

0001437749-24-037491mbrx20241210_s1.htm Table of ContentsAs filed with the Securities and Exchange Commission on December 13, 2024.Â Â Registration No. 333-_____Â UNITED STATESSECURITIES AND EXCHANGE COMMISSIONWashington, D.C. 20549Â FORM S-1REGISTRATION STATEMENTUNDERTHE SECURITIES ACT OF 1933Â Moleculin Biotech, Inc. (Exact name of registrant as specified in its charter)Â Delaware 2834 47-4671997 (State or other jurisdiction of (Primary Standard Industrial (I.R.S. Employer incorporation or organization) Classification Code Number) Identification Number) Â 5300 Memorial Drive, Suite 950Houston, Texas 77007(713) 300-5160Â (Address, including zip code, and telephone number, including area code, of registrant's principal executive offices)Â Walter V. Klemp, Chief Executive Officer and Chairman5300 Memorial Drive, Suite 950Houston, Texas 77007(713) 300-5160Â (Name, address, including zip code, and telephone number, including area code, of agent for service)Â Copies to:Â Cavas S. Pavri Johnathan C. Duncan ArentFox Schiff LLP 1717 K Street NW Washington, DC 20006 Telephone: (202) 857-6000 Fax: (202) 857-6395 Â Â Approximate date of commencement of proposed sale to the public: As soon as practicable after the effective date of this Registration Statement.Â If any of the securities being registered on this Form are to be offered on a delayed or continuous basis pursuant to Rule 415 under the Securities Act of 1933, check the following box. Â If this Form is filed to register additional securities for an offering pursuant to Rule 462(b) under the Securities Act, please check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. Â If this Form is a post-effective amendment filed pursuant to Rule 462(c) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. Â If this Form is a post-effective amendment filed pursuant to Rule 462(d) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. Â Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Securities Exchange Act. (Check one):Â Large accelerated filerÂ Accelerated filerÂ Non-accelerated filerÂ Smaller reporting companyÂ Emerging growth companyÂ If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 7(a)(2)(B) of the Securities Act. Â The Registrant hereby amends this Registration Statement on such date or dates as may be necessary to delay its effective date until the Registrant shall file a further amendment which specifically states that this Registration Statement shall thereafter become effective in accordance with Section 8(a) of the Securities Act of 1933 or until the Registration Statement shall become effective on such date as the Commission, acting pursuant to said Section 8(a), may determine.Â Table of ContentsÂ The information in this preliminary prospectus is not complete and may be changed. These securities may not be sold until the registration statement filed with the Securities and Exchange Commission is effective. This preliminary prospectus is not an offer to sell these securities and we are not soliciting offers to buy these securities in any jurisdiction where the offer or sale is not permitted.Â Preliminary Prospectus Subject to Completion Dated December 13, 2024 Â Moleculin Biotech, Inc.Â Up to [â—] Shares of Common Stock, up to [â—] Accompanying Series C Warrants to Purchase up to [â—] Shares of Common Stock and up to [â—] Accompanying Series D Warrants to Purchase up to [â—] Shares of Common Stock or Up to [â—] Pre-Funded Warrants to Purchase up to [â—] Shares of Common Stock, up to [â—] Accompanying Series C Warrants to Purchase up to [â—] Shares of Common Stock and up to [â—] Accompanying Series D Warrants to Purchase up to [â—] Shares of Common StockÂ Up to [â—] Placement Agent Warrants to Purchase up to [â—] Shares of Common StockÂ Up to [â—] Shares of Common Stock underlying the Prefunded Warrants, Series C Warrants, Series D Warrants and Placement Agent WarrantsÂ We are offering up to [â—] shares of common stock, together with Series C warrants to purchase up to [â—] shares of common stock (the "Series C Warrants") and Series D warrants to purchase up to [â—] shares of common stock (the "Series D Warrants"), which we refer to collectively as the "common warrants," at an assumed combined public offering price of \$[â—] per share and common warrants, which is equal to the last reported sale price per share of our common stock on The Nasdaq Capital Market, on December [â—], 2024 (and the shares issuable from time to time upon exercise of the common warrants) pursuant to this prospectus. The shares of common stock and common warrants will be separately issued, but the shares of common stock and common warrants will be issued to purchasers in the ratio of one-to-one. Each common warrant will have an exercise price of \$[â—] per share (100% of the combined public offering price) and will be exercisable beginning on the effective date of stockholder approval of the issuance of the shares upon exercise of the common warrants ("Warrant Stockholder Approval"), provided, however, that, if and only if the Pricing Conditions (as defined below) are met, the common warrants will be exercisable upon issuance. As used herein "Pricing Conditions" means that the combined offering price per share and accompanying common warrants is such that the Warrant Stockholder Approval is not required under the rules of the Nasdaq Stock Market LLC ("Nasdaq") because either (i) the offering is an at-the-market offering under Nasdaq rules and such price equals or exceeds the sum of (a) the applicable "Minimum Price" per share under Nasdaq Rule 5635(d) plus (b) \$0.125 per whole share of common stock underlying the common warrants or (ii) the offering is a discounted offering where the pricing and discount (including attributing a value of \$0.125 per whole share underlying the common warrants) meet the pricing requirements under Nasdaq's rules. The Series C Warrants will expire [â—] years from the initial exercise date. The Series D Warrants will expire [â—] years from the initial exercise date. This is a "best efforts" offering and we may sell fewer than all of the shares of common stock, common warrants and pre-funded warrants offered hereby, which may significantly reduce the amount of proceeds received by us, and investors in this offering will not receive a refund if we do not sell all of the securities offered hereby.Â We are also offering to certain purchasers whose purchase of shares of common stock in this offering would otherwise result in the purchaser, together with its affiliates and certain related parties, beneficially owning more than 4.99% (or, at the election of the purchaser, 9.99%) of our outstanding common stock immediately following the consummation of this offering, the opportunity to purchase, if any such purchaser so chooses, pre-funded warrants to purchase up to [â—] shares of common stock, in lieu of shares of common stock that would otherwise result in such purchaser's beneficial ownership exceeding 4.99% (or, at the election of the purchaser, 9.99%) of our outstanding common stock. The purchase price of each pre-funded warrant and related common warrants will be equal to the public offering price for the common stock and related common warrants in this offering, minus \$0.001. Each pre-funded warrant is exercisable for one share of our common stock and has an exercise price of \$0.001 per share. For each pre-funded warrant that we sell, the number of shares of common stock we are offering will be reduced on a one-for-one

basis. There is no established public trading market for the pre-funded warrants or common warrants, and we do not expect a market to develop. We do not intend to apply for listing of the pre-funded warrants or common warrants on any securities exchange or other nationally recognized trading system. Without an active trading market, the liquidity of the pre-funded warrants and common warrants will be limited. This offering will terminate on [—], 2025, unless we decide to terminate the offering (which we may do at any time in our discretion) prior to that date. We will have one closing for all the securities purchased in this offering. The combined public offering price per share (or pre-funded warrant) and common warrants will be fixed for the duration of this offering. Table of Contents We have engaged [—] to act as our exclusive placement agent (the “placement agent”) in connection with this offering. The placement agent has agreed to use its reasonable best efforts to arrange for the sale of the securities offered by this prospectus. The placement agent is not purchasing or selling any of the securities we are offering and the placement agent is not required to arrange the purchase or sale of any specific number or dollar amount of securities. We have agreed to pay to the placement agent the placement agent fees set forth in the table below, which assumes that we sell all of the securities offered by this prospectus. There is no arrangement for funds to be received in escrow, trust or similar arrangement. There is no minimum number of securities or minimum aggregate amount of proceeds that is a condition for this offering to close. We may sell fewer than all of the shares of common stock, common warrants and pre-funded warrants offered hereby, which may significantly reduce the amount of proceeds received by us, and investors in this offering will not receive a refund if we do not sell all of the securities offered hereby. Because there is no escrow account and no minimum number of securities or amount of proceeds, investors could be in a position where they have invested in us, but we have not raised sufficient proceeds in this offering to adequately fund the intended uses of the proceeds as described in this prospectus. We will bear all costs associated with the offering. See “Plan of Distribution” on page [—] of this prospectus for more information regarding these arrangements. Our common stock is listed on The Nasdaq Capital Market, or Nasdaq, under the symbol “MBRX”. The last reported sale price of our common stock on Nasdaq on December [—], 2024 was \$[—] per share. We do not intend to list the common warrants or pre-funded warrants on the Nasdaq Capital Market, any other national securities exchange or any other nationally recognized trading system. The actual public offering price per share and common warrants and the actual public offering price per pre-funded warrant and common warrants will be determined between us, the placement agent and the investors based on market conditions at the time of pricing, and may be at a discount to the current market price of our common stock. You should read this prospectus, together with additional information described under the headings “Information Incorporated by Reference” and “Where You Can Find More Information,” carefully before you invest in any of our securities. Investing in our securities involves a high degree of risk. See the section entitled “Risk Factors” beginning on page 7 of this prospectus and in the documents incorporated by reference into this prospectus for a discussion of risks that should be considered in connection with an investment in our securities. Neither the Securities and Exchange Commission nor any other regulatory body has approved or disapproved of these securities or passed upon the accuracy or adequacy of this prospectus. Any representation to the contrary is a criminal offense.

	Per Share and accompanying Common Warrants	Per Pre-Funded Warrant and accompanying Common Warrants	Total
Public offering price	\$	\$	\$
Placement agent fees (1)	\$	\$	\$
Proceeds to us, before expenses	\$	\$	\$

(1) Includes a cash fee of 7.0% of the gross proceeds of this offering. We have also agreed to pay the placement agent a reimbursement for non-accountable expenses equal to \$50,000, a reimbursement for legal fees and expenses in the amount of up to \$100,000 and for its clearing expenses in the amount of \$15,950. In addition, we have agreed to issue the placement agent, or its designees, warrants to purchase a number of shares of common stock equal to 5.0% of the aggregate number of shares of common stock, including shares of common stock underlying the pre-funded warrants, sold in this offering with an assumed exercise price of \$[—] per share, or 125% of the assumed public offering price per share. See “Plan of Distribution” for additional information about the compensation payable to the placement agent. The delivery of the securities offered hereby is expected to be made on or about [—], subject to satisfaction of certain customary closing conditions. Neither the Securities and Exchange Commission nor any other regulatory body has approved or disapproved of these securities or passed upon the accuracy or adequacy of this prospectus. Any representation to the contrary is a criminal offense.

The date of this prospectus is [—].

TABLE OF CONTENTS
ABOUT THIS PROSPECTUS
1 PROSPECTUS SUMMARY
2 THE OFFERING
5 RISK FACTORS
7 CAUTIONARY NOTE REGARDING FORWARD-LOOKING STATEMENTS
10 USE OF PROCEEDS
11 DILUTION
11 DESCRIPTION OF CAPITAL STOCK
13 DESCRIPTION OF COMMON WARRANTS
17 DESCRIPTION OF PRE-FUNDED WARRANTS
19 PLAN OF DISTRIBUTION
20 INCORPORATION OF CERTAIN INFORMATION BY REFERENCE
22 WHERE YOU CAN FIND MORE INFORMATION
22 LEGAL MATTERS
23 EXPERTS

iTable of Contents ABOUT THIS PROSPECTUS We incorporate by reference important information into this prospectus. You may obtain the information incorporated by reference without charge by following the instructions under “Where You Can Find More Information.” You should carefully read this prospectus as well as additional information described under “Incorporation of Certain Information by Reference,” before deciding to invest in our securities. We have not, and the placement agent has not, authorized anyone to provide any information or to make any representations other than those contained in this prospectus or in any free writing prospectuses prepared by or on behalf of us or to which we have referred you. We take no responsibility for, and can provide no assurance as to the reliability of, any other information that others may give you. This prospectus is an offer to sell only the securities offered hereby, and only under circumstances and in jurisdictions where it is lawful to do so. The information contained in this prospectus or in any applicable free writing prospectus is current only as of its date, regardless of its time of delivery or any sale of our securities. Our business, financial condition, results of operations and prospects may have changed since that date. For investors outside the United States: We have not, and the placement agent has not, done anything that would permit this offering or possession or distribution of this prospectus in any jurisdiction where action for that purpose is required, other than in the United States. Persons outside the United States who come into possession of this prospectus must inform themselves about, and observe any restrictions relating to, the offering of the securities and the distribution of this prospectus outside the United States. This prospectus and the information incorporated by reference into this prospectus may contain references to trademarks belonging to other entities. Solely for convenience, trademarks and trade names referred to in this prospectus and the information incorporated by reference into this prospectus, including logos, artwork, and other visual displays, may appear without the ® or TM symbols. We do not intend our use or display of other companies’ trade names or trademarks to imply a relationship with, or endorsement or sponsorship of us by, any other company. No dealer, salesperson or other person is authorized to give any information or to represent anything not

contained in this prospectus. You must not rely on any unauthorized information or representations. This prospectus is an offer to sell only the securities offered hereby, but only under circumstances and in jurisdictions where it is lawful to do so. The information contained in this prospectus is current only as of its date.Â This prospectus contains estimates and other statistical data made by independent parties and by us relating to market size and growth and other data about our industry. We obtained the industry and market data in this prospectus from our own research as well as from industry and general publications, surveys and studies conducted by third parties. This data involves a number of assumptions and limitations and contains projections and estimates of the future performance of the industries in which we operate that are subject to a high degree of uncertainty. We caution you not to give undue weight to such projections, assumptions and estimates.Â 1Table of ContentsÂ PROSPECTUS SUMMARYÂ This summary highlights information contained elsewhere in this prospectus. This summary does not contain all of the information that you should consider before deciding to invest in our securities. You should read this entire prospectus carefully, including the "Risk Factors" section in this prospectus and under similar captions in the documents incorporated by reference into this prospectus. The terms the "Company", "our", or "we" refer to Moleculin Biotech, Inc. and its subsidiaries.Â OverviewÂ We are a Phase 3 clinical stage pharmaceutical company with a portfolio of technologies for hard-to-treat cancers and viruses. We have three core technologies, each of which have had one or more drugs successfully complete a Phase 1 clinical trial, based substantially on discoveries made at and licensed from the University of Texas MD Anderson Cancer Center (MD Anderson) in Houston, Texas. Three of our six drug candidates have shown human activity in clinical trials and are currently or have been in Phase 1B/2 or Phase 2 clinical trials. Since our inception, our drugs have completed, are currently in, or have been permitted to proceed in, fourteen clinical trials. Annamycin is our lead molecule and we have recently concluded one Phase 1B/2 clinical trial for treating Acute Myeloid Leukemia (AML) and are embarking on a Phase 3 clinical trial for the treatment of AML, which we believe will be pivotal. Annamycin is also in two Phase 1B/2 clinical trials for treating Soft Tissue Sarcoma metastasized to the lungs (STS lung metastases, STS lung mets, or Advanced STS).Â One of our core management beliefs is that anthracyclines represent the most important treatment for AML and Advanced STS, and we believe Annamycin may, for the first time ever, allow a majority of these patients to benefit from this treatment, mainly due to its lack of cardiotoxicity (which is found in currently prescribed anthracyclines) and its ability to avoid multidrug resistance mechanisms. This belief, coupled with our limited resources, leads us to currently focus mainly on the development of Annamycin. We intend to advance our other drug candidates via investigator led studies " both clinically and preclinically.Â Our core technologies consist of the following programs:Â a) Annamycin or L-Annamycin is a "next generation" anthracycline (one of the most widely used classes of chemotherapy), designed to be different than currently approved anthracyclines, which are limited in utility because of cardiotoxicity risks and their susceptibility to multidrug resistance mechanisms. Annamycin was designed to avoid multidrug resistance and to be non-cardiotoxic and, with intensive cardiac monitoring, has shown no cardiotoxicity in subjects treated in our four Annamycin clinical trials to date. Furthermore, we have demonstrated safe dosing significantly beyond the dose limitations imposed by regulatory authorities upon commonly prescribed anthracyclines due to their inherent cardiotoxicity. Annamycin has demonstrated efficacy in two of its Phase 1B/2 trials in subjects with AML and Advanced STS. We believe that Annamycin has potential to fill an unmet need as a second line therapy (2nd line or 2L) in AML and potentially as first line therapy in Advanced STS.Â As part of our Annamycin clinical trials, we have engaged an independent expert to assess cardiotoxicity associated with chemotherapy at the Cleveland Clinic (Expert or Independent Expert). The data made available to the Expert include left ventricular ejection fraction (LVEF) as determined by echocardiograms, and ECHO strain imaging, as well as serum Troponin levels (a biochemical marker of acute heart damage). "ECHO strain imaging" is a method in echocardiography (medical ultrasound) for measuring regional or global deformation (contraction or beating) of the myocardium (heart muscle). By strain rate imaging, the simultaneous function of different regions can be displayed and measured. Cardiac health biomarkers such as blood Troponin levels are considered an indicator of potential long-term heart damage. The Expert has issued and will continue to issue periodic reports as additional data are provided to him in batches of subject data. Such data include some data which are preliminary and subject to change. In our discussions regarding the lack of Annamycin's cardiotoxicity, we rely on the Expert's assessment.Â Annamycin benefits from a promising advancement in lipid enabled drug delivery developed in collaboration with and exclusively licensed from MD Anderson. The unique patented lipid composition allows us to combine a new concept in chemotherapeutic agents within a lipid structure that helps target the delivery of the payload and reduce the potential for toxicity. In the case of Annamycin, our unique use of lipid technology enables improved tissue/organ distribution, and as demonstrated in multiple clinical trials, dramatically reduced toxicity, including cardiotoxicity. Annamycin has composition of matter patent protection through 2040.Â b) Our WP1066 Portfolio includes WP1066, WP1193 and WP1220, three of several Immune/Transcription Modulators in the portfolio designed to inhibit p-STAT3 (phosphorylated signal transducer and activator of transcription) among other transcription factors associated with tumor activity. These also stimulate a natural immune response to tumors by inhibiting the errant activity of Regulatory T-Cells (TRegs). WP1066, in oral formulation, has been in two clinical trials for central nervous system (CNS) tumors, including compassionate use cases, in pediatric subjects. WP1066 and WP1193 are being tested in preclinical programs in intravenous (IV) formulations. WP1066 and WP1220 have been in clinical trials in a topical formulation. WP1066 and WP1220 have both independently successfully completed Phase 1 clinical trials and have demonstrated efficacy in their varied indications.Â 2Table of ContentsÂ c) Our WP1122 Portfolio contains compounds (including WP1122, WP1096, and WP1097) designed to exploit the potential uses of inhibitors of glycolysis such as 2-deoxy-D-glucose (2-DG). We believe such compounds may provide an opportunity to cut off the energy supply of tumors by taking advantage of their high degree of dependence on glucose in comparison to healthy cells, as well as viruses that also depend upon glycolysis and glycosylation to infect and replicate. WP1122 has completed a Phase 1 clinical study in normal volunteers, successfully establishing a Recommended Phase 2 Dose or RP2D.Â Recent Developments Â Phase 3 MIRACLE TrialÂ We are in the process of evaluating and visiting potential sites for our Phase 3 pivotal trial for the treatment of AML patients who are refractory to or relapsed after induction therapy (R/R AML) with Annamycin in combination with Cytarabine (also known as "Ara-C" and for which the combination of Annamycin and Ara-C is referred to as "AnnAraC"). This Phase 3 "MIRACLE" trial (derived from (M)olecul(i)n (R)/(r) AML (A)nnAraC (C)linical (E)valuation) will be a global trial.Â We plan to focus on sites in the North America, Europe, Eastern Europe, Western Asia, and MENA (Middle East and Africa) for the initial Part A of MIRACLE. Our initial target will be approximately 45 sites. We expect that this will enable the enrollment of approximately 45 subjects by the third quarter of 2025 and approximately 90 subjects by the second half of 2026. The data may also be unblinded after the initial 45 subjects and, as currently planned, the data will be unblinded after approximately 90 subjects complete their efficacy

analyses. We believe that we will have the data for approximately the first 90 subjects by the second half of 2026. The trial is designed to enable the review of interim analyses for safety and efficacy upon reaching these enrollment milestones. We held a conference call on August 6, 2024, along with Dr. Michael Andreeff, a member of our Science Advisory Board, to discuss the results of our most recent meeting with the FDA and the plans for the MIRACLE trial. That meeting, the MIRACLE trial and the current data from the MB-106 trial are discussed further below. On August 1, 2024, we announced the discussion in and our resulting plans from our End of Phase 1B/2 (EOP1B/2) meeting held in late June with the FDA supporting the advancement of Annamycin in combination with Cytarabine (AnnAraC to a Phase 3 pivotal trial for the treatment of AML patients who are refractory to or relapsed after induction therapy (R/R AML). This Phase 3 “MIRACLE” trial will be a global study, including sites in the US and consistent with the FDA’s recommendations, the adaptive Phase 3 trial is expected to rely solely on CR (complete remission) at day 35 (+/- 14 days) as the primary endpoint versus the control arm. We plan to utilize a double-blind, placebo-controlled design, where the control arm is high dose cytarabine (HiDAC) plus placebo. The MIRACLE trial will focus on AnnAraC as a 2nd line treatment for R/R AML subjects, with a subsequent trial to be focused on AnnAraC as a 3rd line treatment for R/R AML. Based on our discussions with the FDA, we intend to amend our current investigational new drug application or IND to allow dosing above the lifetime maximum allowable dose (LTMAX) for currently prescribed anthracyclines in this trial in the US. The MIRACLE study, subject to appropriate future filings with and potential additional feedback from the FDA, their foreign equivalents and/or institutional review boards (IRBs), is expected to initially utilize an adaptive design whereby the first 90 subjects will be randomized to receive HiDAC combined with either placebo, 190 mg/m² of Annamycin, or 230 mg/m² of Annamycin with such doses recommended by the FDA based on their review of our safety and efficacy data. At that point, the trial data will be unblinded to select the optimum dose for Annamycin. For the second half of the trial, approximately 240 subjects will be randomized to receive either HiDAC plus placebo or HiDAC plus the optimum dose of Annamycin. The selection of the optimum dose by the independent Data Monitoring Committee will be based on the overall balance of efficacy, safety, and pharmacokinetics, consistent with the FDA’s new Project Optimus initiative. We believe the FDA wants to see the durability of response (DoR) and overall survival (OS) as secondary endpoints. In addition, we believe the FDA wants to see data for subjects beyond 2nd line and, accordingly, our plan includes a follow-on MIRACLE2 trial in 3rd line subjects starting once the optimum dose is established in the MIRACLE trial. We have established plans for the following milestones with regard to the MIRACLE trial: — 2024 2H “Begin contracting with MIRACLE trial sites— 2025 Q1 “First subject treated in MIRACLE trial— 2025 Q4 “Recruitment and interim data (n=~45)— 2H 2026 “Interim efficacy and safety data (n=~90) unblinded and Optimum Dose set for MIRACLE trial— 2027 “Begin enrollment of 3rd line subjects in MIRACLE2— 2027 “Enrollment ends in 2nd line subjects— 2028 “Primary endpoint efficacy data for 2nd line subjects in MIRACLE— 2028 2H “Begin submission of a new drug application (NDA) the treatment of R/R AML for accelerated approval on primary endpoint of CR from MIRACLE. 3Table of Contents 4Corporate Information 5Our principal executive offices are located at 5300 Memorial Drive, Suite 950, Houston, Texas 77007. Our website address is www.moleculin.com. The information on or accessible through our website is not part of this prospectus. 4Table of Contents 5THE OFFERING 6Common stock we are offering 6Up to [—] shares of our common stock on a “best efforts” basis based on an assumed public offering price of \$[—] per share and accompanying common warrants, which was the closing price of our common stock as reported on Nasdaq on December [—], 2024. 6 6 6 Pre-funded warrants we are offering 6 We are also offering to certain purchasers whose purchase of shares of common stock in this offering would otherwise result in the purchaser, together with its affiliates and certain related parties, beneficially owning more than 4.99% (or, at the election of the purchaser, 9.99%) of our outstanding common stock immediately following the closing of this offering, the opportunity to purchase, if such purchasers so choose, pre-funded warrants to purchase shares of common stock, in lieu of shares of common stock that would otherwise result in any such purchaser’s beneficial ownership exceeding 4.99% (or, at the election of the purchaser, 9.99%) of our outstanding common stock. Each pre-funded warrant is exercisable for one share of our common stock. The purchase price of each pre-funded warrant and common warrants is equal to the price at which a share of common stock and common warrants are being sold to the public in this offering, minus \$0.001, and the exercise price of each pre-funded warrant is \$0.001 per share. The pre-funded warrants are exercisable immediately and may be exercised at any time until all of the pre-funded warrants are exercised in full. This offering also relates to the shares of common stock issuable upon exercise of any pre-funded warrants sold in this offering. For each pre-funded warrant that we sell, the number of shares of common stock that we are offering will be reduced on a one-for-one basis. 6 6 6 Common warrants we are offering 6 We are issuing to purchasers of shares of our common stock and/or pre-funded warrants in this offering a Series C common warrant to purchase one share of our common stock for each share and/or pre-funded warrant purchased in this offering and a Series D common warrant to purchase one share of our common stock for each share and/or pre-funded warrant purchased in this offering. We refer to these warrants collectively as the “common warrants”. The combined purchase price per share (or pre-funded warrant) and common warrants will be fixed for the duration of this offering. Because common warrants to purchase share(s) of our common stock are being sold together in this offering with each share of common stock or, in the alternative, each pre-funded warrant to purchase one share of common stock, the number of common warrants sold in this offering will not change as a result of a change in the mix of the shares of our common stock and pre-funded warrants sold. Each common warrant will have an exercise price of \$[—] per share (100% of the combined public offering price), at an assumed public offering price of \$[—] per share, which was the closing price of our common stock as reported on Nasdaq on December [—], 2024. The Series C Warrants will expire 6 6 years from the initial exercise date. The Series D Warrants will expire 6 6 years from the initial exercise date. Each of the common warrants will be exercisable beginning on the effective date the Warrant Stockholder Approval, provided, however, that, if and only if the Pricing Conditions are met, then the common warrants will be immediately exercisable upon issuance. See “Description of Common Warrants.” This prospectus also relates to the offering of the shares of common stock issuable upon exercise of the common warrants. 6 6 6 Term of the offering 6 This offering will terminate on 6 6 6 , 2025, unless we decide to terminate the offering (which we may do at any time in our discretion) prior to that date. 6 6 6 Common stock outstanding immediately before this offering 6 3,190,895 shares 6 6 6 Common stock outstanding immediately after this offering 6 [—] shares, based on an assumed public offering price of \$[—] per share, which was the closing price of our common stock as reported on Nasdaq on December [—], 2024, and assuming no sale of any pre-funded warrants and assuming none of the common warrants or placement agent warrants issued in this offering are exercised. 6 6 6 Use of proceeds 6 We estimate that the net proceeds from this offering will be approximately \$[—] million at an assumed public offering price of \$[—] per share, which was the closing price of our common stock as reported on Nasdaq on December [—],

2024, after deducting the placement agent fees and estimated offering expenses payable by us. We intend to use the proceeds from this offering to advance Annamycin and our other two drug portfolios through clinical development, advancing the remainder of the existing portfolio through preclinical studies and into INDs or their equivalent, sponsoring research at MD Anderson and HPI, and for working capital. See "Use of Proceeds." Table of Contents

Risk Factors An investment in our securities involves a high degree of risk. See "Risk Factors" beginning on page 6 of this prospectus and the other information included and incorporated by reference in this prospectus for a discussion of the risk factors you should carefully consider before deciding to invest in our securities.

Nasdaq listing symbol Our common stock is listed on The Nasdaq Capital Market under the symbol "MBRX." There is no established trading market for the common warrants or 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 common warrants or pre-funded warrants on any national securities exchange or other trading market. Without an active trading market, the liquidity of the common warrants and pre-funded warrants will be limited.

The number of shares of common stock to be outstanding after this offering is based on 3,190,895 shares outstanding as of December 10, 2024, and does not give effect to the shares of common stock issuable upon exercise of the pre-funded warrants being offered by us in this offering, as well as:

- 7,999,145 shares of common stock underlying outstanding warrants at a weighted average exercise price of \$2.75 per share;
- 793,882 shares of common stock underlying outstanding options with a weighted average exercise price of \$19.43 per share, which options vest over a three to four-year period;
- 66,547 shares of common stock underlying outstanding restricted stock units, which restricted stock units vest over a four-year period;
- 73,335 shares of common stock underlying outstanding performance-based restricted stock units, which performance-based restricted stock units vest dependent on specific milestones;
- 114,166 shares available for future issuance under the Moleculin Biotech, Inc. 2024 Stock Plan; and
- the shares of common stock issuable upon exercise of the pre-funded warrants, the common warrants and the placement agent warrants issued in this offering.

Except as otherwise indicated, the information in this prospectus assumes no exercise of options or exercise of warrants, and, unless otherwise noted.

Table of Contents

RISK FACTORS Investing in our securities involves a high degree of risk. Before investing in our securities, you should consider carefully the risks and uncertainties discussed under "Risk Factors" in our latest annual report on Form 10-K and subsequent quarterly reports on Form 10-Q and current reports on Form 8-K, which are incorporated by reference herein in their entirety. You should carefully consider each of the following risks, together with all other information set forth in or incorporated in this prospectus, including the financial statements and the related notes, before making a decision to buy our securities. If any of the following risks actually occur, our business could be harmed. In that case, the trading price of our common stock could decline, and you may lose all or part of your investment.

Risks Related to this Offering We have broad discretion in how we use the proceeds of this offering and may not use these proceeds effectively, which could affect our results of operations and cause our common stock to decline. We will have considerable discretion in the application of the net proceeds of this offering. We intend to use the net proceeds from this offering to advance Annamycin and our other two drug portfolios through clinical development, advancing the remainder of the existing portfolio through preclinical studies and into INDs or their equivalent, sponsoring research at MD Anderson and HPI, and for working capital. As a result, investors will be relying upon management's judgment with only limited information about our specific intentions for the use of the net proceeds of this offering. We may use the net proceeds for purposes that do not yield a significant return or any return at all for our stockholders. In addition, pending their use, we may invest the net proceeds from this offering in a manner that does not produce income or that loses value. If our stock price fluctuates after the offering, you could lose a significant part of your investment.

The market price of our common stock could be subject to wide fluctuations in response to, among other things, the risk factors described in this prospectus, and other factors beyond our control, such as fluctuations in the valuation of companies perceived by investors to be comparable to us. Furthermore, the stock markets have experienced price and volume fluctuations that have affected and continue to affect the market prices of equity securities of many companies. These fluctuations often have been unrelated or disproportionate to the operating performance of those companies. These broad market and industry fluctuations, as well as general economic, political, and market conditions, such as recessions, interest rate changes or international currency fluctuations, may negatively affect the market price of our common stock. In the past, many companies that have experienced volatility in the market price of their stock have been subject to securities class action litigation. We may be the target of this type of litigation in the future. Securities litigation against us could result in substantial costs and divert our management's attention from other business concerns, which could seriously harm our business.

If we are required to obtain Warrant Stockholder Approval, until we are able to receive such approval the common warrants will not be exercisable, and if we are unable to obtain such approval the common warrants will have no value. If we are required to obtain Warrant Stockholder Approval, the common warrants will not be exercisable until, and unless, we obtain the Warrant Stockholder Approval from our stockholders. While we intend to promptly seek stockholder approval, if required, there is no guarantee that the Warrant Stockholder Approval will ever be obtained. If we are unable to obtain the Warrant Stockholder Approval, the common warrants will have no value. In addition, we will incur substantial cost, and management will devote substantial time and attention, in attempting to obtain the Warrant Stockholder Approval.

We will require additional capital funding, the receipt of which may impair the value of our common stock. Our future capital requirements depend on many factors, including our research, development, sales and marketing activities. We will need to raise additional capital through public or private equity or debt offerings or through arrangements with strategic partners or other sources in order to continue to develop our drug candidates. There can be no assurance that additional capital will be available when needed or on terms satisfactory to us, if at all. To the extent we raise additional capital by issuing equity securities, our stockholders may experience substantial dilution and the new equity securities may have greater rights, preferences or privileges than our existing common stock.

We do not intend to pay dividends in the foreseeable future. We have never paid cash dividends on our common stock and currently do not plan to pay any cash dividends in the foreseeable future.

Table of Contents

Purchasers in this offering may experience immediate and substantial dilution in net tangible book value. The public offering price per share of common stock and related common warrants and the public offering price of each pre-funded warrant and related common warrants may be substantially higher than the pro forma as adjusted net tangible book value per share of our common stock after giving effect to this offering. Assuming the sale of [] shares of our common stock and the common warrants to purchase up to [] shares of common stock at an assumed combined public offering price of \$[] per share and accompanying common warrants, the closing sale price per share of our common stock on The Nasdaq Capital Market on December [], 2024, assuming no sale of any pre-funded

warrants in this offering, no exercise of the warrants being offered in this offering and after deducting the placement agent fees and commissions and estimated offering expenses payable by us, you may incur immediate dilution in pro forma as adjusted net tangible book value. As a result of the dilution to investors purchasing securities in this offering, investors may receive significantly less than the purchase price paid in this offering, if anything, in the event of the liquidation of our company. See the section entitled “Dilution” below for a more detailed discussion of the dilution you will incur if you participate in this offering. To the extent shares are issued under outstanding options and warrants at exercise prices lower than the public offering price of our common stock in this offering, you will incur further dilution. Your ownership may be diluted if additional capital stock is issued to raise capital, to finance acquisitions or in connection with strategic transactions. We intend to seek to raise additional funds for our operations, to finance acquisitions or to develop strategic relationships by issuing equity or convertible debt securities in addition to the securities issued in this offering, which would reduce the percentage ownership of our existing stockholders. Our board of directors has the authority, without action or vote of the stockholders, to issue all or any part of our authorized but unissued shares of common or preferred stock. Our amended and restated certificate of incorporation authorizes us to issue up to 100,000,000 shares of common stock and 5,000,000 shares of preferred stock. Future issuances of common or preferred stock would reduce your influence over matters on which stockholders vote and would be dilutive to earnings per share. In addition, any newly issued preferred stock could have rights, preferences and privileges senior to those of the common stock. Those rights, preferences and privileges could include, among other things, the establishment of dividends that must be paid prior to declaring or paying dividends or other distributions to holders of our common stock or providing for preferential liquidation rights. These rights, preferences and privileges could negatively affect the rights of holders of our common stock, and the right to convert such preferred stock into shares of our common stock at a rate or price that would have a dilutive effect on the outstanding shares of our common stock. There is no public market for the common warrants or pre-funded warrants being offered in this offering. There is no established public trading market for the common warrants or pre-funded warrants being offered in this offering, and we do not expect a market to develop. In addition, we do not intend to apply to list the common warrants or pre-funded warrants on any securities exchange or nationally recognized trading system, including The Nasdaq Stock Market. Without an active market, the liquidity of the common warrants and pre-funded warrants will be limited. Holders of our common warrants and pre-funded warrants will have no rights as a common stockholder until they acquire our common stock. Until holders of our common warrants and pre-funded warrants acquire shares of our common stock upon exercise of such common warrants or pre-funded warrants, the holders will have no rights with respect to shares of our common stock issuable upon exercise of such common warrants or pre-funded warrants. Upon exercise of the common warrants or pre-funded warrants, holders will be entitled to exercise the rights of a common stockholder only as to matters for which the record date occurs after the exercise date. If we do not maintain a current and effective prospectus relating to the common stock issuable upon exercise of the common warrants, public holders will only be able to exercise such common warrants on a “cashless basis.” If we do not maintain a current and effective prospectus relating to the shares of common stock issuable upon exercise of the common warrants at the time that holders wish to exercise such warrants, they will only be able to exercise them on a “cashless basis,” and under no circumstances would we be required to make any cash payments or net cash settle such warrants to the holders. As a result, the number of shares of common stock that holders will receive upon exercise of the common warrants will be fewer than it would have been had such holders exercised their common warrants for cash. We will do our best efforts to maintain a current and effective prospectus relating to the shares of common stock issuable upon exercise of such warrants until the expiration of such warrants. However, we cannot assure you that we will be able to do so. If we are unable to do so, the potential “upside” of the holder’s investment in our company may be reduced. The common warrants are speculative in nature. The common warrants offered hereby do not confer any rights of common stock ownership on their holders, such as voting rights or the right to receive dividends, but rather merely represent the right to acquire shares of common stock at a fixed price. Specifically, commencing on the date of issuance, holders of the common warrants may acquire the common stock issuable upon exercise of such warrants at an exercise price of \$[—] per share of common stock, at an assumed public offering price of \$[—] per share, which was the closing price of our common stock as reported on Nasdaq on December [—], 2024. Moreover, following this offering, the market value of the common warrants will be uncertain and there can be no assurance that the market value of the common warrants will equal or exceed their public offering price. There can be no assurance that the market price of the common stock will ever equal or exceed the exercise price of the common warrants, and consequently, whether it will ever be profitable for holders of the common warrants to exercise the common warrants.

Table of Contents This is a “best efforts” offering. No minimum amount of securities is required to be sold, and we may not raise the amount of capital we believe is required for our business plans, including our near-term business plans. The placement agent has agreed to use their reasonable best efforts to solicit offers to purchase the securities in 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. There is no required minimum number of securities that must be sold as a condition to completion of this offering. Because there is no minimum offering amount required as a condition to the closing of this offering, the actual offering amount, placement agent fees and proceeds to us are not presently determinable and may be substantially less than the maximum amounts set forth above. We may sell fewer than all of the securities offered hereby, which may significantly reduce the amount of proceeds received by us, and investors in this offering will not receive a refund in the event that we do not sell an amount of securities sufficient to support our continued operations, including our near-term continued operations. We may be required to repurchase the common warrants, which may prevent or deter a third party from acquiring us. The common warrants provide that in the event of a “Fundamental Transaction” (as defined in the related warrant agreement, which generally includes any merger with another entity, the sale, transfer or other disposition of all or substantially all of our assets to another entity, or the acquisition by a person of more than 50% of our common stock), each common warrant holder will have the right at any time prior to the consummation of the Fundamental Transaction to require us to repurchase the common warrant for a purchase price in cash equal to the Black-Scholes value (as calculated under the warrant agreement) of the then remaining unexercised portion of such common warrant on the date of such Fundamental Transaction, which may materially adversely affect our financial condition and/or results of operations and may prevent or deter a third party from acquiring us. We will require substantial additional funding, which may not be available to us on acceptable terms, or at all, and, if not so available, may require us to delay, limit, reduce or cease our operations. We have used and we intend to use the proceeds from this offering and any future offerings, to, among other uses, advance Annamycin and its other two drug portfolios through clinical development, advancing the

remainder of the existing portfolio through preclinical studies and into INDs or their equivalent, and sponsoring research at MD Anderson and HPI. Developing pharmaceutical products, including conducting preclinical studies and clinical trials, is expensive. We will require substantial additional future capital in order to complete clinical development and commercialize Annamycin. Based on the results of our Annamycin Phase 1B/2 clinical trials, we intend to enter discussions with the FDA and EMA about conducting a single arm study that would be an accelerated pivotal trial supporting US and European approval of Annamycin for relapsed or refractory AML. We can provide no assurance that the FDA will permit such reliance, and we may be required to provide additional data or conduct additional trials. If the FDA or its EU equivalent requires that we perform additional nonclinical studies or clinical trials, our expenses would further increase beyond what we currently expect and the anticipated timing of any potential approval of Annamycin would likely be delayed. Further, there can be no assurance that the costs we will need to incur to obtain regulatory approval of Annamycin will not increase. We believe that our existing cash and cash equivalents of \$9.4 million as of September 30, 2024 will be sufficient to fund our planned operations, which include our current Phase 1B/2 clinical programs and preparations for future clinical trials, into the first quarter of 2025, without the issuance of additional equity for cash. Assuming that we receive net proceeds of approximately \$[] million from this offering (assuming an offering with gross proceeds of approximately \$[] million), we believe that the net proceeds from this offering will satisfy our capital needs into the [] quarter of 2025 under our current business plan. Assuming that we receive net proceeds of approximately \$[] million from this offering (assuming an offering with gross proceeds of approximately \$[] million), we believe that the net proceeds from this offering will satisfy our capital needs into the [] quarter of 2025 under our current business plan. As we commence our MIRACLE trial, our estimated uses of cash may deviate from our expectations based on the speed of our ability to launch the trial.

Table of Contents

CAUTIONARY NOTE REGARDING FORWARD-LOOKING STATEMENTS Some of the information in this prospectus, and the documents we incorporate by reference, contain forward-looking statements within the meaning of the federal securities laws. You should not rely on forward-looking statements in this prospectus, and the documents we incorporate by reference. Forward-looking statements typically are identified by use of terms such as “anticipate,” “believe,” “plan,” “expect,” “future,” “intend,” “may,” “will,” “should,” “estimate,” “predict,” “potential,” “continue,” and similar words, although some forward-looking statements are expressed differently. This prospectus, and the documents we incorporate by reference, may also contain forward-looking statements attributed to third parties relating to their estimates regarding the markets we may enter in the future. All forward-looking statements address matters that involve risk and uncertainties, and there are many important risks, uncertainties and other factors that could cause our actual results to differ materially from the forward-looking statements contained in this prospectus, and the documents we incorporate by reference. You should also carefully consider the statements under “Risk Factors” and other sections of this prospectus, which address additional facts that could cause our actual results to differ from those set forth in the forward-looking statements. We caution investors not to place significant reliance on the forward-looking statements contained in this prospectus, and the documents we incorporate by reference. We undertake no obligation to publicly update or review any forward-looking statements, whether as a result of new information, future developments or otherwise.

Table of Contents

USE OF PROCEEDS We estimate that the net proceeds from the offering will be approximately \$[] million, assuming a public offering price of \$[] per share of common stock and related common warrants (which is equal to the last reported sale price per share of our common stock on The Nasdaq Capital Market, on December [], 2024), and the sale of all the securities offered under this prospectus, after deducting the placement agent fees and estimated offering expenses payable by us, assuming no sale of any pre-funded warrants. However, because this is a “best efforts” offering and there is no minimum offering amount required as a condition to the closing of this offering, the actual offering amount, the placement agent’s fees and net proceeds to us are not presently determinable and may be substantially less than the maximum amounts set forth on the cover page of this prospectus. The combined public offering price per share (or pre-funded warrant) and common warrants will be fixed for the duration of this offering. Each \$1.00 increase (decrease) in the assumed public offering price of \$[] per share (the last reported price for our common stock as reported on The Nasdaq Capital Market on December [], 2024) would change our net proceeds by \$[] million, assuming the number of shares offered by us, as set forth on the cover of this prospectus, remains the same and after deducting the placement agent fees and estimated offering expenses payable by us. We may also increase or decrease the number of shares we are offering. An increase (decrease) of 100,000 in the number of shares we are offering would increase (decrease) the net proceeds to us from this offering, after deducting the placement agent fees and estimated offering expenses payable by us, by approximately \$[] million, assuming the assumed public offering price stays the same. We intend to use the net proceeds to advance Annamycin and our other two drug portfolios through clinical development, advancing the remainder of the existing portfolio through preclinical studies and into INDs or their equivalent, sponsoring research at MD Anderson and HPI, and for working capital. As of the date of this prospectus, we cannot specify with certainty all of the particular uses for the net proceeds to us from this offering. Accordingly, our management will have broad discretion in the application of these proceeds. Net offering proceeds not immediately applied to the uses summarized above will be invested in short-term investments such as money market funds, commercial paper, U.S. treasury bills and similar securities investments pending their use.

DILUTION If you invest in our securities in this offering, your interest will be diluted immediately to the extent of the difference between the public offering price paid by the purchasers of the shares of common stock (and pre-funded warrants) and related common warrants sold in this offering and the as adjusted net tangible book value per shares of common stock after this offering. As of September 30, 2024, our net tangible book value was \$[] million, or \$[] per share of common stock. Net tangible book value per share represents our total tangible assets, less our total liabilities, divided by the number of outstanding shares of our common stock. Dilution represents the difference between the amount per share paid by purchasers in this offering and the as adjusted net tangible book value per share of common stock after the offering. After giving effect to the sale of shares of common stock and accompanying common warrants in this offering at an assumed public offering price of \$[] per share, which was the closing price of our common stock as reported on Nasdaq on December [], 2024, and after deducting placement agent commissions and estimated offering expenses payable by us, but without adjusting for any other change in our net tangible book value subsequent to September 30, 2024, our net tangible book value would have been \$[] per share. This represents an immediate decrease in net tangible book value of \$[] per share to our existing stockholders and new investors purchasing securities at the proposed public offering price will experience a decrease in net tangible book value per share of \$[] per share. The dilution figures assume no sale of pre-funded warrants, which, if sold, would reduce the number of shares of common stock that we are offering on a one-

for-one basis, and excludes the proceeds, if any, from the exercise of any common warrants issued in this offering. The following table illustrates the dilution in net tangible book value per share to new investors as of September 30, 2024:

Assumed public offering price per share and accompanying common warrants	Historical net tangible book value per share at September 30, 2024	Decrease in net tangible book value per share to the existing stockholders attributable to this offering	As adjusted net tangible book value per share after this offering
\$ [â—]	\$ [â—]	\$ [â—]	\$ [â—]

Each \$1.00 increase (decrease) in the assumed public offering price of \$[â—] per share, would increase (decrease) our as adjusted net tangible book value per share to existing investors by (\$[â—]) and (\$[â—]), respectively, and would increase (decrease) dilution per share to new investors in this offering by \$[â—] and (\$[â—]), respectively, assuming that the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same, and after deducting the estimated placement agent fees and estimated offering expenses payable by us. We may also increase or decrease the number of securities to be issued in this offering. Each increase (decrease) of approximately 100,000 shares offered by us would increase (decrease) our as adjusted net tangible book value per share by (\$[â—]) and (\$[â—]), respectively, and the dilution per share to new investors purchasing securities in this offering by \$[â—] and \$[â—], respectively, assuming that the assumed public offering price remains the same, and after deducting placement agent fees and estimated offering expenses payable by us. The information discussed above is illustrative only and will be adjusted based on the actual public offering price and other terms of this offering as determined between us and the placement agent at pricing.

The number of shares of common stock to be outstanding after this offering is based on [â—] shares outstanding as of September 30, 2024, and does not give effect to the shares of common stock issuable upon exercise of the pre-funded warrants being offered by us in this offering, as well as:

- â— shares of common stock underlying outstanding warrants at a weighted average exercise price of \$[â—] per share;
- â— shares of common stock underlying outstanding options with a weighted average exercise price of \$[â—] per share, which options vest over a three to four-year period;
- â— shares of common stock underlying outstanding restricted stock units, which restricted stock units vest over a four-year period;
- â— shares available for future issuance under the Moleculin Biotech, Inc. Amended and Restated 2015 Stock Plan; and
- the shares of common stock issuable upon exercise of the pre-funded warrants, the common warrants and the placement agent warrants issued in this offering.

DESCRIPTION OF CAPITAL STOCK

The following summary is a description of the material terms of our capital stock. This summary is not complete and is qualified by reference to our amended and restated certificate of incorporation and our amended and restated bylaws, each as amended, which are filed as exhibits to this prospectus and are incorporated by reference herein. We encourage you to read our amended and restated certificate of incorporation, our amended and restated bylaws and the applicable provisions of the Delaware General Corporation Law for additional information.

Our certificate of incorporation authorizes us to issue up to 100,000,000 shares of common stock, par value \$0.001 per share, and 5,000,000 shares of preferred stock par value \$0.001 per share.

Common Stock

Shares of our common stock have the following rights, preferences, and privileges:

Voting.

Each holder of common stock is entitled to one vote for each share of common stock held on all matters submitted to a vote of stockholders. Any action at a meeting at which a quorum is present will be decided by a majority of the voting power present in person or represented by proxy, except in the case of any election of directors, which will be decided by a plurality of votes cast. There is no cumulative voting.

Dividends.

Holders of our common stock are entitled to receive dividends when, as and if declared by our board of directors out of funds legally available for payment, subject to the rights of holders, if any, of any class of stock having preference over the common stock. Any decision to pay dividends on our common stock will be at the discretion of our board of directors. Our board of directors may or may not determine to declare dividends in the future. The board's determination to issue dividends will depend upon our profitability and financial condition any contractual restrictions, restrictions imposed by applicable law and the SEC, and other factors that our board of directors deems relevant.

Liquidation Rights.

In the event of a voluntary or involuntary liquidation, dissolution or winding up of the company, the holders of our common stock will be entitled to share ratably on the basis of the number of shares held in any of the assets available for distribution after we have paid in full, or provided for payment of, all of our debts and after the holders of all outstanding series of any class of stock have preference over the common stock, if any, have received their liquidation preferences in full.

Other.

Our issued and outstanding shares of common stock are fully paid and nonassessable. Holders of shares of our common stock are not entitled to preemptive rights. Shares of our common stock are not convertible into shares of any other class of capital stock, nor are they subject to any redemption or sinking fund provisions.

Preferred Stock

We are authorized to issue up to 5,000,000 shares of preferred stock. Our certificate of incorporation authorizes the board to issue these shares in one or more series, to determine the designations and the powers, preferences and relative, participating, optional or other special rights and the qualifications, limitations and restrictions thereof, including the dividend rights, conversion or exchange rights, voting rights (including the number of votes per share), redemption rights and terms, liquidation preferences, sinking fund provisions and the number of shares constituting the series. Our board of directors could, without stockholder approval, issue preferred stock with voting and other rights that could adversely affect the voting power and other rights of the holders of common stock and which could have the effect of making it more difficult for a third party to acquire, or of discouraging a third party from attempting to acquire, a majority of our outstanding voting stock.

December 2023 Warrants

On December 20, 2023, we entered into Securities Purchase Agreements (the December Purchase Agreement) with an institutional investor and several of our executive officers, advisors, and a member of our board of directors (collectively, the December Investors) for the sale of: (i) 240,151 shares (the December Shares) of our common stock, and (ii) pre-funded warrants to purchase 229,506 shares of common stock in lieu thereof (the December Pre-Funded Warrants) in a registered direct offering (the December Offering). In a concurrent private placement (the December Private Placement), we also sold to the Investors unregistered warrants to purchase up to an aggregate of 939,312 shares of common stock (the December Common Warrants). The combined purchase price of one share of common stock (or December Pre-Funded Warrant in lieu thereof) and accompanying December Common Warrant was \$9.60 for the institutional investor, and \$10.35 for the executive officers, employees, advisors and the member of our board of directors who participated in the December Offering. The December Offering closed on December 26, 2023.

Subject to certain ownership limitations, each of the December Common Warrants became exercisable on the effective date of the stockholder approval required by the applicable rules and regulations of the Nasdaq Stock Market with respect to the issuance of all of the December Common Warrants and the common stock upon the exercise thereof. On February 14, 2024, we held a special meeting of stockholders at which our stockholders approved the issuance of up to 939,312 shares of our common stock upon the exercise of the December Common Warrants.

Subject to certain ownership limitations, each

December Common Warrant has an exercise price of \$9.60 per share and expires five years from the date of stockholder approval. On August 15, 2024, we entered into a warrant amendment agreement (the “Warrant Amendment”) with the institutional investor from the December Offering pursuant to which we agreed to amend December Common Warrant to purchase 895,834 shares of common stock for the institutional investor to have an exercise price of \$2.23 per share, beginning on the effective date of stockholder approval of the issuance of the shares upon exercise of the December Common Warrant (the “Warrant Stockholder Approval”) and expiring five years from the date of Warrant Stockholder Approval. The Warrant Stockholder Approval was received on October 24, 2024. The December Common Warrants may only be exercised on a cashless basis if there is no registration statement registering, or the prospectus contained therein is not available for, the issuance of shares of Common stock underlying the December Common Warrants to the holder. The holder of a December Common Warrant may not exercise any such warrants to the extent that such exercise would result in the number of shares of common stock beneficially owned by such holder and its affiliates exceeding 4.99% or 9.99% (at the election of the holder) of the total number of shares of common stock outstanding immediately after giving effect to the exercise, which percentage may be increased or decreased at the holder’s election not to exceed 9.99% (the “Beneficial Ownership Limitation”); provided that a holder with a Beneficial Ownership Limitation of 4.99%, upon notice to us and effective sixty-one (61) days after the date such notice is delivered to us, may increase the Beneficial Ownership Limitation so long as it in no event exceeds 9.99% of the number of shares of common stock outstanding immediately after exercise. In the event of certain fundamental transactions, the holder of the December Common Warrants will have the right to receive the Black Scholes value of its December Common Warrants calculated pursuant to a formula set forth in the December Common Warrants, payable either in cash or in the same type or form of consideration that is being offered and being paid to the holders of Common stock. Under the terms of the December Common Warrants, we may at any time during the term of the December Common Warrants reduce the then current exercise price to any amount and for any period of time deemed appropriate by our Board of Directors.

August 2024 Series A/B Warrants On August 15, 2024, we entered into a Securities Purchase Agreement (the August Purchase Agreement) with an institutional investor (the August Investor) for the sale by the Company of (i) 283,000 shares (the August Shares) of the Company’s common stock and 2,183,368 pre-funded warrants to purchase shares of common stock in lieu thereof (the August Pre-Funded Warrants); (ii) Series A Warrants to purchase up to an aggregate of 2,466,368 shares of common stock (the Series A Warrants); and (iii) Series B Warrants to purchase up to an aggregate of 2,466,368 shares of common stock (the Series B Warrants, and together with the Series A Warrants, the Series A/B Warrants) (the August Offering). The combined purchase price for the securities was \$2.23 per share of common stock (or August Pre-Funded Warrant in lieu thereof) and accompanying Series A/B Warrants. H.C. Each Series A/B Warrant has an exercise price of \$2.23 per share. The Series A Warrants expire on the earlier of (i) two years from the initial exercise date, or (ii) 60 days from the Company’s public announcement that it has achieved the Series A Milestone Event (defined below). The Series B warrants expire on the earlier of (i) five years from the initial exercise date, or (ii) six months from the Company’s public announcement that it has achieved the Series B Milestone Event (defined below). As used herein, “Series A Milestone Event” means the Company releases interim data for the first subject group from the MIRACLE trial whereby the complete remission rate for either dose of the Company’s study drug is greater than placebo; and “Series B Milestone Event” means the Company releases final topline data from the MIRACLE trial and documented a statistically significant improvement in the primary efficacy endpoint. The Series A/B Warrants may only be exercised on a cashless basis if there is no registration statement registering, or the prospectus contained therein is not available for, the issuance of shares of Common stock underlying the Series A/B Warrants to the holder. The holder of an Series A/B Warrant may not exercise any such warrants to the extent that such exercise would result in the number of shares of common stock beneficially owned by such holder and its affiliates exceeding 4.99% or 9.99% (at the election of the holder) of the total number of shares of common stock outstanding immediately after giving effect to the exercise, which percentage may be increased or decreased at the holder’s election not to exceed 9.99% (the “Beneficial Ownership Limitation”); provided that a holder with a Beneficial Ownership Limitation of 4.99%, upon notice to us and effective sixty-one (61) days after the date such notice is delivered to us, may increase the Beneficial Ownership Limitation so long as it in no event exceeds 9.99% of the number of shares of common stock outstanding immediately after exercise.

Table of Contents In the event of certain fundamental transactions, the holder of the Series A/B Warrants will have the right to receive the Black Scholes value of its Series A/B Warrants calculated pursuant to a formula set forth in the Series A/B Warrants, payable either in cash or in the same type or form of consideration that is being offered and being paid to the holders of Common stock. Under the terms of the Series A/B Warrants, we may at any time during the term of the Series A/B Warrants reduce the then current exercise price to any amount and for any period of time deemed appropriate by our Board of Directors.

August 2024 Placement Agent Warrants In connection with the August Offering, the Company issued to the placement agent in such offering warrants (the “August Placement Agent Warrants”) to purchase up to 123,318 shares of common stock (which represents 5% of the aggregate number of shares of common stock issued in the August Offering and issuable upon the exercise of the August Pre-Funded Warrants) with an exercise price of \$2.7875 per share and that terminate five years from the date of the commencement of sales in the August Offering.

Pre-Funded Warrants In connection with the August Offering and December Offering, the Company issued pre-funded warrants to purchase shares of common stock of which 1,837,000 are outstanding. Each December Pre-Funded Warrant and August Pre-Funded Warrant is exercisable for one share of common stock at an exercise price of \$0.001 per share (as adjusted from time to time in accordance with the terms thereof) and may be exercised at any time until all of the Pre-Funded Warrants are exercised in full, subject to the beneficial ownership limitations.

Other Warrants In addition to the warrants described above, the Company has additional warrants outstanding to purchase an aggregate of 6,162,145 shares of common stock with a weighted average exercise price of \$3.57 per share and that terminate between 2025 and 2034.

Limitations on Liability and Indemnification of Officers and Directors Our amended and restated certificate of incorporation and our amended and restated bylaws limit the liability of our officers and directors and provide that we will indemnify our officers and directors, in each case, to the fullest extent permitted by the Delaware General Corporation Law. We have entered into separate indemnification agreements with each of our directors and executive officers. Insofar as indemnification for liabilities arising under the Securities Act may be permitted to directors or executive officers, we have been informed that in the opinion of the SEC such indemnification is against public policy and is therefore unenforceable.

Certificate of Incorporation and Bylaw Provisions Our amended and restated certificate of incorporation and our amended and restated bylaws include a number of anti-takeover provisions that may have the effect of encouraging persons considering unsolicited tender offers or other unilateral takeover proposals to negotiate

with our board of directors rather than pursue non-negotiated takeover attempts. These provisions include:

- **Advance Notice Requirements.** Our bylaws establish advance notice procedures with regard to stockholder proposals relating to the nomination of candidates for election as directors or new business to be brought before meetings of stockholders. These procedures provide that notice of stockholder proposals must be timely and given in writing to our corporate Secretary. Generally, to be timely, notice must be received at our principal executive offices not fewer than 120 calendar days prior to the first anniversary date on which our notice of meeting and related proxy statement were mailed to stockholders in connection with the previous year's annual meeting of stockholders. The notice must contain the information required by the bylaws, including information regarding the proposal and the proponent.
- **Special Meetings of Stockholders.** Our bylaws provide that special meetings of stockholders may be called at any time by only the Chairman of the Board, the Chief Executive Officer, the President or the board of directors, or in their absence or disability, by any vice president.
- **No Written Consent of Stockholders.** Our certificate of incorporation and our bylaws provide that any action required or permitted to be taken by stockholders must be effected at a duly called annual or special meeting of stockholders and may not be effected by any consent in writing by such stockholders.
- **Exclusive Forum Provision.** Our certificate of incorporation provides that the Court of Chancery of the State of Delaware shall be the sole and exclusive forum for (i) any derivative action or proceeding brought on our behalf, (ii) any action asserting a claim of breach of a fiduciary duty owed by any of our directors or officers to us or our stockholders, (iii) any action asserting a claim against us arising pursuant to any provision of the Delaware General Corporation Law (the "DGCL"), or our certificate of incorporation or the bylaws, and (iv) any action asserting a claim against us governed by the internal affairs doctrine. This provision would not apply to suits brought to enforce a duty or liability created by the Exchange Act or Securities Act.

Table of Contents

This choice of forum provision may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers or other employees, which may discourage such lawsuits against us and our directors, officers and employees. Alternatively, a court could find these provisions of our certificate of incorporation to be inapplicable or unenforceable in respect of one or more of the specified types of actions or proceedings, which may require us to incur additional costs associated with resolving such matters in other jurisdictions, which could adversely affect our business and financial condition.

Amendment of Bylaws. Our stockholders may amend any provisions of our bylaws by obtaining the affirmative vote of the holders of a majority of each class of issued and outstanding shares of our voting securities, at a meeting called for the purpose of amending and/or restating our bylaws.

Preferred Stock. Our certificate of incorporation authorizes our board of directors to create and issue rights entitling our stockholders to purchase shares of our stock or other securities. The ability of our board to establish the rights and issue substantial amounts of preferred stock without the need for stockholder approval may delay or deter a change in control of us. See "Preferred Stock" above.

Delaware Takeover Statute

We are subject to Section 203 of the DGCL which, subject to certain exceptions, prohibits a Delaware corporation from engaging in any "business combination" (as defined below) with any interested stockholder for a period of three years following the date that such stockholder became an interested stockholder, unless:

- (1) prior to such date, the board of directors of the corporation approved either the business combination or the transaction that resulted in the stockholder becoming an interested stockholder;
- (2) on consummation of the transaction that resulted in the stockholder becoming an interested stockholder, the interested stockholder owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced, excluding for purposes of determining the voting stock outstanding those shares owned (x) by persons who are directors and also officers and (y) by employee stock plans in which employee participants do not have the right to determine confidentially whether shares held subject to this plan will be tendered in a tender or exchange offer; or
- (3) on or subsequent to such date, the business combination is approved by the board of directors and authorized at an annual or special meeting of stockholders, and not by written consent, by the affirmative vote of at least 66 2/3% of the outstanding voting stock that is not owned by the interested stockholder.

Section 203 of the DGCL defines generally "business combination" to include:

- (1) any merger or consolidation involving the corporation and the interested stockholder;
- (2) any sale, transfer, pledge or other disposition of 10% or more of the assets of the corporation involving the interested stockholder;
- (3) subject to certain exceptions, any transaction that results in the issuance or transfer by the corporation of any stock of the corporation to the interested stockholder;
- (4) any transaction involving the corporation that has the effect of increasing the proportionate share of the stock of any class or series of the corporation beneficially owned by the interested stockholder; or
- (5) the receipt by the interested stockholder of the benefit of any loans, advances, guarantees, pledges or other financial benefits provided by or through the corporation.

In general, Section 203 defines an "interested stockholder" as any entity or person beneficially owning 15% or more of the outstanding voting stock of the corporation and any entity or person affiliated with or controlling or controlled by such entity or person.

Listing

Our common stock is listed on the Nasdaq Capital Market under the symbol "MBRX".

Transfer Agent

The transfer agent for our common stock is VStock Transfer, LLC located at 18 Lafayette Place, Woodmere, New York 11598.

Table of Contents

DESCRIPTION OF COMMON WARRANTS

The following summary of certain terms and provisions of common warrants that are being offered hereby is not complete and is subject to, and qualified in its entirety by, the provisions of the common warrants, the forms of which are filed as exhibits to the registration statement of which this prospectus forms a part.

Series C Warrant

Form. The Series C warrants will be issued as individual warrant agreements to the investors. You should review the form of Series C warrant, filed as an exhibit to the registration statement of which this prospectus forms a part, for a complete description of the terms and conditions applicable to the Series C warrants.

Exercisability. Subject to the receipt of the Warrant Stockholder Approval, the Series C 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 in immediately available funds for the number of shares of our common stock purchased upon such exercise (except in the case of a cashless exercise as described below). A holder (together with its affiliates) may not exercise any portion of the Series C warrant to the extent that the holder would own more than 4.99% (or, at the election of the holder, 9.99%) of the outstanding common stock immediately after exercise, except that upon at least 61 days' prior notice from the holder to us, the holder may increase the amount of ownership of outstanding stock after exercising the holder's Series C warrants up to 9.99% of the number of shares of our common stock outstanding immediately after giving effect to the exercise, as such percentage ownership is determined in accordance with the terms of the Series C warrants. Purchasers of Series C warrants in this offering may also elect prior to the issuance of the common warrants to have the initial exercise limitation set at 9.99% of our outstanding common stock. No fractional shares of common stock will be issued in connection with the exercise of a Series C warrant. In lieu of fractional shares, we will pay the holder an amount in cash equal to the fractional amount multiplied by the exercise price.

Duration and Exercise Price. The exercise price per

whole share of our common stock purchasable upon the exercise of the Series C warrants would be \$[â—] per share of common stock, at an assumed public offering price of \$[â—] per share and accompanying Series C warrant, which was the closing price of our common stock as reported on Nasdaq on December [â—], 2024. The Series C warrants will be exercisable beginning on the effective date of the Warrant Stockholder Approval, provided, however, that, if and only if the Pricing Conditions are met, then the Series C warrants will be immediately exercisable on the original issue date. The Series C warrants may be exercised for a period expiring [] years from the initial exercise date. We intend to promptly, and in no event later than [] days after the consummation of this offering, seek stockholder approval for the issuance of shares of common stock issuable upon exercise of the Series C warrants but we cannot assure you that such stockholder approval will be obtained, provided, however, that if and only if the Pricing Conditions are met, then we will not seek Warrant Stockholder Approval. 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 Series C warrants at the first stockholder meeting for such purpose after this offering, we will call a stockholder meeting every [] days thereafter until the earlier of the date we obtain such approval or the Series C warrants are no longer outstanding. The exercise price of the Series C 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 and also upon any distributions of assets, including cash, stock or other property to our stockholders. Cashless Exercise. If, at any time after the holder's purchase of Series C warrants, such holder exercises its Series C warrants and a registration statement registering the issuance of the shares of common stock underlying the Series C warrants under the Securities Act is not then effective or available (or a prospectus is not available for the resale of shares of common stock underlying the Series C warrants), then in lieu of making the cash payment otherwise contemplated to be made to us upon such exercise in payment of the aggregate exercise price, the holder shall instead receive upon such exercise (either in whole or in part) only the net number of shares of common stock determined according to a formula set forth in the Series C warrants. Notwithstanding anything to the contrary, in the event we do not have or maintain an effective registration statement, there are no circumstances that would require us to make any cash payments or net cash settle the Series C warrants to the holders. Transferability. Subject to applicable laws, the Series C warrants may be offered for sale, sold, transferred or assigned at the option of the holder upon surrender of the Series C warrants to us together with the appropriate instruments of transfer. Exchange Listing. We do not plan on applying to list the Series C warrants on the Nasdaq Capital Market, any other national securities exchange or any other nationally recognized trading system. Fundamental Transactions. In the event of a fundamental transaction, as described in the Series C warrants and generally including any reorganization, recapitalization or reclassification of our common stock, the sale, transfer or other disposition of all or substantially all of our properties or assets, our consolidation or merger with or into another person, the acquisition of more than 50% of our outstanding common stock, or any person or group becoming the beneficial owner of 50% of the voting power represented by our outstanding common stock, the holders of the Series C warrants will be entitled to receive upon exercise of the Series C warrants the kind and amount of securities, cash or other property that the holders would have received had they exercised the Series C warrants immediately prior to such fundamental transaction. In the case of certain fundamental transactions affecting us, a holder of Series C warrants, upon exercise of such warrants after such fundamental transaction, will have the right to receive, in lieu of shares of our common stock, the same amount and kind of securities, cash or property that such holder would have been entitled to receive upon the occurrence of the fundamental transaction, had the Series C warrants been exercised immediately prior to such fundamental transaction. In lieu of such consideration, a holder of Series C warrants may instead elect to receive a cash payment based upon the Black-Scholes value of their Series C warrants. Table of Contents Rights as a Stockholder. Except by virtue of such holder's ownership of shares of our common stock, the holder of a Series C warrant does not have the rights or privileges of a holder of our common stock, including any voting rights, until the holder exercises the Series C warrant. Series D Warrant Form. The Series D warrants will be issued as individual warrant agreements to the investors. You should review the form of Series D warrant, filed as an exhibit to the registration statement of which this prospectus forms a part, for a complete description of the terms and conditions applicable to the Series D warrants. Exercisability. Subject to the receipt of the Warrant Stockholder Approval, the Series D 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 in immediately available funds for the number of shares of our common stock purchased upon such exercise (except in the case of a cashless exercise as described below). A holder (together with its affiliates) may not exercise any portion of the Series D warrant to the extent that the holder would own more than 4.99% (or, at the election of the holder, 9.99%) of the outstanding common stock immediately after exercise, except that upon at least 61 days' prior notice from the holder to us, the holder may increase the amount of ownership of outstanding stock after exercising the holder's Series D warrants up to 9.99% of the number of shares of our common stock outstanding immediately after giving effect to the exercise, as such percentage ownership is determined in accordance with the terms of the Series D warrants. Purchasers of Series D warrants in this offering may also elect prior to the issuance of the common warrants to have the initial exercise limitation set at 9.99% of our outstanding common stock. No fractional shares of common stock will be issued in connection with the exercise of a Series D warrant. In lieu of fractional shares, we will pay the holder an amount in cash equal to the fractional amount multiplied by the exercise price. Duration and Exercise Price. The exercise price per whole share of our common stock purchasable upon the exercise of the Series D warrants would be \$[â—] per share of common stock, at an assumed public offering price of \$[â—] per share and accompanying Series D warrant, which was the closing price of our common stock as reported on Nasdaq on December [â—], 2024. The Series D warrants will be exercisable beginning on the effective date of the Warrant Stockholder Approval, provided, however, that, if and only if the Pricing Conditions are met, then the Series D warrants will be immediately exercisable on the original issue date. The Series D warrants may be exercised for a period expiring [] years from the initial exercise date. We intend to promptly, and in no event later than [] days after the consummation of this offering, seek stockholder approval for the issuance of shares of common stock issuable upon exercise of the Series D warrants but we cannot assure you that such stockholder approval will be obtained, provided, however, that if and only if the Pricing Conditions are met, then we will not seek Warrant Stockholder Approval. 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 Series D warrants at the first stockholder meeting for such purpose after this offering, we will call a stockholder meeting every [] days thereafter until the earlier of the date we obtain such approval or the Series D warrants are no longer outstanding. The exercise price of the Series D 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 and also upon any distributions of assets, including cash, stock or other property to our stockholders.Â Cashless Exercise. If, at any time after the holder's purchase of Series D warrants, such holder exercises its Series D warrants and a registration statement registering the issuance of the shares of common stock underlying the Series D warrants under the Securities Act is not then effective or available (or a prospectus is not available for the resale of shares of common stock underlying the Series D warrants), then in lieu of making the cash payment otherwise contemplated to be made to us upon such exercise in payment of the aggregate exercise price, the holder shall instead receive upon such exercise (either in whole or in part) only the net number of shares of common stock determined according to a formula set forth in the Series D warrants. Notwithstanding anything to the contrary, in the event we do not have or maintain an effective registration statement, there are no circumstances that would require us to make any cash payments or net cash settle the Series D warrants to the holders.Â Transferability. Subject to applicable laws, the Series D warrants may be offered for sale, sold, transferred or assigned at the option of the holder upon surrender of the Series D warrants to us together with the appropriate instruments of transfer.Â Exchange Listing. We do not plan on applying to list the Series D warrants on the Nasdaq Capital Market, any other national securities exchange or any other nationally recognized trading system.Â Fundamental Transactions. In the event of a fundamental transaction, as described in the Series D warrants and generally including any reorganization, recapitalization or reclassification of our common stock, the sale, transfer or other disposition of all or substantially all of our properties or assets, our consolidation or merger with or into another person, the acquisition of more than 50% of our outstanding common stock, or any person or group becoming the beneficial owner of 50% of the voting power represented by our outstanding common stock, the holders of the Series D warrants will be entitled to receive upon exercise of the Series D warrants the kind and amount of securities, cash or other property that the holders would have received had they exercised the Series D warrants immediately prior to such fundamental transaction. In the case of certain fundamental transactions affecting us, a holder of Series D warrants, upon exercise of such warrants after such fundamental transaction, will have the right to receive, in lieu of shares of our common stock, the same amount and kind of securities, cash or property that such holder would have been entitled to receive upon the occurrence of the fundamental transaction, had the Series D warrants been exercised immediately prior to such fundamental transaction. In lieu of such consideration, a holder of Series D warrants may instead elect to receive a cash payment based upon the Black-Scholes value of their Series D warrants.Â Rights as a Stockholder. Except by virtue of such holder's ownership of shares of our common stock, the holder of a Series D warrant does not have the rights or privileges of a holder of our common stock, including any voting rights, until the holder exercises the Series D warrant.Â 18Table of ContentsÂ Placement Agent WarrantsÂ We have agreed to issue to the placement agent or its designees warrants to purchase up to [] shares of common stock (which represents 5% of the assumed aggregate number of shares of common stock issued in this offering and issuable upon the exercise of the pre-funded warrants issued in this offering based on an assumed public offering price of \$[] per share, which was the closing price of our common stock as reported on Nasdaq on December [], 2024) with an assumed exercise price of \$[] per share (representing 125% of the public offering price per share and accompanying common warrants) and terminate five years from the date of the commencement of sales in this offering.Â Â DESCRIPTION OF PRE-FUNDED WARRANTSÂ The following summary of certain terms and provisions of 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 warrant, the form of which is filed as exhibits to the registration statement of which this prospectus forms a part.Â Form. The pre-funded warrants will be issued as individual warrant agreements to the investors. You should review the form of pre-funded warrant, filed as an exhibit to the registration statement of which this prospectus forms a part, for a complete description of the terms and conditions applicable to the pre-funded warrants.Â 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 in immediately available funds for the number of shares of our common stock purchased upon such exercise (except in the case of a cashless exercise as described below). A holder (together with its affiliates) may not exercise any portion of the pre-funded warrant to the extent that the holder would own more than 4.99% (or, at the election of the holder, 9.99%) of the outstanding common stock immediately after exercise, except that upon at least 61 days' prior notice from the holder to us, the holder may increase the amount of ownership of outstanding stock after exercising the holder's pre-funded warrants up to 9.99% of the number of shares of our 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. Purchasers of pre-funded warrants in this offering may also elect prior to the issuance of the pre-funded warrants to have the initial exercise limitation set at 9.99% of our outstanding common stock. No fractional shares of common stock will be issued in connection with the exercise of a pre-funded warrant. In lieu of fractional shares, we will pay the holder an amount in cash equal to the fractional amount multiplied by the exercise price.Â Duration and Exercise Price. The exercise price per whole share of our common stock purchasable upon the exercise of the pre-funded warrants is \$0.001 per share of common stock. The pre-funded warrants will be immediately exercisable and may be exercised at any time until the pre-funded warrants are exercised in full. 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 and also upon any distributions of assets, including cash, stock or other property to our stockholders.Â Cashless Exercise. If, at any time after the holder's purchase of pre-funded warrants, such holder exercises its pre-funded warrants, then in lieu of making the cash payment otherwise contemplated to be made to us upon such exercise in payment of the aggregate exercise price, the holder shall instead receive upon such exercise (either in whole or in part) only the net number of shares of common stock determined according to a formula set forth in the pre-funded warrants.Â Â Transferability. Subject to applicable laws, the pre-funded warrants may be offered for sale, sold, transferred or assigned at the option of the holder upon surrender of the pre-funded warrant to us together with the appropriate instruments of transfer.Â 19Table of ContentsÂ Exchange Listing. We do not plan on applying to list the pre-funded warrants on the Nasdaq Capital Market, any other national securities exchange or any other nationally recognized trading system.Â Fundamental Transactions. In the event of a fundamental transaction, as described in the pre-funded warrants and generally including any reorganization, recapitalization or reclassification of our common stock, the sale, transfer or other disposition of all or substantially all of our properties or assets, our consolidation or merger with or into another person, the acquisition of more than 50% of our outstanding common stock, or any person or group becoming the beneficial owner of 50% of the voting power represented by our outstanding common stock, the holders of the pre-funded warrants will be entitled to receive upon exercise of the pre-funded warrants the kind and amount of securities, cash or other property that the holders would have received had

they exercised the pre-funded warrants immediately prior to such fundamental transaction.Â Rights as a Stockholder. Except 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.Â PLAN OF DISTRIBUTIONÂ We engaged (the "placement agent") to act as our exclusive placement agent to solicit offers to purchase the securities offered by this prospectus on a reasonable best efforts basis. The placement agent is not purchasing any securities, nor are they required to arrange for the purchase and sale of any specific number or dollar amount of securities, other than to use its reasonable best efforts to arrange for the sale of the securities by us. Therefore, we may not sell the entire amount of securities being offered. There is no minimum amount of proceeds that is a condition to closing of this offering. The placement agent does not guarantee that it will be able to raise new capital in this offering. The terms of this offering were subject to market conditions and negotiations between us and prospective investors in consultation with the placement agent. The placement agent will have no authority to bind us. We will enter into a securities purchase agreement directly with the institutional investors, at the investor's option, who purchase our securities in this offering. Investors who do not enter into a securities purchase agreement shall rely solely on this prospectus in connection with the purchase of our securities in this offering. The placement agent may engage one or more sub-placement agents or selected dealers to assist with the offering. This offering will terminate on , 2025, unless we decide to terminate the offering (which we may do at any time in our discretion) prior to that date. We will have one closing for all the securities purchased in this offering.Â Fees and ExpensesÂ We have agreed to pay the placement agent a total cash fee equal to 7.0% of the aggregate gross proceeds of this offering. We will also pay the placement agent a non-accountable expense allowance of \$50,000, reimburse the placement agent for legal fees and expenses in an amount up to \$100,000. We have also agreed (a) to the extent an escrow agent or clearing agent is utilized, pay the placement agent's closing costs (which includes reimbursement of out-of-pocket costs of the escrow agent or clearing agent) of up to \$15,950, and, if applicable, (b) pay the costs associated with the use of third-party electronic road show service not to exceed \$5,000. We estimate the total offering expenses of this offering that will be payable by us, excluding the placement agent fees, will be approximately . After deducting the placement agent fees and our estimated offering expenses, we expect the net proceeds from this offering to be approximately \$[â€] million.Â Placement Agent WarrantsÂ In addition, we have agreed to issue to the placement agent or its designees warrants to purchase up to [â€] shares of common stock (which represents 5% of the assumed aggregate number of shares of common stock issued in this offering and issuable upon the exercise of the pre-funded warrants issued in this offering based on an assumed public offering price of \$[â€] per share and accompanying common warrants, which was the closing price of our common stock as reported on Nasdaq on December [â€], 2024). The Placement Agent Warrants will have substantially the same terms as the common warrants except that the Placement Agent Warrants will have an assumed exercise price of \$[â€] per share (representing 125% of the public offering price per share and accompanying common warrants) and will terminate five years from the date of the commencement of sales in this offering (the "Placement Agent Warrants").Â Right of First RefusalÂ In addition, with certain exceptions, for a period of nine months following the closing of this offering, we have granted the placement agent the right to act as sole book-runner, sole manager, sole placement agent or sole agent with respect to any financing or refinancing of indebtedness; and if we decide to raise funds by means of a public offering (including at-the-market facility, but excluding an equity line transaction) or a private placement or any other capital-raising financing of equity, equity-linked or debt securities, we have granted the placement agent (or any affiliate designated by the placement agent) the right to act as sole book-running manager, sole underwriter or sole placement agent for such financing.Â Table of ContentsÂ TailÂ We have also agreed to pay the placement agent a tail fee equal to both the cash and warrant compensation in this offering, if any investor, who was contacted or introduced to us by the placement agent during the term of its engagement, provides us with capital in any public or private offering or other financing or capital raising transaction during the nine-month period following expiration or termination of our engagement with the placement agent.Â Determination of Offering PriceÂ The public offering price per share (or pre-funded warrant) and accompanying common warrants we are offering and the exercise prices and other terms of the warrants were negotiated between us and the investors, in consultation with the placement agent based on the trading of our common stock prior to this offering, among other things. Other factors considered in determining the public offering prices of the securities we are offering and the exercise prices and other terms of the warrants include the history and prospects of our company, the stage of development of our business, our business plans for the future and the extent to which they have been implemented, an assessment of our management, general conditions of the securities markets at the time of the offering and such other factors as were deemed relevant. The combined public offering price per share (or pre-funded warrant) and common warrants will be fixed for the duration of this offering.Â IndemnificationÂ We have agreed to indemnify the placement agent against certain liabilities, including certain liabilities arising under the Securities Act, or to contribute to payments that the placement agent may be required to make for these liabilities.Â Regulation MÂ The placement agent may be deemed to be underwriters within the meaning of Section 2(a)(11) of the Securities Act and any fees received by them and any profit realized on the sale of the securities by them 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 of 1934, as amended (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.Â Electronic DistributionÂ A prospectus in electronic format may be made available on a website maintained by the placement agent and the placement agent may distribute prospectuses electronically. Other than the prospectus in electronic format, the information on these websites is not part of this prospectus or the registration statement of which this prospectus forms a part, has not been approved and/or endorsed by us or the placement agent and should not be relied upon by investors.Â Lock-up AgreementsÂ Our officers and directors have agreed to be subject to a lock-up period of Â days following the closing of this offering. This means that, during the applicable lock-up period, such persons may not offer for sale, contract to sell, sell, distribute, grant any option, right or warrant to purchase, pledge, hypothecate or otherwise dispose of, directly or indirectly, any shares of our common stock or any securities convertible into, or exercisable or exchangeable for, shares of our common stock. Certain limited transfers are permitted during the lock-up period if the transferee agrees to these lock-up restrictions. We have also agreed to

similar lock-up restrictions on the issuance and sale of our securities for 180 days following the closing of this offering, subject to certain exceptions. The placement agent may, in its sole discretion and without notice, waive the terms of any of these lock-up agreements. We have also agreed that until the 180th anniversary from the closing of this offering we will not enter into a variable rate transaction (as defined in the securities purchase agreement), subject to certain exceptions.

Other Relationships The placement agent and its affiliates have engaged, and may in the future engage, in investment banking transactions and other commercial dealings in the ordinary course of business with us or our affiliates. The placement agent has received, or may in the future receive, customary fees and commissions for these transactions. In addition, in the ordinary course of their business activities, the placement agent and its affiliates may make or hold a broad array of investments and actively trade debt and equity securities (or related derivative securities) for their own account and for the accounts of their customers. Such investments and securities activities may involve securities and/or instruments of ours or our affiliates. The placement agent and its affiliates may also make investment recommendations and/or publish or express independent research views in respect of such securities or financial instruments and may hold, or recommend to clients that they acquire, long and/or short positions in such securities and instruments.

Table of Contents

INCORPORATION OF CERTAIN INFORMATION BY REFERENCE The SEC allows us to “incorporate by reference” information from other documents that we file with it, which means that we can disclose important information to you by referring you to those documents. The information incorporated by reference is considered to be part of this prospectus. Information in this prospectus supersedes information incorporated by reference that we filed with the SEC prior to the date of this prospectus. We incorporate by reference into this prospectus and the registration statement of which this prospectus is a part the information or documents listed below that we have filed with the SEC:

- Our Annual Report on Form 10-K for the year ended December 31, 2023 (filed on March 22, 2024), as amended on Form 10-K/A (filed April 26, 2024);
- Our Quarterly Reports on Form 10-Q for the fiscal quarters ended March 31, 2024 (filed on May 10, 2024); June 30, 2024 (filed August 13, 2024); and September 30, 2024 (filed November 8, 2024);
- Our Current Reports on Form 8-K filed on January 5, 2024; February 14, 2024; March 19, 2024; April 8, 2024; August 16, 2024; and October 25, 2024
- the description of our common stock, par value \$0.001 per share contained in our Registration Statement on Form 8-A, dated and filed with the SEC on April 28, 2016, and any amendment, exhibit to Form 10-K, or report filed with the SEC for the purpose of updating the description.

Additionally, all documents filed by us with the SEC under Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act after (i) the date of the initial registration statement and prior to effectiveness of the registration statement, and (ii) the date of this prospectus and before the termination or completion of any offering hereunder, shall be deemed to be incorporated by reference into this prospectus from the respective dates of filing of such documents, except that we do not incorporate any document or portion of a document that is “furnished” to the SEC, but not deemed “filed.” We will furnish without charge to you, on written or oral request, a copy of any or all of the documents incorporated by reference in this prospectus, including exhibits to these documents. You should direct any requests for documents to: Moleculin Biotech, Inc., Attn: Corporate Secretary, 5300 Memorial Drive, Suite 950, Houston, TX 77007. You also may access these filings on our website at www.moleculin.com. We do not incorporate the information on our website into this prospectus or any supplement to this prospectus and you should not consider any information on, or that can be accessed through, our website as part of this prospectus or any supplement to this prospectus (other than those filings with the SEC that we specifically incorporate by reference into this prospectus or any supplement to this prospectus). Any statement contained in a document incorporated or deemed to be incorporated by reference in this prospectus will be deemed modified, superseded or replaced for purposes of this prospectus to the extent that a statement contained in this prospectus modifies, supersedes or replaces such statement.

WHERE YOU CAN FIND MORE INFORMATION We have filed with the SEC a registration statement on Form S-1 under the Securities Act for the securities being offered by this prospectus. This prospectus, which is part of the registration statement, does not contain all of the information included in the registration statement and the exhibits. For further information about us and the securities offered by this prospectus, you should refer to the registration statement and its exhibits. References in this prospectus to any of our contracts or other documents are not necessarily complete, and you should refer to the exhibits attached to the registration statement for copies of the actual contract or document. SEC filings are also available to the public at the SEC’s website at www.sec.gov. We are subject to the reporting and information requirements of the Exchange Act and, as a result, we file periodic and current reports, proxy statements and other information with the SEC. We make our periodic reports and other information filed with or furnished to the SEC, available, free of charge, through our website as soon as reasonably practicable after those reports and other information are filed with or furnished to the SEC. Additionally, these periodic reports, proxy statements and other information are available for inspection and copying at the public reference room and website of the SEC referred to above.

Table of Contents

LEGAL MATTERS The validity of the securities offered hereby will be passed upon for us by ArentFox Schiff LLP, Washington, DC. The placement agent is being represented by _____ in connection with this offering.

EXPERTS The audited financial statements incorporated by reference in this prospectus and elsewhere in the registration statement have been so incorporated by reference in reliance upon the report of Grant Thornton LLP, independent registered public accountants, upon the authority of said firm as experts in accounting and auditing.

Table of Contents

Moleculin Biotech, Inc. Up to _____ Shares of Common Stock, up to _____ Accompanying Series C Warrants to Purchase up to _____ Shares of Common Stock and up to _____ Accompanying Series D Warrants to Purchase up to _____ Shares of Common Stock or Up to _____ Pre-Funded Warrants to Purchase up to _____ Shares of Common Stock, up to _____ Accompanying Series C Warrants to Purchase up to _____ Shares of Common Stock and up to _____ Accompanying Series D Warrants to Purchase up to _____ Shares of Common Stock

Up to _____ Placement Agent Warrants to Purchase up to _____ Shares of Common Stock

Up to _____ Shares of Common Stock underlying the Prefunded Warrants, Series C Warrants, Series D Warrants and Placement Agent Warrants

PROSPECTUS _____, _____

Table of Contents

PART II - INFORMATION NOT REQUIRED IN PROSPECTUS

Item 13. Other Expenses of Issuance and Distribution. The following table sets forth the estimated costs and expenses to be incurred in connection with the issuance and distribution of the securities of Moleculin Biotech, Inc. (the “Registrant”) which are registered under this Registration Statement on Form S-1 (this “Registration Statement”), other than placement agent commissions. All amounts are estimates except the Securities and Exchange Commission registration fee and the Financial Industry Regulatory Authority, Inc. (“FINRA”) filing fee. The following expenses will be borne solely by the Registrant:

Amount to be Paid	SEC Registration fee	\$ 3,750	FINRA filing fee	4,175	Printing and engraving expenses	5,000	Legal fees and expenses	175,000	Accounting fees and expenses	45,000	Transfer
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Agent's fees \$ 5,000 Miscellaneous fees and expenses \$ 5,000 Total \$ 242,925 Item 14. Indemnification of Directors and Officers. The Amended and Restated Certificate of Incorporation and Amended and Restated Bylaws of Moleculin Biotech, Inc. ("MBI") authorize it to indemnify directors, officers, employees and agents of MBI against expenses (including attorneys' fees), judgments, fines and amounts paid in settlement, actually and reasonably incurred in connection with any action, suit or proceeding, if the party to be indemnified acted in good faith and in a manner that he or she reasonably believed to be in or not opposed to the best interests of MBI, and, with respect to any criminal action or proceeding, such party had no reasonable cause to believe his conduct was unlawful. The Amended and Restated Certificate of Incorporation and the Amended and Restated Bylaws of MBI also authorize it to indemnify directors, officers, employees and agents of MBI who are or were a party to or threatened to be a party to, any threatened, pending, or completed action or suit by or in the right of MBI to procure a judgment in its favor by reason of the fact the he or she was a director, officer, employee or agent of MBI or of another entity at the request of MBI, against expenses (including reasonable attorneys' fees) actually and reasonably incurred by him or her in connection with the defense or settlement of such action or suit if he or she acted in good faith and in a manner he or she reasonably believed to be in or not opposed to the best interests of MBI. The Amended and Restated Bylaws also permit MBI to enter into indemnity agreements with its employees and agents. MBI has entered into such agreements with its directors and officers and may in the future enter into such agreements with other employees or agents. These agreements, together with the Amended and Restated Bylaws and Amended and Restated Certificate of Incorporation, may require MBI, among other things, to indemnify employees or agents against certain liabilities that may arise by reason of their status or service as directors (other than liabilities resulting from willful misconduct of a culpable nature), to advance expenses to them as they are incurred, provided that they undertake to repay the amount advanced if it is ultimately determined by a court that they are not entitled to indemnification, and to obtain and maintain directors' and officers' insurance if available on reasonable terms. MBI's Amended and Restated Certificate of Incorporation provides that directors shall have no personal liability to MBI or its stockholders for monetary damages for breach of fiduciary duty as a director, except (i) for any breach of a director's duty of loyalty to MBI 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 General Corporation Law of Delaware as it may from time to time be amended or any successor provision thereto, or (iv) for any transaction from which a director derived an improper personal benefit. MBI currently has directors' and officers' liability insurance. Delaware General Corporation Law, Section 145, and the Amended and Restated Certificate of Incorporation and Amended and Restated Bylaws of MBI provide for the indemnification of officers, directors and other corporate agents in terms sufficiently broad to indemnify such persons, under certain circumstances, for liabilities (including reimbursement of expenses incurred) arising under the Securities Act. Insofar as indemnification for liabilities arising under the Securities Act may be permitted to directors, officers and controlling persons pursuant to the foregoing provisions, or otherwise, MBI has been advised that in the opinion of the SEC such indemnification is against public policy as expressed in the Securities Act and is, therefore, unenforceable.

II-1 Table of Contents Item 15. Recent Sales of Unregistered Securities. Except as set forth below, in the three years preceding the filing of this Registration Statement, the Registrant has not issued any securities that were not registered under the Securities Act. During the three months ended June 30, 2022, the Company issued warrants to purchase 3,334 shares of common stock with an exercise price of \$22.35 per share to two entities providing clinical trial advisory services. During the three months ended September 30, 2022, the Company entered into a portfolio advisory agreement with a related party entity, and in connection with the agreement, the Company granted warrants to purchase 16,667 shares of common stock with a ten-year term and an exercise price of \$18.60. In March 2023, the Company terminated a sublicense agreement, and pursuant to the termination, the Company agreed to pay sublicensee (or its designees) shares of Company common stock valued at \$800,000. On March 22, 2023, the Company issued 54,808 shares of common stock to the sublicensee (or its designee) to satisfy this commitment. In June 2023, the Company issued warrants to purchase 10,001 shares of common stock with an exercise price of \$9.00 per share to two entities providing consulting services, which warrants will vest annually over four years while services are being performed. In August 2023, the Company issued warrants to purchase 6,667 shares of common stock with an exercise price of \$9.30 to an entity providing consulting services, which warrants will vest based on performance of certain services. On December 20, 2023, we entered into Securities Purchase Agreements (the "December Purchase Agreements") with an institutional investor and several of our executive officers, advisors, and a member of our board of directors (collectively, the "Investors") for the sale of: (i) 240,151 shares (the "December Shares") of our common stock, par value \$0.001 per share, and (ii) pre-funded warrants to purchase 229,506 shares of common stock in lieu thereof (the "December Pre-Funded Warrants") in a registered direct offering (the "December Offering"). In a concurrent private placement (the "December Private Placement"), we also sold to the Investors unregistered warrants to purchase up to an aggregate of 939,316 shares of common stock (the "December Common Warrants"). The combined purchase price of one share of common stock (or December Pre-Funded Warrant in lieu thereof) and accompanying December Common Warrant was \$9.60 for the institutional investor, and \$10.35 for the executive officers, employees, advisors and the member of our board of directors who participated in the December Offering. Subject to certain ownership limitations, each of the December Common Warrants becomes exercisable on the effective date of such stockholder approval as may be required by the applicable rules and regulations of the Nasdaq Stock Market with respect to the issuance of all of the December Common Warrants and the common stock upon the exercise thereof. On February 14, 2024, we held a special meeting of stockholders at which our stockholders approved the issuance of up to 939,316 shares of our common stock upon the exercise of the December Common Warrants. Subject to certain ownership limitations, each December Common Warrant will have an exercise price of \$9.60 per share, expire five years from the date of stockholder approval and will become exercisable beginning on the effective date of stockholder approval (February 14, 2024) for the shares issuable upon the exercise of the December Common Warrants. All of the securities above were issued in reliance on the exemption from registration provided by Section 4(a)(2) of the Securities Act or Regulation D promulgated thereunder.

II-2 Table of Contents Item 16. Exhibits and Financial Statement Schedules. (a) Exhibits: Exhibit Number Description 1.1*** Engagement Agreement 3.1 Amended and Restated Certificate of Incorporation of Moleculin Biotech, Inc. (incorporated by reference to exhibit 3.1 of the Form S-1/A filed March 21, 2016) 3.2 Certificate of Amendment of the Amended and Restated Certificate of Incorporation of Moleculin Biotech, Inc. (incorporated by reference to Exhibit 3.1 of the Form 8-K filed May 24, 2019) 3.3 Certificate of Amendment of the Amended and Restated Certificate of Incorporation of Moleculin Biotech, Inc. (incorporated by reference to Exhibit 3.1 of the Form 8-K filed January 29, 2021) 3.4 Certificate of Amendment of the Amended and Restated

Certificate of Incorporation of Moleculin Biotech, Inc. (incorporated by reference to Exhibit 3.1 of the Form 8-K filed March 19, 2024) Â Â 3.5Â Amended and Restated Bylaws of Moleculin Biotech., Inc. (incorporated by reference to Exhibit 3.1 of the Form 8-K filed December 21, 2023)Â Â Â 4.1Â Form of Warrant Agreement issued in March 2019 offering (incorporated by reference to Exhibit 4.1 of the Form 8-K filed March 28, 2019)Â Â Â 4.2Â Form of Underwriter Warrant Agreement issued in March 2019 offering (incorporated by reference to Exhibit 4.2 of the Form 8-K filed March 28, 2019)Â Â Â 4.3Â Form of Warrant Agreement issued in April 2019 offering (incorporated by reference to Exhibit 4.1 of the Form 8-K filed April 24, 2019)Â Â Â 4.4 Form of Placement Agent Warrant Agreement issued in April 2019 offering (incorporated by reference to Exhibit 4.2 of the Form 8-K filed April 24, 2019)Â Â Â 4.5Â Form of Warrant Agreement issued in February 2020 offering (incorporated by reference to Exhibit 4.1 of the Form 8-K filed February 6, 2020)Â Â Â 4.6Â Form of Placement Agent Warrant Agreement issued in February 2020 offering (incorporated by reference to Exhibit 4.2 of the Form 8-K filed February 6, 2020)Â Â Â 4.7Â Form of Pre-Funded Warrant issued in December 2023 offering (incorporated by reference to Exhibit 4.1 of the Form 8-K filed December 21, 2023)Â Â Â 4.8Â Form of Common Warrant issued in December 2023 offering (incorporated by reference to Exhibit 4.2 of the Form 8-K filed December 21, 2023)Â Â Â 4.9 Form of Pre-Funded Warrant in August 2024 offering (incorporated by reference to Exhibit 4.9 of the Form S-1/A filed August 15, 2024) Â Â 4.10 Form of Series A Common Warrant in August 2024 offering (incorporated by reference to Exhibit 4.10 of the Form S-1/A filed August 15, 2024) Â Â 4.11 Form of Series B Common Warrant in August 2024 offering (incorporated by reference to Exhibit 4.11 of the Form S-1/A filed August 15, 2024) Â Â 4.12Â Form of Placement Agent Warrant in August 2024 offering (incorporated by reference to Exhibit 4.12 of the Form S-1/A filed August 15, 2024) Â II-3Table of ContentsÂ 4.13*** Form of Series C Warrant Â Â 4.14*** Form of Series D Warrant Â Â 4.15***Â Form of Placement Agent Warrant Â Â 5.1*** Opinion of ArentFox Schiff LLPÂ Â Â 10.1**Â Moleculin Biotech, Inc. Amended and Restated 2015 Stock Plan, as amended (incorporated by reference to Exhibit 4.5 of the Form S-8 file number 333-272814, filed June 21, 2023) Â Â 10.2Â Rights Transfer Agreement between Moleculin Biotech, Inc. and AnnaMed, Inc. (incorporated by reference to exhibit 10.2 of the Form S-1/A filed March 21, 2016)Â Â Â 10.3Â Patent and Technology License Agreement dated June 21, 2010Â by and between The Board of Regents of the University of Texas System and Moleculin, LLC (incorporated by reference to exhibit 10.3 of the Form S-1/A filed March 21, 2016)Â Â Â 10.4Â Amendment No. 1 to the Patent and Technology License Agreement dated June 21, 2010 by and between The Board of Regents of the University of Texas System and Moleculin, LLC (incorporated by reference to exhibit 10.4 of the Form S-1/A filed March 21, 2016)Â Â Â 10.5Â Patent and Technology License Agreement dated April 2, 2012 by and between The Board of Regents of the University of Texas System and IntertechBio Corporation (incorporated by reference to exhibit 10.5 of the Form S-1/A filed March 21, 2016)Â Â Â 10.6Â Amendment No. 1 to the Patent and Technology License Agreement dated April 2, 2012 by and between The Board of Regents of the University of Texas System and IntertechBio Corporation (incorporated by reference to exhibit 10.6 of the Form S-1/A filed March 21, 2016)Â Â Â 10.7Â Rights Transfer Agreement dated between Moleculin Biotech, Inc. and IntertechBio Corporation dated August 11, 2015 (incorporated by reference to exhibit 10.10 of the Form S-1/A filed March 21, 2016)Â Â Â 10.8Â Agreement and Plan of Merger between Moleculin Biotech, Inc. and Moleculin, LLC (incorporated by reference to exhibit 10.11 of the Form S-1/A filed March 21, 2016)Â Â Â 10.9Â Technology Rights and Development License Agreement to be entered into by Moleculin Biotech, Inc. and Houston Pharmaceuticals, Inc. (incorporated by reference to exhibit 10.13 of the Form S-1/A filed April 15, 2016)Â Â Â 10.10Â Lease Agreement for 5300 Memorial (incorporated by reference to Exhibit 10.1 of the Form 10-Q filed May 14, 2018)Â Â Â 10.11Â Patent And Technology License Agreement dated February 12, 2018 by and between The Board of Regents of The University Of Texas System on behalf of The University Of Texas M. D. Anderson Cancer Center and Moleculin Biotech, Inc. (incorporated by reference to Exhibit 10.2 of the Form 10-Q filed May 14, 2018)Â Â Â 10.12Â Sublicense Agreement dated as of February 19, 2019 entered into between the Company and Animal Life Sciences, LLC (incorporated by reference to Exhibit 10.22 of the Form 10-K filed February 21, 2019)Â Â Â 10.13Â Consulting Agreement, dated March 16, 2020, entered into between the Company and Houston Pharmaceuticals, Inc. (HPI) (incorporated by reference to Exhibit 10.24 of the Form 10-K filed March 19, 2020)Â Â Â 10.14Â Equipment Lab Letter, dated March 16, 2020, entered into between the Company and Houston Pharmaceuticals, Inc. (HPI) (incorporated by reference to Exhibit 10.25 of the Form 10-K filed March 19, 2020)Â Â Â 10.15Â Scientific Advisory Board Agreement, dated February 28, 2020, entered into between the Company and Waldemar Priebe, PhD (incorporated by reference to Exhibit 10.26 of the Form 10-K filed March 19, 2020)Â Â Â 10.16Â Purchase Agreement dated June 25, 2021 by and between Moleculin Biotech, Inc. and Lincoln Park Capital Fund, LLC. (incorporated by reference to Exhibit 10.1 of the Form 8-K filed June 25, 2021)Â Â Â 10.17Â Registration Rights Agreement dated June 25, 2021 by and between Moleculin Biotech, Inc. and Lincoln Park Capital Fund, LLC. (incorporated by reference to Exhibit 10.2 of the Form 8-K filed June 25, 2021)Â Â II-4Table of ContentsÂ 10.18+Â Amendment No. 3 to Patent and Technology License Agreement between the Parties dated April 2, 2012, dated May 20, 2020, entered into between the Company and the Board of Regents of The University of Texas System, on behalf of The University of Texas M.D. Anderson Cancer Center (incorporated by reference to Exhibit 10.1 of the Form 10-Q filed August 12, 2020)Â Â Â 10.19+Â Amendment No. 4 to Patent and Technology License Agreement between the Parties dated April 2, 2012, dated June 15, 2021, entered into between the Company and the Board of Regents of The University of Texas System, on behalf of The University of Texas M.D. Anderson Cancer Center (incorporated by reference to Exhibit 10.4 of the Form 10-Q filed August 12, 2021)Â Â Â 10.20+Â Patent And Technology License Agreement dated June 29, 2017 by and between The Board of Regents of The University Of Texas System on behalf of The University Of Texas M. D. Anderson Cancer Center and Moleculin Biotech, Inc. (incorporated by reference to Exhibit 10.30 of the Form 10-K filed March 24, 2022)Â Â Â 10.21+Â Amendment No. 1 to the Patent And Technology License Agreement dated June 29, 2017 by and between The Board of Regents of The University Of Texas System on behalf of The University Of Texas M. D. Anderson Cancer Center and Moleculin Biotech, Inc. (incorporated by reference to Exhibit 10.31 of the Form 10-K filed March 24, 2022)Â Â Â 10.22+Â Patent And Technology License Agreement dated December 2, 2021 by and between The Board of Regents of The University Of Texas System on behalf of The University Of Texas M. D. Anderson Cancer Center and Moleculin Biotech, Inc. (incorporated by reference to Exhibit 10.32 of the Form 10-K filed March 24, 2022)Â Â Â 10.23+Â Patent And Technology License Agreement dated December 3, 2021 by and between The Board of Regents of The University Of Texas System on behalf of The University Of Texas M. D. Anderson Cancer Center and Moleculin Biotech, Inc. (incorporated by reference to Exhibit 10.33 of the Form 10-K filed March 24, 2022)Â Â Â 10.24+Â Patent And Technology License Agreement dated February 3, 2022 by and between The Board of Regents of The University Of Texas System on behalf of The University Of Texas M. D. Anderson Cancer Center and Moleculin Biotech, Inc. (incorporated by reference to Exhibit 10.34 of the Form 10-K filed

March 24, 2022)Â Â 10.25+Â Patent and Technology License Agreement dated October 21, 2022 by and between The Board of The University Of Texas System on behalf of The University Of Texas M.D. Anderson Cancer Center and Moleculin Biotech, Inc.Â (incorporated by reference to Exhibit 10.27 of the Form 10-K filed March 22, 2023) Â Â 10.26Â First Amendment to Commercial Lease Agreement for 5300 Memorial (incorporated by reference to Exhibit 10.1 of the Form 10-Q filed November 13, 2023)Â Â 10.27Â Form of Securities Purchase Agreement from December 2023 (incorporated by reference to Exhibit 10.1 of the Form 8-K filed December 21, 2023)Â Â 10.28Â Form of Placement Agency Agreement from December 2023 (incorporated by reference to Exhibit 10.2 of the Form 8-K filed December 21, 2023)Â Â 10.29**Â Amended and Restated Employment Agreement between Moleculin Biotech, Inc. and Walter V. Klemp dated January 4, 2024 (incorporated by reference to Exhibit 10.1 of the Form 8-K filed January 5, 2024)Â Â 10.30**Â Amended and Restated Employment Agreement between Moleculin Biotech, Inc. and Jonathan P. Foster dated January 4, 2024 (incorporated by reference to Exhibit 10.2 of the Form 8-K filed January 5, 2024)Â Â 10.31Â ** Employment Agreement between Moleculin Biotech, Inc. and Donald Picker dated January 4, 2024 (incorporated by reference to Exhibit 10.3 of the Form 8-K filed January 5, 2024)Â Â 10.32 Form of Securities Purchase Agreement in August 2024 offering (incorporated by reference to Exhibit 10.32 of the Form S-1/A filed August 15, 2024) Â Â 10.33 Form of Warrant Amendment Agreement (incorporated by reference to Exhibit 10.2 of the 8-K filed August 16, 2024) Â Â 10.34*** Form of Securities Purchase Agreement Â 21Â Subsidiaries of the Registrant (incorporated by reference to Exhibit 21 of the Form 10-K filed March 22, 2023)Â Â II-5Table of ContentsÂ 23.1* Consent of Grant ThorntonÂ LLPÂ Â 23.2*** Consent of ArentFox Schiff LLP (included in Exhibit 5.1)Â Â 24.1* Power of Attorney (included on signature page) Â Â 107* Filing Fee Table Â Â * Filed herewith. ** Management contract or compensatory plan, contract or arrangement. *** To be filed by amendment. Â Â + Pursuant to Item 601(b) (10)(iv) of Regulation S-K promulgated by the SEC, certain portions of this exhibit have been redacted. The Company hereby agrees to furnish supplementally to the SEC, upon its request, an unredacted copy of this exhibit. Â (b) Consolidated Financial Statement Schedules: All schedules are omitted because the required information is inapplicable or the information is presented in the consolidated financial statements and the related notesÂ II-6Table of ContentsÂ ItemÂ 17. Undertakings Â (a) The undersigned Registrant hereby undertakes that:Â (1) To file, during any period in which offers or sales are being made, a post-effective amendment to this registration statement:Â (i) Â To include any prospectus required by Section 10(a)(3) of the Securities Act;Â (ii) Â To reflect in the prospectus any facts or events arising after the effective date of the registration statement (or the most recent post-effective amendment thereof) which, individually or in the aggregate, represent a fundamental change in the information set forth in the registration statement. Notwithstanding the foregoing, any increase or decrease in volume of securities offered (if the total dollar value of securities offered would not exceed that which was registered) and any deviation from the low or high end of the estimated maximum offering range may be reflected in the form of prospectus filed with the Commission pursuant to Rule 424(b) if, in the aggregate, the changes in volume and price represent no more than 20 percent change in the maximum aggregate offering price set forth in the "Calculation of Registration Fee" table in the effective registration statement;Â (iii) Â To include any material information with respect to the plan of distribution not previously disclosed in the registration statement or any material change to such information in the registration statement;Â provided, however, that paragraphs (1)(i), (1)(ii) and (1)(iii) above do not apply if the information required to be included in a post-effective amendment by those paragraphs is contained in reports filed with or furnished to the Commission by the registrant pursuant to Section 13 or Section 15(d) of the Exchange Act that are incorporated by reference in this Registration Statement or is contained in a form of prospectus filed pursuant to Rule 424(b) that is part of the Registration Statement.Â (2) That, for the purpose of determining any liability under the Securities Act, each such post-effective amendment shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof.Â (3) To remove from registration by means of a post-effective amendment any of the securities being registered which remain unsold at the termination of the offering.Â (4) That, for the purpose of determining liability under the Securities Act to any purchaser:Â (A) Each prospectus filed by the registrant pursuant to Rule 424(b)(3) shall be deemed to be part of the registration statement as of the date the filed prospectus was deemed part of and included in the registration statement; andÂ (B) Each prospectus filed pursuant to Rule 424(b) as part of a registration statement relating to an offering, other than registration statements relying on Rule 430B or other than prospectuses filed in reliance on Rule 430A, shall be deemed to be part of and included in the registration statement as of the date it is first used after effectiveness. Provided, however, that no statement made in a registration statement or prospectus that is part of the registration statement or made in a document incorporated or deemed incorporated by reference into the registration statement or prospectus that is part of the registration statement will, as to a purchaser with a time of contract of sale prior to such first use, supersede or modify any statement that was made in the registration statement or prospectus that was part of the registration statement or made in any such document immediately prior to such date of first use.Â (5) That, for the purpose of determining liability of the registrant under the Securities Act to any purchaser in the initial distribution of the securities, the undersigned registrant undertakes that in a primary offering of securities of the undersigned registrant pursuant to this registration statement, regardless of the underwriting method used to sell the securities to the purchaser, if the securities are offered or sold to such purchaser by means of any of the following communications, the undersigned registrant will be a seller to the purchaser and will be considered to offer or sell such securities to such purchaser:Â (i) Any preliminary prospectus or prospectus of the undersigned registrant relating to the offering required to be filed pursuant to Rule 424;Â (ii) Any free writing prospectus relating to the offering prepared by or on behalf of the undersigned registrant or used or referred to by the undersigned registrant;Â (iii) The portion of any other free writing prospectus relating to the offering containing material information about the undersigned registrant or its securities provided by or on behalf of the undersigned registrant; andÂ (iv) Any other communication that is an offer in the offering made by the undersigned registrant to the purchaser.Â II-7Table of ContentsÂ (b) The undersigned Registrant hereby undertakes that, for purposes of determining any liability under the Securities Act, each filing of the registrant's annual report pursuant to section 13(a) or section 15(d) of the Exchange Act (and, where applicable, each filing of an employee benefit plan's annual report pursuant to section 15(d) of the Exchange Act) that is incorporated by reference in the registration statement shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof.Â (c) Insofar as indemnification for liabilities arising under the Securities Act may be permitted to directors, officers and controlling persons of the registrant pursuant to the foregoing provisions, or otherwise, the Registrant has been advised that in the opinion of the Securities and Exchange Commission such indemnification is against public policy as expressed in the Securities Act and is,

therefore, unenforceable. In the event that a claim for indemnification against such liabilities (other than the payment by the registrant of expenses incurred or paid by a director, officer, or controlling person of the registrant in the successful defense of any action, suit or proceeding) is asserted by such director, officer or controlling person in connection with the securities being registered hereunder, the registrant will, unless in the opinion of its counsel the matter has been settled by controlling precedent, submit to a court of appropriate jurisdiction the question of whether such indemnification by it is against public policy as expressed in the Securities Act and will be governed by the final adjudication of such issue. (d) The undersigned Registrant hereby undertakes that: (1) For purposes of determining any liability under the Securities Act, the information omitted from the form of prospectus filed as part of this registration statement in reliance upon Rule 430A and contained in a form of prospectus filed by the registrant pursuant to Rule 424(b)(1) or (4) or 497(h) under the Securities Act shall be deemed to be part of this registration statement as of the time it was declared effective. (2) For the purpose of determining any liability under the Securities Act, each post-effective amendment that contains a form of prospectus shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof. II-8Table of Contents SIGNATURES Pursuant to the requirements of the Securities Act, the registrant has duly caused this Registration Statement to be signed on its behalf by the undersigned, thereunto duly authorized, in the city of Houston, Texas, on December 13, 2024. MOLECULIN BIOTECH, INC. (Registrant) By: /s/ Walter V. Klemp Walter V. Klemp President, Chief Executive Officer and Chairman POWER OF ATTORNEY KNOW ALL MEN BY THESE PRESENTS, that the undersigned officers and directors of Moleculin Biotech, Inc., a Delaware corporation, that is filing a registration statement on Form S-1 with the Securities and Exchange Commission under the provisions of the Securities Act of 1933, as amended, hereby constitute and appoint Walter V. Klemp and Jonathan P. Foster their true and lawful attorneys-in-fact and agents, with full power of substitution and re-substitution, for him and in his name, place and stead, in any and all capacities, to sign any or all amendments (including post-effective amendments, exhibits thereto and other documents in connection therewith) to the registration statement, any subsequent registration statement filed by the registrant pursuant to Rule 462(b) of the Securities Act of 1933, as amended, which relates to this registration statement, and to file the same, with all exhibits thereto, and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys-in-fact and agents full power and authority to do and perform each and every act and thing requisite and necessary to be done in and about the premises, as fully to all interests and purposes as they might or could do in person, hereby ratifying and confirming all that said attorneys-in-fact and agents or either of them, or their substitute or substitutes, may lawfully do or cause to be done by virtue hereof. Pursuant to the requirements of the Securities Act of 1933, as amended, this registration statement has been signed below by the following persons in the capacities and on the dates indicated: SIGNATURE TITLE DATE /s/ Walter V. Klemp President, Chief Executive Officer and Chairman December 13, 2024 Walter V. Klemp (Principal Executive Officer) /s/ Jonathan P. Foster Executive Vice President and Chief Financial Officer December 13, 2024 Jonathan P. Foster (Principal Financial Officer and Principal Accounting Officer) /s/ Robert George Director December 13, 2024 Robert George /s/ Michael Cannon Director December 13, 2024 Michael Cannon /s/ John Climaco Director December 13, 2024 John Climaco /s/ Elizabeth Cermak Director December 13, 2024 Elizabeth Cermak /s/ Joy Yan Director December 13, 2024 Joy Yan II-9 0001437749-24-037491ex_756751.htm Exhibit 23.1 CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM We have issued our report dated March 22, 2024, with respect to the consolidated financial statements of Moleculin Biotech, Inc. included in the Annual Report on Form 10-K for the year ended December 31, 2023, which are incorporated by reference in this Registration Statement. We consent to the incorporation by reference of the aforementioned report in this Registration Statement, and to the use of our name as it appears under the caption "Experts." /s/ GRANT THORNTON LLP Fort Lauderdale, Florida December 13, 2024 0001437749-24-037491ex_757033.htm Exhibit 107 Calculation of Filing Fee Tables FORM S-1 (Form Type) Moleculin Biotech, Inc. (Exact Name of Registrant as Specified in its Charter) Table 1: Newly Registered Securities Security Type Security Class Title Fee Calculation or Carry Forward Rule Amount Registered Proposed Maximum Offering Price Per Unit Maximum Aggregate Offering Price(1) Fee Rate Amount of Registration Fee(1) Newly Registered Securities Fees to Be Paid Equity Common Stock, \$0.001 par value per share(2) 457(o) \$8,000,000(5) 0.00015310 \$ 1,224.80 Fees to Be Paid Equity Series C Warrants to purchase common stock(3) 457(g) Fees to Be Paid Equity Series D Warrants to purchase common stock(3) 457(g) Fees to Be Paid Equity Pre-Funded Warrants to purchase common stock(3) 457(g) Fees to Be Paid Equity Placement Agent Warrants to purchase common stock(3) 457(g) Fees to Be Paid Equity Common Stock issuable upon exercise of Series C Warrants(2) 457(o) \$8,000,000(1) 0.00015310 \$ 1224.80 Fees to Be Paid Equity Common Stock issuable upon exercise of Series D Warrants(2) 457(o) \$8,000,000(1) 0.00015310 \$ 1224.80 Fees to Be Paid Equity Common Stock issuable upon exercise of Pre-Funded Warrants(2) 457(o) Fees to Be Paid Equity Common Stock issuable upon exercise of Placement Agent Warrants(2) (4) 457(o) \$500,000 0.00015310 \$76.55 Carry Forward Securities Carry Forward Securities Total Offering Amounts \$24,500,000 Total Fees Previously Paid \$0 Total Fee Offsets \$0 Net Fee Due \$3,750.95 (1) Estimated solely for the purpose of computing the amount of the registration fee pursuant to Rule 457(o) under the Securities Act. (2) Pursuant to Rule 416 under the Securities Act, the securities being registered hereunder include such indeterminate number of additional shares of common stock as may be issued after the date hereof as a result of stock splits, stock dividends or similar transactions. (3) Pursuant to Rule 457(g) of the Securities Act, no separate registration fee is required for the warrants because the warrants are being registered in the same registration statement as the common stock issuable upon exercise of the warrants. (4) Represents warrants issuable to the placement agent, or its designees, to purchase a number of shares of common stock equal to 5.0% of the shares of common stock sold in this offering (including the shares of common stock issuable upon the exercise of the Pre-Funded Warrants), at an exercise price equal to 125% of the public offering price per share and accompanying common warrants. (5) The proposed maximum aggregate offering price of the common stock proposed to be sold in the offering will be reduced on a dollar-for-dollar basis based on the offering price of any Pre-Funded Warrants sold in the offering, and, as such, the proposed maximum aggregate offering price of the common stock and Pre-Funded Warrants (including the common stock issuable upon exercise of the Pre-Funded Warrants), if any, is \$8,000,000.