team members as our operations grow and our ability to replace our management team members in the event any leave us for any reason. We expect to experience intense competition for qualified personnel and might be unable to attract and retain the personnel necessary for the development of our business. Finally, we do not currently maintain, nor do we intend to obtain in the future, "key man" life insurance that would compensate us in the event of the death or disability of any of the members of our management team.

The failure by us to retain, attract and motivate executives and other key employees could have a material adverse impact on our business, financial condition and results of operations.

If we are unable to hire and retain additional qualified personnel, our ability to grow our business might be harmed.

As of September 30, 2019, we had 107 employees and contracts with a number of temporary contractors, consultants and contract research organizations. We will need to hire or contract with additional qualified personnel with expertise in clinical research and testing, formulation and manufacturing and sales and marketing to commercialize our HBV drug candidates and our microbiome biotherapeutic candidates or any other product candidate we may seek to develop. We compete for qualified individuals with numerous biopharmaceutical companies, universities and other research institutions. Competition for these individuals is intense, and we cannot be certain that our search for such personnel will be successful. Attracting and retaining qualified personnel will be critical to our success.

Significant disruptions of information technology systems or breaches of data security could materially adversely affect our business, results of operations and financial condition.

We collect and maintain information in digital form that is necessary to conduct our business, and we are increasingly dependent on information technology systems and infrastructure to operate our business. In the ordinary course of our business, we collect, store and transmit large amounts of confidential information, including intellectual property, proprietary business information and personal information. It is critical that we do so in a secure manner to maintain the confidentiality and integrity of such confidential information. We have established physical, electronic and organizational measures to safeguard and secure our systems to prevent this data from being compromised, and we rely on commercially available systems, software, tools, and monitoring to provide security for our information technology systems and the processing, transmission and storage of digital information. We have also outsourced elements of our information technology infrastructure, and as a result, a number of third-party vendors may or could have access to our confidential information. Our internal information technology systems and infrastructure, and those of our current and any future collaborators, contractors and consultants and other third parties on which we rely, are vulnerable to damage from computer viruses, malware, natural disasters, terrorism, war, telecommunication and electrical failures, cyberattacks or cyber intrusions over the Internet, attachments to emails, persons inside our organization, or persons with access to systems inside our organization.

The risk of a security breach or disruption, particularly through cyberattacks or cyber intrusion, including by computer hackers, foreign governments and cyberterrorists, has generally increased as the number, intensity and sophistication of attempted attacks and intrusions from around the world have increased. In addition, the prevalent use of mobile devices that access confidential information increases the risk of data security breaches, which could lead to the loss of confidential information or other intellectual property. The costs to us to mitigate network security problems, bugs, viruses, worms, malicious software programs and security vulnerabilities could be significant, and while we have implemented security measures to protect our data and information technology systems, our efforts to address these problems may not be successful, and these problems could result in unexpected interruptions, delays, cessation of service and other harm to our business and our competitive position. If such an event were to occur and cause interruptions in our operations, it could result in a material disruption of our product development programs. For example, the loss of clinical study data from completed or ongoing or planned clinical studies could result in delays in our regulatory approval efforts and significantly increase our costs to recover or reproduce the data.

Moreover, if a computer security breach affects our systems or results in the unauthorized release of personally identifiable information, our reputation could be materially damaged. In addition, such a breach may require notification to governmental agencies, the media or individuals pursuant to various federal, state and non-U.S. privacy and security laws, if applicable, including the Health Insurance Portability and Accountability Act of 1996 (HIPAA), as amended by the Health Information Technology for Clinical Health Act of 2009 (HITECH), and its implementing rules and regulations, as well as regulations promulgated by the Federal Trade Commission, state breach notification law and the European Union's General Data Protection Regulation (GDPR). We would also be exposed to a risk of loss or litigation and potential liability, which could materially adversely affect our business, results of operations and financial condition.

We might not successfully manage our growth.

Our success will depend upon the expansion of our operations and the effective management of our growth, which will place a significant strain on our current and future management and other administrative and operational resources. To manage this growth, we may need to expand our facilities, augment our operational, financial and management systems and hire and train additional qualified personnel. If we are unable to manage our growth effectively, our business would be harmed.

We might seek to develop our business through acquisitions of or investment in new or complementary businesses, products or technologies, and the failure to manage these acquisitions or investments, or the failure to integrate them with our existing business, could have a material adverse effect on us.

We might consider opportunities to acquire or invest in other technologies, products and businesses that might enhance our capabilities or complement our current product candidates. Potential and completed acquisitions and strategic investments involve numerous risks, including potential problems or issues associated with the following:

- assimilating the purchased technologies, products or business operations;
- maintaining uniform standards, procedures, controls and policies;
- unanticipated costs associated with the acquisition or investment;
- diversion of our management's attention from our preexisting business;
- maintaining or obtaining the necessary regulatory approvals or complying with regulatory requirements; and
- adverse effects on existing business operations.

We have no current commitments with respect to any acquisition or investment in other technologies or businesses. We do not know if we will identify suitable acquisitions, whether we will be able to successfully complete any acquisitions, or whether we will be able to successfully integrate any acquired product, technology or business into our business or retain key personnel, suppliers or collaborators.

Our ability to develop successfully our business through acquisitions would depend on our ability to identify, negotiate, complete and integrate suitable target businesses or technologies and obtain any necessary financing. These efforts could be expensive and time consuming and might disrupt our ongoing operations. If we are unable to integrate efficiently any acquired business, technology or product into our business, our business and financial condition might be adversely affected.

Risks Related to Our Regulatory and Legal Environment

We are and will be subject to extensive and costly government regulation and the failure to comply with these regulations may have a material adverse effect on our operations and business.

Product candidates employing our technology are subject to extensive and rigorous domestic government regulation including regulation by the FDA, the Centers for Medicare and Medicaid Services, other divisions of the U.S. Department of Health and Human Services, the U.S. Department of Justice, state and local governments, and their respective foreign equivalents. Both before and after approval of any product, we and our collaborators, suppliers, contract manufacturers and clinical investigators are subject to extensive regulation by governmental authorities in the United States and other countries, covering, among other things, testing, manufacturing, quality control, clinical studies, post-marketing studies, labeling, advertising, promotion, distribution, import and export, governmental pricing, price reporting and rebate requirements. Failure to comply with applicable requirements could result in one

or more of the following actions: warning or untitled letters; unanticipated expenditures; delays in approval or refusal to approve a product candidate; voluntary product recall; product seizure; interruption of manufacturing or clinical studies; operating or marketing restrictions; injunctions; criminal prosecution and civil or criminal penalties including fines and other monetary penalties; exclusion from federal health care programs such as Medicare and Medicaid; adverse publicity; and disruptions to our business. Further, government investigations into potential violations of these laws would require us to expend considerable resources and face adverse publicity and the potential disruption of our business even if we are ultimately found not to have committed a violation. If products employing our technologies are marketed abroad, they will also be subject to extensive regulation by foreign governments, whether or not they have obtained FDA approval for a given product and its uses. Such foreign regulation might be equally or more demanding than corresponding U.S. regulation.

Government regulation substantially increases the cost and risk of researching, developing, manufacturing, and selling our product candidates. The regulatory review and approval process, which includes nonclinical testing and clinical studies of each product candidate, is lengthy, expensive, and uncertain. We or our collaborators must obtain and maintain regulatory authorization to conduct clinical studies and approval for each product we intend to market, and the manufacturing facilities used for the products must be inspected and meet legal requirements. Securing regulatory approval requires submitting extensive nonclinical and clinical data and other supporting information for each proposed therapeutic indication in order to establish the product's safety and efficacy for each intended use. The development and approval process might take many years, requires substantial resources, and might never lead to the approval of a product.

Even if we or our collaborators are able to obtain regulatory approval for a particular product, the approval might limit the intended medical uses for the product, limit our ability to promote, sell, and distribute the product, require that we conduct costly post-marketing surveillance, and/or require that we conduct ongoing post-marketing studies. Material changes to an approved product, such as, for example, manufacturing changes or revised labeling, might require further regulatory review and approval. Once obtained, any approvals might be withdrawn, including, for example, if there is a later discovery of previously unknown problems with the product, such as a previously unknown safety issue.

If we, our collaborators, or our contract manufacturers fail to comply with applicable regulatory requirements at any stage during the regulatory process, such noncompliance could result in, among other things, delays in the approval of applications or supplements to approved applications; refusal by a regulatory authority, including the FDA, to review pending market approval applications or supplements to approved applications; untitled letters or warning letters; fines; import and export restrictions; product recalls or seizures; injunctions; total or partial suspension of production; civil penalties; withdrawals of previously approved marketing applications; recommendations by the FDA or other regulatory authorities against governmental contracts; and/or criminal prosecutions.

The regulatory approval processes of the FDA and comparable foreign authorities are lengthy, time consuming and inherently unpredictable, and if we or our collaborators are ultimately unable to obtain regulatory approval for our product candidates, our business will be substantially harmed.

We, or any current or future collaborators, cannot assure you that we will receive the approvals necessary to commercialize for sale any of our product candidates, or any product candidate we acquire or develop in the future. We will need FDA approval to commercialize our product candidates in the United States and approvals from the applicable regulatory authorities in foreign jurisdictions to commercialize our product candidates in those jurisdictions. In order to obtain FDA approval of any product candidate, we must submit to the FDA an NDA, in the case of our HBV-cure program, or a BLA, in the case of our product candidates in our Microbiome program, demonstrating that the product candidate is safe for humans and effective for its intended use (for biological products, this standard is referred to as safe, pure and potent). This demonstration requires significant research, nonclinical studies, and clinical studies. Satisfaction of the FDA's regulatory requirements typically takes many years, depends upon the type, complexity and novelty of the product candidate and requires substantial resources for research, development and testing. We cannot predict whether our research and clinical approaches will result in drugs or biological products that the FDA considers safe for humans and effective for their indicated uses. The FDA has substantial discretion in the approval process and might require us to conduct additional nonclinical and clinical testing, perform post-marketing studies or otherwise limit or impose conditions on any approval we obtain.

The approval process might also be delayed by changes in government regulation, future legislation or administrative action or changes in FDA policy that occur prior to or during our regulatory review. Delays in obtaining regulatory approvals might:

- delay commercialization of, and our ability to derive product revenues from, our product candidates;
- impose costly procedures on us; and
- diminish any competitive advantages that we might otherwise enjoy.

Even if we comply with all FDA requests, the FDA might ultimately reject one or more of our NDAs or BLAs. We cannot be sure that we will ever obtain regulatory approval for our product candidates. Failure to obtain FDA approval of our product candidates will severely undermine our business by leaving us without a saleable product, and therefore without any source of revenues, until another product candidate could be developed or obtained. There is no guarantee that we will ever be able to develop an existing, or acquire another, product candidate.

In foreign jurisdictions, we must receive approval from the appropriate regulatory authorities before we can commercialize any product candidates. The risks associated with foreign regulatory approval processes are similar to the risks associated with the FDA approval procedures described above. We cannot assure you that we will receive the approvals necessary to commercialize our product candidates for sale outside the United States.

Even if our product candidates are approved, we and our collaborators will be subject to extensive post-approval regulation, including ongoing obligations and continued regulatory review, which may result in significant additional expense. If approved, our product candidates could be subject to post-marketing restrictions or withdrawal from the market and we, or any collaborators, may be subject to substantial penalties if we, or they, fail to comply with regulatory requirements or if we, or they, experience unanticipated problems with our products following approval.

Once a product candidate is approved, numerous post-approval requirements apply. Among other things, we and our collaborators will be subject to requirements regarding testing, manufacturing, quality control, clinical studies, post-marketing studies, labeling, advertising, promotion, distribution, import and export, governmental pricing, price reporting and rebate requirements. The holder of an approved NDA or BLA is subject to ongoing FDA oversight, monitoring and reporting obligations, including obligations to monitor and report adverse events and instances of the failure of a product to meet the specifications in the NDA or BLA. Application holders must submit new or supplemental applications and obtain FDA approval for changes to the approved product, product labeling, or manufacturing process, depending on the nature of the change. Application holders also must submit advertising and other promotional material to the FDA and report on ongoing clinical studies. The FDA also has the authority to require changes in the labeling of approved drug products and to require post-marketing studies. The FDA can also impose distribution and use restrictions under a REMS.

Advertising and promotional materials must comply with FDA rules in addition to other applicable federal and state laws. The distribution of product samples to physicians must comply with the requirements of the Prescription Drug Marketing Act. Manufacturing facilities remain subject to FDA inspection and must continue to adhere to the FDA's cGMP requirements. Sales, marketing, and scientific/educational grant programs, among other activities, must comply with the anti-fraud and abuse provisions of the Social Security Act, the False Claims Act, and similar state laws, each as amended. Pricing and rebate programs must comply with the Medicaid rebate requirements of the Omnibus Budget Reconciliation Act of 1990 and the Veterans Health Care Act of 1992, each as amended. If products are made available to authorized users of the Federal Supply Schedule of the General Services Administration, additional laws and requirements apply. All of these activities are also potentially subject to federal and state consumer protection and unfair competition laws.

Depending on the circumstances, failure to meet these post-approval requirements can result in criminal prosecution, fines, injunctions, recall or seizure of products, total or partial suspension of production, denial or withdrawal of pre-marketing product approvals, or refusal to allow us to enter into supply contracts, including government contracts. In addition, even if we comply with FDA and other requirements, new information regarding the safety or effectiveness of a product could lead the FDA to modify or withdraw product approval.

The policies of the FDA and of other regulatory authorities 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 or executive action, either in the United States or abroad. For example, certain policies of the current administration may impact our business and industry. Namely, the current administration has taken several executive actions, including the issuance of a number of Executive Orders, that could impose significant burdens on, or otherwise materially delay, FDA's ability to engage in routine oversight activities such as implementing statutes through rulemaking, issuance of guidance, and review and approval of marketing applications. Notably, on January 30, 2017, an Executive Order was issued directing all executive agencies, including the FDA, that, for each notice of proposed rulemaking or final regulation to be issued in fiscal years 2018 and beyond, the agencies must identify regulations to offset any incremental cost of a new regulation. On September 8, 2017, the FDA published notices in the Federal Register soliciting broad public comment to identify regulations that could be modified in compliance with these Executive Orders. It is difficult to predict how these requirements will be implemented, and the extent to which they will impact the FDA's ability to exercise its regulatory authority. If these executive actions impose restrictions on FDA's ability to engage in oversight and implementation activities in the normal course, our business may be negatively impacted. In addition, if we are slow or unable to adapt to changes in existing requirements or the adoption of new requirements or policies, or if we are not able to maintain regulatory compliance, we may lose any marketing approval that we may have obtained and we may not achieve or sustain profitability.

Even if we or our collaborators are able to commercialize any product candidates, those products may become subject to unfavorable pricing regulations, third-party coverage and reimbursement practices or healthcare reform initiatives, which would harm our business.

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

Our ability to commercialize any medicines successfully also will depend in part on the extent to which reimbursement for these medicines and related treatments will be available from government health administration authorities, private health insurers and other organizations. Government authorities and third-party payors, such as private health insurers and health maintenance organizations, decide which medications they will pay for and establish reimbursement levels. A primary trend in the U.S. healthcare industry and elsewhere is cost containment. Government authorities and third-party payors have attempted to control costs by limiting coverage and the amount of reimbursement for particular medications. Increasingly, third-party payors are requiring that drug companies provide them with predetermined discounts from list prices and are challenging the prices charged for medical products. We cannot be sure that reimbursement will be available for any product candidate that we commercialize and, if reimbursement is available, the level of reimbursement. Reimbursement may impact the demand for, or the price of, any product candidate for which we obtain marketing approval. If reimbursement is not available or is available only to limited levels, we may not be able to commercialize successfully any product candidate for which we obtain marketing approval.

There may be significant delays in obtaining reimbursement for newly approved medicines, and coverage may be more limited than the purposes for which the medicine is approved by the FDA or similar regulatory authorities outside the United States. Moreover, eligibility for reimbursement does not imply that any medicine will be paid for in all cases or at a rate that covers our costs, including research, development, manufacture, sale and distribution. Interim reimbursement levels for new medicines, if applicable, may also not be sufficient to cover our costs and may not be made permanent. Reimbursement rates may vary according to the use of the medicine and the clinical setting in which it is used, may be based on reimbursement levels already set for lower cost medicines and may be

incorporated into existing payments for other services. Net prices for medicines may be reduced by mandatory discounts or rebates required by government healthcare programs or private payors and by any future relaxation of laws that presently restrict imports of medicines from countries where they may be sold at lower prices than in the United States. Third-party payors often rely upon Medicare coverage policy and payment limitations in setting their own reimbursement policies. Our inability to obtain promptly coverage and profitable payment rates from both government-funded and private payors for any approved product candidates that we develop could have a material adverse effect on our operating results, our ability to raise capital needed to commercialize product candidates and our overall financial condition.

In the United States and in other countries, there have been, and we expect there will continue to be, a number of legislative and regulatory proposals to change the healthcare system in ways that could significantly affect our business. International, federal and state lawmakers regularly propose and, at times, enact legislation that would result in significant changes to the healthcare system, some of which are intended to contain or reduce the costs of medical products and services. The U.S. government and other governments have shown significant interest in pursuing healthcare reform, as evidenced by the Affordable Care Act and its amendment, the Health Care and Education Reconciliation Act (the ACA).

Among the provisions of the ACA of importance to our potential drug candidates are the following:

- an annual, nondeductible fee on any entity that manufactures or imports specified branded prescription drugs and biologics;
- an increase in the statutory minimum rebates a manufacturer must pay under the Medicaid Drug Rebate Program;
- expansion of healthcare fraud and abuse laws, including the False Claims Act and the Anti-Kickback Statute, new government investigative powers, and enhanced penalties for noncompliance;
- a new Medicare Part D coverage gap discount program, in which manufacturers must agree to offer 50% point-of-sale discounts off negotiated prices (which was increased to 70% as of January 1, 2019 under the Bipartisan Budget Act of 2018 (BBA));
- extension of manufacturers' Medicaid rebate liability;
- expansion of eligibility criteria for Medicaid programs;
- expansion of the entities eligible for discounts under the Public Health Service Act pharmaceutical pricing program;
- new requirements to report financial arrangements with physicians and teaching hospitals;
- a new requirement to annually report drug samples that manufacturers and distributors provide to physicians; and
- a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research.

Since its enactment, there have been many judicial, Presidential, and Congressional challenges to numerous aspects of the ACA. In 2012, the U.S. Supreme Court heard challenges to the constitutionality of the individual mandate and the viability of certain provisions of the Healthcare Reform Act. The Supreme Court's decision upheld most of the Healthcare Reform Act and determined that requiring individuals to maintain "minimum essential" health insurance coverage or pay a penalty to the Internal Revenue Service was within Congress's constitutional taxing authority. However, as a result of tax reform legislation passed in late December 2017, the individual mandate has been eliminated. The long ranging effects of the elimination of the individual mandate on the viability of the ACA are unknown at this time.

On January 20, 2017, President Trump signed an Executive Order directing federal agencies with authorities and responsibilities under the ACA to waive, defer, grant exemptions from, or delay the implementation of any provision of the ACA that would impose a fiscal burden on states or a cost, fee, tax, penalty or regulatory burden on individuals, healthcare providers, health insurers, or manufacturers of pharmaceuticals or medical devices. On October 13, 2017, President Trump signed an Executive Order terminating the cost-sharing subsidies that reimburse insurers under the ACA. Several state Attorneys General filed suit to stop the administration from terminating the subsidies, but their request for a restraining order was denied by a federal judge in California on October 25, 2017. In addition, Centers for Medicare & Medicaid Services has recently finalized regulations that would give states greater flexibility in setting benchmarks for insurers in the individual and small group marketplaces, which may have the effect of relaxing the essential health benefits required under the ACA for plans sold through such marketplaces. The Tax Cuts and Jobs Act of 2017 (the Tax Act) includes a provision repealing, effective January 1, 2019, the tax-based shared responsibility payment imposed by the ACA 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 December 14, 2018, a U.S. District Court Judge in the Northern District of Texas, or the Texas District Court Judge, ruled that the individual mandate is a critical and inseverable feature of the Affordable Care Act, and therefore, because it was repealed as part of the Tax Act, the remaining provisions of the ACA are invalid as well. The Texas District Court Judge, as well as the Trump Administration and the Centers for Medicare & Medicaid Services (CMS), have stated that the ruling will have no immediate effect, and on December 30, 2018, the Texas District Court Judge issued an order staying the judgment pending appeal. It is unclear what effects this decision, subsequent appeals of this decision, and other efforts to repeal and replace the ACA will have. Additionally, on January 22, 2018, President Trump signed a continuing resolution on appropriations for fiscal year 2018 that delayed the implementation of certain ACA mandated fees, including the so called "Cadillac" tax on certain high cost employer-sponsored insurance plans, the annual fee imposed 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 exercise tax on nonexempt medical devices. On October 9, 2019, the Department of Health and Human Services (HHS) Office of Inspector General proposed modifications to federal Anti-Kickback Statute safe harbors which, among other things, may affect rebates paid by manufacturers to Medicare Part D plans, the purpose of which is to further reduce the cost of drug products to consumers. Further, the BBA, among other things, amended the ACA, effective January 1, 2019, to reduce the coverage gap in most Medicare drug plans, commonly referred to as the "donut hole." In July 2018, CMS announced that it is suspending further collections and payments to and from certain ACA-qualified health plans and health insurance issuers under the ACA risk adjustment program pending the outcome of federal district court litigation regarding the method CMS uses to determine this risk adjustment. The full impact of the ACA, any law repealing and/or replacing elements of it, and the political uncertainty surrounding any repeal or replacement legislation on our business remains unclear.

In addition, other legislative changes have been proposed and adopted since the ACA was enacted. These changes included aggregate reductions to Medicare payments to providers of up to 2% per fiscal year, starting in 2013. In January 2013, then President Obama signed into law the American Taxpayer Relief Act of 2012, which, among other things, reduced Medicare payments to several providers, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. These laws may result in additional reductions in Medicare and other healthcare funding. There has been increasing legislative and enforcement interest in the United States with respect to specialty drug pricing practices. Specifically, there have been several recent U.S. Congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to drug pricing, reduce the cost of prescription drugs under Medicare, review the relationship between pricing and manufacturer patient programs and reform government program reimbursement methodologies for drugs. For example, on September 25, 2019, the Senate Finance Committee introduced a bill intended to reduce Medicare and Medicaid prescription drug prices. Named the Prescription Drug Pricing Reduction Action of 2019, the proposed legislation would restructure the Part D benefit, modify payment methodologies for certain drugs, and impose an inflation cap on drug price increases. An even more restrictive bill was introduced in the House of Representatives on September 19, 2019, the Lower Drug Costs Now Act of 2019, which would require HHS to directly negotiate drug prices with manufacturers. It is unclear whether either of these bills will make it through both chambers and be signed into law, and if either is enacted, what effect it would have on our business. Further, in some foreign jurisdictions, there have been a number of legislative and regulatory proposals to change the healthcare system in ways that could affect our ability to sell our products profitably. The continuing efforts of U.S. and other governments, insurance companies, managed care organizations and other payors of healthcare services to contain or reduce healthcare costs may adversely affect our ability to set satisfactory prices for our products, to generate revenues from the sale of products, and to achieve and maintain profitability.

We and our collaborators may be subject, directly or indirectly, to applicable U.S. federal and state anti-kickback, false claims laws, physician payment transparency laws, fraud and abuse laws or similar healthcare and security laws and regulations, and health information privacy and security laws, which could expose us or them to criminal sanctions, civil penalties, contractual damages, reputational harm and diminished profits and future earnings.

Healthcare providers, physicians and others play a primary role in the recommendation and prescription of any products for which we obtain regulatory approval. If we obtain FDA approval for any of our drug candidates and begin commercializing those drugs in the United States, our operations may be subject to various federal and state fraud and abuse laws, including, without limitation, the federal Anti-Kickback Statute, the federal False Claims Act, and physician payment sunshine laws and regulations. These laws may impact, among other things, our proposed sales, marketing and education programs. In addition, we may be subject to patient privacy regulation by both the federal government and the states and foreign jurisdictions in which we conduct our business. The laws that may affect our ability to operate include:

- the federal Anti-Kickback Statute, which prohibits, among other things, 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, 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 can be found guilty of violating the statute without actual knowledge of the statute or specific intent to violate it. The Anti-Kickback Statute has been interpreted to apply to arrangements between pharmaceutical manufacturers on the one hand and prescribers, purchasers, and formulary managers on the other;

- federal civil and criminal false claims laws and civil monetary penalty laws, such as the federal False Claims Act, which impose criminal and civil penalties and authorize civil whistleblower or qui tam actions, against individuals or entities for, among other things: knowingly presenting, or causing to be presented, to the federal government, claims for payment that are false or fraudulent; making a false statement or record material to a false or fraudulent claim or obligation to pay or transmit money or property to the federal government; or knowingly concealing or knowingly and improperly avoiding or decreasing 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 False Claims Act;

- HIPAA, which created new federal criminal statutes that prohibit 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) and knowingly and willfully falsifying, concealing or covering up by any trick or device a material fact or making any materially false statements in connection with the delivery of, or payment for, healthcare benefits, items or services relating to healthcare matters;

- HIPAA, as amended by 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 use, or disclosure of, individually identifiable health information, relating to the privacy, security and transmission of individually identifiable health information;

- the federal false statements statute prohibits knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statement in connection with the delivery of or payment for healthcare benefits, items or services;

- the U.S. federal Food, Drug and Cosmetic Act (FDCA), which prohibits, among other things, the adulteration or misbranding of drugs, biologics and medical devices, and the Public Health Service Act (PHSA), which prohibits, among other things, the introduction into interstate commerce of a biological product unless a biologics license is in effect for that product;

- the federal transparency requirements under the ACA, including the provision commonly referred to as the Physician Payments Sunshine Act, which requires manufacturers of drugs, devices, biologics and medical supplies for which payment is available under Medicare, Medicaid or the Children's Health Insurance Program to report annually to the U.S. Department of Health and Human Services information related to payments or other transfers of value made to physicians and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members; 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 and non-U.S. equivalents of each of the healthcare laws described above, among others, some of which may be broader in scope and may apply regardless of the payor. Many U.S. states have adopted laws similar to the federal Anti-Kickback Statute, some of which apply to the referral of patients for healthcare services reimbursed by any source, not just governmental payors, including private insurers. In addition, some states have passed laws that require pharmaceutical companies to comply with the April 2003 Office of Inspector General Compliance Program Guidance for Pharmaceutical Manufacturers and/or the Pharmaceutical Research and Manufacturers of America's Code on Interactions with Healthcare Professionals. Several states also impose other marketing restrictions or require pharmaceutical companies to make marketing or price disclosures to the state. There are ambiguities as to what is required to comply with these state requirements and if we fail to comply with an applicable state law requirement we could be subject to penalties.

In addition, regulators globally are also imposing greater monetary fines for privacy violations. The GDPR, which went into effect on May 25, 2018, applies to any company established in the European Union (EU) as well as to those outside the EU if they collect and use personal data in connection with the offering goods or services to individuals in the EU or the monitoring of their behavior. The GDPR enhances data protection obligations for processors and controllers of personal data, including, for example, expanded disclosures about how personal information is to be used, limitations on retention of information, mandatory data breach notification requirements and onerous new obligations on services providers. Noncompliance with the GDPR may result in monetary penalties of up to €20 million or 4% of worldwide revenue, whichever is higher. Compliance with the GDPR and other changes in laws or regulations associated with the enhanced protection of certain types of personal data, such as healthcare data or other sensitive information, could greatly increase our cost of developing our products and services or even prevent us from offering certain products in jurisdictions that we may operate in. Given the limited enforcement of the GDPR to date, particularly in the pharmaceutical space, we face uncertainty as to the exact interpretation of the new requirements on our trials and we may be unsuccessful in implementing all measures required by data protection authorities or courts in interpretation of the new law.

Because of the breadth of these laws and the narrowness of the statutory exceptions and safe harbors available, it is possible that some of our business activities could be subject to challenge under one or more of such laws. In addition, recent health care reform legislation has strengthened these laws. For example, the ACA, among other things, amends the intent requirement of the federal Anti-Kickback and criminal healthcare fraud statutes. As a result of such amendment, a person or entity no longer needs to have actual knowledge of these statutes or specific intent to violate them in order to have committed a violation. Moreover, the ACA provides that the government may assert that a claim including items or services resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the False Claims Act.

Violations of fraud and abuse laws may be punishable by criminal and/or civil sanctions, including penalties, fines and/or exclusion or suspension from federal and state healthcare programs such as Medicare and Medicaid and debarment from contracting with the U.S. government. In addition, private individuals have the ability to bring actions on behalf of the U.S. government under the federal False Claims Act as well as under the false claims laws of several states.

Law enforcement authorities are increasingly focused on enforcing fraud and abuse laws, and it is possible that some of our practices may be challenged under these laws. Efforts to ensure that our business arrangements with third parties will comply with applicable healthcare laws and regulations will involve substantial costs. It is possible that governmental authorities will conclude that our business practices may not comply with current or future statutes, regulations or case law involving applicable fraud and abuse or other healthcare laws and regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those

actions could have a significant impact on our business, including the imposition of civil, criminal and administrative penalties, damages, disgorgement, monetary fines, possible exclusion from participation in Medicare, Medicaid and other federal healthcare programs, contractual damages, reputational harm, diminished profits and future earnings, and curtailment of our operations, any of which could adversely affect our ability to operate our business and our results of operations. In addition, the approval and commercialization of any of our drug candidates outside the United States will also likely subject us to non-U.S. equivalents of the healthcare laws mentioned above, among other non-U.S. laws.

If any of the physicians or other providers or entities with whom we expect to do business with are found to be not in compliance with applicable laws, they may be subject to criminal, civil or administrative sanctions, including exclusions from government funded healthcare programs, which may also adversely affect our business.

If we fail to maintain an effective system of disclosure controls and internal control over financial reporting, our ability to produce timely and accurate financial statements or comply with applicable regulations could be impaired.

The Sarbanes-Oxley Act requires, among other things, that we maintain effective disclosure controls and procedures and internal control over financial reporting. We are continuing to refine our disclosure controls and other procedures that are designed to ensure that the information that we are required to disclose in the reports that we will file with the SEC is properly recorded, processed, summarized and reported within the time periods specified in SEC rules and forms. We are also continuing to improve our internal control over financial reporting. We have expended, and anticipate that we will continue to expend, significant resources in order to maintain and improve the effectiveness of our disclosure controls and procedures and internal control over financial reporting.

Our current controls and any new controls that we develop in the future may become inadequate because of changes in conditions in our business. Further, weaknesses in our disclosure controls or our internal control over financial reporting may be discovered in the future. Any failure to develop or maintain effective controls, or any difficulties encountered in their implementation or improvement, could harm our operating results or cause us to fail to meet our reporting obligations and may result in a restatement of our financial statements for prior periods. Any failure to implement and maintain effective internal control over financial reporting could also adversely affect the results of management reports and independent registered public accounting firm audits of our internal control over financial reporting that we will be required to include in our periodic reports that will be filed with the SEC. If we were to have ineffective disclosure controls and procedures or internal control over financial reporting, our investors could lose confidence in our reported financial and other information, which would likely have a negative effect on the market price of our common stock.

We face the risk of product liability claims and might not be able to obtain insurance.

Our business exposes us to the risk of product liability claims that are inherent in the development of drugs and biotherapeutics. If the use of one or more of our product candidates or approved drugs, if any, harms people, we might be subject to costly and damaging product liability claims brought against us by clinical study participants, consumers, health care providers, pharmaceutical companies or others selling our products. Our inability to obtain sufficient product liability/clinical study insurance at an acceptable cost to protect against potential product liability claims could prevent or inhibit the commercialization of pharmaceutical products we develop. We cannot predict all of the possible harms or side effects that might result and, therefore, the amount of insurance coverage we maintain might not be adequate to cover all liabilities we might incur. We intend to expand our insurance coverage to include product liability insurance covering the sale of commercial products if we obtain marketing approval for our drug candidates in development, but we might be unable to obtain commercially reasonable product liability insurance for any products approved for marketing. If we are unable to obtain insurance at an acceptable cost or otherwise protect against potential product liability claims, we will be exposed to significant liabilities, which might materially and adversely affect our business and financial position. If we are sued for any injury allegedly caused by our products, our liability could exceed our total assets and our ability to pay the liability. Any successful product liability claims or series of claims brought against us would decrease our cash and could cause the value of our common stock to decrease.

We might be exposed to liability claims associated with the use of hazardous materials and chemicals.

Our research, development and manufacturing activities and/or those of our third-party contractors might involve the controlled use of hazardous materials and chemicals. Although we will strive to have our safety procedures, and those of our contractors, for using, storing, handling and disposing of these materials comply with federal, state and local laws and regulations, we cannot completely eliminate the risk of accidental injury or contamination from these materials. In the event of such an accident, we could be held liable for any resulting damages, and any liability could materially adversely affect our business, financial condition and results of operations. In addition, the federal, state and local laws and regulations governing the use, manufacture, storage, handling and disposal of hazardous or radioactive materials and waste products might require us to incur substantial compliance costs that could materially adversely affect our business, financial condition and results of operations. We currently do not carry hazardous materials liability insurance. We intend to obtain such insurance in the future, if necessary, but cannot give assurance that we could obtain such coverage.

Our employees, independent contractors, consultants, collaborators and contract research organizations may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements, which could result in significant liability for us and harm our reputation.

We are exposed to the risk of fraud or other misconduct, including intentional failure to:

- comply with FDA regulations or similar regulations of comparable foreign regulatory authorities;
- provide accurate information to the FDA or comparable foreign regulatory authorities;
- comply with federal and state healthcare fraud and abuse laws and regulations and similar laws and regulations established and enforced by comparable foreign regulatory authorities;
- comply with the United States Foreign Corrupt Practices Act (the FCPA), the U.K. Bribery Act 2010, the PRC Criminal Law, the PRC Anti-unfair Competition Law and other anti-bribery laws;
- report financial information or data accurately; or
- disclose unauthorized activities to us.

Misconduct could also involve the improper use or misrepresentation of information obtained in the course of clinical studies, creating fraudulent data in our nonclinical studies or clinical studies or illegal misappropriation of product materials, which could result in regulatory sanctions, delays in clinical studies, or serious harm to our reputation. We have adopted a code of conduct for our directors, officers and employees (the Code of Conduct), but it is not always possible to identify and deter employee misconduct. The precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to be in compliance with such laws or regulations. Additionally, we are subject to the risk that a person or government could allege such fraud or other misconduct, even if none occurred. If any such actions are instituted against us and we are not successful in defending ourselves or asserting our rights, those actions could harm our business, results of operations, financial condition and cash flows, including through the imposition of significant fines or other sanctions.

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

Among other matters, Trade Laws prohibit companies and their employees, agents, clinical research organizations, legal counsel, accountants, consultants, contractors, and other partners from authorizing, promising, offering, providing, soliciting, or receiving directly or indirectly, corrupt or improper payments or anything else of value to or from recipients in the public or private sector. Violations of Trade Laws can result in substantial criminal fines and civil penalties, imprisonment, the loss of trade privileges, debarment, tax reassessments, breach of contract and fraud litigation, reputational harm, and other consequences. We have direct or indirect interactions with officials and employees of government agencies or government-affiliated hospitals, universities, and other organizations. We also expect our non-U.S. activities, particularly in China, to increase in time. We engage third parties for clinical studies and/or to obtain necessary permits, licenses, patent registrations, and other regulatory approvals. We can be held liable for the corrupt or other illegal activities of our personnel, agents, or partners, even if we do not explicitly authorize or have prior knowledge of such activities.

We have international operations, including in China, and conduct clinical studies outside of the United States. A number of risks associated with international operations could materially and adversely affect our business.

We expect to be subject to a number of risks related with our international operations, many of which may be beyond our control. These risks include:

- different regulatory requirements for drug approvals in foreign countries;
- different standards of care in various countries that could complicate the evaluation of our product candidates;
- different U.S. and foreign drug import and export rules;
- different reimbursement systems and different competitive drugs indicated to treat the indication for which our product candidates are being developed;
- reduced protection for intellectual property rights in certain countries;
- unexpected changes in tariffs, trade barriers and regulatory requirements;
- compliance with the FCPA and other anti-corruption and anti-bribery laws;
- compliance with tax, employment, immigration and labor laws for employees living or traveling abroad;
- foreign taxes, including withholding of payroll taxes;
- foreign currency fluctuations and compliance with foreign currency exchange rules, which could result in increased operating expenses and reduced revenues, and other obligations incident to doing business in another country; and
- business interruptions resulting from geopolitical actions, including tariffs, war and terrorism, or natural disasters.

The results of the United Kingdom's referendum on withdrawal from the EU may have a negative effect on global economic conditions, financial markets and our business.

In June 2016, the United Kingdom (UK) held a referendum in which voters approved an exit from the EU, commonly referred to as "Brexit." This referendum has created political and economic uncertainty, particularly in the UK and the EU, and this uncertainty may persist for years. A withdrawal could, among other outcomes, disrupt the free movement of goods, services and people between the UK and the EU, and result in increased legal and regulatory complexities, as well as potential higher costs of conducting business in Europe. The UK's vote to exit the EU could also result in similar referendums or votes in other European countries in which we do business. Given the lack of comparable precedent, it is unclear what financial, trade and legal implications the withdrawal of the UK from the EU would have and how such withdrawal would affect us.

For example, Brexit could result in the UK or the EU significantly altering its regulations affecting the clearance or approval of our product candidates that are developed in the UK. Any new regulations could add time and expense to the conduct of our business, as well as the process by which our products receive regulatory approval in the UK, the EU and elsewhere. In addition, the announcement of Brexit and the withdrawal of the UK from the EU have had and may continue to have a material adverse effect on global economic conditions and the stability of global financial markets and may significantly reduce global market liquidity and restrict the ability of key market participants to operate in certain financial markets. Any of these effects of Brexit, among others, could adversely affect our business, our results of operations, liquidity and financial condition.

Risks Related to Our Intellectual Property

Our business depends on protecting our intellectual property.

If we and our licensors, IURTC and Therabiome, do not obtain protection for our respective intellectual property rights, our competitors might be able to take advantage of our research and development efforts to develop competing drugs. Our success, competitive position and future revenues, if any, depend in part on our ability and the abilities of our licensors to obtain and maintain patent protection for our products, methods, processes and other technologies, to preserve our trade secrets, to prevent third parties from infringing on our proprietary rights and to operate without infringing the proprietary rights of third parties.

We seek to protect our proprietary position by filing patent applications in the United States and abroad related to our novel technologies and chemical and biological compositions that are important to our business. To date, we and our licensors have filed patent applications intended to cover our products candidates and their methods of use. Although we co-own and have in-licensed two issued patents in the U.S. directed to compositions of matter that includes ABI-H0731, which are expected to expire in 2035 and 2036, and we have an in-licensed issued U.S. patent related to delivery technology for our Microbiome program, which is expected to expire in 2034, we do not own or have any rights to any issued patents that cover any of our other product candidates, and we cannot be certain that we will secure any rights to any issued patents with claims that cover any of our proprietary product candidates and technologies. The patent prosecution process is expensive and time-consuming, and we may not be able to file and prosecute all necessary or desirable patent applications at a reasonable cost or in a timely manner. It is also possible that we will fail to identify patentable aspects of our research and development output before it is too late to obtain patent protection.

The patent process also is subject to numerous risks and uncertainties, and there can be no assurance that we will be successful in protecting our products by obtaining and defending patents. These risks and uncertainties include the following:

- Any patent rights, if obtained, might be challenged, invalidated, or circumvented, or otherwise might not provide any competitive advantage;
- Our competitors, many of which have substantially greater resources than we do and many of which might make significant investments in competing technologies, might seek, or might already have obtained, patents that will limit, interfere with, or eliminate our ability to make, use, and sell our potential products either in the United States or in international markets;
- As a matter of public policy regarding worldwide health concerns, there might be significant pressure on the U.S. government and other international governmental bodies to limit the scope of patent protection both inside and outside the United States for disease treatments that prove successful; and
- Countries other than the United States might have patent laws that provide less protection than those governing U.S. courts, allowing foreign competitors the ability to exploit these laws to create, develop, and market competing products.

In addition, the U.S. Patent and Trademark Office (the USPTO) and patent offices in other jurisdictions have often required that patent applications concerning pharmaceutical and/or biotechnology-related inventions be limited or narrowed substantially to cover only the specific innovations exemplified in the patent application, thereby limiting the scope of protection against competitive challenges. Thus, even if we or our licensors are able to obtain patents, the patents might be substantially narrower than anticipated.

Patent and other intellectual property protection is crucial to the success of our business and prospects, and there is a substantial risk that such protections, if obtained, will prove inadequate. Our business and prospects will be harmed if we fail to obtain these protections or they prove insufficient.

If we fail to comply with our obligations under our license agreements, we could lose rights to our product candidates or key technologies.

We have obtained rights to develop, market and sell some of our product candidates and technologies through intellectual property license agreements with third parties, including IURTC and Therabiome. These license agreements impose various diligence, milestone payment, royalty and other obligations on us. If we fail to comply with our obligations under our license agreements, we could lose some or all of our rights to develop, market and sell products covered by these licenses, and our ability to form collaborations or partnerships may be impaired. In addition, disputes may arise under our license agreements with third parties, which could prevent or impair our ability to maintain our current licensing arrangements on acceptable terms and to develop and commercialize the affected product candidates.

We may incur substantial costs as a result of litigation or other proceedings relating to patent and other intellectual property rights.

If we choose to go to court to stop another party from using the inventions claimed in any patents we obtain, that individual or company has the right to ask the court to rule that such patents are invalid or should not be enforced against that third party. These lawsuits are expensive and would consume time and resources and divert the attention of managerial and scientific personnel even if we were successful in stopping the infringement of such patents. There is a risk that the court will decide that such patents are not valid and that we do not have the right to stop the other party from using the inventions. There is also the risk that, even if the validity of such patents is upheld, the court will refuse to stop the other party on the ground that such other party's activities do not infringe our rights to such patents. If we were not successful in defending our intellectual property, our competitors could develop and market products based on our discoveries, which may reduce demand for our products.

We rely on trade secret protections through confidentiality agreements with our employees, collaborators and other parties, and the breach of these agreements could adversely affect our business and prospects.

We rely on trade secrets and proprietary know-how, which we seek to protect, in part, through confidentiality, invention, and nondisclosure agreements with our employees, scientific advisors, consultants, collaborators, suppliers, and other parties. There can be no assurance that these agreements will not be breached, that we would have adequate remedies for any such breach or that our trade secrets will not otherwise become known to or independently developed by our competitors. If any of these events occurs, or we otherwise lose protection for our trade secrets or proprietary know-how, the value of this information may be greatly reduced.

If our employees or consultants breach their confidentiality obligations, to be able to enforce these confidentiality provisions, we would need to know of the breach and have sufficient funds to enforce the provisions. We cannot assure you that we would know of or be able to afford enforcement of any breach. In addition, such provisions are subject to state law and interpretation by courts, which could limit the scope and duration of these provisions. Any limitation on or non-enforcement of these confidentiality provisions could have an adverse effect on our business.

We may infringe the intellectual property rights of others, which may prevent or delay our product development efforts and stop us from commercializing or increase the costs of commercializing our product candidates.

Our success will depend in part on our ability to operate without infringing the proprietary rights of third parties. Our competitors may have filed, and may in the future file, patent applications covering products and technologies similar to ours. Any such patent application may have priority over our patent applications, which could further require us to obtain rights from third parties to issued patents covering such products and technologies. We cannot guarantee that the manufacture, use or marketing of any product candidates that we develop will not infringe third-party patents.

A third party may claim that we are using inventions covered by the third party's patent rights and may go to court to stop us from engaging in our normal operations and activities, including making or selling our product candidates. Patent litigation is costly and time consuming. We may not have sufficient resources to address these actions, and such actions could affect our results of operations and divert the attention of managerial and scientific personnel.

If a patent infringement suit were brought against us, we may be forced to stop or delay developing, manufacturing, or selling potential products that are claimed to infringe a third party's intellectual property, unless that third party grants us rights to use its intellectual property. In such cases, we may be required to obtain licenses to patents or proprietary rights of others in order to continue development, manufacture or sale of our products. If we are unable to obtain a license or develop or obtain non-infringing technology, or if we fail to defend an infringement action successfully, or if we are found to have infringed a valid patent, we may incur substantial monetary damages, encounter significant delays in bringing our product candidates to market and be precluded from manufacturing or selling our product candidates, any of which could harm our business significantly.

If our efforts to protect our proprietary technologies are not adequate, we may not be able to compete effectively in our market.

We rely upon a combination of patents, trade secret protection and contractual arrangements to protect the intellectual property related to our technologies. We will only be able to protect our products and proprietary information and technology by preventing unauthorized use by third parties to the extent that our patents, trade secrets, and contractual position allow us to do so. Any disclosure to or misappropriation by third parties of our trade secrets or confidential information could compromise our competitive position. Moreover, we may in the future be involved in legal or administrative proceedings involving our intellectual property initiated by third parties, and which proceedings can result in significant costs and commitment of management time and attention. As our product candidates continue in development, third parties may attempt to challenge the validity and enforceability of our patents and proprietary information and technologies.

We may in the future be involved in initiating legal or administrative proceedings involving the product candidates and intellectual property of our competitors. These proceedings can result in significant costs and commitment of management time and attention, and there can be no assurance that our efforts would be successful in preventing or limiting the ability of our competitors to market competing products.

Composition-of-matter patents relating to the active pharmaceutical ingredient (API) are generally considered to be the strongest form of intellectual property protection for pharmaceutical products. Such patents provide protection not limited to any one method of use. Method-of-use patents protect the use of a product for the specified method(s), and do not prevent a competitor from making and marketing a product that is identical to our product for an indication that is outside the scope of the patented method. We rely on a combination of these and other types of patents to protect our product candidates, and there can be no assurance that our intellectual property will create and sustain the competitive position of our product candidates.

Biotechnology and pharmaceutical product patents involve highly complex legal and scientific questions and can be uncertain. Any patent applications that we own or license may fail to result in issued patents. Even if patents do successfully issue from our applications, third parties may challenge their validity or enforceability, which may result in such patents being narrowed, invalidated, or held unenforceable. Even if our patents and patent applications are not challenged by third parties, those patents and patent applications may not prevent others from designing around our claims and may not otherwise adequately protect our product candidates. If the breadth or strength of protection provided by the patents and patent applications we hold with respect to our product candidates is threatened, competitors with significantly greater resources could threaten our ability to commercialize our product candidates. Discoveries are generally published in the scientific literature well after their actual development, and patent applications in the United States and other countries are typically not published until 18 months after filing, and in some cases are never published. Therefore, we cannot be certain that we or our licensors were the first to make the inventions claimed in our owned and licensed patents or patent applications, or that we or our licensors were the first to file for patent protection covering such inventions. Subject to meeting other requirements for patentability, for U.S. patent applications filed prior to March 16, 2013, the first to invent the claimed invention is entitled to receive patent protection for that invention while, outside the United States, the first to file a patent application encompassing the invention is entitled to patent protection for the invention. The United States moved to a "first to file" system under the Leahy-Smith America Invents Act (AIA), effective March 16, 2013. The effects of this change and other elements of the AIA are currently unclear, as the USPTO is still implementing associated regulations, and the applicability of the AIA and associated regulations to our patents and patent applications have not been fully determined. This new system also includes new procedures for challenging issued patents and pending patent applications, which creates additional uncertainty. We may become involved in any variety of proceedings challenging our patents and patent applications or the patents and patent applications of others, and the

outcome of any such proceedings are highly uncertain. An unfavorable outcome in any such proceedings could reduce the scope of, invalidate, and/or find our patent rights unenforceable, allowing third parties to commercialize our technology and compete directly with us, or result in our inability to manufacture, develop or commercialize our product candidates without infringing the patent rights of others. In addition to ongoing changes with the AIA and USPTO regulations, recent decisions of the Supreme Court of the United States, and the possibility of statutory change to patent subject matter eligibility law advocated by such groups as the Intellectual Property Owners Association and the American Intellectual Property Law Association, provide additional uncertainty.

In addition to the protection afforded by patents, we seek to rely on trade secret protection and confidentiality agreements to protect proprietary know-how, information, or technology that is not covered by our patents. Although our agreements require all of our employees to assign their inventions to us, and we require all of our employees, consultants, advisors and any third parties who have access to our trade secrets, proprietary know-how and other confidential information and technology to enter into appropriate confidentiality agreements, we cannot be certain that our trade secrets, proprietary know-how and other confidential information and technology will not be subject to unauthorized disclosure or that our competitors will not otherwise gain access to or independently develop substantially equivalent trade secrets, proprietary know-how and other information and technology. Furthermore, the laws of some foreign countries, in particular China, where we anticipate increasing our activity and commercializing our product candidates, do not protect proprietary rights to the same extent or in the same manner as the laws of the United States. As a result, we may encounter significant problems in protecting and defending our intellectual property globally. If we are unable to prevent unauthorized disclosure of our intellectual property related to our product candidates and technology to third parties, we may not be able to establish or maintain a competitive advantage in our market, which could materially adversely affect our business and operations.

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

Our reliance on third-party contractors to develop and manufacture our product candidates is based upon agreements that limit the rights of the third parties to use or disclose our confidential information, including our trade secrets and know-how. Despite the contractual provisions, the need to share trade secrets and other confidential information increases the risk that such trade secrets and information are disclosed or used, even if unintentionally, in violation of these agreements. In the highly competitive markets in which our product candidates are expected to compete, protecting our trade secrets, including our strategies for addressing competing products, is imperative, and any unauthorized use or disclosure could impair our competitive position and may have a material adverse effect on our business and operations.

In addition, some of our collaboration partners are larger, more complex organizations than ours, and the risk of inadvertent disclosure of our proprietary information may be increased despite their internal procedures and contractual obligations in place with our collaboration partners. Despite our efforts to protect our trade secrets and other confidential information, a competitor’s discovery of such trade secrets and information could impair our competitive position and have an adverse impact on our business.

We are developing an extensive worldwide patent portfolio. The cost of maintaining our patent protection is high and maintaining our patent protection requires continuous review and compliance in order to maintain worldwide patent protection. We may not be able to maintain effectively our intellectual property position throughout the major markets of the world.

The USPTO and foreign patent authorities require maintenance fees and payments as well as continued compliance with a number of procedural and documentary requirements. Noncompliance may result in abandonment or lapse of the subject patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. Noncompliance may result in reduced royalty payments for lack of patent coverage in a particular jurisdiction from our collaboration partners or may result in competition, either of which could have a material adverse effect on our business.

We have made, and will continue to make, certain strategic decisions in balancing costs and the potential protection afforded by the patent laws of certain countries. As a result, we may not be able to prevent third parties from practicing our inventions in all countries throughout the world, or from selling or importing products made using our inventions in and into the United States or other countries. Third parties may use our technologies in territories in which we have not obtained patent protection to develop their own products and, further, may infringe our patents in territories which provide inadequate enforcement mechanisms, even if we have patent protection. Such third-party products may compete with our product candidates, and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

The laws of some foreign countries do not protect proprietary rights to the same extent as do the laws of the United States, and we may encounter significant problems in securing and defending our intellectual property rights outside the United States.

Many companies have encountered significant problems in protecting and defending intellectual property rights in certain countries. The legal systems of certain countries, particularly countries such as China, do not always favor the enforcement of patents, trade secrets, and other intellectual property rights, particularly those relating to pharmaceutical and biotechnology products, which could make it difficult for us to stop infringement of our patents, misappropriation of our trade secrets, or marketing of competing products in violation of our proprietary rights. In China, our intended establishment of significant operations will depend in substantial part on our ability to enforce effectively our intellectual property rights in that country. Proceedings to enforce our intellectual property rights in foreign countries could result in substantial costs and divert our efforts and attention from other aspects of our business and could put our patents in these territories at risk of being invalidated or interpreted narrowly, or our patent applications at risk of not being granted and could provoke third parties to assert claims against us. We may not prevail in all legal or other proceedings that we may initiate and, if we were to prevail, 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.

Intellectual property rights do not address all potential threats to any competitive advantage we may have.

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

- Others may be able to make compounds that are the same as or similar to our current or future product candidates but that are not covered by the claims of the patents that we own or have exclusively licensed.
- We or any of our licensors or strategic partners might not have been the first to make the inventions covered by the issued patents or pending patent applications that we own or have exclusively licensed.
- We or any of our licensors or strategic partners might not have been the first to file patent applications covering certain of our inventions.
- Others may independently develop similar or alternative technologies or duplicate any of our technologies without infringing our intellectual property rights.
- The prosecution of our pending patent applications may not result in granted patents.
- Granted patents that we own or have exclusively licensed may not provide us with any competitive advantages, or may be held invalid or unenforceable, as a result of legal challenges by our competitors.
- Patent protection on our product candidates may expire before we are able to develop and commercialize the product, or before we are able to recover our investment in the product.
- Our competitors might conduct research and development activities in the United States and other countries that provide a safe harbor from patent infringement claims for such activities, as well as in countries in which we do not have patent rights and may then use the information learned from such activities to develop competitive products for sale in markets where we intend to market our product candidates.

The existence of counterfeit pharmaceutical products in pharmaceutical markets may damage our brand and reputation and have a material adverse effect on our business, operations and prospects.

Counterfeit products, including counterfeit pharmaceutical products, are a significant problem, particularly in China. Counterfeit pharmaceuticals are products sold or used for research under the same or similar names, or similar mechanism of action or product class, but which are sold without proper licenses or approvals. The proliferation of counterfeit pharmaceuticals has grown in recent years and may continue to grow in the future. Such products may be used for indications or purposes that are not recommended or approved or for which there is no data or inadequate data with regard to safety or efficacy. Such products divert sales from genuine products, often are of lower cost, often are of lower quality (having different ingredients or formulations, for example), and have the potential to damage the reputation for quality and effectiveness of the genuine product. If counterfeit pharmaceuticals illegally sold or used for research result in adverse events or side effects to consumers, we may be associated with any negative publicity resulting from such incidents. Consumers may buy counterfeit pharmaceuticals that are in direct competition with our pharmaceuticals, which could have an adverse impact on our revenues, business and results of operations. In addition, counterfeit products could be used in nonclinical studies or clinical studies or could otherwise produce undesirable side effects or adverse events that may be attributed to our products as well, which could cause us or regulatory authorities to interrupt, delay or halt clinical studies and could result in the delay or denial of regulatory approval by the FDA or other regulatory authorities and potential product liability claims. With respect to China, although the government has recently been increasingly active in policing counterfeit pharmaceuticals, there is not yet an effective counterfeit pharmaceutical regulation control and enforcement system in China. As a result, we may not be able to prevent third parties from selling or purporting to sell our products in China. The existence of and any increase in the sales and production of counterfeit pharmaceuticals, or the technological capabilities of counterfeiters, could negatively impact our revenues, brand reputation, business and results of operations.

Risks Related to Our Common Stock

We might not be able to maintain the listing of our common stock on the Nasdaq Global Select Market.

Our common stock is listed on the Nasdaq Global Select Market under the symbol “ASMB.” We might not be able to maintain the listing standards of that exchange. If we fail to maintain the listing requirements, our common stock might trade on the OTC Bulletin Board or in the “pink sheets” maintained by OTC Markets Group Inc. These alternative markets are generally considered to be markets that are less efficient and less broad than the Nasdaq Global Select Market. A delisting of our common stock from the Nasdaq Global Select Market and our inability to list the stock on another national securities exchange could negatively impact us by: (i) reducing the liquidity and market price of our common stock; (ii) reducing the number of investors willing to hold or acquire our common stock, which could negatively impact our ability to raise equity financing; (iii) limiting our ability to use a registration statement to offer and sell freely tradable securities, thereby preventing us from accessing the public capital markets and (iv) impairing our ability to provide equity incentives to our employees.

The price of our common stock might fluctuate significantly, and you could lose all or part of your investment.

Since our merger with Assembly Pharmaceuticals on July 11, 2014 through September 30, 2019, the closing price of our common stock has fluctuated between $4.54 and $64.16. Continued volatility in the market price of our common stock might prevent a stockholder from being able to sell shares of our common stock at or above the price paid for such shares. The trading price of our common stock might be volatile and subject to wide price fluctuations in response to various factors, including:

- the progress, results and timing of our clinical studies and nonclinical studies and other studies involving our product candidates;
- success or failure of our product candidates;
- the receipt or loss of required regulatory approvals for our product candidates;
- availability of capital;
- future issuances by us of our common stock or securities exercisable for or convertible into common stock;
- sale of shares of our common stock by our significant stockholders or members of our management;

- additions or departures of key personnel;
- investor perceptions of us and the pharmaceutical industry;
- issuance of new or changed securities analysts' reports or recommendations, or the announcement of any changes to our credit rating;
- introduction of new products or announcements of significant contracts, acquisitions or capital commitments by us or our competitors;
- threatened or actual litigation and government investigations;
- legislative, political or regulatory developments;
- the overall performance of the equity markets;
- actual or anticipated fluctuations in our quarterly financial and operating results;
- general economic conditions;
- changes in interest rates; and
- changes in accounting standards, policies, guidance, interpretations or principles.

These and other factors might cause the market price of our common stock to fluctuate substantially, which might limit or prevent investors from readily selling their shares of our common stock and might otherwise negatively affect the liquidity of our common stock. In addition, in recent years, the stock market has experienced significant price and volume fluctuations. This volatility has had a significant impact on the market price of securities issued by many companies across many industries. The changes frequently appear to occur without regard to the operating performance of the affected companies. Accordingly, the price of our common stock could fluctuate based upon factors that have little or nothing to do with our company, and these fluctuations could materially reduce our share price.

We may be subject to securities litigation, which is expensive and could divert management attention.

The market price of our common stock may be volatile, and in the past, companies that have experienced volatility in the market price of their stock have been subject to securities class action litigation. We may be the target of this type of litigation in the future. Securities litigation against us could result in substantial costs and divert our management's attention from other business concerns, which could seriously harm our business.

Our ability to use our net operating loss and credit carryforwards to offset future taxable income may be subject to certain limitations.

At December 31, 2018, we had potentially utilizable gross Federal net operating loss carryforwards of approximately $209.2 million, State net operating loss carryforwards of approximately $209.0 million, Federal and California research and development credit carryforwards of approximately $3.6 million and $2.4 million, respectively, all of which expire between 2027 and 2038. Our ability to utilize our net operating loss and credit carryforwards is dependent upon our ability to generate taxable income in future periods and may be limited due to restrictions imposed on utilization of net operating loss and credit carryforwards under federal and state laws upon a change in ownership.

Under Sections 382 and 383 of the Internal Revenue Code of 1986, as amended, a corporation that undergoes an "ownership change," is subject to annual limitations on its ability to use its pre-change net operating loss carryforwards (NOLs) and other pre-change tax attributes (such as research tax credits) to offset its post-change income or taxes. For these purposes, an ownership change generally occurs where the equity ownership of one or more stockholders or groups of stockholders who owns at least 5% of a corporation's stock increases its ownership by more than 50 percentage points over its lowest ownership percentage within a three-year period (calculated on a rolling basis). We have determined that an ownership change occurred in each of December 2010, January 2013 and October 2014. The result of these ownership changes is that approximately $40.0 million of our approximately $153.2 million of net operating losses will not be available to us to offset future taxable income. In addition, we may experience ownership changes in the future, some of which are outside our control. Accordingly, we may not be able to utilize a material portion of our net operating losses or credits. Limitations on our ability to utilize our net operating losses to offset U.S. federal taxable income could potentially result in increased future tax liability to us. In addition, at the state level, there may be periods during which the use of net operating losses is suspended or otherwise limited, which could accelerate or permanently increase state taxes owed.

Because U.S. federal net operating losses incurred in taxable periods beginning before January 1, 2018 generally may be carried forward for up to 20 years, the annual limitation may effectively provide a cap on the cumulative amount of pre-ownership change losses, including certain recognized built-in losses that may be utilized. Such pre-ownership change losses in excess of the cap may be lost. In addition, if an ownership change were to occur, it is possible that the limitations imposed on our ability to use pre-ownership change losses and certain recognized built-in losses could cause a net increase in our U.S. federal income tax liability and require U.S. federal income taxes to be paid earlier than otherwise would be paid if such limitations were not in effect. Further, if for financial reporting purposes the amount or value of these deferred tax assets is reduced, such reduction would have a negative impact on the book value of our common stock.

In addition, under the Tax Act, the amount of U.S. federal net operating losses generated in taxable periods beginning after December 31, 2017 that we are permitted to deduct in any taxable year is limited to 80% of our taxable income in such year, where taxable income is determined without regard to the NOL deduction itself. The Tax Act generally eliminates the ability to carry back any post-2017 NOL to prior taxable years, while allowing unused post-2017 NOLs to be carried forward indefinitely. There is a risk that due to ownership changes, changes in law or other unforeseen reasons, our existing NOLs could expire or otherwise be unavailable to offset future income tax liabilities.

We do not intend to pay dividends for the foreseeable future and our stock may not appreciate in value.

We currently intend to retain our future earnings, if any, to finance the operation and growth of our business and do not expect to pay any cash dividends in the foreseeable future. As a result, the success of an investment in shares of our common stock will depend upon any future appreciation in its value. There is no guarantee that shares of our common stock will appreciate in value or that the price at which our stockholders have purchased their shares will be able to be maintained.

The requirements of being a public company add to our operating costs and might strain our resources and distract our management.

As a public company, we face increased legal, accounting, administrative and other costs and expenses not faced by private companies. We are subject to the reporting requirements of the Exchange Act, which requires that we file annual, quarterly and current reports with respect to our business and financial condition, and the rules and regulations implemented by the SEC, the Sarbanes-Oxley Act, and the listing standards of the Nasdaq Global Select Market, each of which imposes additional reporting and other obligations on public companies. Although we are currently unable to estimate these costs with any degree of certainty, we expect that the requirements of these rules and regulations will continue to increase our legal, accounting and financial compliance costs, make some activities more difficult, time consuming and costly and place significant strain on our personnel, systems and resources. These increased costs will require us to divert a significant amount of money that we could otherwise use to develop our product candidates or otherwise expand our business. Complying with these requirements might divert management's attention from other business concerns, which could have a material adverse effect on our prospects, business, and financial condition. If we are unable to satisfy our obligations as a public company, we could be subject to delisting of our common stock, fines, sanctions and other regulatory action and potentially civil litigation.

Several provisions of the Delaware General Corporation Law and our charter documents could discourage, delay or prevent a merger or acquisition, which could adversely affect the market price of our securities.

Several provisions of the Delaware General Corporation Law and our charter documents could discourage, delay or prevent a merger or acquisition that stockholders may consider favorable, and the market price of our securities could be reduced as a result. These provisions may include:

- authorizing the issuance of "blank check" preferred stock, the terms of which we may establish and shares of which we may issue without stockholders' approval;
- prohibiting us from engaging in a "business combination" with an "interested stockholder" for a period of three years after the date of the transaction in which the person became an interested stockholder unless certain provisions are met;
- prohibiting cumulative voting in the election of directors;
- prohibiting shareholder action by written consent;
- limiting the persons who may call special meetings of stockholders; and
- establishing advance notice requirements for nominations for election to our board of directors or for proposing matters that can be acted on by stockholders at stockholder meetings.

If securities analysts downgrade our stock or cease coverage of us, the price of our stock could decline.

The trading market for our common stock relies in part on the research and reports that industry or financial analysts publish about us or our business. Currently, a limited number of financial analysts publish reports about us and our business. We do not control these analysts or any other analysts. Furthermore, there are many large, well-established, publicly traded companies active in our industry and market, which may mean that it is less likely that we will receive widespread analyst coverage. If any analyst who covers us downgrades our stock, our stock price would likely decline rapidly. If one or more analysts cease coverage of our company, we could lose visibility in the market, which in turn could cause our stock price to decline.

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

None.

Item 3. Defaults upon Senior Securities

None.

Item 4. Mine Safety Disclosures

Not applicable.

Item 5. Other Information

None.

Item 6. Exhibits

(a) *Exhibits.* The following exhibits are filed as part of this quarterly report on Form 10-Q:

Exhibit Number	Description of Document	Filed Herewith	Incorporated by Reference from	Date	Number
3.1	Amended and Restated Bylaws of Assembly Biosciences, as amended on August 6, 2019.	X			
10.1#	Employment Agreement, dated August 6, 2019, between Assembly Biosciences, Inc. and John G. McHutchison, A.O., M.D.	X			
10.2#†	Separation Agreement, dated August 6, 2019, between Assembly Biosciences, Inc. and Derek A. Small.	X			
10.3#†	Consulting Agreement, effective January 1, 2020, between Assembly Biosciences, Inc. and Derek A. Small.	X			
10.4#	Assembly Biosciences, Inc. 2019 Inducement Award Plan (the 2019 Inducement Award Plan).	X			
10.5#	Form of Notice of Stock Option Grant and Stock Option Agreement under the 2019 Inducement Award Plan.	X			
10.6#	Employment Agreement, dated September 30, 2019, between Assembly Biosciences, Inc. and Thomas J. Russo, effective as of October 28, 2019.	X			
31.1	Certification of Chief Executive Officer Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.	X			
31.2	Certification of the Chief Financial Officer Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.	X			
32.1*	Certification of Chief Executive Officer Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.	X			
32.2*	Certification of the Chief Financial Officer Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.	X			
101.SCH	Inline XBRL Taxonomy Extension Schema Document	X			
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document	X			
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document	X			
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document	X			
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document	X			
104	Cover Page Interactive Data File (formatted as inline XBRL with applicable taxonomy extension information contained in Exhibits 101.)	X			

Represents management contracts or compensatory plans or arrangements.
† Portions of this exhibit (indicated by asterisks) have been omitted in accordance with the rules of the Securities and Exchange Commission.

* The certification attached as Exhibit 32.1 that accompanies this Quarterly Report on Form 10-Q is not deemed filed with the SEC and is not to be incorporated by reference into any filing of Assembly Biosciences, Inc. 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 Quarterly Report on Form 10-Q, irrespective of any general incorporation language contained in such filing.

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

Assembly Biosciences, Inc.

Date: November 7, 2019

By: /s/ John G. McHutchison, A.O., M.D.
John G. McHutchison, A.O., M.D.
Chief Executive Officer and President
(Principal Executive Officer)

Date: November 7, 2019

By: /s/ Thomas J. Russo, CFA
Thomas J. Russo, CFA
Chief Financial Officer
(Principal Financial Officer and Principal Accounting Officer)

Exhibit 3.1

AMENDED AND RESTATED BYLAWS

OF

ASSEMBLY BIOSCIENCES, INC.

(as amended through August 6, 2019)

ARTICLE I
OFFICES

1.1 Registered Office. The registered office of **ASSEMBLY BIOSCIENCES, INC.** (the "**Corporation**"), in the State of Delaware is 251 Little Falls Drive, Wilmington, New Castle County, Delaware 19808, and its registered agent at such address is Corporation Service Company.

1.2 Principal Office. The principal office for the transaction of the business of the Corporation shall be at such location, within or without the State of Delaware, as shall be designated by the board of directors of the Corporation.

1.3 Other Offices. The Corporation may also have an office or offices at such other place or places, either within or without the State of Delaware, as the board of directors may from time to time determine or as the business of the Corporation may require.

ARTICLE II
MEETINGS OF STOCKHOLDERS

2.1 Place of Meetings. Meetings of stockholders shall be held at any place (if any), within or outside the State of Delaware, designated by the board of directors. The board of directors may, in its sole discretion, determine that a meeting shall not be held at any place, but may instead be held solely by means of remote communication as authorized by Section 211 of the General Corporation Law of Delaware.

If authorized by the board of directors in its sole discretion, and subject to such guidelines and procedures as the board of directors may adopt, stockholders and proxyholders not physically present at a meeting of stockholders may, by means of remote communication, participate in a meeting of stockholders, be deemed present in person and vote at a meeting of stockholders whether such meeting is to be held at a designated place or solely by means of remote communication, provided that (i) the Corporation shall implement reasonable measures to verify that each person deemed present and permitted to vote at the meeting by means of remote communication is a stockholder or proxyholder, (ii) the Corporation shall implement reasonable measures to provide such stockholders and proxyholders a reasonable opportunity to participate in the meeting and to vote on matters submitted to the stockholders, including an opportunity to read or hear the proceedings of the meeting substantially concurrently with such proceedings, and (iii) if any stockholder or proxyholder votes or takes other action at the meeting by means of remote communication, a record of such vote or other action shall be maintained by the Corporation.

2.2 Annual Meeting. The annual meeting of stockholders shall be held each year on a date and at a time and place (if any) designated by the board of directors, which date, time and place (if any) may subsequently be changed at any time by vote of the board of directors. In the absence of such designation, the annual meeting of stockholders shall be held on the fourth Tuesday in May of each year at 10:00 a.m. However, if such day falls on a legal holiday, then the meeting shall be held at the same time and place on the next succeeding full business day. At the meeting, directors shall be elected and any other proper business may be transacted. If no

annual meeting has been held for a period of thirteen (13) months after the Corporation's last annual meeting, a special meeting in lieu thereof may be held, and such special meeting shall have, for the purposes of these bylaws or otherwise, all the force and effect of an annual meeting. Any and all references hereafter in these bylaws to an annual meeting or annual meetings also shall be deemed to refer to any special meeting(s) in lieu thereof.

2.3 Special Meeting. Except as otherwise required by statute and subject to the rights, if any, of the holders of any series of preferred stock, special meetings of the stockholders may be called, at any time for any purpose or purposes, by the board of directors or by such person or persons as may be authorized by the certificate of incorporation, or by such person or persons duly designated by the board of directors whose powers and authority, as expressly provided in a resolution of the board of directors, include the power to call such meetings, but such special meetings may not be called by any other person or persons. Only those matters set forth in the notice of the special meeting or brought by or at the direction of the board of directors may be considered or acted upon at a special meeting of stockholders of the Corporation. Nominations of persons for election to the board of directors of the Corporation and stockholder proposals of other business shall not be brought before a special meeting of stockholders to be considered by the stockholders unless such special meeting is held in lieu of an annual meeting of stockholders in accordance with Article II, Section 2.2 of these bylaws, in which case such special meeting in lieu thereof shall be deemed an annual meeting for purposes of these bylaws and the provisions of Article II of these bylaws shall govern such special meeting.

2.4 Notice of Stockholders' Meetings.

(a) Except to the extent otherwise required by law, all notices of meetings of stockholders shall be in writing and shall be sent or otherwise given in accordance with Section 2.5 of these bylaws not less than ten (10) nor more than sixty (60) days before the date of the meeting to each stockholder entitled to vote at such meeting as of the record date for determining the stockholders entitled to notice of such meeting. The notice shall specify the place, if any, date, and hour of the meeting, the means of remote communication, if any, by which stockholders and proxyholders may be deemed to be present in person and vote at such meeting, the record date for determining stockholder entitled to vote at such meeting (if such date is different from the record date for determining stockholders entitled to notice of such meeting), and, in the case of a special meeting, the purpose or purposes for which the meeting is called.

(b) Without limiting the manner by which notice otherwise may be given effectively to stockholders, any notice to stockholders given by the Corporation under any provision of the General Corporation Law of Delaware, the certificate of incorporation of the Corporation or these bylaws shall also be effective if given by a form of electronic transmission consented to by the stockholder to whom the notice is given. Any such consent shall be revocable by the stockholder by written notice to the Corporation. Any such consent shall be deemed revoked if (i) the Corporation is unable to deliver by electronic transmission two consecutive notices given by the Corporation in accordance with such consent, and (ii) such inability becomes known to the secretary or an assistant secretary of the Corporation or to the transfer agent, or other person responsible for the giving of notice; provided, however, the inadvertent failure to recognize such revocation shall not invalidate any meeting or other action.

(c) Without limiting the manner by which notice otherwise may be given effectively to stockholders, any notice to stockholders given by the Corporation under any provision of the General Corporation Law of Delaware, the certificate of incorporation of the Corporation or these bylaws shall be effective if given by a single written notice to stockholders who share an address if consented to by the stockholders at that address to whom such notice is given. Any such consent shall be revocable by the stockholder by written notice to the Corporation. Any stockholder who fails to object in writing to the Corporation, within sixty (60) days of having been given written notice by the Corporation of its intention to send the single notice permitted under this subsection 2.4(c), shall be deemed to have consented to receiving such single written notice.

(d) Sections 2.4(b) and (c) shall not apply to any notice given to stockholders under sections 164 (notice of sale of shares of stockholder who failed to pay an installment or call on stock not fully paid), 296 (notice of disputed claims relating to insolvent corporations), 311 (notice of meeting of stockholders to revoke dissolution of corporation), 312 (notice of meeting of stockholders of corporation whose certificate of incorporation has been renewed or revived) and 324 (notice when stock has been attached as required for sale upon execution process) of the General Corporation Law of Delaware.

(e) Notice of all special meetings of stockholders shall be given in the same manner as provided for annual meetings, except that the notice of all special meetings shall state the purpose or purposes for which the meeting has been called.

2.5 Manner of Giving Notice; Affidavit of Notice

(a) Written notice of any meeting of stockholders, if mailed, is given when deposited in the United States mail, postage prepaid, directed to the stockholder at his, her or its address as it appears on the records of the Corporation. An affidavit of the secretary or an assistant secretary or of the transfer agent or other agent of the Corporation that the notice has been given shall, in the absence of fraud, be prima facie evidence of the facts stated therein.

(b) Notice given pursuant to Section 2.4 shall be deemed given: (i) if by facsimile telecommunication, when directed to a number at which the stockholder has consented to receive notice; (ii) if by electronic mail, when directed to an electronic mail address at which the stockholder has consented to receive notice; (iii) if by a posting on an electronic network together with separate notice to the stockholder of such specific posting, upon the later of such posting and the giving of such separate notice; and (iv) if by any other form of electronic transmission, when directed to the stockholder. An affidavit of the secretary, an assistant secretary or the transfer agent or other agent of the Corporation that the notice has been given by a form of electronic transmission shall, in the absence of fraud, be prima facie evidence of the facts stated therein.

2.6 Quorum; Action at Meeting. The holders of a majority of the stock issued and outstanding and entitled to vote thereat, present in person or represented by proxy, shall constitute a quorum at all meetings of the stockholders for the transaction of business except as otherwise required by statute or provided by the certificate of incorporation; provided, however, that where a separate vote by a class or series or classes or series is required, a majority of the voting power of the stock of such class or series or classes or series outstanding and entitled to

vote on that matter, present in person or represented by proxy, shall constitute a quorum entitled to take action with respect to such matter. If, however, such quorum is not present or represented at any meeting of the stockholders, then the presiding officer or the stockholders holding a majority of the voting power entitled to vote thereat, present in person or represented by proxy, shall have power to adjourn the meeting from time to time in accordance with Section 2.7, without notice other than announcement at the meeting, until a quorum is present or represented. At such adjourned meeting at which a quorum is present or represented, any business may be transacted that might have been transacted at the meeting as originally noticed. Subject to applicable law, the stockholders present at a duly constituted meeting may continue to transact business until adjournment, notwithstanding the withdrawal of enough stockholders to leave less than a quorum. When a quorum is present at any meeting of stockholders, any matter before any such meeting (other than an election of a director or directors) shall be decided by a majority of the votes properly cast for and against such matter, except where a larger vote is required by law, by the certificate of incorporation or by these bylaws. Any election of directors by stockholders shall be determined by a plurality of the votes properly cast on the election of directors.

2.7 Adjournments; Notice

(a) The board of directors may postpone and reschedule any previously scheduled annual meeting or special meeting of stockholders and any record date with respect thereto, regardless of whether any notice or public disclosure with respect to any such meeting has been sent or made pursuant to these bylaws or otherwise. In no event shall the public announcement of an adjournment, postponement or rescheduling of any previously scheduled meeting of stockholders commence a new time period for the giving of a stockholder's notice under these bylaws.

(b) Any meeting of stockholders, whether or not a quorum is present, may be adjourned to any other time and to any other place at which a meeting of stockholders may be held under these bylaws by the chairperson of the board of directors, or in the absence of such person, by any officer entitled to preside at or to act as secretary of such meeting. When a meeting is adjourned to another time or place, unless these bylaws otherwise require, notice need not be given of the adjourned meeting if the time and place thereof, and the means of remote communication, if any, by which stockholders and proxyholders may be deemed to be present in person and vote at such meeting, are announced at the meeting at which the adjournment is taken. At the adjourned meeting, the Corporation may transact any business that might have been transacted at the original meeting. If the adjournment is for more than thirty (30) days, or if after the adjournment a new record date is fixed for the adjourned meeting, a notice of the adjourned meeting shall be given to each stockholder of record entitled to vote at the meeting. If after the adjournment a new record date for stockholders entitled to vote is fixed for the adjourned meeting, the board of directors shall fix a new record date for notice of such adjourned meeting in accordance with Section 213(a) of General Corporation Law of Delaware, and shall give notice of the adjourned meeting to each stockholder of record entitled to vote at such adjourned meeting as of the record date fixed for notice of such adjourned meeting.

2.8 Voting. The stockholders entitled to vote at any meeting of stockholders shall be determined in accordance with the provisions of Section 2.11 of these bylaws, subject to the provisions of Sections 217 and 218 of the General Corporation Law of Delaware (relating to voting rights of fiduciaries, pledgors and joint owners of stock and to voting trusts and other voting agreements).

Except as otherwise provided in the certificate of incorporation or by law, each stockholder shall be entitled to one vote for each share of capital stock held by such stockholder of record according to the stock ledger of the Corporation as of the record date for determining the stockholders entitled to vote, unless otherwise provided by law or by the certificate of incorporation.

2.9 Waiver of Notice. Whenever notice is required to be given under any provision of the General Corporation Law of Delaware or of the certificate of incorporation or these bylaws, a written waiver thereof, signed by the person entitled to notice, or a waiver by electronic transmission by the person entitled to notice, whether before or after the time stated therein, shall be deemed equivalent to notice. Attendance of a person at a meeting shall constitute a waiver of notice of such meeting, except when the person attends a meeting for the express purpose of objecting, at the beginning of the meeting, to the transaction of any business because the meeting is not lawfully called or convened. Neither the business to be transacted at, nor the purpose of, any regular or special meeting of the stockholders need be specified in any written waiver or any waiver by electronic transmission of notice unless so required by the certificate of incorporation or these bylaws.

2.10 No Stockholder Action by Written Consent Without a Meeting. Any action required or permitted to be taken by the stockholders of the Corporation must be effected at a duly called annual or special meeting of the stockholders of the Corporation and may not be effected by any consent in writing by such stockholders.

2.11 Record Date for Stockholder Notice; Voting; Giving Consents

(a) In order that the Corporation may determine the stockholders entitled to notice of any meeting of stockholders or any adjournment thereof, the board of directors may fix a record date, which record date shall not precede the date upon which the resolution fixing the record date is adopted by the board of directors, and which record date shall not be more than 60 nor less than 10 days before the date of such meeting. If the board of directors so fixes a date, such date shall also be the record date for determining the stockholders entitled to vote at such meeting unless the board of directors determines, at the time it fixes such record date, that a later date on or before the date of the meeting shall be the date for making such determination. If no record date is fixed by the board of directors, the record date for determining stockholders entitled to notice of and to vote at a meeting of stockholders shall be at the close of business on the day next preceding the day on which notice is given, or, if notice is waived, at the close of business on the day next preceding the day on which the meeting is held. A determination of stockholders of record entitled to notice of or to vote at a meeting of stockholders shall apply to any adjournment of the meeting; provided, however, that the board of directors may fix a new record date for determination of stockholders entitled to vote at the adjourned meeting, and in such case shall also fix as the record date for stockholders entitled to notice of such adjourned meeting the same or an earlier date as that fixed for determination of stockholders entitled to vote in accordance with the foregoing provisions of this Section 2.11(a) at the adjourned meeting.

(b) In order that the Corporation may determine the stockholders entitled to receive payment of any dividend or other distribution or allotment of any rights or the stockholders entitled to exercise any rights in respect of any change, conversion or exchange of stock, or for the purpose of any other lawful action, the board of directors may fix a record date, which record date shall not precede the date upon which the resolution fixing the record date is adopted, and which record date shall be not more than 60 days prior to such action. If no record date is fixed, the record date for determining stockholders for any such purpose shall be at the close of business on the day on which the board of directors adopts the resolution relating thereto.

2.12 Proxies. Each stockholder entitled to vote at a meeting of stockholders may authorize another person or persons to act for such stockholder by proxy, but no such proxy shall be voted or acted upon after 3 years from its date, unless the proxy provides for a longer period. Without limiting the manner in which a stockholder may authorize another person or persons to act for such stockholder as proxy pursuant to this Section 2.12, the following shall constitute a valid means by which a stockholder may grant such authority:

(a) A stockholder may execute a writing authorizing another person or persons to act for such stockholder as proxy. Execution may be accomplished by the stockholder or such stockholder's authorized officer, director, employee or agent signing such writing or causing such person's signature to be affixed to such writing by any reasonable means including, but not limited to, by facsimile signature.

(b) A stockholder may authorize another person or persons to act for such stockholder as proxy by transmitting or authorizing the transmission of a telegram, cablegram, or other means of electronic transmission to the person who will be the holder of the proxy or to a proxy solicitation firm, proxy support service organization or like agent duly authorized by the person who will be the holder of the proxy to receive such transmission, provided that any such telegram, cablegram or other means of electronic transmission must either set forth or be submitted with information from which it can be determined that the telegram, cablegram or other electronic transmission was authorized by the stockholder. If it is determined that such telegrams, cablegrams or other electronic transmissions are valid, the inspectors or, if there are no inspectors, such other persons making that determination shall specify the information upon which they relied.

Any copy, facsimile telecommunication or other reliable reproduction of the writing or transmission created pursuant to this Section 2.12 may be substituted or used in lieu of the original writing or transmission for any and all purposes for which the original writing or transmission could be used, provided that such copy, facsimile telecommunication or other reproduction shall be a complete reproduction of the entire original writing or transmission. A duly executed proxy shall be irrevocable if it states that it is irrevocable and if, and only as long as, it is coupled with an interest sufficient in law to support an irrevocable power. A proxy may be made irrevocable regardless of whether the interest with which it is coupled is an interest in the stock itself or an interest in the corporation generally.

2.13 List of Stockholders Entitled to Vote. The Corporation shall prepare and make, at least ten (10) days before every meeting of stockholders, a complete list of the stockholders entitled to vote at the meeting; provided, however, if the record date for determining stockholders entitled to vote is less than ten (10) days before the meeting date, the list shall reflect the stockholders entitled to vote as of the tenth (10^{th}) day before the meeting date, arranged in alphabetical order, and showing the address of each stockholder and the number of shares registered in the name of each stockholder. The Corporation shall not be required to include electronic mail addresses or other electronic contact information on such list. Such list shall be open to the examination of any stockholder for any purpose germane to the meeting for a period of at least ten (10) days prior to the meeting: (a) on a reasonably accessible electronic network, provided that the information required to gain access to such list is provided with the notice of the meeting, or (b) during ordinary business hours, at the principal place of business of the Corporation. In the event that the Corporation determines to make the list available on an electronic network, the Corporation may take reasonable steps to ensure that such information is available only to stockholders of the Corporation. If the meeting is to be held at a place, then the list shall be produced and kept at the time and place of the meeting during the whole time thereof, and may be examined by any stockholder who is present. If the meeting is to be held solely by means of remote communication, then the list shall also be open to the examination of any stockholder during the whole time of the meeting on a reasonably accessible electronic network, and the information required to access such list shall be provided with the notice of the meeting.

2.14 Stockholder Proposals.

(a) Nominations of persons for election to the board of directors of the Corporation and the proposal of other business to be considered by the stockholders may be brought before an annual meeting (i) pursuant to the Corporation's proxy materials, (ii) by or at the direction of the board of directors, (iii) by any stockholder of the Corporation who was a stockholder of record at the time of giving of notice provided for in this bylaw, who is entitled to vote at the meeting, who is present (in person or by proxy) at the meeting and who complies with the notice procedures set forth in this bylaw (including to the extent applicable, Section 3.15) as to such nomination or business or (iv) by way of proxy access in accordance with Section 3.16. For the avoidance of doubt, the foregoing clauses (iii) and (iv) shall be the exclusive means for a stockholder to bring nominations or business properly before an annual meeting (other than matters properly brought under Rule 14a-8 (or any successor rule) under the Securities Exchange Act of 1934, as amended (the "**Exchange Act**")), and such stockholder must comply with the notice and other procedures set forth in these bylaws to bring such nominations or business properly before an annual meeting. In addition to the other requirements set forth in this bylaw, for any proposal of business to be considered at an annual meeting, it must be a proper subject for action by stockholders of the Corporation under Delaware law.

(b) Any stockholder wishing to bring any other business before a meeting of stockholders, except for the nomination of persons for election as directors which shall be made pursuant to Sections 3.15 or 3.16 of these bylaws, must provide notice to the Corporation not more than ninety (90) and not less than sixty (60) days before the meeting in writing by registered mail, return receipt requested, of the business to be presented by the stockholders at the stockholders' meeting**;** provided, however, that in the event that less than seventy (70) days'

notice or prior public disclosure of the date of the annual meeting is given or made to stockholders, notice by a stockholder, to be timely, must be received no later than the close of business on the tenth (10th) day following the day on which such notice of the date of annual meeting was mailed or such public disclosure was made, whichever first occurs.

(c) Any such notice shall set forth the following as to each matter the stockholder proposes to bring before the meeting: (i) a brief description of the business desired to be brought before the meeting and the reasons for conducting such business at the meeting and, if such business includes a proposal to amend the bylaws of the Corporation, the language of the proposed amendment; (ii) the name and address, as they appear on the Corporation's books, of the stockholder proposing such business; (iii) the class and number of shares of the Corporation that are beneficially owned by such stockholder; (iv) a representation that the stockholder is a holder of record of stock of the Corporation entitled to vote at such meeting and intends to appear in person or by proxy at the meeting to propose such business and (v) a statement whether or not the stockholder giving the notice and/or making a proposal, if any, will deliver a proxy statement and form of proxy to holders of, in the case of a business proposal, at least the percentage of voting power of all of the shares of capital stock of the Corporation required under applicable law to approve the proposal or, in the case of a nomination or nominations, at least the percentage of voting power of all of the shares of capital stock of the Corporation reasonably believed by the stockholder making the proposal to be sufficient to elect the nominee or nominees proposed to be nominated by such stockholder (such statement being the "**Solicitation Statement**"). In the absence of such notice to the Corporation meeting the above requirements, a stockholder shall not be entitled to present any business at any meeting of stockholders.

(d) In any such event, such stockholder must also set forth in its notice: (i) any material interest in such business of such stockholder and any Stockholder Associated Person (as defined below), individually or in aggregate, including any anticipated benefit to the stockholder or the Stockholder Associated Person therefrom; (ii) as to the stockholder giving notice and any Stockholder Associated Person, (A) the class, series and number of all shares of the Corporation beneficially owned, directly or indirectly, by such stockholder and by such Stockholder Associated Person, (B) the nominee holder for, and number of, shares owned beneficially but not of record by such stockholder and by any such Stockholder Associated Person, (C) any proxy, contract, arrangement, understanding or relationship pursuant to which either the stockholder or the Stockholder Associated Person has the right to vote, directly or indirectly, any shares of stock of the Corporation; and (D) whether and the extent to which any hedging or other transaction or series of transactions has been entered into by or on behalf of, or any other agreement, arrangement or understanding (including any short position or any borrowing or lending of shares) has been made, the effect or intent of which is to mitigate loss to or manage risk or benefit of share price changes for, or to increase or decrease the voting power of, such stockholder of any such Stockholder Associated Person with respect to any share of stock of the Corporation; (iii) as to the stockholder giving the notice and any Stockholder Associated Person, the name and address of such stockholder, as they appear on the Corporation's stock ledger, and current name and address, if different, and of such Stockholder Associated Person; and (iv) to the extent known by the stockholder giving the notice, the name and address of any other stockholder supporting the proposal of other business on the date of such stockholder's notice.

(e) For nominations or other business to be properly brought before an annual meeting by a stockholder pursuant to this bylaw, the stockholder must (i) have given notice as described above (or in Sections 3.15 or 3.16 with respect to nominations), (ii) have provided any updates or supplements to such notice at the times and in the forms required by this bylaw and (iii) together with the beneficial owner(s), if any, on whose behalf the nomination or business proposal is made, have acted in accordance with the representations set forth in the Solicitation Statement (as described above) required by this bylaw.

(f) Except as set forth in Section 3.4 of Article III of these bylaws and subject to the Corporation's certificate of incorporation, only such business shall be conducted at a meeting of stockholders as shall have been brought before the meeting in accordance with the procedures set forth in this Section 2.14. The presiding officer of the meeting shall have the power and duty to determine whether any business proposed to be brought before the meeting was made in accordance with the procedures set forth in this Section 2.14 and, if any proposed business is not in compliance with this Section 2.14, to declare that such defective proposal be disregarded.

(g) Notwithstanding the foregoing provisions of this Section 2.14, a stockholder shall also comply with all applicable requirements of state law and of the Exchange Act and the rules and regulations thereunder with respect to the matters set forth in this Section 2.14. Nothing in this Section 2.14 shall be deemed to affect any rights of (i) stockholders to have proposals included in the Corporation's proxy statement pursuant to Rule 14a-8 (or any successor rule), as applicable, under the Exchange Act and, to the extent required by such rule, have such proposals considered and voted on at an annual meeting or (ii) the holders of any series of preferred stock to elect directors under specified circumstances.

(h) Except as otherwise required by law or Section 3.16 of these Bylaws, nothing in this Section 2.14 shall obligate the Corporation or the board of directors to include in any proxy statement or other stockholder communication distributed on behalf of the Corporation or the board of directors information with respect to any nominee for director or any other matter of business submitted by a stockholder.

(i) Notwithstanding the foregoing provisions of this Section 2.14 or the provisions of Section 3.15, if the nominating or proposing stockholder (or qualified representative of the stockholder) does not appear at the annual meeting to present a nomination or any business, the presiding officer shall have the discretion to declare that such nomination or business shall be disregarded, notwithstanding that proxies in respect of such vote may have been received by the Corporation. For purposes of this Section 2.14, to be considered a qualified representative of the proposing stockholder, a person must be authorized by a written instrument executed by such stockholder or an electronic transmission delivered by such stockholder to act for such stockholder as proxy at the meeting of stockholders and such person must produce such written instrument or electronic transmission, or a reliable reproduction of the written instrument or electronic transmission, to the presiding officer at the meeting of stockholders.

(j) For the purposes of these bylaws, "**Stockholder Associated Person**" of any stockholder shall mean (i) any person controlling, directly or indirectly, or acting in concert with, such stockholder, (ii) any beneficial owner of shares of stock of the Corporation owned of record or beneficially by such stockholder and (iii) any person controlling, controlled by or under common control with such Stockholder Associated Person.

2.15 Presiding Officer. The board of directors shall designate a representative to preside over all annual meetings or special meetings of stockholders, provided that if the board of directors does not so designate such a presiding officer, then the chairperson of the board of directors, if one is elected, shall preside over such meetings. If the board of directors does not so designate such a presiding officer and there is no chairperson of the board of directors or the chairperson of the board of directors is unable to so preside or is absent, then the chief executive officer, if one is elected, shall preside over such meetings, provided further that if there is no chief executive officer or the chief executive officer is unable to so preside or is absent, then the president shall preside over such meetings. The presiding officer at any annual meeting or special meeting of stockholders shall have the power, among other things, to adjourn such meeting at any time and from time to time, subject to Sections 2.6 and 2.7 of this Article II. The order of business and all other matters of procedure at any meeting of the stockholders shall be determined by the presiding officer. The presiding officer and the board of directors shall have the authority to adopt and enforce rules providing for the orderly conduct of the meeting and the safety of those in attendance, including without limitation the authority to: (i) determine when the polls will open and close on items submitted for stockholder action; (ii) fix the time allotted for consideration of each agenda item and for questions and comments by persons in attendance; (iii) adopt rules for determining who may pose questions and comments during the meeting; (iv) adopt rules for determining who may attend the meeting; and (v) adopt procedures (if any) requiring attendees to provide the Corporation advance notice of their intent to attend the meeting.

2.16 Inspector of Elections. The Corporation shall, in advance of any meeting of stockholders, appoint one or more inspectors to act at the meeting and make a written report thereof. The Corporation may designate one or more persons as alternate inspectors to replace any inspector who fails to act. If no inspector or alternate is able to act at a meeting of stockholders, the presiding officer shall appoint one or more inspectors to act at the meeting. Any inspector may, but need not, be an officer, employee or agent of the Corporation. Each inspector, before entering upon the discharge of his or her duties, shall take and sign an oath faithfully to execute the duties of inspector with strict impartiality and according to the best of his or her ability. The inspectors shall perform such duties as are required by the General Corporation Law of Delaware, including the counting of all votes and ballots. The inspectors may appoint or retain other persons or entities to assist the inspectors in the performance of the duties of the inspectors. All determinations by the inspectors shall be subject to further review by any court of competent jurisdiction.

ARTICLE III
DIRECTORS

3.1 Powers. Except as may be otherwise provided in the General Corporation Law of Delaware or the certificate of incorporation, the business and affairs of the Corporation shall be managed by or under the direction of the board of directors.

3.2 Number of Directors. Subject to the rights, if any, of the holders of any series of preferred stock, the number of directors constituting the board of directors shall be not more than ten (10) but not less than three (3), and may be fixed or changed, by resolution adopted by the board of directors. No reduction of the authorized number of directors shall have the effect of removing any director before that director’s term of office expires.

3.3 Election, Qualification and Term of Office of Directors. Except as provided in Section 3.4 of these bylaws, directors shall be elected at each annual meeting of stockholders to hold office until the next annual meeting. Directors need not be stockholders unless so required by the certificate of incorporation or these bylaws, wherein other qualifications for directors may be prescribed. Each director, including a director elected to fill a vacancy, shall hold office until his or her successor is elected and qualified or until his or her earlier resignation or removal. Each director shall be a natural person.

Elections of directors need not be by written ballot.

3.4 Resignation and Vacancies. Any director may resign at any time upon notice given in writing or electronic transmission to the Corporation. When one or more directors so resigns and the resignation is effective at a future date, a majority of the directors then in office, including those who have so resigned, shall have power to fill such vacancy or vacancies, the vote thereon to take effect when such resignation or resignations shall become effective, and each director so chosen shall hold office as provided in this Section 3.4 in the filling of other vacancies. Unless otherwise provided in the certificate of incorporation or these bylaws:

(a) vacancies and newly created directorships resulting from any increase in the authorized number of directors elected by all of the stockholders having the right to vote as a single class may be filled by a majority of the directors then in office, although less than a quorum, or by a sole remaining director; and

(b) whenever the holders of any class or classes of stock or series thereof are entitled to elect one or more directors by the provisions of the certificate of incorporation, vacancies and newly created directorships of such class or classes or series may be filled by a majority of the directors elected by such class or classes or series thereof then in office, or by a sole remaining director so elected.

If at any time, by reason of death or resignation or other cause, the Corporation should have no directors in office, then any officer or any stockholder or an executor, administrator, trustee or guardian of a stockholder, or other fiduciary entrusted with like responsibility for the person or estate of a stockholder, may call a special meeting of stockholders in accordance with the provisions of the certificate of incorporation or these bylaws, or may apply to the Court of Chancery for a decree summarily ordering an election as provided in Section 211 of the General Corporation Law of Delaware.

3.5 Place of Meetings; Meetings by Telephone. The board of directors of the Corporation may hold meetings, both regular and special, either within or outside the State of Delaware.

Unless otherwise restricted by the certificate of incorporation or these bylaws, members of the board of directors, or any committee designated by the board of directors, may participate in a meeting of the board of directors, or any committee, by means of conference telephone or other communications equipment by means of which all persons participating in the meeting can hear each other, and such participation in a meeting shall constitute presence in person at the meeting.

3.6 Regular Meetings. Regular meetings of the board of directors may be held without notice at such time and at such place as shall from time to time be determined by the board of directors and publicized among the directors.

3.7 Special Meetings; Notice. Special meetings of the board of directors for any purpose or purposes may be called at any time by the chairperson of the board of directors, the chief executive officer, the president, or any two directors. The person calling any such special meeting of the board of directors may fix the hour, date and place thereof.

Notice of the time and place of special meetings shall be delivered either personally or by mail, facsimile, telephone or electronic transmission to each director, addressed to each director at such director's address and/or phone number and/or electronic transmission address as it is shown on the records of the Corporation. If the notice is mailed, it shall be deposited in the United States mail at least four (4) days before the time of the holding of the meeting. If the notice is delivered personally or by facsimile, telephone or electronic transmission, it shall be delivered by telephone or transmitted at least forty-eight (48) hours before the time of the holding of the meeting. Any oral notice given personally or by telephone may be communicated either to the director or to a person at the office of the director who the person giving the notice has reason to believe will promptly communicate it to the director. The notice need not specify (1) the purpose of the meeting (and, unless indicated in the notice thereof, any and all business may be transacted at a special meeting) or (2) the place of the meeting (if the meeting is to be held at the principal executive office of the Corporation). Notice may be delivered by any person entitled to call a special meeting or by an agent of such person.

3.8 Quorum. At all meetings of the board of directors, a majority of the authorized number of directors shall constitute a quorum for the transaction of business and the act of a majority of the directors present at any meeting at which there is a quorum shall be the act of the board of directors, except as otherwise specifically required by statute or provided the certificate of incorporation. If a quorum is not present at any meeting of the board of directors, then the directors present thereat may adjourn the meeting from time to time, without notice other than announcement at the meeting, until a quorum is present. Any business which might have been transacted at the meeting as originally noticed may be transacted at such adjourned meeting at which a quorum is present. For purposes of this section, the total number of directors for quorum purposes includes any unfilled vacancies on the board of directors.

3.9 Waiver Of Notice. Whenever notice is required to be given under any provision of the General Corporation Law of Delaware or of the certificate of incorporation or these bylaws, a written waiver thereof, signed by the person entitled to notice, or a waiver by electronic transmission by the person entitled to notice, whether before or after the time stated therein, shall be deemed equivalent to notice. Attendance of a person at a meeting shall constitute a waiver of notice of such meeting, except when the person attends a meeting for the express purpose of objecting, at the beginning of the meeting, to the transaction of any business because the meeting is not lawfully called or convened. Neither the business to be transacted at, nor the purpose of, any regular or special meeting of the directors, or meeting of a committee of directors, need be specified in any written waiver of notice unless so required by the certificate of incorporation or these bylaws.

3.10 Adjourned Meeting; Notice. If a quorum is not present at any meeting of the board of directors, then the directors present thereat may adjourn the meeting from time to time, without notice other than announcement at the meeting, until a quorum is present.

3.11 Board of Directors Action by Written Consent Without a Meeting. Unless otherwise restricted by the certificate of incorporation or these bylaws, any action required or permitted to be taken at any meeting of the board of directors, or of any committee thereof, may be taken without a meeting if all members of the board of directors or committee, as the case may be, consent thereto in writing or by electronic transmission and the writing or writings or electronic transmission or transmissions are filed with the minutes of proceedings of the board of directors or committee. Such filing shall be in paper form if the minutes are maintained in paper form and shall be in electronic form if the minutes are maintained in electronic form. Such consent shall be treated as a resolution of the board of directors for all purposes. Any person (whether or not then a director) may provide, whether through instruction to an agent or otherwise, that a consent to action will be effective at a future time (including a time determined upon the happening of an event), no later than 60 days after such instruction is given or such provision is made and such consent shall be deemed to have been given for purposes of this subsection at such effective time so long as such person is then a director and did not revoke the consent prior to such time. Any such consent shall be revocable prior to its becoming effective.

3.12 Fees and Compensation of Directors. Unless otherwise restricted by the certificate of incorporation or these bylaws, the board of directors, or a designated committee thereof, shall have the authority to fix the compensation of directors, provided that directors who are serving the Corporation as employees and who receive compensation for their services as such, shall not receive any salary or other compensation for their services as directors of the Corporation.

3.13 Removal of Directors. Unless otherwise restricted by statute, by the certificate of incorporation or by these bylaws, any director or the entire board of directors may be removed, with or without cause, by the holders of a majority of the shares then entitled to vote at an election of directors; provided, that, whenever the holders of any class or classes or stock, or series thereof, are entitled to elect one or more directors by the provisions of the certificate of incorporation, removal without cause of any directors elected by such class or classes of stock, or series thereof, shall be by the holders of a majority of the shares or such class or classes or stock, or series of stock, then entitled to vote at an election of directors.

No reduction of the authorized number of directors shall have the effect of removing any director prior to the expiration of such director’s term of office.

3.14 Chairperson of the board of directors. The Corporation may also have, at the discretion of the board of directors, a chairperson of the board of directors. The chairperson of the board of directors shall, if such a person is elected, preside at the meetings of the board of directors and exercise and perform such other powers and duties as may from time to time be assigned to him or her by the board of directors, or as may be prescribed by these bylaws.

3.15 Nominating Procedures. Nominations for election of directors (other than nominations pursuant to Section 3.16) shall be governed by this Section 3.15. Any stockholder of record entitled to vote generally in elections of directors may nominate one or more persons for election as directors at a meeting of stockholders pursuant to this Section 3.15 only if written notice of such stockholder's intent to make such nomination or nominations has been given, either by personal delivery or by United States certified mail, postage prepaid, to the secretary of the Corporation (i) with respect to an election to be held at an annual meeting of stockholders, not more than ninety (90) days nor less than sixty (60) days in advance of such meeting; provided, however, that in the event that less than seventy (70) days' notice or prior public disclosure of the date of the annual meeting is given or made to stockholders, notice by a stockholder, to be timely, must be received no later than the close of business on the tenth (10th) day following the day on which such notice of the date of annual meeting was mailed or such public disclosure was made, whichever first occurs, and (ii) with respect to an election to be held at a special meeting of stockholders called for the purpose of the election of directors in accordance with Section 2.2, not later than the close of business on the tenth business day following the date on which notice of such meeting is first given to stockholders. Each such notice of a stockholder's intent to nominate a director or directors at an annual or special meeting shall set forth the following: (A) the name and address, as they appear on the Corporation's books, of (i) the stockholder who intends to make the nomination and the name and residence address of the person or persons to be nominated, and (ii) any Stockholder Associated Person; (B) the information required in Section 2.14(c) and (d) of these bylaws; (C) a representation that the stockholder is a holder of record of stock of the Corporation entitled to vote at such meeting and intends to appear in person or by proxy at the meeting to nominate the person or persons specified in the notice; (D) a description of all arrangements or understandings between the stockholder and any Stockholder Associated Person and each nominee and any other person or persons (naming such person or persons) pursuant to which the nomination or nominations are to be made by the stockholder; (E) such other information regarding each nominee proposed by such stockholder as would be required to be disclosed in solicitations of proxies for election of directors, or as would otherwise be required, in each case pursuant to Regulation 14A under the Exchange Act including any information that would be required to be included in a proxy statement filed pursuant to Regulation 14A had the nominee been nominated by the board of directors; and (F) the written consent of each nominee to be named in a proxy statement and to serve as director of the Corporation if so elected. Subject to Section 3.16, no person shall be eligible to serve as a director of the Corporation unless nominated in accordance with this Section 3.15. If the chairperson of the stockholders' meeting shall determine that a nomination was not made in accordance with the procedures described by these bylaws (including Section 2.14(e), (g), (h) and (i) to the extent applicable), he or she shall so declare to the meeting, and the defective nomination shall be disregarded. Notwithstanding the foregoing provisions of this Section, a stockholder shall also comply with all applicable requirements of the Exchange Act and the rules and regulations promulgated thereunder with respect to the matters set forth in this Section.

3.16 Proxy Access.

(a) Inclusion of Shareholder Nominees in Corporation's Proxy Statement.

(i) Subject to the provisions of this Section 3.16, if expressly requested in the relevant Nomination Notice (as defined below), the Corporation shall include in its proxy statement for any annual meeting of stockholders (but not at any special meeting of stockholders): (A) the names of any person or persons therein nominated for the election of directors (each, a "**Shareholder Nominee**"), who shall also be included on the Corporation's form of proxy and ballot, by any Eligible Shareholder (as defined below) or group of up to 20 Eligible Shareholders that, as determined by the board of directors, has (individually and collectively, in the case of a group) satisfied all applicable conditions and complied with all applicable procedures and requirements set forth in this Section 3.16 (such Eligible Shareholder or group of Eligible Shareholders being a "**Nominating Shareholder**"); (B) disclosure about each Shareholder Nominee and the Nominating Shareholder required under the rules of the SEC or other applicable law to be included in the proxy statement; (C) any statement included by the Nominating Shareholder in the Nomination Notice for inclusion in the proxy statement in support of each Shareholder Nominee's election to the board of directors (subject, without limitation, to Section 3.16(e)(ii), and provided that such statement does not exceed 500 words and fully complies with Section 14 of the Exchange Act, including Rule 14a-9 thereunder (the "**Supporting Statement**")); and (D) any other information that the Corporation or the board of directors determines, in their discretion, to include in the proxy statement relating to the Nominating Shareholder and the nomination of each Shareholder Nominee, including, without limitation, any statement in opposition to the nomination, any of the information provided pursuant to this Section 3.16 and any solicitation materials or related information with respect to a Shareholder Nominee.

(ii) For purposes of this Section 3.16, any determination to be made by the board of directors may be made by the board of directors, a committee of the board of directors or any officer of the Corporation designated by the board of directors or a committee of the board of directors, and any such determination shall be final and binding on any Eligible Shareholder, any Nominating Shareholder, any Shareholder Nominee and any other person for purposes of this Section 3.16 so long as made in good faith (without any further requirements). If any intervening events, facts or circumstances arise subsequent to any such determination, the presiding officer of any annual meeting of stockholders, in addition to making any other determinations that may be appropriate to the conduct of the meeting, shall have the power and duty to determine whether a Shareholder Nominee has been nominated in accordance with the requirements of this Section 3.16 and, if not so nominated, shall direct and declare at the meeting that such Shareholder Nominee shall not be considered.

(b) Maximum Number of Shareholder Nominees.

(i) The Corporation shall not be required to include in the proxy statement for an annual meeting of stockholders more Shareholder Nominees than that number constituting the greater of (A) two or (B) 20% of the total number of directors of the Corporation then serving on the last day on which a Nomination Notice may be submitted pursuant to this Section 3.16 (rounded down to the nearest whole number) (the "**Maximum Number**").

(ii) The Maximum Number for a particular annual meeting shall be reduced by: (A) each Shareholder Nominee whose nomination is withdrawn by the Nominating Shareholder or who becomes unwilling to serve on the board of directors; (B) each Shareholder Nominee who ceases to satisfy, or each Shareholder Nominee of a Nominating Shareholder that ceases to satisfy, the eligibility requirements in this Section 3.16, as determined by the board of directors; (C) each Shareholder Nominee who the board of directors itself decides to nominate for election at such annual meeting; and (D) the number of incumbent directors who had been Shareholder Nominees at either of the preceding two annual meetings of stockholders and whose reelection at the upcoming annual meeting of stockholders is being recommended by the board of directors. In the event that one or more vacancies for any reason occurs on the board of directors after the deadline for submitting a Nomination Notice as set forth in Section 3.16(d) but before the date of the annual meeting of stockholders and the board of directors resolves to reduce the size of the board of directors in connection therewith, the Maximum Number shall be calculated based on the number of directors in office as so reduced.

(iii) If the number of Shareholder Nominees pursuant to this Section 3.16 for any annual meeting of stockholders exceeds the Maximum Number then, promptly upon notice from the Corporation, each Nominating Shareholder will select one Shareholder Nominee for inclusion in the proxy statement until the Maximum Number is reached, going in order of the amount (largest to smallest) of shares of the Corporation's common stock that each Nominating Shareholder disclosed as owned in its Nomination Notice, with the process repeated if the Maximum Number is not reached after each Nominating Shareholder has selected one Shareholder Nominee. If, after the deadline for submitting a Nomination Notice as set forth in Section 3.16(d), a Nominating Shareholder or a Shareholder Nominee ceases to satisfy the eligibility requirements in this Section 3.16, as determined by the board of directors, a Nominating Shareholder withdraws its nomination or a Shareholder Nominee becomes unwilling to serve on the board of directors, whether before or after the mailing or other distribution of the definitive proxy statement, then the Corporation: (A) shall not be required to include in its proxy statement or on any ballot or form of proxy the Shareholder Nominee or any successor or replacement Shareholder Nominee proposed by the Nominating Shareholder or by any other Nominating Shareholder and (B) may otherwise communicate to the stockholders of the Corporation, including without limitation by amending or supplementing its proxy statement or ballot or form of proxy, that the Shareholder Nominee will not be included as a Shareholder Nominee in the proxy statement or on any ballot or form of proxy and will not be voted on at the annual meeting of stockholders (notwithstanding that proxies in respect of such vote may have been received by the Corporation).

(c) Eligibility of Nominating Shareholder.

(i) An "**Eligible Shareholder**" is a person who has either (A) been a record holder of the shares of common stock of the Corporation used to satisfy the eligibility requirements in this Section 3.16(c) continuously for the three-year period specified in Section 3.16(c)(ii) or (B) provides to the Secretary, within the time period referred to in Section 3.16(d), evidence of continuous ownership of such shares for such three-year period from one or more securities intermediaries in a form that the board of directors determines acceptable.

(ii) An Eligible Shareholder or group of up to 20 Eligible Shareholders may submit a nomination in accordance with this Section 3.16 only if the person or group (in the aggregate) has continuously owned at least the Minimum Number (as defined below) (as adjusted for any stock splits, reverse stock splits, stock dividends or similar events) of shares of the Corporation's common stock throughout the three-year period preceding and including the date of submission of the Nomination Notice, and continues to own at least the Minimum Number of shares through the date of the annual meeting of stockholders. The following shall be treated as one Eligible Shareholder if such Eligible Shareholder shall provide together with the Nomination Notice documentation satisfactory to the board of directors that the Eligible Shareholder consists only of persons or entities that are: (A) under common management and investment control; (B) under common management and funded primarily by the same employer; or (C) a "group of investment companies" (as defined in the Investment Company Act of 1940, as amended). In the event of a nomination by a Nominating Shareholder that includes a group of Eligible Shareholders, any and all requirements and obligations for an Eligible Shareholder shall apply to each Eligible Shareholder in such group; provided, however, that the Minimum Number shall apply to the aggregate ownership of the group of Eligible Shareholders constituting the Nominating Shareholder. Should any Eligible Shareholder cease to satisfy the eligibility requirements in this Section 3.16, as determined by the board of directors, or withdraw from a group of Eligible Shareholders constituting a Nominating Shareholder at any time prior to the annual meeting of stockholders, the Nominating Shareholder shall be deemed to own only the shares held by the remaining Eligible Shareholders. As used in this Section 3.16, any reference to a "**group**" or "**group of Eligible Shareholders**" refers to any Nominating Shareholder that consists of more than one Eligible Shareholder and to all the Eligible Shareholders that make up such Nominating Shareholder.

(iii) The "**Minimum Number**" of shares of the Corporation's common stock means 3% of the aggregate number of shares outstanding of each class of the Corporation's common stock, as disclosed in each filing by the Corporation under the Exchange Act during the three-year period prior to the submission of the Nomination Notice.

(iv) For purposes of this Section 3.16, an Eligible Shareholder "**owns**" only those outstanding shares of the Corporation's common stock as to which such Eligible Shareholder possesses both: (A) the full voting and investment rights pertaining to such shares and (B) the full economic interest in (including the opportunity for profit from and the risk of loss on) such shares; *provided* that the number of shares calculated in accordance with clauses (A) and (B) shall not include any shares: (w) purchased or sold by such Eligible Shareholder or any of its affiliates in any transaction that has not been settled or closed, (x) that are subject to short positions or were otherwise sold short by such Eligible Shareholder or any of its affiliates, (y) borrowed by such Eligible Shareholder or any of its affiliates for any purpose or purchased by such Eligible Shareholder or any of its affiliates pursuant to an agreement to resell or subject to any other obligation to resell to another person, or (z) subject to any option, warrant, forward contract, swap, contract of sale, other derivative or similar agreement entered into by such Eligible Shareholder or any of its affiliates, whether any such instrument or agreement is to be settled with shares, with cash based on the notional amount or value of

outstanding shares of common stock of the Corporation or a combination thereof, in any such case, which instrument or agreement has, or is intended to have, or if exercised or settled would have, the purpose or effect of: (1) reducing in any manner, to any extent or at any time in the future, such Eligible Shareholder's or any of its affiliates' full right to vote or direct the voting of any such shares and/or (2) hedging, offsetting or altering to any degree any gain or loss arising from the full economic interest in such shares by such Eligible Shareholder or any of its affiliates. An Eligible Shareholder "owns" shares held in the name of a nominee or other intermediary so long as the Eligible Shareholder retains the right to instruct how the shares are voted with respect to the election of directors and possesses the full economic interest in the shares. An Eligible Shareholder's ownership of shares shall be deemed to continue during any period in which the Eligible Shareholder has delegated any voting power by means of a proxy, power of attorney or other similar instrument or arrangement that is revocable at any time by the Eligible Shareholder. An Eligible Shareholder's ownership of shares shall be deemed to continue during any period in which the Eligible Shareholder has loaned such shares; provided that the Eligible Shareholder has the power to recall such loaned shares on not more than five business days' notice. The terms "**owned**," "**owning**" and other variations of the word "**own**" shall have correlative meanings. Whether outstanding shares of the Corporation are "**owned**" for these purposes shall be determined by the board of directors. For purposes of this Section 3.16(c)(iv), the term "**affiliate**" or "**affiliates**" shall have the meaning ascribed thereto under the General Rules and Regulations under the Exchange Act.

(v) No Eligible Shareholder shall be permitted to be in more than one group constituting a Nominating Shareholder, and if any Eligible Shareholder appears as a member of more than one such group, such Eligible Shareholder shall be deemed to be a member of only the group that owns the largest aggregate number of shares of each class of the Corporation's common stock, as reflected in the Nomination Notice.

(d) Nomination Notice.

(i) To nominate a Shareholder Nominee pursuant to this Section 3.16, the Nominating Shareholder (including each Eligible Shareholder in the case of a Nominating Shareholder consisting of a group of Eligible Shareholders) must deliver to the Secretary at the principal executive offices of the Corporation all of the following information and documents in a form that the board of directors determines acceptable (collectively, the "**Nomination Notice**"), not less than 120 days nor more than 150 days prior to the anniversary of the date that the Corporation first mailed or otherwise distributed its proxy statement for the prior year's annual meeting of stockholders; provided, however, that if (and only if) the annual meeting of stockholders is not scheduled to be held within a period that commences 30 days before and concludes 30 days after the first anniversary date of the preceding year's annual meeting of stockholders, or if no annual meeting was held in the preceding year, the Nomination Notice shall be given in the manner provided herein by the later of the close of business on the date that is 180 days prior to such annual meeting or the tenth day following the date such annual meeting is first publicly announced or disclosed (in no event shall the adjournment or postponement of an annual meeting, or the public announcement thereof, commence a new time period (or extend any time period) for the giving of the Nomination Notice):

(A) one or more written statements from the record holder of the shares (and from each intermediary through which the shares are or have been held during the requisite three-year holding period) verifying that, as of a date within seven days prior to the date of the Nomination Notice, the Nominating Shareholder owns, and has continuously owned for the preceding three years, the Minimum Number of shares, and the Nominating Shareholder's agreement to provide, within five business days after the record date for the annual meeting, written statements from the record holder and intermediaries verifying the Nominating Shareholder's continuous ownership of the Minimum Number of shares through the record date;

(B) an agreement to hold the Minimum Number of shares through the annual meeting and to provide immediate notice if the Nominating Shareholder ceases to own the Minimum Number of shares at any time prior to the date of the annual meeting;

(C) a Schedule 14N (or any successor form) relating to each Shareholder Nominee, completed and filed with the SEC by the Nominating Shareholder, as applicable, in accordance with SEC rules;

(D) the written consent of each Shareholder Nominee to being named in the Corporation's proxy statement, form of proxy and ballot as a Shareholder Nominee and to serving as a Director if elected;

(E) a written notice, in a form deemed satisfactory by the board of directors, of the nomination of each Shareholder Nominee that includes the following additional information, agreements, representations and warranties by the Nominating Shareholder: (1) the information that would be required to be set forth in a stockholder's notice of nomination pursuant to Section 3.15; (2) a representation and warranty that the Nominating Shareholder acquired the securities of the Corporation in the ordinary course of business and did not acquire, and is not holding, securities of the Corporation for the purpose or with the intent of changing or influencing control of the Corporation; (3) a representation and warranty that the Nominating Shareholder has not nominated and will not nominate for election to the board of directors at the annual meeting any person other than such Nominating Shareholder's Shareholder Nominee(s); (4) a representation and warranty that the Nominating Shareholder has not engaged in and will not engage in a "**solicitation**" within the meaning of Rule 14a-1(l) under the Exchange Act (without reference to the exception in Section 14a-1(l)(2)(iv)) with respect to the annual meeting, other than with respect to such Nominating Shareholder's Shareholder Nominee(s) or any nominee of the board of directors; (5) a representation and warranty that the Nominating Shareholder will not use any form of proxy and ballot other than the Corporation's form of proxy and ballot in soliciting stockholders in connection with the election of a Shareholder Nominee at the annual meeting; (6) a representation and warranty that each Shareholder Nominee's candidacy or, if elected, membership on the board of directors would not violate the Certificate of Incorporation, these bylaws,

any applicable law, rule, regulation, order or decree to which the Corporation is subject, including rules or regulations of any stock exchange on which the Corporation's shares of common stock are listed; (7) a representation and warranty that each Shareholder Nominee: (a) does not have any direct or indirect relationship with the Corporation that would cause the Shareholder Nominee to be deemed not independent pursuant to the Corporation's standards in its Corporate Governance Guidelines and otherwise qualifies as independent under any other standards established by the Corporation and the rules of any stock exchange on which the Corporation's shares of common stock are listed; (b) meets the audit committee and compensation committee independence requirements under the rules of any stock exchange on which the Corporation's shares of common stock are listed; (c) is a "non-employee director" for the purposes of Rule 16b-3 under the Exchange Act (or any successor rule); (d) is an "outside director" for the purposes of Section 162(m) of the Internal Revenue Code (or any successor provision); (e) is not and has not been subject to any event specified in Rule 506(d)(1) of Regulation D (or any successor rule) under the Securities Act of 1933 or Item 401(f) of Regulation S-K (or any successor rule) under the Exchange Act, without reference to whether the event is material to an evaluation of the ability or integrity of such Shareholder Nominee; and (f) meets the Director qualifications set forth in the Corporation's Corporate Governance Guidelines and any other standards established by the Corporation (notwithstanding this clause (7), for the avoidance of doubt, the board of directors is responsible for making the final determination of the Shareholder Nominee's independence); (8) a representation and warranty that the Nominating Shareholder satisfies the eligibility requirements set forth in Section 3.16(c) and intends to continue to satisfy such eligibility requirements through the date of the annual meeting; (9) details of any position of a Shareholder Nominee as an employee, officer or director of any company, and of any other material relationship with or material financial interest in any company, within the three years preceding the submission of the Nomination Notice; (10) if desired, a Supporting Statement; and (11) in the case of a nomination by a Nominating Shareholder comprised of a group, the designation by all Eligible Shareholders in such group of one Eligible Shareholder that is authorized to act on behalf of the Nominating Shareholder with respect to matters relating to the nomination, including withdrawal of the nomination;

(F) an executed agreement, in a form deemed satisfactory by the board of directors, pursuant to which the Nominating Shareholder (including in the case of a group, each Eligible Shareholder in that group) agrees: (1) to comply with all applicable laws, rules and regulations in connection with the nomination, solicitation and election of the Shareholder Nominee; (2) to file any written solicitation or other communication with the Corporation's stockholders relating to one or more of the Corporation's directors or director nominees or any Shareholder Nominee with the SEC, regardless of whether any such filing is required under any rule or regulation or whether any exemption from filing is available for such materials under any rule or regulation; (3) to assume all liability stemming from any action, suit or proceeding concerning any actual or alleged legal or regulatory violation arising out of any communication by the Nominating

Shareholder or any of its Shareholder Nominees with the Corporation, the stockholders of the Corporation or any other person in connection with the nomination or election of Directors, including, without limitation, the Nomination Notice; (4) to indemnify and hold harmless (jointly with all other Eligible Shareholders, in the case of a group of Eligible Shareholders) the Corporation and each of its Directors, officers and employees individually against any liability, loss, damages, expenses or other costs (including attorneys' fees) incurred in connection with any threatened or pending action, suit or proceeding, whether legal, administrative or investigative, against the Corporation or any of its Directors, officers or employees arising out of or relating to a failure or alleged failure of the Nominating Shareholder or any of its Shareholder Nominees to comply with, or any breach or alleged breach of, its or their obligations, agreements or representations under, this Section 3.16; (5) in the event that any information included in the Nomination Notice or any other communication by the Nominating Shareholder (including with respect to any Eligible Shareholder included in a group) with the Corporation, the stockholders of the Corporation or any other person in connection with the nomination or election ceases to be true and accurate in all material respects (or omits a material fact necessary to make the statements made not misleading), to promptly (and in any event within 48 hours of discovering such misstatement or omission) notify the Corporation and any other recipient of such communication of the misstatement or omission in such previously provided information and of the information that is required to correct the misstatement or omission; and (6) in the event that the Nominating Shareholder (including any Eligible Shareholder in a group) has failed to continue to satisfy the eligibility requirements described in Section 3.16(c), to promptly notify the Corporation; and

(G) an executed agreement, in a form deemed satisfactory by the board of directors, by each Shareholder Nominee: (1) to promptly, but in any event within ten business days after such request, provide to the Corporation such other information and certifications, including completion of the Corporation's director nominee questionnaire, as the Corporation may reasonably request; (2) at the reasonable request of the board of directors, any committee or any officer of the Corporation, to meet with the board of directors, any committee or any officer of the Corporation to discuss matters relating to the nomination of such Shareholder Nominee to the board of directors, including the information provided by such Shareholder Nominee to the Corporation in connection with his or her nomination and such Shareholder Nominee's eligibility to serve as a member of the board of directors; (3) that such Shareholder Nominee has read and agrees, if elected, to comply with all of the Corporation's corporate governance guidelines, code of conduct, conflict of interest, confidentiality, and stock ownership and trading policies and guidelines, and any other Corporation policies and guidelines applicable to directors; (4) understands his or her duties as a director under Delaware law and agrees to act in accordance with those duties while serving as a director, and (5) that such Shareholder Nominee is not and will not become a party to: (a) any agreement, arrangement or understanding with any person with respect to any direct or indirect compensation, reimbursement or indemnification

of the Shareholder Nominee in connection with being a Shareholder Nominee that has not been fully disclosed in writing to the Corporation prior to or concurrently with the Nominating Shareholder's submission of the Nomination Notice; (b) any agreement, arrangement, or understanding with any person other than the Corporation with respect to any direct or indirect compensation, reimbursement, or indemnification of the Shareholder Nominee in connection with service or action as a director of the Corporation if so elected; (c) any agreement, arrangement or understanding with any person or entity as to how such Shareholder Nominee, if elected, will vote or act on any issue (a "**Voting Commitment**") except such as is already existing and has been fully disclosed to the Corporation prior to or concurrently with the Nominating Shareholder's submission of the Nomination Notice; or (d) any Voting Commitment that could limit or interfere with such Shareholder Nominee's ability to comply, if elected, with his or her fiduciary duties under applicable law.

(ii) The information and documents required by this Section 3.16(d) to be provided by the Nominating Shareholder shall be: (A) provided with respect to and executed by each Eligible Shareholder in the case of a Nominating Shareholder comprised of a group of Eligible Shareholders; and (B) provided with respect to both the persons specified in Instructions 1 and 2 to Items 6(c) and (d) of Schedule 14N (or any successor item) and limited liability companies (x) in the case of a Nominating Shareholder that is an entity and (y) in the case of a Nominating Shareholder that is a group that includes one or more Eligible Shareholders that are entities. The Nomination Notice shall be deemed submitted on the date on which all of the information and documents referred to in this Section 3.16(d) (other than such information and documents contemplated to be provided after the date the Nomination Notice is provided) have been delivered to and received by the Secretary.

(e) Exceptions.

(i) Notwithstanding anything to the contrary contained in this Section 3.16, the Corporation may omit from its proxy statement any Shareholder Nominee and any information concerning such Shareholder Nominee (including a Nominating Shareholder's Supporting Statement) and no vote on such Shareholder Nominee will occur (notwithstanding that proxies in respect of such vote may have been received by the Corporation), and the Nominating Shareholder may not, after the last day on which a Nomination Notice would be timely, cure in any way any defect preventing the nomination of such Shareholder Nominee, if: (A) the Corporation receives a notice pursuant to the advance notice requirements set forth in Section 3.15 that a stockholder intends to nominate a candidate for director at the annual meeting, whether or not such notice is subsequently withdrawn or made the subject of a settlement with the Corporation; (B) the Nominating Shareholder (or, in the case of a Nominating Shareholder consisting of a group of Eligible Shareholders, the Eligible Shareholder that is authorized to act on behalf of the Nominating Shareholder), or any qualified representative thereof, does not appear at the annual meeting to present the

nomination submitted pursuant to this Section 3.16, the Nominating Shareholder withdraws its nomination or the presiding officer of the annual meeting declares that such nomination was not made in accordance with the procedures prescribed by this Section 3.16 and shall therefore be disregarded; (C) the board of directors in good faith determines that such Shareholder Nominee fails to satisfy all the standards set forth in Section 3.16(d)(i)(E)(7)(a)-(f), such Shareholder Nominee has been, within the past three years, an officer or director of a competitor, as defined for purposes of Section 8 of the Clayton Antitrust Act of 1914, as amended, or if such Shareholder Nominee's nomination or election to the board of directors would result in the Corporation violating or failing to be in compliance with the Certificate of Incorporation, these bylaws or any applicable law, rule, regulation, order or decree to which the Corporation is subject, including any rules or regulations of any stock exchange on which the Corporation's shares of common stock are listed; (D) such Shareholder Nominee was nominated for election to the board of directors pursuant to this Section 3.16 at one of the Corporation's two preceding annual meetings of stockholders and either withdrew from or became ineligible or unavailable for election at such annual meeting or received less than 25% of the votes that all stockholders are entitled to cast in favor of the election of such Shareholder Nominee; or (E) the Corporation is notified, or the board of directors determines, that the Nominating Shareholder or such Shareholder Nominee has failed to continue to satisfy the eligibility requirements described in Section 3.16(c), any of the representations and warranties made in the Nomination Notice ceases to be true and accurate in all material respects (or omits a material fact necessary to make the statements made not misleading), such Shareholder Nominee becomes unwilling or unable to serve on the board of directors or any material violation or breach occurs of any of the obligations, agreements, representations or warranties of the Nominating Shareholder or such Shareholder Nominee under this Section 3.16.

(ii) Notwithstanding anything to the contrary contained in this Section 3.16, the Corporation may omit from its proxy statement, or may supplement or correct, any information, including all or any portion of the Supporting Statement or any other statement in support of a Shareholder Nominee included in the Nomination Notice, if the board of directors determines that: (A) such information is not true in all material respects or omits a material statement necessary to make the statements made not misleading; (B) such information directly or indirectly impugns the character, integrity or personal reputation of, or directly or indirectly makes charges concerning improper, illegal or immoral conduct or associations, without factual foundation, with respect to, any individual, corporation, partnership, association or other entity, organization or governmental authority; (C) the inclusion of such information in the proxy statement would otherwise violate SEC proxy rules or any other applicable law, rule or regulation; or (D) the inclusion of such information in the proxy statement would impose a material risk of liability upon the Corporation.

(iii) The Corporation may solicit against, and include in the proxy statement its own statement relating to, any Shareholder Nominee.

ARTICLE IV
COMMITTEES

4.1 Committees of Directors. The board of directors may, by resolution passed by a majority of the whole board of directors, designate one or more committees, including, without limitation, a Compensation Committee, a Nominating & Governance Committee and an Audit Committee, with each committee to consist of one or more of the directors of the Corporation. In the absence or disqualification of a member of a committee, the member or members present at any meeting and not disqualified from voting, whether or not the member or members present constitute a quorum, may unanimously appoint another member of the board of directors to act at the meeting in the place of any such absent or disqualified member. The board of directors may delegate thereto some or all of its powers except those which by law, by the certificate of incorporation or by these bylaws may not be delegated. Any such committee, to the extent provided in the resolution of the board of directors or in the bylaws of the Corporation, shall have and may exercise all the powers and authority of the board of directors in the management of the business and affairs of the Corporation, and may authorize the seal of the Corporation to be affixed to all papers that may require it; but no such committee shall have the power or authority to (i) approve or adopt, or recommend to the stockholders, any action or matter expressly required by the General Corporation Law of Delaware to be submitted to stockholders for approval (other than the election or removal of directors), or (ii) adopt, amend or repeal any bylaws of the Corporation. All members of such committees shall hold such offices at the pleasure of the board of directors. The board of directors may abolish any such committee at any time.

4.2 Committee Minutes. Each committee shall keep regular minutes of its meetings and report the same to the board of directors when required.

4.3 Meetings and Action of Committees. Meetings and actions of committees shall be governed by, and be held and taken in accordance with, the provisions of Article III of these bylaws, Section 3.5 (place of meetings; meetings by telephone), Section 3.6 (regular meetings), Section 3.7 (special meetings and notice), Section 3.8 (quorum), Section 3.9 (waiver of notice), Section 3.10 (adjourned meeting; notice), and Section 3.11 (board of directors action by written consent without a meeting), with such changes in the context of those bylaws as are necessary to substitute the committee and its members for the board of directors and its members; provided, however, that the time of regular meetings of committees may also be called by resolution of the board of directors, who shall have the right to attend all meetings of the committee. The board of directors may adopt rules for the governance of any committee not inconsistent with the provisions of these bylaws.

ARTICLE V
OFFICERS

5.1 Officers. The officers of the Corporation shall be a president, one or more vice presidents, a secretary and a treasurer. The Corporation may also have, at the discretion of the board of directors, a chairperson of the board of directors (who must be a director), one or more assistant vice presidents, assistant secretaries, assistant treasurers, and any such other officers as may be appointed in accordance with the provisions of Section 5.3 of these bylaws.

5.2 Election of Officers. The officers of the Corporation, except such officers as may be appointed in accordance with the provisions of Sections 5.3 of these bylaws, shall be chosen by the board of directors, subject to the rights, if any, of an officer under any contract of employment. Except as otherwise provided by the certificate of incorporation or by these bylaws, each of the officers of the Corporation shall hold office until his or her successor is elected and qualified or until his or her earlier resignation and removal.

5.3 Subordinate Officers. The board of directors may appoint, or empower the president to appoint, such other officers and agents as the business of the Corporation may require, each of whom shall hold office for such period, have such authority, and perform such duties as are provided in these bylaws or as the board of directors may from time to time determine.

5.4 Qualification. No officer need be a stockholder or a director. Any person may occupy more than one office of the Corporation at any time.

5.5 Removal and Resignation of Officers. Subject to the rights, if any, of an officer under any contract of employment, any officer may be removed, either with or without cause, by an affirmative vote of the majority of the board of directors at any regular or special meeting of the board of directors or by any officer upon whom such power of removal may be conferred by the board of directors.

Any officer may resign at any time by giving written notice to the Corporation. Any resignation shall take effect at the date of the receipt of that notice or at any later time specified in that notice; and, unless otherwise specified in that notice, the acceptance of the resignation shall not be necessary to make it effective. Any resignation is without prejudice to the rights, if any, of the Corporation under any contract to which the officer is a party.

5.6 Absence or Disability. In the event of the absence or disability of any officer, the board of directors may designate another officer to act temporarily in place of such absent or disabled officer.

5.7 Vacancies in Offices. Any vacancy occurring in any office of the Corporation shall be filled by the board of directors.

5.8 Chairperson of the Board. The chairperson of the board of directors, if such an officer be elected, shall, if present, preside at meetings of the board of directors and exercise and perform such other powers and duties as may from time to time be assigned to him or her by the board of directors or as may be prescribed by these bylaws. The chairperson of the board of directors shall be chosen by the board of directors. The chairperson shall preside at all meetings of stockholders to the extent provided pursuant to Article II, Section 2.15.

5.9 Chief Executive Officer. Subject to the control of the Board and such supervisory powers, if any, as may be given by the Board, the powers and duties of the chief executive officer of the Corporation are:

(a) To act as the general manager and, subject to the control of the Board, to have general supervision, direction and control of the business and affairs of the Corporation;

(b) To the extent provided pursuant to Article II, Section 2.15, to preside at all meetings of the stockholders; and

(c) To affix the signature of the Corporation to all deeds, conveyances, mortgages, guarantees, leases, obligations, bonds, certificates and other papers and instruments in writing which have been authorized by the Board or which, in the judgment of the chief executive officer, should be executed on behalf of the Corporation; and, subject to the direction of the Board, to have general charge of the property of the Corporation and to supervise and control all officers, agents and employees of the Corporation.

The president shall be the chief executive officer of the Corporation unless the Board shall designate another officer to be the chief executive officer.

5.10 President. The chief executive officer shall be the president of the Corporation unless the Board shall have designated one individual as the president and a different individual as the chief executive officer of the Corporation. Subject to the provisions of these Bylaws and to the direction of the Board, and subject to the supervisory powers of the chief executive officer (if the chief executive officer is an officer other than the president), and subject to such supervisory powers and authority as may be given by the Board to the Chairperson of the Board, and/or to any other officer, the president shall have the responsibility for the general management and control of the business and affairs of the Corporation and the general supervision and direction of all of the officers, employees and agents of the Corporation (other than the chief executive officer, if the chief executive officer is an officer other than the president) and shall perform all duties and have all powers that are commonly incident to the office of president or that are delegated to the president by the Board.

5.11 Vice Presidents. The vice presidents shall have such other powers and perform such other duties as from time to time may be prescribed for them by the board of directors, these bylaws, the chief executive officer or the chairperson of the board of directors.

5.12 Chief Financial Officer. The chief financial officer shall be the treasurer of the Corporation unless the Board shall have designated another officer as the treasurer of the Corporation. Subject to the direction of the Board and the chief executive officer, the chief financial officer shall perform all duties and have all powers that are commonly incident to the office of chief financial officer.

5.13 Treasurer. The treasurer shall keep and maintain, or cause to be kept and maintained, adequate and correct books and records of accounts of the properties and business transactions of the Corporation, including accounts of its assets, liabilities, receipts, disbursements, gains, losses, capital, retained earnings, and shares. The books of account shall at all reasonable times be open to inspection by any director.

The treasurer shall deposit all money and other valuables in the name and to the credit of the Corporation with such depositaries as may be designated by the board of directors. The treasurer shall disburse the funds of the Corporation as may be ordered by the board of directors, shall render to the president and directors, whenever they request it, an account of all of his or her transactions as treasurer and of the financial condition of the Corporation, and shall have such other powers and perform such other duties as may be prescribed by the board of directors or these bylaws.

5.14 Secretary. The secretary or an agent of the Corporation shall keep or cause to be kept, at the principal executive office of the Corporation or such other place as the board of directors may direct, a book of minutes of all meetings and actions of directors, committees of directors, and stockholders. The minutes shall show the time and place of each meeting, whether regular or special (and, if special, how authorized and the notice given), the names of those present at directors' meetings or committee meetings, the number of shares present or represented at stockholders' meetings, and the proceedings thereof.

The secretary shall keep, or cause to be kept, at the principal executive office of the Corporation or at the office of the Corporation's transfer agent or registrar, as determined by resolution of the board of directors, a share register, or a duplicate share register, showing the names of all stockholders and their addresses, the number and classes of shares held by each, the number and date of certificates evidencing such shares, and the number and date of cancellation of every certificate surrendered for cancellation.

The secretary shall give, or cause to be given, notice of all meetings of the stockholders and of the board of directors required to be given by law or by these bylaws. The secretary shall keep the seal of the Corporation, if one be adopted, in safe custody and shall have such other powers and perform such other duties as may be prescribed by the board of directors or by these bylaws.

5.15 Assistant Secretary. The assistant secretary, or, if there is more than one, the assistant secretaries in the order determined by the stockholders or board of directors (or if there be no such determination, then in the order of their election) shall, in the absence of the secretary or in the event of his or her inability or refusal to act, perform the duties and exercise the powers of the secretary and shall perform such other duties and have such other powers as the board of directors or the stockholders may from time to time prescribe.

5.16 Representation of Securities of Other Entities. The chairperson of the board of directors, the chief executive officer, the president, any vice president, the treasurer, the secretary or assistant secretary of this corporation, or any other person authorized by the board of directors or the chief executive officer, president or a vice president, is authorized to vote, represent, and exercise on behalf of this corporation all rights incident to any and all securities of any other entity standing in the name of the Corporation. The authority granted herein may be exercised either by such person directly or by any other person authorized to do so by proxy or power of attorney duly executed by such person having the authority.

5.17 Authority and Duties of Officers. In addition to the foregoing authority and duties, all officers of the Corporation shall respectively have such authority and perform such duties in the management of the business of the Corporation as may be designated from time to time by the board of directors.

ARTICLE VI
INDEMNITY

6.1 Indemnification of Directors and Officers. The Corporation shall, to the maximum extent and in the manner permitted by the General Corporation Law of Delaware (as such law may from time to time be amended, but, in the case of any such amendment, only to the extent that such amendment permits the Corporation to provide broader indemnification rights), indemnify each of its directors and officers (each such person sometimes referred to in this Section 6.1 as an "**indemnitee**") against Expenses (as herein defined), judgments, fines, penalties, ERISA excise taxes, settlements, loss, liability, and other amounts actually and reasonably incurred in connection with any Proceeding (as herein defined), arising by reason of such person's Official Capacity or anything done or not done in such person's Official Capacity (as herein defined); provided, however, that except as provided in Section 6.1(d) with respect to Proceedings to enforce rights to indemnification and advancement, the Corporation shall indemnify any such indemnitee in connection with a Proceeding (or part thereof) initiated by such indemnitee only if such Proceeding (or part thereof) was authorized by the board of directors. For purposes of this Section 6.1, a director or officer of the Corporation includes any person (a) who is or was a director or officer of the Corporation, (b) who is or was serving at the request of the Corporation as a director, officer, manager, member, partner, trustee, or other agent of another corporation, limited liability company, partnership, joint venture, trust or other enterprise, or (c) who was a director or officer of a corporation that was a predecessor corporation of the Corporation or of another enterprise at the request of such predecessor corporation. Such indemnification shall include the right to receive payment of any Expenses incurred by the indemnitee in connection with any Proceeding in advance of its final disposition, consistent with the provisions of applicable law as then in effect. The right of indemnification provided in this Section 6.1 shall not be exclusive of any other rights to which those seeking indemnification may otherwise be entitled, and the provisions of this Section 6.1 shall inure to the benefit of the heirs and legal representatives of any person entitled to indemnity under this Section 6.1 and shall be applicable to Proceedings commenced or continuing after the adoption of this Section 6.1, whether arising from acts or omissions occurring before or after such adoption. In furtherance, but not in limitation of the foregoing provisions, the following procedures, presumptions and remedies shall apply with respect to advancement of Expenses and the right to indemnification under this Section 6.1. Indemnitee shall be entitled to indemnification and advancement against all Expenses reasonably incurred for serving as a witness by reason of indemnitee's Official Capacity in any Proceeding with respect to which indemnitee is not a party.

(a) Advancement of Expenses. All reasonable Expenses incurred by or on behalf of the indemnitee in connection with any Proceeding shall be advanced to the indemnitee by the Corporation within twenty (20) days after the receipt by the Corporation of a statement or statements from the indemnitee requesting such advance or advances from time to time, whether prior to or after final disposition of such, Proceeding. Such statement or statements shall reasonably evidence the Expenses incurred by the indemnitee and, if required by law at the time of such advance, shall include or be accompanied by an undertaking by or on behalf of the indemnitee to repay the amounts advanced if it should ultimately be determined that the indemnitee is not entitled to be indemnified against such Expenses pursuant to this Section 6.1.

(b) Procedure for Determination of Entitlement to Indemnification.

(i) To obtain indemnification under this Section 6.1, an indemnitee shall submit to the secretary of the Corporation a written request, including such documentation and information as is reasonably available to the indemnitee and reasonably necessary to determine whether and to what extent the indemnitee is entitled to indemnification (the "**Supporting Documentation**"). The determination of the indemnitee's entitlement to indemnification shall be made not later than sixty (60) days after receipt by the Corporation of the written request for indemnification together with the Supporting Documentation. The secretary of the Corporation shall, promptly upon receipt of such a request for indemnification, advise the board of directors in writing that the indemnitee has requested indemnification, whereupon the Corporation shall provide such indemnification, including without limitation advancement of Expenses, so long as the indemnitee is legally entitled thereto in accordance with applicable law.

(ii) The indemnitee's entitlement to indemnification under this Section 6.1 shall be determined in one of the following ways: (A) by a majority vote of the Disinterested Directors (as hereinafter defined), even though less than a quorum of the board of directors; (B) by a committee of such Disinterested Directors designated by a majority vote of the Disinterested Directors, even though less than a quorum of the board of directors; (C) by a written opinion of Independent Counsel (as hereinafter defined) if (x) a Change of Control (as hereinafter defined) shall have occurred and the indemnitee so requests or (y) if there are no Disinterested Directors; (D) by the stockholders of the Corporation (but only if a majority of the Disinterested Directors, if they constitute a quorum of the board of directors, presents the issue of entitlement to indemnification to the stockholders for their determination); or (E) as provided in paragraph (c) below.

(iii) In the event the determination of entitlement to indemnification is to be made by Independent Counsel pursuant to paragraph (b)(ii) above, a majority of the Disinterested Directors shall select the Independent Counsel, but only an Independent Counsel to which the indemnitee does not reasonably object; provided, however, that if a Change of Control shall have occurred, or there are no Disinterested Directors, the indemnitee shall select such Independent Counsel, but only an Independent Counsel to which the board of directors does not reasonably object.

(iv) The only basis upon which a finding that indemnification may not be made is that such indemnification is prohibited by law.

(v) The Corporation shall pay all costs associated with its determination of indemnitee's eligibility for indemnification.

(c) Presumptions and Effect of Certain Proceedings. Except as otherwise expressly provided in this Section 6.1, if a Change of Control shall have occurred, the indemnitee shall be presumed to be entitled to indemnification under this Section 6.1 upon submission of a request for indemnification together with the Supporting Documentation in accordance with paragraph (b)(i), and thereafter the Corporation shall have the burden of proof to overcome that presumption in reaching a contrary determination. In any event, if the person or persons

empowered under paragraph (b)(ii) above to determine entitlement to indemnification shall not have been appointed or shall not have made a determination within sixty (60) days after receipt by the Corporation of the request therefor together with the Supporting Documentation, the indemnitee shall be deemed to be entitled to indemnification and the indemnitee shall be entitled to such indemnification unless (A) the indemnitee misrepresented a material fact, or omitted a material fact necessary to make indemnitee's statement not misleading, in making the request for indemnification or in the Supporting Documentation or (B) such indemnification is prohibited by law. The termination of any Proceeding described in this Section 6.1, or of any claim, issue or matter therein, by judgment, order, settlement or conviction, or upon a plea of nolo contendere or its equivalent, shall not, of itself, adversely affect the right of the indemnitee to indemnification or create a presumption that the indemnitee did not act in good faith and in a manner that the indemnitee reasonably believed to be in or not opposed to the best interests of the Corporation or, with respect to any criminal Proceeding, that the indemnitee had reasonable cause to believe that the indemnitee's conduct was unlawful.

(d) Remedies of Indemnitee.

(i) In the event that a determination is made pursuant to paragraph (b)(ii) that the indemnitee is not entitled to indemnification under this Section 6.1: (A) the indemnitee shall be entitled to seek an adjudication of his or her entitlement to such indemnification either, at the indemnitee's sole option, in (x) an appropriate court of the State of Delaware, or (y) an arbitration to be conducted by a single arbitrator pursuant to the rules of the American Arbitration Association; (B) any such judicial Proceeding or arbitration shall be de novo and the indemnitee shall not be prejudiced by reason of such adverse determination; and (C) in any such judicial Proceeding or arbitration the Corporation shall have the burden of proving that the indemnitee is not entitled to indemnification under this Section 6.1.

(ii) If a determination shall have been made or is deemed to have been made, pursuant to paragraph (b)(ii) or (iii), that the indemnitee is entitled to indemnification, the Corporation shall be obligated to pay the amounts constituting such indemnification within five (5) days after such determination has been made or is deemed to have been made and shall be conclusively bound by such determination unless (A) the indemnitee misrepresented a material fact, or omitted a material fact necessary to make indemnitee's statement not misleading, in making the request for indemnification or in the Supporting Documentation, or (B) such indemnification is prohibited by law. In the event that: (X) advancement of Expenses is not timely made pursuant to paragraph (a); or (Y) payment of indemnification is not made within five (5) days after a determination of entitlement to indemnification has been made or deemed to have been made pursuant to paragraph (b)(ii) or (iii), the indemnitee shall be entitled to seek judicial enforcement of the Corporation's obligation to pay to the indemnitee such advancement of Expenses or indemnification. Notwithstanding the foregoing, the Corporation may bring an action, in an appropriate court in the State of Delaware, contesting the right of the indemnitee to receive indemnification hereunder due to the occurrence of an event described in subclause (A) or (B) of this clause (ii) (a "**Disqualifying Event**"); provided, however, that in any such action the Corporation shall have the burden of proving the occurrence of such Disqualifying Event.

(iii) The Corporation shall be precluded from asserting in any judicial Proceedings or arbitration commenced pursuant to this paragraph (d) that the procedures and presumptions of this Section 6.1 are not valid, binding and enforceable and shall stipulate in any such court or before any such arbitrator that the Corporation is bound by all the provisions of this Section 6.1.

(iv) In the event that the indemnitee, pursuant to this paragraph (d), seeks a judicial adjudication of or an award in arbitration to enforce his or her rights under, or to recover damages for breach of, this Section 6.1, the indemnitee shall be entitled to recover from the Corporation, and shall be indemnified by the Corporation against, any Expenses actually and reasonably incurred by the indemnitee if the indemnitee prevails in such judicial adjudication or arbitration. If it shall be determined in such judicial adjudication or arbitration that the indemnitee is entitled to receive part but not all of the indemnification or advancement of Expenses sought, the Expenses incurred by the indemnitee in connection with such judicial adjudication shall be prorated accordingly.

(e) Definitions. For purposes of this Section 6:

(i) "**Change in Control**" means a change in control of the Corporation of a nature that would be required to be reported in response to Item 6(e) of Schedule 14A of Regulation 14A promulgated under the Exchange Act, whether or not the Corporation is then subject to such reporting requirement; provided that, without limitation, such a change in control shall be deemed to have occurred if (i) any "person" (as such term is used in Sections 13(d) and 14(d) of the Exchange Act) is or becomes the "beneficial owner" (as defined in Rule 13d-3 under the Exchange Act), directly or indirectly, of securities of the Corporation representing 25% or more of the combined voting power of the Corporation's then outstanding securities without the prior approval of at least a majority of the members of the board of directors in office immediately prior to such acquisition; (ii) the Corporation is a party to a merger, consolidation, sale of assets or other reorganization, or a proxy contest, as a consequence of which members of the board of directors in office immediately prior to such transaction or event constitute less than a majority of the board of directors thereafter; or (iii) during any period of two consecutive years, individuals who at the beginning of such period constituted the board of directors (including for this purpose any new director whose election or nomination for election by the Corporation's stockholders was approved by a vote of at least a majority of the directors then still in office who were directors at the beginning of such period) cease for any reason to constitute at least a majority of the board of directors;

(ii) "**Disinterested Director**" means a director of the Corporation who is not a party to the Proceeding in respect of which indemnification or advancement of Expenses is sought by the indemnitee;

(iii) "**Expenses**" shall include all direct and indirect costs including, but not limited to, attorneys' fees, retainers, court costs, transcript costs, fees of experts, witness fees, advisory fees, travel expenses, duplicating costs, printing and binding costs, telephone charges, postage, delivery service fees, and all other disbursements or expenses of the types customarily incurred in connection with investigating, prosecuting, defending (or preparing to investigate, prosecute or defend) a Proceeding, or being or preparing to be a witness in a Proceeding;

(iv) "**Independent Counsel**" means a law firm or a member of a law firm that neither presently is, nor in the past five (5) years has been, retained to represent: (A) the Corporation or the indemnitee in any matter material to either such party or (B) any other party to the Proceeding giving rise to a claim for indemnification under this Section 6.1. Notwithstanding the foregoing, the term "Independent Counsel" shall not include any person who, under the applicable standards of professional conduct then prevailing under such persons relevant jurisdiction of practice, would have a conflict of interest in representing either the Corporation or the indemnitee in an action to determine the indemnitee's rights under this Section 6.1;

(v) "**Official Capacity**" means indemnitee's corporate status as an officer and/or director and any other fiduciary capacity in which indemnitee serves the Corporation, its subsidiaries or affiliates, and any other entity which indemnitee serves in such capacity at the request of any of the Corporation's board of directors or any committee of its board of directors, chief executive officer, chairperson of the board of directors, or president. "Official Capacity" also refers to all actions which indemnitee takes or does not take while serving in such capacity; and

(vi) "**Proceeding**" includes any actual or threatened inquiry, investigation, action, suit, arbitration, or any other such actual or threatened action or occurrence, whether civil, criminal, administrative or investigative.

(f) Invalidity; Severability; Interpretation. If any provision or provisions of this Section 6.1 shall be held to be invalid, illegal or unenforceable for any reason whatsoever: (i) the validity, legality and enforceability of the remaining provisions of this Section 6.1 (including, without limitation, all portions of any paragraph of this Section 6.1 containing any such provision held to be invalid, illegal or unenforceable, that are not themselves invalid, illegal or unenforceable) shall not in any way be affected or impaired thereby; and (ii) to the fullest extent possible, the provisions of this Section 6.1 (including, without limitation, all portions of any paragraph of this Section 6.1 containing any such provision held to be invalid, illegal or unenforceable, that are not themselves invalid; illegal or unenforceable) shall be construed so as to give effect to the intent manifested by the provision held invalid, illegal or unenforceable. Reference herein to laws, regulations or agencies shall be deemed to include all amendments thereof, substitutions therefor and successors thereto.

(g) Contractual Rights; Applicability. The right to be indemnified or to the reimbursement or advancement of Expenses pursuant hereto (i) is a contract right based upon good and valuable consideration, pursuant to which the person entitled thereto may bring suit as if the provisions hereof were set forth in a separate written contract between the Corporation and the director or officer, (ii) is intended to be retroactive and shall be available with respect to events occurring prior to the adoption hereof, and (iii) shall continue to exist after the rescission or restrictive modification hereof.

6.2 Indemnification of Others. The Corporation shall have the power, to the extent and in the manner permitted by the General Corporation Law of Delaware, to indemnify each of its employees and agents (other than directors and officers) against Expenses, judgments, fines, settlements, and other amounts actually and reasonably incurred in connection with any Proceeding, arising by reason of the fact that such person is or was an employee or agent of the Corporation. For purposes of this Section 6.2, an employee or agent of the Corporation (other than a director or officer) includes any person (a) who is or was an employee or agent of the Corporation, (b) who is or was serving at the request of the Corporation as a director, officer, manager, member, partner, trustee, employee or other agent of another corporation, limited liability company, partnership, joint venture, trust or other enterprise, or (c) who was an officer, employee or agent of a corporation that was a predecessor corporation of the Corporation or of another enterprise at the request of such predecessor corporation.

6.3 Insurance. The Corporation may purchase and maintain insurance on behalf of any person who is or was a director, officer, manager, member, partner, trustee, employee or other agent of the Corporation, or is or was serving at the request of the Corporation as a director, officer, employee or agent of another corporation, limited liability company, partnership, joint venture, trust or other enterprise against any liability asserted against him and incurred by him in any such capacity, or arising out of his or her status as such, whether or not the Corporation would have the power to indemnify him against such liability under the provisions of the General Corporation Law of Delaware.

ARTICLE VII
RECORDS AND REPORTS

7.1 Maintenance and Inspection of Records.

(a) The Corporation shall, either at its principal executive office or at such place or places as designated by the board of directors, keep a record of its stockholders listing their names and addresses and the number and class of shares held by each stockholder, a copy of these bylaws as amended to date, a copy of the certificate of incorporation as amended to date, records of all meetings of the incorporators, stockholders and the board of directors, the stock transfer books, accounting books, and other records.

(b) Any stockholder, in person or by attorney or other agent, shall, upon written demand under oath stating the purpose thereof, have the right during the usual hours for business to inspect for any proper purpose, and to make copies and extracts from:

(i) The Corporation’s stock ledger, a list of its stockholders, and its other books and records; and

(ii) A subsidiary’s books and records, to the extent that:

(A) The Corporation has actual possession and control of such records of such subsidiary; or

(B) The Corporation could obtain such records through the exercise of control over such subsidiary, provided that as of the date of the making of the demand:

(1) The stockholder inspection of such books and records of the subsidiary would not constitute a breach of an agreement between the Corporation or the subsidiary and a person or persons not affiliated with the Corporation; and

(2) The subsidiary would not have the right under the law applicable to it to deny the Corporation access to such books and records upon demand by the Corporation.

In every instance where the stockholder is other than a record holder of stock of the Corporation, the demand under oath shall state the person's status as a stockholder, be accompanied by documentary evidence of beneficial ownership of the stock, and state that such documentary evidence is a true and correct copy of what it purports to be. A proper purpose shall mean a purpose reasonably related to such person's interest as a stockholder. In every instance where an attorney or other agent shall be the person who seeks the right to inspection, the demand under oath shall be accompanied by a power of attorney or such other writing which authorizes the attorney or other agent to so act on behalf of the stockholder.

As used in this Section 7.1(b):

(1) "**Stockholder**" means a holder of record of stock of the Corporation, or a person who is the beneficial owner of shares of such stock held either in a voting trust or by a nominee on behalf of such person.

(2) "**Subsidiary**" means any entity directly or indirectly owned, in whole or in part, by the Corporation and over the affairs of which the Corporation directly or indirectly exercises control, and includes, without limitation, corporations, partnerships, limited partnerships, limited liability partnerships, limited liability companies, statutory trusts and/or joint ventures.

(3) "**Under oath**" includes statements the declarant affirms to be true under penalty of perjury under the laws of the United States or any state.

7.2 Inspection by Directors. Any director shall have the right to examine the Corporation's stock ledger, a list of its stockholders, and its other books and records for a purpose reasonably related to his or her position as a director. The Court of Chancery is hereby vested with the exclusive jurisdiction to determine whether a director is entitled to the inspection sought. The Court may summarily order the Corporation to permit the director to inspect any and all books and records, the stock ledger, and the stock list and to make copies or extracts therefrom. The burden of proof shall be upon the Corporation to establish that the inspection such director seeks is for an improper purpose. The Court may, in its discretion, prescribe any limitations or conditions with reference to the inspection, or award such other and further relief as the Court may deem just and proper.

ARTICLE VIII
GENERAL MATTERS

8.1 Checks. From time to time, the board of directors shall determine by resolution which person or persons may sign or endorse all checks, drafts, other orders for payment of money, notes or other evidences of indebtedness that are issued in the name of or payable to the Corporation, and only the persons so authorized shall sign or endorse those instruments.

8.2 Execution of Corporate Contracts and Instruments. The board of directors, except as otherwise provided in these bylaws, may authorize any officer or officers, or agent or agents, to enter into any contract or execute any instrument in the name of and on behalf of the Corporation; such authority may be general or confined to specific instances. Unless so authorized or ratified by the board of directors or within the agency power of an officer, no officer, agent or employee shall have any power or authority to bind the Corporation by any contract or engagement or to pledge its credit or to render it liable for any purpose or for any amount.

8.3 Stock Certificates; Partly Paid Shares. The shares of the Corporation shall be represented by certificates, provided that the board of directors of the Corporation may provide by resolution or resolutions that some or all of any or all classes or series of its stock shall be uncertificated shares. Any such resolution shall not apply to shares represented by a certificate until such certificate is surrendered to the Corporation. Notwithstanding the adoption of such a resolution by the board of directors, every holder of stock represented by certificates and upon request every holder of uncertificated shares shall be entitled to have a certificate signed by, or in the name of the Corporation by any two of the chairperson of the board of directors, the vice-chairperson of the board of directors, the president, a vice president, the treasurer, an assistant treasurer, the secretary, an assistant secretary or any other authorized officer of the Corporation representing the number of shares registered in certificate form. Any or all of the signatures on the certificate may be a facsimile. In case any officer, transfer agent or registrar who has signed or whose facsimile signature has been placed upon a certificate has ceased to be such officer, transfer agent or registrar before such certificate is issued, it may be issued by the Corporation with the same effect as if he were such officer, transfer agent or registrar at the date of issue. The Corporation shall not have power to issue a certificate in bearer form.

The Corporation may issue the whole or any part of its shares as partly paid and subject to call for the remainder of the consideration to be paid therefor. Upon the face or back of each stock certificate issued to represent any such partly paid shares, or upon the books and records of the Corporation in the case of uncertificated partly paid shares, the total amount of the consideration to be paid therefor and the amount paid thereon shall be stated. Upon the declaration of any dividend on fully paid shares, the Corporation shall declare a dividend upon partly paid shares of the same class, but only upon the basis of the percentage of the consideration actually paid thereon.

8.4 Special Designation on Certificates. If the Corporation is authorized to issue more than one class of stock or more than one series of any class, then the powers, the designations, the preferences, and the relative, participating, optional or other special rights of each class of stock or series thereof and the qualifications, limitations or restrictions of such preferences and/or rights shall be set forth in full or summarized on the face or back of the certificate that the Corporation shall issue to represent such class or series of stock; provided, however, that, except as otherwise provided in Section 202 of the General Corporation Law of Delaware, in lieu of the foregoing requirements there may be set forth on the face or back of the certificate that the Corporation shall issue to represent such class or series of stock a statement that the Corporation will furnish without charge to each stockholder who so requests the powers, the designations, the preferences, and the relative, participating, optional or other special rights of each class of stock or series thereof and the qualifications, limitations or restrictions of such preferences and/or rights.

8.5 Lost Certificates. Except as provided in this Section 8.5, no new certificates for shares shall be issued to replace a previously issued certificate unless the latter is surrendered to the Corporation and cancelled at the same time. The Corporation may issue a new certificate of stock or uncertificated shares in the place of any certificate theretofore issued by it, alleged to have been lost, stolen or destroyed, and the Corporation may require the owner of the lost, stolen or destroyed certificate, or his or her legal representative, to give the Corporation a bond sufficient to indemnify it against any claim that may be made against it on account of the alleged loss, theft or destruction of any such certificate or the issuance of such new certificate or uncertificated shares.

8.6 Construction; Definitions. Unless the context requires otherwise, the general provisions, rules of construction and definitions in the Delaware General Corporation Law shall govern the construction of these bylaws. Without limiting the generality of this provision, the singular number includes the plural, the plural number includes the singular, the masculine includes the feminine, and the term “person” includes a corporation, an entity and a natural person.

8.7 Dividends. The directors of the Corporation, subject to any rights or restrictions contained in the certificate of incorporation, may declare and pay dividends upon the shares of its capital stock pursuant to the General Corporation Law of Delaware. Dividends may be paid in cash, in property, or in shares of the Corporation’s capital stock.

The directors of the Corporation may set apart out of any of the funds of the Corporation available for dividends a reserve or reserves for any proper purpose and may abolish any such reserve. Such purposes shall include but not be limited to equalizing dividends, repairing or maintaining any property of the Corporation, and meeting contingencies.

8.8 Fiscal Year. The fiscal year of the Corporation shall be fixed by resolution of the board of directors and may be changed by the board of directors.

8.9 Seal. The Corporation may adopt a corporate seal which may be altered as desired, and may use the same by causing it or a facsimile thereof, to be impressed or affixed or in any other manner reproduced.

8.10 Transfer of Stock. Upon surrender to the Corporation or the transfer agent of the Corporation of a certificate for shares duly endorsed or accompanied by proper evidence of succession, assignation or authority to transfer, it shall be the duty of the Corporation to issue a new certificate to the person entitled thereto, cancel the old certificate, and record the transaction in its books. Subject to any restrictions on transfer and unless otherwise provided by the board of directors, shares of stock that are represented by a certificate may be transferred on the books of the Corporation by the surrender to the Corporation or its transfer agent of the certificate theretofore properly endorsed or accompanied by a written assignment or power of attorney properly executed, with transfer stamps (if necessary) affixed, and with such proof of authenticity of signature as the Corporation or its transfer agent may reasonably require. Shares of stock that are not represented by a certificate may be transferred on the books of the Corporation by submitting to the Corporation or its transfer agent such evidence of transfer and following such other procedures as the Corporation or its transfer agent may require.

8.11 Stock Transfer Agreements and Restrictions. The Corporation shall have power to enter into and perform any agreement with any number of stockholders of any one or more classes of stock of the Corporation to restrict the transfer of shares of stock of the Corporation of any one or more classes owned by such stockholders in any manner not prohibited by the General Corporation Law of Delaware.

8.12 Record Holders. Except as may otherwise be required by law, by the certificate of incorporation or by these bylaws, the Corporation shall be entitled to treat the record holder of stock as shown on its books as the owner of such stock for all purposes, including the payment of dividends and the right to vote with respect thereto, regardless of any transfer, pledge or other disposition of such stock, until the shares have been transferred on the books of the Corporation in accordance with the requirements of these bylaws.

8.13 Electronic Transmission. For purposes of these bylaws, “electronic transmission” means any form of communication, not directly involving the physical transmission of paper, that creates a record that may be retained, retrieved, and reviewed by a recipient thereof, and that may be directly reproduced in paper form by such a recipient through an automated process.

8.14 Exclusive Jurisdiction of Delaware Courts. Unless the Corporation consents in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware (or if such court does not have jurisdiction, the Superior Court of Delaware, or if such other court does not have jurisdiction, the United States District Court for the District of Delaware) shall be the sole and exclusive forum for (i) any derivative action or proceeding brought on behalf of the Corporation, (ii) any action asserting a claim of breach of a fiduciary duty owed by any current or former director, officer or other employee of the Corporation to the Corporation or the Corporation’s stockholders, (iii) any action asserting a claim arising pursuant to any provision of the Delaware General Corporation Law or the certificate of incorporation or bylaws, or (iv) any action asserting a claim against the Corporation governed by the internal affairs doctrine. Any person or entity holding any interest in shares of capital stock of the Corporation shall be deemed to have notice of and consented to the provisions of this Section 8.14.

ARTICLE IX
AMENDMENTS

9.1 Amendment by Directors. Except as provided otherwise by law, these Bylaws may be amended or repealed by the board of directors.

9.2 Amendment by Stockholders. These bylaws may be amended or repealed at any Annual Meeting, or special meeting of stockholders called for such purpose in accordance with these bylaws, by the affirmative vote of a majority of the outstanding shares entitled to vote on such amendment or repeal, voting together as a single class. Notwithstanding the foregoing, stockholder approval shall not be required unless mandated by the Certificate, these bylaws, or other applicable law.

ARTICLE X
DISSOLUTION

If it should be deemed advisable in the judgment of the board of directors of the Corporation that the Corporation should be dissolved, the board of directors, after the adoption of a resolution to that effect by a majority of the whole board of directors at any meeting called for that purpose, shall cause notice to be mailed to each stockholder entitled to vote thereon of the adoption of the resolution and of a meeting of stockholders to take action upon the resolution.

At the meeting a vote shall be taken for and against the proposed dissolution. If a majority of the outstanding stock of the Corporation entitled to vote thereon votes for the proposed dissolution, then a certificate stating, among other things, that the dissolution has been authorized in accordance with the provisions of Section 275 of the General Corporation Law of Delaware and setting forth the names and residences of the directors and officers shall be executed, acknowledged, and filed and shall become effective in accordance with Section 103 of the General Corporation Law of Delaware. Upon such certificate's becoming effective in accordance with Section 103 of the General Corporation Law of Delaware, the Corporation shall be dissolved.

ARTICLE XI
CUSTODIAN

11.1 Appointment of a Custodian in Certain Cases. The Court of Chancery, upon application of any stockholder, may appoint one or more persons to be custodians and, if the Corporation is insolvent, to be receivers, of and for the Corporation when:

(a) at any meeting held for the election of directors the stockholders are so divided that they have failed to elect successors to directors whose terms have expired or would have expired upon qualification of their successors;

(b) the business of the Corporation is suffering or is threatened with irreparable injury because the directors are so divided respecting the management of the affairs of the Corporation that the required vote for action by the board of directors cannot be obtained and the stockholders are unable to terminate this division; or

(c) the Corporation has abandoned its business and has failed within a reasonable time to take steps to dissolve, liquidate or distribute its assets.

11.2 Duties of Custodian. The custodian shall have all the powers and title of a receiver appointed under Section 291 of the General Corporation Law of Delaware, but the authority of the custodian shall be to continue the business of the Corporation and not to liquidate its affairs and distribute its assets, except when the Court of Chancery otherwise orders and except in cases arising under Sections 226(a)(3) or 352(a)(2) of the General Corporation Law of Delaware.

Exhibit 10.1

EMPLOYMENT AGREEMENT

This EMPLOYMENT AGREEMENT (the "**Agreement**"), is entered into as of August 6, 2019, with an effective date of August 6, 2019 (the "**Effective Date**"), by and between Assembly Biosciences, Inc., a Delaware corporation with principal executive offices at 11711 N. Meridian Street, Suite 310, Carmel, IN 46032 (the "**Company**"), and John G. McHutchison, A.O., M.D. (the "**Executive**").

W I T N E S S E T H:

WHEREAS, the Company desires to employ the Executive as Chief Executive Officer and President as of the Effective Date, and the Executive desires to accept employment by the Company as of the Effective Date; and

WHEREAS, the parties desire to enter into this Agreement, setting forth the terms and conditions of the Executive's employment with the Company;

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein contained, the parties hereto hereby agree as follows:

1. Employment.

(a) Services. The Executive will be employed by the Company initially as its Chief Executive Officer and President, reporting to the Company's Board of Directors of the Company (the "**Board**"), shall perform such duties as are consistent with a position as Chief Executive Officer and President (the "**Services**"). The Executive agrees to perform such Services faithfully, to devote his full working time, attention and energies to the business of the Company and, while he remains employed and subject to the terms of this Agreement, not to engage in any other business activity that is in conflict with his duties and obligations to the Company.

(b) Acceptance. The Executive hereby accepts such employment and agrees to render the Services.

2. Term. The Executive's employment under this Agreement shall commence as of the Effective Date and shall continue on an "at-will" basis until terminated pursuant to Section 8 of this Agreement (the "**Term**").

3. Best Efforts. The Executive shall use his reasonable best efforts to advance the best interests of the Company and, subject to the terms of this Agreement, during the Term shall not be actively engaged in any other business activity, whether or not such business activity is pursued for gain, profit or other pecuniary advantage, that will interfere with the performance by the Executive of his duties hereunder or the Executive's availability to perform such duties or that will adversely affect, or negatively reflect upon, the Company. The Executive shall not join any board of directors of any for profit entity or engage in outside consulting without the prior written consent of the Company's Board (which consent shall not be unreasonably withheld). Notwithstanding the foregoing, Executive may (a) continue service on the board of directors for Oxford

BioTherapeutics, and (b) serve on advisory boards for third party charities and non-profit organizations (collectively, the "**Advisory Activities**"); in each case provided that such Advisory Activities (i) do not (either individually or collectively) conflict with or interfere with Executive's services hereunder or conflict with any of the Company's policies; and (ii) are not competitive with any business or activity of the Company.

4. Directorship**.** So long as the Executive serves as the Company's Chief Executive Officer, the Company shall include the Executive in the management slate for election as a director at every stockholders meeting and use its reasonable best efforts to cause the Executive to be elected as a voting member of its Board. The Executive agrees to accept such election and to serve as a member of the Company's Board without any compensation therefor other than as specified in this Agreement. Upon termination of the Executive's employment for any reason, or in the event the Executive ceases to remain the Company's Chief Executive Officer for any other reason, the Executive will immediately resign from the Board unless otherwise unanimously requested by all the other members of the Board.

5. Compensation. During the Term, as full compensation for the performance by the Executive of his duties under this Agreement, the Company shall pay the Executive as follows:

(a) Base Salary. The Company shall pay the Executive an initial base salary at the annualized rate of eight hundred thousand dollars ($800,000). The base salary in effect at any given time is referred to herein as the "**Base Salary.**" Payment shall be made in accordance with the Company's normal payroll practices, as they may be changed from time to time. The Base Salary will be reviewed by the Board, or a committee thereof, no less frequently than annually.

(b) Annual Performance Bonus. At the sole discretion of the Board (or a committee thereof), the Executive shall be eligible to receive an annual performance-based bonus during the Term (the "**Annual Performance Bonus**") targeted at seventy-five percent (75%) of the Executive's then current Base Salary based on the attainment by the Company and the Executive of certain performance objectives as established annually by the Board (or a committee thereof) in consultation with Executive. Any Annual Performance Bonus earned with respect to the 2019 fiscal year shall be based on the attainment by the Company of the performance objectives established by the Board (or a committee thereof) for the other named executive officers of the Company for the 2019 fiscal year will be prorated based upon the number of days the Executive is employed in the 2019 fiscal year. The Annual Performance Bonus shall be payable in a single lump-sum as soon as practicable following determination by the Board (or a committee thereof) in its sole discretion regarding the level of performance achieved. Except as otherwise provided in this Agreement, to earn any particular Annual Performance Bonus, the Executive must, in addition to satisfying the performance objectives, remain employed on the date the Annual Performance Bonus is paid; *provided*, *further*, that the Annual Performance Bonus will be paid no later than seventy-five (75) days after the end of the period to which the Annual Performance Bonus pertains.

(c) Sign-on Bonus. The Company will pay the Executive a sign-on bonus in the gross amount of $300,000 (the "**Sign-on Bonus**"), less such taxes and applicable withholdings as required by law. The Sign-on Bonus will be payable to the Executive in a cash lump sum within 30 days following the Effective Date. If, prior to the six-month anniversary of the Effective Date, the Executive terminates employment with the Company other than for Good Reason (as defined

in Section 8(d)) or death or Disability (as defined in Section 8(b)) or the Company terminates the Executive for Cause (as defined in Section 8(a)), then the Executive will promptly repay to the Company 100% of the net amount of the Sign-On Bonus. If, on or after the six-month anniversary of the Effective Date and prior to the one-year anniversary of the Effective Date, the Executive terminates employment with the Company other than for Good Reason or death or Disability or the Company terminates Executive for Cause, then the Executive will promptly repay to the Company 66-2/3% of the net amount of the Sign-On Bonus. If, on or after the one-year anniversary of the Effective Date and prior to the eighteen (18) month anniversary of the Effective Date, the Executive terminates employment with the Company other than for Good Reason or death or Disability or the Company terminates Executive for Cause, then the Executive will promptly repay to the Company 33-1/3% of the net amount of the Sign-On Bonus. If the Executive is obligated under this Section 5(c) to repay to the Company the Sign-on Bonus, then the Company may, in its discretion and as permitted under applicable law, off-set all or part of the Executive's obligation under this Section 5(c) against amounts otherwise due to the Executive from the Company.

(d) Withholding. Amounts payable to the Executive under this Agreement, including Section 5 and Section 9, shall be net of all applicable federal, state and local taxes, social security and such other amounts as the Company may be required by law to withhold from such amounts.

(e) Equity. As a material inducement to accept the Company's offer of employment, the Company will recommend to the Board (or a committee thereof) that the Executive be granted, subject to the Executive's acceptance of this Agreement and commencement of employment, (i) an option to purchase 500,000 shares of common stock of the Company (the "**New Hire Stock Option**"), (ii) a restricted stock unit award for 100,000 shares of common stock of the Company with time-based vesting (the "**New Hire RSUs**"), and (iii) a restricted stock unit award for 100,000 shares of common stock of the Company with performance-based vesting (the "**New Hire PSUs**" and together with the New Hire Stock Option and the New Hire RSUs, the "**New Hire Equity Awards**"). The New Hire Equity Awards will have the following terms:

(i) As an inducement that is material to the Executive's employment with the Company, the New Hire Stock Option will be granted to the Executive under the Company's 2019 Inducement Award Plan (the "**Inducement Plan**") pursuant to the inducement grant exception under Nasdaq Rule 5635(c)(4). Subject to the Executive's continued employment and the terms of Inducement Plan and the applicable non-qualified stock option agreement entered into by the Executive and the Company pursuant to the Inducement Plan, the New Hire Stock Option will be granted as of the Effective Date, will have a term of ten years and the shares underlying the New Hire Stock Option shall vest in installments over three years with the first installment (representing approximately 33-1/3% of the shares) vesting on the first anniversary of the grant date and the balance vesting over the next two years thereafter in approximately equal monthly installments. The New Hire Stock Options will have an exercise price equal to the closing price of a common share of the Company on the Nasdaq Global Select Market on the grant date.

(ii) Subject to the Executive's continued employment and the terms of the Company's 2018 Stock Incentive Plan, as amended (the "**2018 Plan**") and the applicable restricted stock unit award agreement entered into by the Executive and the Company pursuant to the 2018 Plan, the New Hire RSUs will be granted as of the Effective Date and shall vest in three equal installments (representing 33-1/3% of the shares issuable under the New Hire RSUs) over three years with each installment vesting on the anniversary of the grant date.

(iii) Subject to the Executive's continued employment and the terms of the Company's 2018 Plan and the applicable restricted stock unit award agreement entered into by the Executive and the Company pursuant to the 2018 Plan, the New Hire PSUs shall be granted within forty-five (45) days following the Effective Date and the New Hire PSUs shall vest upon achievement of the performance milestones to be determined by the Board in consultation with Executive as provided in the applicable restricted stock unit award agreement; provided that the performance milestones are achieved by the third anniversary of the date of the grant.

(iv) The New Hire Equity Awards with time-based vesting shall be subject to accelerated vesting in connection with a termination of employment to the extent and as provided in Section 9(b) and Section 9(c) of this Agreement. The New Hire Equity Awards and any subsequently granted equity or stock-based awards under the Company's equity incentive plans, including stock options and restricted stock unit awards, will be collectively referred to in this Agreement as the "**Equity Awards**." Equity Awards with performance vesting shall not be subject to accelerated vesting under Section 9(c) of this Agreement but, to the extent provided in such Equity Awards, shall be subject to accelerated vesting in connection with a termination of employment to the extent and as provided under Section 9(b) of this Agreement.

(f) Expenses. The Company shall provide the Executive with a corporate credit card for business use and shall reimburse the Executive for all normal, usual and necessary expenses incurred by the Executive in furtherance of the business and affairs of the Company, including reasonable travel and entertainment, upon timely receipt by the Company of appropriate vouchers or other proof of the Executive's expenditures and otherwise in accordance with any expense reimbursement policy as may from time to time be adopted by the Company.

(g) Other Benefits. The Executive shall be entitled to all rights and benefits for which he shall be eligible under any benefit or other plans (including, without limitation, dental, medical, medical reimbursement and hospital plans, pension plans, employee stock purchase plans, profit sharing plans, bonus plans and other so-called "**Fringe Benefits**") as the Company shall make available to its senior executives from time to time, subject to the terms of such plans. In addition, if applicable, the Company shall reimburse the Executive for his reasonable licensing fees, continuing professional education, and other professional dues upon timely receipt by the Company of appropriate vouchers or other proof of the Executive's expenditures and otherwise in accordance with any expense reimbursement policy as may from time to time be adopted by the Company. The Company shall also name the Executive as a covered person under its Directors & Officers insurance policies. The Company shall pay Executive's reasonably attorney's fees (not to exceed $15,000) in connection with the negotiation of this Agreement and the New Hire Equity Awards within 30 days of receipt of an invoice.

(h) Vacation. The Executive will be entitled to paid vacation in accordance with the Company's vacation policy, as in effect from time to time.

6. Confidential Information and Inventions. The Executive agrees to execute and comply with the Company's standard form of Proprietary Information and Inventions Agreement, as it may be amended from time to time (the "**PIIA**").

7. Representations and Warranties.

(a) The Executive hereby represents and warrants to the Company as follows:

(i) Neither the execution or delivery of this Agreement nor the performance by the Executive of his duties and other obligations hereunder violate or will violate any statute, law, determination or award, or conflict with or constitute a default or breach of any covenant or obligation under (whether immediately, upon the giving of notice or lapse of time or both) any prior employment agreement, contract, or other instrument to which the Executive is a party or by which he is bound.

(ii) The Executive has the full right, power and legal capacity to enter and deliver this Agreement and to perform his duties and other obligations hereunder. This Agreement constitutes the legal, valid and binding obligation of the Executive enforceable against him in accordance with its terms. No approvals or consents of any persons or entities are required for the Executive to execute and deliver this Agreement or perform his duties and other obligations hereunder.

(b) The Company hereby represents and warrants to the Executive that this Agreement and the employment of the Executive hereunder have been duly authorized by and on behalf of the Company, including, without limitation, by all required action by the Board.

8. Termination. The Executive's employment hereunder shall be terminated immediately upon the Executive's death and may be otherwise terminated as follows:

(a) The Executive's employment hereunder may be terminated by the Company for Cause as determined by the Board. Any of the following actions by the Executive shall constitute "**Cause**":

(i) The willful and repeated failure or disregard or continuing refusal by the Executive to perform his duties hereunder;

(ii) Any act of willful or intentional misconduct, or a grossly negligent act by the Executive having the effect of injuring, in a material way (as determined in good-faith by the Board), the business or reputation of the Company, including but not limited to, any officer, director, or executive of the Company;

(iii) Willful misconduct by the Executive in carrying out his duties or obligations under this Agreement, including, without limitation, insubordination with respect to lawful directions received by the Executive from the Board, having the effect of injuring, in a material way (as determined in good-faith by the Board), the business or reputation of the Company;

(iv) The Executive's indictment of any felony or a misdemeanor involving moral turpitude (including entry of a nolo contendere plea);

(v) The determination by the Board, based upon clear and convincing evidence, after a reasonable and good-faith investigation by the Company following a written allegation by another employee of the Company, that the Executive engaged in some form of harassment or discrimination prohibited by law (including, without limitation, age, sex or race discrimination);

(vi) Any intentional misappropriation of the property of the Company, or embezzlement of its funds or assets (whether or not a misdemeanor or felony);

(vii) Material breach by the Executive of any of the provisions of the PIIA; and

(viii) Material breach by the Executive of any provision of this Agreement other than those contained in the PIIA which is not cured by the Executive within thirty (30) business days after notice thereof is given to the Executive by the Company.

Except for a failure, misconduct, breach, or refusal which, by its nature, cannot reasonably be expected to be cured, the Executive shall have ten (10) business days from the delivery of written notice by the Company within which to cure any acts constituting Cause, unless a longer cure period is provided in the act constituting Cause described above; provided however, that, if the Company reasonably expects irreparable injury from a delay of ten (10) business days, the Company may give the Executive notice of such shorter period within which to cure as is reasonable under the circumstances, which may include the termination of the Executive's employment for Cause without notice and with immediate effect.

(b) The Executive's employment hereunder may be terminated by the Board due to the Executive's Disability. For purposes of this Agreement, a termination for "**Disability**" shall occur (i) when the Board has provided a written termination notice to the Executive supported by a written statement from a reputable independent physician mutually selected by the Company and the Executive, or the Executive's legal representatives in the event he is unable to make such selection due to mental incapacity, to the effect that the Executive shall have become so physically or mentally incapacitated as to be unable to resume, even with reasonable accommodation as may be required under the Americans With Disabilities Act, within the ensuing twelve (12) months, his employment hereunder by reason of physical or mental illness or injury, or (ii) upon rendering of a written termination notice by the Company after the Executive has been unable to substantially perform his duties hereunder, even with reasonable accommodation as may be required under the Americans With Disabilities Act, for one hundred twenty (120) or more consecutive days, or more than one hundred eighty (180) days in any consecutive twelve (12) month period, by reason of any physical or mental illness or injury. For purposes of this Section 8(b), the Executive agrees to make himself available and to cooperate in any reasonable examination by a reputable independent physician mutually selected by the Company and the Executive and paid for by the Company. Notwithstanding the foregoing, nothing herein shall give the Company the right to terminate the Executive prior to discharging its obligations to the Executive, if any, under the Family and Medical Leave Act, the Americans With Disabilities Act, or any other applicable law. The Company shall reimburse the Executive for his actual cost of maintaining a supplementary long-term disability insurance policy during the Term up to a maximum reimbursement of $10,000 per year.

(c) The Executive's employment hereunder may be terminated by the Company (or its successor) by written notice to the Executive upon the occurrence of a Change of Control. For purposes of this Agreement, "**Change of Control**" means (i) the acquisition, directly or indirectly, following the Effective Date by any person (as such term is defined in Section 13(d) and 14(d)(2) of the Securities Exchange Act of 1934, as amended), in one transaction or a series of related transactions, of securities of the Company representing in excess of fifty percent (50%) of the

combined voting power of the Company's then outstanding securities if such person or his or its affiliate(s) do not own in excess of fifty percent (50%) of such voting power on the Effective Date of this Agreement, (ii) the future disposition by the Company (whether direct or indirect, by sale of assets or stock, merger, consolidation or otherwise) of all or substantially all of its business and/or assets in one transaction or series of related transactions other than a merger effected exclusively for the purpose of changing the domicile of the Company, or (iii) a "corporate transaction" as defined in the Company equity incentive plans under which the Executive has been granted Equity Awards. Notwithstanding the foregoing, if the Change of Control does not constitute a change in the ownership or effective control of the Company, or in the ownership of a substantial portion of the assets of the Company, within the meaning of Section 409A of the Internal Revenue Code of 1986, as amended (the "**Cod**e"), the amount of cash severance payable pursuant to Section 9(b), if any, shall be paid in equal installments in accordance with the Company's then payroll practice over an 18-month period. Solely for purposes of Section 409A of the Code, each installment payment under this Agreement is considered a separate payment.

(d) The Executive's employment hereunder may be voluntarily terminated by the Executive for Good Reason. For purposes of this Agreement, "**Good Reason**" shall mean any of the following without the Executive's written consent: (i) any material reduction by the Company of the Executive's duties, or responsibilities or authority; (ii) any material reduction by the Company of the Executive's Base Salary (it being understood that an across-the-board reduction (which reduction may not exceed 10%) applicable to all executive officers of the Company, including the Executive, shall not be deemed a reduction for purposes of this definition); (iii) any material reduction by the Company of the Executive's target percentage applicable to the Annual Performance Bonus payable hereunder (iv) the Executive no longer reports to the Board of the Company or its successor; (v) any requirement by the Company that the Executive locate the Executive's residence or primary place of employment to a location outside a 50-mile radius of such location mutually agreed upon between the Company and the Executive as of the Effective Date, or such other location that the Company and the Executive may mutually agree upon and designate from time to time during the Term; or (vi) a material breach by the Company of Sections 4, 5(c), 5(e) or 7(b) of this Agreement which is not cured by the Company within thirty (30) days after written notice thereof is given to the Company by the Executive. However, notwithstanding the above, Good Reason shall not exist unless: (x) the Executive notifies the Board within thirty (30) days of the initial existence of one of the adverse events described above, and (y) the Company fails to correct the adverse event within thirty (30) days of such notice, and (z) the Executive's voluntary termination because of the existence of one or more of the adverse events described above occurs within ninety (90) days of the initial existence of the event.

(e) The Executive's employment may be terminated by the Company without Cause by delivery of written notice to the Executive effective the date of delivery of such notice. For the avoidance of doubt, termination of the Executive's employment due to his death or Disability does not constitute a termination for Cause.

(f) The Executive's employment may be terminated by the Executive in the absence of Good Reason by delivery of written notice to the Company effective fifteen (15) days after the date of delivery of such notice.

9. Compensation upon Termination.

(a) Accrued Benefits. Upon termination of the Executive's employment by either party regardless of the cause or reason, the Executive shall be entitled to the following, referred to herein as the "**Accrued Benefits**": (i) payment for any accrued, unpaid Base Salary through the termination date; (ii) if provided for under the Company's vacation plan or policy or required by applicable law, payment for any accrued, unused vacation days through the termination date; and (iii) reimbursement for any approved business expenses that the Executive has timely submitted for reimbursement in accordance with the Company's business expense reimbursement policy or practice. Except as otherwise expressly provided by this Agreement, the Company shall have no further payment obligations to the Executive and all Equity Awards that have not vested as of the termination date shall be forfeited to the Company as of such date. Subject to this Section 9, the vested portion of any stock options held by the Executive as of the Executive's termination date shall remain exercisable for ninety (90) days following such termination.

(b) Change of Control Separation Benefits. If the Executive's employment is terminated due to death, by the Company due to Disability pursuant to Section 8(b), by the Company without Cause pursuant to Section 8(e) or by the Executive for Good Reason pursuant to Section 8(d) and such termination occurs during the period beginning one (1) month preceding the date of a Change of Control and ending twelve (12) months immediately following such Change of Control (the "**COC Period**"), *provided* that the Executive signs and does not revoke a general release of claims against the Company within the time period specified therein (which time period shall not exceed sixty (60) days), in form and substance reasonably satisfactory to the Company and the Executive (the "**Release**"), then the Company shall provide the following benefits to the Executive, referred to herein as the "**Change of Control Separation Benefits**": (i) a lump sum payment equal to eighteen (18) months of the Executive's then-current Base Salary; (ii) the full target Annual Performance Bonus for the year in which such termination occurs multiplied by 1.5, less any installments paid in advance (items (i) and (ii) being the "**Change of Control Separation Pay**"); (iii) immediate vesting in full of all Equity Awards (including Equity Awards that vested based on performance but only to the extent accelerated vesting is provided in the such Equity Awards); provided, however, that (A) in the event that a termination without Cause or termination for Good Reason or termination due to death or Disability occurs during the one (1) month immediately preceding a Change of Control (i.e., the first month of a COC Period), any Equity Awards outstanding as of the Executive's termination shall not accelerate in connection with such termination but instead will remain outstanding and eligible to vest pursuant to this provision immediately prior to the consummation of such Change of Control (assuming the timely execution and non-revocation of a Release) and (B) in the event that termination without Cause or a termination for Good Reason or termination due to death or Disability occurs prior to a Change of Control and such Change of Control is not consummated on or prior to the one (1) month anniversary of such termination, no vesting shall occur pursuant to this Section 9(b) and any Equity Awards outstanding as of the Executive's termination shall vest, if at all, and terminate in accordance with, and to the extent provided in, Section 9(c) of this Agreement; (iv) extension of the exercise period for all vested stock options held by the Executive as of the termination date until the end of their term; and (v) if the Executive properly and timely elects to continue his health insurance benefits under COBRA or applicable state continuation coverage after the termination date, reimbursement for the portion of the Executive's health continuation coverage premiums that the Company would have paid had the Executive remained employed by the Company until the

earlier of (A) eighteen (18) months following the month in which the Executive's termination date occurs, or (B) the maximum period permitted by applicable law, provided that the Company's obligation to pay a portion of the Executive's health continuation coverage premiums will terminate if he becomes eligible for health insurance benefits from another employer during the reimbursement period, The Change of Control Separation Pay will be paid within sixty (60) days after the termination date; *provided, however*, that if the 60-day period begins in one calendar year and ends in a second calendar year, such payments, to the extent they qualify as "non-qualified deferred compensation" within the meaning of Section 409A of the Code, shall be paid no earlier than the first Company payroll date in the second calendar year and, in any case, by the last day of such 60-day period.

(c) Base Separation Benefits. If the Executive's employment is terminated during the Term and outside of the COC Period as a result of the Executive's Disability pursuant to Section 8(b), by the Company without Cause pursuant to Section 8(e), or by the Executive for Good Reason pursuant to Section 8(d), *provided* that the Executive signs and does not revoke the Release within the time period specified therein (which time period shall not exceed sixty (60) days), then the Company shall provide the following benefits to the Executive, referred to herein as the "**Base Separation Benefits**": (i) the continued payment in installments of the Executive's then-current Base Salary for a period of twelve (12) months following the termination date (the "**Base Separation Pay**"); (ii) an Annual Performance Bonus, if any, for the year in which termination occurs in an amount equal to the amount Executive would have earned based on Company's performance if Executive was employed for the full year, pro-rated based on the number of days employed for the year of termination; (iii) all Equity Awards which would have time vested during the twelve (12) months following the termination date shall accelerate and vest; (iv) extension of the exercise period for all vested stock options held by the Executive as of the termination date until the earlier of the first anniversary of the employment termination date and the termination date of the vested stock options; and (v) if the Executive properly and timely elects to continue his health insurance benefits under COBRA or applicable state continuation coverage after the termination date, reimbursement for the portion of the Executive's health continuation coverage premiums that the Company would have paid had the Executive remained employed by the Company until the earlier of (A) the twelve (12) month period following the month in which the Executive's termination date occurs, or (B) the maximum period permitted by applicable law, provided that the Company's obligation to pay a portion of the Executive's health continuation coverage premiums will terminate if he becomes eligible for health insurance benefits from another employer during the reimbursement period. The first installment of the Base Separation Pay will be paid on the Company's first regular payday occurring following the effectiveness of the Release in an amount equal to the sum of payments of Base Salary that would have been paid if he had remained in employment for the period from the termination date through the payment date. The remaining installments will be paid until the end of the 12-month period at the same rate as the Base Salary in accordance with the Company's normal payroll practices for its employees. Notwithstanding the foregoing, if the 60-day period for the execution and non-revocation of the Release begins in one calendar year and ends in a second calendar year, the Base Separation Pay, to the extent it qualifies as "non-qualified deferred compensation" within the meaning of Section 409A of the Code, shall begin to be paid no earlier than the first Company payroll date in the second calendar year and, in any case, by the last day of such 60-day period; *provided, however*, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the termination date. The Executive understands that if he is eligible to

receive the Base Separation Benefits, such Base Separation Benefits shall be in lieu of and not in addition to the Change of Control Separation Benefits described in Section 8(b) of this Agreement. Notwithstanding the foregoing, if the Executive is entitled to receive the Base Separation Benefits but violates any provisions of this Agreement or any other agreement entered into by the Executive and the Company after termination of employment, the Company will be entitled to immediately stop paying any further installments of the Base Separation Benefits.

(d) If the Executive's employment is terminated during the Term as a result of the Executive's death and outside of the COC Period, then the Company shall provide to the Executive's estate the continued payment of Executive's then-current Base Salary for a period of twelve (12) months following the termination date, beginning on the Company's first regular payday following the such termination date. Notwithstanding the foregoing, if at the time of the Executive's death the Company provides or causes to be provided life insurance benefits for the Executive at the Company's sole expense, the Company's obligation under the preceding sentence shall be reduced to the extent of such life insurance coverage and shall be fully satisfied if the Company maintains life insurance benefits for the Executive equal to or greater than the Executive's then current annualized Base Salary. The Executive agrees to participate in any medical exams reasonably required to provide for such life insurance coverage.

(e) This Section 9 sets forth the only obligations of the Company with respect to the termination of the Executive's employment with the Company, except as otherwise required by law, and the Executive acknowledges that, upon the termination of his employment, he shall not be entitled to any payments or benefits which are not explicitly provided in Section 9.

(f) Upon termination of the Executive's employment hereunder for any reason, the Executive shall be deemed to have resigned as director and officer of the Company and each subsidiary of the Company, to the extent applicable, effective as of the date of such termination, unless otherwise requested by the Board.

(g) The provisions of this Section 9 shall survive any termination of this Agreement.

10. Section 409A. The intent of the parties to this Agreement is that the payments, compensation and benefits under this Agreement be exempt from or comply with Section 409A of the Code and the regulations and guidance promulgated thereunder (collectively, "**Section 409A**") and, in this connection, the following shall be applicable:

(a) To the greatest extent possible, this Agreement shall be interpreted to be exempt from or in compliance with Section 409A.

(b) If any severance, compensation, or benefit required by this Agreement is to be paid in a series of installment payments, each individual payment in the series shall be considered a separate payment for purposes of Section 409A.

(c) If any severance, compensation, or benefit required by this Agreement that constitutes "nonqualified deferred compensation" within the meaning of Section 409A is considered to be paid on account of "separation from service" within the meaning of Section 409A, and the Executive is a "specified employee" within the meaning of Section 409A, no payments of any of such severance, compensation, or benefit shall be made until the earlier of six (6) months

plus one (1) day after such separation from service or the Executive's death (the "**New Payment Date**"). The aggregate amount of any such payments that would have otherwise been paid during the period between the date of separation from service and the New Payment Date shall be paid to the Executive or his estate in a lump sum payment on the New Payment Date. Thereafter, any severance, compensation, or benefit required by this Agreement that remains outstanding as of the day immediately following the New Payment Date shall be paid without delay over the time period originally scheduled, in accordance with the terms of this Agreement.

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

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

(f) The provisions of this Section 10 shall survive any termination of this Agreement.

11. Section 280G.

(a) Notwithstanding any other provision of this Agreement or any other plan, arrangement or agreement to the contrary, if any of the payments or benefits provided or to be provided by the Company or its affiliates to the Executive or for the Executive's benefit pursuant to the terms of this Agreement or otherwise ("**Covered Payments**") constitute parachute payments ("**Parachute Payments**") within the meaning of Section 280G of the Code and would, but for this Section 11 be subject to the excise tax imposed under Section 4999 of the Code (or any successor provision thereto) or any similar tax imposed by state or local law or any interest or penalties with respect to such taxes (collectively, the "**Excise Tax**"), then prior to making the Covered Payments, a calculation shall be made comparing (i) the Net Benefit (as defined below) to the Executive of the Covered Payments after payment of the Excise Tax to (ii) the Net Benefit to the Executive if the Covered Payments are limited to the extent necessary to avoid being subject to the Excise Tax. Only if the amount calculated under (i) above is less than the amount under (ii) above will the Covered Payments be reduced to the minimum extent necessary to ensure that no portion of the Covered Payments is subject to the Excise Tax (that amount, the "**Reduced Amount**"). "**Net Benefit**" shall mean the present value of the Covered Payments net of all federal, state, local, foreign income, employment and excise taxes.

(b) Any such reduction shall be made in accordance with Section 409A of the Code and the following: (i) the Covered Payments which do not constitute nonqualified deferred compensation subject to Section 409A of the Code shall be reduced first; and (ii) all other Covered Payments shall then be reduced as follows: (A) cash payments shall be reduced before non-cash payments; and (B) payments to be made on a later payment date shall be reduced before payments to be made on an earlier payment date.

(c) Any determination required under this Section 11 shall be made in writing in good faith by the accounting firm that was the Company's independent auditor immediately before the Change of Control (the "**Accounting Firm**"). The Accounting Firm shall provide detailed supporting calculations to the Company and the Executive as requested by the Company or the Executive. The Company and the Executive shall provide the Accounting Firm with such information and documents as the Accounting Firm may reasonably request in order to make a determination under this Section 11. For purposes of making the calculations and determinations required by this Section 11, the Accounting Firm may rely on reasonable, good faith assumptions and approximations concerning the application of Section 280G and Section 4999 of the Code. The Accounting Firm's determinations shall be final and binding on the Company and the Executive. The Company shall be responsible for all fees and expenses incurred by the Accounting Firm in connection with the calculations required by this Section 11.

(d) It is possible that after the determinations and selections made pursuant to this Section 11 the Executive will receive Covered Payments that are in the aggregate more than the amount provided under this Section 11 ("**Overpaymen**t") or less than the amount provided under this Section 11 ("**Underpayment**").

(i) In the event that: (A) the Accounting Firm determines, based upon the assertion of a deficiency by the Internal Revenue Service against either the Company or the Executive which the Accounting Firm believes has a high probability of success, that an Overpayment has been made or (B) it is established pursuant to a final determination of a court or an Internal Revenue Service proceeding that has been finally and conclusively resolved that an Overpayment has been made, then the Executive shall pay any such Overpayment to the Company.

(ii) In the event that: (A) the Accounting Firm, based upon controlling precedent or substantial authority, determine that an Underpayment has occurred or (B) a court of competent jurisdiction determines that an Underpayment has occurred, any such Underpayment will be paid promptly by the Company to or for the benefit of the Executive.

12. Miscellaneous.

(a) This Agreement shall be governed by, and construed and interpreted in accordance with, the laws of the State of California, without giving effect to its principles of conflicts of laws.

(b) In the event of any dispute arising out of, or relating to, this Agreement or the breach thereof, or regarding the interpretation thereof, the parties agree to submit any differences to nonbinding mediation prior to pursuing resolution through the courts. The parties hereby submit to the exclusive jurisdiction of the state and federal courts situated in San Francisco County, California, and agree that service of process in such court proceedings shall be satisfactorily made upon each other if sent by registered mail addressed to the recipient at the address referred to in Section 12(g) below.

(c) This Agreement shall be binding upon and inure to the benefit of the parties hereto, and their respective heirs, legal representatives, successors and permitted assigns.

(d) This Agreement, and the Executive's rights and obligations hereunder, may not be assigned by the Executive. The rights and obligations of the Company under this Agreement shall inure to the benefit of and shall be binding upon the successors and assigns of the Company, including any successors or assigns in connection with any sale, transfer or other disposition of all or substantially all of its business or assets.

(e) This Agreement cannot be amended orally, or by any course of conduct or dealing, but only by a written agreement signed by the parties hereto.

(f) The failure of either party to insist upon the strict performance of any of the terms, conditions and provisions of this Agreement shall not be construed as a waiver or relinquishment of future compliance therewith, and such terms, conditions and provisions shall remain in full force and effect. No waiver of any term or condition of this Agreement on the part of either party shall be effective for any purpose whatsoever unless such waiver is in writing and signed by such party.

(g) All notices, requests, consents and other communications, required or permitted to be given hereunder, shall be in writing and shall be delivered personally or by an overnight courier service or sent by registered or certified mail, postage prepaid, return receipt requested, to the Executive at the last address of record in his personnel file and to the Company at the addresses set forth on the first page of this Agreement, and shall be deemed given when so delivered personally or by overnight courier, or, if mailed, five days after the date of deposit in the United States mail. Either party may designate another address, for receipt of notices hereunder by giving notice to the other party in accordance with this Section 12(g).

(h) This Agreement sets forth the entire agreement and understanding of the parties relating to the subject matter hereof, and supersedes all prior agreements, arrangements and understandings, written or oral, relating to the subject matter hereof. No representation, promise or inducement has been made by either party that is not embodied in this Agreement, and neither party shall be bound by or liable for any alleged representation, promise or inducement not so set forth.

(i) As used in this Agreement, "affiliate" of a specified person or entity shall mean and include any person or entity controlling, controlled by or under common control with the specified person or entity.

(j) The section headings contained herein are for reference purposes only and shall not in any way affect the meaning or interpretation of this Agreement.

(k) This Agreement may be executed in one or more counterparts, each of which shall be deemed an original and all of which together shall constitute one and the same original, binding document. Any facsimile, PDF reproduction of original signatures or other electronic transmission of a signed counterpart shall be deemed to be an original counterpart and any signature appearing thereon shall be deemed to be an original signature. Each party agrees that the electronic signatures of the parties included in this Agreement, including via DocuSign®, are intended to authenticate this writing and to have the same force and effect as manual signatures.

[*Remainder of Page Intentionally Left Blank – Signature Page Follows*]

IN WITNESS WHEREOF, the parties hereto have executed this Agreement and intend it to be effective as of the Effective Date by proper person thereunto duly authorized.

ASSEMBLY BIOSCIENCES, INC.

By: /s/ William R. Ringo, Jr.
Name: William R. Ringo, Jr.
Title: Chairman of the Board of Directors

EXECUTIVE

/s/ John G. McHutchison, A.O., M.D.
Name: John G. McHutchison, A.O., M.D.

Exhibit 10.2

*** Certain information in this exhibit has been excluded because it either (1) is both (a) not material and (b) would likely cause competitive harm if publicly disclosed or (2) constitutes personal information that, if disclosed, would constitute a clearly unwarranted invasion of privacy.

Assembly Biosciences, Inc.

August 6, 2019

PERSONAL AND CONFIDENTIAL

Derek A. Small
[***]

Re: Separation Agreement and General Release of Claims

Dear Derek:

This letter (this "Agreement") is executed as of August 6, 2019 and provides notice to you that effective immediately you will cease to serve as the Chief Executive Officer and President of the Company and on December 31, 2019 (the "Separation Date"), your employment with Assembly Biosciences, Inc. (the "Company") is being terminated without Cause pursuant to Section 9(e) of that certain Employment Agreement by and between you and the Company entered into as of July 11, 2014 as amended by Amendment No. 1 to Employment Agreement dated as of October 10, 2018 (the "Employment Agreement"). Each capitalized term used herein and not otherwise defined shall have the meaning assigned to such term in the Employment Agreement. The Company thanks you for your contributions and wishes you well in your future endeavors.

This Agreement also sets forth the terms of the Release referenced in Section 10(c) of the Employment Agreement and you acknowledge that this Agreement becoming effective is a condition of your right to receive the Separation Benefits defined in such Section 10(c). Finally, you are eligible to receive additional compensation in return for you providing transition services to the Company, as described in more detail below.

Regardless of whether you enter into this Agreement, you shall be entitled to the Accrued Benefits as defined in Section 10(a) of the Employment Agreement. Also regardless of whether you enter into this Agreement, you will remain bound by your continuing obligations to the Company under your Proprietary Information and Inventions Agreement dated February 19, 2016 and under Sections 6 [Confidential Information and Inventions] and 7 [Non-Competition and Non-Solicitation] of your Employment Agreement, and the other provisions of the Employment Agreement which by their terms or by the nature of the obligation survive the termination of your employment (the "Continuing Obligations"). Such Continuing Obligations include, without limitation, your confidentiality obligations, return of property obligations, non-competition obligations, and non-solicitation obligations.

The remainder of this Agreement sets forth the terms of the Agreement. You acknowledge that you are entering into this Agreement knowingly and voluntarily. With those understandings, you and the Company agree as follows:

1. Separation from Employment

This confirms that your employment with the Company shall terminate on the Separation Date. You further confirm that as of the date of this Agreement you shall be deemed to have resigned as an officer of the Company, including the positions of Chief Executive Officer, President, Principal Executive Officer and Principal Financial Officer. Following the date of this Agreement, you further agree that upon the request of the Company's Chairman of the Board or the Chief Executive Officer you shall resign from any and all positions you hold with any or all of the subsidiaries of the Company, including as an officer and director of each such subsidiary. Accordingly, your right to participate in the employee benefit plans of the Company shall cease on the Separation Date, except you will continue to be eligible for benefits under the Company's group health insurance through the last day of the month in which the Separation Date occurs and as noted in Sections 2(c) and 2(d) below, if applicable, you will continue to have certain rights under our equity incentive plans.

2. Separation Benefits

Subject to this Agreement becoming effective and your compliance with this Agreement and the Continuing Obligations, the Company shall provide you with the following "Separation Benefits" as set forth in Section 10(c) of the Employment Agreement except as modified by this Agreement:

(a) Separation Pay. The Company shall provide you with continued payment of your final Base Salary (which is at the annualized rate of $562,000) for a period of twelve (12) months following the date of your "separation from service" within the meaning of Treasury Regulation §1.409A-1(h) (such separation date being referred to in this Agreement as the "Separation from Service Date," such payment being the "Separation Pay" and such twelve (12) month period commencing upon the Separation from Service Date being the "Separation Pay Period"). The first installment of the Separation Pay will be paid on the Company's first regular payday occurring after the Separation from Service Date. The remaining installments will be paid until the end of the Separation Pay Period at the same rate as the Base Salary in accordance with the Company's normal payroll practices for its employees. All payments will be less applicable taxes and withholdings, in accordance with the Company's normal payroll practices for its employees. The Company and you intend for the Separation Date to be your Separation from Service Date.

(b) Acceleration of Equity Awards. Exhibit A to this Agreement sets forth all of your outstanding Equity Awards (as defined in the Employment Agreement) as of the date hereof. Notwithstanding anything to the contrary in the Employment Agreement or in the applicable equity award agreements, all Equity Awards which would have vested during the twelve (12) months following the Separation Date shall accelerate and vest on the Separation from Service Date. For avoidance of doubt, any acceleration of vesting set forth in an equity award that provides for acceleration in connection with a termination of employment by the Company shall have no further effect following the cessation of your employment. Upon the effective date of your Consulting Agreement, each of your outstanding Equity Awards to the extent unvested as of the effective date of your Consulting Agreement shall be hereby modified to provide that upon the termination of your Continuous Service by the Company for any reason other than for Cause within 6 months following the occurrence of a Corporate Transaction (as defined in the applicable stock incentive plan), all unvested Options or RSUs, as applicable, shall immediately vest.

(c) Extension of Exercise Period. Pursuant to the terms of your Employment Agreement, immediately following the Separation from Service Date the exercise period for all vested Stock Options (as defined in the Employment Agreement) granted prior to 2018 shall be extended until the end of their respective terms unless earlier terminated in accordance with the terms of the applicable equity award agreement. Pursuant to the Stock Option Agreements governing Stock Options granted in 2018 and 2019, the exercise period for all vested Stock Options granted in 2018 and 2019 shall be extended until the later of (i) the first anniversary of the termination of your Continuous Service (as defined in the Assembly Biosciences, Inc. Amended and Restated 2014 Stock Option Plan or the Assembly Biosciences, Inc. 2018 Stock Incentive Plan, as applicable) and (ii) two years following you departure from the Board of Directors other than for "cause;" provided, however, in no event shall the exercise period of the Stock Options extend beyond the end of their respective terms.

(d) Health Benefit. Notwithstanding anything in the contrary in the Employment Agreement, provided that you properly and timely elect to continue your health insurance benefits (including health, dental and/or vision) and remain eligible under COBRA after the Separation Date, the Company shall pay your applicable COBRA premiums, less any required withholding, for the eighteen (18) months following your Separation Date or until you become eligible under another employer's health insurance, whichever is earlier (the "Health Benefit").

(e) Office Space. Commencing on the Separation Date and continuing during the term of your Consulting Agreement (as defined below), so long as the Company maintains offices in Carmel, Indiana, you will be able to maintain your current office at that location, for no additional cost.

(f) 2019 Bonus. Additionally, regardless of whether you are an employee of the Company as of the date 2019 annual performance bonuses are paid in 2020, you will be entitled to receive your annual performance bonus, if any, for calendar year 2019 in an amount equal to the amount you would have earned based on Company's performance as if you were employed for the full year, pro-rated based on the number of days employed in 2019.

3. Consulting Agreement

Upon signing this Agreement, the Company will enter into the consulting agreement set forth in Exhibit B attached hereto (the "Consulting Agreement") to be effective immediately following the Separation Date that shall provide for your continuation of service to the Company on the terms and subject to the conditions set forth therein. Your service as a Consultant pursuant to the Consulting Agreement will constitute "Continuous Service" (as defined in the Company's Amended and Restated 2014 Stock Incentive Plan and 2018 Stock Incentive Plan) and any portion of the Equity Awards that remain unvested as of the Separation Date will continue to vest during the term of the Consulting Agreement in accordance with the terms of the applicable stock incentive plan and equity award grant agreement. No modification to any of your outstanding equity awards is intended to occur as a result of the change in your status to a consultant except those changes that occur by operation of law and those expressly set forth in Sections 2(b) and 2(c) of this Agreement

4. Release of Claims

In consideration for, among other terms, the Separation Benefits, to which you acknowledge you would otherwise not be entitled, you, on behalf of yourself and your heirs, executors, representatives, agents, insurers, administrators, successors and assigns (collectively the "Releasors") voluntarily release and forever discharge the Company, its affiliated and related entities, its and their respective predecessors, successors and assigns, its and their respective employee benefit plans and fiduciaries of such plans, the Company's former affiliated professional employer organization, Insperity PEO Services, L.P., and the current and former officers, directors, shareholders, employees, attorneys, insurers, accountants and agents of each of the foregoing in their official and personal capacities (collectively referred to as the "Releasees") generally from all claims, demands, debts, damages and liabilities of every name and nature, known or unknown ("Claims") that, as of the date when you sign this Agreement and as of the Separation Date, you and the other Releasors have, ever had, now claim to have or ever claimed to have had against any or all of the Releasees. This release includes, without limitation, all Claims: relating to your employment by the Company and the termination of your employment; of wrongful discharge or violation of public policy; of breach of contract; of defamation or other torts; of retaliation or discrimination under federal, state or local law (including, without limitation, Claims of discrimination or retaliation under the Age Discrimination in Employment Act, the Americans with Disabilities Act, Title VII of the Civil Rights Act of 1964, the Indiana Civil Rights Law); under any other federal or state statute (including, without limitation, Claims under the Fair Labor Standards Act and the Family and Medical Leave Act); for wages, bonuses, incentive compensation, commissions, stock, stock options, vacation pay or any other compensation or benefits, either under the Indiana Wage Payment and Wage Claims Acts, or otherwise; and for damages or other remedies of any sort, including, without limitation, compensatory damages, punitive damages, injunctive relief and attorney's fees. This release will not waive any of your rights, or obligations of the Company, regarding: (a) any right to indemnification and/or contribution, advancement or payment of related expenses that you may have pursuant to the Company's Bylaws, Certificate of Incorporation or other organizing documents, under any written indemnification or other agreement between the parties, and/or under applicable law; (b) any rights that you may have to insurance coverage under any directors and officers liability insurance, other insurance policies of the Company, COBRA or any similar state law; (c) rights to any vested benefits under any equity, compensation or other employee benefit plan or agreement with the Company, including the Company's Section 401(k) plan; (d) rights to any applicable severance benefits under this Agreement; (e) rights that cannot be waived as a matter of law, and (f) any claims arising after the Separation Date.

5. Non-Disparagement

You agree not to make any disparaging statements concerning the Company, or any of its affiliates, or its or their current or former officers, directors, shareholders, employees or agents, or any of the Company's or its respective affiliates' products or services. These non-disparagement obligations shall not in any way affect your obligation to testify truthfully in any legal proceeding.

6. Confidentiality of Agreement-Related Information

You agree, to the fullest extent permitted by law, to keep all Agreement-Related Information completely confidential. "Agreement-Related Information" means the negotiations leading to this Agreement. Notwithstanding the foregoing, you may disclose Agreement-Related Information to your spouse, your attorney and your financial and tax advisors, and to them only provided that they first agree for the benefit of the Company to keep Agreement-Related Information confidential. Nothing in this Agreement or any other agreement between you and the Company shall be construed to prevent you from disclosing Agreement-Related Information or any other information or documents to the extent required by applicable law, a lawfully issued subpoena or duly issued court order; *provided* that, except where otherwise prohibited by law, you provide the Company with advance written notice and a reasonable opportunity to contest such subpoena or court order. In addition, nothing in this Agreement or any other agreement between you and the Company prohibits you from disclosing any information or documents in any action for enforcement of this Agreement, but solely to the extent relevant and necessary for such enforcement action.

7. Other Provisions

(a) Termination of Payments. If you breach any of your obligations under this Agreement or your Continuing Obligations, in addition to any other legal or equitable remedies it may have for such breach, the Company shall have the right to terminate and recover its payments to you or for your benefit under this Agreement. The termination of such payments in the event of your breach will not affect your obligations under this Agreement or your Continuing Obligations.

(b) Protected Disclosures and Other Protected Actions. Nothing contained in this Agreement or in your Continuing Obligations limits your ability to file a charge or complaint with any federal, state or local governmental agency or commission (a "Government Agency"). In addition, nothing contained in this Agreement or your Continuing Obligations limits your ability to communicate with or respond accurately and fully to any questions, injury or request for information form any Government Agency or otherwise participate in any investigation or proceeding that may be conducted by any Government Agency, including your ability to provide documents or other information, without notice to the Company, nor does anything contained in this Agreement apply to truthful testimony in litigation. If you file any charge or complaint with any Government Agency and if the Government Agency pursues any claim on your behalf, or if any other third party pursues any claim on your behalf, you waive any right to monetary or other individualized relief (either individually, or as part of any collective or class action); *provided* that nothing in this Agreement limits any right you may have to receive a whistleblower award or bounty for information provided to the Securities and Exchange Commission.

(c) Absence of Reliance. In signing this Agreement, you are not relying upon any promises or representations made by anyone at or on behalf of the Company.

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

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

(f) Jurisdiction. You and the Company hereby agree that the state and federal courts situated in Indianapolis, Indiana shall have the exclusive jurisdiction to consider any matters related to this Agreement, including without limitation any claim of a violation of this Agreement. With respect to any such court action, you submit to the jurisdiction of such courts and you acknowledge that venue in such courts is proper.

(g) Relief. You agree that it would be difficult to measure any harm caused to the Company that might result from any breach by you of your promises set forth in Section 4 of this Agreement. You further agree that money damages would be an inadequate remedy for any breach of Sections 4 or Section 5. Accordingly, you agree that if you breach, or propose to breach, Section 4 or Section 5, the Company shall be entitled, in addition to all other remedies it may have, to an injunction or other appropriate equitable relief to restrain any such breach, without showing or proving any actual damage to the Company and without the necessity of posting a bond.

(h) Governing Law; Interpretation. This Agreement shall be interpreted and enforced under the laws of the State of Indiana, without regard to conflict of law principles. In the event of any dispute, this Agreement is intended by the parties to be construed as a whole, to be interpreted in accordance with its fair meaning, and not to be construed strictly for or against either you or the Company or the “drafter” of all or any portion of this Agreement.

(i) Entire Agreement. This Agreement and the exhibits attached hereto constitute the entire agreement between you and the Company. This Agreement supersedes any previous agreements or understandings between you and the Company, except the Continuing Obligations, the Company’s applicable stock incentive plan and your equity award agreements (as such documents may be amended by Sections 2(b) and 2(c) above), and any other obligations specifically preserved in this Agreement.

(j) Time for Consideration; Effective Date. You acknowledge that you have knowingly and voluntarily entered into this Agreement and that the Company advises you to consult with an attorney before signing this Agreement. You understand and acknowledge that you have been given the opportunity to consider this Agreement for twenty-one (21) days from your receipt of this Agreement before signing it (the "Consideration Period"). To accept this Agreement, you must return a signed original or a signed PDF copy of this Agreement so that it is received by the Company's General Counsel (elizabeth@assemblybio.com) at or before the expiration of the Consideration Period. If you sign this Agreement before the end of the Consideration Period, you acknowledge that such decision was entirely voluntary and that you had the opportunity to consider this Agreement for the entire Consideration Period. For the period of seven (7) days from the date when you sign this Agreement and deliver it to the Company, you have the right to revoke this Agreement by written notice to the Company's General Counsel, provided that such notice is delivered so that it is received at or before the expiration of the seven (7) day revocation period. This Agreement shall not become effective or enforceable during the revocation period. This Agreement shall become effective on the first business day following the expiration of the revocation period (the "Effective Date").

(k) Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original and all of which together shall constitute one and the same original, binding document. Any facsimile, PDF reproduction of original signatures or other electronic transmission of a signed counterpart shall be deemed to be an original counterpart and any signature appearing thereon shall be deemed to be an original signature. Each party agrees that the electronic signatures of the parties included in this Agreement, including via DocuSign®, are intended to authenticate this writing and to have the same force and effect as manual signatures.

(l) Board of Director Compensation. You agree and acknowledge that you will not be entitled to any additional compensation for your service as a director of the Company through the Company's 2020 annual stockholders meeting.

[*signature page follows*]

Please indicate your agreement to the terms of this Agreement by signing and returning to the Company's General Counsel the original or a PDF copy of this letter within the time period set forth above.

Sincerely,

ASSEMBLY BIOSCIENCES, INC.

By: /s/ William R. Ringo, Jr. August 6, 2019
William R. Ringo, Jr. Date
Chairman of the Board

You are advised to consult with an attorney before signing this Agreement. This is a legal document. Your signature will commit you to its terms. By signing below, you acknowledge that you have carefully read and fully understand all of the provisions of this Agreement and that you are knowingly and voluntarily entering into this Agreement.

/s/ Derek A. Small August 6, 2019
Derek A. Small

EXHIBIT A – SUMMARY OF EQUITY AWARDS

[***]

Exhibit 10.3

*** Certain information in this exhibit has been excluded because constitutes personal information that, if disclosed, would constitute a clearly unwarranted invasion of privacy.

CONSULTING AGREEMENT

This CONSULTING AGREEMENT (this "**Consulting Agreement**") is executed as of August 6, 2019 to be effective as of January 1, 2020 (the "**Effective Date**"), by and between Assembly Biosciences, Inc., a Delaware corporation with its principal place of business at 11711 N. Meridian Street, Suite 301, Carmel, IN 46032 (the "**Company**"), and Derek A. Small residing at [***] (the "**Consultant**"). This Consulting Agreement is being entered into by the parties pursuant to that certain Separation Agreement dated August 6, 2019 (the "**Separation Agreement**") and is Exhibit B to such Separation Agreement. Each capitalized term used herein and not otherwise defined shall have the meaning assigned to such term in the Separation Agreement.

WITNESSETH:

WHEREAS, Company desires to engage Consultant to provide certain strategic advisory services on an independent contractor basis as outlined below, and Consultant wishes to provide such services to Company; and

WHEREAS, Company and Consultant desire to establish and document the terms and conditions of such consulting relationship between them.

NOW, THEREFORE, in consideration of the mutual promises and obligations of the parties set forth herein and for other good and valuable consideration, the receipt and legal sufficiency of which are hereby acknowledged, the parties agree as follows:

1. Appointment of Consultant; Services. Company appoints Consultant and Consultant hereby accepts appointment as consultant to the Company. In this capacity, Consultant shall perform strategic advisory services and other projects as may be requested from time to time by the Chief Executive Officer of the Company, and agreed to by Consultant, including providing an orderly transition of Consultant's responsibilities to the Chief Executive Officer and President and providing strategic advisory services to the executive officers as requested (the "**Services**"). Consultant and Company shall work together to delineate the scope of each project and the timeline and deliverables related thereto. Consultant is expected to work no more than 10 hours per week for the Company, which is less than 20% of his average weekly service level with the Company over the 36 months prior to the end of the Initial Consulting Period.

2. Term; Termination. Upon the Separation Agreement becoming effective, this Consulting Agreement will be effective as of the first day following the Separation Date (as defined in the Separation Agreement) and will continue in effect until the first anniversary of the Effective Date (the "**Term**"). This Consulting Agreement may be terminated at any time by either party, with or without Cause (as defined in the 2018 Stock Incentive Plan, as amended), and without prejudice to any right or remedy a party may have due to any failure of the other party to perform their obligations under this Consulting Agreement, upon one hundred eighty (180) days written notice to the other party. The Company may, in addition to any other rights it may have at law or in equity, terminate this Consulting Agreement immediately and without prior notice for Cause or if Consultant is in breach of any material provision of this Consulting Agreement or the Separation Agreement and fails to cure such breach (to the extent capable of being cured) within thirty (30) days after receipt of written notice describing in detail Consultant's breach. In the event of a dispute over what constitutes a breach hereunder or a termination for Cause, the parties shall agree to resolve the matter in accordance with Section 15.

3. **Duties of Consultant**. Consultant agrees to faithfully, diligently, competently, and to the best of his ability perform the Services; provided, that Consultant will at all times retain sole and absolute discretion and judgment in the manner and means of carrying out the Services. Consultant shall use best efforts to perform the Services in a manner satisfactory to the Company. Without limiting the foregoing, Consultant shall provide Services to Company in accordance with generally accepted professional standards as applied to similar projects performed under similar conditions prevailing in the industry at the time such Services are rendered to the Company. Consultant shall not subcontract any portion of Consultant's duties or obligations under this Consulting Agreement without the prior written consent of the Company.

4. **Services for Others.** Subject to the limitations in this Section 4, Consultant will be free to perform consulting services for other persons and entities during the Term. During the Term, Consultant will not directly or indirectly, (i) engage in any business for Consultant's own account that competes with the Business (as defined below) of Company in any geographical area in which Company does business, (ii) enter the employ of, or render any services to, any person engaged in any business that competes with the Business of Company in any geographical area in which Company does business but only to the extent Consultant is being employed or retained to provide services to the competitor in the Business, (iii) acquire a financial interest in, or otherwise become actively involved with, any person engaged in any business that competes with the Business of Company in any geographical area in which Company does business as an individual, partner, shareholder, officer, director, principal, agent, trustee or consultant, or (iv) interfere with business relationships (whether formed before or after the Term with Company) between Company and strategic partner, vendor or suppliers of, or consultants to, Company that were engaged in, or were immediate prospects for engaging in, business with Company before my consulting relationship with Company was terminated. For purposes of this Section 4, "Business" shall mean any business directly or indirectly related to design, development, and marketing of hepatitis B virus, antiviral and/or microbiome therapeutics and technology and any other product or services that the Company may during the Term of this Consulting Agreement be designing, developing and/or marketing and on which Consultant provides Services to during the Term of this Consulting Agreement. Notwithstanding the foregoing, Consultant may, directly or indirectly own, solely as an investment, securities of any person engaged in the Business of Company which are publicly traded on a national or regional stock exchange or on the over-the-counter market if Consultant (i) is not a controlling person of, or a member of a group which controls, such person and (ii) does not, directly or indirectly, own 3% or more of any class of securities of such person. Company agrees and acknowledges that Consultant may provide consulting services to third parties and this provision is not intended to unreasonably restrict Consultant's ability to engage in such other business activities.

5. **Compensation of Consultant.** Subject to approval by the Board of Directors of the Company or the Compensation Committee of the Board of Directors, promptly following the Effective Date of this Agreement, Company shall issue Consultant an award of restricted stock units relating to 125,000 shares of common stock, par value $0.001 per share, of the Company, pursuant to a Restricted Stock Unit Award Agreement, substantially in the form of Exhibit 1 attached hereto (the "**Equity Award Agreement**") under the Company's 2018 Stock Incentive Plan, as may be amended, from time to time which restricted stock unit award shall vest over twelve months following the Effective Date as provided in the Equity Award Agreement and shall settle with respect to vested restricted stock units as provided in the Equity Award Agreement.

6. **Expenses**. Consultant shall be reimbursed for any reasonable expenses incurred while performing Services on behalf of Company, including travel (i.e., airfare, meals and lodging), provided such expenses are approved by Company in advance. All air travel on behalf of Company shall be coach class unless otherwise mutually agreed by the parties. As a condition to receipt of reimbursement, Consultant shall be required to submit to Company reasonable evidence that the amount involved was expended and related to Services provided under this Consulting Agreement.

7. Independent Contractor Status of Consultant.

(a) Consultant's legal status is an independent contractor of Company. Nothing in this Consulting Agreement makes Consultant the agent, partner, joint venturer, employee or legal representative of Company for any purpose whatsoever; nor shall Consultant hold himself out as such. Consultant will have no authority to bind Company in any manner or for any purpose.

(b) Consultant will not be an employee of Company for any purpose, including for purposes of the Fair Labor Standards Act's minimum wage and overtime provisions, nor any other provision of federal, state, or local law applicable to employees. Further, except for the Health Benefits provided in the Separation Agreement, Consultant understands and agrees that he will not be entitled to any employee benefits that may be made available by the Company to its employees, including but not limited to vacation pay, sick leave, retirement benefits, social security, workers' compensation, health or disability benefits, and unemployment insurance benefits.

(c) Consultant acknowledges that he has not relied on any statements or representations by the Company or its attorneys with respect to the tax treatment of any compensation due under this Consulting Agreement. Consultant understands that the Company will not be responsible for withholding or paying any federal or state income, social security or other taxes in connection with any compensation paid under this Consulting Agreement, and Consultant agrees that he is solely responsible for any such tax payments.

8. Representations. Consultant hereby represents and warrants to Company that (a) Consultant is free to enter into this Consulting Agreement with Company and to perform the Services described herein; (b) the execution of this Consulting Agreement and the performance of the Services by Consultant will not result in the breach of any express or implied, oral or written, contract or agreement, to which Consultant is bound (including, without limitation, any non-competition agreement with a current or prior employer); and (c) the execution of this Consulting Agreement and the performance of the Services will not at any time interfere with or violate any third party rights (including, without limitation, the use, disclosure, misappropriation, or infringement of any confidential information, proprietary rights or intellectual property belonging to any other person or entity).

9. Indemnification. Consultant shall indemnify and hold Company, its affiliates and their respective directors, officers, agents and employees harmless from and against all claims, demands, losses, damages and judgments, including court costs and attorneys' fees, arising out of or based upon (i) Consultant's gross negligence or willful misconduct; and (ii) any breach or alleged breach by Consultant of any representation, warranty, certification, covenant, obligation or other agreement set forth in this Consulting Agreement.

10. Ownership of Intellectual Property

(a) Consultant will immediately and fully disclose in writing to the Company all intellectual property and other proprietary information, including without limitation, all inventions, methods, processes, innovations, discoveries, developments, ideas, technologies, computer code and programs, macros, trade secrets, know-how, formulae, designs, patterns, marks, names, improvements, industrial designs, mask works, works of authorship, technical materials relating to the business of the Company conceived or developed by the Consultant during the Term (collectively, "**Intellectual Property**") whether or not any such Intellectual Property is patentable, copyrightable, or otherwise protectable. Notwithstanding the foregoing, this Consulting Agreement shall not be construed to apply to, and shall not create any assignment of any Intellectual Property of Consultant that Consultant developed entirely on his own time without using the Company's equipment, facilities, confidential or trade secret information, except for Intellectual Property that results from any work performed by the Consultant for the Company.

(b) Consultant does hereby, and will from time to time immediately upon the conception or development of any Intellectual Properly in the course of Consultant's engagement with the Company assign to the Company all of his right, title and interest in and to all such Intellectual Property (whether or not patentable, registrable, recordable or protectable by copyright and regardless of whether the Company pursues any of the foregoing). If any Intellectual Property falls within the definition of "work made for hire," as such term is defined in 17 U.S.C. § 101, such Intellectual Property will be considered "work made for hire," and the copyright of such Intellectual Property will be owned solely and exclusively by the Company. If any Intellectual Property does not fall within such definition of "work made for hire", then the right, title, and interest in and to such Intellectual Property of Consultant will be assigned to the Company pursuant to the first sentence of this Section 9(b).

(c) Consultant will execute and deliver any assignment instruments and do all other things reasonably requested by the Company (both during and after Consultant's engagement with the Company) in order to more fully vest in the Company sole and exclusive right, title, and interest in and to all Intellectual Property. Consultant agrees to cooperate with and provide reasonable assistance to the Company in the preparation of applications for letters patent, copyright, and other forms of protection for Intellectual Property, including but not limited to the execution and delivery of any instruments reasonably requested by the Company (both during and after Consultant's engagement with the Company), in order to protect the Company's interest in and to all Intellectual Property. If the Company is unable for any reason to secure Consultant's signature on any lawful and necessary document required to apply for or execute any patent, trademark, copyright or other applications with respect to any Intellectual Property (including renewals, extensions, continuations, divisions or continuations in part thereof), Consultant hereby irrevocably designates and appoints the Company and its then current Chief Executive Officer or General Counsel as Consultant's agent and attorney-in-fact to act for and in behalf and instead of Consultant, to execute and file any such application and to do all other lawfully permitted acts to further the prosecution and issuance of patents, trademarks, copyrights or other rights thereon with the same legal force and effect as if executed by Consultant.

11. Confidential Information.

(a) Consultant acknowledges that during his engagement with Company he will have access to certain highly-sensitive, confidential, and proprietary information belonging to the Company or third parties who may have furnished such information under obligations of confidentiality, relating to and used in the Company's business (collectively, "**Confidential Information**"). Consultant acknowledges that, unless otherwise available to the public, Confidential Information includes, but is not limited to, the following categories of information and material, including all copies, notes, or other reproductions or replicas thereof: financial statements and information; budgets, forecasts, and projections; business and strategic plans; marketing, sales, and distribution strategies; research and development projects; records relating to any intellectual property developed by, owned by, controlled, licensed, or maintained by the Company; information related to the Company's inventions, research, products, designs, methods, know-how, formulae, techniques, systems, processes; customer lists; non-public information relating to the Company's customers, suppliers, employees, distributors, or investors; the specific terms of the Company's agreements or arrangements, whether oral or written, with any customer, supplier, vendor, collaborator or contractor with which the Company may be associated from time to time; and any and all information relating to the operation of the Company's business which the Company may from time to time designate as confidential or proprietary or that Consultant reasonably knows should be, or has been, treated by the Company as confidential or proprietary. Confidential Information encompasses all formats in which information is preserved, whether electronic, print, or any other form, including all originals, copies, notes, or other reproductions or replicas thereof.

(b) Consultant agrees that he will maintain the confidentiality of the Confidential Information at all times during and for ten years following the Term and will not, directly or indirectly, use or disclose any Confidential Information for any purpose other than to the extent necessary to perform the Services.

(c) Consultant's obligations under this Section 11 will not apply to any information that (i) becomes generally known to the public without any breach of this Consulting Agreement by Consultant or of any similar agreement by any other employee or contractor of the Company, (ii) is disclosed to Consultant by a third party under no obligation of confidentiality to the Company and/or any client of the Company, or (iii) the Consultant is required to disclose by law, provided that Consultant first notifies Company of the existence and terms of such requirement, gives Company a reasonable opportunity to seek a protective order or similar relief to prevent or limit such disclosure, and only discloses that information actually required to be disclosed.

(d) The foregoing notwithstanding, pursuant to the federal Defend Trade Secrets Act of 2016, Consultant shall not be held criminally or civilly liable under any federal or state trade secret law for the disclosure of a trade secret that: (A) is made in confidence to a federal, state or local government official, either directly or indirectly, or to an attorney, and solely for the purpose of reporting or investigating a suspected violation of law; or (B) is made in a complaint or other document filed in a lawsuit or other proceeding, if such filing is made under seal. Nothing in this Consulting Agreement shall limit Consultant's right to report possible violations of law or regulation with any federal, state or local government agency or to discuss the terms and conditions of Consultant's engagement by the Company to the extent that such disclosure is protected under applicable provisions of law or regulation, including but not limited to "whistleblower" statutes or other similar provisions that protect such disclosure.

12. Return of Property. Upon termination of Consultant's engagement with the Company for any reason, or at any time upon request of the Company, Consultant will promptly deliver to the Company all Confidential Information in any form along with all personal property belonging to the Company that is in Consultant's possession, custody, or control, including, without limitation, all files, memoranda, designs, correspondence, manuals, programs, data, records, notes, notebooks, reports, papers, equipment, computer software, proposals, or any other files, material, document or possession (whether in hard copy or any electronic format), however obtained, along with any reproductions or copies.

13. Remedies. Consultant acknowledges and agrees that the breach or threatened breach of Sections 4, 10, 11 and/or 12 of this Consulting Agreement may result in immediate and irreparable injury to Company, which injury may not be subject to redress by monetary damages. Accordingly, Consultant agrees that Company is entitled to enforce this Consulting Agreement by seeking a temporary restraining order, preliminary and permanent injunction and/or any other appropriate equitable relief. Nothing in this Section prohibits the Company from pursuing any other remedies available to it in law or equity, including but not limited to the recovery of monetary damages.

14. Assignment. Due to the personal nature of the Services to be rendered hereunder, Consultant may not assign this Consulting Agreement. The Company may assign this Consulting Agreement without the consent of Consultant. Subject to the foregoing, this Consulting Agreement will inure to the benefit of and be binding upon each of the heirs, assigns and successors of the respective parties.

15. Governing Law; Venue. This Consulting Agreement will be governed by and construed in accordance with the laws of the State of Indiana, without regard to that body of law known as choice of law. Any litigation arising out of or related to this Consulting Agreement will be brought exclusively in any state or federal court in Indianapolis, Indiana. Each party (i) consents to the personal jurisdiction of said courts, (ii) waives any venue or inconvenient forum defense to any proceeding maintained in such courts, and (iii) agrees not to bring any proceeding arising out of or relating to this Consulting Agreement in any other court.

16. Compliance with Laws

(a) Absence of Debarrment/Exclusion. Consultant has not been debarred, and to the best of Consultant's knowledge, is not under consideration to be debarred, by the U.S. Food and Drug Administration or comparable foreign equivalent from working in or providing services to any pharmaceutical or biotechnology company under the Generic Drug Enforcement Act of 1992 or comparable foreign law or regulation. Consultant will immediately notify Company if it becomes aware of any such action being taken or threatened to be taken against Consultant.

(b) Anti-Bribery and Corruption Covenant. Consultant shall not violate any applicable anti-bribery and anti-corruption laws or regulations, including the US Foreign Corrupt Practices Act, the UK Bribery Act 2010, the China anti-bribery and corruptions laws or other local laws applicable to your Services (collectively, the "**Anti-Bribery Laws**"). Consultant shall not make, directly or indirectly, in connection with this Consulting Agreement or any Services or in connection with any other business transaction related to Company, a payment or gift of, or an offer, promise or authorization to give money or anything of value to any (a) (i) director, officer, employee, agent or representative (including anyone elected, nominated, or appointed to be a director, officer, employee, agent or representative) of any Government Entity (as defined below), or anyone otherwise acting in an official capacity on behalf of a Government Entity; (ii) political party, political party official or political party employee; (iii) candidate for public or political office; (iv) any royal or ruling family member; or (v) agent or representative of any of those persons listed in subcategories (i) through (iv) (collectively, "**Government Official**"); (b) person or entity; or (c) other person or entity while knowing or having reason to believe that some portion or all of the payment or thing of value will be offered, given or promised, directly or indirectly, to a Government Official or another person or entity; for the purpose of: influencing any act or decision of such Government Official or such person or entity in his/her or its official capacity, including a decision to do or omit to do any act in violation of his/her or its lawful duties or proper performance of functions; or inducing such Government Official or such person or entity to use his/her or its influence or position with any Government Entity or other person or entity to influence any act or decision; in order to obtain or retain business for, direct business to, or secure an improper advantage for Company. "**Government Entity**" means (i) any national, state, regional or local government (including, in each case, any agency, department or subdivision of such government), and any government agency or department; (ii) any political party; (iii) any entity or business that is owned or controlled by any of those bodies listed in subcategory (i) or (ii); or (iv) any international organization, such as the United Nations or the World Bank. Consultant shall when requested by Company from time to time, provide a certification in form and substance satisfactory to Company, signed by Consultant, certifying that Consultant is in compliance with this Section 16(b). A violation of this Section 16(b) shall constitute a material breach of this Consulting Agreement by Consultant.

(c) Insider Trading. Consultant acknowledges that the Company is an issuer with securities registered pursuant to U.S. Securities Act of 1933, as amended and that the disclosure of non-public information regarding the Company or any of its subsidiaries by Consultant or trading in the securities of the Company while in the possession of material nonpublic information is a material breach of the terms of this Consulting Agreement and may subject the Company and/or Consultant to liability.

17. Miscellaneous.

(a) The provisions of Sections 2, 4 and 6-17 will survive the termination of this Consulting Agreement for any reason.

(b) Should any provision of this Consulting Agreement or the application thereof, to any extent, be held invalid or unenforceable, the remainder of this Consulting Agreement and the application thereof other than those provisions held invalid or unenforceable, shall not be affected thereby and shall continue valid and enforceable to the fullest extent permitted by law or equity.

(c) No waiver by either party of any breach of this Consulting Agreement shall be construed as a waiver of any succeeding breach of this Consulting Agreement.

(d) This Consulting Agreement may be executed in one or more counterparts, each of which shall be deemed an original and all of which together shall constitute one and the same agreement. Any facsimile, PDF reproduction of original signatures or other electronic transmission of a signed counterpart shall be deemed to be an original counterpart and any signature appearing thereon shall be deemed to be an original signature.

(e) This Consulting Agreement, together with the Separation Agreement and the documents referenced therein, represents the entire and integrated agreement between the parties and supersedes all prior negotiations, representations or agreements, either written or oral regarding the subject matter thereof.

(f) This Consulting Agreement may be amended only by a written instrument signed by both Company and Consultant.

[Signature Page Follows]

IN WI'INESS WHEREOF, the parties hereto have executed this Consulting Agreement to be effective as of the Effective Date.

CONSULTANT:

/s/ Derek A. Small
Derek A. Small

COMPANY:

ASSEMBLY BIOSCIENCES, INC.

By: /s/ William R. Ringo, Jr.
William R. Ringo, Jr.
Chairman of the Board

[Signature Page to Consulting Agreement]

EXHIBIT 1

EQUITY AWARD AGREEMENT

(See Attached)

ASSEMBLY BIOSCIENCES, INC.
2018 STOCK INCENTIVE PLAN
RESTRICTED STOCK UNIT AWARD NOTICE

Grant Number _____

Derek A. Small
[***]

On the first day following the effective date of your Consulting Agreement, in your role as a consultant, you have been granted Restricted Stock Units ("RSUs") of Assembly Biosciences, Inc. (the "Company"), as follows:

Effective Date:	January 2, 2020[1] or if earlier, the date the Consulting Agreement becomes effective.
Total Number of RSUs Granted:	125,000
Vesting Schedule:	1/12 of the RSUs shall vest on the last day of each month for 12 months; in each case subject to your Continuous Services through each vesting date and otherwise in accordance with the terms and conditions of the Plan (as defined below) and the Restricted Stock Unit Agreement attached hereto. RSUs to vest on any vesting date shall be rounded down to nearest whole number. Monthly installments shall take into effect prior rounding so that each monthly installment including the last installment is approximately the same. On [December 31, 2020,] assuming Continuous Service, the RSUs shall be fully vested. Immediately prior to the occurrence of a Corporate Transaction, all unvested RSUs shall immediately vest. As of the date of your death or Disability, all unvested RSUs shall immediately vest.
Payment Date:	TBD before executing- [**Alternative 1:** The Company shall deliver, to you one Share (as defined in the Plan) in respect of each vested RSU. Delivery shall be made as soon as practicable following each Vesting Date and in no event later than 30 days following the applicable Vesting Date (the date of delivery, the "Payment Date").] [**Alternative2** : Vested RSUs shall be settled as follows: XXXX RSUs on the first to occur of a Corporate Transaction, your death and [Specify date]; XXXX RSUs on the first to occur of a Corporate Transaction, your death and [Specify Date]; and XXXX RSUs on the first to occur of a Corporate Transaction, your death and [Specify Date] (each such settlement date, a "Payment Date"). For the avoidance of doubt, upon the occurrence of a Corporate Transaction, all RSUs that have not been settled as of such date shall be settled. The Company shall deliver, to you, one Share (as defined in the Plan) in respect of each vested RSU. Delivery shall be made as soon as practicable following the applicable Payment Date and in no event later than 30 days following the applicable Payment Date.]

[1] First date following effective date of Consulting Agreement.

By your signature or electronic acceptance of the RSUs and the signature of the Company's representative below, you and the Company agree that these RSUs are granted under and governed by the terms and conditions of the Assembly Biosciences, Inc. 2018 Stock Incentive Plan (the "Plan") and the Restricted Stock Unit Agreement, all of which are attached and made a part of this document. Capitalized terms used in this Notice of Restricted Stock Unit Award and not otherwise defined herein shall have the meaning assigned to such term in the Plan.

Dated: [First day following Effective date of Consulting Agreement]

GRANTEE:

Derek A. Small

ASSEMBLY BIOSCIENCES, INC.

By:
Name: William R. Ringo, Jr.
Title: Chairman of the Board

ASSEMBLY BIOSCIENCES, INC.
RESTRICTED STOCK UNIT AWARD AGREEMENT
UNDER THE 2018 STOCK INCENTIVE PLAN

THIS RESTRICTED STOCK UNIT AWARD AGREEMENT (this "Award Agreement") is made and entered into by and between Assembly Biosciences, Inc. (the "Company") and the individual named in the Restricted Stock Unit Award Notice (the "Grantee") under the Company's 2018 Stock Incentive Plan (the "Plan"). The Award Notice also establishes the Effective Date of the Award, the number of Restricted Stock Units awarded, vesting conditions, and the Payment Date of the Award.

WHEREAS, the Grantee is expected to provide valuable services to the Company;

WHEREAS, the Company considers it desirable and in the best interests of the Company that the Grantee be given an opportunity to acquire a proprietary interest in the Company as an incentive to advance the interests of the Company and to perform future services that will contribute materially to the successful operation of the Company; and

WHEREAS, the Company, acting through the Board of Directors of the Company (the "Board") or (ii) the Committee appointed by the Board under the Plan (the "Committee"), desires to grant the Grantee a Restricted Stock Unit Award measured in shares of common stock of the Company (the "Common Stock"), in accordance with the Plan. Capitalized terms used herein which are not otherwise defined herein shall have the meanings ascribed to them under the Plan.

NOW, THEREFORE, in consideration of the premises, it is agreed by and between the parties as follows:

1. Grant of Restricted Stock Unit Award. The Company awards the Grantee Restricted Stock Units in a number that is specified in the Award Notice provided to the Grantee. The Award is subject to the vesting, payment and other provisions of this Award Agreement, the Award Notice and the Plan. Each Restricted Stock Unit represents one (1) Share of Common Stock of the Company. The Company will account for the Restricted Stock Units in a bookkeeping account on the Grantee's behalf until they become payable or are forfeited. The number of Restricted Stock Units shall be adjusted if the Common Stock is split, combined, if stock dividends are paid on Common Stock, or upon a similar event in the same manner that the Common Stock is adjusted.

2. Dividend Equivalents. For each Restricted Stock Unit that is granted and credited to the Grantee's account, the Grantee's account will also be credited with a Dividend Equivalent Rights in an amount equal to any cash dividends paid by the Company upon one Share of Common Stock after the Effective Date and before the Payment Date (as provided in the Award Notice) for the Restricted Stock Unit, subject to the vesting and other provisions of this Award Agreement and the Award Notice.

3. Vesting. The Restricted Stock Units (and Dividend Equivalent Rights associated with the Restricted Stock Units) shall be unvested and shall be subject to the restrictions set forth in this Award Agreement and the Award Notice. Unless sooner forfeited in accordance with Section 5, the Restricted Stock Units and Dividend Equivalent Rights associated with the Restricted Stock Unit shall vest as set forth in the Grantee's Award Notice.

4. Settlement of Vested Restricted Stock Units and Restricted Dividend Equivalents. If any of the Restricted Stock Units vest on a Vesting Date, the Company shall settle such Restricted Stock Units (the "Vested Restricted Stock Units") and Dividend Equivalent Rights attributable to such Vested Restricted Stock Units ("Vested Dividend Equivalents") on the Payment Date established in the Award Notice (the "Payment Date") by delivering to the Grantee (a) shares of Common Stock of the Company and (b) cash, determined as follows:

(a) *Number of Shares of Common Stock*. The Company will determine the value as of the Payment Date of the Vested Restricted Stock Units and the Vested Dividend Equivalent Rights (together, the "Total Amount"). For this purpose, the Vested Dividend Equivalents shall be valued at their original value and shall not be increased or decreased by an interest or earnings factor, and

(b) *Cash*. The remainder resulting from the division in (a) above to determine the number of shares of Common Stock will be the dollar amount of the cash payable to the Grantee, and such amount shall be paid to the Grantee by check.

The Vested Restricted Stock Units and Vested Dividend Equivalents will be settled by the Company within thirty (30) days of the applicable Vesting Date.

5. Forfeiture of Restricted Stock Units (and Dividend Equivalent Rights Attributable to Restricted Stock Units). In the event of Termination of the Grantee's Continuous Service from the Company, any Restricted Stock Units and Dividend Equivalent Rights attributable to such Restricted Stock Units that were not already vested on the termination shall be forfeited on that date.

6. Certain Tax Matters. The Grantee acknowledges that the Grantee understands the federal, state and local income, employment and foreign (if applicable) tax consequences of the Restricted Stock Unit Award, and the issuance, vesting and forfeiture provisions relating to the Restricted Stock Unit Award.

7. Rights Prior to Vesting. The Restricted Stock Units and Dividend Equivalent Rights represent a right to payment from the Company if the conditions of this Award Agreement are met and do not give the Grantee ownership of any Common Stock prior to delivery as provided in Section 4. No assets have been set aside by the Company or otherwise to pay the amounts promised by this Award Agreement, the right to payment is unsecured, and the Grantee is a general creditor of the Company for payment under this Award Agreement.

8. Investment Representation. The Grantee represents and warrants to the Company that the Grantee has read this Award Agreement carefully, and to the extent believed necessary, has discussed this Award Agreement and its impact and limitations upon the Grantee with counsel.

9. Transferability. The right to payment under this Award Agreement may not be sold, exchanged, transferred, pledged, hypothecated, encumbered or otherwise disposed of except as provided in the Plan. The Company shall have the right to assign to any of its affiliates any of its rights, or to delegate to any of its affiliates any of its obligations under this Award Agreement.

10. Defined Terms. The following terms shall have the meanings set forth below:

(a) "Corporate Transaction" has the meaning assigned to such term in the Plan. Notwithstanding the foregoing, a Corporate Transaction shall not be deemed to have occurred unless such transaction also constitutes a "change in the ownership" of the Company or a "change in the ownership of a substantial portion of the Company's assets" for purposes of Section 409A of the Code.

11. Section 409A of the Code.

(a) This Award Agreement has been drafted with the intent that payments (and the right to payments) under it are exempt from or comply with the requirements of Section 409A of the Internal Revenue Code of 1986, as amended ("Code"), and the regulations thereunder applicable to nonqualified deferred compensation. This Award Agreement shall be interpreted in a manner consistent with such intent.

(b) The parties agree that this Award Agreement may be amended, as reasonably requested by either party, and as may be necessary to fully comply with Section 409A of the Code and all related rules and regulations in order to preserve the payments and benefits provided hereunder without additional cost to either party.

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

12. Binding Effect. This Award Agreement shall inure to the benefit of and be binding upon the parties hereto and their respective heirs, executors, administrators, successors and assigns.

13. Gender and Number. All terms used in this Award Agreement shall be deemed to refer to the masculine, feminine, neuter, singular or plural as the context may require.

14. Terms and Conditions of Plan. The terms and conditions included in the Plan and the Award Notice are incorporated by reference herein, and to the extent that any conflict may exist between any term or provision of this Award Agreement and any term or provision of the Plan as in effect from time to time, such term or provision of the Plan shall control.

15. Certain Remedies. Without intending to limit the remedies available to the Company, the Grantee agrees that damages at law will be an insufficient remedy in the event the Grantee violates the terms of this Award Agreement. The Grantee agrees that the Company may apply for and have injunctive or other equitable relief in any court of competent jurisdiction to restrain the breach or threatened breach of, or otherwise specifically to enforce, any of the provisions hereof.

16. Waiver. The waiver by either party of compliance with any provision of this Award Agreement by the other party shall not operate or be construed as a waiver of any other provision of this Award Agreement, or of any subsequent breach by such party of a provision of this Award Agreement.

17. No Restriction on Right of Company to Effect Corporate Changes. Neither the Plan nor this Award Agreement shall affect in any way the right or power of the Company or its stockholders to make or authorize any or all adjustments, recapitalizations, reorganizations or other changes in the capital structure or business of the Company, or any merger or consolidation of the Company, or any issue of stock or of options, warrants or rights to purchase stock or of bonds, debentures, preferred or prior preference stocks whose rights are superior to or affect the Common Stock or the rights thereof or which are convertible into or exchangeable for Common Stock, or the dissolution or liquidation of the Company, or any sale or transfer of all or any part of the assets or business of the Company, or any other corporate act or proceeding, whether of a similar character or otherwise.

16. Entire Agreement. This Award Agreement (including the Award Notice, and the Plan which are incorporated herein by reference and all additional riders incorporated herein) sets forth all of the promises, agreements, conditions and understandings between the parties hereto with respect to the Award, and there are no promises, agreements, conditions, understandings, warranties or representations, oral or written, express or implied, between them with respect to the Restricted Stock Unit Award other than as set forth therein or herein. This Award Agreement supersedes and replaces any and all prior agreements between the parties hereto with respect to Restricted Stock Units and Dividend Equivalent Rights. This Award Agreement is, and is intended by the parties to be, an integration of any and all prior agreements or understandings, oral or written, with respect to Restricted Stock Units and Dividend Equivalent Rights. No modification, amendment or waiver of any of the provisions of this Award Agreement shall be effective unless approved in writing by both parties.

17. Invalid or Unenforceable Provision. The invalidity or unenforceability of any particular provision of this Award Agreement shall not affect the other provisions hereof, and this Award Agreement shall be construed in all respects as if such invalid or unenforceable provision was omitted.

18. Governing Law. This Award Agreement shall be construed and enforced in accordance with the laws of Delaware, without giving effect to principles of conflicts of laws.

19. Miscellaneous.

(a) Neither the granting or vesting of the Restricted Stock Units and Dividend Equivalent Rights nor any other provision of this Award Agreement shall be construed as conferring upon the Grantee any right to continue in the service of the Company, or as interfering with or restricting in any way the right of the Company to terminate such service at any time.

(b) The Company, the Board (or the Committee) and any employees or agents thereof are relieved from any liability for the non-issuance or non-transfer, or any delay in the issuance or transfer, of any Common Stock which results from the inability of the Company to obtain, or in any delay in obtaining, from each regulatory body having jurisdiction all requisite authority to issue or transfer the Common Stock in satisfaction of this Award Agreement if counsel for the Company deems such authorization necessary for the lawful issuance or transfer of any of the Common Stock.

(c) No Common Stock shall be sold or otherwise disposed of in violation of any federal or state securities law or regulations.

(d) All decisions of the Board (or the Committee) with respect to the interpretation, construction and application of the Plan and/or this Award Agreement shall be conclusive and binding upon the Grantee and all other persons.

Exhibit 10.4

ASSEMBLY BIOSCIENCES, INC.

2019 INDUCEMENT AWARD PLAN

1. Purposes of the Plan. The purposes of this Plan are to attract and retain the best available personnel, to provide an inducement material for such persons to enter into employment with the Company or a Related Entity within the meaning of Rule 5635(c)(4) of the NASDAQ Listing Rules and to promote the success of the Company's business.

2. Definitions. The following definitions shall apply as used herein and in the individual Award Agreements except as defined otherwise in an individual Award Agreement. In the event a term is separately defined in an individual Award Agreement, such definition shall supersede the definition contained in this Section 2.

(a) "***Administrator***" means the Board or any of the Committees appointed to administer the Plan.

(b) "***Affiliate***" and "***Associate***" shall have the respective meanings ascribed to such terms in Rule 12b-2 promulgated under the Exchange Act.

(c) "***Applicable Laws***" means the legal requirements relating to the Plan and the Awards under applicable provisions of federal and state securities laws, the corporate laws of the state of Delaware, the Code, the rules of any applicable stock exchange or national market system, and the rules of any non-U.S. jurisdiction applicable to Awards granted to residents therein.

(d) "***Assumed***" means that pursuant to a Corporate Transaction either (i) the Award is expressly affirmed by the Company or (ii) the contractual obligations represented by the Award are expressly assumed (and not simply by operation of law) by the successor entity or its Parent in connection with the Corporate Transaction with appropriate adjustments to the number and type of securities of the successor entity or its Parent subject to the Award and the exercise or purchase price thereof which at least preserves the compensation element of the Award existing at the time of the Corporate Transaction as determined in accordance with the instruments evidencing the agreement to assume the Award.

(e) "***Award***" means the grant of an Option, SAR, Dividend Equivalent Right, Restricted Stock, Restricted Stock Unit or other right or benefit under the Plan.

(f) "***Award Agreement***" means the written agreement evidencing the grant of an Award executed by the Company and the Grantee, including any amendments thereto.

(g) "***Board***" means the Board of Directors of the Company.

(h) "***Cause***" means, with respect to the termination by the Company or a Related Entity of the Grantee's Continuous Service, that such termination is for "Cause" as such term (or word of like import) is expressly defined in a then-effective written agreement between the Grantee and the Company or such Related Entity, or in the absence of such then-effective written agreement and definition, is based on, in the determination of the Administrator, the Grantee's: (i) performance of any act or failure to perform any act in bad faith and to the detriment of the Company or a Related Entity; (ii) dishonesty, intentional misconduct or material breach of any agreement with the Company or a Related Entity; or (iii) commission of a crime involving dishonesty, breach of trust, or physical or emotional harm to any person; provided, however, that with regard to any agreement that defines "Cause" on the occurrence of or in connection with a Corporate Transaction, such definition of "Cause" shall not apply until a Corporate Transaction actually occurs.

(i) "***Code***" means the Internal Revenue Code of 1986, as amended, or any successor statute.

(j) "***Committee***" means any committee composed of members of the Board appointed by the Board to administer the Plan.

(k) "***Common Stock***" means the Company's Common Stock, par value $0.001 per share.

(l) "***Company***" means Assembly Biosciences, Inc., a Delaware corporation, or any successor entity that adopts the Plan in connection with a Corporate Transaction.

(m) "***Consultant***" means any natural person (other than an Employee or a Director, solely with respect to rendering services in such person's capacity as a Director) who provides bona fide services to the Company or any Related Entity, within the meaning of Form S-8 promulgated under the Securities Act of 1933, as amended.

(n) "***Continuous Service***" means that the provision of services to the Company or a Related Entity in any capacity of Employee, Director or Consultant is not interrupted or terminated. In jurisdictions requiring notice in advance of an effective termination as an Employee, Director or Consultant, Continuous Service shall be deemed terminated upon the actual cessation of providing services to the Company or a Related Entity notwithstanding any required notice period that must be fulfilled before a termination as an Employee, Director or Consultant can be effective under Applicable Laws. A Grantee's Continuous Service shall be deemed to have terminated either upon an actual termination of Continuous Service or upon the entity for which the Grantee provides services ceasing to be a Related Entity. Continuous Service shall not be considered interrupted in the case of (i) any approved leave of absence, (ii) transfers among the Company, any Related Entity, or any successor in any capacity of Employee, Director or Consultant, or (iii) any change in status as long as the individual remains in the service of the Company or a Related Entity in any capacity of Employee, Director or Consultant (except as otherwise provided in the Award Agreement). An approved leave of absence shall include sick leave, military leave, or any other authorized personal leave.

(o) "***Corporate Transaction***" means any of the following transactions, provided, however, that the Administrator shall determine under parts (iv) and (v) whether multiple transactions are related, and its determination shall be final, binding and conclusive:

(i) a merger or consolidation in which the Company is not the surviving entity, except for a transaction the principal purpose of which is to change the state in which the Company is incorporated;

(ii) the sale, transfer or other disposition of all or substantially all of the assets of the Company;

(iii) the complete liquidation or dissolution of the Company;

(iv) any reverse merger or series of related transactions culminating in a reverse merger (including, but not limited to, a tender offer followed by a reverse merger) in which the Company is the surviving entity but (A) the shares of Common Stock outstanding immediately prior to such merger are converted or exchanged by virtue of the merger into other property, whether in the form of securities, cash or otherwise, or (B) in which securities possessing more than fifty percent (50%) of the total combined voting power of the Company's outstanding securities are transferred to a person or persons different from those who held such securities immediately prior to such merger or the initial transaction culminating in such merger; or

(v) acquisition in a single or series of related transactions by any person or related group of persons (other than the Company or by a Company-sponsored employee benefit plan) of beneficial ownership (within the meaning of Rule 13d-3 of the Exchange Act) of securities possessing more than fifty percent (50%) of the total combined voting power of the Company's outstanding securities.

(p) "***Director***" means a member of the Board or the board of directors of any Related Entity.

(q) "***Disability***" means "disability" as defined in the long-term disability policy of the Company or the Related Entity to which the Grantee provides services regardless of whether the Grantee is covered by such policy. If the Company or the Related Entity to which the Grantee provides service does not have a long-term disability plan in place, "Disability" means that a Grantee is unable to carry out the responsibilities and functions of the position held by the Grantee by reason of any medically determinable physical or mental impairment for a period of not less than ninety (90) consecutive days. A Grantee will not be considered to have incurred a Disability unless he or she furnishes proof of such impairment sufficient to satisfy the Administrator in its discretion.

(r) "***Dividend Equivalent Right***" means a right entitling the Grantee to compensation measured by dividends paid with respect to Common Stock.

(s) "***Employee***" means any person, including an Officer or Director, who is in the employ of the Company or any Related Entity, subject to the control and direction of the Company or any Related Entity as to both the work to be performed and the manner and method of performance. The payment of a director's fee by the Company or a Related Entity shall not be sufficient to constitute "employment" by the Company.

(t) "***Exchange Act***" means the Securities Exchange Act of 1934, as amended.

(u) "***Fair Market Value***" means, as of any date, the value of Common Stock determined as follows.

(i) If the Common Stock is listed on one or more established stock exchanges or national market systems, including without limitation The NASDAQ Global Select Market, The NASDAQ Global Market or The NASDAQ Capital Market of The NASDAQ Stock Market LLC, its Fair Market Value shall be the closing sales price for such stock (or the closing bid, if no sales were reported) as quoted on the principal exchange or system on which the Common Stock is listed (as determined by the Administrator) on the date of determination (or, if no closing sales price or closing bid was reported on that date, as applicable, on the last trading date such closing sales price or closing bid was reported), as reported in The Wall Street Journal or such other source as the Administrator deems reliable;

(ii) If the Common Stock is regularly quoted on an automated quotation system (including the OTC Bulletin Board) or by a recognized securities dealer, its Fair Market Value shall be the closing sales price for such stock as quoted on such system or by such securities dealer on the date of determination, but if selling prices are not reported, the Fair Market Value of a share of Common Stock shall be the mean between the high bid and low asked prices for the Common Stock on the date of determination (or, if no such prices were reported on that date, on the last date such prices were reported), as reported in The Wall Street Journal or such other source as the Administrator deems reliable; or

(iii) In the absence of an established market for the Common Stock of the type described in (i) and (ii), above, the Fair Market Value thereof shall be determined by the Administrator in a manner in compliance with Section 409A of the Code.

(v) "***Grantee***" means an individual who receives an Award under the Plan.

(w) "***Non-Qualified Stock Option***" means an Option not intended to qualify as an incentive stock option within the meaning of Section 422 of the Code.

(x) "***Officer***" means a person who is an officer of the Company or a Related Entity within the meaning of Section 16 of the Exchange Act and the rules and regulations promulgated thereunder.

(y) "***Option***" means a Non-Qualified Stock Option to purchase Shares pursuant to an Award Agreement granted under the Plan.

(z) "***Parent***" means a "parent corporation," whether now or hereafter existing, as defined in Section 424(e) of the Code.

(aa) "***Plan***" means this Assembly Biosciences, Inc. 2019 Inducement Award Plan.

(bb) "***Post-Termination Exercise Period***" means the period specified in the Award Agreement of not less than thirty (30) days commencing on the date of termination (other than termination by the Company or any Related Entity for Cause) of the Grantee's Continuous Service, or such longer period as may be applicable upon death or Disability.

(cc) "***Related Entity***" means any Parent or Subsidiary of the Company**.**

(dd) "***Replaced***" means that pursuant to a Corporate Transaction the Award is replaced with a comparable stock award or a cash incentive program of the Company, the successor entity (if applicable) or Parent of either of them which preserves the compensation element of such Award existing at the time of the Corporate Transaction and provides for subsequent payout in accordance with the same (or a more favorable) vesting schedule applicable to such Award. The determination of Award comparability shall be made by the Administrator and its determination shall be final, binding and conclusive.

(ee) "***Restricted Stock***" means Shares issued under the Plan to the Grantee for such consideration, and subject to such restrictions on transfer, rights of first refusal, repurchase provisions, forfeiture provisions, and other terms and conditions as established by the Administrator.

(ff) "***Restricted Stock Units***" means an Award which may be earned in whole or in part upon the passage of time or the attainment of performance criteria established by the Administrator and which may be settled for cash, Shares or other securities or a combination of cash, Shares or other securities as established by the Administrator.

(gg) "***Rule 16b-3***" means Rule 16b-3 promulgated under the Exchange Act or any successor thereto.

(hh) "***SAR***" means a stock appreciation right entitling the Grantee to Shares or cash compensation, as established by the Administrator, measured by appreciation in the value of Common Stock.

(ii) "***Share***" means a share of the Common Stock.

(jj) "***Subsidiary***" means a "subsidiary corporation," whether now or hereafter existing, as defined in Section 424(f) of the Code.

3. Stock Subject to the Plan.

(a) Subject to the provisions of Sections 3(b) and 12 below, the maximum aggregate number of Shares which may be issued pursuant to all Awards is Five Hundred Thousand (500,000) Shares. The Shares granted under the Plan may be authorized, but unissued, or reacquired Common Stock.

(b) Any Shares covered by an Award (or portion of an Award) which is forfeited, canceled or expires (whether voluntarily or involuntarily) shall be deemed not to have been issued for purposes of determining the maximum aggregate number of Shares which may be issued under the Plan. Shares that actually have been issued under the Plan pursuant to an Award shall not be returned to the Plan and shall not become available for future issuance under the Plan, except that if Options or other Awards granted under this Plan are forfeited, canceled, expired or repurchased by the Company, such Shares shall become available for future grant under the Plan. In the event any Option or other Award granted under the Plan is exercised through the tendering of shares of Common Stock (either actually or through attestation) or

withholding shares of Common Stock, or in the event tax withholding obligations are satisfied by tendering or withholding shares of Common Stock, any shares of Common Stock so tendered or withheld shall not again be available for awards under the Plan. Shares of Common Stock subject to an SAR granted pursuant to Section 6(k) of this Plan that are not issued in connection with cash or stock settlement of the exercise of the SAR shall not again be available for award under the Plan. Shares of Common Stock reacquired by the Company on the open market or otherwise using cash proceeds from the exercise of Options shall not be available for awards under the Plan.

4. Administration of the Plan.

(a) Plan Administrator.

(i) Administration – General. The Plan shall be administered by (A) the Board or (B) a Committee designated by the Board, which Committee shall be constituted in such a manner as to satisfy the Applicable Laws and to permit such grants and related transactions under the Plan to be exempt from Section 16(b) of the Exchange Act in accordance with Rule 16b-3. Once appointed, such Committee shall continue to serve in its designated capacity until otherwise directed by the Board.

(ii) Administration in Compliance with Rule 5605(a)(2) of the NASDAQ Listing Rules. Notwithstanding the foregoing or anything in the Plan to the contrary, the grant of Awards will be approved by the Company's independent compensation committee or a majority of the Company's independent directors (as defined in Rule 5605(a)(2) of the NASDAQ Listing Rules) in order to comply with the exemption from the stockholder approval requirement for "inducement grants" provided under Rule 5635(c)(4) of the NASDAQ Listing Rules.

(b) Powers of the Administrator. Subject to Applicable Laws and the provisions of the Plan (including any other powers given to the Administrator hereunder), and except as otherwise provided by the Board, the Administrator shall have the authority, in its discretion:

(i) to select the individuals to whom Awards may be granted from time to time hereunder; provided that Awards may only be granted to individuals who satisfy the standards for inducement grants under Rule 5635(c)(4) of the NASDAQ Listing Rules;

(ii) to determine whether and to what extent Awards are granted hereunder;

(iii) to determine the number of Shares or the amount of other consideration to be covered by each Award granted hereunder;

(iv) to approve forms of Award Agreements for use under the Plan;

(v) to determine the type, terms and conditions of any Award granted hereunder;

(vi) to establish additional terms, conditions, rules or procedures to accommodate the rules or laws of applicable non-U.S. jurisdictions and to afford Grantees favorable treatment under such rules or laws; provided, however, that no Award shall be granted under any such additional terms, conditions, rules or procedures with terms or conditions which are inconsistent with the provisions of the Plan;

(vii) to amend the terms of any outstanding Award granted under the Plan, provided that any amendment that would adversely affect the Grantee's rights under an outstanding Award shall not be made without the Grantee's written consent;

(viii) to construe and interpret the terms of the Plan and Awards, including without limitation, any notice of award or Award Agreement, granted pursuant to the Plan;

(ix) to institute an option exchange program; and

(x) to take such other action, not inconsistent with the terms of the Plan, as the Administrator deems appropriate.

The express grant in the Plan of any specific power to the Administrator shall not be construed as limiting any power or authority of the Administrator; provided that the Administrator may not exercise any right or power reserved to the Board. Any decision made, or action taken, by the Administrator or in connection with the administration of this Plan shall be final, conclusive and binding on all persons having an interest in the Plan.

(c) Indemnification. In addition to such other rights of indemnification as they may have as members of the Board or as Officers or Employees of the Company or a Related Entity, members of the Board and any Officers or Employees of the Company or a Related Entity to whom authority to act for the Board, the Administrator or the Company is delegated shall be defended and indemnified by the Company to the extent permitted by law on an after-tax basis against all reasonable expenses, including attorneys' fees, actually and necessarily incurred in connection with the defense of any claim, investigation, action, suit or proceeding, or in connection with any appeal therein, to which they or any of them may be a party by reason of any action taken or failure to act under or in connection with the Plan, or any Award granted hereunder, and against all amounts paid by them in settlement thereof (provided such settlement is approved by the Company) or paid by them in satisfaction of a judgment in any such claim, investigation, action, suit or proceeding, except in relation to matters as to which it shall be adjudged in such claim, investigation, action, suit or proceeding that such person is liable for gross negligence, bad faith or intentional misconduct; provided, however, that within thirty (30) days after the institution of such claim, investigation, action, suit or proceeding, such person shall offer to the Company, in writing, the opportunity at the Company's expense to defend the same.

5. Eligibility. Awards may be granted to individuals who become employees of the Company and any Related Entity who satisfy the standards for inducement grants under Rule 5635(c)(4) of the NASDAQ Listing Rules and where the Award is an inducement material to the individual's entering into employment with the Company or a Related Entity. A person who previously served as an Employee or Director will not be eligible to receive Awards under the Plan, other than following a bona fide period of non-employment. Subject to the foregoing, Awards may be granted to such individuals who are residing in non-U.S. jurisdictions as the Administrator may determine from time to time. For clarity, Awards may not be granted to (1) Consultants or Directors for service in such capacity, or (2) any individual who was previously an Employee or Director, other than following a bona fide period of non-employment. All Awards must be granted either by a majority of the Company's independent directors or by the Company's compensation committee comprised of independent directors within the meaning of Rule 5605(a)(2) of the NASDAQ Listing Rules.

6. Terms and Conditions of Awards.

(a) Types of Awards. The Administrator is authorized under the Plan to award any type of arrangement to an individual who becomes an employee that is not inconsistent with the provisions of the Plan and that by its terms involves or might involve the issuance of (i) Shares, (ii) cash or (iii) an Option, an SAR, or similar right with a fixed or variable price related to the Fair Market Value of the Shares and with an exercise or conversion privilege related to the passage of time, the occurrence of one or more events, or the satisfaction of performance criteria or other conditions. Such awards include, without limitation, Options, SARs, Restricted Stock, Restricted Stock Units or Dividend Equivalent Rights, and an Award may consist of one such security or benefit, or two (2) or more of them in any combination or alternative.

(b) Designation of Award. Each Award shall be designated in the Award Agreement. In the case of an Option, the Option shall be designated as a Non-Qualified Stock Option.

(c) Conditions of Award. Subject to the terms of the Plan, the Administrator shall determine the provisions, terms, and conditions of each Award including, but not limited to, the Award vesting schedule, repurchase provisions, rights of first refusal, forfeiture provisions, form of payment (cash, Shares, or other consideration) upon settlement of the Award, payment contingencies, and satisfaction of any performance criteria. The performance criteria established by the Administrator may be based on any one of, or combination of, increase in share price, earnings per share, total stockholder return, return on equity, return on assets, return on investment, net operating income, cash flow, revenue, economic value added, initiation or completion of clinical trials, results of clinical trials, regulatory approval, regulatory submissions, drug development or commercialization milestones, collaboration milestones or strategic partnerships. Partial achievement of the specified criteria may result in a payment or vesting corresponding to the degree of achievement as specified in the Award Agreement.

(d) Acquisitions and Other Transactions. The Administrator may issue Awards under the Plan in settlement, assumption or substitution for, outstanding awards or obligations to grant future awards in connection with the Company or a Related Entity acquiring another entity, an interest in another entity or an additional interest in a Related Entity whether by merger, stock purchase, asset purchase or other form of transaction.

(e) Deferral of Award Payment. The Administrator may establish one or more programs under the Plan to permit selected Grantees the opportunity to elect to defer receipt of consideration upon exercise of an Award, satisfaction of performance criteria, or other event that absent the election would entitle the Grantee to payment or receipt of Shares or other consideration under an Award. The Administrator may establish the election procedures, the timing of such elections, the mechanisms for payments of, and accrual of interest or other earnings, if any, on amounts, Shares or other consideration so deferred, and such other terms, conditions, rules and procedures that the Administrator deems advisable for the administration of any such deferral program.

(f) Separate Programs. The Administrator may establish one or more separate programs under the Plan for the purpose of issuing particular forms of Awards to one or more classes of Grantees on such terms and conditions as determined by the Administrator from time to time.

(g) Early Exercise. The Award Agreement may, but need not, include a provision whereby the Grantee may elect at any time while an Employee, Director or Consultant to exercise any part or all of the Award prior to full vesting of the Award. Any unvested Shares received pursuant to such exercise may be subject to a repurchase right in favor of the Company or a Related Entity or to any other restriction the Administrator determines to be appropriate.

(h) Term of Option or SAR. The term of each Option or SAR shall be the term stated in the Award Agreement, provided, however, that the term shall be no more than ten (10) years from the date of grant thereof.

(i) Transferability of Awards. Unless the Administrator provides otherwise, in its sole discretion, no Award may be sold, pledged, assigned, hypothecated, transferred, or disposed of in any manner other than by will or by the laws of descent or distribution and may be exercised, during the lifetime of the Grantee, only by the Grantee. Notwithstanding the foregoing, the Grantee may designate one or more beneficiaries of the Grantee's Award in the event of the Grantee's death on a beneficiary designation form provided by the Administrator.

(j) Time of Granting Awards. The date of grant of an Award shall for all purposes be the date on which the Administrator makes the determination to grant such Award, or such other later date as is determined by the Administrator.

(k) Stock Appreciation Rights. An SAR may be granted (i) with respect to any Option granted under this Plan, either concurrently with the grant of such Option or at such later time as determined by the Administrator (as to all or any portion of the shares of Common Stock subject to the Option), or (ii) alone, without reference to any related Option. Each SAR granted by the Administrator under this Plan shall be subject to the following terms and conditions. Each SAR granted to any participant shall relate to such number of shares of Common Stock as shall be determined by the Administrator, subject to adjustment as provided in Section 12. In the case of an SAR granted with respect to an Option, the number of shares of Common Stock to which the SAR pertains shall be reduced in the same proportion that the holder of the Option exercises the related Option. The exercise price of an SAR will be determined by the Administrator, in its discretion, at the date of grant but may not be less than one-hundred percent (100%) of the Fair Market Value of the shares of Common Stock subject thereto on the date of grant. Subject to the right of the Administrator to deliver cash in lieu of shares of Common Stock (which, as it pertains to Officers and Directors of the Company, shall comply with all requirements of the Exchange Act), the number of shares of Common Stock which shall be issuable upon the exercise of an SAR shall be determined by dividing:

(i) the number of shares of Common Stock as to which the SAR is exercised multiplied by the amount of the appreciation in such shares (for this purpose, the "appreciation" shall be the amount by which the Fair Market Value of the shares of Common Stock subject to the SAR on the exercise date exceeds (1) in the case of an SAR related to an Option, the exercise price of the shares of Common Stock under the Option or (2) in the case of an SAR granted alone, without reference to a related Option, an amount which shall be determined by the Administrator at the time of grant, subject to adjustment under Section 12); by

(ii) the Fair Market Value of a share of Common Stock on the exercise date.

In lieu of issuing shares of Common Stock upon the exercise of an SAR, the Administrator may elect to pay the holder of the SAR cash equal to the Fair Market Value on the exercise date of any or all of the shares which would otherwise be issuable. No fractional shares of Common Stock shall be issued upon the exercise of an SAR; instead, the holder of the SAR shall be entitled to receive a cash adjustment equal to the same fraction of the Fair Market Value of a share of Common Stock on the exercise date or to purchase the portion necessary to make a whole share at its Fair Market Value on the date of exercise. The exercise of an SAR related to an Option shall be permitted only to the extent that the Option is exercisable under Section 10 on the date of surrender.

(l) Compliance with Section 409A of the Code. Notwithstanding anything to the contrary set forth herein, any Award that is not exempt from the requirements of Section 409A of the Code shall contain such provisions so that such Award will comply with the requirements of Section 409A of the Code. Such restrictions, if any, shall be determined by the Administrator and contained in the Award Agreement evidencing such Award. To the extent that the Administrator determines that any Award granted hereunder is subject to Section 409A of the Code, the Award Agreement evidencing such Award shall incorporate the terms and conditions necessary to avoid the consequences specified in Section 409A(a)(1) of the Code. To the extent applicable, the Plan and Award Agreements shall be interpreted in accordance with Section 409A of the Code and Department of Treasury regulations and other interpretive guidance issued thereunder, including without limitation any such regulations or other guidance that may be issued or amended after the effective date of the Plan. Notwithstanding any provision of the Plan to the contrary, in the event that following the effective date of the Plan, the Administrator determines that any Award may be subject to Section 409A of the Code and related Department of Treasury guidance (including such Department of Treasury guidance as may be issued after the effective date of the Plan), the Administrator may adopt such amendments to the Plan and the applicable Award Agreement or adopt other policies and procedures (including amendments, policies and procedures with retroactive effect), or take any other actions, that the Administrator determines are necessary or appropriate to (1) exempt the Award from Section 409A of the Code and/or preserve the intended tax treatment of the benefits provided with respect to the Award, or (2) comply with the requirements of Section 409A of the Code and related Department of Treasury guidance.

(m) Minimum Vesting. Awards granted to Employees under the Plan that are subject to time vesting shall not vest or become exercisable until at least one year after the date of grant, except in the case of death, Disability, retirement, separation of service or a Corporate Transaction.

7. Award Exercise or Purchase Price, Consideration and Taxes.

(a) Exercise or Purchase Price. The exercise or purchase price, if any, for an Award shall be as follows.

(i) In the case of an Option, the per Share exercise price shall be not less than one-hundred percent (100%) of the Fair Market Value per Share on the date of grant.

(ii) In the case of other Awards, such price as is determined by the Administrator.

(iii) Notwithstanding the foregoing provisions of this Section 7(a), in the case of an Award issued pursuant to Section 6(d), above, the exercise or purchase price for the Award shall be determined in accordance with the provisions of the relevant instrument evidencing the agreement to issue such Award.

(b) Consideration. Subject to Applicable Laws, the consideration to be paid for the Shares to be issued upon exercise or purchase of an Option or upon the issuance of another Award, including the method of payment, shall be determined by the Administrator. In addition to any other types of consideration the Administrator may determine, the Administrator is authorized to accept as consideration for Shares issued under the Plan the following:

(i) cash;

(ii) check;

(iii) surrender of Shares or delivery of a properly executed form of attestation of ownership of Shares as the Administrator may require which have a Fair Market Value on the date of surrender or attestation equal to the aggregate exercise price of the Shares as to which said Award shall be exercised;

(iv) payment through a broker-dealer sale and remittance procedure pursuant to which the Grantee (A) shall provide written instructions to a Company designated brokerage firm to effect the immediate sale of some or all of the purchased Shares and remit to the Company sufficient funds to cover the aggregate exercise price payable for the purchased Shares and (B) shall provide written directives to the Company to deliver the certificates (or other evidence satisfactory to the Company to the extent that the Shares are uncertificated) for the purchased Shares directly to such brokerage firm in order to complete the sale transaction;

(v) with respect to Options, payment through a “net exercise” such that, without the payment of any funds, the Grantee may exercise the Option and receive the net number of Shares equal to (i) the number of Shares as to which the Option is being exercised, multiplied by (ii) a fraction, the numerator of which is the Fair Market Value per Share (on such date as is determined by the Administrator) less the Exercise Price per Share, and the denominator of which is such Fair Market Value per Share; or

(vi) future services to be rendered to the Company or a Related Entity; or

(vii) any combination of the foregoing methods of payment.

The Administrator may at any time or from time to time, by adoption of or by amendment to the standard forms of Award Agreement described in Section 4(c)(iv), or by other means, grant Awards which do not permit all of the foregoing forms of consideration to be used in payment for the Shares or which otherwise restrict one or more forms of consideration.

8. [Intentionally Omitted].

9. Withholding of Additional Income Taxes.

(a) Upon the exercise of an Option or SAR, the grant of any other Award for less than the Fair Market Value of the Common Stock or the vesting of restricted Common Stock acquired on the exercise of an Award hereunder, the Company, in accordance with Section 3402(a) of the Code and any applicable state statute or regulation, may require the Grantee to pay to the Company additional withholding taxes in respect of the amount that is considered compensation includable in such person's gross income. With respect to (i) the exercise of an Option, (ii) the grant of any other Award for less than its Fair Market Value, (iv) the vesting of restricted Common Stock acquired by exercising an Award, or (v) the exercise of an SAR, the Committee in its discretion may condition such event on the payment by the Grantee of any such additional withholding taxes.

(b) At the sole and absolute discretion of the Administrator, the holder of Awards may pay all or any part of the total estimated federal and state income tax liability arising out of the exercise or receipt of such Awards or the vesting of restricted Common Stock acquired on the exercise of an Award hereunder (each of the foregoing, a "***Tax Event***") by tendering already-owned shares of Common Stock or by directing the Company to withhold shares of Common Stock otherwise to be transferred to the Grantee as a result of the exercise or receipt thereof in an amount equal to the estimated federal and state income tax liability arising out of such event, provided that no more Shares may be withheld than are necessary to satisfy the Grantee's withholding obligation with respect to the exercise of Awards; provided, however, that the amount withheld does not exceed the maximum statutory tax rate or such lesser amount as is necessary to avoid liability accounting treatment for Awards granted under the Plan. In such event, the Grantee must, however, notify the Administrator of his or her desire to pay all or any part of the total estimated federal and state income tax liability arising out of a Tax Event by tendering already-owned shares of Common Stock or having shares of Common Stock withheld prior to the date that the amount of federal or state income tax to be withheld is to be determined. For purposes of this Section 9, shares of Common Stock shall be valued at their Fair Market Value on the date that the amount of the tax withholdings is to be determined.

10. Exercise of Award.

(a) Procedure for Exercise; Rights as a Stockholder.

(i) Any Award granted hereunder shall be exercisable at such times and under such conditions as determined by the Administrator under the terms of the Plan and specified in the Award Agreement.

(ii) An Award shall be deemed to be exercised when written notice of such exercise has been given to the Company in accordance with the terms of the Award by the person entitled to exercise the Award and full payment for the Shares with respect to which the Award is exercised has been made, including, to the extent selected, use of the broker-dealer sale and remittance procedure to pay the purchase price as provided in Section 7(b)(v).

(b) Exercise of Award Following Termination of Continuous Service. In the event of termination of a Grantee's Continuous Service for any reason other than Disability or death (but not in the event of a Grantee's change of status from Employee to Consultant), such Grantee may, but only during the Post-Termination Exercise Period (but in no event later than the expiration date of the term of such Award as set forth in the Award Agreement), exercise the portion of the Grantee's Award that was vested at the date of such termination or such other portion of the Grantee's Award as may be determined by the Administrator. The Grantee's Award Agreement may provide that upon the termination of the Grantee's Continuous Service for Cause, the Grantee's right to exercise the Award shall terminate concurrently with the termination of Grantee's Continuous Service. To the extent that the Grantee's Award was unvested at the date of termination, or if the Grantee does not exercise the vested portion of the Grantee's Award within the Post-Termination Exercise Period, the Award shall terminate.

(c) Disability of Grantee. In the event of termination of a Grantee's Continuous Service as a result of his or her Disability, such Grantee may, but only within twelve (12) months from the date of such termination (or such longer period as specified in the Award Agreement but in no event later than the expiration date of the term of such Award as set forth in the Award Agreement), exercise the portion of the Grantee's Award that was vested at the date of such termination. To the extent that the Grantee's Award was unvested at the date of termination, or if Grantee does not exercise the vested portion of the Grantee's Award within the time specified herein, the Award shall terminate.

(d) Death of Grantee. In the event of a termination of the Grantee's Continuous Service as a result of his or her death, or in the event of the death of the Grantee during the Post-Termination Exercise Period or during the twelve (12) month period following the Grantee's termination of Continuous Service as a result of his or her Disability, the Grantee's estate or a person who acquired the right to exercise the Award by bequest or inheritance may exercise the portion of the Grantee's Award that was vested as of the date of termination, within twelve (12) months from the date of death (or such longer period as specified in the Award Agreement but in no event later than the expiration of the term of such Award as set forth in the Award Agreement). To the extent that, at the time of death, the Grantee's Award was unvested, or if the Grantee's estate or a person who acquired the right to exercise the Award by bequest or inheritance does not exercise the vested portion of the Grantee's Award within the time specified herein, the Award shall terminate.

(e) Extension if Exercise Prevented by Law. Notwithstanding the foregoing, if the exercise of an Award within the applicable time periods set forth in this Section 10 is prevented by the provisions of Section 11 below, the Award shall remain exercisable until one (1) month after the date the Grantee is notified by the Company that the Award is exercisable, but in any event no later than the expiration of the term of such Award as set forth in the Award Agreement.

11. Conditions Upon Issuance of Shares.

(a) If at any time the Administrator determines that the delivery of Shares pursuant to the exercise, vesting or any other provision of an Award is or may be unlawful under Applicable Laws, the vesting or right to exercise an Award or to otherwise receive Shares pursuant to the terms of an Award shall be suspended until the Administrator determines that such delivery is lawful and shall be further subject to the approval of counsel for the Company with respect to such compliance. The Company shall have no obligation to effect any registration or qualification of the Shares under foreign, federal or state laws.

(b) As a condition to the exercise of an Award, the Company may require the person exercising such Award to represent and warrant at the time of any such exercise that the Shares are being purchased only for investment and without any present intention to sell or distribute such Shares if, in the opinion of counsel for the Company, such a representation is required by any Applicable Laws.

12. Adjustments. Subject to any required action by the stockholders of the Company, the number of Shares covered by each outstanding Award, and the number of Shares which have been authorized for issuance under the Plan but as to which no Awards have yet been granted or which have been returned to the Plan, the exercise or purchase price of each such outstanding Award, as well as any other terms that the Administrator determines require adjustment shall be proportionately adjusted for (i) any increase or decrease in the number of issued Shares resulting from a stock split, reverse stock split, stock dividend, combination or reclassification of the Shares, or similar transaction affecting the Shares, (ii) any other increase or decrease in the number of issued Shares effected without receipt of consideration by the Company, or (iii) any other transaction with respect to the Company's Common Stock including a corporate merger, consolidation, acquisition of property or stock, separation (including a spin-off or other distribution of stock or property), reorganization, liquidation (whether partial or complete) or any similar transaction; provided, however that conversion of any convertible securities of the Company shall not be deemed to have been "effected without receipt of consideration." Such adjustment shall be made by the Administrator and its determination shall be final, binding and conclusive. Except as the Administrator determines, no issuance by the Company of shares of stock of any class, or securities convertible into shares of stock of any class, shall affect, and no adjustment by reason hereof shall be made with respect to, the number or price of Shares subject to an Award. No adjustments shall be made for dividends paid in cash or in property other than Common Stock of the Company, nor shall cash dividends or dividend equivalents accrue or be paid in respect of unexercised Options or unvested Awards hereunder.

13. Corporate Transactions.

(a) Termination of Award to Extent Not Assumed in Corporate Transaction. Effective upon the consummation of a Corporate Transaction, all outstanding Awards under the Plan shall terminate. However, all such Awards shall not terminate to the extent they are Assumed in connection with the Corporate Transaction.

(b) Acceleration of Award Upon Corporate Transaction. The Administrator shall have the authority, exercisable either in advance of any actual or anticipated Corporate Transaction or at the time of an actual Corporate Transaction and exercisable at the time of the grant of an Award under the Plan or any time while an Award remains outstanding, to provide for the full or partial automatic vesting and exercisability of one or more outstanding unvested Awards under the Plan and the release from restrictions on transfer and repurchase or forfeiture rights of such Awards in connection with a Corporate Transaction on such terms and conditions as the Administrator may specify. The Administrator also shall have the authority to condition any such Award vesting and exercisability or release from such limitations upon the subsequent termination of the Continuous Service of the Grantee within a specified period following the effective date of the Corporate Transaction. The Administrator may provide that any Awards so vested or released from such limitations in connection with a Corporate Transaction shall remain fully exercisable until the expiration or sooner termination of the Award.

14. Effective Date and Term of Plan. The Plan shall become effective upon the its adoption by the Board. It shall continue in effect for a term of ten (10) years from the date of its adoption.

15. Amendment, Suspension or Termination of the Plan.

(a) The Board may at any time amend, suspend or terminate the Plan in any respect, except that it may not, without the approval of the stockholders obtained within twelve (12) months before or after the Board adopts a resolution authorizing any of the following actions, do any of the following:

(i) increase the total number of shares that may be issued under the Plan (except by adjustment pursuant to Section 12);

(ii) modify the provisions of Section 7(a) regarding the exercise price at which shares may be offered pursuant to Options (except by adjustment pursuant to Section 12);

(iii) extend the expiration date of the Plan; and

(iv) except as provided in Section 12 (including, without limitation, due to any stock dividend, stock split, extraordinary cash dividend, recapitalization, reorganization, merger, consolidation, split-up, spin-off, combination, or exchange of shares), amend an Award granted under the Plan to reduce its exercise price per share, cancel and regrant new Awards with lower prices per share than the original prices per share of the cancelled Awards, or cancel any Awards in exchange for cash or the grant of replacement Awards with an exercise price that is less than the exercise price of the original Awards, essentially having the effect of a repricing.

(b) No Award may be granted during any suspension of the Plan or after termination of the Plan.

(c) No suspension or termination of the Plan (including termination of the Plan under Section 15, above) shall adversely affect any rights under Awards already granted to a Grantee without his or her consent.

16. Reservation of Shares.

(a) The Company, during the term of the Plan, will at all times reserve and keep available such number of Shares as shall be sufficient to satisfy the requirements of the Plan.

(b) The inability of the Company to obtain authority from any regulatory body having jurisdiction, which authority is deemed by the Company's counsel to be necessary to the lawful issuance and sale of any Shares hereunder, shall relieve the Company of any liability in respect of the failure to issue or sell such Shares as to which such requisite authority shall not have been obtained.

17. No Effect on Terms of Employment/Consulting Relationship. The Plan shall not confer upon any Grantee any right with respect to the Grantee's Continuous Service, nor shall it interfere in any way with his or her right or the right of the Company or a Related Entity to terminate the Grantee's Continuous Service at any time, with or without Cause, and with or without notice. The ability of the Company or any Related Entity to terminate the employment of a Grantee who is employed at will is in no way affected by its determination that the Grantee's Continuous Service has been terminated for Cause for the purposes of this Plan.

18. No Effect on Retirement and Other Benefit Plans. Except as specifically provided in a retirement or other benefit plan of the Company or a Related Entity, Awards shall not be deemed compensation for purposes of computing benefits or contributions under any retirement plan of the Company or a Related Entity, and shall not affect any benefits under any other benefit plan of any kind or any benefit plan subsequently instituted under which the availability or amount of benefits is related to level of compensation. The Plan is not a "Retirement Plan" or "Welfare Plan" under the Employee Retirement Income Security Act of 1974, as amended.

19. Electronic Delivery. The Administrator may, in its sole discretion, decide to deliver any documents related to any Award granted under the Plan through an online or electronic system established and maintained by the Company or another third party designated by the Company or to request a Grantee's consent to participate in the Plan by electronic means. Each Grantee hereunder consents to receive such documents by electronic delivery and agrees to participate in the Plan through an online or electronic system established and maintained by the Company or another third party designated by the Company, and such consent shall remain in effect throughout Grantee's term of employment or service with the Company and any Related Entity and thereafter until withdrawn in writing by Grantee.

20. Data Privacy. The Administrator may, in its sole discretion, decide to collect, use and transfer, in electronic or other form, personal data as described in this Plan or any Award for the exclusive purpose of implementing, administering and managing participation in the Plan. Each Grantee hereunder acknowledges that the Company holds certain personal information about Grantee, including, but not limited to, name, home address and telephone number, date of birth, social security number or other identification number, salary, nationality, job title, details of all Awards awarded, cancelled, exercised, vested or unvested, for the purpose of implementing, administering and managing the Plan (the "***Data***"). Each Grantee hereunder further acknowledges that Data may be transferred to any third parties assisting in the implementation, administration and management of the Plan and sale and issuance of shares issued pursuant to

Awards and that these third parties may be located in jurisdictions that may have different data privacy laws and protections, and Grantee authorizes such third parties to receive, possess, use, retain and transfer the Data, in electronic or other form, for the purposes of implementing, administering and managing the Plan, including any requisite transfer of such Data as may be required to a broker or other third party with whom the recipient or the Company may elect to deposit any shares of Common Stock acquired upon any Award.

21. Unfunded Obligation. Grantees shall have the status of general unsecured creditors of the Company. Any amounts payable to Grantees pursuant to the Plan shall be unfunded and unsecured obligations for all purposes, including, without limitation, Title I of the Employee Retirement Income Security Act of 1974, as amended. Neither the Company nor any Related Entity shall be required to segregate any monies from its general funds, or to create any trusts, or establish any special accounts with respect to such obligations. The Company shall retain at all times beneficial ownership of any investments, including trust investments, which the Company may make to fulfill its payment obligations hereunder. Any investments or the creation or maintenance of any trust or any Grantee account shall not create or constitute a trust or fiduciary relationship between the Administrator, the Company or any Related Entity and a Grantee, or otherwise create any vested or beneficial interest in any Grantee or the Grantee's creditors in any assets of the Company or a Related Entity. The Grantees shall have no claim against the Company or any Related Entity for any changes in the value of any assets that may be invested or reinvested by the Company with respect to the Plan.

22. Construction. Captions and titles contained herein are for convenience only and shall not affect the meaning or interpretation of any provision of the Plan. Except when otherwise indicated by the context, the singular shall include the plural and the plural shall include the singular. Use of the term "or" is not intended to be exclusive, unless the context clearly requires otherwise.

As approved by the Board of Directors on August 6, 2019

Exhibit 10.5

ASSEMBLY BIOSCIENCES, INC.
2019 Inducement Award Plan
NOTICE OF STOCK OPTION GRANT

Grant Number 2019-IAP-###

_____

_____

You have been granted an option to purchase Common Stock of Assembly Biosciences, Inc. (the "Company"), as follows:

Date of Grant	[_____]
Vesting Commencement Date	[_____]
Exercise Price per Share	$____
Total Number of Shares Granted	_____
Total Exercise Price	$_____
Type of Option:	Nonstatutory Stock Option
Term/Expiration Date:	10 years
Vesting Schedule:	[___] to vest on the first anniversary of the vesting commencement date; and thereafter [__] of remaining option shares to vest each month thereafter for [___] months; in each case subject to your Continuous Services through such vesting date and otherwise in accordance with the terms and conditions of the Plan (as defined below) and the Stock Option Agreement attached hereto. Shares to vest on any vesting date shall be rounded down to nearest whole number. Monthly installments shall take into effect prior rounding so that each monthly installment including the last installment is approximately the same. On the [____] anniversary of the vesting commencement date, assuming Continuous Service through each vesting date, the option shall be fully vested. Upon the termination of your employment by the Company for any reason other than for Cause within 6 months following the occurrence of a Corporate Transaction, all unvested options shall immediately vest. [Subject to the terms and conditions set forth in your employment agreement dated as of _____ (your "Employment Agreement"), including the condition that you execute a release in form and substance reasonably satisfactory to the Company and you, in connection with your termination of employment this option shall be subject to additional provisions relating to the acceleration of vesting of equity awards as set forth in Section ____ of your Employment Agreement.]
Termination Period:	Vested option shares may be exercised for up to 90 days after termination of Continuous Service, unless a longer post-termination exercise period is provided in your Employment Agreement or the Stock Option Agreement attached hereto. By your signature or electronic acceptance of this option and the signature of the Company's representative below, you and the Company agree that this option is granted under and governed by the terms and conditions of the Assembly Biosciences, Inc. 2019 Inducement Award Plan (the "Plan") and the Stock Option Agreement, all of which are attached and made a part of this document. Capitalized terms used in this Notice of Stock Option Grant and not otherwise defined herein shall have the meaning assigned to such term in the Plan.

Dated: _____

OPTIONEE:

_____
[Name]

ASSEMBLY BIOSCIENCES, INC.

By: _____

Name: _____

Title: _____

ASSEMBLY BIOSCIENCES, INC.

STOCK OPTION AGREEMENT

1. Grant of Option. Assembly Biosciences, Inc. (the "Company"), hereby grants to the Optionee named in the Notice of Grant (the ""Optionee") an option (this "Option") to purchase a total number of shares of Common Stock (the "Shares") set forth in the Notice of Grant, at the exercise price per share set forth in the Notice of Grant (the "Exercise Price") subject to the terms, definitions and provisions of the Assembly Biosciences, Inc. 2019 Inducement Award Plan (the "Plan") adopted by the Company, which is incorporated herein by reference. Unless otherwise defined herein, the terms defined in the Plan shall have the same defined meanings in this Option.

2. Exercise of Option. This Option shall be exercisable during its term in accordance with the Vesting Schedule set out in the Notice of Grant and with the provisions of Sections 10 and 11 of the Plan as follows:

(a) Right to Exercise.

(i) This Option may not be exercised for a fraction of a share.

(ii) In no event may this Option be exercised after the date of expiration of the term of this Option as set forth in the Notice of Grant.

(b) Method of Exercise. This Option shall be exercisable by written notice (in the form attached hereto as ***Exhibit A***) which shall state the election to exercise this Option, the number of Shares in respect of which this Option is being exercised, and such other representations and agreements as to the holder's investment intent with respect to such shares of Common Stock as may be required by the Company pursuant to the provisions of the Plan. Such written notice shall be signed by the Optionee and shall be delivered in person, by certified mail or electronic transmission (with confirmation of receipt) to the Secretary of the Company. The written notice shall be accompanied by payment of the Exercise Price. This Option shall be deemed to be exercised upon receipt by the Company of such written notice accompanied by the Exercise Price. Alternatively, this Option may be exercised through the Company's online equity platform and in compliance with the procedures set forth therein.

Notwithstanding anything to the contrary contained herein, you may not exercise your option unless the shares of Common Stock issuable upon such exercise are then registered under the Securities Act of 1933, as amended (the "Securities Act"), or, if such shares of Common Stock are not then so registered, the Company has determined that such exercise and issuance would be exempt from the registration requirements of the Securities Act. The exercise of your Option also must comply with other applicable laws and regulations governing your Option, and you may not exercise your Option if the Company determines that such exercise would not be in material compliance with such laws and regulations. No Shares will be issued pursuant to the exercise of this Option unless such issuance and such exercise shall comply with all relevant provisions of law and the requirements of any stock exchange upon which the Shares may then be listed. Assuming such compliance, for income tax purposes the Shares shall be considered transferred to the Optionee on the date on which this Option is exercised with respect to such Shares.

3. Method of Payment. Payment of the Exercise Price shall be by any of the following, or a combination thereof, at the election of the Optionee:

(i) cash; or

(ii) check; or

(iii) surrender of other shares of Common Stock of the Company, or attestation of ownership of such shares, as described in Section 7(b)(iv) of the Plan; or

(iv) "net exercise" as described in Section 7(b)(vi) of the Plan; or

(v) a broker-assisted exercise as described in Section 7(b)(v) of the Plan; or

(vi) any combination of the foregoing methods of payment.

4. Nontransferability of Option. This Option may not be transferred in any manner other than as set forth in the Plan. The terms of this Option shall be binding upon the executors, administrators, heirs, successors transferees and assigns of the Optionee as if such persons were the Optionee.

5. Termination of Relationship. In the event of termination of the Optionee's Continuous Service, the Optionee may, to the extent otherwise so entitled at the date of such termination (the "Termination Date"), exercise this Option during the Termination Period set out in the Notice of Grant. To the extent that the Optionee was not entitled to exercise this Option at the date of such termination, or if Optionee does not exercise this Option within the time specified herein, this Option shall terminate.

6. Term of Option. This Option may be exercised only within the term set out in the Notice of Grant and the Plan, and may be exercised during such term only in accordance with the Plan and the terms of this Option.

7. Disability of Optionee. Notwithstanding the provisions of Section 5 above, in the event of termination of Optionee's Continuous Service as a result of Optionee's Disability, Optionee may, but only within twelve (12) months from the date of termination of Continuous Service (but in no event later than the date of expiration of the term of this Option as set forth in the Notice of Grant), exercise this Option to the extent Optionee was entitled to exercise it at the Termination Date. To the extent that Optionee was not entitled to exercise this Option at the Termination Date, or if Optionee does not exercise such Option (which Optionee was entitled to exercise) within the time specified herein, this Option shall terminate.

8. Death of Optionee. In the event of the death of the Optionee during the ''Optionee's Continuous Service or within ninety (90) days of termination of such 'Continuous Service, this Option may be exercised at any time within twelve (12) months following the Termination Date (but in no event later than the date of expiration of the term of this Option as set forth in the Notice of Grant), by Optionee's estate or by a person who acquired the right to exercise this Option by bequest or inheritance, but only to the extent of the right to exercise that Optionee was entitled to at the date of death.

9. Taxation Upon Exercise of Option. Pursuant to Section 9 of the Plan, the Company may require the Optionee to pay to the Company amounts necessary to satisfy any applicable Company withholding obligations. The Optionee shall satisfy Optionee's tax withholding obligation arising upon the exercise of this Option by one or some combination of the following methods: (i) by cash payment, or (ii) out of Optionee's current compensation, or (iii) if permitted by the Board or Committee, in its discretion, by surrendering to the Company already-owned Shares or by directing the Company to withhold shares otherwise to be transferred to the Optionee, in each case in accordance with Section 9(b) of the Plan. For this purpose, the Fair Market Value of the Shares to be withheld shall be determined on the date that the amount of tax to be withheld is to be determined (the "Tax Date").

If the Optionee is subject to Section 16 of the Securities Exchange Act of 1934, as amended (the "Exchange Act (an "Insider"), any surrender of previously owned Shares to satisfy tax withholding obligations arising upon exercise of this Option must comply with the applicable provisions of Rule 16b-3 promulgated under the Exchange Act ("Rule 16b-3") and shall be subject to such additional conditions or restrictions as may be required thereunder to qualify for the maximum exemption from Section 16 of the Exchange Act with respect to Plan transactions.

All elections by an Optionee to have Shares withheld to satisfy tax-withholding obligations shall be made in writing in a form acceptable to the Committee and shall be subject to the following restrictions:

(1) the election must be made on or prior to the applicable Tax Date;

(2) once made, the election shall be irrevocable as to the particular Shares of this Option as to which the election is made;

(3) all elections shall be subject to the consent or disapproval of the Board or Committee;

(4) if the Optionee is an Insider, the election must comply with the applicable provisions of Rule 16b-3 and shall be subject to such additional conditions or restrictions as may be required thereunder to qualify for the maximum exemption from Section 16 of the Exchange Act with respect to Plan transactions.

10. Tax Consequences. Set forth below is a brief summary as of the date of this Option of some of the federal tax consequences of exercise of this Option and disposition of the Shares. THIS SUMMARY IS NECESSARILY INCOMPLETE, AND THE TAX LAWS AND REGULATIONS ARE SUBJECT TO CHANGE. OPTIONEE SHOULD CONSULT A TAX ADVISER BEFORE EXERCISING THIS OPTION OR DISPOSING OF THE SHARES.

(a) Exercise of Nonstatutory Stock Option. There may be a regular federal income tax liability and a state income tax liability upon the exercise of this Option. The Optionee will be treated as having received compensation income (taxable at ordinary income tax rates) equal to the excess, if any, of the fair market value of the Shares on the date of exercise over the Exercise Price and the Company will qualify for a deduction in the same amount. The Company will be required to withhold from Optionee's compensation or collect from Optionee and pay to the applicable taxing authorities an amount equal to a percentage of this compensation income at the time of exercise.

(b) Disposition of Shares. If Shares are held for at least one year, any gain realized on disposition of the Shares will be treated as long-term capital gain for federal income tax purposes.

11. Successors and Assigns. The Company may assign any of its rights under this Agreement to single or multiple assignees, and this Agreement shall inure to the benefit of the successors and assigns of the Company. Subject to the restrictions on transfer herein set forth, this Agreement shall be binding upon Optionee and his or her heirs, executors, administrators, successors, transferees and assigns.

12. Interpretation. Any dispute regarding the interpretation of this Agreement shall be submitted by Optionee or by the Company forthwith to the Company's Board of Directors or the Committee that administers the Plan, which shall review such dispute at its next regular meeting. The resolution of such a dispute by the Board or committee shall be final and binding on the Company and on Optionee.

13. Governing Law; Severability. This Agreement shall be governed by and construed in accordance with the laws of the State of Delaware excluding that body of law pertaining to conflicts of law. Should any provision of this Agreement be determined by a court of law to be illegal or unenforceable, the other provisions shall nevertheless remain effective and shall remain enforceable.

14. Notices. Any notice required or permitted hereunder shall be given in writing and shall be deemed effectively given upon receipt or three (3) days after deposit in the United States mail by certified mail, with postage and fees prepaid, addressed to in the case of the Company at its corporate headquarters and in the case of Optionee at the last address Optionee provided to the Company. Notwithstanding the foregoing, the Company may, in its sole discretion, decide to deliver any documents related to participation in the Plan and this option by electronic means or to request your consent to participate in the Plan by electronic means. You hereby consent to receive such documents by electronic delivery and, if requested, to agree to participate in the Plan through an on-line or electronic system established and maintained by the Company or another third party designated by the Company.

15. Option Not a Service Contract.

(a) Your Continuous Service with the Company or a Related Entity is not for any specified term and may be terminated by you or by the Company or a Related Entity at any time, for any reason, with or without cause and with or without notice. Nothing in this Agreement (including, but not limited to, the vesting of your Option pursuant to the schedule set forth in the Notice of Stock Option Grant or the issuance of the shares upon exercise of your Option), the Plan or any covenant of good faith and fair dealing that may be found implicit in this Agreement or the Plan shall: (i) confer upon you any right to continue in the employ of, or affiliation with, the Company or a Related Entity; (ii) constitute any promise or commitment by the Company or a Related Entity regarding the fact or nature of future positions, future work assignments, future compensation or any other term or condition of employment or affiliation; (iii) confer any right or benefit under this Agreement or the Plan unless such right or benefit has specifically accrued under the terms of this Agreement or Plan; or (iv) deprive the Company of the right to terminate you at will and without regard to any future vesting opportunity that you may have.

(b) By accepting this Option, you acknowledge and agree that the right to continue vesting in this Option pursuant to the schedule set forth in Notice of Stock Option Grant is earned only by Continuous Service (not through the act of being hired, being granted this Option or any other award or benefit) and that the Company has the right to reorganize, sell, spin-out or otherwise restructure one or more of its businesses or Related Entity at any time or from time to time, as it deems appropriate (a "reorganization"). You further acknowledge and agree that such a reorganization could result in the termination of your Continuous Service, or the termination of Related Entity status of your employer and the loss of benefits available to you under this Agreement, including but not limited to, the termination of the right to continue vesting in the Option. You further acknowledge and agree that this Agreement, the Plan, the transactions contemplated hereunder and the vesting schedule set forth herein or any covenant of good faith and fair dealing that may be found implicit in any of them do not constitute an express or implied promise of continued engagement as an employee or consultant for the term of this Agreement, for any period, or at all, and shall not interfere in any way with your right or the Company's right to terminate your Continuous Service at any time, with or without Cause and with or without notice.

16. Further Instruments. The parties agree to execute such further instruments and to take such further action as may be reasonably necessary to carry out the purposes and intent of this Agreement.

17. 2019 Inducement Award Plan. This Option shall be subject to and governed by the terms and conditions of the Plan in all respects, and to the extent of any inconsistency between this Option and the terms of the Plan, the terms of the Plan will control. Optionee acknowledges receipt of a copy of the Plan and represents that Optionee is familiar with the terms and provisions thereof, and hereby accepts this Option subject to all of the terms and provisions thereof. Optionee has reviewed the Plan and this Option in their entirety, has had an opportunity to obtain the advice of counsel prior to executing this Option and fully understands all provisions of this Option. Optionee hereby agrees to accept as binding, conclusive and final all decisions or interpretations of the Board or Committee upon any questions arising under the Plan or this Option.

18. Other Documents. You acknowledge receipt of the Company's insider trading policy and agree to comply with its terms.

EXHIBIT A

ASSEMBLY BIOSCIENCES, INC.

EXERCISE NOTICE[1]

Assembly Biosciences, Inc.

Attention: Secretary

1. Exercise of Option. Effective as of today, the undersigned ("Optionee") hereby elects to exercise Optionee's option to purchase _____ shares of the Common Stock (the "Shares") of Assembly Biosciences, Inc. (the "Company") under and pursuant to the Company's 2019 Inducement Award Plan (as amended from time to time, the "Plan") and the Notice of Stock Option Grant dated _____, 20___ with its attached Stock Option Agreement (the "Option Agreement"). The purchase price for the Shares shall be $_____ as required by this Option Agreement. Optionee herewith delivers to the Company the full Exercise Price for the Shares.

2. Representations of Optionee. Optionee acknowledges that Optionee has received, read and understood the Plan and this Option Agreement and agrees to abide by and be bound by their terms and conditions. Optionee represents that Optionee is purchasing the Shares for Optionee's own account for investment and not with a view to, or for sale in connection with, a distribution of any of such Shares.

3. Rights as Stockholder. Until the stock certificate evidencing such Shares is issued (as evidenced by the appropriate entry on the books of the Company or of a duly authorized transfer agent of the Company), no right to vote or receive dividends or any other rights as a stockholder shall exist with respect to the optioned Shares, notwithstanding the exercise of this Option. The Company shall issue (or cause to be issued) such stock certificate promptly after this Option is exercised.

4. Tax Consultation. Optionee understands that Optionee may suffer adverse tax consequences as a result of Optionee's purchase or disposition of the Shares. Optionee represents that Optionee has consulted with any tax consultants Optionee deems advisable in connection with the purchase or disposition of the Shares and that Optionee is not relying on the Company for any tax advice.

5. Entire Agreement. The Plan and Option Agreement are incorporated herein by reference. This Exercise Notice, the Plan and this Option Agreement shall constitute the entire agreement of the parties and supersede in their entirety all prior undertakings and agreements of the Company and Optionee with respect to the subject matter hereof, and is governed by Delaware law except for that body of law pertaining to conflict of laws.

[1] Exercises may be effected through the Company's online equity award platform in lieu of this Exercise Notice.

Submitted by:

OPTIONEE:

_____

Address: _____

_____

_____

Accepted by:

Assembly Biosciences, Inc.

By: _____

Name: _____

Title: _____

Address: _____

_____

_____

Exhibit 10.6

EMPLOYMENT AGREEMENT

This EMPLOYMENT AGREEMENT (the "**Agreement**"), is entered into as of September 30, 2019 (the "**Execution Date**") with an effective date of October 28, 2019 (the "**Effective Date**"), by and between Assembly Biosciences, Inc., a Delaware corporation with principal executive offices at 11711 N. Meridian Street, Suite 310, Carmel, IN 46032 (the "**Company**"), and Thomas J. Russo, CFA (the "**Executive**").

W I T N E S S E T H:

WHEREAS, the Company desires to employ the Executive as the Chief Financial Officer as of the Effective Date, and the Executive desires to accept employment by the Company as of the Effective Date; and

WHEREAS, the parties desire to enter into this Agreement, setting forth the terms and conditions of the Executive's employment with the Company;

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein contained, the parties hereto hereby agree as follows:

1. Employment.

(a) Services. The Executive will be employed by the Company initially as its Chief Financial Officer, reporting to the Company's Chief Executive Officer, and shall perform such duties as are consistent with a position as Chief Financial Officer (the "**Services**"). The Executive agrees to perform such Services faithfully, to devote Executive's full working time, attention and energies to the business of the Company and, while Executive remains employed and subject to the terms of this Agreement, not to engage in any other business activity that is in conflict with Executive's duties and obligations to the Company.

(b) Acceptance. The Executive hereby accepts such employment and agrees to render the Services.

2. Term. The Executive's employment under this Agreement shall commence as of the Effective Date and shall continue on an "at-will" basis until terminated pursuant to Section 7 of this Agreement (the "**Term**").

3. Best Efforts. The Executive shall devote Executive's full business time, attention and energies to the business and affairs of the Company and shall use Executive's reasonable best efforts to advance the best interests of the Company and during the Term shall not be actively engaged in any other business activity, whether or not such business activity is pursued for gain, profit or other pecuniary advantage, that will interfere with the performance by the Executive of Executive's duties hereunder or the Executive's availability to perform such duties or that will adversely affect, or negatively reflect upon, the Company.

4. Compensation. During the Term, as full compensation for the performance by the Executive of his duties under this Agreement, the Company shall pay the Executive as follows:

(a) Base Salary. The Company shall pay the Executive an initial base salary at the annualized rate of four hundred twenty-five thousand dollars ($425,000). The base salary in effect at any given time is referred to herein as the "**Base Salary**." Payment shall be made in accordance with the Company's normal payroll practices, as they may be changed from time to time. The Base Salary will be reviewed by the Chief Executive Officer and the Board of Directors (the "**Board**"), or a committee thereof, no less frequently than annually.

(b) Annual Performance Bonus. At the sole discretion of the Board (or a committee thereof), the Executive shall be eligible to receive an annual performance-based bonus during the Term (the "**Annual Performance Bonus**") targeted at forty percent (40%) of Executive's then current Base Salary based on the attainment by the Executive of performance objectives as established annually by the Chief Executive Officer. Any Annual Performance Bonus earned with respect to the 2019 fiscal year shall be based on the attainment by the Company of the performance objectives established by the Board (or a committee thereof) for the other named executive officers of the Company for the 2019 fiscal year and will be prorated based upon the number of days the Executive is employed in the 2019 fiscal year. The Annual Performance Bonus shall be payable in a single lump-sum as determined by the Board (or a committee thereof) in its sole discretion. Except as otherwise provided in this Agreement, to earn any particular Annual Performance Bonus, the Executive must, in addition to satisfying the performance objectives, remain employed on the date the Annual Performance Bonus is paid; *provided*, *further*, that the Annual Performance Bonus will be paid no later than seventy-five (75) days after the end of the period to which the Annual Performance Bonus pertains.

(c) Sign-on Bonus. The Company will pay the Executive a sign-on bonus in the gross amount of $100,000 (the "**Sign-on Bonus**"), less such taxes and applicable withholdings as required by law. The Sign-on Bonus will be payable to the Executive in a cash lump sum within 30 days following the Effective Date. If, prior to the one year anniversary of the Effective Date, the Executive terminates employment with the Company other than for Good Reason (as defined in Section 7(d)) or death or Disability (as defined in Section 7(b)) or the Company terminates the Executive for Cause (as defined in Section 7(a)), then the Executive will promptly repay to the Company 100% of the net amount of the Sign-On Bonus. If the Executive is obligated under this Section 4(c) to repay to the Company the Sign-on Bonus, then the Company may, in its discretion and as permitted under applicable law, off-set all or part of the Executive's obligation under this Section 4(c) against amounts otherwise due to the Executive from the Company.

(d) Withholding. Amounts payable to the Executive under this Agreement, including Section4 and Section 8, shall be net of all applicable federal, state and local taxes, social security and such other amounts as the Company may be required by law to withhold from such amounts.

(e) Equity. As a material inducement to accept the Company's offer of employment, the Company will recommend to the Board (or a committee thereof) that the Executive be granted, subject to the Executive's acceptance of this Agreement and commencement of employment, an option to purchase 185,000 shares of common stock of the Company (the "**New Hire Stock Option**"). As an inducement that is material to the Executive's employment with the Company, the New Hire Stock Option will be granted to the Executive under the Company's 2017 Inducement Award Plan (the "**Inducement Plan**") pursuant to the inducement grant exception under Nasdaq Rule 5635(c)(4). Subject to the Executive's continued employment and the terms of the Company's Inducement Plan and the applicable non-qualified stock option agreement entered into by the Executive and the Company pursuant to the Inducement Plan, the New Hire Stock Option will be granted as of the Effective Date, will have a term of ten years and the shares underlying the New Hire Stock Option shall vest in installments over four years with the first installment (representing approximately 25% of the shares) vesting on the first anniversary of the grant date and the balance vesting over the next three years thereafter in approximately equal monthly installments. The New Hire Stock Option will have an exercise price equal to the closing price of a common share of the Company on the Nasdaq Global Select Market on the grant date. The New Hire Stock Option shall be subject to accelerated vesting of time-based vesting awards in connection with a termination of employment to the extent and as provided in Section 8(b) of this Agreement. The New Hire Stock Option and any subsequently granted equity or stock-based awards under the Company's equity incentive plans, including stock options and restricted stock unit awards, will be collectively referred to in this Agreement as the "**Equity Awards**."

(f) Expenses. The Company shall provide the Executive with a corporate credit card for business use, and shall reimburse the Executive for all normal, usual and necessary expenses incurred by the Executive in furtherance of the business and affairs of the Company, including reasonable travel and entertainment, upon timely receipt by the Company of appropriate vouchers or other proof of the Executive's expenditures and otherwise in accordance with any expense reimbursement policy as may from time to time be adopted by the Company.

(g) Other Benefits. The Executive shall be entitled to all rights and benefits for which Executive shall be eligible under any benefit or other plans (including, without limitation, dental, medical, medical reimbursement and hospital plans, pension plans, employee stock purchase plans, profit sharing plans, bonus plans and other so-called "**Fringe Benefits**") as the Company shall make available to its senior executives from time to time, subject to the terms of such plans. In addition, if applicable, the Company shall reimburse the Executive for Executive's reasonable licensing fees, continuing professional education, and other professional dues upon timely receipt by the Company of appropriate vouchers or other proof of the Executive's expenditures and otherwise in accordance with any expense reimbursement policy as may from time to time be adopted by the Company. The Company shall also name the Executive as a covered person under its Directors & Officers insurance policies.

(h) Vacation. The Executive will be entitled to paid vacation in accordance with the Company's vacation policy, as in effect from time to time.

5. Confidential Information and Inventions. The Executive agrees to execute and comply with the Company's standard form of Proprietary Information and Inventions Agreement, as it may be amended from time to time (the "**PIIA**").

6. Representations and Warranties.

(a) The Executive hereby represents and warrants to the Company as follows:

(i) Neither the execution or delivery of this Agreement nor the performance by the Executive of Executive's duties and other obligations hereunder violate or will violate any statute, law, determination or award, or conflict with or constitute a default or breach of any covenant or obligation under (whether immediately, upon the giving of notice or lapse of time or both) any prior employment agreement, contract, or other instrument to which the Executive is a party or by which he is bound.

(ii) The Executive has the full right, power and legal capacity to enter and deliver this Agreement and to perform Executive's duties and other obligations hereunder. This Agreement constitutes the legal, valid and binding obligation of the Executive enforceable against him in accordance with its terms. No approvals or consents of any persons or entities are required for the Executive to execute and deliver this Agreement or perform Executive's duties and other obligations hereunder.

(b) The Company hereby represents and warrants to the Executive that this Agreement and the employment of the Executive hereunder have been duly authorized by and on behalf of the Company, including, without limitation, by all required action by the Board.

7. Termination. The Executive's employment hereunder shall be terminated immediately upon the Executive's death and may be otherwise terminated as follows:

(a) The Executive's employment hereunder may be terminated by the Company for Cause as determined by the Chief Executive Officer. Any of the following actions by the Executive shall constitute "**Cause**":

(i) The willful failure or disregard or continuing refusal by the Executive to perform his duties hereunder;

(ii) Any act of willful or intentional misconduct, or a grossly negligent act by the Executive having the effect of injuring, in a material way (as determined in good-faith by the Company), the business or reputation of the Company, including but not limited to, any officer, director, or executive of the Company;

(iii) Willful misconduct by the Executive in carrying out his duties or obligations under this Agreement, including, without limitation, insubordination with respect to lawful directions received by the Executive from the Chief Executive Officer or from the Board having the effect of injuring, in a material way (as determined in good-faith by the Chief Executive Officer), the business or reputation of the Company;

(iv) The Executive's indictment of any felony or a misdemeanor involving moral turpitude (including entry of a nolo contendere plea);

(v) The determination by the Company, based upon clear and convincing evidence, after a reasonable and good-faith investigation by the Company following a written allegation by another employee of the Company, that the Executive engaged in some form of harassment or discrimination prohibited by law (including, without limitation, age, sex or race discrimination);

(vi) Any intentional misappropriation of the property of the Company, or embezzlement of its funds or assets (whether or not a misdemeanor or felony);

(vii) Breach by the Executive of any of the provisions of the PIIA; and

(viii) Breach by the Executive of any provision of this Agreement other than those contained in the PIIA, which is not cured by the Executive within thirty (30) business days after notice thereof is given to the Executive by the Company.

Except for a failure, misconduct, breach, or refusal which, by its nature, cannot reasonably be expected to be cured, the Executive shall have ten (10) business days from the delivery of written notice by the Company within which to cure any acts constituting Cause, unless a longer cure period is provided in the act constituting Cause described above; provided however, that, if the Company reasonably expects irreparable injury from a delay of ten (10) business days, the Company may give the Executive notice of such shorter period within which to cure as is reasonable under the circumstances, which may include the termination of the Executive's employment for Cause without notice and with immediate effect.

(b) The Executive's employment hereunder may be terminated by the Chief Executive Officer due to the Executive's Disability. For purposes of this Agreement, a termination for "**Disability**" shall occur (i) when the Chief Executive Officer has provided a written termination notice to the Executive supported by a written statement from a reputable independent physician mutually selected by the Company and the Executive, or the Executive's legal representatives in the event the Executive is unable to make such selection due to mental incapacity, to the effect that the Executive shall have become so physically or mentally incapacitated as to be unable to resume, even with reasonable accommodation as may be required under the Americans With Disabilities Act, within the ensuing twelve (12) months, the Executive's employment hereunder by reason of physical or mental illness or injury, or (ii) upon rendering of a written termination notice by the Company after the Executive has been unable to substantially perform his duties hereunder, even with reasonable accommodation as may be required under the Americans With Disabilities Act, for one hundred twenty (120) or more consecutive days, or more than one hundred eighty (180) days in any consecutive twelve (12) month period, by reason of any physical or mental illness or injury. For purposes of this Section 7(b), the Executive agrees to make himself available and to cooperate in any reasonable examination by a reputable independent physician mutually selected by the Company and the Executive and paid for by the Company. Notwithstanding the foregoing, nothing herein shall give the Company the right to terminate the Executive prior to discharging its obligations to the Executive, if any, under the Family and Medical Leave Act, the Americans With Disabilities Act, or any other applicable law. The Company shall reimburse the Executive for the Executive's actual cost of maintaining a supplementary long-term disability insurance policy during the Term up to a maximum reimbursement of $10,000 per year.

(c) The Executive's employment hereunder may be terminated by the Company (or its successor) by written notice to the Executive upon the occurrence of a Change of Control. For purposes of this Agreement, "**Change of Control**" means (i) the acquisition, directly or indirectly, following the Effective Date by any person (as such term is defined in Section 13(d) and 14(d)(2) of the Securities Exchange Act of 1934, as amended), in one transaction or a series of related transactions, of securities of the Company representing in excess of fifty percent (50%) of the combined voting power of the Company's then outstanding securities if such person or his or its affiliate(s) do not own in excess of fifty percent (50%) of such voting power on the Effective Date of this Agreement, (ii) the future disposition by the Company (whether direct or indirect, by sale of assets or stock, merger, consolidation or otherwise) of all or substantially all of its business and/or assets in one transaction or series of related transactions other than a merger effected exclusively for the purpose of changing the domicile of the Company, or (iii) a "corporate transaction" as defined in the Company equity incentive plans under which the Executive has been granted Equity Awards. Notwithstanding the foregoing, if the Change of Control does not constitute a change in the ownership or effective control of the Company, or in the ownership of a substantial portion of the assets of the Company, within the meaning of Section 409A of the Internal Revenue Code of 1986, as amended (the "**Cod**e"), the amount of cash severance payable pursuant to Section 8(b), if any, shall be paid in equal installments in accordance with the Company's then payroll practice over a 12-month period. Solely for purposes of Section 409A of the Code, each installment payment under this Agreement is considered a separate payment.

(d) The Executive's employment hereunder may be voluntarily terminated by the Executive for Good Reason. For purposes of this Agreement, "**Good Reason**" shall mean any of the following: (i) any material reduction by the Company of the Executive's duties, or responsibilities or authority that, taken as a whole, results in a material diminution of position; provided, however, that a change in the Executive's title or reporting relationship shall not by itself constitute a termination by the Executive for Good Reason under this clause (i); (ii) any material (meaning 10% or more) reduction by the Company of the Executive's Base Salary and/or target Annual Performance Bonus payable hereunder (it being understood that an across-the-board reduction applicable to all similarly situated employees of the Company, including the Executive, shall not be deemed a reduction for purposes of this definition); (iii) any requirement by the Company, without the Executive's prior written consent, that the Executive locate the Executive's residence or primary place of employment to a location outside a 50-mile radius of such location mutually agreed upon between the Company and the Executive as of the Effective Date, or such other location that the Company and the Executive may mutually agree upon and designate from time to time during the Term; or (iv) a material breach by the Company of Section 6(b) of this Agreement which is not cured by the Company within thirty (30) days after written notice thereof is given to the Company by the Executive. However, notwithstanding the above, Good Reason shall not exist unless: (x) the Executive notifies in writing the Chief Executive Officer within thirty (30) days of the initial existence of one of the adverse events described above, and (y) the Company fails to correct the adverse event within thirty (30) days of such written notice, and (z) the Executive's voluntary termination because of the existence of one or more of the adverse events described above occurs within ninety (90) days of the initial existence of the event.

(e) The Executive's employment may be terminated by the Company without Cause by delivery of written notice to the Executive effective the date of delivery of such notice. For the avoidance of doubt, termination of the Executive's employment due to his death or Disability does not constitute a termination for Cause.

(f) The Executive's employment may be terminated by the Executive in the absence of Good Reason by delivery of written notice to the Company effective fifteen (15) days after the date of delivery of such notice.

8. Compensation upon Termination.

(a) Accrued Benefits. Upon termination of the Executive's employment by either party regardless of the cause or reason, the Executive shall be entitled to the following, referred to herein as the "**Accrued Benefits**": (i) payment for any accrued, unpaid Base Salary through the termination date; (ii) if provided for under the Company's vacation plan or policy or required by applicable law, payment for any accrued, unused vacation days through the termination date; and (iii) reimbursement for any approved business expenses that the Executive has timely submitted for reimbursement in accordance with the Company's business expense reimbursement policy or practice. Except as otherwise expressly provided by this Agreement, the Company shall have no further payment obligations to the Executive and all Equity Awards that have not vested as of the termination date shall be forfeited to the Company as of such date. Subject to this Section 8, the vested portion of any stock options held by the Executive as of the Executive's termination date shall remain exercisable for ninety (90) days following such termination.

(b) Change of Control Separation Benefits. If the Executive's employment is terminated by the Company due to Disability pursuant to Section 7(b), by the Company without Cause pursuant to Section 7(e) or by the Executive for Good Reason pursuant to Section 7(d) and such termination occurs during the period beginning on the Change of Control and ending twelve (12) months immediately following such Change of Control (the "**COC Period**"), *provided* that the Executive signs and does not revoke a general release of claims against the Company within the time period specified therein (which time period shall not exceed sixty (60) days), in form and substance satisfactory to the Company (the "**Release**"), then the Company shall provide the following benefits to the Executive, referred to herein as the "**Change of Control Separation Benefits**": (i) a lump sum payment equal to twelve (12) months of the Executive's then-current Base Salary; (ii) the full target Annual Performance Bonus for the year in which such termination occurs, less any installments paid in advance (items (i) and (ii) being the "**Change of Control Separation Pay**"); (iii) immediate vesting in full of all Equity Awards with time based vesting; and (iv) if the Executive properly and timely elects to continue his health insurance benefits under COBRA or applicable state continuation coverage after the termination date, reimbursement for the portion of Executive's health continuation coverage premiums that the Company would have paid had the Executive remained employed by the Company until the earlier of (A) the twelve (12) months following the month in which the Executive's termination date occurs, or (B) the maximum period permitted by applicable law, provided that the Company's obligation to pay a portion of the Executive's health continuation coverage premiums will terminate if Executive becomes eligible for health insurance benefits from another employer during the reimbursement period. Subject to the Release being effective, the Change of Control Separation Pay will be paid within sixty (60) days after the termination date; *provided, however*, that if the 60-day period begins in one calendar year and ends in a second calendar year, such payments, to the extent they qualify as "non-qualified deferred compensation" within the meaning of Section 409A of the Code, shall be paid no earlier than the first Company payroll date in the second calendar year and, in any case, by the last day of such 60-day period.

(c) Base Separation Benefits. If the Executive's employment is terminated during the Term and outside of the COC Period as a result of the Executive's Disability pursuant to Section 7(b), by the Company without Cause pursuant to Section 7(e), or by the Executive for Good Reason pursuant to Section 7(d), *provided* that the Executive signs and does not revoke the Release within the time period specified therein (which time period shall not exceed sixty (60) days), then the Company shall provide the following benefits to the Executive, referred to herein as the "**Base Separation Benefits**": (i) the continued payment in installments of the Executive's then-current Base Salary for a period of twelve (12) months following the termination date (the "**Base Separation Pay**"); and (ii) if the Executive properly and timely elects to continue Executive's health insurance benefits under COBRA or applicable state continuation coverage after the termination date, reimbursement for the portion of the Executive's health continuation coverage premiums that the Company would have paid had the Executive remained employed by the Company until the earlier of (A) the twelve (12) months following the month in which the Executive's termination date occurs, or (B) the maximum period permitted by applicable law, provided that the Company's obligation to pay a portion of the Executive's health continuation coverage premiums will terminate if he becomes eligible for health insurance benefits from another employer during the reimbursement period. The first installment of the Base Separation Pay will be paid on the Company's first regular payday occurring following the effectiveness of the Release in an amount equal to the sum of payments of Base Salary that would have been paid if Executive had remained in employment for the period from the termination date through the payment date. The remaining installments will be paid until the end of the 12-month period at the same rate as the Base Salary in accordance with the Company's normal payroll practices for its employees. Notwithstanding the foregoing, if the 60-day period for the execution and non-revocation of the Release begins in one calendar year and ends in a second calendar year, the Base Separation Pay, to the extent it qualifies as "non-qualified deferred compensation" within the meaning of Section 409A of the Code, shall begin to be paid no earlier than the first Company payroll date in the second calendar year and, in any case, by the last day of such 60-day period; *provided, however*, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the termination date. The Executive understands that if the Executive is eligible to receive the Base Separation Benefits, such Base Separation Benefits shall be in lieu of and not in addition to the Change of Control Separation Benefits described in Section 8(b) of this Agreement. Notwithstanding the foregoing, if the Executive is entitled to receive the Base Separation Benefits but violates any provisions of this Agreement, the PIIA or any other agreement entered into by the Executive and the Company after termination of employment, the Company will be entitled to immediately stop paying any further installments of the Base Separation Benefits.

(d) This Section 8 sets forth the only obligations of the Company with respect to the termination of the Executive's employment with the Company, except as otherwise required by law, and the Executive acknowledges that, upon the termination of the Executive's employment, the Executive shall not be entitled to any payments or benefits which are not explicitly provided in Section 8.

(e) Upon termination of the Executive's employment hereunder for any reason, the Executive shall be deemed to have resigned as director and/or officer of the Company and each subsidiary of the Company, to the extent applicable, effective as of the date of such termination, unless otherwise requested by the Board.

(f) The provisions of this Section 8 shall survive any termination of this Agreement.

9. Section 409A. The intent of the parties to this Agreement is that the payments, compensation and benefits under this Agreement be exempt from or comply with Section 409A of the Code and the regulations and guidance promulgated thereunder (collectively, "**Section 409A**") and, in this connection, the following shall be applicable:

(a) To the greatest extent possible, this Agreement shall be interpreted to be exempt from or in compliance with Section 409A.

(b) If any severance, compensation, or benefit required by this Agreement is to be paid in a series of installment payments, each individual payment in the series shall be considered a separate payment for purposes of Section 409A.

(c) If any severance, compensation, or benefit required by this Agreement that constitutes "nonqualified deferred compensation" within the meaning of Section 409A is considered to be paid on account of "separation from service" within the meaning of Section 409A, and the Executive is a "specified employee" within the meaning of Section 409A, no payments of any of such severance, compensation, or benefit shall be made until the earlier of six (6) months plus one (1) day after such separation from service or the Executive's death (the "**New Payment Date**"). The aggregate amount of any such payments that would have otherwise been paid during the period between the date of separation from service and the New Payment Date shall be paid to the Executive or his estate in a lump sum payment on the New Payment Date. Thereafter, any severance, compensation, or benefit required by this Agreement that remains outstanding as of the day immediately following the New Payment Date shall be paid without delay over the time period originally scheduled, in accordance with the terms of this Agreement.

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

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

(f) The provisions of this Section 9 shall survive any termination of this Agreement.

10. Section 280G.

(a) Notwithstanding any other provision of this Agreement or any other plan, arrangement or agreement to the contrary, if any of the payments or benefits provided or to be provided by the Company or its affiliates to the Executive or for the Executive's benefit pursuant to the terms of this Agreement or otherwise ("**Covered Payments**") constitute parachute payments ("**Parachute Payments**") within the meaning of Section 280G of the Code and would, but for this Section 10 be subject to the excise tax imposed under Section 4999 of the Code (or any successor provision thereto) or any similar tax imposed by state or local law or any interest or penalties with respect to such taxes (collectively, the "**Excise Tax**"), then prior to making the Covered Payments, a calculation shall be made comparing (i) the Net Benefit (as defined below) to the Executive of the Covered Payments after payment of the Excise Tax to (ii) the Net Benefit to the Executive if the Covered Payments are limited to the extent necessary to avoid being subject to the Excise Tax. Only if the amount calculated under (i) above is less than the amount under (ii) above will the Covered Payments be reduced to the minimum extent necessary to ensure that no portion of the Covered Payments is subject to the Excise Tax (that amount, the "**Reduced Amount**"). "**Net Benefit**" shall mean the present value of the Covered Payments net of all federal, state, local, foreign income, employment and excise taxes.

(b) Any such reduction shall be made in accordance with Section 409A of the Code and the following: (i) the Covered Payments which do not constitute nonqualified deferred compensation subject to Section 409A of the Code shall be reduced first; and (ii) all other Covered Payments shall then be reduced as follows: (A) cash payments shall be reduced before non-cash payments; and (B) payments to be made on a later payment date shall be reduced before payments to be made on an earlier payment date.

(c) Any determination required under this Section 10 shall be made in writing in good faith by the accounting firm that was the Company's independent auditor immediately before the Change of Control (the "**Accounting Firm**"). The Accounting Firm shall provide detailed supporting calculations to the Company and the Executive as requested by the Company or the Executive. The Company and the Executive shall provide the Accounting Firm with such information and documents as the Accounting Firm may reasonably request in order to make a determination under this Section 10. For purposes of making the calculations and determinations required by this Section 10, the Accounting Firm may rely on reasonable, good faith assumptions and approximations concerning the application of Section 280G and Section 4999 of the Code. The Accounting Firm's determinations shall be final and binding on the Company and the Executive. The Company shall be responsible for all fees and expenses incurred by the Accounting Firm in connection with the calculations required by this Section 10.

(d) It is possible that after the determinations and selections made pursuant to this Section 10 the Executive will receive Covered Payments that are in the aggregate more than the amount provided under this Section 10 ("**Overpayment**") or less than the amount provided under this Section 10 ("**Underpayment**").

(i) In the event that: (A) the Accounting Firm determines, based upon the assertion of a deficiency by the Internal Revenue Service against either the Company or the Executive which the Accounting Firm believes has a high probability of success, that an Overpayment has been made or (B) it is established pursuant to a final determination of a court or an Internal Revenue Service proceeding that has been finally and conclusively resolved that an Overpayment has been made, then the Executive shall pay any such Overpayment to the Company.

(ii) In the event that: (A) the Accounting Firm, based upon controlling precedent or substantial authority, determine that an Underpayment has occurred or (B) a court of competent jurisdiction determines that an Underpayment has occurred, any such Underpayment will be paid promptly by the Company to or for the benefit of the Executive.

11. Miscellaneous.

(a) This Agreement shall be governed by, and construed and interpreted in accordance with, the laws of the State of California, without giving effect to its principles of conflicts of laws.

(b) In the event of any dispute arising out of, or relating to, this Agreement or the breach thereof, or regarding the interpretation thereof, the parties agree to submit any differences to nonbinding mediation prior to pursuing resolution through the courts. The parties hereby submit to the exclusive jurisdiction of the state and federal courts situated in San Francisco County, California, and agree that service of process in such court proceedings shall be satisfactorily made upon each other if sent by registered mail addressed to the recipient at the address referred to in Section 11(g) below.

(c) This Agreement shall be binding upon and inure to the benefit of the parties hereto, and their respective heirs, legal representatives, successors and permitted assigns.

(d) This Agreement, and the Executive's rights and obligations hereunder, may not be assigned by the Executive. The rights and obligations of the Company under this Agreement shall inure to the benefit of and shall be binding upon the successors and assigns of the Company, including any successors or assigns in connection with any sale, transfer or other disposition of all or substantially all of its business or assets.

(e) This Agreement cannot be amended orally, or by any course of conduct or dealing, but only by a written agreement signed by the parties hereto.

(f) The failure of either party to insist upon the strict performance of any of the terms, conditions and provisions of this Agreement shall not be construed as a waiver or relinquishment of future compliance therewith, and such terms, conditions and provisions shall remain in full force and effect. No waiver of any term or condition of this Agreement on the part of either party shall be effective for any purpose whatsoever unless such waiver is in writing and signed by such party.

(g) All notices, requests, consents and other communications, required or permitted to be given hereunder, shall be in writing and shall be delivered personally or by an overnight courier service or sent by registered or certified mail, postage prepaid, return receipt requested, to the Executive at the last address of record in his personnel file and to the Company at the address for its corporate headquarters, and shall be deemed given when so delivered personally or by overnight courier, or, if mailed, five days after the date of deposit in the United States mail. Either party may designate another address, for receipt of notices hereunder by giving notice to the other party in accordance with this Section 11(g).

(h) This Agreement sets forth the entire agreement and understanding of the parties relating to the subject matter hereof, and supersedes all prior agreements, arrangements and understandings, written or oral, relating to the subject matter hereof. No representation, promise or inducement has been made by either party that is not embodied in this Agreement, and neither party shall be bound by or liable for any alleged representation, promise or inducement not so set forth.

(i) As used in this Agreement, "affiliate" of a specified person or entity shall mean and include any person or entity controlling, controlled by or under common control with the specified person or entity.

(j) The section headings contained herein are for reference purposes only and shall not in any way affect the meaning or interpretation of this Agreement.

(k) This Agreement may be executed in one or more counterparts, each of which shall be deemed an original and all of which together shall constitute one and the same original, binding document. Any facsimile, PDF reproduction of original signatures or other electronic transmission of a signed counterpart shall be deemed to be an original counterpart and any signature appearing thereon shall be deemed to be an original signature. Each party agrees that the electronic signatures of the parties included in this Agreement, including via DocuSign®, are intended to authenticate this writing and to have the same force and effect as manual signatures.

[*Remainder of Page Intentionally Left Blank – Signature Page Follows*]

IN WITNESS WHEREOF, the parties hereto have executed this Agreement and intend it to be effective as of the Effective Date by proper person thereunto duly authorized.

ASSEMBLY BIOSCIENCES, INC.

By: /s/ John G. McHutchison, A.O., M.D.
Name: John G. McHutchison, A.O., M.D.
Title: Chief Executive Officer and President

EXECUTIVE

/s/ Thomas J. Russo, CFA
Name: Thomas J. Russo, CFA

EXHIBIT 31.1

CERTIFICATION

I, John G. McHutchison, A.O., M.D., certify that:

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

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

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

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

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

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

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

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

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

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

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

Date: November 7, 2019

By: /s/ John G. McHutchison, A.O., M.D.
John G. McHutchison, A.O., M.D.
Chief Executive Officer and President
(Principal Executive Officer)

EXHIBIT 31.2

CERTIFICATION

I, Thomas J. Russo, CFA, certify that:

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

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

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

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

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

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

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

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

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

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

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

Date: November 7, 2019

By: /s/ Thomas J. Russo, CFA
Thomas J. Russo, CFA
Chief Financial Officer
(Principal Financial Officer)

EXHIBIT 32.1

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

In connection with the Quarterly Report on Form 10-Q of Assembly Biosciences, Inc. (the Company) for the period ended September 30, 2019 as filed with the Securities and Exchange Commission on or about the date hereof (the Report), I, John G. McHutchison, A.O., M.D., Chief Executive Officer, 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 my knowledge:

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

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company as of, and for, the periods presented in the Report.

/s/ John G. McHutchison, A.O., M.D.
John G. McHutchison, A.O., M.D.
Chief Executive Officer and President
(Principal Executive Officer)

Date: November 7, 2019

EXHIBIT 32.2

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

In connection with the Quarterly Report on Form 10-Q of Assembly Biosciences, Inc. (the Company) for the period ended September 30, 2019 as filed with the Securities and Exchange Commission on or about the date hereof (the Report), I, Thomas J. Russo, CFA, Chief Financial Officer, 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 my knowledge:

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

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company as of, and for, the periods presented in the Report.

/s/ Thomas J. Russo, CFA
Thomas J. Russo, CFA
Chief Financial Officer
(Principal Financial Officer)

Date: November 7, 2019