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[TABLE OF CONTENTS](#)

[Table of Contents](#)

Filed Pursuant to Rule 424(b)(3)
Registration No. 333-234527

PROSPECTUS



Up to \$100,000,000

Common Stock

We have entered into a sales agreement with Cowen and Company, LLC, or Cowen, relating to shares of our common stock offered by this prospectus. In accordance with the terms of the sales agreement, we may offer and sell shares of our common stock having an aggregate offering price of up to \$100,000,000 from time to time through Cowen acting as our agent.

Our common stock is listed on The Nasdaq Global Select Market under the symbol "VYGR". On December 2, 2019, the last reported sales price of our common stock was \$13.20 per share.

Sales of our common stock, if any, under this prospectus will be made in sales deemed to be an "at the market offering" as defined in Rule 415(a)(4) promulgated under the Securities Act of 1933, as amended, or the Securities Act. Cowen is not required to sell any specific number or dollar amount of securities but will act as a sales agent using commercially reasonable efforts consistent with its normal trading and sales practices, on terms mutually agreed between Cowen and us. There is no arrangement for funds to be received in any escrow, trust or similar arrangement.

The compensation to Cowen for sales of common stock sold pursuant to the sales agreement will be an amount equal to 3.0% of the aggregate gross proceeds of any shares of common stock sold under the sales agreement. In connection with the sale of the common stock on our behalf, Cowen will be deemed to be an "underwriter" within the meaning of the Securities Act and the compensation of Cowen will be deemed to be underwriting commissions or discounts. We have also agreed to provide indemnification and contribution to Cowen with respect to certain liabilities, including liabilities under the Securities Act or the Securities Exchange Act of 1934, as amended, or the Exchange Act.

Our business and an investment in our common stock involve significant risks. These risks are described under the caption "Risk Factors" beginning on page 7 of this prospectus and in the documents incorporated by reference into this prospectus.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or passed on the adequacy or accuracy of this prospectus. Any representation to the contrary is a criminal offense.

Cowen

The date of this prospectus is December 2, 2019.

TABLE OF CONTENTS

ABOUT THIS PROSPECTUS	1
CAUTIONARY NOTE REGARDING FORWARD-LOOKING STATEMENTS AND INDUSTRY DATA	3
PROSPECTUS SUMMARY	5
THE OFFERING	6
RISK FACTORS	7
USE OF PROCEEDS	8
DIVIDEND POLICY	9
DILUTION	10
DESCRIPTION OF CAPITAL STOCK	11
PLAN OF DISTRIBUTION	17
LEGAL MATTERS	18
EXPERTS	18
WHERE YOU CAN FIND MORE INFORMATION	18
INCORPORATION BY REFERENCE	18

ABOUT THIS PROSPECTUS

This prospectus is part of a registration statement that we filed with the Securities and Exchange Commission, which we refer to as the SEC, utilizing a "shelf" registration process. We may from time to time sell shares of our common stock having an aggregate offering price of up to \$100,000,000 under this prospectus at prices and on terms to be determined at the time of each such offering.

Before buying any of the common stock that we are offering, we urge you to carefully read this prospectus, together with the information incorporated by reference as described under the headings "Where You Can Find More Information" and "Incorporation by Reference" in this prospectus, and any free writing prospectus that we have authorized for use in connection with this offering. These documents contain important information that you should consider when making your investment decision.

This prospectus describes the terms of this offering of common stock and also adds to and updates information contained in the documents incorporated by reference into this prospectus. To the extent there is a conflict between the information contained in this prospectus, on the one hand, and the information contained in any document incorporated by reference into this prospectus that was filed with the Securities and Exchange Commission, or the SEC, before the date of this prospectus, on the other hand, you should rely on the information in this prospectus. If any statement in one of these documents is inconsistent with a statement in another document having a later date—for example, a document incorporated by reference into this prospectus—the statement in the document having the later date modifies or supersedes the earlier statement.

We have not, and Cowen has not, authorized anyone to provide you with information in addition to or different from that contained in or incorporated by reference into this prospectus and any related free writing prospectus filed by us with the SEC. We and Cowen take no responsibility for, and can provide no assurances as to the reliability of, any information that others may provide to you. If anyone provides you with different or inconsistent information, you should not rely on it. This prospectus does not constitute an offer to sell or the solicitation of an offer to buy any securities other than the securities described in this prospectus or an offer to sell or the solicitation of an offer to buy any securities in any circumstances in which such offer or solicitation is unlawful. You should assume that the information in this prospectus or any related free writing prospectus is accurate only as of the date on the front of such document and that any information incorporated by reference is accurate only as of the date of the document incorporated by reference, regardless of the time of delivery of this prospectus or any related free writing prospectus, or any sale of a security. Our business, financial condition, results of operations and prospects may have changed materially since those dates.

This prospectus contains summaries of certain provisions contained in some of the documents described herein, but reference is made to the actual documents for complete information. All of the summaries are qualified in their entirety by the actual documents. Copies of some of the documents referred to herein have been filed, will be filed or will be incorporated by reference as exhibits to the registration statement of which this prospectus forms a part. You may obtain copies of those documents as described below under the heading "Where You Can Find More Information".

Unless the context otherwise indicates, references in this prospectus to "Voyager", "Voyager Therapeutics", "we", "our", "us" and "the Company" refer, collectively, to Voyager Therapeutics, Inc., a Delaware corporation, and its consolidated subsidiaries.

We own various U.S. federal trademark registrations and applications and unregistered trademarks, including our corporate logo. This prospectus and the information incorporated herein by reference contains references to trademarks, service marks and trade names referred to in this prospectus and the information incorporated herein, including logos, artwork, and other visual displays, may appear without the ® or ™ symbols, but such references are not intended to indicate, in any way, that we will

not assert, to the fullest extent under applicable law, our rights or the rights of the applicable licensor to these trademarks, service marks or trade names. We do not intend our use or display of other companies' trade names, service marks or trademarks to imply a relationship with, or endorsement or sponsorship of us by, any other companies. All trademarks, service marks and trade names included or incorporated by reference into this prospectus, any applicable prospectus supplement or any related free writing prospectus are the property of their respective owners.

CAUTIONARY NOTE REGARDING FORWARD-LOOKING STATEMENTS AND INDUSTRY DATA

This prospectus and the information incorporated by reference in this prospectus include "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Exchange Act. All statements, other than statements of historical facts, contained or incorporated by reference in this prospectus, including statements regarding our strategy, future operations, future financial position, future revenue, projected costs, prospects, plans, objectives of management, and expected market growth, are forward-looking statements. The words "anticipate," "believe," "estimate," "expect," "intend," "may," "might," "plan," "predict," "project," "target," "potential," "contemplate," "anticipate," "goals," "will," "would," "could," "should," "continue" and similar expressions are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words.

These forward-looking statements contained in this prospectus and incorporated by reference herein include, among other things, statements about:

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

timing of AbbVie exercising its options to certain of our programs as specified in the applicable collaboration agreements;

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

These forward-looking statements are only predictions, and we may not actually achieve the plans, intentions or expectations disclosed in our forward-looking statements. You should not place undue reliance on our forward-looking statements. Actual results or events could differ materially from the plans, intentions and expectations disclosed in the forward-looking statements we make. We have based these forward-looking statements largely on our current expectations and projections about future events and trends that we believe may affect our business, financial condition and operating results. You are cautioned that these forward-looking statements are subject to risks, uncertainties and assumptions that are referenced in the sections entitled "Risk Factors" of this prospectus and of any accompanying prospectus supplement. You should also carefully review the risk factors and cautionary statements described in the other documents that we file from time to time with the SEC, specifically our most recent Annual Report on Form 10-K, our Quarterly Reports on Form 10-Q, and our Current Reports on Form 8-K. Our forward-looking statements do not reflect the potential impact of any future acquisitions, mergers, dispositions, joint ventures, collaborations or investments we may make.

You should read this prospectus, the documents incorporated by reference in this prospectus and the documents that we have filed as exhibits to the registration statement of which this prospectus forms a part completely and with the understanding that our actual future results may be materially different from what we expect. The forward-looking statements contained in this prospectus and incorporated by reference herein are made as of the date hereof, and we do not assume any obligation to update any forward-looking statements, whether as a result of new information, future events or otherwise, except as required by applicable law.

This prospectus includes and incorporates by reference certain statistical and other industry and market data that we obtained from industry publications and research, surveys and studies conducted by third parties as well as our own estimates of potential market opportunities. Industry publications and third-party research, surveys and studies generally indicate that their information has been obtained from sources believed to be reliable, although they do not guarantee the accuracy or completeness of such information. Our estimates of the potential market opportunities for our product candidates include several key assumptions based on our industry knowledge, industry publications, third-party research and other surveys, which may be based on a small sample size and may fail to accurately reflect market opportunities. While we believe that our internal assumptions are reasonable, no independent source has verified such assumptions.

PROSPECTUS SUMMARY

This summary highlights certain information about us, this offering and selected information contained elsewhere in or incorporated by reference into this prospectus. This summary is not complete and does not contain all of the information that you should consider before deciding whether to invest in our common stock. For a more complete understanding of our company and this offering, we encourage you to read and consider carefully the more detailed information in this prospectus, including the information incorporated by reference in this prospectus, and the information included in any free writing prospectus that we have authorized for use in connection with this offering, including the information under the heading "Risk Factors" in this prospectus on page 7 and in the documents incorporated by reference into this prospectus.

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

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

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

We were incorporated under the laws of the State of Delaware in June 2013. Our principal executive offices are located at 75 Sidney Street, Cambridge, Massachusetts 02139, and our telephone number is (857) 259-5340. Our website address is <http://www.voyagertherapeutics.com>. The information contained on, or that can be accessed through, our website does not constitute part of this prospectus. We have included our website address in this prospectus only as an inactive textual reference.

THE OFFERING

Common stock offered by us	Shares of our common stock having an aggregate offering price of up to \$100,000,000.
Common stock to be outstanding immediately after this offering	Up to 43,557,598 shares, assuming sales at an offering price of \$14.86 per share, which was the last reported sale price of our common stock on The Nasdaq Global Select Market on November 5, 2019. The actual number of shares issued will vary depending on the sales price under this offering.
Manner of offering	"At the market offering" that may be made from time to time through our sales agent, Cowen. See "Plan of Distribution" beginning on page 17.
Use of proceeds	<p>We intend to use the net proceeds from the sale of any shares of common stock offered hereby for general corporate purposes. Although we have not yet identified specific uses for these proceeds, we currently anticipate using the proceeds for some or all of the following: to further our clinical and preclinical research and development efforts; to support related regulatory submissions, if any; to expand our manufacturing capacity; and for working capital and other general corporate purposes, which could include the acquisition or in-license of other products, product candidates, businesses or technologies.</p> <p>See "Use of Proceeds" on page 8.</p>
Risk factors	You should read the "Risk Factors" section of this prospectus beginning on page 7, as well as those risk factors that are incorporated by reference herein for a discussion of factors to consider carefully before deciding to invest in shares of our common stock.
The Nasdaq Global Select Market symbol	"VYGR"

The number of shares of common stock shown above to be outstanding after this offering is based on 36,828,123 shares outstanding as of September 30, 2019, and excludes as of that date:

- 5,235,548 shares of common stock issuable upon the exercise of stock options outstanding as of September 30, 2019, at a weighted-average exercise price of \$16.04 per share;
- 412,182 shares of common stock issuable upon the vesting of restricted stock units outstanding as of September 30, 2019;
- 2,011,018 shares of common stock that are available for future issuance under our Voyager Therapeutics, Inc. 2015 Stock Option and Incentive Plan, or 2015 Plan, as of September 30, 2019; and
- 1,244,929 shares of common stock that are available for future issuance under our Voyager Therapeutics, Inc. 2015 Employee Stock Purchase Plan, or 2015 ESPP, as of September 30, 2019.

Unless otherwise indicated, all information in this prospectus supplement assumes:

- no exercise of the outstanding options described above; and
- no vesting and settlement of the outstanding restricted stock units described above.

RISK FACTORS

Investing in our common stock involves a high degree of risk. You should carefully consider the risks and uncertainties described in the following risk factors as well as the other information contained in this prospectus and in the documents incorporated by reference into this prospectus before making an investment decision. Our business, financial condition or results of operations could be materially adversely affected by the materialization of any of these risks. The trading price of our common stock could decline due to the materialization of any of these risks, and you may lose all or part of your investment. This prospectus and the documents incorporated herein by reference also contain forward-looking statements that involve risks and uncertainties. Actual results could differ materially from those anticipated in these forward-looking statements as a result of certain factors, including the risks described in the documents incorporated herein by reference, including our most recent Annual Report on [Form 10-K for the year ended December 31, 2018](#) and our Quarterly Reports on Form 10-Q for the quarters ended [March 31, 2019](#), [June 30, 2019](#), and September 30, 2019, which are on file with the SEC and are incorporated by reference into this prospectus, and other documents we file with the SEC that are deemed incorporated by reference into this prospectus. The risks and uncertainties we have described are not the only ones facing our company. Additional risks and uncertainties not presently known to us or that we currently deem immaterial may also affect our business, financial condition, and results of operations.

Risks Related to this Offering

We have broad discretion in how we apply our available funds, including the net proceeds we receive from this offering, and we may not use these funds effectively, which could affect our results of operations and cause our stock price to decline.

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

If you purchase shares of common stock in this offering, you will experience immediate dilution of your investment. In addition, we may issue additional equity in the future, which may result in additional dilution to you.

The shares sold in this offering, if any, will be sold from time to time at various prices. However, we expect that the offering price of our common stock in this offering will be substantially higher than the net tangible book value per share of our outstanding common stock. Therefore, if you purchase shares of our common stock in this offering, you will pay a price per share that substantially exceeds our net tangible book value per share after this offering. To the extent outstanding options are exercised, you will incur further dilution. Based on an assumed public offering price of \$14.86 per share, the last reported sale price of our common stock on The Nasdaq Global Select Market on November 5, 2019, you will experience immediate dilution of \$10.16 per share, representing the difference between our as adjusted net tangible book value per share as of September 30, 2019 after giving effect to this offering and the assumed public offering price. See the section titled "Dilution" below for a more detailed illustration of the dilution you would incur if you participate in this offering.

In addition to this offering, subject to market conditions and other factors, we may pursue additional equity financings in the future, including future public offerings or future private placements of equity securities or securities convertible into or exchangeable for equity securities. Further, the exercise of outstanding options could result in further dilution to investors and any additional shares issued in connection with acquisitions will result in dilution to investors. In addition, the market price of our common stock could fall as a result of resales of any of these shares of common stock due to an increased number of shares available for sale in the market.

USE OF PROCEEDS

We may issue and sell shares of our common stock having aggregate sales proceeds of up to \$100,000,000 from time to time. Because there is no minimum offering amount required as a condition to close this offering, the actual total public offering amount, commissions and net proceeds to us, if any, are not determinable at this time.

We intend to use the net proceeds from the sale of any shares of common stock offered hereby for general corporate purposes. Although we have not yet identified specific uses for these proceeds, we currently anticipate using the proceeds for some or all of the following: to further our clinical and preclinical research and development efforts; to support related regulatory submissions, if any; to expand our manufacturing capacity; and for working capital and other general corporate purposes, which could include the acquisition or in-license of other products, product candidates, businesses or technologies.

We have not determined the exact amounts we plan to spend on any of the items listed above or the timing of these expenditures. The amounts and timing of our actual expenditures may vary significantly depending on numerous factors, including the actual net proceeds from this offering, the factors described under "Risk Factors" in this prospectus and in the documents incorporated by reference herein, the progress of our development efforts, the status of and results from clinical trials, as well as any collaborations that we may enter into with third parties for our product candidates, and any unforeseen cash needs. As a result, our management will retain broad discretion over the allocation of the net proceeds from this offering. We have no current understandings, agreements or commitments for any material acquisitions or licenses of any products, businesses or technologies.

Pending application of the net proceeds as described above, we may temporarily invest the net proceeds in a variety of capital preservation instruments, including short-term, investment-grade, interest-bearing instruments and U.S. government securities.

DIVIDEND POLICY

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

DILUTION

If you invest in our common stock in this offering, your ownership interest will be diluted immediately to the extent of the difference between the price per share you pay in this offering and the net tangible book value per share of our common stock immediately after this offering.

Our net tangible book value as of September 30, 2019, was approximately \$108.2 million, or \$2.94 per share of common stock. Net tangible book value per share is determined by dividing our total tangible assets, less total liabilities, by the 36,828,123 shares of our common stock outstanding as of September 30, 2019. Dilution with respect to net tangible book value per share represents the difference between the amount per share paid by purchasers of shares of common stock in this offering and the net tangible book value per share of our common stock immediately after this offering.

After giving effect to the assumed sale by us of shares of our common stock in the aggregate amount of \$100,000,000 in this offering at an assumed public offering price of \$14.86 per share, the last reported sale price of our common stock on The Nasdaq Global Select Market on November 5, 2019, and after deducting commissions and estimated offering expenses payable by us, our as adjusted net tangible book value as of September 30, 2019, would have been approximately \$204.9 million, or \$4.70 per share of common stock. This represents an immediate increase in net tangible book value of \$1.77 per share of common stock to existing stockholders. Dilution per share to new investors is determined by subtracting as adjusted net tangible book value per share after this offering from the public offering price per share paid by new investors. Investors purchasing our common stock in this offering will have paid \$10.16 more than the as adjusted net tangible book value per share of common stock after this offering. The following table illustrates this on a per share basis:

Assumed public offering price per share	\$ 14.86
Net tangible book value per share as of September 30, 2019	\$ 2.94
Increase per share attributable to new investors purchasing shares in this offering	\$ 1.77
As adjusted net tangible book value per share after this offering	\$ 4.70
Dilution per share to new investors	\$ 10.16

The as adjusted information above is illustrative only and will change based on the actual price to the public, the actual number of shares sold and other terms of the offering determined at the time shares of our common stock are sold pursuant to this prospectus. The shares sold in this offering, if any, will be sold from time to time at various prices.

The above discussion and table are based on 36,828,123 shares of our common stock outstanding as of September 30, 2019, and excludes as of that date:

- 5,235,548 shares of common stock issuable upon the exercise of stock options outstanding as of September 30, 2019, at a weighted-average exercise price of \$16.04;
- 412,182 shares of common stock issuable upon the vesting of restricted stock units outstanding as of September 30, 2019;
- 2,011,018 shares of common stock that are available for future issuance under the 2015 Plan as of September 30, 2019; and
- 1,244,929 shares of common stock that are available for future issuance under the 2015 ESPP as of September 30, 2019.

DESCRIPTION OF CAPITAL STOCK

The following description of our capital stock is intended as a summary only and therefore is not a complete description of our capital stock. This description is based upon, and is qualified by reference to, our certificate of incorporation, our bylaws and applicable provisions of Delaware corporate law. You should read our certificate of incorporation and bylaws, which are filed as exhibits to the registration statement of which this prospectus forms a part, for the provisions that are important to you.

Our authorized capital stock consists of 120,000,000 shares of common stock, \$0.001 par value per share, and 5,000,000 shares of preferred stock, \$0.001 par value per share. As of November 1, 2019, 37,073,347 shares of common stock were outstanding and no shares of preferred stock were outstanding.

Common Stock

Annual Meeting. Annual meetings of our stockholders are held on the date designated in accordance with our bylaws. Written notice must be mailed to each stockholder entitled to vote not less than ten nor more than 60 days before the date of the meeting. The presence in person or by proxy of the holders of record of a majority of our issued and outstanding shares entitled to vote at such meeting constitutes a quorum for the transaction of business at meetings of the stockholders. Special meetings of the stockholders may be called only by a majority of the board of directors acting pursuant to a resolution approved by the affirmative vote of a majority of the directors then in office. Except as may be otherwise provided by applicable law, our certificate of incorporation or our bylaws, all elections of directors shall be decided by a plurality of the votes properly cast by the stockholders entitled to vote on the election and all other questions shall be decided by a majority of the votes properly cast by stockholders entitled to vote thereon and voting for or against the matter at a duly held meeting of stockholders at which a quorum is present.

Voting Rights. Each holder of common stock is entitled to one vote for each share held of record on all matters to be voted upon by stockholders.

Dividends. Subject to the rights, powers and preferences of any outstanding preferred stock, and except as provided by law or in our certificate of incorporation, dividends may be declared and paid or set aside for payment on the common stock out of legally available assets or funds when and as declared by the board of directors or a duly authorized committee thereof.

Liquidation, Dissolution and Winding Up. Subject to the rights, powers and preferences of any outstanding preferred stock, in the event of our liquidation, dissolution or winding up, our net assets will be distributed pro rata to the holders of our common stock.

Other Rights. Holders of the common stock have no right to:

- convert the stock into any other security;
- have the stock redeemed;
- purchase additional stock; or
- maintain their proportionate ownership interest.

The common stock does not have cumulative voting rights. Holders of shares of the common stock are not required to make additional capital contributions.

Transfer Agent and Registrar. Computershare Trust Company N.A. is transfer agent and registrar for the common stock.

Preferred Stock

We are authorized to issue "blank check" preferred stock, which may be issued in one or more series upon authorization of our board of directors or a duly authorized committee thereof. Our board of directors or such committee thereof is authorized to fix the designations, powers, preferences and the relative, participating, optional or other special rights and any qualifications, limitations and restrictions of the shares of each series of preferred stock. The authorized shares of our preferred stock are available for issuance without further action by our stockholders, unless such action is required by applicable law or the rules of any stock exchange on which our securities may be listed. If the approval of our stockholders is not required for the issuance of shares of our preferred stock, our board may determine not to seek stockholder approval. Currently, we have no shares of preferred stock outstanding.

Registration Rights

We have entered into a second amended and restated investor rights' agreement dated as of April 10, 2015, or the Investor Rights Agreement, with holders of our preferred stock prior to the closing of our initial public offering. The holders of these shares have the right to require us to register these shares under the Securities Act under specified circumstances. These rights include demand registration rights, short-form registration rights and piggyback registration rights. All fees, costs and expenses of underwritten registrations will be borne by us and all selling expenses, including underwriting discounts and selling commissions, will be borne by the holders of the shares being registered. As of November 1, 2019, the holders of 6,391,176 shares of our common stock are entitled to rights with respect to the registration of these shares pursuant to the Investor Rights Agreement.

Demand Registration Rights. Subject to specified limitations set forth in the Investor Rights Agreement, we will be required, upon the written request of holders of a majority of the then-outstanding Registrable Securities, as such term is defined in the Investor Rights Agreement, requesting registration of at least 75% of the then-outstanding shares of Registrable Securities having the anticipated aggregate offering amount of at least \$3.0 million, to use our commercially reasonable efforts to effect the registration of such shares for public resale. We are not obligated to file a registration statement pursuant to this demand provision on more than two occasions, subject to specified exceptions.

Form S-3 Registration Rights. Subject to specified limitations set forth in the Investor Rights Agreement, we will be required, upon the written request of holders of at least 25% of the then-outstanding Registrable Securities, requesting that we register their shares for public resale on Form S-3 with an aggregate price to the public of the shares to be registered, net of underwriting discounts and commissions, of at least \$1.0 million, to use our commercially reasonable efforts to effect such registration within 45 days.

Piggyback or Incidental Registration Rights. If we register any of our securities either for our own account or for the account of other security holders solely for cash and on a form that would also permit the registration of Registrable Securities, the holders of the then-outstanding Registrable Securities are entitled to notice of such registration and, subject to specified exceptions set forth in the Investor Rights Agreement, include their shares in the registration. The holders of Registrable Securities waived these piggyback or incidental registration rights in connection with this offering. We have the right to terminate or withdraw any registration that we initiate before the effective date of the registration.

Indemnification. Our Investor Rights Agreement contains customary cross-indemnification provisions, under which we are obligated to indemnify holders of Registrable Securities in the event of

material misstatements or omissions in the registration statement attributable to us, and they are obligated to indemnify us for material misstatements or omissions attributable to them.

Termination of Registration Rights. The registration rights granted under the Investor Rights Agreement will terminate upon the earliest to occur of (i) the closing of a Deemed Liquidation Event, as defined in the Investor Rights Agreement; (ii) November 16, 2020, which is the fifth anniversary of our initial public offering; or (iii), with respect to any holder of Registrable Securities, such earlier time as all such Registrable Securities held by such holder are available for resale without limitation during a three-month period without registration, pursuant to Rule 144 or another similar exemption under the Securities Act.

Provisions of Our Certificate of Incorporation and Bylaws and Delaware Law That May Have Anti-Takeover Effects

Delaware law, our restated certificate of incorporation, and our amended and restated bylaws contain provisions that could have the effect of delaying, deferring or discouraging another party from acquiring control of us. These provisions, which are summarized below, are expected to discourage coercive takeover practices and inadequate takeover bids. These provisions are also designed to encourage persons seeking to acquire control of us to first negotiate with our board of directors.

Staggered Board; Removal of Directors. Our certificate of incorporation divides our board of directors into three classes with staggered three-year terms. In addition, our certificate of incorporation provides that directors may be removed only for cause and only by the affirmative vote of the holders of 75% of our shares of capital stock present in person or by proxy and entitled to vote. Under our certificate of incorporation and bylaws, any vacancy on our board of directors, including a vacancy resulting from an enlargement of our board of directors, may be filled only by a vote of a majority of our directors then in office. Furthermore, our certificate of incorporation and bylaws provide that the authorized number of directors may be fixed solely and exclusively by a resolution of the board of directors. The classification of our board of directors and the limitations on the ability of our stockholders to remove directors, change the authorized number of directors and fill vacancies could make it more difficult for a third party to acquire, or discourage a third party from seeking to acquire, control of our company.

Stockholder Action by Written Consent; Special Meeting of Stockholders. Our certificate of incorporation and our bylaws provide that any action required or permitted to be taken by our stockholders at an annual meeting or special meeting of stockholders may only be taken if it is properly brought before such meeting and may not be taken by written action in lieu of a meeting. Our certificate of incorporation and our bylaws also provide that, except as otherwise required by law, special meetings of the stockholders can only be called by a majority of the board of directors acting pursuant to a resolution approved by the affirmative vote of a majority of the directors then in office.

Advance Notice Requirements for Stockholder Proposals and Director Nominations. Our bylaws establish an advance notice procedure for stockholder proposals to be brought before an annual meeting of stockholders, including proposed nominations of candidates for election to our board of directors. Stockholders at an annual meeting may only consider proposals or nominations specified in the notice of meeting or brought before the meeting by or at the direction of our board of directors, or by a stockholder of record on the record date for the meeting, who is entitled to vote at the meeting and who has delivered timely written notice in proper form to our secretary of the stockholder's intention to bring such business before the meeting. Specifically, our bylaws provide that a stockholder must notify us in writing of any stockholder nomination of a director not earlier than the close of business on the 120th day and not later than the close of business on the 90th day prior to the first anniversary of the preceding year's annual meeting; provided, that if the date of the annual meeting is advanced by more than 30 days or delayed more than 60 days from such anniversary date, or if no

annual meeting were held in the preceding year, notice by the stockholder to be timely must be so delivered not later than the later of (x) the 90th day prior to the date of such annual meeting and (y) the 10th day following the day on which public announcement of the date of such annual meeting is first made by us. These provisions could have the effect of delaying until the next stockholder meeting stockholder actions that are favored by the holders of a majority of our outstanding voting securities. These provisions also could discourage a third party from making a tender offer for our common stock, because even if it acquired a majority of our outstanding voting stock, it would be able to take action as a stockholder, such as electing new directors or approving a merger, only at a duly called stockholders meeting and not by written consent.

Exclusive Forum Selection. Our restated certificate of incorporation provides that the Court of Chancery of the State of Delaware shall be the sole and exclusive forum for (1) any derivative action or proceeding brought on behalf of our company, (2) any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers, or other employees to our company or our stockholders, (3) any action asserting a claim against our company arising pursuant to any provision of the DGCL or our certificate of incorporation or bylaws, or (4) any action asserting a claim against our company governed by the internal affairs doctrine. Although our certificate of incorporation contains the choice of forum provision described above, it is possible that a court could rule that such a provision is inapplicable for a particular claim or action or that such provision is unenforceable.

Super-Majority Voting. The General Corporation Law of the State of Delaware, which we refer to as the DGCL, provides generally that the affirmative vote of a majority of the shares entitled to vote on any matter is required to amend a corporation's certificate of incorporation or bylaws, unless a corporation's certificate of incorporation or bylaws, as the case may be, requires a greater percentage. Our bylaws may be amended or repealed by a majority vote of our board of directors or the affirmative vote of the holders of at least 75% of the votes that all our stockholders would be entitled to vote on such amendment or repeal, voting as a single class. In addition, the affirmative vote of the holders of at least 75% of the votes that all our stockholders would be entitled to cast in any election of directors is required to amend or repeal or to adopt any provisions inconsistent with provisions of our certificate of incorporation described above under "—Staggered Board; Removal of Directors," "—Stockholder Action by Written Consent; Special Meeting of Stockholders", and "—Exclusive Forum."

Blank Check Preferred Stock. Our certificate of incorporation provides for 5,000,000 authorized shares of preferred stock. The existence of authorized but unissued shares of preferred stock may enable our board of directors to render more difficult or to discourage an attempt to obtain control of our company by means of a merger, tender offer, proxy contest, or otherwise. For example, if in the due exercise of its fiduciary obligations, our board of directors were to determine that a takeover proposal is not in the best interests of our company, our board of directors could cause shares of preferred stock to be issued without stockholder approval in one or more private offerings or other transactions that might dilute the voting or other rights of the proposed acquiror or insurgent shareholder or shareholder group. In this regard, our certificate of incorporation grants our board of directors or a duly authorized committee thereof broad power to establish the rights and preferences of authorized and unissued shares of preferred stock. The issuance of shares of preferred stock could decrease the amount of earnings and assets available for distribution to holders of shares of common stock. The issuance may also adversely affect the rights and powers, including voting rights, of such holders and may have the effect of delaying, deterring, or preventing a change in control of the company. Our board of directors currently does not intend to seek shareholder approval prior to any issuance of shares of preferred stock, unless otherwise required by law.

Delaware Business Combination Statute. Section 203 of the DGCL is applicable to us. Section 203 of the DGCL restricts some types of transactions and business combinations between a corporation and a 15% stockholder. A 15% stockholder is generally considered by Section 203 to be a person owning

15% or more of the corporation's outstanding voting stock. Section 203 refers to a 15% stockholder as an "interested stockholder." Section 203 restricts these transactions for a period of three years from the date the stockholder acquires 15% or more of our outstanding voting stock. With some exceptions, unless the transaction is approved by the board of directors and the holders of at least two-thirds of the outstanding voting stock of the corporation, Section 203 prohibits significant business transactions such as:

- a merger with, disposition of significant assets to or receipt of disproportionate financial benefits by the interested stockholder, and
- any other transaction that would increase the interested stockholder's proportionate ownership of any class or series of our capital stock.

The shares held by the interested stockholder are not counted as outstanding when calculating the two-thirds of the outstanding voting stock needed for approval.

The prohibition against these transactions does not apply if:

- prior to the time that any stockholder became an interested stockholder, the board of directors approved either the business combination or the transaction in which such stockholder acquired 15% or more of our outstanding voting stock, or
- the interested stockholder owns at least 85% of our outstanding voting stock as a result of a transaction in which such stockholder acquired 15% or more of our outstanding voting stock. Shares held by persons who are both directors and officers or by some types of employee stock plans are not counted as outstanding when making this calculation.

Directors' Liability

Our certificate of incorporation limits the personal liability of directors for breach of fiduciary duty to the maximum extent permitted by the DGCL and provides that no director will have personal liability to us or to our stockholders for monetary damages for breach of fiduciary duty or other duty as a director. However, these provisions do not eliminate or limit the liability of any of our directors:

- for any breach of the director's duty of loyalty to us or our stockholders;
- for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law;
- for voting or assenting to unlawful payments of dividends, stock repurchases or other distributions; or
- for any transaction from which the director derived an improper personal benefit.

Any amendment to or repeal of these provisions will not eliminate or reduce the effect of these provisions in respect of any act, omission or claim that occurred or arose prior to such amendment or repeal. If the DGCL is amended to provide for further limitations on the personal liability of directors of corporations, then the personal liability of our directors will be further limited to the greatest extent permitted by the DGCL.

Our certificate of incorporation provides that we must indemnify our directors and officers and we must advance expenses, including attorneys' fees, to each of our directors and officers in connection with legal proceedings arising out of his or her service as one of our directors or officers, as applicable, subject to very limited exceptions.

We maintain a general liability insurance policy that covers certain liabilities of our directors and officers arising out of claims based on acts or omissions in their capacities as directors or officers. In addition, we have entered into indemnification agreements with our directors and executive officers.

These indemnification agreements may require us, among other things, to indemnify each such director or executive officer, as applicable, for some expenses, including attorneys' fees, judgments, fines and settlement amounts incurred by him or her in any action or proceeding arising out of his or her service as one of our directors or executive officers, as applicable.

Certain of our non-employee directors may, through their relationships with their employers, be insured or indemnified against certain liabilities incurred in their capacity as members of our board of directors.

PLAN OF DISTRIBUTION

We have entered into a sales agreement with Cowen, under which we may offer and sell from time to time up to an aggregate of \$100,000,000 of our common stock through Cowen as our sales agent. Sales of our common stock, if any, will be made at market prices by any method that is deemed to be an "at the market offering" as defined in Rule 415(a)(4) under the Securities Act, including sales made into The Nasdaq Global Select Market or any other existing trading market for our common stock. If authorized by us in writing, Cowen may purchase shares of our common stock as principal.

Cowen will offer our common stock subject to the terms and conditions of the sales agreement on a daily basis or as otherwise agreed upon by us and Cowen. We will designate the maximum amount of common stock to be sold through Cowen on a daily basis or otherwise determine such maximum amount together with Cowen. Subject to the terms and conditions of the sales agreement, Cowen will use its commercially reasonable efforts to sell on our behalf all of the shares of common stock requested to be sold by us. We may instruct Cowen not to sell common stock if the sales cannot be effected at or above the price designated by us in any such instruction. Cowen or we may suspend the offering of our common stock being made through Cowen under the sales agreement upon proper notice to the other party. Cowen and we each have the right, by giving written notice as specified in the sales agreement, to terminate the sales agreement in each party's sole discretion at any time.

The aggregate compensation payable to Cowen as sales agent equals 3.0% of the aggregate gross sales price of the shares sold through it pursuant to the sales agreement. We have also agreed to reimburse Cowen up to \$50,000 of Cowen's actual outside legal expenses incurred by Cowen in connection with this offering. We have also agreed to reimburse Cowen for its FINRA counsel fee of up to \$10,000. We estimate that the total expenses of the offering payable by us, excluding commissions payable to Cowen under the sales agreement, will be approximately \$0.3 million.

The remaining sales proceeds, after deducting any expenses payable by us and any transaction fees imposed by any governmental, regulatory, or self-regulatory organization in connection with the sales, will equal our net proceeds for the sale of such common stock.

Cowen will provide written confirmation to us following the close of trading on The Nasdaq Global Select Market on each day in which common stock is sold through it as sales agent under the sales agreement. Each confirmation will include the number of shares of common stock sold through it as sales agent on that day, the volume weighted average price of the shares sold, the percentage of the daily trading volume and the net proceeds to us.

We will report at least quarterly the number of shares of common stock sold through Cowen under the sales agreement, the net proceeds to us and the compensation paid by us to Cowen in connection with the sales of common stock.

Settlement for sales of common stock will occur, unless the parties agree otherwise, on the second business day that is also a trading day following the date on which any sales were made in return for payment of the net proceeds to us. There is no arrangement for funds to be received in an escrow, trust or similar arrangement.

In connection with the sales of our common stock on our behalf, Cowen will be deemed to be an "underwriter" within the meaning of the Securities Act, and the compensation paid to Cowen will be deemed to be underwriting commissions or discounts. We have agreed in the sales agreement to provide indemnification and contribution to Cowen against certain liabilities, including liabilities under the Securities Act. As sales agent, Cowen will not engage in any transactions that stabilizes our common stock.

Our common stock is listed on The Nasdaq Global Select Market and trades under the symbol "VYGR." The transfer agent of our common stock is Computershare Trust N.A.

Cowen and/or its affiliates have provided, and may in the future provide, various investment banking and other financial services for us for which services they have received and, may in the future receive, customary fees.

LEGAL MATTERS

The validity of the shares of common stock offered hereby will be passed upon for us by Wilmer Cutler Pickering Hale and Dorr LLP, New York, New York. Cowen and Company, LLC is being represented in connection with this offering by Cooley LLP, New York, New York.

EXPERTS

Ernst & Young LLP, independent registered public accounting firm, has audited our consolidated financial statements included in our Annual Report on Form 10-K for the year ended December 31, 2018, as set forth in their report, which is incorporated by reference in this prospectus and elsewhere in the registration statement. Our financial statements are incorporated by reference in reliance on Ernst & Young LLP's report, given on their authority as experts in accounting and auditing.

WHERE YOU CAN FIND MORE INFORMATION

We file annual, quarterly and current reports, proxy statements and other information with the SEC. Our SEC filings are available to the public over the Internet at the SEC's website at <http://www.sec.gov>. Copies of certain information filed by us with the SEC are also available on our website at <http://www.voyagertherapeutics.com>. Our website is not a part of this prospectus and is not incorporated by reference in this prospectus.

This prospectus is part of a registration statement we filed with the SEC. This prospectus omits some information contained in the registration statement in accordance with SEC rules and regulations. You should review the information and exhibits in the registration statement for further information about us and our consolidated subsidiaries and the securities we are offering. Statements in this prospectus concerning any document we filed as an exhibit to the registration statement or that we otherwise filed with the SEC are not intended to be comprehensive and are qualified by reference to these filings. You should review the complete document to evaluate these statements. You can obtain a copy of the registration statement from the SEC's website.

INCORPORATION BY REFERENCE

The SEC allows us to incorporate by reference much of the information we file with the SEC, which means that we can disclose important information to you by referring you to those publicly available documents. The information that we incorporate by reference in this prospectus is considered to be part of this prospectus. Because we are incorporating by reference future filings with the SEC, this prospectus is continually updated and those future filings may modify or supersede some of the information included or incorporated in this prospectus. This means that you must look at all of the SEC filings that we incorporate by reference to determine if any of the statements in this prospectus or in any document previously incorporated by reference have been modified or superseded. This prospectus incorporates by reference the documents listed below (File No. 001-37625) and any future filings we make with the SEC under Sections 13(a), 13(c), 14 or 15(d) of the Securities Exchange Act of 1934, as amended, or the Exchange Act (in each case, other than those documents or the portions of those documents not deemed to be filed) between the date of the initial registration statement and the effectiveness of the registration statement and following the effectiveness of the registration statement until the offering of the securities under the registration statement is terminated or completed:

- [Annual Report on Form 10-K for the fiscal year ended December 31, 2018, filed on February 26, 2019, including the information specifically incorporated by reference into the Annual Report on Form 10-K from our definitive proxy statement for the 2019 Annual Meeting of Stockholders;](#)

[Table of Contents](#)

- Quarterly Reports on Form 10-Q for the fiscal quarters ended March 31, 2019, filed on [May 7, 2019](#); June 30, 2019, filed on [August 9, 2019](#); and September 30, 2019, filed on November 6, 2019;
- Current Reports on Form 8-K filed on [January 29, 2019](#); [February 22, 2019](#); [March 12, 2019](#); [May 21, 2019](#); [June 14, 2019](#); [June 17, 2019](#); and [August 9, 2019](#); and
- [The description of our common stock contained in our Registration Statement on Form 8-A filed on November 6, 2015, including any amendments or reports filed for the purpose of updating such description.](#)

You may request a copy of these filings, at no cost, by writing or telephoning us at the following address or telephone number:

Voyager Therapeutics, Inc.
75 Sidney Street
Cambridge, Massachusetts 02139
(857) 259-5340



Up to \$100,000,000

Common Stock

PROSPECTUS

Cowen

December 2, 2019
