Filed Pursuant to Rule 424(b)(5)
Registration No. 333-279891

PROSPECTUS SUPPLEMENT
To the Prospectus dated June 12, 2024

3,025,000 Shares of Common Stock
3,105,000 Pre-Funded Warrants to Purchase up to 3,105,000 Shares of Common Stock
Up to 3,105,000 Shares of Common Stock Underlying the Pre-Funded Warrants

We are offering 3,025,000 shares of our common stock, par value $0.0001 per share ("common stock"), and pre-funded warrants ("Pre-funded Warrants") to purchase up to 3,105,000 shares of our common stock directly to a single institutional investor pursuant to this prospectus supplement and the accompanying prospectus. Each Pre-funded Warrant will have an exercise price of $0.0001 per share and will be exercisable upon issuance until exercised in full, and is subject to adjustments in the event of stock splits, dividends, subsequent rights offerings, pro rata distributions, and certain fundamental transactions, as more fully described in the section of this prospectus supplement titled "*Description of Securities We are Offering*." The offering price per share of common stock and per Pre-funded Warrant is $0.41 and $0.4099, respectively.

In a concurrent private placement, we are also selling to the same institutional investor that received shares of common stock and Pre-funded Warrants pursuant to this prospectus supplement and the accompanying prospectus, unregistered warrants to purchase up to 6,130,000 shares of common stock (the "Warrants"). The Warrants are being sold for $0.41 per Warrant (which is included in the offering price per share and Pre-funded Warrant), have an exercise price of $0.41 per share and are exercisable for a period of five (5) years from the date on which stockholder approval is received with respect to the issuance of the shares of common stock issuable upon exercise of the Warrants (the "Warrant Shares"). The Warrants and the Warrant Shares are being offered pursuant to the exemption provided in Section 4(a)(2) under the Securities Act of 1933, as amended (the "Securities Act"), and Rule 506(b) promulgated thereunder and are not being registered under the Securities Act at this time or offered pursuant to this prospectus supplement and the accompanying prospectus. The Warrants are more fully described in the section of this prospectus supplement titled "*Private Placement Transaction*."

Our common stock is listed on the Nasdaq Capital Market under the symbol "MBIO." On June 18, 2024, the last trading day before our entry into the securities purchase agreement providing for the sale of the shares of common stock and Pre-funded Warrants, the last reported sale price of our common stock on the Nasdaq Capital Market was $0.8501 per share. There is no established public trading market for the Pre-funded Warrants being offered in this offering and the Warrants being sold in a concurrent private placement, and we do not expect a market to develop. In addition, we do not intend to apply for listing of the Pre-funded Warrants or the Warrants on any national securities exchange or other trading market. Without an active market, the liquidity of the Pre-funded Warrants and the Warrants will be limited.

As of June 18, 2024, the aggregate market value of our outstandingcommon stock held by non-affiliates, or public float, was approximately $21.5 million, based on 27,392,832 shares of outstanding common stock, of which approximately 2,105,357 shares were held by affiliates, and a price of $0.85 per share, which was the price at which our common stock was last sold on the Nasdaq Capital Market on June 18, 2024. We have sold approximately $3.3 million of securities pursuant to General Instruction I.B.6 of Form S-3 during the prior 12-calendar month period that ends on and includes the date of this prospectus supplement (excluding this offering). Accordingly, based on the foregoing, we are currently eligible under General Instruction I.B.6 of Form S-3 to offer and sell shares of our common stock having an aggregate offering price of up to approximately $3.9 million. Pursuant to General Instruction I.B.6 of Form S-3, in no event will we sell securities in a public primary offering with a value exceeding one-third of our public float in any 12-month period so long as our public float remains below $75.0 million.

We have engaged H.C. Wainwright & Co., LLC (the "Placement Agent") as our exclusive placement agent in connection with this offering. The Placement Agent has no obligation to buy any of the securities from us or to arrange for the purchase or sale of any specific number or dollar amount of the securities. We have agreed to pay the Placement Agent the fees set forth in the table below. We have not made any arrangements to place the funds from the investors in an escrow, trust or similar account. See "*Plan of Distribution*" beginning on page S-33 of this prospectus supplement for more information regarding these arrangements.

Investing in our securities involves a high degree of risk. See "Risk Factors" beginning on page S-15 of this prospectus supplement as well as the information under the caption "Risk Factors" in our Annual Report on Form 10-K for the year ended December 31, 2023, in our Quarterly Report on Form 10-Q for the quarter ended March 31, 2024, and in the other documents incorporated by reference into this prospectus supplement and the accompanying prospectus for a discussion of the factors you should carefully consider before investing in our securities.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or determined if this prospectus supplement or the accompanying prospectus is truthful or complete. Any representation to the contrary is a criminal offense.

	Per Share	Per Pre-funded Warrant	Total
Offering price	$ 0.4100	$ 0.4099	$ 2,512,989.50
Placement agent fees[(1)]	$ 0.0287	$ 0.0287	$ 175,931.00
Proceeds, before expenses, to us[(2)]	$ 0.3813	$ 0.3812	$ 2,337,058.50

(1) We have also agreed to (i) issue warrants to purchase up to 367,800 shares ofcommon stock to the Placement Agent, or its designees and (ii) pay the Placement Agent for certain expenses. See "*Plan of Distribution*" beginning on page S-33 for additional information regarding the compensation to be paid to the Placement Agent.

(2) The amount of the offering proceeds to us presented in this table does not include proceeds from the exercise of any of the Warrants being issued in the concurrent private placement.

Delivery of shares of common stock and Pre-funded Warrants is expected to be made on or about June 21, 2024, subject to the satisfaction of certain closing conditions.

H.C. Wainwright & Co.

The date of this prospectus supplement is June 19, 2024.

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ABOUT THIS PROSPECTUS SUPPLEMENT

This document is in two parts. The first part is this prospectus supplement, which describes the specific terms of this offering and also adds to and updates information contained in the accompanying prospectus and the documents incorporated by reference in this prospectus supplement and the accompanying prospectus. The second part, the accompanying prospectus dated June 12, 2024, including the documents incorporated by reference, provides more general information, some of which may not apply to this offering. Generally, when we refer to this prospectus supplement, we are referring to both parts of this document combined.

To the extent there is a conflict between the information contained in this prospectus supplement and the information contained in the accompanying prospectus or any document incorporated by reference that was filed with the U.S. Securities and Exchange Commission (the "SEC") prior to the date of this prospectus supplement, you should rely on the information in this prospectus supplement; provided that, 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 in the accompanying prospectus—the statement in the document having the later date modifies or supersedes the earlier statement.

We have not, and the Placement Agent has not, authorized anyone to provide you with information that is in addition to or different from that contained or incorporated by reference in this prospectus supplement and the accompanying prospectus. We take no responsibility for, and can provide no assurance as to the reliability of, any other information that others may give to you. Neither the delivery of this prospectus supplement or the accompanying prospectus, including any free writing prospectus that we have authorized for use in this offering, nor the sale of our securities means that information contained in this prospectus supplement and the accompanying prospectus, including any free writing prospectus that we have authorized for use in this offering, is correct after their respective dates. It is important for you to read and consider all information contained in this prospectus supplement and the accompanying prospectus, including the information incorporated by reference into this prospectus supplement and the accompanying prospectus, and any free writing prospectus that we have authorized for use in connection with this offering, in making your investment decision. You should also read and consider the information in the documents to which we have referred you in the sections titled "*Where You Can Find More Information*" and "*Incorporation of Certain Information By Reference*" in this prospectus supplement.

We further note that the representations, warranties and covenants made by us in any agreement that is filed as an exhibit to any document that is incorporated by reference herein, were made solely for the benefit of the parties to such agreement, including, in some cases, for the purpose of allocating risk among the parties to such agreements, and should not be deemed to be a representation, warranty or covenant to you. Moreover, such representations, warranties or covenants were accurate only as of the date when made. Accordingly, such representations, warranties and covenants should not be relied on as accurately representing the current state of our affairs.

Unless otherwise stated, all references in this prospectus supplement to "we," "us," "our," "Mustang," the "Company" and similar designations refer to Mustang Bio, Inc. and its consolidated subsidiaries.

SPECIAL CAUTIONARY NOTICE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus supplement contains predictive or "forward-looking statements" for purposes of the Securities Act and the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from the future results, performance or achievements expressed or implied by such forward-looking statements. The words "anticipate," "believe," "estimate," "may," "expect" and similar expressions are generally intended to identify forward-looking statements. Such forward-looking statements include, but are not limited to, statements about our:

- expectations for increases or decreases in expenses;
- expectations for the clinical and pre-clinical development, manufacturing, regulatory approval, and commercialization of our pharmaceutical product candidates or any other products we may acquire or in-license;
- use of clinical research centers and other contractors;
- expectations for incurring capital expenditures to expand our research and development and manufacturing capabilities;
- expectations for generating revenue or becoming profitable on a sustained basis;
- expectations or ability to enter into marketing and other partnership agreements;
- expectations or ability to enter into product acquisition and in-licensing transactions;
- expectations or ability to build our own commercial infrastructure to manufacture, market and sell our product candidates, if approved;
- expectations for the acceptance of our product candidates, if approved, by doctors, patients or payors;
- our ability to compete against other companies and research institutions;
- our ability to attract, hire and retain qualified personnel, including the impact of our recently announced reduction in work force;
- our ability to secure adequate protection for our intellectual property;
- our ability to attract and retain key personnel;
- our ability to obtain reimbursement for our products, if approved;
- estimates of the sufficiency of our existing cash and cash equivalents and investments to finance our operating requirements, including expectations regarding the value and liquidity of our investments;
- our stock price and the volatility of the equity markets;
- our ability to comply with the requirements of Nasdaq to maintain the listing of our common stock on the Nasdaq Capital Market;
- expected losses; and
- expectations for future capital requirements.

Our actual results may differ materially from the results anticipated in these forward-looking statements due to a variety of factors, including among other things, risks related to the satisfaction of the conditions to closing the sale of the Company's manufacturing facility in the anticipated timeframe or at all; whether the prospective purchaser of the Company's manufacturing facility is able to successfully perform its obligation to produce the Company's products under the manufacturing services agreement on a timely basis and to acceptable standards; disruption from the sale of the Company's manufacturing facility making it more difficult to maintain business and operational relationships; negative effects of the announcement or the consummation of the transaction on the market price of the Company's common stock; significant transaction costs; the development stage of the Company's primary product candidates, our ability to obtain, perform under, and maintain financing and strategic agreements and relationships; risks relating to the results of research and development activities; risks relating to the timing of starting and completing clinical trials; uncertainties relating to preclinical and clinical testing; our dependence on third-party suppliers; our ability to attract, integrate and retain key personnel; the early stage of products under development; our need for substantial additional funds; government regulation; patent and intellectual property matters; competition and those factors described in the section titled "*Risk Factors*" beginning on page S-15 of this prospectus supplement. All written or oral forward-looking statements attributable to us are expressly qualified in their entirety by these cautionary statements.

The forward-looking statements contained in this prospectus supplement reflect our views and assumptions as of the date of this prospectus supplement. Except as required by law, we assume no responsibility for updating any forward-looking statements.

We qualify all of our forward-looking statements by these cautionary statements.

PROSPECTUS SUPPLEMENT SUMMARY

This summary highlights certain information about us, this offering and information appearing elsewhere in this prospectus supplement, in the accompanying prospectus and in the documents we incorporate by reference. This summary is not complete and does not contain all of the information that you should consider before making an investment decision. To fully understand this offering and its consequences to you, you should read this entire prospectus supplement and the accompanying prospectus carefully, including the factors described under the heading "Risk Factors" in this prospectus supplement beginning on page S-15, together with any free writing prospectus we have authorized for use in connection with this offering and the financial statements and all other information incorporated by reference in this prospectus supplement and the accompanying prospectus.

Our Business

Overview and Product Candidate Development

We are a clinical-stage biopharmaceutical company focused on translating today's medical breakthroughs in cell and gene therapies into potential cures for hematologic cancers, solid tumors and rare genetic diseases. We aim to acquire rights to these technologies by licensing or otherwise acquiring an ownership interest in the technologies, funding their research and development and eventually either out-licensing or bringing the technologies to market.

Our pipeline is currently focused in two core areas: CAR T therapies for hematologic malignancies and CAR T therapies for solid tumors. For these therapies we have partnered with world class research institutions, including the City of Hope National Medical Center ("COH" or "City of Hope"), Fred Hutchinson Cancer Center ("Fred Hutch"), and Nationwide Children's Hospital ("Nationwide").

CAR T Therapies

Our pipeline of CAR T therapies is being developed under exclusive licenses from several world class research institutions. Our strategy is to license these technologies, support preclinical and clinical research activities by our partners and transfer the underlying technology to our or our contract manufacturer's cell processing facility in order to conduct our own clinical trials.

We are developing CAR T therapy for hematologic malignancies in partnership with Fred Hutch targeting CD20 (MB-106). In May 2021, we announced that the U.S. Food and Drug Administration ("FDA") accepted our Investigational New Drug ("IND") Application for MB-106. As of December 2023, approximately 40 patients have been treated in an ongoing phase 1 clinical trial sponsored by Fred Hutch (ClinicalTrials.gov Identifier: NCT03277729), and approximately 20 patients have been treated in an ongoing phase 1 clinical trial sponsored by us (ClinicalTrials.gov Identifier: NCT05360238). In 2023, we received Safety Review Committee approval to continue dose escalation in all three active arms of the ongoing Mustang-sponsored phase 1 trial. We presented the latest results, demonstrating a favorable safety profile, complete response rate, and durability, from the ongoing Mustang-sponsored phase 1 trial at the 2023 American Society of Hematology ("ASH") Annual Meeting. As of December 31, 2023, the MB-106 Mustang-sponsored phase 1 trial is pending one patient to complete the final dose level required to advance to phase 2 pivotal studies for treatment of patients with relapsed or refractory indolent B-cell non-Hodgkin lymphoma.

We are also developing CAR T therapy for solid tumors in partnership with COH targeting IL13Rα2 (MB-101). In addition, we have partnered with Nationwide for a herpes simplex virus type 1 ("HSV-1") oncolytic virus (MB-108) in order to enhance the activity of MB-101 for the treatment of patients with high-grade malignant brain tumors. The Phase 1 clinical trial sponsored by COH for MB-101 (ClinicalTrials.gov Identifier: NCT02208362) has completed the treatment phase and patients continue to be assessed for long-term safety. A Phase 1 clinical trial sponsored by the University of Alabama at Birmingham ("UAB") for MB-108 (ClinicalTrials.gov Identifier: NCT03657576) began during the third quarter of 2019. In October 2023, we announced that the FDA accepted our IND application for the combination of MB-101 and MB-108 – which is referred to as MB-109 – for the treatment of patients with *IL13Rα2*+relapsed or refractory glioblastoma ("GBM") and high-grade astrocytoma.

On May 18, 2023, we announced a series of changes resulting from a review of our portfolio of product candidates to determine the future strategy of our programs and the proper allocation of our resources. Following this review, we determined to discontinue development of our MB-102 (CD123), MB-103 (HER2), MB-104 (CS1) and MB-105 (PSCA) programs, all of which were CAR T therapies being developed in partnership with City of Hope.

Terminated Product Candidates (Gene Therapies and in vivo CAR-T)

We formerly developed several gene therapy product candidates, which included MB-117 and MB-217 (based on technologies licensed from St. Jude Children's Research Hospital ("St. Jude")) and MB-110 (based on technologies licensed from Leiden University Medical Centre ("LUMC")). In April 2024, we entered into a termination and release agreement with St. Jude, pursuant to which we agreed to terminate the license agreement underpinning the MB-117 and MB-217 product candidates in exchange for a mutual release of liability and forgiveness by St. Jude of all amounts previously owing to them. Also in April 2024, we delivered a termination notice to LUMC pursuant to which we terminated the license agreement underpinning the MB-110 product candidate; we are currently in discussions with LUMC regarding the terms that will govern such termination. In June 2024, we also agreed with Mayo Foundation for Medical Education and Research ("Mayo Clinic") to terminate the license agreement underpinning our (now former) preclinical in vivo CAR-T program, together with a related sponsored research agreement, in exchange for a mutual release of liability and forgiveness by Mayo Clinic of all amounts previously owing to them.

To date, we have not received approval for the sale of any of our product candidates in any market and, therefore, have not generated any product sales from our product candidates. In addition, we have incurred substantial operating losses since our inception, and expect to continue to incur significant operating losses for the foreseeable future and may never become profitable. As of March 31, 2024, we had an accumulated deficit of $386.2 million.

Therapeutic Pipeline

Therapies for Oncology and Hematologic Malignancies

MB - 106 (CD20 CAR T for B cell non-Hodgkin lymphoma (NHL) and chronic lymphocytic leukemia (CLL))

We believe CD20 is a promising target for immunotherapy of B-cell malignancies. CD20 is a B-cell lineage-specific phosphoprotein that is expressed in high, homogeneous density on the surface of more than 95% of B-cell NHL and CLL. CD20 is stable on the cell surface with minimal shedding, internalization, or modulation upon antibody binding and is present at only nanomolar levels as a soluble antigen. It is well established as an effective immunotherapy target, with extensive studies demonstrating improved tumor responses and survival of B-NHL patients treated with rituximab and other anti-CD20 antibodies. Importantly, CD20 continues to be expressed on the lymphoma cells of most patients with relapsed B-NHL despite repetitive rituximab treatments, and loss of CD20 expression is not a major contributor to

treatment resistance. Thus, there is strong rationale for testing CD20 CAR T cells as an immunotherapy for NHL.

More than 80,000 new cases of NHL are diagnosed each year in the United States, and over 20,000 patients die of this group of diseases annually. Most forms of NHL, including follicular lymphoma, mantle cell lymphoma, marginal zone lymphoma, lymphoplasmacytic lymphoma, and small lymphocytic lymphoma ("SLL"), which account collectively for approximately 45% of all cases of NHL, are incurable with available therapies, except for allogenic stem cell transplant ("allo-SCT"). However, many NHL patients are not suitable candidates for allo-SCT, and this treatment is also limited by significant rates of morbidity and mortality due to graft-versus-host disease. Aggressive B-cell lymphomas such as diffuse large B-cell lymphoma, the most common subtype of lymphoma, account for an additional 30-35% of NHL. The majority of patients with aggressive B-NHL are successfully treated with combination chemotherapy, but a significant proportion relapse or have refractory disease, and the outcome of these patients is poor. Innovative new treatments are therefore urgently needed.

Chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL) is a mature B cell neoplasm characterized by a progressive accumulation of monoclonal B lymphocytes. CLL is considered to be identical (i.e., one disease with different manifestations) to the NHL SLL. The malignant cells seen in CLL and SLL have identical pathologic and immunophenotypic features. The term CLL is used when the disease manifests primarily in the blood, whereas the term SLL is used when involvement is primarily nodal.

CLL is the most common leukemia in adults in Western countries, accounting for approximately 25 to 35 percent of all leukemias in the United States. An estimated 20,700 new cases of CLL will be diagnosed in the United States in 2024. CLL is considered to be mainly a disease afflicting older adults, with a median age at diagnosis of approximately 70 years; however, it is not unusual to make this diagnosis in younger individuals (e.g., from approximately 30 to 39 years of age). The incidence increases rapidly with increasing age. The natural history of CLL is extremely variable, with survival times from initial diagnosis that range from approximately 2 to 20 years, and a median survival of approximately 10 years.

Most patients will have a complete or partial response to initial therapy. However, conventional therapy for CLL is not curative and most patients experience relapse. In addition, many patients will require a change in therapy due to intolerance. Since patients with CLL are generally elderly with a median age older than 70 years, and due to the relatively benign course of the disease in the majority of patients, only selected patients are candidates for intensive treatments such as allo-SCT. Innovative new treatments with a favorable safety profile are therefore urgently needed for patients with relapsed and refractory disease.

Under their IND, Fred Hutch is currently conducting a Phase 1/2 clinical study to evaluate the anti-tumor activity and safety of administering CD20-directed third-generation CAR T cells incorporating both 4-1BB and CD28 co-stimulatory signaling domains (MB-106) to patients with relapsed or refractory B-cell NHL or CLL (ClinicalTrials.gov Identifier: NCT03277729). Secondary endpoints of this study include safety and toxicity, preliminary antitumor activity as measured by overall response rate and complete remission rate, progression-free survival, and overall survival. The study is also assessing CAR T cell persistence and the potential immunogenicity of the cells. Finally, this study was designed so that, together with Fred Hutch, we could determine a recommended Phase 2 dose. Fred Hutch intends to enroll approximately 50 subjects in this study, which is being led by the Principal Investigator Mazyar Shadman, M.D., M.P.H., Associate Professor of Fred Hutch's Clinical Research Division.

The Fred Hutch IND was amended in 2019 to incorporate an optimized manufacturing process that had been developed in collaboration with us.

In May 2021, we announced that the FDA issued a safe to proceed letter for our IND application allowing for initiation of a multi-center Phase 1/2 clinical study of MB-106 in patients with relapsed or refractory B cell NHL or CLL (Clinicaltrials.gov Identifier: NCT05360238). In August 2022, the first patient was treated in our study.

In November 2021, Mustang was awarded a grant of approximately $2.0 million from NCI of the National Institutes of Health. This two-year award partially funded the Mustang-sponsored multicenter trial to assess the safety, tolerability and efficacy of MB-106. In August 2023, we fully utilized the grant.

In June 2022, MB-106 received Orphan Drug Designation for the treatment of Waldenstrom macroglobulinemia ("WM").

In December 2023, we presented preliminary clinical data for the indolent lymphoma patients treated in the ongoing Phase 1/2 clinical study at the American Society of Hematology (ASH) annual meeting. All 9 patients responded clinically to treatment; the observed overall response rate was 100%. All 5 follicular lymphoma patients achieved a complete response. Among the WM patients 1 patient attained a very good partial response, and 2 patients attained a partial response. The single patient with a hairy cell leukemia variant experienced stable disease. The safety profile demonstrated that MB-106 was well tolerated with no occurrences of cytokine release syndrome ("CRS") above grade 1, and no immune effector cell-associated neurotoxicity syndrome ("ICANS") of any grade was reported. Cell expansion and persistence were also demonstrated.

In the first quarter of 2024, we completed a successful End-of-Phase 1 meeting with the FDA regarding a potential pivotal Phase 2 single-arm clinical trial for the treatment of WM. Per the discussions, the FDA agreed with the proposed overall design of the pivotal trial for WM at the recommended dose of 1 x 107 CAR-T cells/kg and requested only minimal modifications to the study protocol. No additional nonclinical studies are expected prior to Phase 2 or a Biologics License Application ("BLA") filing. Due to limited resources, and as a result of the reduction in work force described below, we have suspended patient accrual and follow-up activities under the ongoing Phase 1 trial and do not expect to initiate our pivotal Phase 2 single-arm clinical trial of MB-106 for the treatment of WM trial in 2024. Subject to available funds, we intend to rely on third party service providers to conduct study and manufacturing services to advance our priority potential product candidates.

Also in the first quarter of 2024, we completed enrollment of the indolent lymphoma arm in our multicenter Phase 1 trial. The tenth and final patient enrolled was a patient with follicular lymphoma (FL) who achieved a complete response following treatment with 1 x 10^7 CAR-T cells/kg. As a result, the overall complete response rate for FL in the Phase 1 portion of this trial was sustained at 100% (N=6), with no occurrence of CRS above grade 1 and no ICANS of any grade, despite not using prophylactic tocilizumab or dexamethasone.

In March 2024, we announced plans to collaborate with Fred Hutch for a proof-of-concept Phase 1 investigator-sponsored clinical trial evaluating MB-106 in autoimmune diseases.

In March 2024, we were granted the Regenerative Medicine Advanced Therapy ("RMAT") designation by the FDA for the treatment of relapsed or refractory CD20 positive WM and FL, based on potential improvement in response as seen in clinical data-to-date. Drugs eligible for RMAT designation are those intended to treat, modify, reverse or cure a serious or life-threatening disease or condition, and that present preliminary clinical evidence indicating the drug has the potential to address unmet

medical needs for such disease or condition. RMAT designation provides regenerative medicine advanced therapy products with the same benefits to expedite the development and review of a marketing application that are available to drugs that receive Breakthrough Therapy Designation. These advantages include timely advice and interactive communications with FDA, as well as proactive and collaborative involvement by senior FDA managers and experienced review and regulatory health project management staff. A product designated as an RMAT also may be eligible for other FDA-expedited programs, such as Priority Review. The FDA also may conduct a rolling review of products in its expedited programs, reviewing portions of a marketing application before the complete application is submitted.

MB-109: Combination MB-101(IL13Rα2 CAR T Cell Program for Glioblastoma) and MB-108 (HSV-1 oncolytic virus C134) as a Potential Treatment for IL13Rα2+ Relapsed or Refractory Glioblastoma (GBM) and High-Grade Astrocytoma

An attractive novel approach to control glioblastoma is adoptive cellular immunotherapy utilizing CAR T cells. CAR T cells can be engineered to recognize very specific antigenically distinct tumor populations and to migrate through the brain parenchyma to kill malignant cells. In addition, oncolytic viruses ("OVs") have been developed to effectively infect and kill cancer cells in the tumor, as well as modify the microenvironment to increase tumor immunogenicity and immune cell trafficking within the tumor. Due to these properties, OVs have been studied in combination with other treatments to enhance the effectiveness of immunotherapies.

Preliminary anti-tumor activity has been observed in clinical studies administering the OV (MB-108) and CAR T cell therapy (MB-101) as single agents; however, the combination has not yet been explored. To determine if the combination of both therapies will result in a synergistic effect, investigators from COH developed preclinical studies in orthotopic GBM models in nude mice. Dr. Christine Brown from City of Hope presented these preclinical studies at the American Association for Cancer Research 2022 Annual Meeting. It was observed that co-treatment with HSV-1 OV and IL13Rα2-directed CAR-T cells resulted in no additional adverse events beyond those seen with the individual therapies, and, more notably, that pre-treatment with HSV-1 OV re-shaped the tumor microenvironment by increasing immune cell infiltrates and enhanced the efficacy of sub-therapeutic doses of IL13Rα2-directed CAR-T cell therapy delivered either intraventricularly or intratumorally. These preclinical studies aimed to provide a deeper understanding of this combination approach to support the potential benefit of a combination study that will evaluate HSV-1 OV (MB-108) and IL13Rα2-directed CAR-T cells (MB-101).

In October 2023, we received a safe-to-proceed "approval" from the FDA for our MB-109 IND application allowing us to initiate a Phase 1, open-label, non-randomized, multicenter study of MB-109 in patients with IL13Ra2+ recurrent GBM and high-grade astrocytoma. In this Phase 1 clinical study, we intend to evaluate the combination of CAR-T cells (MB-101) and the herpes simplex virus type 1 oncolytic virus (MB-108) in patients with IL13Ra2+ high-grade gliomas. The design of this study involves first a lead in cohort, wherein patients are treated with MB-101 alone without prior MB-108 administration. After successful confirmation of the safety profile of MB-101 alone, the study will then investigate increasing doses of intratumorally administered MB-108 followed by dual intratumoral (ICT) and intraventricular (ICV) administration of MB-101. Due to limited resources, we do not currently expect to initiate this study until such time, if any, that additional resources become available to us.

MB-101 (IL13Rα2 CAR T Cell Program for Glioblastoma)

GBM is the most common brain and central nervous system ("CNS") cancer, accounting for approximately 49.1% of malignant primary brain and CNS tumors, approximately 54% of all gliomas, and approximately 16% of all primary brain and CNS tumors. More than 14,490 new GBM cases were predicted to be diagnosed in the U.S. for 2023. Malignant brain tumors are the second leading cause of cancer-related deaths in adolescents and young adults aged 15-39 and the most common cancer occurring among 15-19-year-olds in the U.S. While GBM is a rare disease 2-3 cases per 100,000 persons per year in the U.S. and European Union ("EU"), it is quite lethal, with five-year survival rate historically under 10%, which has been virtually unchanged for decades. Standard of care therapy consists of maximal surgical resection, radiation, and chemotherapy with temozolomide, which, while rarely curative, is shown to extend median overall survival from 4.5 to 15 months. GBM remains difficult to treat due to the inherent resistance of the tumor to conventional therapies.

Immunotherapy approaches targeting brain tumors offer promise over conventional treatments. IL13Rα2 is an attractive target for CAR T therapy, as it has limited expression in normal tissue but is overexpressed on the surface of greater than 50% of GBM tumors. CAR-T cells are designed to express membrane-tethered IL-13 receptor ligand ("IL-13") mutated at a single site (glutamic acid at position 13 to a tyrosine; E13Y) with high affinity for IL13Rα2 and reduced binding to IL13Rα1 in order to reduce healthy tissue targeting (Kahlon KS *et al. Cancer Research.* 2004;64:9160-9166).

We are developing an optimized CAR-T product incorporating enhancements in CAR-T design and T cell engineering to improve antitumor potency and T cell persistence. These include a second-generation hinge-optimized CAR containing mutations in the IgG4 linker to reduce off-target Fc interactions (Jonnalagadda M *et al. Molecular Therapy.* 2015;23(4):757-768.), a 4-1BB (CD137) co-stimulatory signaling domain for improved survival and maintenance of CAR T cells, and the extracellular domain of CD19 as a selection/tracking marker. In order to further improve persistence, either central memory T-cells (T_{CM}) or enriched CD62L+ naïve and memory T cells ($T_{N/MEM}$) are isolated and enriched. Our manufacturing process limits *ex vivo* expansion, which is designed to reduce T cell exhaustion and maintain a T_{CM} or $T_{N/MEM}$ phenotype. Based on experiments with CAR-Ts in mouse xenograft models of GBM, these CAR-modified T_{CM} and $T_{N/MEM}$ cells have been shown to be more potent and persistent than earlier generations of CAR-T cells.

Our academic partners at COH have recently completed the treatment phase of their Phase 1 study, which was designed to assess the feasibility and safety of using T_{CM} or $T_{N/MEM}$ enriched IL13Rα2-specific CAR-engineered T cells for clinical study participants with IL13Rα2 recurrent/refractory malignant glioma (ClinicalTrials.gov Identifier: NCT02208362). In this study, COH enrolled and treated 65 patients, with 58 patients receiving 3 cycles of CAR T cells per the study protocol. MB-109: Combination MB-101(IL13Rα2 CAR T Cell Program for Glioblastoma) and MB-108 (HSV-1 oncolytic virus C134) as a Potential Treatment for IL13Rα2+ Relapsed or Refractory Glioblastoma (GBM) and High-Grade Astrocytoma. Preliminary data indicated that the CAR-T cells were well tolerated, and no dose-limiting toxicities were observed in any of the study arms nor where there any occurrences of CRS or treatment-related deaths. Of the 58 patients evaluable for disease response, 50% achieved stable disease (SD) or better; 22%, including 8 patients with grade 4 gliomas, achieved SD or better for at least 90 days. Two patients achieved partial response, and one patient achieved complete response on the study. In 2016 COH reported that a patient had achieved a complete response to treatment based on the imaging and clinical features set forth by the Response Assessment in Neuro-Oncology Criteria ("RANO"). This result was published as a case report in the *New England Journal of Medicine* (Brown CE et al. *NEJM.* 2016;375:2561-9). As described in the paper, this patient diagnosed with recurrent multifocal glioblastoma received multiple infusions of IL13Rα2-specific CAR-T cells over 220 days through two intracranial delivery routes – infusions into the resected tumor cavity followed by infusions into the ventricular system. Intracranial infusions of IL13Rα2-targeted CAR-T cells were not associated with any toxic effects of grade 3 or higher. After CAR-T cell treatment, regression of all intracranial and spinal tumors was observed, along with corresponding increases in levels of cytokines and immune cells in the cerebrospinal fluid. This clinical response was sustained for 7.5 months after the initiation of CAR T-cell therapy; however, the patient's disease eventually recurred at four new locations that were distinct and non-adjacent to the original tumors, and biopsy of one of these lesions showed decreased expression of IL13Rα2.

Results from this COH study have laid the foundation for potentially three new MB-101 studies listed below. Due to limited resources, we do not expect to initiate these studies until such time, if any, that additional resources become available to us.

1. MB-101 with or without nivolumab and ipilimumab in treating patients with recurrent or refractory glioblastoma (currently enrolling patients; ClinicalTrials.gov Identifier: NCT04003649) sponsored by COH;

2. MB-101 in treating patients with recurrent or refractory glioblastoma with a substantial component of leptomeningeal disease (currently enrolling patients; ClinicalTrials.gov Identifier: NCT04661384) sponsored by COH;

3. MB-101 in combination with the herpes simplex virus type 1 oncolytic virus (MB-108) in treating patients with recurrent or refractory glioblastoma or high-grade astrocytoma, as described above. This combination therapy, to be administered in a phase 1 two-center trial under our IND, will be referred to as MB-109.

MB - 108 (HSV 1 oncolytic virus C134)

MB-108 is a next-generation oncolytic herpes simplex virus ("oHSV") that is conditionally replication competent; that is, it can replicate in tumor cells, but not in normal cells, thus killing the tumor cells directly through this process. Replication of C134 in the tumor itself not only kills the infected tumor cells but causes the tumor cell to act as a factory to produce new virus. These virus particles are released as the tumor cell dies and can then proceed to infect other tumor cells in the vicinity and continue the process of tumor kill. In addition to this direct oncolytic activity, the virus promotes an immune response against surviving tumor cells, which increases the antitumor effect of the therapy. The virus expresses a gene from another virus from the same overall virus family, human cytomegalovirus, which allows it to replicate better in the tumor cells than its first-generation predecessors. However, the virus has also been genetically engineered to minimize the production of any toxic effects for the patient receiving the therapy.

To improve this virus over its first-generation predecessors, modifications have focused on improving viral replication and spread within the tumor bed and on enhancing bystander damage to uninfected tumor cells. These effects cumulatively should result in converting an immunologically cold tumor to an immunologically hot tumor, which we anticipate will increase the efficacy of our IL13Rα2 directed CAR T for the treatment of GBM and high-grade astrocytoma.

The O'Neal Comprehensive Cancer Center at the UAB is the single clinical trial site for the Phase 1 trial of MB - 108, and this site has initiated a Phase 1 trial that began enrolling patients in 2019 (ClinicalTrials.gov Identifier: NCT03657576). The primary objective of this study is to determine the safety and tolerability of a single dose of MB-108 administered via a stereotactic intracerebral injection and to determine the maximally tolerated dose ("MTD") of the oncolytic virus. Secondary objectives are to obtain preliminary information about the potential benefit of MB - 108 in the treatment of patients with recurrent malignant gliomas, including relevant data on markers of efficacy, including time to tumor progression and patient survival. As of April 2023, 9 patients had been enrolled in this study.

Recent Developments

Sale of Manufacturing Facility – Overview of Transaction

On May 18, 2023, we entered into an Asset Purchase Agreement (the "Original Asset Purchase Agreement") with uBriGene (Boston) Biosciences, Inc., a Delaware corporation ("uBriGene"), pursuant to which we agreed to sell our leasehold interest in our cell processing facility located in Worcester, Massachusetts (the "Facility"), and associated assets relating to the manufacturing and production of cell and gene therapies at the Facility to uBriGene (the "Transaction"). We and uBriGene subsequently entered into Amendment No. 1, dated as of June 29, 2023, and Amendment No. 2, dated as of July 28, 2023, to the Original Asset Purchase Agreement (the Original Asset Purchase Agreement, as so amended, the "Asset Purchase Agreement").

On July 28, 2023 (the "Closing Date"), pursuant to the Asset Purchase Agreement, we completed the sale of all of our assets that primarily relate to the manufacturing and production of cell and gene therapies at the Facility (such operations, the "Transferred Operations" and such assets, the "Transferred Assets") to uBriGene for upfront consideration of $6 million cash (the "Base Amount"). The Transferred Assets that were transferred to uBriGene on the Closing Date include, but are not limited to: (i) our leases of equipment and other personal property and all other property, equipment, machinery, tools, supplies, inventory, fixtures and all other personal property primarily related to the Transferred Operations, (ii) the data, information, methods, quality management systems, and intellectual property primarily used for the purposes of the Transferred Operations, (iii) the records and filings, including customer and vendor lists, production data, standard operating procedures and business records relating to, used in or arising under the Transferred Operations and (iv) all transferrable business license, permits and approvals necessary to operate the Transferred Operations. As described in greater detail below, certain Transferred Assets, including our lease of the Facility and contracts that are primarily used in the Transferred Operations (the "Transferred Contracts") did not transfer to uBriGene on the Closing Date.

Voluntary Notice to U.S. Committee on Foreign Investment in the United States

uBriGene is an indirect, wholly owned subsidiary of UBrigene (Jiangsu) Biosciences Co., Ltd., a Chinese contract development and manufacturing organization. Under the Asset Purchase Agreement, we and uBriGene agreed to use our reasonable best efforts to obtain clearance for the Transaction from the U.S. Committee on Foreign Investment in the United States ("CFIUS"), although obtaining such clearance was not a condition to closing the Transaction. In accordance with the Asset Purchase Agreement, we and uBriGene previously submitted a voluntary joint notice to CFIUS on August 10, 2023.

Following an initial 45-day review period and subsequent 45-day investigation period, on November 13, 2023, CFIUS requested that we and uBriGene withdraw and re-file our joint voluntary notice to allow more time for review and discussion regarding the nature and extent of national security risk posed by the Transaction. Upon CFIUS's request, we and uBriGene submitted a request to withdraw and re-file our joint voluntary notice to CFIUS, and on November 13, 2023, CFIUS granted this request, accepted the joint voluntary notice and commenced a new 45-day review period on November 14, 2023. CFIUS's 45-day review ended on December 28, 2023. Since CFIUS had not concluded its review by December 28, 2023, the proceeding transitioned to a subsequent 45-day investigation period, which ended on February 12, 2024.

Following the 45-day review period and subsequent 45-day investigation period described above, on February 12, 2024, we and uBriGene requested permission to withdraw and re-file our joint voluntary notice to allow more time for review and discussion regarding the nature and extent of national security risk posed by the Transaction. Upon our joint request to withdraw and re-file their joint voluntary notice to CFIUS, on February 12, 2024, CFIUS granted this request, accepted the joint voluntary notice and commenced a new 45-day review period on February 13, 2024. CFIUS's new 45-day review ended on March 28, 2024. Because CFIUS had not yet concluded its action, the proceeding transitioned to a second 45-day phase as CFIUS further investigated the Transaction. On March 28, 2024, CFIUS advised us that its investigation would be completed no later than May 13, 2024.

On May 13, 2024, together with uBriGene and CFIUS, we executed a National Security Agreement (the "NSA"), pursuant to which we and uBriGene agreed to abandon the Transaction and all other transactions contemplated by the Asset Purchase Agreement and the agreements entered into in connection therewith. The execution of the NSA was the result of CFIUS' determination that such transactions posed a risk to the national security of the United States. We disagree with this position but did not feel a meaningful likelihood existed that the Transaction would be consummated in light of CFIUS' objections. The NSA imposes certain conditions on us and uBriGene and its affiliates. Most significantly, we agreed (i) not to effect the Transaction with uBriGene or any of its affiliates; and (ii) to appoint a point of contact representative with whom CFIUS and uBriGene's designated contact person may interact as needed. The NSA also obligates uBriGene to sell, or otherwise dispose of, the equipment assets purchased within 180 days after the execution of the NSA, with uBriGene able to eliminate some of its obligations under the NSA if it is able to sell the equipment assets purchased back to us within 45 days after the execution of the NSA.

Notification of Non-Compliance with Nasdaq Continued Listing Requirements

On March 13, 2024, we received a deficiency letter (the "Letter") from the Listing Qualifications Department (the "Staff") of The Nasdaq Stock Market ("Nasdaq") notifying us that we were not in compliance with the minimum stockholders' equity requirement for continued listing on the Nasdaq Capital Market under Nasdaq Listing Rule 5550(b)(1). Nasdaq Listing Rule 5550(b)(1) requires companies listed on The Nasdaq Capital Market to maintain stockholders' equity of at least $2,500,000 (the "Stockholders' Equity Requirement"). As of December 31, 2023, we reported stockholders' equity of $123,000. The Letter further noted that as of its date, we did not have a market value of listed securities of $35 million, or net income from continued operations of $500,000 in the most recently completed fiscal year or in two of the last three most recently completed fiscal years, the alternative quantitative standards for continued listing on the Nasdaq Capital Market.

The Letter had no immediate effect on our continued listing on the Nasdaq Capital Market, subject to our compliance with the other continued listing requirements. In accordance with Nasdaq rules, we were provided 45 calendar days, or until April 29, 2024, to submit a plan to regain compliance (the "Compliance Plan"). We submitted our Compliance Plan on April 29, 2024 and the Staff granted the our request for an extension of 180 calendar days through September 9, 2024 to regain compliance with the Stockholders Equity Requirement.

On May 16, 2024, we received a notice (the "Second Letter") from the Staff of Nasdaq indicating that the bid price of our common stock had closed below $1.00 per share for 31 consecutive business days and, as a result, we were not in compliance with Nasdaq Listing Rule 5550(a)(2), which sets forth the minimum bid price requirement for continued listing on the Nasdaq Capital Market. The Second Letter from Nasdaq had no immediate effect on the listing of our common stock on Nasdaq. Pursuant to Nasdaq Listing Rule 5810(c)(3)(A), we were afforded a 180-calendar day grace period, or until November 12, 2024, to regain compliance with the bid price requirement. Compliance can be achieved by evidencing a closing bid price of at least $1.00 per share for a minimum of ten consecutive business days (but generally not more than 20 consecutive business days) during the 180-calendar day grace period.

If we do not regain compliance with the bid price requirement by November 12, 2024, we may be eligible for an additional 180-calendar day compliance period so long as it satisfies the criteria for initial listing on Nasdaq and the continued listing requirement for market value of publicly held shares and we provide written notice to Nasdaq of our intention to cure the deficiency during the second compliance period by effecting a reverse stock split, if necessary. In the event we are not eligible for the second grace period, Nasdaq staff will provide written notice that our common stock is subject to delisting; however, we may request a hearing before the Nasdaq Hearings Panel (the "Panel"), which request, if timely made, would stay any further suspension or delisting action by the Staff pending the conclusion of the hearing process and expiration of any extension that may be granted by the Panel. There can be no assurance that we would be successful in our efforts to maintain the listing of our common stock on the Nasdaq Capital Market.

April 2024 Reduction in Work Force

On April 10, 2024, our board of directors approved a reduction of our workforce by approximately 81% of our employee base in order to reduce costs and preserve capital due to the fundraising environment and continued uncertainty regarding the CFIUS review of the sale of the Facility and the Transaction with uBriGene. The workforce reduction took place primarily in April 2024 and is expected to be substantially completed in the second quarter of 2024. As a result of these actions, we expect to incur personnel-related restructuring charges of approximately $0.2 million in connection with one-time employee termination cash expenditures, which are expected to be incurred in the second quarter of 2024. We may also incur other charges or cash expenditures not currently contemplated due to events that may occur as a result of, or associated with, the workforce reduction or retention efforts. The estimates of the costs expected to be incurred, and the timing thereof, are subject to various assumptions and actual costs may differ. We and our board of directors continue to evaluate all strategic and other alternatives related to the business.

Due to limited resources, and as a result of the reduction in work force described above, we do not expect to initiate our pivotal Phase 2 single-arm clinical trial of MB-106 for the treatment of WM trial in 2024. Subject to available funds, we intend rely on third party service providers to conduct study and manufacturing services to advance our priority potential product candidates.

Corporate Information

We are a majority-controlled subsidiary of Fortress Biotech, Inc. We were incorporated under the laws of the State of Delaware on March 13, 2015. Our principal executive offices are located at 377 Plantation Street, Worcester, Massachusetts 01605, and our telephone number is 781-652-4500. We maintain a website on the Internet at www.mustangbio.com and our e-mail address is info@mustangbio.com. Information on our website, or any other website, is not incorporated by reference in this prospectus. We have included our website address in this prospectus solely as an inactive textual reference.

Implications of Being a Smaller Reporting Company

We are a smaller reporting company as defined in the Securities Exchange Act of 1934, as amended (the "Exchange Act"). We may take advantage of certain of the scaled disclosures available to smaller reporting companies and will be able to take advantage of these scaled disclosures for so long as (i) the market value of our voting and non-voting common stock held by non-affiliates is less than $250 million measured on the last business day of our second fiscal quarter or (ii) our annual revenue is less than $100 million during the most recently completed fiscal year and the market value of our voting and non-voting common stock held by non-affiliates is less than $700 million measured on the last business day of our second fiscal quarter. Specifically, as a smaller reporting company, we may choose to present only the two most recent fiscal years of audited financial statements in our Annual Reports on Form 10-K and have reduced disclosure obligations regarding executive compensation, and if we are a smaller reporting company with less than $100 million in annual revenue, we would not be required to obtain an attestation report on internal control over financial reporting issued by our independent registered public accounting firm.

THE OFFERING

Securities Offered by Us:	3,025,000 shares of common stock Pre-funded Warrants to purchase up to 3,105,000 shares of common stock at an exercise price of $0.0001 per share. Each Pre-funded Warrant will be exercisable immediately upon issuance and will not expire until exercised in full. This prospectus supplement also relates to the offering of the shares of common stock issuable upon exercise of such Pre-funded Warrants. There is no established public trading market for the Pre-funded Warrants, and we do not expect a market to develop. In addition, we do not intend to list the Pre-funded Warrants on the Nasdaq Capital Market or any other nationally recognized trading system. See "*Description of the Securities We are Offering—Pre-funded Warrants Issued in This Offering*" for a discussion of the terms of the Pre-funded Warrants.
Offering Price:	$0.41 per share of common stock and $0.4099 per Pre-funded Warrant
Common Stock to be Outstanding After the Offering:	33,522,832 shares of common stock, assuming exercise of all Pre-funded Warrants being offered herein, and no exercise of the Warrants being issued in the concurrent private placement transaction.
Use of Proceeds:	We estimate the net proceeds from this offering will be approximately $2.2 million, after deducting placement agent fees and estimated offering expenses payable by us. The net proceeds from this offering will be used for general corporate purposes and working capital requirements, which may include, among other things, the advancement of our product candidates to obtain regulatory approval from the FDA. We will, however, have broad discretion to allocate the net proceeds of this offering. See "*Use of Proceeds*" on page S-24 of this prospectus supplement.
Concurrent Private Placement:	In a concurrent private placement, we are issuing to the same institutional investor purchasing shares of ourcommon stock and Pre-funded Warrants in this offering, Warrants to purchase up to 6,130,000 shares of common stock at an exercise price of $0.41 per share, exercisable for a period of five (5) years from the date on which stockholder approval is received with respect to the issuance of the shares of common stock issuable upon exercise of the Warrants (the "Warrant Shares"). We will receive gross proceeds from the concurrent private placement transaction solely to extent such Warrants are exercised for cash. The Warrants and Warrant Shares are not being offered pursuant to this prospectus supplement and the accompanying prospectus and are being offered pursuant to the exemption provided in Section 4(a)(2) under the Securities Act. There is no established public trading market for the Warrants, and we do not expect a market to develop. In addition, we do not intend to list the Warrants on the Nasdaq Capital Market or any other nationally recognized trading system. See "*Private Placement Transaction*" on page S-31 of this prospectus supplement.

Prohibitions on Subsequent Equity Sales:	Pursuant to the securities purchase agreement with the investor, we are prohibited from entering into any agreement to issue or announcing the issuance or proposed issuance of any shares of common stock or securities convertible or exercisable into common stock, subject to certain exceptions, for a period commencing on the date of the securities purchase agreement and expiring July 31, 2024. Furthermore, we are prohibited from entering into any agreement to issue common stock or common stock equivalent involving a Variable Rate Transaction (as defined in the securities purchase agreement), subject to certain exceptions, for a period commencing on the date of the securities purchase agreement and expiring one year from the closing date of the offering.
Risk Factors:	See "*Risk Factors*" beginning on page S-15 of this prospectus supplement and in our Annual Report on Form 10-K for the year ended December 31, 2023, which is incorporated by reference herein, for a discussion of factors that you should consider before investing in our securities.
Nasdaq Capital Market Symbol:	MBIO

The number of shares of common stock to be outstanding after this offering is based on 27,392,832 shares of our common stock outstanding as of June 18, 2024, and excludes:

- 54,459,204 shares of common stock issuable upon exercise of outstanding warrants having a weighted-average exercise price of $0.273 per share;
- 14,310 shares of common stock issuable upon the vesting and settlement of outstanding restricted stock units;
- 76,112 shares of common stock issuable upon the vesting and exercise of outstanding stock options;
- 56,359 shares of our common stock issuable upon conversion of the Class A common stock, at the holders' election;
- 16,666 shares of our common stock issuable upon conversion of the Class A Preferred Stock, at the holders' election;
- 394,363 shares of common stock reserved for issuance and available for future grant under our 2016 Incentive Plan; and
- 338,315 shares of our common stock reserved for future issuance under the Mustang Bio, Inc. 2019 Employee Stock Purchase Plan, as amended, plus any future increases, including annual automatic evergreen increases, in the number of shares of common stock reserved for issuance thereunder.

Unless otherwise indicated, all information in this prospectus supplement assumes no exercise of the outstanding warrants or settlement of outstanding restricted stock

awards/units, described above.

RISK FACTORS

Investing in our securities involves a high degree of risk. This prospectus supplement does not describe all of those risks. You should consider the risk factors described in this prospectus supplement below, as well as the those described under the caption "Risk Factors" in the accompanying prospectus, and in the documents incorporated by reference herein, including our Annual Report on Form 10-K for the fiscal year ended December 31, 2023, as filed with the SEC on March 11, 2024, and in our most recent Quarterly Report on Form 10-Q, together with the other information contained or incorporated by reference in this prospectus supplement and the accompanying prospectus, and in any free writing prospectus that we have authorized for use in connection with this offering, before making an investment decision.

If any of these risks occur, our business, financial condition, results of operations and future prospects would likely be materially and adversely affected. In these circumstances, the market price of our common stock would likely decline and you may lose all or part of your investment. Share information set forth in these risk factors is as of the dates set forth herein or therein and unless otherwise indicated, does not give effect to the issuance of the securities in connection with this offering.

Risks Related to this Offering and our Securities

There is substantial doubt about our ability to continue as a going concern, which may hinder our ability to obtain future financing.

We are not yet generating revenue, have incurred substantial operating losses since our inception and expect to continue to incur significant operating losses for the foreseeable future as we execute on our product development plan and may never become profitable. As of March 31, 2024, we had cash and cash equivalents of $1.3 million and an accumulated deficit of $386.2 million, and, as of December 31, 2023, we had cash and cash equivalents of $6.2 million and an accumulated deficit of $381.0 million. We do not believe that our cash is sufficient for the next twelve months. As a result, there is substantial doubt about our ability to continue as a going concern. Our ability to continue as a going concern will depend on our ability to obtain additional funding, as to which no assurances can be given. If we are unable to obtain funds when needed or on acceptable terms, we may be required to curtail our current development programs, cut operating costs, forgo future development and other opportunities or even terminate our operations.

We believe that the proceeds of this offering, combined with our limited funds currently on hand, will only be sufficient for us to operate for a limited amount of time. Since we will be unable to generate sufficient funds, if any, to fund our operations for at least several years, we will need to seek additional equity or debt financing to provide the capital required to implement our business plan. If we are unable to raise capital, we could be required to seek bankruptcy protection or other alternatives that would likely result in our securityholders losing some or all of their investment in us.

We believe that the proceeds of this offering, combined with our limited funds currently on hand, will only be sufficient for us to operate for a limited amount of time. Since we will be unable to generate sufficient, if any, revenue or cash flow to fund our operations for at least several years, we will likely need to seek additional equity or debt financing to provide the capital required to implement our business plan.

We do not currently have any arrangements or credit facilities in place as a source of funds. There can be no assurance that we will be able to raise sufficient additional capital on acceptable terms, or at all. If such financing is not available on satisfactory terms, or is not available at all, we may be required to further delay, scale back or eliminate the development of business opportunities and our operations and financial condition may be materially adversely affected. Furthermore if we are unable to raise capital, we could be required to seek bankruptcy protection or other alternatives that would likely result in our securityholders losing some or all of their investment in us.

The trading price of the shares of our common stock has been and is likely to continue to be highly volatile, and purchasers of our common stock could incur substantial losses.

Our stock price has been and will likely continue to be volatile for the foreseeable future. The stock market in general and the market for biotechnology companies in particular have experienced extreme volatility that has often been unrelated to the operating performance of particular companies. As a result of this volatility, investors may not be able to sell their common stock at or above the price they paid.

In addition, in the past, stockholders have initiated class action lawsuits against biotechnology and pharmaceutical companies following periods of volatility in the market prices of these companies' securities. Such litigation and any litigation that may be instituted against us, our officers and/or our directors in the future, could cause us to incur substantial costs and divert management's attention and resources, which could have a material adverse effect on our business, financial condition and results of operations.

You will experience immediate and substantial dilution.

Because the price per share of common stock being offered is substantially higher than the pro forma as adjusted net tangible book value per share of common stock, you will incur substantial dilution in the pro forma as adjusted net tangible book value of the common stock you purchase in this offering. If you purchase shares of common stock in this offering, you will incur immediate and substantial dilution of $0.39 per share in the pro forma as adjusted net tangible book value of the common stock. In addition, we may issue additional securities in the future, including shares of common stock, securities that are convertible into or exchangeable for, or that represent the right to receive, common stock or substantially similar securities. The issuance of these securities may cause further dilution to our stockholders. The exercise of outstanding stock options and the vesting of outstanding restricted stock units may also result in further dilution of your investment, the Warrants sold in our concurrent private placement or other previously outstanding warrants. See the section titled "*Dilution*" below for a more detailed discussion of the dilution you would incur if you purchase securities in this offering.

The Pre-funded Warrants are not listed for trading on any exchange, and we do not expect a market to develop for the Pre-funded Warrants.

There is no established public trading market for the Pre-funded Warrants, and we do not expect a market to develop. In addition, we do not intend to apply for listing the Pre-funded Warrants on any national securities exchange or other trading market. Without an active market, the liquidity of the Pre-funded Warrants will be limited. Further, the existence of the Pre-funded Warrants and Warrants may act to reduce both the trading volume and the trading price of our common stock.

The Pre-funded Warrants are speculative in nature and do not entitle the holder to any rights as common stockholders until the holder exercises the warrant for shares of our common stock, except as set forth in the Pre-funded Warrants.

Except as otherwise provided in the Pre-funded Warrants, until holders of Pre-funded Warrants acquire shares of common stock upon exercise of the Pre-funded Warrants, holders of Pre-funded Warrants will have no rights with respect to our common stock underlying such Pre-funded Warrants. Upon exercise of the Pre-funded Warrants, the holders will be entitled to exercise the rights of a stockholder only as to matters for which the record date occurs after the exercise date. Moreover, following this offering, the

market value of the Pre-funded Warrants is uncertain. There can be no assurance that the market price of our common stock will ever equal or exceed the price of the Pre-funded Warrants, and, consequently, whether it will ever be profitable for investors to exercise their Pre-funded Warrants.

A substantial number of shares of our common stock could be sold into the public market in the near future, which could depress our stock price.

Sales of substantial amounts of common stock in the public market could reduce the prevailing market prices for our common stock. Substantially all of our outstanding common stock is eligible for sale as are shares of common stock issuable under vested and exercisable stock options. If our existing stockholders sell a large number of shares of our common stock, or the public market perceives that existing stockholders might sell shares of common stock, the market price of our common stock could decline significantly. These sales might also make it more difficult for us to sell equity securities at a time and price that we deem appropriate.

We have broad discretion over the use of our cash and cash equivalents, including the net proceeds we receive in this offering, and may not use them effectively.

Our management has broad discretion to use our cash and cash equivalents, including the net proceeds we receive in this offering, to fund our operations 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 these funds effectively could result in financial losses that could have a material adverse effect on our business, cause the price of our common stock to decline or delay the development of our product candidates. Pending their use to fund operations, we may invest our cash, cash equivalents and marketable securities in a manner that does not produce income or that loses value.

Provisions of the Pre-funded Warrants offered by this prospectus could discourage an acquisition of us by a third party.

Certain provisions of the Pre-funded Warrants offered by this prospectus could make it more difficult or expensive for a third party to acquire us. The Pre-funded Warrants prohibit us from engaging in certain transactions constituting "fundamental transactions" unless, among other things, the surviving entity assumes our obligations under the Pre-funded Warrants. These and other provisions of the Pre-funded Warrants offered by this prospectus could prevent or deter a third party from acquiring us even where the acquisition could be beneficial to stockholders.

You may experience future dilution as a result of future equity offerings.

In order to raise additional capital, we may in the future offer additional shares of ourcommon stock or other securities convertible into or exchangeable for our common stock at prices that may not be the same as the price per share in this offering. We may sell shares or other securities in any other offering at a price per share that is less than the price per share paid by investors in this offering, and investors purchasing shares or other securities in the future could have rights superior to existing stockholders. The price per share at which we sell additional shares of our common stock, or securities convertible or exchangeable into common stock, in future transactions may be higher or lower than the price per share paid by investors in this offering.

Fortress Biotech, Inc. ("Fortress") will continue to control a voting majority of our common stock following the offering.

Pursuant to the terms of the Class A Preferred Stock held by Fortress, Fortress is entitled to cast, for each share of Class A Preferred Stock held by Fortress, the number of votes that is equal to one and one-tenth (1.1) times a fraction, the numerator of which is the sum of the shares of outstanding common stock and the denominator of which is the number of shares of outstanding Class A Preferred Stock. Accordingly, as long as Fortress owns any shares of Class A Preferred Stock, it will be able to control or significantly influence all matters requiring approval by our stockholders, including the election of directors and the approval of mergers or other business combination transactions. The consummation of this offering will not impact Fortress's holdings of Class A Preferred Stock, so Fortress will continue to be able to exercise such control and influence over us. The interests of Fortress may not always coincide with the interests of other stockholders, and Fortress may take actions that advance its own interests and are contrary to the desires of our other stockholders. Moreover, this concentration of voting power may delay, prevent or deter a change in control of us even when such a change may be in the best interests of all stockholders, could deprive our stockholders of an opportunity to receive a premium for their common stock as part of a sale of Mustang or our assets, and might affect the prevailing market price of our common stock.

Our stock price can be volatile, which increases the risk of litigation, and may result in a significant decline in the value of your investment.

The trading price of our common stock has been and is likely to continue to be highly volatile and subject to wide fluctuations in price in response to various factors, many of which are beyond our control. These factors include:

- the commencement, enrollment, or results of our current and future preclinical studies and clinical trials, and the results of trials of our competitors or those of other companies in our market sector;
- regulatory approval of our product candidates, or limitations to specific label indications or patient populations for its use, or changes or delays in the regulatory review process;
- manufacturing, supply or distribution delays or shortages;
- our ability to identify and successfully acquire or in-license new product candidates on acceptable terms;
- FDA, state or international regulatory actions, including actions on regulatory applications any of our product candidates;
- legislative or regulatory changes;
- judicial pronouncements interpreting laws and regulations;
- changes in government programs;
- announcements of new products, services or technologies, commercial relationships, acquisitions or other events by us or our competitors;
- market conditions in the pharmaceutical and biotechnology sectors;
- fluctuations in stock market prices and trading volumes of similar companies;
- changes in accounting principles;
- litigation or public concern about the safety of our product candidates or similar product candidates;
- sales of large blocks of our common stock, including sales by our executive officers, directors and significant shareholders; and
- our ability to obtain additional financing to advance our development operations.

In addition, equity markets in general, and the market for biotechnology and life sciences companies in particular, have experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of companies traded in those markets. These broad market and industry factors may materially affect the market price of our common stock, regardless of our development and operating performance. In the past, following periods of volatility in the market price of a company's securities, securities class-action litigation has often been instituted against that company. Such litigation, if instituted against us, could cause us to incur substantial costs to defend such claims and divert management's attention and resources, which could seriously harm our business.

We do not intend to pay dividends on our common stock, so any returns will be limited to increases, if any, in our common stock's value. Your ability to achieve a return on your investment will depend on appreciation, if any, in the price of our common stock.

We currently anticipate that we will retain future earnings for the development, operation and expansion of our business and do not anticipate declaring or paying any cash dividends for the foreseeable future. Any future determination to declare dividends will be made at the discretion of our board of directors and will depend on, among other factors, our financial condition, operating results, capital requirements, general business conditions and other factors that our board of directors may deem relevant. Any return to stockholders will therefore be limited to the appreciation in the value of their stock, if any.

If we are unable to maintain compliance with all applicable continued listing requirements and standards of Nasdaq, our common stock may be delisted from Nasdaq.

On March 13, 2024, we received a deficiency letter (the "Letter") from the Listing Qualifications Department (the "Staff") of The Nasdaq Stock Market ("Nasdaq") notifying us that we were not in compliance with the minimum stockholders' equity requirement for continued listing on the Nasdaq Capital Market under Nasdaq Listing Rule 5550(b)(1). Nasdaq Listing Rule 5550(b)(1) requires companies listed on the Nasdaq Capital Market to maintain stockholders' equity of at least $2,500,000 (the "Stockholders' Equity Requirement"). As of December 31, 2023, we reported stockholders' equity of $123,000. The Letter further noted that as of its date, we did not have a market value of listed securities of $35 million, or net income from continued operations of $500,000 in the most recently completed fiscal year or in two of the last three most recently completed fiscal years, the alternative quantitative standards for continued listing on the Nasdaq Capital Market.

The Letter has no immediate effect on our continued listing on the Nasdaq Capital Market, subject to our compliance with the other continued listing requirements. In accordance with Nasdaq rules, we were provided 45 calendar days, or until April 29, 2024, to submit a plan to regain compliance (the "Compliance Plan"). We submitted our Compliance Plan on April 29, 2024 and the Staff granted our request for an extension of 180 calendar days through September 9, 2024 to regain compliance with the Stockholders Equity Requirement.

On May 16, 2024, we received a notice (the "Second Letter") from the Staff of Nasdaq indicating that the bid price of our common stock had closed below $1.00 per share for 31 consecutive business days and, as a result, we were not in compliance with Nasdaq Listing Rule 5550(a)(2), which sets forth the minimum bid price requirement for continued listing on the Nasdaq Capital Market. The Second Letter from Nasdaq had no immediate effect on the listing of our common stock on Nasdaq. Pursuant to Nasdaq Listing Rule 5810(c)(3)(A), we were afforded a 180-calendar day grace period, or until November 12, 2024, to regain compliance with the bid price requirement. Compliance can be achieved by evidencing a closing bid price of at least $1.00 per share for a minimum of ten consecutive business days (but generally not more than 20 consecutive business days) during the 180-calendar day grace period.

If we do not regain compliance with the bid price requirement by November 12, 2024, we may be eligible for an additional 180-calendar day compliance period so long as we satisfy the criteria for initial listing on Nasdaq and the continued listing requirement for market value of publicly held shares and we provide written notice to Nasdaq of its intention to cure the deficiency during the second compliance period by effecting a reverse stock split, if necessary. In the event we are not eligible for the second grace period, Nasdaq staff will provide written notice that our common stock is subject to delisting; however, we may request a hearing before the Nasdaq Hearings Panel (the "Panel"), which request, if timely made, would stay any further suspension or delisting action by the Staff pending the conclusion of the hearing process and expiration of any extension that may be granted by the Panel. Although we intend to take all reasonable measures available to regain compliance under the Nasdaq Listing Rules and remain listed on the Nasdaq Capital Market, there can be no assurance that we would be successful in its efforts to maintain listing on the Nasdaq Capital Market.

If we are delisted from Nasdaq, there can be no assurance that our common stock will be eligible for trading on another stock exchange or quotation on an over-the-counter market. If we are not able to obtain a listing on another stock exchange or quotation service for our common stock, it may be extremely difficult or impossible for stockholders to sell their shares. Additionally, if we are delisted from Nasdaq, but obtain a substitute listing or quotation service for our common stock, it will likely be on a market with less liquidity and our common stock may therefore experience potentially more price volatility than it has historically experienced on Nasdaq. Stockholders may not be able to sell their shares of common stock on any such substitute market in the quantities, at the times, or at the prices that could potentially be available on a more liquid trading market. As a result of these factors, if our common stock is delisted from Nasdaq, the value and liquidity of our common stock would likely be adversely affected. A delisting of our common stock from Nasdaq could also adversely affect our ability to obtain financing for our operations and/or result in a loss of confidence by investors, employees and/or business partners.

CAPITALIZATION

The following table sets forth our capitalization as of March 31, 2024:

- on an actual basis;
- after giving effect to the issuance of 1,160,000 shares of common stock in connection with the public offering contemplated in May 2024; and the issuance of 16,681,638 shares of common stock in connection with the exercise of certain pre-funded warrants; and
- on a pro forma as adjusted basis to give further effect to the issuance and sale of (a) 3,025,000 shares of common stock at an offering price of $0.41 per share; and (b) Pre-funded Warrants to purchase up to 3,105,000 shares of common stock at an offering price of $0.4099 per Pre-funded Warrant, after deducting placement agent fees and estimated offering expenses payable by us.

You should read this table together with our financial statements and related notes and the "*Management's Discussion and Analysis of Financial Condition and Results of Operations*" in each of our Annual Report on Form 10-K for the year ended December 31, 2023 and our Quarterly Report on Form 10-Q for the quarter ended March 31, 2024.

			March 31, 2024 (unaudited)		
($ in thousands, except share and per share amounts)	Actual	Pro Forma Adj. May 2024 Offering	Pro Forma As Adjusted	Pro Forma Adj. for offering	Pro Forma As Adjusted
Cash and cash equivalents	$ 1,337	$ 3,537	$ 4,874	$ 2,162	$ 7,036
Stockholders' Equity (Deficit)					

Preferred Stock ($0.0001 par value), 2,000,000 shares authorized, 250,000 shares of Class A Preferred Stock issued and outstanding					
Class A Preferred Stock	—	—	—	—	—
Common Stock ($0.0001 par value), 200,000,000 shares authorized					
Class A Common shares	—	—	—	—	—
Common shares	1	2	3	—	3
Additional paid-in capital	381,218	3,535	384,753	2,162	386,915
Accumulated deficit	(386,162)	—	(386,162)	—	(386,162)
Total Stockholders' Equity (Deficit)	(4,493)	3,537	(1,406)	2,162	756
Total Capitalization	$ (4,493)	$ 3,537	$ (1,406)	$ 2,162	$ 756

The number of shares of common stock to be outstanding after this offering is based on 27,387,179 shares of our common stock outstanding pro forma as adjusted as of March 31, 2024, and excludes:

- 54,459,204 shares of common stock issuable upon exercise of outstanding warrants having a weighted-average exercise price of $0.273 per share;
- 23,222 shares of common stock issuable upon the vesting and settlement of outstanding restricted stock units;
- 76,112 shares of common stock issuable upon the vesting and exercise of outstanding stock options;
- 56,359 shares of common stock issuable upon the conversion of the Class A common stock, at the holders' election;

- 16,666 shares of common stock issuable upon the conversion of the Class A Preferred Stock, at the holders' election;
- 421,941 shares of common stock issuable to Fortress for equity fee pursuant to the Founders Agreement;
- 345,782 shares of common stock reserved for issuance and available for future grant under our 2016 Incentive Plan; and
- 338,315 shares of common stock reserved for future issuance under the Mustang Bio, Inc. 2019 Employee Stock Purchase Plan, as amended (the "ESPP"), plus any future increases, including annual automatic evergreen increases, in the number of shares of common stock reserved for issuance thereunder.

Except as otherwise indicated, all information in this prospectus supplement assumes no exercise of the outstanding stock options or warrants and no settlement of the restricted stock units described above. In addition, we may choose to raise additional capital due to market conditions or strategic considerations even if we believe we have sufficient funds for our current or future operating plans. To the extent that additional capital is raised through the sale of equity or convertible debt securities, the issuance of these securities could result in further dilution to our stockholders. See "*Risk Factors*" beginning on page S-15 of this prospectus supplement.

DILUTION

Purchasers of the shares of common stock or Pre-funded Warrants offered by this prospectus supplement and the accompanying prospectus will suffer immediate and substantial dilution in the net tangible book value per share of common stock or Pre-funded Warrant they purchase. Net tangible book value per share represents the amount of total tangible assets less total liabilities, divided by the number of shares of common stock outstanding as March 31, 2024. Our net tangible book value as of March 31, 2024 was approximately $(4.9) million, or $(0.48) per share of our common stock.

Our pro forma net tangible book value as of March 31, 2024, was $(1.4) million or $(0.05) per common share. Pro forma net tangible book value per share represents total tangible assets less total liabilities, divided by the number of shares of our common shares outstanding as of March 31, 2024, after giving effect to the issuance of (iii) 1,160,000 shares of common stock in connection with the public offering completed in May 2024, and (iv) the issuance of 16,681,638 shares of common stock in connection with the exercise of certain pre-funded warrants.

Dilution in net tangible book value per share represents the difference between the amount per share paid by purchasers in this offering and the pro forma as adjusted net tangible book value per share of our common stock immediately after this offering. After giving effect to the pro forma transactions described above and (i) the sale of 3,025,000 shares of our common stock in this offering at an offering price of $0.41 per share, (ii) the sale of Pre-funded Warrants to purchase 3,105,000 shares of common stock for $.4099 per share and (iii) assuming the exercise in full of the Pre-funded Warrants, and after deducting the fees of the placement agent and the estimated expenses payable by us, our pro forma as adjusted net tangible book value as of March 31, 2024 would have been approximately $0.8 million, or $0.02 per share of common stock. This represents an immediate increase in pro forma net tangible book value of $0.07 per share to our existing stockholders and an immediate dilution in pro forma net tangible book value of $0.39 per share to new investors participating in this offering.

The following table illustrates this calculation on a per share basis:

Offering price per share			$	0.41
Net tangible book value per share as of March 31, 2024	$	(0.48)		
Increase per share attributable to pro forma adjustments	$	0.43		
Pro forma net tangible book value per share on March 31, 2024	$	(0.05)		
Increase in pro forma net tangible book value per share attributable to the offering	$	0.07		
Pro forma as-adjusted net tangible book value per share after giving effect to the offering			$	0.02
Dilution in net tangible book value per share to new investors			$	0.39

The foregoing discussion and table do not take into account further dilution to new investors that could occur upon the exercise of outstanding warrants having a per share exercise or conversion price less than the per share offering price in this offering.

The number of shares of common stock to be outstanding after this offering is based on 27,387,179 shares of our common stock outstanding pro forma as adjusted as of March 31, 2024, and excludes:

- 54,459,204 shares of common stock issuable upon exercise of outstanding warrants having a weighted-average exercise price of $0.273 per share;
- 22,888 shares of common stock issuable upon the vesting and settlement of outstanding restricted stock units;
- 76,112 shares of common stock issuable upon the vesting and exercise of outstanding stock options;
- 56,359 shares of common stock issuable upon the conversion of the Class A common stock, at the holders' election;
- 16,666 shares of common stock issuable upon the conversion of the Class A Preferred Stock, at the holders' election;

- 421,941 shares of common stock issuable to Fortress for equity fee pursuant to the Founders Agreement;
- 394,393 shares of common stock reserved for issuance and available for future grant under our 2016 Incentive Plan; and
- 338,315 shares of common stock reserved for future issuance under the ESPP, plus any future increases, including annual automatic evergreen increases, in the number of shares of common stock reserved for issuance thereunder.

Except as otherwise indicated, all information in this prospectus supplement assumes no exercise of the outstanding stock options or warrants and no settlement of the restricted stock units described above. In addition, we may choose to raise additional capital due to market conditions or strategic considerations even if we believe we have sufficient funds for our current or future operating plans. To the extent that additional capital is raised through the sale of equity or convertible debt securities, the issuance of these securities could result in further dilution to our stockholders. See "*Risk Factors*" beginning on page S-15 of this prospectus supplement.

USE OF PROCEEDS

We estimate that the proceeds from the sale of common stock and Pre-funded Warrants in this offering, after deducting placement agent fees and estimated offering expenses payable by us and underwriting fees, will be approximately $2.2 million.

We will only receive additional proceeds from the exercise of the Warrants issuable in connection with the concurrent private placement if the Warrants are exercised and the holders of such Warrants pay the exercise price in cash upon such exercise and do not utilize the cashless exercise provision of the Warrants.

The net proceeds from this offering will be used for general corporate purposes and working capital requirements, which may include, among other things, the advancement of our product candidates to obtain regulatory approval from the FDA. We have not determined the amounts we plan to spend on the areas listed above or the timing of these expenditures, and we have no current plans with respect to acquisitions as of the date of this prospectus supplement. As a result, we will have broad discretion to allocate the net proceeds of this offering. The timing and amounts of our actual expenditures will depend on several factors. As of the date of this prospectus supplement, we cannot specify with certainty all of the particular uses for the net proceeds to us from an offering. Accordingly, our management will have broad discretion in the application of proceeds.

DIVIDEND POLICY

We have never declared or paid any cash dividends on our common stock and do not anticipate paying any cash dividends in the foreseeable future. Any future determination to pay dividends will be at the discretion of our board of directors and will depend on our financial condition, results of operations, capital requirements and other factors our board of directors deems relevant.

DESCRIPTION OF THE SECURITIES WE ARE OFFERING

We are offering through this prospectus supplement and the accompanying prospectus (i) 3,025,000 shares of our common stock, and (ii) Pre-funded Warrants to purchase up to 3,105,000 shares of our common stock. We are also registering the offer and sale of shares of our common stock issuable from time to time upon exercise of the Pre-funded Warrants offered hereby.

Common Stock

The holders of common stock are entitled to one vote per share held.

As of June 18, 2024, there were 27,392,832 shares of our common stock outstanding held by 71 stockholders of record.

Class A Common Stock

Voting Rights

The holders of our Class A common stock are entitled to cast the number of votes equal to the number of whole shares of common stock into which the shares of Class A common stock held by such holder are convertible. For a period of ten (10) years from issuance, the holders of the Class A common stock have the right to appoint one member of the Board of Directors of the Company. To date, the holders of Class A common stock have not yet appointed such director.

Preemptive, Conversion, or Similar Rights

Each share of Class A common stock is convertible, at the option of the holder, into one fully paid and nonassessable share of common stock, subject to certain adjustments. If the Company, at any time effects a subdivision or combination of the outstanding common stock (by any stock split, stock dividend, recapitalization, reverse stock split or otherwise), the applicable conversion ratio in effect immediately before that subdivision is proportionately decreased or increased, as applicable, so that the number of shares of common stock issuable on conversion of each share of Class A common stock shall be increased or decreased, as applicable, in proportion to such increase or decrease in the aggregate number of shares of common stock outstanding. Additionally, if any reorganization, recapitalization, reclassification, consolidation or merger involving the Company occurs in which the common stock (but not the Class A common stock) is converted into or exchanged for securities, cash or other property, then each share of Class A common stock becomes convertible into the kind and amount of securities, cash or other property which a holder of the number of shares of common stock of the Company issuable upon conversion of one share of the Class A common stock immediately prior to such reorganization, recapitalization, reclassification, consolidation or merger would have been entitled to receive pursuant to such transaction.

Class A Preferred Stock

The Class A Preferred Stock is identical to undesignated common stock other than as to voting rights, conversion rights, and the PIK dividend right.

The holders of the outstanding shares of Class A Preferred Stock receive on each January 1 (each a "PIK Dividend Payment Date") after the original issuance date of the Class A Preferred Stock until the date all outstanding Class A Preferred Stock is converted into common stock or redeemed (and the purchase price is paid in full), pro rata per share dividends paid in additional fully paid and non-assessable shares of common stock such that the aggregate number of shares of common stock issued pursuant to such PIK dividend is equal to 2.5% of the Corporation's fully-diluted outstanding capitalization on the date that is one business day prior to any PIK Dividend Payment Date ("PIK Record Date"). In the event the Class A Preferred Stock converts into common stock, the holders shall receive all PIK dividends accrued through the date of such conversion. No dividend or other distribution shall be paid, or declared and set apart for payment (other than dividends payable solely in capital stock on the capital stock) on the shares of common stock until all PIK dividends on the Class A Preferred Stock shall have been paid or declared and set apart for payment. All dividends are non-cumulative.

On any matter presented to the stockholders for their action or consideration at any meeting of stockholders (or by written consent of stockholders in lieu of meeting), each holder of outstanding shares of Class A Preferred Stock shall be entitled to cast for each share of Class A Preferred Stock held by such holder as of the record date for determining stockholders entitled to vote on such matter, the number of votes that is equal to one and one-tenth (1.1) times a fraction, the numerator of which is the sum of (A) the number of shares of outstanding common stock and (B) the whole shares of common stock in to which the shares of outstanding Class A common stock and the Class A Preferred Stock are convertible, and the denominator of which is number of shares of outstanding Class A Preferred Stock. Thus, the Class A Preferred Stock will at all times constitute a voting majority.

Each share of Class A Preferred Stock is convertible, at the option of the holder, into one fully paid and nonassessable share of common stock, subject to certain adjustments. If the Company, at any time effects a subdivision or combination of the outstanding common stock (by any stock split, stock dividend, recapitalization, reverse stock split or otherwise), the applicable conversion ratio in effect immediately before that subdivision is proportionately decreased or increased, as applicable, so that the number of shares of common stock issuable on conversion of each share of Class A Preferred Stock shall be increased or decreased, as applicable, in proportion to such increase or decrease in the aggregate number of shares of common stock outstanding. Additionally, if any reorganization, recapitalization, reclassification, consolidation or merger involving the Company occurs in which the common stock (but not the Class A Preferred Stock) is converted into or exchanged for securities, cash or other property, then each share of Class A Preferred Stock becomes convertible into the kind and amount of securities, cash or other property which a holder of the number of shares of common stock of the Company issuable upon conversion of one share of the Class A Preferred Stock immediately prior to such reorganization, recapitalization, reclassification, consolidation or merger would have been entitled to receive pursuant to such transaction.

The undesignated preferred stock may be issued from time to time in one or more series. Our board of directors is authorized to determine or alter the dividend rights, dividend rate, conversion rights, voting rights, rights and terms of redemption (including sinking fund provisions, if any), the redemption price or prices, the liquidation preferences and other designations, powers, preferences and relative, participating, optional or other special rights, if any, and the qualifications, limitations and restrictions granted to or imposed upon any wholly unissued series of preferred stock, and to fix the number of shares of any series of preferred stock (but not below the number of shares of any such series then outstanding).

Additional Features

Other features of our capital stock include:

- *Dividend Rights*. The holders of outstanding shares of our common stock, including Class A common stock, are entitled to receive dividends out of funds legally available at the times and in the amounts that our Board of Directors may determine. All dividends are non-cumulative.
- *Voting Rights*. The holders of our common stock are entitled to one vote for each share of common stock held on all matters submitted to a vote of the stockholders, including the election of directors. Our certificate of incorporation and bylaws do not provide for cumulative voting rights.
- *No Preemptive or Similar Rights.* The holders of our common stock have no preemptive, conversion, or subscription rights, and there are no redemption or sinking fund provisions applicable to our common stock.
- *Right to Receive Liquidation Distributions.* Upon our liquidation, dissolution, or winding-up, the assets legally available for distribution to our stockholders would be distributable ratably among the holders of our common stock, including Class A common stock, outstanding at that time after payment of other claims of creditors, if any.
- *Fully Paid and Non-Assessable*. All of the outstanding shares of our common stock, including Class A common stock, and the Class A Preferred Stock are duly issued, fully paid and non-assessable.

Pre-funded Warrants Issued in This Offering

The following summary of certain terms and provisions of the Pre-funded Warrants that are being offered hereby is not complete and is subject to, and qualified in its entirety by the provisions of, the Pre-funded Warrants. You should carefully review the terms and provisions of the form of the Pre-funded Warrant for a complete description of the terms and conditions of the Pre-funded Warrants.

The term "pre-funded" refers to the fact that the purchase price of ourcommon stock in this offering includes almost the entire exercise price that will be paid under the Pre-funded Warrants, except for a nominal remaining exercise price of $0.0001. The purpose of the Pre-funded Warrants is to enable investors that may have restrictions on their ability to beneficially own more than 4.99% (or, upon election of the holder, 9.99%) of our outstanding common stock following the consummation of this offering the opportunity to make an investment in the Company without triggering their ownership restrictions, by receiving Pre-funded Warrants in lieu of our common stock which would result in such ownership of more than 4.99% (or 9.99%), and receive the ability to exercise their option to purchase the shares underlying the Pre-funded Warrants at such nominal price at a later date.

Duration and Exercise Price. The Pre-funded Warrants offered hereby will entitle the holder thereof to purchase up to an aggregate of 3,105,000 shares of our common stock at an exercise price of $0.0001 per share, commencing immediately on the date of issuance until exercised in full. The Pre-funded Warrants will be issued separately from the common stock and may be transferred separately immediately thereafter.

Exercisability. The Pre-funded Warrants will be exercisable, at the option of each holder, in whole or in part, by delivering to us a duly executed exercise notice accompanied by payment in full for the number of shares of common stock purchased upon such exercise (except in the case of a cashless exercise as discussed below). A holder (together with its affiliates) may not exercise any portion of such holder's warrants to the extent that the holder would own more than 4.99% (or, at the election of the holder, 9.99%) of our outstanding shares of common stock immediately after exercise, except that upon notice from the holder to us, the holder may increase or decrease the amount of ownership of outstanding shares of common stock after exercising the holder's Pre-funded Warrants up to 9.99% of the number of shares of common stock outstanding immediately after giving effect to the exercise, as such percentage ownership is determined in accordance with the terms of the Pre-funded Warrants, provided that any increase in this limitation shall not be effective until 61 days after notice to us.

Cashless Exercise. In lieu of making the cash payment otherwise contemplated to be made to us upon the exercise of a Pre-funded Warrant in payment of the aggregate exercise price, the holder may elect instead to receive upon such exercise (either in whole or in part) the net number of shares of common stock determined according to a formula set forth in the Pre-funded Warrant.

Exercise Price Adjustment. The exercise price of the Pre-funded Warrants is subject to appropriate adjustment in the event of certain stock dividends and distributions, stock splits, stock combinations, reclassifications or similar events affecting our common stock.

Fundamental Transaction. In the event of any fundamental transaction, as described in the Pre-funded Warrants and generally including any merger with or into another entity, sale of all or substantially all of our assets, tender offer or exchange offer, reclassification of our shares of common stock or acquisition of more than 50% of the voting power represented by our common stock, then upon any subsequent exercise of a Pre-funded Warrant, the holder will have the right to receive as alternative consideration, for each share of common stock that would have been issuable upon such exercise immediately prior to the occurrence of such fundamental transaction, the number of shares of common stock of the successor or acquiring corporation or of our Company, if it is the surviving corporation, and any additional consideration receivable upon or as a result of such transaction by a holder of the number of shares of common stock for which the Pre-funded Warrant is exercisable immediately prior to such event.

Transferability. In accordance with its terms and subject to applicable laws, a Pre-funded Warrant may be transferred at the option of the holder upon surrender of the Pre-funded Warrant to us together with the appropriate instruments of transfer and payment of funds sufficient to pay any transfer taxes (if applicable).

Fractional Shares. No fractional shares of common stock will be issued upon the exercise of the Pre-funded Warrants. Rather, the number of shares of common stock to be issued will, at our election, either be rounded up to the nearest whole number or we will pay a cash adjustment in respect of such final fraction in an amount equal to such fraction multiplied by the exercise price.

Exchange Listing. There is no established trading market for the Pre-funded Warrants, and we do not expect a market to develop. In addition, we do not intend to apply for the listing of the Pre-funded Warrants on any national securities exchange or other trading market. Without an active trading market, the liquidity of the Pre-funded Warrants will be limited.

Rights as a Stockholder. Except as otherwise provided in the Pre-funded Warrants or by virtue of such holder's ownership of shares of our common stock, the holder of a Pre-funded Warrant does not have the rights or privileges of a holder of our common stock, including any voting rights, until the holder exercises the Pre-funded Warrant.

Anti-Takeover Effects of Various Provisions of Delaware Law and Our Certificate of Incorporation and Bylaws

Provisions of the General Corporation Law of the State of Delaware ("DGCL") and our Certificate of Incorporation and Bylaws could make it more difficult to acquire us by means of a tender offer, a proxy contest or otherwise, or to remove incumbent officers and directors. These provisions, including those summarized below, may encourage certain types of coercive takeover practices and takeover bids.

Delaware Anti-Takeover Statute. In general, Section 203 of the DGCL prohibits a publicly held Delaware corporation from engaging in a "business combination" with an "interested stockholder" for a period of three years following the time the person became an interested stockholder, unless the business combination or the acquisition of shares that resulted in a stockholder becoming an interested stockholder is approved in a prescribed manner. Generally, a "business combination" includes a merger, asset or stock sale or other transaction resulting in a financial benefit to the interested stockholder. Generally, an "interested stockholder" is a person who, together with affiliates and associates, owns (or within three years prior to the determination of interested stockholder status did own) 15% or more of a corporation's voting stock. However, our Certificate of Incorporation provides that we are not subject to the anti-takeover provisions of Section 203 of the DGCL.

Removal. Subject to the rights of any holders of any outstanding series of our preferred stock, stockholders may remove our directors with or without cause, by a vote of the stockholders. Removal will require the affirmative vote of holders of a majority of our voting stock.

Size of Board and Vacancies. Our Bylaws provide that the number of directors be fixed exclusively by the board of directors. Any vacancies may only be filled by a majority of the remaining directors, even if less than a quorum is present, or by a sole remaining director. Any director appointed to fill a vacancy on our board of directors will be appointed until the next annual meeting and until his or her successor has been elected and qualified.

Requirements for Advance Notification of Stockholder Nominations and Proposals. Our Bylaws establish advance notice procedures with respect to stockholder proposals and nomination of candidates for election as directors other than nominations made by or at the direction of its board of directors or a committee of our board of directors.

Undesignated Preferred Stock. Our board of directors is authorized to issue up to 2,000,000 shares of preferred stock without additional stockholder approval, which preferred stock could have voting rights or conversion rights that, if exercised, could adversely affect the voting power of the holders of common stock. The issuance of shares of preferred stock may have the effect of delaying, deferring or preventing a change in control of the Company without any action by the Company's stockholders.

Limitation on Liability of Directors and Indemnification of Directors and Officers

Elimination of Liability of Directors. The DGCL authorizes corporations to limit or eliminate the personal liability of directors to corporations and their stockholders for monetary damages for breaches of directors' fiduciary duties as directors, and our Certificate of Incorporation includes such an exculpation provision. Our Certificate of Incorporation provides that, to the fullest extent permitted by the DGCL, no director will be personally liable to us or to our stockholders for monetary damages for breach of fiduciary duty as a director except for liability (i) for any breach of the director's duty of loyalty to the Company or its stockholders, (ii) for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law, (iii) under Section 174 of the DGCL, or (iv) for any transaction from which the director derived any improper personal benefit. While our Certificate of Incorporation provides directors with protection from awards for monetary damages for breaches of their duty of care, it does not eliminate this duty. Accordingly, our Certificate of Incorporation has no effect on the availability of equitable remedies such as an injunction or rescission based on a director's breach of his or her duty of care. The provisions apply to an officer of Mustang Bio only if he or she is a director of Mustang Bio and is acting in his or her capacity as director, and do not apply to officers of Mustang Bio who are not directors.

Indemnification of Directors, Officers and Employees. Our Bylaws require us to indemnify any person who was or is a party or is threatened to be made a party to, or was otherwise involved in, a legal proceeding by reason of the fact that he or she is or was a director, officer or employee or agent of Mustang Bio or, while a director, officer or employee of Mustang Bio, or is or was serving at the request of Mustang Bio as a director, officer, employee or agent of another corporation, partnership, joint venture, trust or other enterprise, against expenses (including attorneys' fees), judgments, fines and amounts paid in settlement actually and reasonably incurred by him in connection with such action, suit or proceeding if he or she acted in good faith and in a manner he reasonably believed to be in or not opposed to the best interests of the Mustang Bio and, with respect to any criminal action or proceeding, had no reasonable cause to believe his or her conduct was unlawful. The termination of any action, suit or proceeding by judgment, order, settlement, conviction or upon a plea of nolo contendere or its equivalent, would not, of itself, create a presumption that the person did not act in good faith and in a manner which he or she reasonably believed to be in or not opposed to the best interests of Mustang Bio and, with respect to any criminal action or proceeding, had reasonable cause to believe that his conduct was unlawful. We are authorized under our Bylaws to carry directors' and officers' insurance protecting us, any director, officer or employee or agent of ours or, against any expense, liability or loss, whether or not we have the power to indemnify the person under the DGCL. We may, to the extent authorized from time to time, indemnify any of our agents to the fullest extent permitted with respect to directors, officers and employees in our Bylaws.

The limitation of liability and indemnification provisions in our Certificate of Incorporation and Bylaws may discourage stockholders from bringing a lawsuit against our directors for breach of fiduciary duty. These provisions also may reduce the likelihood of derivative litigation against our directors and officers, even though such an action, if successful, might otherwise benefit us and our stockholders. By its terms, the indemnification provided for in our Bylaws is not exclusive of any other rights that the indemnified party may be or become entitled to under any law, agreement, vote of stockholders or directors, provisions of our Certificate of Incorporation or Bylaws or otherwise. Any amendment, alteration or repeal of our Bylaws' indemnification provisions is, by the terms of our Bylaws, prospective only and will not adversely affect the rights of any indemnity in effect at the time of any act or omission occurring prior to such amendment, alteration or repeal.

PRIVATE PLACEMENT TRANSACTION

In a concurrent private placement, we plan to issue and sell to the single institutional investor the Warrants to purchase up to an aggregate of up to 6,130,000 shares of common stock. The Warrants have an exercise price equal to $0.41 per share, subject to adjustment.

The Warrants and the shares of common stock issuable upon the exercise of such Warrants are not being registered under the Securities Act, are not being offered pursuant to this prospectus supplement and the accompanying prospectus and are being offered pursuant to the exemption provided in Section 4(a)(2) under the Securities Act. Accordingly, investors may only sell shares of common stock issued upon exercise of the Warrants pursuant to an effective registration statement under the Securities Act covering the resale of those shares, an exemption under Rule 144 under the Securities Act or another applicable exemption under the Securities Act.

Exercisability. The Warrants will be exercisable immediately upon receipt of stockholder approval of the issuance of the shares of common stock issuable upon exercise of the Warrants (the "Stockholder Approval Date") and will have a term of five (5) years from the Stockholder Approval Date. The Warrants will be exercisable, at the option of the holder, in whole or in part by delivering to us a duly executed exercise notice and, at any time a registration statement registering the issuance of shares of common stock underlying the Warrants under the Securities Act is effective and available for the issuance of such shares, or an exemption from registration under the Securities Act is available for the issuance of such shares, by payment in full in immediately available funds for the number of shares of common stock purchased upon such exercise.

We intend to promptly, and in no event later than 60 days after the consummation of this offering, seek stockholder approval for the issuance of shares of common stock issuable upon exercise of the Warrants but we cannot assure you that such stockholder approval will be obtained. We have agreed with the investors in this offering that, if we do not obtain stockholder approval for the issuance of the shares of common stock upon exercise of the Warrants at the first stockholder meeting for such purpose after this offering, we will call a stockholder meeting every 90 days thereafter until the earlier of the date we obtain such approval or the Warrants are no longer outstanding. We have also agreed to file a preliminary proxy statement for the purpose of obtaining stockholder approval within ten days of the date of this prospectus supplement.

Cashless Exercise. If at the time of exercise there is no effective registration statement registering, or the prospectus contained therein is not available for the issuance of the shares of common stock underlying the Warrants, then the Warrants may also be exercised, in whole or in part, at such time by means of a cashless exercise, in which case the holder would receive upon such exercise the net number of shares of common stock determined according to the formula set forth in the warrant.

Exercise Limitation. A holder will not have the right to exercise any portion of the Warrants if the holder (together with its affiliates) would beneficially own in excess of 4.99% (or, upon election of the holder, 9.99%) of the number of our shares of common stock outstanding immediately after giving effect to the exercise, as such percentage ownership is determined in accordance with the terms of the Warrants. However, any holder may increase or decrease such percentage, but in no event may such percentage be increased to more than 9.99%, provided that any increase will not be effective until the 61st day after such election.

Exercise Price Adjustment. The exercise price of the Warrants is subject to appropriate adjustment in the event of certain stock dividends and distributions, stock splits, stock combinations, reclassifications or similar events affecting our shares of common stock.

Transferability. Subject to applicable laws, the Warrants may be offered for sale, sold, transferred or assigned without our consent.

Exchange Listing. There is no established trading market for the Warrants, and we do not expect a market to develop. In addition, we do not intend to apply for the listing of the Warrants on any national securities exchange or other trading market.

Fundamental Transactions. In the event of any fundamental transaction, as described in the Warrants and generally including any merger with or into another entity, sale of all or substantially all of our assets, tender offer or exchange offer, reclassification of our shares of common stock or acquisition of more than 50% of the voting power represented

by our outstanding common stock, then upon any subsequent exercise of a Warrant, the holder will have the right to receive as alternative consideration, for each share of common stock that would have been issuable upon such exercise immediately prior to the occurrence of such fundamental transaction, the number of shares of common stock of the successor or acquiring corporation of our company, if it is the surviving corporation, and any additional consideration receivable upon or as a result of such transaction by a holder of the number of shares of common stock for which the Warrant is exercisable immediately prior to such event.

Notwithstanding the foregoing, in the event of a fundamental transaction, we or a successor entity shall, at the holder's option, exercisable at any time concurrently or within thirty (30) days following the consummation of a fundamental transaction, purchase the Warrant by paying to the holder an amount equal to the Black Scholes Value (as defined in each Warrant) of the remaining unexercised portion of the Warrant on the date of the fundamental transaction. If the fundamental transaction is not within our control, the holders of the Warrants will only be entitled to receive from us or a successor entity the same type or form of consideration (and in the same proportion), at the Black Scholes Value of the unexercised portion of the Warrant, that is being offered and paid to the holders of our common stock in connection with the fundamental transaction, whether that consideration is in the form of cash, stock or any combination thereof, or whether the holders of our common stock are given the choice to receive alternative forms of consideration in connection with the fundamental transaction.

Rights as a Stockholder. Except as otherwise provided in the Warrants or by virtue of such holder's ownership of our common stock, the holder of a Warrant will not have the rights or privileges of a holder of our common stock, including any voting rights, until the holder exercises the warrant.

You should review a copy of the securities purchase agreement and a copy of the form of the Warrant to be issued to the investors under the securities purchase agreement, which are executed or issued in connection with this offering and will be filed as exhibits to a Current Report on Form 8-K that we file with the SEC, for a complete description of the terms and conditions of the Warrants and the related transaction agreements.

PLAN OF DISTRIBUTION

We engaged H.C. Wainwright & Co., LLC ("Wainwright" or the "Placement Agent") to act as our exclusive placement agent in connection with this offering. The Placement Agent is not purchasing or selling any securities offered by us in this offering, nor is it required to arrange for the purchase and sale of any specific number or dollar amount of such securities, other than to use its "reasonable best efforts" to arrange for the sale of such securities by us. Therefore, we may not sell all of securities being offered. The terms of this offering were subject to market conditions and negotiations between us, the Placement Agent and prospective investors. The Placement Agent will have no authority to bind us by virtue of the engagement letter. We have entered into a securities purchase agreement directly with the institutional investor who has agreed to purchase securities in this offering. We will only sell securities in this offering to investors who have entered into securities purchase agreements.

Delivery of the securities offered hereby is expected to take place on or about June 21, 2024, subject to satisfaction of certain closing conditions.

We have agreed to pay the Placement Agent (i) a cash fee equal to 7.0% of the aggregate gross proceeds of this offering, (ii) a management fee equal to 1.0% of the gross proceeds raised in this offering, (iii) a non-accountable expense allowance of $25,000, and (iv) up to $50,000 for fees and expenses of legal counsel and other out-of-pocket expenses in connection with this offering.

We have also agreed to pay Wainwright a tail fee equal to the cash and warrant compensation in this offering if any investor who had been wall-crossed by Wainwright in connection with this offering during the term of our engagement of Wainwright, provides us with capital in any offering during the 12-month period following expiration or termination of our engagement of Wainwright, subject to certain exceptions.

The following table shows the per share and total placement agent fees we will pay to the Placement Agent in connection with the sale of common stock and Pre-funded Warrants pursuant to this prospectus supplement and the accompanying prospectus, assuming the purchase of all shares of common stock and Pre-funded Warrants offered hereby. Wainwright is also acting as the placement agent for the private placement transaction.

	Per Share	Per Pre-funded Warrant	Total
Offering price	$ 0.41	$ 0.4099	$ 2,512,989.50
Placement agent fees	$ 0.0287	$ 0.0287	$ 175,931,00
Proceeds to us, before expenses	$ 0.3813	$ 0.3812	$ 2,337,058.50

We estimate the total expenses of this offering paid or payable by us will be approximately $0.3 million. After deducting the fees due to the placement agent and our estimated expenses in connection with this offering, we expect the net proceeds from this offering will be approximately $2.2 million.

Subsequent Equity Sales

Under the terms of the securities purchase agreement, from the date of such agreement until July 31, 2024, neither we nor any subsidiary shall (i) issue, enter into any agreement to issue or announce the issuance or proposed issuance of any shares of common stock or common stock equivalents, or (ii) file any registration statement or prospectus, or any amendment or supplement thereto, subject to certain exceptions.

We have also agreed under the terms of the securities purchase agreement, until one year after the closing of this offering, not to (i) issue or sell any debt or equity securities that are convertible into, exchangeable or exercisable for, or include the right to receive, additional shares of common stock either (A) at a conversion price, exercise price or exchange rate or other price that is based upon, and/or varies with, the trading prices of or quotations for the shares of common stock at any time after the initial issuance of such debt or equity securities or (B) with a conversion, exercise or exchange price that is subject to being reset at some future date after the initial issuance of such debt or equity security or upon the occurrence of specified or contingent events directly or indirectly related to our business or the market for our common stock or (ii) enter into, or effect a transaction under, any agreement, including, but not limited to, an equity line of credit or an "at-the-market offering", subject to certain exceptions (including our ability to use our existing "at-the-market" facility with Wainwright).

Placement Agent Warrants

In addition, we have agreed to issue to the Placement Agent, or its designees, at the closing of this offering, warrants to purchase 6.0% of the number of shares of our common stock (and shares of common stock underlying the Pre-funded Warrants) sold in this offering (or warrants to purchase up to 367,800 shares of our common stock). Such warrants will have substantially the same terms as the Warrants being sold and issued in the private placement, except that the Placement Agent's warrants will have a term of exercise equal to five (5) years from the commencement of the sales in this offering and will have an exercise price equal to 125% of the offering price per share (or $0.5125 per share). Neither the Placement Agent's warrants nor the shares of our common stock issuable upon exercise thereof are being registered hereby.

Indemnification

We have agreed to indemnify the Placement Agent against certain liabilities, including liabilities under the Securities Act and liabilities arising from breaches of representations and warranties contained in our engagement letter with the Placement Agent. We have also agreed to contribute to payments the Placement Agent may be required to make in respect of such liabilities.

Right of First Refusal

We have also granted Wainwright, subject to certain exceptions, a right of first refusal for a period of ten (10) months following the closing of this offering to act as sole book-running manager, sole underwriter or sole placement agent for each and every future public or private equity offering by us.

Other Relationships

From time to time, Wainwright may provide in the future various advisory, investment and commercial banking and other services to us in the ordinary course of business, for which they have received and may continue to receive customary fees and commissions. However, except as disclosed in this prospectus supplement, we have no present arrangements with Wainwright for any further services.

Regulation M Compliance

The Placement Agent may be deemed to be an underwriter within the meaning of Section 2(a)(11) of the Securities Act, and any commissions received by it and any profit realized on the sale of our shares of common stock offered hereby by it while acting as principal might be deemed to be underwriting discounts or commissions under the Securities Act. The Placement Agent will be required to comply with the requirements of the Securities Act and the Exchange Act, including, without limitation, Rule 10b-5 and Regulation M under the Exchange Act. These rules and regulations may limit the timing of purchases and sales of our securities by the Placement Agent. Under these rules and regulations, the Placement Agent may not (i) engage in any stabilization activity in connection with our securities; and (ii) bid for or purchase any of our securities or attempt to induce any person to purchase any of our securities, other than as permitted under the Exchange Act, until they have completed their participation in the distribution.

Transfer Agent and Registrar

The transfer agent and registrar for ourcommon stock is VStock Transfer, LLC.

Trading Market

Our common stock is listed on the Nasdaq Capital Market under the symbol "MBIO." We do not intend to apply for listing of the Pre-funded Warrants or the Warrants on any national securities exchange or other trading market.

LEGAL MATTERS

The validity of the securities offered in this prospectus will be passed upon for us by Troutman Pepper Hamilton Sanders LLP, Charlotte, North Carolina. The Placement Agent is being represented by Ellenoff Grossman & Schole LLP, New York, New York.

EXPERTS

The financial statements of Mustang Bio, Inc. as of December 31, 2023 and 2022, and for each of the years in the two-year period ended December 31, 2023, have been incorporated by reference herein in reliance upon the reports of KPMG LLP, independent registered public accounting firm, incorporated by reference herein, and upon the authority of said firm as experts in accounting and auditing. The audit report covering the December 31, 2023 financial statements contains an explanatory paragraph that states the Company's expectation to generate operating losses and negative operating cash flows in the future, and the need for additional funding to support its planned operations raise substantial doubt about its ability to continue as a going concern. The financial statements do not include any adjustments that might result from the outcome of that uncertainty.

WHERE YOU CAN FIND MORE INFORMATION

We are a public company and file reports with the SEC on an annual basis using Form 10-K, quarterly reports on Form 10-Q and current reports on Form 8-K. Additionally, the SEC maintains a website that contains annual, quarterly, and current reports, proxy statements, and other information that issuers (including us) file electronically with the SEC. The SEC's website address is http://www.sec.gov. You can also obtain copies of materials we file with the SEC from our Internet website found at www.mustangbio.com. Our stock is quoted on the Nasdaq Capital Market under the symbol "MBIO". We have not incorporated by reference into this prospectus supplement the information on our website, and you should not consider it to be a part of this prospectus supplement.

INCORPORATION OF CERTAIN INFORMATION BY REFERENCE

The SEC allows us to "incorporate by reference" the information we file with them which means that we can disclose important information to you by referring you to those documents instead of having to repeat the information in this prospectus supplement and accompanying prospectus. The information incorporated by reference is considered to be part of this prospectus supplement and accompanying prospectus, and later information that we file with the SEC will automatically update and supersede this information. This prospectus supplement incorporates by reference the documents listed below and any future filings made with the SEC under Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act (1) after the date of the initial registration statement, as amended, and prior to effectiveness of the registration statement, and (2) after the date of this prospectus supplement and prior to the termination of this offering. Such information will automatically update and supersede the information contained in this prospectus supplement and the documents listed below; provided, however, that we are not, unless specifically indicated, incorporating any information furnished under Item 2.02 or Item 7.01 of any current report on Form 8-K, whether listed below or filed in the future, or related exhibits furnished pursuant to Item 9.01 of Form 8-K:

a) Our Annual Report on Form 10-K for the year ended December 31, 2023 filed with the SEC on March 11, 2024 (the "2023 Form 10-K");

b) Our Quarterly Report on Form 10-Q, for the quarterly period ended March 31, 2024, filed with the SEC May 15, 2024;

d) Our Current Reports on Form 8-K filed with the SEC on January 4, 2024, January 25, 2024, February 14, 2024, March 15, 2024, March 29, 2024, April 12, 2024, May 2, 2024, May 21, 2024 and June 6, 2024; and

e) The description of our common stock included in our registration statement on Form 8-A12B, filed with the SEC on August 21, 2017, and any amendment or report filed for the purpose of further updating such description.

All reports and other documents we subsequently file pursuant to Section 13(a), 13(c), 14 or 15(d) of the Exchange Act prior to the termination of this offering, including all such documents we may file with the SEC after the date of the initial registration statement and prior to the effectiveness of the registration statement, but excluding any information furnished to, rather than filed with, the SEC, will also be incorporated by reference into this prospectus supplement and deemed to be part of this prospectus supplement from the date of the filing of such reports and documents.

We will provide to each person, including any beneficial owner, to whom a copy of this prospectus supplement and the related prospectus is delivered, a copy of any or all of the information that we have incorporated by reference into this prospectus supplement and the related prospectus, but not delivered with this prospectus supplement and the related prospectus. We will provide this information upon written or oral request at no cost to the requester. You may request this information by contacting our corporate headquarters at the following address: 377 Plantation Street, Worcester, Massachusetts 01605, Attn: General Counsel, or by calling (781) 652-4500.

PROSPECTUS

$40,000,000

Common Stock
Preferred Stock
Warrants
Debt Securities
Units

The following are types of securities that we may offer, issue and sell from time to time, together or separately:

- shares of our common stock;
- shares of our preferred stock;
- warrants;
- debt securities; and
- units consisting of any combination of our common stock, preferred stock, warrants or debt securities.

We may offer these securities in amounts, at prices, and on terms determined at the time of offering, up to an aggregate amount of $40 million; however, as of the date of this prospectus, under the limitations described below, we are currently only eligible to sell approximately $5.6 million of securities. We may sell these securities directly to you through agents we select or through underwriters and dealers we select. If we use agents, underwriters or dealers to sell these securities, we will name them and describe their compensation in a prospectus supplement. See "*Plan of Distribution*." You should read this prospectus and any applicable prospectus supplement carefully before you invest.

This prospectus provides a general description of the securities we may offer. Each time we sell securities, we will provide specific terms of the securities offered in a supplement to this prospectus. The prospectus supplement may also add, update or change information contained in this prospectus. You should read this prospectus and the applicable prospectus supplement carefully, together with additional information described under the heading "*Where You Can Find More Information*," before you invest in any securities. This prospectus may not be used to consummate a sale of securities unless accompanied by the applicable prospectus supplement.

Our common stock is traded on the Nasdaq Capital Market under the symbol "MBIO." On May 30, 2024, the per share closing price of our common stock as reported on the Nasdaq Capital Market was $0.2114 per share.

The aggregate market value of our outstanding common stock held by non-affiliates is approximately $26.5 million, which was calculated in accordance with General Instruction I.B.6 of Form S-3, based on 27,390,295 shares of common stock outstanding as of May 30, 2024, of which 25,284,938 shares are held by non-affiliates, at the closing share price of $1.05 on April 1, 2024, which was the highest closing price of our common stock reported on the the Nasdaq Capital Market within the last 60 days prior to the date of this filing.

In this prospectus we are offering up to $40 million of securities; however, pursuant to General Instruction I.B.6 of Form S-3, in no event will we sell the securities described in this prospectus in a primary public offering with a value exceeding more than one-third of the aggregate market value of our common stock held by non-affiliates in the twelve month period prior to the date of the sale of any such securities, so long as the aggregate market value of our outstanding common stock held by non-affiliates remains below $75.0 million. As of the date of this prospectus, under such rules and including our prior sales within the twelve-month period, we are only eligible to sell up to approximately $5.6 million, of securities, until our circumstances, as described, change.

Investing in our securities involves a high degree of risk. You should review carefully the risks and uncertainties described under the heading "Risk Factors" contained in the applicable prospectus supplement and any related free writing prospectus, and under similar headings in the other documents that are incorporated by reference into this prospectus as described on page 10 of this prospectus.

NEITHER THE SECURITIES AND EXCHANGE COMMISSION NOR ANY STATE SECURITIES COMMISSION HAS APPROVED OR DISAPPROVED OF THESE SECURITIES OR DETERMINED IF THIS PROSPECTUS IS TRUTHFUL OR COMPLETE. ANY REPRESENTATION TO THE CONTRARY IS A CRIMINAL OFFENSE.

The date of this prospectus is June 12, 2024.

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ABOUT THIS PROSPECTUS

In this prospectus, unless the context suggests otherwise, references to "Mustang Bio," "Mustang," the "Company," "we," "us" and "our" refer to Mustang Bio, Inc.

This prospectus is part of a "shelf" registration statement that we filed with the Securities and Exchange Commission ("SEC"). By using a shelf registration statement, we may sell our securities, as described in this prospectus, from time to time in one or more offerings. This prospectus provides you with a general description of the securities offered by us. Each time we sell securities, we will provide a prospectus supplement to this prospectus that contains specific information about the terms of such offering. The prospectus or prospectus supplement may also add, update or change information contained in this prospectus.

You should rely only on the information contained or incorporated by reference in this prospectus and any prospectus supplement or issuer free writing prospectus relating to a particular offering. No person has been authorized to give any information or make any representations in connection with this offering other than those contained or incorporated by reference in this prospectus, any accompanying prospectus supplement and any related issuer free writing prospectus in connection with the offering described herein and therein, and, if given or made, such information or representations must not be relied upon as having been authorized by us. Neither this prospectus nor any prospectus supplement nor any related issuer free writing prospectus shall constitute an offer to sell or a solicitation of an offer to buy offered securities in any jurisdiction in which it is unlawful for such person to make such an offering or solicitation. This prospectus does not contain all of the information included in the registration statement. For a more complete understanding of the offering of the securities, you should refer to the registration statement, including its exhibits. You should read the entire prospectus and any prospectus supplement and any related issuer free writing prospectus, as well as the documents incorporated by reference into this prospectus or any prospectus supplement or any related issuer free writing prospectus, before making an investment decision. Neither the delivery of this prospectus or any prospectus supplement or any issuer free writing prospectus nor any sale made hereunder shall under any circumstances imply that the information contained or incorporated by reference herein or in any prospectus supplement or issuer free writing prospectus is correct as of any date subsequent to the date hereof or of such prospectus supplement or issuer free writing prospectus, as applicable.

THIS PROSPECTUS MAY NOT BE USED TO CONSUMMATE A SALE OF SECURITIES UNLESS IT IS ACCOMPANIED BY A PROSPECTUS SUPPLEMENT.

PROSPECTUS SUMMARY

This summary highlights selected information from this prospectus and does not contain all of the information that may be important to you in making an investment decision. This summary is qualified in its entirety by the more detailed information included elsewhere in this prospectus and/or incorporated by reference herein. Before making your investment decision with respect to our securities, you should carefully read this entire prospectus, including the information in our filings with the SEC incorporated by reference into this prospectus.

Our Business

Overview and Product Candidate Development

We are a clinical-stage biopharmaceutical company focused on translating today's medical breakthroughs in cell and gene therapies into potential cures for hematologic cancers, solid tumors and rare genetic diseases. We aim to acquire rights to these technologies by licensing or otherwise acquiring an ownership interest in the technologies, funding their research and development and eventually either out-licensing or bringing the technologies to market.

Our pipeline is currently focused in two core areas: CAR T therapies for hematologic malignancies and CAR T therapies for solid tumors. For these therapies we have partnered with world class research institutions, including the City of Hope National Medical Center ("COH" or "City of Hope"), Fred Hutchinson Cancer Center ("Fred Hutch"), Nationwide Children's Hospital ("Nationwide") and the Mayo Foundation for Medical Education and Research ("Mayo Clinic").

CAR T Therapies

Our pipeline of CAR T therapies is being developed under exclusive licenses from several world class research institutions. Our strategy is to license these technologies, support preclinical and clinical research activities by our partners and transfer the underlying technology to our or our contract manufacturer's cell processing facility in order to conduct our own clinical trials.

We are developing CAR T therapy for hematologic malignancies in partnership with Fred Hutch targeting CD20 (MB-106). In May 2021, we announced that the U.S. Food and Drug Administration ("FDA") accepted our Investigational New Drug ("IND") Application for MB-106. As of December 2023, approximately 40 patients have been treated in an ongoing phase 1 clinical trial sponsored by Fred Hutch (ClinicalTrials.gov Identifier: NCT03277729), and approximately 20 patients have been treated in an ongoing phase 1 clinical trial sponsored by us (ClinicalTrials.gov Identifier: NCT05360238). In 2023, we received Safety Review Committee approval to continue dose escalation in all three active arms of the ongoing Mustang-sponsored phase 1 trial. We presented the latest results, demonstrating a favorable safety profile, complete response rate, and durability, from the ongoing Mustang-sponsored phase 1 trial at the 2023 American Society of Hematology ("ASH") Annual Meeting. As of December 31, 2023, the MB-106 Mustang-sponsored phase 1 trial is pending one patient to complete the final dose level required to advance to phase 2 pivotal studies for treatment of patients with relapsed or refractory indolent B-cell non-Hodgkin lymphoma.

We are also developing CAR T therapy for solid tumors in partnership with COH targeting IL13Rα2 (MB-101). In addition, we have partnered with Nationwide for a herpes simplex virus type 1 ("HSV-1") oncolytic virus (MB-108) in order to enhance the activity of MB-101 for the treatment of patients with high-grade malignant brain tumors. The Phase 1 clinical trial sponsored by COH for MB-101 (ClinicalTrials.gov Identifier: NCT02208362) has completed the treatment phase and patients continue to be assessed for long-term safety. A Phase 1 clinical trial sponsored by the University of Alabama at Birmingham ("UAB") for MB-108 (ClinicalTrials.gov Identifier: NCT03657576) began during the third quarter of 2019. In October 2023, we announced that the FDA accepted our IND application for the combination of MB-101 and MB-108 – which is referred to as MB-109 – for the treatment of patients with *IL13Rα2+*relapsed or refractory glioblastoma ("GBM") and high-grade astrocytoma.

Finally, we are collaborating with the Mayo Clinic to develop a novel technology that may be able to transform the administration of CAR T therapies and potentially be used as an off-the-shelf therapy. We are evaluating plans to file an IND application for a multicenter Phase 1 clinical trial once a lead construct has been identified, subject to allocation of resources.

On May 18, 2023, we announced a series of changes resulting from a review of our portfolio of product candidates to determine the future strategy of our programs and the proper allocation of our resources. Following this review, we determined to discontinue development of our MB-102 (CD123), MB-103 (HER2), MB-104 (CS1) and MB-105 (PSCA) programs, all of which were CAR T therapies being developed in partnership with City of Hope.

Terminated Gene Therapy Product Candidates

We formerly developed several gene therapy product candidates, which included MB-117 and MB-217 (based on technologies licensed from St. Jude Children's Research Hospital ("St. Jude")) and MB-110 (based on technologies licensed from Leiden University Medical Centre ("LUMC")). In April 2024, we entered into a termination and release agreement with St. Jude, pursuant to which we agreed to terminate the license agreement underpinning the MB-117 and MB-217 product candidates in exchange for a mutual release of liability and forgiveness by St. Jude of all amounts previously owing to them. Also in April 2024, we delivered a termination notice to LUMC pursuant to which we terminated the license agreement underpinning the MB-110 product candidate; we are currently in discussions with LUMC regarding the terms that will govern such termination.

To date, we have not received approval for the sale of any of our product candidates in any market and, therefore, have not generated any product sales from our product candidates. In addition, we have incurred substantial operating losses since our inception, and expect to continue to incur significant operating losses for the foreseeable future and may never become profitable. As of March 31, 2024, we had an accumulated deficit of $386.2 million.

Therapeutic Pipeline

Therapies for Oncology and Hematologic Malignancies

MB - 106 (CD20 CAR T for B cell non-Hodgkin lymphoma (NHL) and chronic lymphocytic leukemia (CLL))

We believe CD20 is a promising target for immunotherapy of B-cell malignancies. CD20 is a B-cell lineage-specific phosphoprotein that is expressed in high, homogeneous density on the surface of more than 95% of B-cell NHL and CLL. CD20 is stable on the cell surface with minimal shedding, internalization, or modulation upon antibody binding and is present at only nanomolar levels as a soluble antigen. It is well established as an effective immunotherapy target, with extensive studies demonstrating improved tumor responses and survival of B-NHL patients treated with rituximab and other anti-CD20 antibodies. Importantly, CD20 continues to be expressed on the lymphoma cells of most patients with relapsed B-NHL despite repetitive rituximab treatments, and loss of CD20 expression is not a major contributor to treatment resistance. Thus, there is strong rationale for testing CD20 CAR T cells as an immunotherapy for NHL.

More than 80,000 new cases of NHL are diagnosed each year in the United States, and over 20,000 patients die of this group of diseases annually. Most forms of NHL, including follicular lymphoma, mantle cell lymphoma, marginal zone lymphoma, lymphoplasmacytic lymphoma, and small lymphocytic lymphoma ("SLL"), which account collectively for approximately 45% of all cases of NHL, are incurable with available therapies, except for allogenic stem cell transplant ("allo-SCT"). However, many NHL patients are not suitable candidates for allo-SCT, and this treatment is also limited by significant rates of morbidity and mortality due to graft-versus-host disease. Aggressive B-cell lymphomas such as diffuse large B-cell lymphoma, the most common subtype of lymphoma, account for an additional 30-35% of NHL. The majority of patients with aggressive B-NHL are successfully treated with combination chemotherapy, but a significant proportion relapse or have refractory disease, and the outcome of these patients is poor. Innovative new treatments are therefore urgently needed.

Chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL) is a mature B cell neoplasm characterized by a progressive accumulation of monoclonal B lymphocytes. CLL is considered to be identical (i.e., one disease with different manifestations) to the NHL SLL. The malignant cells seen in CLL and SLL have identical pathologic and immunophenotypic features. The term CLL is used when the disease manifests primarily in the blood, whereas the term SLL is used when involvement is primarily nodal.

CLL is the most common leukemia in adults in Western countries, accounting for approximately 25 to 35 percent of all leukemias in the United States. An estimated 20,700 new cases of CLL will be diagnosed in the United States in 2024. CLL is considered to be mainly a disease afflicting older adults, with a median age at diagnosis of approximately 70 years; however, it is not unusual to make this diagnosis in younger individuals (e.g., from approximately 30 to 39 years of age). The incidence increases rapidly with increasing age. The natural history of CLL is extremely variable, with survival times from initial diagnosis that range from approximately 2 to 20 years, and a median survival of approximately 10 years.

Most patients will have a complete or partial response to initial therapy. However, conventional therapy for CLL is not curative and most patients experience relapse. In addition, many patients will require a change in therapy due to intolerance. Since patients with CLL are generally elderly with a median age older than 70 years, and due to the relatively benign course of the disease in the majority of patients, only selected patients are candidates for intensive treatments such as allo-SCT. Innovative new treatments with a favorable safety profile are therefore urgently needed for patients with relapsed and refractory disease.

Under their IND, Fred Hutch is currently conducting a Phase 1/2 clinical study to evaluate the anti-tumor activity and safety of administering CD20-directed third-generation CAR T cells incorporating both 4-1BB and CD28 co-stimulatory signaling domains (MB-106) to patients with relapsed or refractory B-cell NHL or CLL (ClinicalTrials.gov Identifier: NCT03277729). Secondary endpoints of this study include safety and toxicity, preliminary antitumor activity as measured by overall response rate and complete remission rate, progression-free survival, and overall survival. The study is also assessing CAR T cell persistence and the potential immunogenicity of the cells. Finally, this study was designed so that, together with Fred Hutch, we could determine a recommended Phase 2 dose. Fred Hutch intends to enroll approximately 50 subjects in this study, which is being led by the Principal Investigator Mazyar Shadman, M.D., M.P.H., Associate Professor of Fred Hutch's Clinical Research Division.

The Fred Hutch IND was amended in 2019 to incorporate an optimized manufacturing process that had been developed in collaboration with us.

In May 2021, we announced that the FDA issued a safe to proceed letter for our IND application allowing for initiation of a multi-center Phase 1/2 clinical study of MB-106 in patients with relapsed or refractory B cell NHL or CLL (Clinicaltrials.gov Identifier: NCT05360238). In August 2022, the first patient was treated in our study.

In November 2021, Mustang was awarded a grant of approximately $2.0 million from NCI of the National Institutes of Health. This two-year award partially funded the Mustang-sponsored multicenter trial to assess the safety, tolerability and efficacy of MB-106. In August 2023, we fully utilized the grant.

In June 2022, MB-106 received Orphan Drug Designation for the treatment of Waldenstrom macroglobulinemia ("WM").

In December 2023, we presented preliminary clinical data for the indolent lymphoma patients treated in the ongoing Phase 1/2 clinical study at the American Society of Hematology (ASH) annual meeting. All 9 patients responded clinically to treatment; the observed overall response rate was 100%. All 5 follicular lymphoma patients achieved a complete response. Among the WM patients 1 patient attained a very good partial response, and 2 patients attained a partial response. The single patient with a hairy cell leukemia variant experienced stable disease. The safety profile demonstrated that MB-106 was well tolerated with no occurrences of cytokine release syndrome ("CRS") above grade 1, and no immune effector cell-associated neurotoxicity syndrome ("ICANS") of any grade was reported. Cell expansion and persistence were also demonstrated.

In the first quarter of 2024, we completed a successful End-of-Phase 1 meeting with the FDA regarding a potential pivotal Phase 2 single-arm clinical trial for the treatment of WM. Per the discussions, the FDA agreed with the proposed overall design of the pivotal trial for WM at the recommended dose of 1 x 107 CAR-T cells/kg and requested only minimal modifications to the study protocol. No additional nonclinical studies are expected prior to Phase 2 or a Biologics License Application ("BLA") filing. Due to limited resources, and as a result of the reduction in work force described below, we do not expect to initiate our pivotal Phase 2 single-arm clinical trial of MB-106 for the treatment of WM trial in 2024. Subject to available funds, we intend to rely on third party service providers to conduct study and manufacturing services to advance our priority potential product candidates.

Also in the first quarter of 2024, we completed enrollment of the indolent lymphoma arm in our multicenter Phase 1 trial. The tenth and final patient enrolled was a patient with follicular lymphoma (FL) who achieved a complete response following treatment with 1 x 10^7 CAR-T cells/kg. As a result, the overall complete response rate for FL in the Phase 1 portion of this trial was sustained at 100% (N=6), with no occurrence of CRS above grade 1 and no ICANS of any grade, despite not using prophylactic tocilizumab or dexamethasone.

In March 2024, we announced plans to collaborate with Fred Hutch for a proof-of-concept Phase 1 investigator-sponsored clinical trial evaluating MB-106 in autoimmune diseases.

In March 2024, we were granted the Regenerative Medicine Advanced Therapy ("RMAT") designation by the FDA for the treatment of relapsed or refractory CD20 positive WM and FL, based on potential improvement in response as seen in clinical data-to-date. Drugs eligible for RMAT designation are those intended to treat, modify, reverse or cure a serious or life-threatening disease or condition, and that present preliminary clinical evidence indicating the drug has the potential to address unmet medical needs for such disease or condition. RMAT designation provides regenerative medicine advanced therapy products with the same benefits to expedite the development and review of a marketing application that are available to drugs that receive Breakthrough Therapy Designation. These advantages include timely advice and interactive communications with FDA, as well as proactive and collaborative involvement by senior FDA managers and experienced review and regulatory health project management staff. A product designated as an RMAT also may be eligible for other FDA-expedited programs, such as Priority Review. The FDA also may conduct a rolling review of products in its expedited programs, reviewing portions of a marketing application before the complete application is submitted.

MB-109: Combination MB-101(IL13Rα2 CAR T Cell Program for Glioblastoma) and MB-108 (HSV-1 oncolytic virus C134) as a Potential Treatment for IL13Rα2+ Relapsed or Refractory Glioblastoma (GBM) and High-Grade Astrocytoma

An attractive novel approach to control glioblastoma is adoptive cellular immunotherapy utilizing CAR T cells. CAR T cells can be engineered to recognize very specific antigenically distinct tumor populations and to migrate through the brain parenchyma to kill malignant cells. In addition, oncolytic viruses ("OVs") have been developed to effectively infect and kill cancer cells in the tumor, as well as modify the microenvironment to increase tumor immunogenicity and immune cell trafficking within the tumor. Due to these properties, OVs have been studied in combination with other treatments to enhance the effectiveness of immunotherapies.

Preliminary anti-tumor activity has been observed in clinical studies administering the OV (MB-108) and CAR T cell therapy (MB-101) as single agents; however, the combination has not yet been explored. To determine if the combination of both therapies will result in a synergistic effect, investigators from COH developed preclinical studies in orthotopic GBM models in nude mice. Dr. Christine Brown from City of Hope presented these preclinical studies at the American Association for Cancer Research 2022 Annual Meeting. It was observed that co-treatment with HSV-1 OV and IL13Rα2-directed CAR-T cells resulted in no additional adverse events beyond those seen with the individual therapies, and, more notably, that pre-treatment with HSV-1 OV re-shaped the tumor microenvironment by increasing immune cell infiltrates and enhanced the efficacy of sub-therapeutic doses of IL13Rα2-directed CAR-T cell therapy delivered either intraventricularly or intratumorally. These preclinical studies aimed to provide a deeper understanding of this combination approach to support the potential benefit of a combination study that will evaluate HSV-1 OV (MB-108) and IL13Rα2-directed CAR-T cells (MB-101).

In October 2023, we received a safe-to-proceed "approval" from the FDA for our MB-109 IND application allowing us to initiate a Phase 1, open-label, non-randomized, multicenter study of MB-109 in patients with IL13Ra2+ recurrent GBM and high-grade astrocytoma. In this Phase 1 clinical study, we intend to evaluate the combination of CAR-T cells (MB-101) and the herpes simplex virus type 1 oncolytic virus (MB-108) in patients with IL13Ra2+ high-grade gliomas. The design of this study involves first a lead in cohort, wherein patients are treated with MB-101 alone without prior MB-108 administration. After successful confirmation of the safety profile of MB-101 alone, the study will then investigate increasing doses of intratumorally administered MB-108 followed by dual intratumoral (ICT) and intraventricular (ICV) administration of MB-101. Due to limited resources, we do not currently expect to initiate this study until such time, if any, that additional resources become available to us.

MB-101 (IL13Rα2 CAR T Cell Program for Glioblastoma)

GBM is the most common brain and central nervous system ("CNS") cancer, accounting for approximately 49.1% of malignant primary brain and CNS tumors, approximately 54% of all gliomas, and approximately 16% of all primary brain and CNS tumors. More than 14,490 new GBM cases were predicted to be diagnosed in the U.S. for 2023. Malignant brain tumors are the second leading cause of cancer-related deaths in adolescents and young adults aged 15-39 and the most common cancer occurring among 15-19-year-olds in the U.S. While GBM is a rare disease 2-3 cases per 100,000 persons per year in the U.S. and European Union ("EU"), it is quite lethal, with five-year survival rate historically under 10%, which has been virtually unchanged for decades. Standard of care therapy consists of maximal surgical resection, radiation, and chemotherapy with temozolomide, which, while rarely curative, is shown to extend median overall survival from 4.5 to 15 months. GBM remains difficult to treat due to the inherent resistance of the tumor to conventional therapies.

Immunotherapy approaches targeting brain tumors offer promise over conventional treatments. IL13Rα2 is an attractive target for CAR T therapy, as it has limited expression in normal tissue but is overexpressed on the surface of greater than 50% of GBM tumors. CAR-T cells are designed to express membrane-tethered IL-13 receptor ligand ("IL-13") mutated at a single site (glutamic acid at position 13 to a tyrosine; E13Y) with high affinity for IL13Rα2 and reduced binding to IL13Rα1 in order to reduce healthy tissue targeting (Kahlon KS *et al. Cancer Research.* 2004;64:9160-9166).

We are developing an optimized CAR-T product incorporating enhancements in CAR-T design and T cell engineering to improve antitumor potency and T cell persistence. These include a second-generation hinge-optimized CAR containing mutations in the IgG4 linker to reduce off-target Fc interactions (Jonnalagadda M *et al. Molecular Therapy.* 2015;23(4):757-768.), a 4-1BB (CD137) co-stimulatory signaling domain for improved survival and maintenance of CAR T cells, and the extracellular domain of CD19 as a selection/tracking marker. In order to further improve persistence, either central memory T-cells (T_{CM}) or enriched CD62L+ naïve and memory T cells ($T_{N/MEM}$) are isolated and enriched. Our manufacturing process limits *ex vivo* expansion, which is designed to reduce T cell exhaustion and maintain a T_{CM} or $T_{N/MEM}$ phenotype. Based on experiments with CAR-Ts in mouse xenograft models of GBM, these CAR-modified T_{CM} and $T_{N/MEM}$ cells have been shown to be more potent and persistent than earlier generations of CAR-T cells.

Our academic partners at COH have recently completed the treatment phase of their Phase 1 study, which was designed to assess the feasibility and safety of using T_{CM} or $T_{N/MEM}$ enriched IL13Rα2-specific CAR-engineered T cells for clinical study participants with IL13Rα2 recurrent/refractory malignant glioma (ClinicalTrials.gov Identifier: NCT02208362). In this study, COH enrolled and treated 65 patients, with 58 patients receiving 3 cycles of CAR T cells per the study protocol. MB-109: Combination MB-101(IL13Rα2 CAR T Cell Program for Glioblastoma) and MB-108 (HSV-1 oncolytic virus C134) as a Potential Treatment for IL13Rα2+ Relapsed or Refractory Glioblastoma (GBM) and High-Grade Astrocytoma. Preliminary data indicated that the CAR-T cells were well tolerated, and no dose-limiting toxicities were observed in any of the study arms nor where there any occurrences of CRS or treatment-related deaths. Of the 58 patients evaluable for disease response, 50% achieved stable disease (SD) or better; 22%, including 8 patients with grade 4 gliomas, achieved SD or better for at least 90 days. Two patients achieved partial response, and one patient achieved complete response on the study. In 2016 COH reported that a patient had achieved a complete response to treatment based on the imaging and clinical features set forth by the Response Assessment in Neuro-Oncology Criteria ("RANO"). This result was published as a case report in the *New England Journal of Medicine* (Brown CE et al. *NEJM.* 2016;375:2561-9). As described in the paper, this patient diagnosed with recurrent multifocal glioblastoma received multiple infusions of IL13Rα2-specific CAR-T cells over 220 days through two intracranial delivery routes – infusions into the resected tumor cavity followed by infusions into the ventricular system. Intracranial infusions of IL13Rα2-targeted CAR-T cells were not associated with any toxic effects of grade 3 or higher. After CAR-T cell treatment, regression of all intracranial and spinal tumors was observed, along with corresponding increases in levels of cytokines and immune cells in the cerebrospinal fluid. This clinical response was sustained for 7.5 months after the initiation of CAR T-cell therapy; however, the patient's disease eventually recurred at four new locations that were distinct and non-adjacent to the original tumors, and biopsy of one of these lesions showed decreased expression of IL13Rα2.

Results from this COH study have laid the foundation for potentially three new MB-101 studies listed below. Due to limited resources, we do not expect to initiate these studies until such time, if any, that additional resources become available to us.

1. MB-101 with or without nivolumab and ipilimumab in treating patients with recurrent or refractory glioblastoma (currently enrolling patients; ClinicalTrials.gov Identifier: NCT04003649) sponsored by COH;

2. MB-101 in treating patients with recurrent or refractory glioblastoma with a substantial component of leptomeningeal disease (currently enrolling patients; ClinicalTrials.gov Identifier: NCT04661384) sponsored by COH;

3. MB-101 in combination with the herpes simplex virus type 1 oncolytic virus (MB-108) in treating patients with recurrent or refractory glioblastoma or high-grade astrocytoma, as described above. This combination therapy, to be administered in a phase 1 two-center trial under our IND, will be referred to as MB-109.

MB - 108 (HSV 1 oncolytic virus C134)

MB-108 is a next-generation oncolytic herpes simplex virus ("oHSV") that is conditionally replication competent; that is, it can replicate in tumor cells, but not in normal cells, thus killing the tumor cells directly through this process. Replication of C134 in the tumor itself not only kills the infected tumor cells but causes the tumor cell to act as a factory to produce new virus. These virus particles are released as the tumor cell dies and can then proceed to infect other tumor cells in the vicinity and continue the process of tumor kill. In addition to this direct oncolytic activity, the virus promotes an immune response against surviving tumor cells, which increases the antitumor effect of the therapy. The virus expresses a gene from another virus from the same overall virus family, human cytomegalovirus, which allows it to replicate better in the tumor cells than its first-generation predecessors. However, the virus has also been genetically engineered to minimize the production of any toxic effects for the patient receiving the therapy.

To improve this virus over its first-generation predecessors, modifications have focused on improving viral replication and spread within the tumor bed and on enhancing bystander damage to uninfected tumor cells. These effects cumulatively should result in converting an immunologically cold tumor to an immunologically hot tumor, which we anticipate will increase the efficacy of our IL13Rα2 directed CAR T for the treatment of GBM and high-grade astrocytoma.

The O'Neal Comprehensive Cancer Center at the UAB is the single clinical trial site for the Phase 1 trial of MB - 108, and this site has initiated a Phase 1 trial that began enrolling patients in 2019 (ClinicalTrials.gov Identifier: NCT03657576). The primary objective of this study is to determine the safety and tolerability of a single dose of MB-108 administered via a stereotactic intracerebral injection and to determine the maximally tolerated dose ("MTD") of the oncolytic virus. Secondary objectives are to obtain preliminary information about the potential benefit of MB - 108 in the treatment of patients with recurrent malignant gliomas, including relevant data on markers of efficacy, including time to tumor progression and patient survival. As of April 2023, 9 patients had been enrolled in this study.

In Vivo CAR T Platform Technology

We are collaborating with the Mayo Clinic to develop a novel technology that may be able to transform the administration of CAR T therapies and potentially be used as an off-the-shelf therapy. The technology, developed by Larry R. Pease, Ph.D., principal investigator and former director of the Center for Immunology and Immune Therapies at Mayo Clinic, is a new platform to administer CAR T therapy using a two-step approach. First, a peptide is administered to the patient to drive the proliferation of the

patient's resident T cells. This is followed by the administration of a viral CAR construct directly into the lymph nodes of the patient. In turn, the viral construct infects the activated T cells and effectively forms CAR T cells in vivo in the patient. Successful implementation may lead to an off-the-shelf product with no need to isolate and expand patient T cells ex vivo in a cell processing facility.

Preclinical proof-of-concept has been established, and the ongoing development of this technology will take place at Mayo Clinic. We are evaluating plans to file an IND application for a multicenter Phase 1 clinical trial once a lead construct has been identified, subject to allocation of resources.

Recent Developments

Sale of Manufacturing Facility – Overview of Transaction

On May 18, 2023, we entered into an Asset Purchase Agreement (the "Original Asset Purchase Agreement") with uBriGene (Boston) Biosciences, Inc., a Delaware corporation ("uBriGene"), pursuant to which we agreed to sell our leasehold interest in our cell processing facility located in Worcester, Massachusetts (the "Facility"), and associated assets relating to the manufacturing and production of cell and gene therapies at the Facility to uBriGene (the "Transaction"). We and uBriGene subsequently entered into Amendment No. 1, dated as of June 29, 2023, and Amendment No. 2, dated as of July 28, 2023, to the Original Asset Purchase Agreement (the Original Asset Purchase Agreement, as so amended, the "Asset Purchase Agreement").

On July 28, 2023 (the "Closing Date"), pursuant to the Asset Purchase Agreement, we completed the sale of all of our assets that primarily relate to the manufacturing and production of cell and gene therapies at the Facility (such operations, the "Transferred Operations" and such assets, the "Transferred Assets") to uBriGene for upfront consideration of $6 million cash (the "Base Amount"). The Transferred Assets that were transferred to uBriGene on the Closing Date include, but are not limited to: (i) our leases of equipment and other personal property and all other property, equipment, machinery, tools, supplies, inventory, fixtures and all other personal property primarily related to the Transferred Operations, (ii) the data, information, methods, quality management systems, and intellectual property primarily used for the purposes of the Transferred Operations, (iii) the records and filings, including customer and vendor lists, production data, standard operating procedures and business records relating to, used in or arising under the Transferred Operations and (iv) all transferrable business license, permits and approvals necessary to operate the Transferred Operations. As described in greater detail below, certain Transferred Assets, including our lease of the Facility and contracts that are primarily used in the Transferred Operations (the "Transferred Contracts") did not transfer to uBriGene on the Closing Date.

Voluntary Notice to U.S. Committee on Foreign Investment in the United States

uBriGene is an indirect, wholly owned subsidiary of UBrigene (Jiangsu) Biosciences Co., Ltd., a Chinese contract development and manufacturing organization. Under the Asset Purchase Agreement, we and uBriGene agreed to use our reasonable best efforts to obtain clearance for the Transaction from the U.S. Committee on Foreign Investment in the United States ("CFIUS"), although obtaining such clearance was not a condition to closing the Transaction. In accordance with the Asset Purchase Agreement, we and uBriGene previously submitted a voluntary joint notice to CFIUS on August 10, 2023.

Following an initial 45-day review period and subsequent 45-day investigation period, on November 13, 2023, CFIUS requested that we and uBriGene withdraw and re-file our joint voluntary notice to allow more time for review and discussion regarding the nature and extent of national security risk posed by the Transaction. Upon CFIUS's request, we and uBriGene submitted a request to withdraw and re-file our joint voluntary notice to CFIUS, and on November 13, 2023, CFIUS granted this request, accepted the joint voluntary notice and commenced a new 45-day review period on November 14, 2023. CFIUS's 45-day review ended on December 28, 2023. Since CFIUS had not concluded its review by December 28, 2023, the proceeding transitioned to a subsequent 45-day investigation period, which ended on February 12, 2024.

Following the 45-day review period and subsequent 45-day investigation period described above, on February 12, 2024, we and uBriGene requested permission to withdraw and re-file our joint voluntary notice to allow more time for review and discussion regarding the nature and extent of national security risk posed by the Transaction. Upon our joint request to withdraw and re-file their joint voluntary notice to CFIUS, on February 12, 2024, CFIUS granted this request, accepted the joint voluntary notice and commenced a new 45-day review period on February 13, 2024. CFIUS's new 45-day review ended on March 28, 2024. Because CFIUS had not yet concluded its action, the proceeding transitioned to a second 45-day phase as CFIUS further investigated the Transaction. On March 28, 2024, CFIUS advised us that its investigation would be completed no later than May 13, 2024.

On May 13, 2024, together with uBriGene and CFIUS, we executed a National Security Agreement (the "NSA"), pursuant to which we and uBriGene agreed to abandon the Transaction and all other transactions contemplated by the Asset Purchase Agreement and the agreements entered into in connection therewith. The execution of the NSA was the result of CFIUS' determination that such transactions posed a risk to the national security of the United States. We disagree with this position but did not feel a meaningful likelihood existed that the Transaction would be consummated in light of CFIUS' objections. The NSA imposes certain conditions on us and uBriGene and its affiliates. Most significantly, we agreed (i) not to effect the Transaction with uBriGene or any of its affiliates; and (ii) to appoint a point of contact representative with whom CFIUS and uBriGene's designated contact person may interact as needed. The NSA also obligates uBriGene to sell, or otherwise dispose of, the equipment assets purchased within 180 days after the execution of the NSA, with uBriGene able to eliminate some of its obligations under the NSA if it is able to sell the equipment assets purchased back to us within 45 days after the execution of the NSA.

Notification of Non-Compliance with Nasdaq Continued Listing Requirements

On March 13, 2024, we received a deficiency letter (the "Letter") from the Listing Qualifications Department (the "Staff") of The Nasdaq Stock Market ("Nasdaq") notifying us that we were not in compliance with the minimum stockholders' equity requirement for continued listing on the Nasdaq Capital Market under Nasdaq Listing Rule 5550(b)(1). Nasdaq Listing Rule 5550(b)(1) requires companies listed on The Nasdaq Capital Market to maintain stockholders' equity of at least $2,500,000 (the "Stockholders' Equity Requirement"). As of December 31, 2023, we reported stockholders' equity of $123,000. The Letter further noted that as of its date, we did not have a market value of listed securities of $35 million, or net income from continued operations of $500,000 in the most recently completed fiscal year or in two of the last three most recently completed fiscal years, the alternative quantitative standards for continued listing on the Nasdaq Capital Market.

The Letter had no immediate effect on our continued listing on the Nasdaq Capital Market, subject to our compliance with the other continued listing requirements. In accordance with Nasdaq rules, we were provided 45 calendar days, or until April 29, 2024, to submit a plan to regain compliance (the "Compliance Plan"). We submitted our Compliance Plan on April 29, 2024 and the Staff granted the our request for an extension of 180 calendar days through September 9, 2024 to regain compliance with the Stockholders Equity Requirement.

On May 16, 2024, we received a notice (the "Second Letter") from the Staff of Nasdaq indicating that the bid price of our common stock had closed below $1.00 per share for 31 consecutive business days and, as a result, we were not in compliance with Nasdaq Listing Rule 5550(a)(2), which sets forth the minimum bid price requirement for continued listing on the Nasdaq Capital Market. The Second Letter from Nasdaq had no immediate effect on the listing of our common stock on Nasdaq. Pursuant to Nasdaq Listing Rule 5810(c)(3)(A), we were afforded a 180-calendar day grace period, or until November 12, 2024, to regain compliance with the bid price requirement. Compliance can be achieved by evidencing a closing bid price of at least $1.00 per share for a minimum of ten consecutive business days (but generally not more than 20 consecutive business days) during the 180-calendar day grace period.

If we do not regain compliance with the bid price requirement by November 12, 2024, we may be eligible for an additional 180-calendar day compliance period so long as it satisfies the criteria for initial listing on Nasdaq and the continued listing requirement for market value of publicly held shares and we provide written notice to Nasdaq of our intention to cure the deficiency during the second compliance period by effecting a reverse stock split, if necessary. In the event we are not eligible for the second grace period, Nasdaq staff will provide written notice that our common stock is subject to delisting; however, we may request a hearing before the Nasdaq Hearings Panel (the "Panel"), which request, if timely made, would stay any further suspension or delisting action by the Staff pending the conclusion of the hearing process and expiration of any extension that may be granted by the Panel. There can be no assurance that we would be successful in our efforts to maintain the listing of our common stock on the Nasdaq Capital Market.

April 2024 Reduction in Work Force

On April 10, 2024, our board of directors approved a reduction of our workforce by approximately 81% of our employee base in order to reduce costs and preserve capital due to the fundraising environment and continued uncertainty regarding the CFIUS review of the sale of the Facility and the Transaction with uBriGene. The workforce reduction took place primarily in April 2024 and is expected to be substantially completed in the second quarter of 2024. As a result of these actions, we expect to incur personnel-related restructuring charges of approximately $0.2 million in connection with one-time employee termination cash expenditures, which are expected to be incurred in the second quarter of 2024. We may also incur other charges or cash expenditures not currently contemplated due to events that may occur as a result of, or associated with, the workforce reduction or retention efforts. The estimates of the costs expected to be incurred, and the timing thereof, are subject to various assumptions and actual costs may differ. We and our board of directors continue to evaluate all strategic and other alternatives related to the business.

Due to limited resources, and as a result of the reduction in work force described above, we do not expect to initiate our pivotal Phase 2 single-arm clinical trial of MB-106 for the treatment of WM trial in 2024. Subject to available funds, we intend rely on third party service providers to conduct study and manufacturing services to advance our priority potential product candidates.

Summary Risk Factors

Our business is subject to risks of which you should be aware before making an investment decision. You should carefully consider the risk factors described under the heading "*Risk Factors*," and in the other reports and documents that we have filed with the SEC.

Corporate Information

We are a majority-controlled subsidiary of Fortress Biotech, Inc. We were incorporated under the laws of the State of Delaware on March 13, 2015. Our principal executive offices are located at 377 Plantation Street, Worcester, Massachusetts 01605, and our telephone number is 781-652-4500. We maintain a website on the Internet at www.mustangbio.com and our e-mail address is info@mustangbio.com. Information on our website, or any other website, is not incorporated by reference in this prospectus. We have included our website address in this prospectus solely as an inactive textual reference.

Implications of Being a Smaller Reporting Company

We are a smaller reporting company as defined in the Securities Exchange Act of 1934, as amended (the "Exchange Act"). We may take advantage of certain of the scaled disclosures available to smaller reporting companies and will be able to take advantage of these scaled disclosures for so long as (i) the market value of our voting and non-voting common stock held by non-affiliates is less than $250 million measured on the last business day of our second fiscal quarter or (ii) our annual revenue is less than $100 million during the most recently completed fiscal year and the market value of our voting and non-voting common stock held by non-affiliates is less than $700 million measured on the last business day of our second fiscal quarter. Specifically, as a smaller reporting company, we may choose to present only the two most recent fiscal years of audited financial statements in our Annual Reports on Form 10-K and have reduced disclosure obligations regarding executive compensation, and if we are a smaller reporting company with less than $100 million in annual revenue, we would not be required to obtain an attestation report on internal control over financial reporting issued by our independent registered public accounting firm.

RISK FACTORS

An investment in our securities involves a high degree of risk. The prospectus supplement applicable to each offering of our securities will contain a discussion of the risks applicable to an investment in our securities. Prior to making a decision about investing in our securities, you should carefully consider the specific factors discussed under the heading "*Risk Factors*" in the applicable prospectus supplement, together with all of the other information contained or incorporated by reference in the prospectus supplement or appearing or incorporated by reference in this prospectus. Each of the referenced risks and uncertainties could adversely affect our business, operating results and financial condition, as well as adversely affect the value of an investment in our securities.

FORWARD-LOOKING STATEMENTS

This prospectus contains predictive or "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act of 1995. All statements other than statements of current or historical fact contained in this prospectus, including statements that express our intentions, plans, objectives, beliefs, expectations, strategies, predictions or any other statements relating to our future activities or other future events or conditions are forward-looking statements. The words "anticipate," "believe,"

"continue," "could," "estimate," "expect," "intend," "may," "plan," "predict," "project," "will," "should," "would" and similar expressions, as they relate to us, are intended to identify forward-looking statements.

These statements are based on current expectations, estimates and projections made by management about our business, our industry and other conditions affecting our financial condition, results of operations or business prospects. These statements are not guarantees of future performance and involve risks, uncertainties and assumptions that are difficult to predict. Therefore, actual outcomes and results may differ materially from what is expressed or forecasted in, or implied by, the forward-looking statements due to numerous risks and uncertainties. Factors that could cause such outcomes and results to differ include, but are not limited to, risks and uncertainties arising from:

- expectations for increases or decreases in expenses;
- expectations for the clinical and pre-clinical development, manufacturing, regulatory approval, and commercialization of our pharmaceutical product candidates or any other products we may acquire or in-license;
- use of clinical research centers and other contractors;
- expectations for incurring capital expenditures to expand our research and development and manufacturing capabilities;
- expectations for generating revenue or becoming profitable on a sustained basis;
- expectations or ability to enter into marketing and other partnership agreements;
- expectations or ability to enter into product acquisition and in-licensing transactions;
- expectations or ability to build our own commercial infrastructure to manufacture, market and sell our product candidates, if approved;
- expectations for the acceptance of our product candidates, if approved, by doctors, patients or payors;
- our ability to compete against other companies and research institutions;
- our ability to attract, hire and retain qualified personnel, including the impact of our recently announced reduction in work force;
- our ability to secure adequate protection for our intellectual property;
- our ability to attract and retain key personnel;
- our ability to obtain reimbursement for our products, if approved;
- estimates of the sufficiency of our existing cash and cash equivalents and investments to finance our operating requirements, including expectations regarding the value and liquidity of our investments;
- our stock price and the volatility of the equity markets;
- our ability to comply with the requirements of Nasdaq to maintain the listing of our common stock on the Nasdaq Capital Market;
- expected losses; and
- expectations for future capital requirements.

Any forward-looking statements speak only as of the date on which they are made, and we undertake no obligation to publicly update or revise any forward-looking statements to reflect events or circumstances that may arise after the date of this prospectus, except as required by applicable law. Investors should evaluate any statements made by us in light of these important factors. We qualify all of our forward-looking statements by these cautionary statements. In addition, with respect to all of our forward-looking statements, we claim the protection of the safe harbor for forward-looking statements contained in the Private Securities Litigation Reform Act of 1995.

USE OF PROCEEDS

Unless otherwise indicated in the prospectus supplement, the net proceeds from the sale of securities offered by this prospectus will be used for general corporate purposes and working capital requirements, which may include, among other things, the advancement of our product candidates to obtain regulatory approval from the U.S. Food and Drug Administration (the "FDA"), and in the event of FDA approval of our product candidates, towards the milestone payments due to our licensor and supplier upon FDA approval of our product candidates. We have not determined the amounts we plan to spend on the areas listed above or the timing of these expenditures, and we have no current plans with respect to acquisitions as of the date of this prospectus. As a result, unless otherwise indicated in the prospectus supplement, our management will have broad discretion to allocate the net proceeds of the offerings. Pending their ultimate use, we intend to invest the net proceeds in a variety of securities, including commercial paper, government and non-government debt securities and/or money market funds that invest in such securities.

DESCRIPTION OF SECURITIES WE MAY OFFER

The descriptions of the securities contained in this prospectus, together with the applicable prospectus supplements, summarize all the material terms and provisions of the various types of securities that we may offer. We will describe in the applicable prospectus supplement relating to any securities the particular terms of the securities offered by that prospectus supplement. If indicated in the applicable prospectus supplement, the terms of the securities may differ from the terms we have summarized below. We will also include information in the prospectus supplement, where applicable, about material United States federal income tax considerations relating to the securities, and the securities exchange, if any, on which the securities will be listed. This prospectus may not be used to consummate a sale of securities unless it is accompanied by a prospectus supplement.

DESCRIPTION OF CAPITAL STOCK

Capital Stock

We are authorized to issue 200,000,000 shares of common stock, par value of $0.0001 per share, of which 1,000,000 shares are designated as Class A common stock, and 2,000,000 of preferred stock, $0.0001 par value per share, of which 250,000 are designated as Class A Preferred Stock.

Common Stock

The holders of common stock are entitled to one vote per share held.

As of May 30, 2024, there were 27,390,295 shares of our common stock outstanding held by 71 stockholders of record.

The undesignated preferred stock may be issued from time to time in one or more series. Our board of directors is authorized to determine or alter the dividend rights, dividend rate, conversion rights, voting rights, rights and terms of redemption (including sinking fund provisions, if any), the redemption price or prices, the liquidation preferences and other designations, powers, preferences and relative, participating, optional or other special rights, if any, and the qualifications, limitations and restrictions granted to or imposed upon any wholly unissued series of preferred stock, and to fix the number of shares of any series of preferred stock (but not below the number of shares of any such series then outstanding).

Class A Common Stock

Voting Rights

The holders of our Class A common stock are entitled to cast the number of votes equal to the number of whole shares of common stock into which the shares of Class A common stock held by such holder are convertible. For a period of ten (10) years from issuance, the holders of the Class A common stock have the right to appoint one member of the Board of Directors of the Company. To date, the holders of Class A common stock have not yet appointed such director.

Preemptive, Conversion, or Similar Rights

Each share of Class A common stock is convertible, at the option of the holder, into one fully paid and nonassessable share of common stock, subject to certain adjustments. If the Company, at any time effects a subdivision or combination of the outstanding common stock (by any stock split, stock dividend, recapitalization, reverse stock split or otherwise), the applicable conversion ratio in effect immediately before that subdivision is proportionately decreased or increased, as applicable, so that the number of shares of common stock issuable on conversion of each share of Class A common stock shall be increased or decreased, as applicable, in proportion to such increase or decrease in the aggregate number of shares of common stock outstanding. Additionally, if any reorganization, recapitalization, reclassification, consolidation or merger involving the Company occurs in which the common stock (but not the Class A common stock) is converted into or exchanged for securities, cash or other property, then each share of Class A common stock becomes convertible into the kind and amount of securities, cash or other property which a holder of the number of shares of common stock of the Company issuable upon conversion of one share of the Class A common stock immediately prior to such reorganization, recapitalization, reclassification, consolidation or merger would have been entitled to receive pursuant to such transaction.

Class A Preferred Stock

The Class A Preferred Stock is identical to undesignated common stock other than as to voting rights, conversion rights, and the PIK dividend right.

The holders of the outstanding shares of Class A Preferred Stock receive on each January 1 (each a "PIK Dividend Payment Date") after the original issuance date of the Class A Preferred Stock until the date all outstanding Class A Preferred Stock is converted into common stock or redeemed (and the purchase price is paid in full), pro rata per share dividends paid in additional fully paid and non-assessable shares of common stock such that the aggregate number of shares of common stock issued pursuant to such PIK dividend is equal to 2.5% of the Corporation's fully-diluted outstanding capitalization on the date that is one business day prior to any PIK Dividend Payment Date ("PIK Record Date"). In the event the Class A Preferred Stock converts into common stock, the holders shall receive all PIK dividends accrued through the date of such conversion. No dividend or other distribution shall be paid, or declared and set apart for payment (other than dividends payable solely in capital stock on the capital stock) on the shares of common stock until all PIK dividends on the Class A Preferred Stock shall have been paid or declared and set apart for payment. All dividends are non-cumulative.

On any matter presented to the stockholders for their action or consideration at any meeting of stockholders (or by written consent of stockholders in lieu of meeting), each holder of outstanding shares of Class A Preferred Stock shall be entitled to cast for each share of Class A Preferred Stock held by such holder as of the record date for determining stockholders entitled to vote on such matter, the number of votes that is equal to one and one-tenth (1.1) times a fraction, the numerator of which is the sum of (A) the number of shares of outstanding common stock and (B) the whole shares of common stock in to which the shares of outstanding Class A common stock and the Class A Preferred Stock are convertible, and the denominator of which is number of shares of outstanding Class A Preferred Stock. Thus, the Class A Preferred Stock will at all times constitute a voting majority.

Each share of Class A Preferred Stock is convertible, at the option of the holder, into one fully paid and nonassessable share of common stock, subject to certain adjustments. If the Company, at any time effects a subdivision or combination of the outstanding common stock (by any stock split, stock dividend, recapitalization, reverse stock split or otherwise), the applicable conversion ratio in effect immediately before that subdivision is proportionately decreased or increased, as applicable, so that the number of shares of common stock issuable on conversion of each share of Class A Preferred Stock shall be increased or decreased, as applicable, in proportion to such increase or decrease in the aggregate number of shares of common stock outstanding. Additionally, if any reorganization, recapitalization, reclassification, consolidation or merger involving the Company occurs in which the common stock (but not the Class A Preferred Stock) is converted into or exchanged for securities, cash or other property, then each share of Class A Preferred Stock becomes convertible into the kind and amount of securities, cash or other property which a holder of the number of shares of common stock of the Company issuable upon conversion of one share of the Class A Preferred Stock immediately prior to such reorganization, recapitalization, reclassification, consolidation or merger would have been entitled to receive pursuant to such transaction.

Additional Features

Other features of our capital stock include:

- *Dividend Rights*. The holders of outstanding shares of our common stock, including Class A common stock, are entitled to receive dividends out of funds legally available at the times and in the amounts that our Board of Directors may determine. All dividends are non-cumulative.
- *Voting Rights*. The holders of our common stock are entitled to one vote for each share of common stock held on all matters submitted to a vote of the stockholders, including the election of directors. Our certificate of incorporation and bylaws do not provide for cumulative voting rights.
- *No Preemptive or Similar Rights.* The holders of our common stock have no preemptive, conversion, or subscription rights, and there are no redemption or sinking fund provisions applicable to our common stock.
- *Right to Receive Liquidation Distributions.* Upon our liquidation, dissolution, or winding-up, the assets legally available for distribution to our stockholders would be distributable ratably among the holders of our common stock, including Class A common stock, outstanding at that time after payment of other claims of creditors, if any.
- *Fully Paid and Non-Assessable.* All of the outstanding shares of our common stock, including Class A common stock, and the Class A Preferred Stock are duly issued, fully paid and non-assessable.

Anti-Takeover Effects of Various Provisions of Delaware Law and Mustang Bio's Certificate of Incorporation and Bylaws

Provisions of the General Corporation Law of the State of Delaware ("DGCL") and our Certificate of Incorporation and Bylaws could make it more difficult to acquire Mustang

Bio by means of a tender offer, a proxy contest or otherwise, or to remove incumbent officers and directors. These provisions, including those summarized below, may encourage certain types of coercive takeover practices and takeover bids.

Delaware Anti-Takeover Statute. In general, Section 203 of the DGCL prohibits a publicly held Delaware corporation from engaging in a "business combination" with an "interested stockholder" for a period of three years following the time the person became an interested stockholder, unless the business combination or the acquisition of shares that resulted in a stockholder becoming an interested stockholder is approved in a prescribed manner. Generally, a "business combination" includes a merger, asset or stock sale or other transaction resulting in a financial benefit to the interested stockholder. Generally, an "interested stockholder" is a person who, together with affiliates and associates, owns (or within three years prior to the determination of interested stockholder status did own) 15% or more of a corporation's voting stock. However, our Certificate of Incorporation provides that we are not subject to the anti-takeover provisions of Section 203 of the DGCL.

Removal. Subject to the rights of any holders of any outstanding series of our preferred stock, stockholders may remove our directors with or without cause, by a vote of the stockholders. Removal will require the affirmative vote of holders of a majority of our voting stock.

Size of Board and Vacancies. Our Bylaws provide that the number of directors be fixed exclusively by the board of directors. Any vacancies may only be filled by a majority of the remaining directors, even if less than a quorum is present, or by a sole remaining director. Any director appointed to fill a vacancy on our board of directors will be appointed until the next annual meeting and until his or her successor has been elected and qualified.

Requirements for Advance Notification of Stockholder Nominations and Proposals. Our Bylaws establish advance notice procedures with respect to stockholder proposals and nomination of candidates for election as directors other than nominations made by or at the direction of its board of directors or a committee of our board of directors.

Undesignated Preferred Stock. Our board of directors is authorized to issue up to 2,000,000 shares of preferred stock without additional stockholder approval, which preferred stock could have voting rights or conversion rights that, if exercised, could adversely affect the voting power of the holders of common stock. The issuance of shares of preferred stock may have the effect of delaying, deferring or preventing a change in control of the Company without any action by the Company's stockholders.

Limitation on Liability of Directors and Indemnification of Directors and Officers

Elimination of Liability of Directors. The DGCL authorizes corporations to limit or eliminate the personal liability of directors to corporations and their stockholders for monetary damages for breaches of directors' fiduciary duties as directors, and our Certificate of Incorporation includes such an exculpation provision. Our Certificate of Incorporation provides that, to the fullest extent permitted by the DGCL, no director will be personally liable to us or to our stockholders for monetary damages for breach of fiduciary duty as a director except for liability (i) for any breach of the director's duty of loyalty to the Company or its stockholders, (ii) for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law, (iii) under Section 174 of the DGCL, or (iv) for any transaction from which the director derived any improper personal benefit. While our Certificate of Incorporation provides directors with protection from awards for monetary damages for breaches of their duty of care, it does not eliminate this duty. Accordingly, our Certificate of Incorporation has no effect on the availability of equitable remedies such as an injunction or rescission based on a director's breach of his or her duty of care. The provisions apply to an officer of Mustang Bio only if he or she is a director of Mustang Bio and is acting in his or her capacity as director, and do not apply to officers of Mustang Bio who are not directors.

Indemnification of Directors, Officers and Employees. Our Bylaws require us to indemnify any person who was or is a party or is threatened to be made a party to, or was otherwise involved in, a legal proceeding by reason of the fact that he or she is or was a director, officer or employee or agent of Mustang Bio or, while a director, officer or employee of Mustang Bio, or is or was serving at the request of Mustang Bio as a director, officer, employee or agent of another corporation, partnership, joint venture, trust or other enterprise, against expenses (including attorneys' fees), judgments, fines and amounts paid in settlement actually and reasonably incurred by him in connection with such action, suit or proceeding if he or she acted in good faith and in a manner he reasonably believed to be in or not opposed to the best interests of the Mustang Bio and, with respect to any criminal action or proceeding, had no reasonable cause to believe his or her conduct was unlawful. The termination of any action, suit or proceeding by judgment, order, settlement, conviction or upon a plea of nolo contendere or its equivalent, would not, of itself, create a presumption that the person did not act in good faith and in a manner which he or she reasonably believed to be in or not opposed to the best interests of Mustang Bio and, with respect to any criminal action or proceeding, had reasonable cause to believe that his conduct was unlawful. We are authorized under our Bylaws to carry directors' and officers' insurance protecting us, any director, officer or employee or agent of ours or, against any expense, liability or loss, whether or not we have the power to indemnify the person under the DGCL. We may, to the extent authorized from time to time, indemnify any of our agents to the fullest extent permitted with respect to directors, officers and employees in our Bylaws.

The limitation of liability and indemnification provisions in our Certificate of Incorporation and Bylaws may discourage stockholders from bringing a lawsuit against our directors for breach of fiduciary duty. These provisions also may reduce the likelihood of derivative litigation against our directors and officers, even though such an action, if successful, might otherwise benefit us and our stockholders. By its terms, the indemnification provided for in our Bylaws is not exclusive of any other rights that the indemnified party may be or become entitled to under any law, agreement, vote of stockholders or directors, provisions of our Certificate of Incorporation or Bylaws or otherwise. Any amendment, alteration or repeal of our Bylaws' indemnification provisions is, by the terms of our Bylaws, prospective only and will not adversely affect the rights of any indemnity in effect at the time of any act or omission occurring prior to such amendment, alteration or repeal.

DESCRIPTION OF PREFERRED STOCK

Preferred Stock

Class A Preferred Stock

Our Class A Preferred Stock is identical to our common stock other than as to voting rights, conversion rights, and the PIK dividend right.

Voting Rights

On any matter presented to our stockholders for their action or consideration at any meeting of our stockholders (or by written consent of stockholders in lieu of meeting), each holder of outstanding shares of Class A Preferred Stock will be entitled to cast for each share of Class A Preferred Stock held by such holder as of the record date for determining stockholders entitled to vote on such matter, the number of votes that is equal to one and one-tenth (1.1) times a fraction, the numerator of which is the sum of (A) the number of shares of outstanding common stock and (B) the whole shares of common stock in to which the shares of outstanding Class A common stock and the Class A Preferred Stock are convertible, and the denominator of which is the number of shares of outstanding Class A Preferred Stock. Thus, the Class A Preferred Stock will at all times constitute a voting majority. Except as provided by law or by the provisions of our Certificate of Incorporation, the holders of Class A common stock and Class A Preferred Stock will vote together with the holders of common stock as a single class.

Preemptive, Conversion, or Similar Rights

Each share of Class A Preferred Stock is convertible, at the option of the holder, into one fully paid and nonassessable share of common stock, subject to certain adjustments. If the Company, at any time effects a subdivision or combination of the outstanding common stock (by any stock split, stock dividend, recapitalization, reverse stock split or otherwise), the applicable conversion ratio in effect immediately before that subdivision is proportionately decreased or increased, as applicable, so that the number of shares of common stock issuable on conversion of each share of Class A Preferred Stock shall be increased or decreased, as applicable, in proportion to such increase or decrease in the aggregate number of shares of common stock outstanding. Additionally, if any reorganization, recapitalization, reclassification, consolidation or merger involving the Company occurs in which the common stock (but not the Class A Preferred Stock) is converted into or exchanged for securities, cash or other property, then each share of Class A Preferred Stock becomes convertible into the kind and amount of securities, cash or other property which a holder of the number of shares of common stock of the Company issuable upon conversion of one share of the Class A Preferred Stock immediately prior to such reorganization, recapitalization, reclassification, consolidation or merger would have been entitled to receive pursuant to such transaction.

Dividends

The holders of the outstanding shares of Class A Preferred Stock receive on each January 1 (each a "PIK Dividend Payment Date") after the original issuance date of the Class A Preferred Stock until the date all outstanding Class A Preferred Stock is converted into common stock or redeemed (and the purchase price is paid in full), pro rata per share dividends paid in additional fully paid and non-assessable shares of common stock such that the aggregate number of shares of common stock issued pursuant to such PIK dividend is equal to 2.5% of the Company's fully-diluted outstanding capitalization on the date that is one business day prior to any PIK Dividend Payment Date ("PIK Record Date"). In the event the Class A Preferred Stock converts into common stock, the holders shall receive all PIK dividends accrued through the date of such conversion. No dividend or other distribution shall be paid, or declared and set apart for payment (other than dividends payable solely in capital stock on the capital stock) on the shares of common stock until all PIK dividends on the Class A Preferred Stock shall have been paid or declared and set apart for payment. All dividends are non-cumulative.

Undesignated Preferred Stock

The undesignated Preferred Stock may be issued from time to time in one or more series. Our Board of Directors is authorized to determine or alter the dividend rights, dividend rate, conversion rights, voting rights, rights and terms of redemption (including sinking fund provisions, if any), the redemption price or prices, the liquidation preferences and other designations, powers, preferences and relative, participating, optional or other special rights, if any, and the qualifications, limitations and restrictions granted to or imposed upon any wholly unissued series of Preferred Stock, and to fix the number of shares of any series of Preferred Stock (but not below the number of shares of any such series then outstanding).

DESCRIPTION OF WARRANTS

We may issue warrants to purchase shares of our common stock and/or preferred stock in one or more series together with other securities or separately, as described in each applicable prospectus supplement.

The prospectus supplement relating to any warrants we offer will include specific terms relating to the offering. These terms will include some or all of the following:

- the title of the warrants;
- the aggregate number of warrants offered;
- the designation, number and terms of the shares of common stock or preferred stock purchasable upon exercise of the warrants and procedures by which those numbers may be adjusted;
- the exercise price of the warrants;
- the dates or periods during which the warrants are exercisable;
- the designation and terms of any securities with which the warrants are issued;
- if the warrants are issued as a unit with another security, the date on and after which the warrants and the other security will be separately transferable;
- if the exercise price is not payable in U.S. dollars, the foreign currency, currency unit or composite currency in which the exercise price is denominated;
- any minimum or maximum amount of warrants that may be exercised at any one time;
- any terms relating to the modification of the warrants;
- any terms, procedures and limitations relating to the transferability, exchange or exercise of the warrants; and
- any other specific terms of the warrants.

DESCRIPTION OF DEBT SECURITIES

We may offer debt securities which may be senior, subordinated or junior subordinated and may be convertible into shares of common stock or preferred stock. We will issue the debt securities offered by this prospectus and any accompanying prospectus supplement under an indenture to be entered into between us and the trustee identified in the applicable prospectus supplement. The terms of the debt securities will include those stated in the indenture and those made part of the indenture by reference to the Trust Indenture Act of 1939, as amended (the "Trust Indenture Act") as in effect on the date of the indenture. We have filed a copy of the form of indenture as an exhibit to the registration statement in which this prospectus is included. The indenture will be subject to and governed by the terms of the Trust Indenture Act.

The following description briefly sets forth certain general terms and provisions of the debt securities that we may offer. The particular terms of the debt securities offered by any prospectus supplement and the extent, if any, to which these general provisions may apply to the debt securities, will be described in the related prospectus supplement. Accordingly, for a description of the terms of a particular issue of debt securities, reference must be made to both the related prospectus supplement and to the following description.

Debt Securities

The aggregate principal amount of debt securities that may be issued under an applicable indenture is unlimited, subject only to the aggregate amount of the offering registered under the registration statement of which this prospectus forms a part. The debt securities may be issued in one or more series as may be authorized from time to time pursuant to a supplemental indenture entered into between us and the trustee or an order delivered by us to the trustee. For each series of debt securities we offer, a prospectus supplement accompanying this prospectus will describe the following terms and conditions of the series of debt securities that we are offering, to the extent applicable:

- title and aggregate principal amount;
- whether the debt securities will be senior, subordinated or junior subordinated;

- applicable subordination provisions, if any;

- provisions regarding whether the debt securities will be convertible or exchangeable into other securities or property of the Company or any other person;
- percentage or percentages of principal amount at which the debt securities will be issued;
- maturity date(s);
- interest rate(s) or the method for determining the interest rate(s);
- whether interest on the debt securities will be payable in cash or additional debt securities of the same series;
- dates on which interest will accrue or the method for determining dates on which interest will accrue and dates on which interest will be payable;
- whether the amount of payment of principal of, premium, if any, or interest on the debt securities may be determined with reference to an index, formula or other method;
- redemption, repurchase or early repayment provisions, including our obligation or right to redeem, purchase or repay debt securities under a sinking fund, amortization or analogous provision;
- if other than the debt securities' principal amount, the portion of the principal amount of the debt securities that will be payable upon declaration of acceleration of the maturity;
- authorized denominations;
- form;
- amount of discount or premium, if any, with which the debt securities will be issued, including whether the debt securities will be issued as "original issue discount" securities;
- the place or places where the principal of, premium, if any, and interest on the debt securities will be payable;
- where the debt securities may be presented for registration of transfer, exchange or conversion;
- the place or places where notices and demands to or upon the Company in respect of the debt securities may be made;
- whether the debt securities will be issued in whole or in part in the form of one or more global securities;
- if the debt securities will be issued in whole or in part in the form of a book-entry security, the depository or its nominee with respect to the debt securities and the circumstances under which the book-entry security may be registered for transfer or exchange or authenticated and delivered in the name of a person other than the depository or its nominee;
- whether a temporary security is to be issued with respect to such series and whether any interest payable prior to the issuance of definitive securities of the series will be credited to the account of the persons entitled thereto;
- the terms upon which beneficial interests in a temporary global security may be exchanged in whole or in part for beneficial interests in a definitive global security or for individual definitive securities;
- the guarantors, if any, of the debt securities, and the extent of the guarantees and any additions or changes to permit or facilitate guarantees of such debt securities;
- any covenants applicable to the particular debt securities being issued;

- any defaults and events of default applicable to the debt securities, including the remedies available in connection therewith;
- currency, currencies or currency units in which the purchase price for, the principal of and any premium and any interest on, such debt securities will be payable;
- time period within which, the manner in which and the terms and conditions upon which the Company or the purchaser of the debt securities can select the payment currency;
- securities exchange(s) on which the debt securities will be listed, if any;
- whether any underwriter(s) will act as market maker(s) for the debt securities;
- extent to which a secondary market for the debt securities is expected to develop;
- provisions relating to defeasance;
- provisions relating to satisfaction and discharge of the indenture;
- any restrictions or conditions on the transferability of the debt securities;
- provisions relating to the modification of the indenture both with and without the consent of holders of debt securities issued under the indenture;
- any addition or change in the provisions related to compensation and reimbursement of the trustee;
- provisions, if any, granting special rights to holders upon the occurrence of specified events;
- whether the debt securities will be secured or unsecured, and, if secured, the terms upon which the debt securities will be secured and any other additions or changes relating to such security; and
- any other terms of the debt securities that are not inconsistent with the provisions of the Trust Indenture Act (but may modify, amend, supplement or delete any of the terms of the indenture with respect to such series of debt securities).

General

One or more series of debt securities may be sold as "original issue discount" securities. These debt securities would be sold at a substantial discount below their stated principal amount, bearing no interest or interest at a rate which at the time of issuance is below market rates. One or more series of debt securities may be variable rate debt securities that may be exchanged for fixed rate debt securities.

United States federal income tax consequences and special considerations, if any, applicable to any such series will be described in the applicable prospectus supplement.

Debt securities may be issued where the amount of principal and/or interest payable is determined by reference to one or more currency exchange rates, commodity prices, equity indices or other factors. Holders of such debt securities may receive a principal amount or a payment of interest that is greater than or less than the amount of principal or interest otherwise payable on such dates, depending upon the value of the applicable currencies, commodities, equity indices or other factors. Information as to the methods for determining the amount of principal or interest, if any, payable on any date, the currencies, commodities, equity indices or other factors to which the amount payable on such date is linked and certain additional United States federal income tax considerations will be set forth in the applicable prospectus supplement.

The term "debt securities" includes debt securities denominated in U.S. dollars or, if specified in the applicable prospectus supplement, in any other freely transferable currency or units based on or relating to foreign currencies.

We expect most debt securities to be issued in fully registered form without coupons and in denominations of $2,000 and any integral multiples thereof. Subject to the limitations provided in the indenture and in the prospectus supplement, debt securities that are issued in registered form may be transferred or exchanged at the principal corporate trust office of the trustee, without the payment of any service charge, other than any tax or other governmental charge payable in connection therewith.

Global Securities

The debt securities of a series may be issued in whole or in part in the form of one or more global securities that will be deposited with, or on behalf of, a depositary identified in the prospectus supplement. Global securities will be issued in registered form and in either temporary or definitive form. Unless and until it is exchanged in whole or in part for the individual debt securities, a global security may not be transferred except as a whole by the depositary for such global security to a nominee of such depositary or by a nominee of such depositary to such depositary or another nominee of such depositary or by such depositary or any such nominee to a successor of such depositary or a nominee of such successor. The specific terms of the depositary arrangement with respect to any debt securities of a series and the rights of and limitations upon owners of beneficial interests in a global security will be described in the applicable prospectus supplement.

Governing Law

The indenture and the debt securities will be construed in accordance with and governed by the laws of the State of New York.

DESCRIPTION OF UNITS

We may issue, in one more series, units comprised of shares of our common stock and/or preferred stock, warrants to purchase common stock and/or preferred stock, debt securities or any combination of those securities. Each unit will be issued so that the holder of the unit is also the holder of each security included in the unit. Thus, the holder of a unit will have the rights and obligations of a holder of each included security. The unit agreement under which a unit is issued may provide that the securities included in the unit may not be held or transferred separately, at any time or at any time before a specified date.

We may evidence units by unit certificates that we issue under a separate agreement. We may issue the units under a unit agreement between us and one or more unit agents. If we elect to enter into a unit agreement with a unit agent, the unit agent will act solely as our agent in connection with the units and will not assume any obligation or relationship of agency or trust for or with any registered holders of units or beneficial owners of units. We will indicate the name and address and other information regarding the unit agent in the applicable prospectus supplement relating to a particular series of units if we elect to use a unit agent.

We will describe in the applicable prospectus supplement the terms of the series of units being offered, including:

- the designation and terms of the units and of the securities comprising the units, including whether and under what circumstances those securities may be held or transferred separately;
- any provisions of the governing unit agreement that differ from those described herein; and
- any provisions for the issuance, payment, settlement, transfer or exchange of the units or of the securities comprising the units.

The other provisions regarding our common stock, preferred stock, warrants and debt securities as described in this section will apply to each unit to the extent such unit consists of shares of our common stock, warrants and/or debt securities.

PLAN OF DISTRIBUTION

We may sell the securities covered in this prospectus in one or more of the following ways:

- through underwriters or dealers;
- in short or long transactions;
- directly to a limited number of purchasers or to a single purchaser;
- through agents, including via an at-the-market program; or
- through a combination of any of these methods of sale.

Each time that we use this prospectus to sell securities, we will also provide a prospectus supplement that contains the specific terms of the offering. The prospectus supplement will set forth the terms of the offering of the securities, including:

- the name or names of any underwriters, dealers or agents and the amounts of any securities underwritten or purchased by each of them; and
- the purchase price of the securities being offered and the proceeds to us and any discounts, commissions or concessions allowed or reallowed or paid to dealers.

Any public offering price and any discounts or concessions allowed or reallowed or paid to dealers may be changed from time to time.

If underwriters are used in the sale of any securities, the securities will be acquired by the underwriters for their own account and may be resold from time to time in one or more transactions, including negotiated transactions, at a fixed public offering price or at varying prices determined at the time of sale. The securities may be either offered to the public through underwriting syndicates represented by managing underwriters, or directly by underwriters. Generally, the underwriters' obligations to purchase the securities will be subject to certain conditions precedent. The underwriters will be obligated to purchase all of the securities if they purchase any of securities. Only underwriters named in the applicable prospectus supplement shall be underwriters of the securities offered thereby.

We may sell the securities through agents from time to time. The prospectus supplement will name any agent involved in the offer or sale of the securities and any commissions we pay to them. Generally, any agent will be acting on a best efforts basis for the period of its appointment.

We may authorize underwriters, dealers or agents to solicit offers by certain purchasers to purchase the securities from us at the public offering price set forth in the prospectus supplement pursuant to delayed delivery contracts providing for payment and delivery on a specified applicable date in the future. The contracts will be subject only to those conditions set forth in the prospectus supplement, and the prospectus supplement will set forth any commissions we pay for solicitation of these contracts.

Agents and underwriters may be entitled to indemnification by us against certain civil liabilities, including liabilities under the Securities Act of 1933, as amended (the "Securities Act"), or to contribution with respect to payments which the agents or underwriters may be required to make in respect thereof. Agents and underwriters may be customers of, engage in transactions with, or perform services for us in the ordinary course of business.

We may enter into derivative transactions with third parties, or sell securities not covered by this prospectus to third parties in privately negotiated transactions. If the applicable prospectus supplement indicates, in connection with those derivatives, the third parties may sell securities covered by this prospectus and the applicable prospectus supplement, including in short sale transactions. If so, the third party may use securities pledged by us or borrowed from us or others to settle those sales or to close out any related open borrowings of securities and may use securities received from us in settlement of those derivatives to close out any related open borrowings of securities. The third party in such sale transactions will be an underwriter and will be identified in the applicable prospectus supplement (or a post-effective amendment). We may also use underwriters or such other third parties with whom we have a material relationship. We will describe the nature of any such relationship in the applicable prospectus supplement.

At-the-Market Offerings

Upon written instruction from us, after entering into a distribution agency agreement with us, a sales agent may use its commercially reasonable efforts to sell on our behalf, as our agent, the shares of common stock offered as agreed upon by us and the sales agent. We will designate the maximum amount of shares of common stock to be sold through

the sales agent, on a daily basis or otherwise as we and the sales agent agree. Subject to the terms and conditions of the applicable distribution agency agreement, the sales agent will use its commercially reasonable efforts to sell, as our sales agent and on our behalf, all of the designated shares of common stock. We may instruct the sales agent not to sell shares of common stock if the sales cannot be effected at or above the price designated by us in any such instruction. We may suspend the offering of shares of common stock under any distribution agency agreement by notifying the sales agent. Likewise, the sales agent may suspend the offering of shares of common stock under the applicable distribution agency agreement by notifying us of such suspension.

We also may sell shares to the sales agent as principal for its own account at a price agreed upon at the time of sale. If we sell shares to the sales agent as principal, we will enter into a separate agreement setting forth the terms of such transaction or such sales may be provided for in the distribution agreement described above.

It is contemplated that the distribution agreements entered into with sales agents will allow such sales agents to make sales in privately negotiated transactions and/or under any other method permitted by law, including sales deemed to be an "at-the-market" offering as defined in Rule 415 promulgated under the Securities Act, sales made directly on The Nasdaq Capital Market, the existing trading market for our common stock, or sales made to or through a market maker other than on an exchange. The name of any such underwriter or agent involved in the offer and sale of our common stock, the amounts underwritten, and the nature of its obligations to take our common stock will be described in the applicable prospectus supplement.

LEGAL MATTERS

The validity of the securities being offered hereby will be passed upon for us by Troutman Pepper Hamilton Sanders LLP, Charlotte, North Carolina. If legal matters in connection with offerings made pursuant to this prospectus are passed upon by counsel for underwriters, dealers or agents, if any, such counsel will be named in the prospectus supplement relating to such offerings.

EXPERTS

The financial statements of Mustang Bio, Inc. as of December 31, 2023 and 2022, and for each of the years in the two-year period ended December 31, 2023, have been incorporated by reference herein in reliance upon the reports of KPMG LLP, independent registered public accounting firm, incorporated by reference herein, and upon the authority of said firm as experts in accounting and auditing. The audit report covering the December 31, 2023 financial statements contains an explanatory paragraph that states the Company's expectation to generate operating losses and negative operating cash flows in the future, and the need for additional funding to support its planned operations raise substantial doubt about its ability to continue as a going concern. The financial statements do not include any adjustments that might result from the outcome of that uncertainty.

WHERE YOU CAN FIND MORE INFORMATION

We are a public company and file reports with the SEC on an annual basis using Form 10-K, quarterly reports on Form 10-Q and current reports on Form 8-K. Additionally, the SEC maintains a website that contains annual, quarterly, and current reports, proxy statements, and other information that issuers (including us) file electronically with the SEC. The SEC's website address is http://www.sec.gov. You can also obtain copies of materials we file with the SEC from our Internet website found at www.mustangbio.com. Our common stock is listed on the Nasdaq Capital Market under the symbol "MBIO". We have not incorporated by reference into this prospectus the information on our website, and you should not consider it to be a part of this prospectus.

INCORPORATION OF CERTAIN INFORMATION BY REFERENCE

The SEC allows us to "incorporate by reference" the information we file with it which means that we can disclose important information to you by referring you to those documents instead of having to repeat the information in this prospectus and any supplements to this prospectus. The information incorporated by reference is considered to be part of this prospectus and any supplements to this prospectus, and later information that we file with the SEC will automatically update and supersede this information. This prospectus incorporates by reference the documents listed below and any future filings made with the SEC under Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act (1) after the date of the initial registration statement, as amended, and prior to effectiveness of the registration statement, and (2) after the date of this prospectus and prior to the termination of this offering. Such information will automatically update and supersede the information contained in this prospectus and the documents listed below; provided, however, that we are not, unless specifically indicated, incorporating any information furnished under Item 2.02 or Item 7.01 of any current report on Form 8-K, whether listed below or filed in the future, or related exhibits furnished pursuant to Item 9.01 of Form 8-K:

a) Our Annual Report on Form 10-K for the year ended December 31, 2023 filed with the SEC on March 11, 2024 (the "2023 Form 10-K");

b) Our Quarterly Report on Form 10-Q, for the quarterly period ended March 31, 2024, filed with the SEC May 15, 2024;

d) Our Current Reports on Form 8-K filed with the SEC on January 4, 2024, January 25, 2024, February 14, 2024, March 15, 2024, March 29, 2024, April 12, 2024, May 2, 2024 and May 21, 2024; and

e) The description of our common stock included in our registration statements on Form 8-A12B, filed with the SEC on August 21, 2017, and any amendment or report filed for the purpose of further updating such description.

All reports and other documents we subsequently file pursuant to Section 13(a), 13(c), 14 or 15(d) of the Exchange Act prior to the termination of this offering, including all such documents we may file with the SEC after the date of the initial registration statement and prior to and after the effectiveness of the registration statement, but excluding any information furnished to, rather than filed with, the SEC, will also be incorporated by reference into this prospectus and deemed to be part of this prospectus from the date of the filing of such reports and documents. A statement contained in a document incorporated by reference into this prospectus shall be deemed to be modified or superseded for purposes of this prospectus to the extent that a statement contained in this prospectus, any prospectus supplement or in any other subsequently filed document which is also incorporated in this prospectus modifies or replaces such statement. Any statements so modified or superseded shall not be deemed, except as so modified or superseded, to constitute a part of this prospectus. We will furnish without charge to any person (including any beneficial owner) a copy of any or all of the documents incorporated by reference, including exhibits to these documents, upon written or oral request. Direct your request to: Corporate Secretary, Mustang Bio, Inc., 377 Plantation Street, Worcester,

Massachusetts, 01605 or (781) 652-4500.

$40,000,000

Mustang Bio, Inc.

Common Stock
Preferred Stock
Warrants
Debt Securities
Units

PROSPECTUS

June 12, 2024

3,025,000 Shares of Common Stock
3,105,000 Pre-funded Warrants to Purchase up to 3,105,000 Shares of Common Stock
Up to 3,105,000 Shares of Common Stock Underlying the Pre-Funded Warrants

MUSTANG BIO, INC.

PROSPECTUS SUPPLEMENT

H.C. Wainwright & Co.

June 19, 2024