Registration No. 333-

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

washington, D.C. 20349

FORM S-3 REGISTRATION STATEMENT UNDER

THE SECURITIES ACT OF 1933

Vor Biopharma Inc.

(Exact name of registrant as specified in its charter)

Delaware (State or other jurisdiction of incorporation or organization) 81-1591163 (I.R.S. Employer Identification Number)

100 Cambridgepark Drive, Suite 101 Cambridge, Massachusetts 02140 (617) 655-6580

(Address, including zip code, and telephone number, including area code of registrant's principal executive offices)

Robert Ang, M.B.B.S. President and Chief Executive Officer Vor Biopharma Inc. 100 Cambridgepark Drive, Suite 101 Cambridge, Massachusetts 02140 (617) 655-6580

(Name, address, including zip code, and telephone number, including area code, of agent for service)

Copies to:

Divakar Gupta Katie Kazem Charles S. Kim Cooley LLP 55 Hudson Yards New York, New York 10001-2157 (212) 479-6000

From time to time after the effective date of this Registration Statement (Approximate date of commencement of proposed sale to the public)

If the only securities being registered on this Form are being offered pursuant to dividend or interest reinvestment plans, please check the following box.

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, other than securities offered only in connection with dividend or interest reinvestment plans, check the following box.

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.

If this Form is a registration statement pursuant to General Instruction I.D. or a post-effective amendment thereto that shall become effective upon filing with the Commission pursuant to Rule 462(e) under the Securities Act, check the following box.

If this Form is a post-effective amendment to a registration statement filed pursuant to General Instruction I.D. filed to register additional securities or additional classes of securities pursuant to Rule 413(b) under the Securities Act, check the following box.

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

Large accelerated filer		Accelerated filer	
Non-accelerated filer	\boxtimes	Smaller reporting company	X
		Emerging growth company	X

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.

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 that specifically states that this registration statement shall thereafter become effective in accordance with Section 8(a) of the Securities Act or until the registration statement shall become effective on such date as the Securities and Exchange Commission, acting pursuant to said Section 8(a), may determine.

The information in this preliminary prospectus is not complete and may be changed. We may not sell these securities or accept an offer to buy these securities until the registration statement filed with the Securities and Exchange Commission is effective. This prospectus is not an offer to sell these securities and it is not soliciting offers to buy these securities in any state where such offer or sale is not permitted.

SUBJECT TO COMPLETION, DATED DECEMBER 14, 2022

PRELIMINARY PROSPECTUS

11,627,907 Shares



Common Stock

This prospectus relates to the proposed resale from time to time of up to 11,627,907 shares of our common stock, par value \$0.0001 per share, (the "Shares") by the selling stockholder named herein, together with any additional selling stockholders listed in a prospectus supplement (together with any of such stockholders' transferees, pledgees, donees or successors).

We are registering the offer and sale of the Shares from time to time by the selling stockholder to satisfy the registration rights they were granted in connection with the issuance of the Shares. We will not receive any proceeds from the sale of the Shares by the selling stockholder.

The selling stockholder may offer and sell or otherwise dispose of the Shares described in this prospectus from time to time through public or private transactions at prevailing market prices, at prices related to prevailing market prices or at privately negotiated prices. The selling stockholder will bear all underwriting fees, commissions and discounts, if any, attributable to the sales of Shares and any transfer taxes. We will bear all other costs, expenses and fees in connection with the registration of the Shares. See the section titled "Plan of Distribution" for more information about how the selling stockholder may sell or dispose of its Shares.

Our common stock is listed on The Nasdaq Global Select Market under the trading symbol "VOR." On December 13, 2022, the closing price of our common stock was \$7.43 per share.

Investing in shares of our common stock involves a high degree of risk. You should review carefully the risks and uncertainties described in the section titled "<u>Risk Factors</u>" on page 8 of this prospectus and any similar section contained in the applicable prospectus supplement and in any free writing prospectuses we have authorized for use in connection with a specific offering, and under similar headings in the documents that are incorporated by reference into this prospectus.

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

The date of this prospectus is , 2022.

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TABLE OF CONTENTS

	Page
ABOUT THIS PROSPECTUS	i
PROSPECTUS SUMMARY	1
<u>RISK FACTORS</u>	8
SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS	9
<u>USE OF PROCEEDS</u>	11
DESCRIPTION OF CAPITAL STOCK	12
SELLING STOCKHOLDER	19
PLAN OF DISTRIBUTION	21
LEGAL MATTERS	24
EXPERTS	24
WHERE YOU CAN FIND ADDITIONAL INFORMATION	24
INCORPORATION OF CERTAIN INFORMATION BY REFERENCE	24

ABOUT THIS PROSPECTUS

This prospectus is part of a registration statement on Form S-3 that we filed with the Securities and Exchange Commission (the "SEC") using a "shelf" registration process. Under this shelf process, the selling stockholder may from time to time sell the shares of common stock described in this prospectus in one or more offerings or otherwise as described under "Plan of Distribution."

This prospectus may be supplemented from time to time by one or more prospectus supplements. Such prospectus supplement may also add, update or change information contained in this prospectus. If there is any inconsistency between the information in this prospectus and the applicable prospectus supplement, you must rely on the information in the prospectus supplement. You should carefully read both this prospectus and any applicable prospectus supplement together with additional information described under the heading "Where You Can Find Additional Information" before deciding to invest in any shares being offered.

Neither we nor the selling stockholder have authorized anyone to provide any information other than that contained or incorporated by reference in this prospectus or in any related prospectus supplement or any free writing prospectus that we have authorized. We take no responsibility for, and can provide no assurance as to the reliability of, any other information that others may give you. The shares are not being offered in any jurisdiction where the offer is not permitted. You should not assume that the information contained in or incorporated by reference in this prospectus is accurate as of any date other than the respective dates of such document. Our business, financial condition, results of operations and prospects may have changed since those dates.

Unless otherwise stated, all references in this prospectus to "Vor," "we," "us," "Vor Biopharma," "Vor Bio" and "our," and similar designations, except where the context requires otherwise, refer collectively to Vor Biopharma Inc.

i

PROSPECTUS SUMMARY

This summary highlights selected information contained elsewhere in this prospectus and in the documents we incorporate by reference. This summary does not contain all of the information you should consider before investing in our common stock. You should read this entire prospectus carefully, especially the risks of investing in our common stock discussed in the section titled "Risk Factors" and under similar headings in our filings with the SEC which are incorporated by reference in this prospectus, along with our consolidated financial statements and notes to those consolidated financial statements and the other information incorporated by reference in this prospectus, before making an investment decision.

Company Overview

We are a clinical-stage cell and genome engineering company with a vision to cure blood cancers through cell and genome engineering. Our mission is to change the standard of care for patients with blood cancer by engineering hematopoietic stem cells ("HSCs") to enable the use of targeted therapies post-transplant. Leveraging our expertise in HSC biology and genome engineering, we genetically modify HSCs to remove surface targets and then provide these cells as hematopoietic stem cell transplants to patients. Once these cells engraft into bone marrow, the patient's healthy cells are protected because they no longer express the surface target, leaving only the cancerous cells exposed. We believe this will unlock the potential of targeted therapies to selectively destroy cancerous cells while sparing healthy cells. As a result, our engineered HSCs ("eHSCs") are designed to limit the on-target toxicities associated with these targeted therapies, thereby enhancing their utility, and broadening their applicability. We intend to pair future eHSC product candidates with targeted therapeutics such as our VCAR33 programs, chimeric antigen receptor ("CAR")-T therapies designed to target CD33, as well as with potentially best-in-class targeted therapies from collaborators, to bring potentially transformative outcomes to patients and establish new standard of care Treatment Systems for blood cancers.

Trem-cel

We are developing our lead eHSC product candidate, trem-cel (formerly VOR33), which we believe has the potential to transform the treatment for acute myeloid leukemia ("AML") and other blood cancers. Trem-cel is created by genetically modifying healthy donor HSCs in order to remove the CD33 surface target. We intend to develop trem-cel as a hematopoietic stem cell transplant product candidate to replace the standard of care in transplant settings.

Our investigational new drug ("IND") application for trem-cel in patients with AML was accepted by the U.S. Food and Drug Administration ("FDA") in January 2021, and we initiated and have been continuing enrollment for our first-in-human Phase 1/2a trial of trem-cel in combination with Mylotarg.

In December 2022, we announced initial clinical data from the first treated patient in this trial. A product dose of 7.6 x10⁶ CD34⁺ viable cells/kg, with a CD33 editing efficiency of 88% was manufactured. Following myeloablative conditioning, trem-cel was infused with no infusion reactions. The patient achieved neutrophil engraftment 10 days post-transplant which was within expectations for CD34-enriched transplants. Platelet recovery was observed on Day 22. Hematopoietic cell sub-population reconstitution was robust with over 90% of peripheral blood cells negative for CD33 expression, and 100% donor chimerism was achieved. These data provide proof-of-concept that trem-cel can engraft as expected and that CD33 does not appear to be biologically necessary for engraftment and hematopoietic reconstitution.

The patient received Mylotarg at a dose of 0.5 mg/m^2 . At this dose, Mylotarg saturates CD33 antigen in patients with relapsed/refractory AML, and in the original Phase 1 trial of Mylotarg, neutropenia was observed across dose levels starting at 0.25mg/m^2 within 14 days of infusion. No treatment related adverse events and no

liver enzyme changes were observed through day 20 following Mylotarg dosing. No negative impacts to neutrophil and platelet counts were observed through day 20, suggesting tolerability at this initial dose level.

The clinical trial continues to enroll patients and additional data are expected in 2023.

VCAR33 Programs

The VCAR33 programs are CAR-T therapy candidates designed to target CD33, a clinically-validated target for AML that we have licensed from the National Institutes of Health ("NIH"). VCAR33 is made up of two programs with different cell sources. The first uses autologous cells from each patient and is being studied in an ongoing Phase 1/2 clinical trial sponsored by the National Marrow Donor Program ("NMDP") in young adult and pediatric patients with relapsed/refractory AML in a bridge-to-transplant study, which we refer to as VCAR33^{AUTO}. The second uses allogeneic healthy donor-derived cells that we refer to as VCAR33^{ALLO}. We plan to submit an IND for our VCAR33^{ALLO} program in the first half of 2023 to support a Phase 1/2 clinical trial for patients with relapsed/refractory AML. The NMDP is currently evaluating VCAR33^{AUTO} in a multi-site Phase 1/2 clinical trial in young adult and pediatric patients with relapsed/refractory AML. We no longer expect data from this Phase 1/2 clinical trial to be reported in 2022 and the timing of the data release is dependent on the investigators conducting the trial. The NMDP is responsible for all aspects of the VCAR33^{AUTO} trial, including the design of the trial, the manufacture of study product, the enrollment, dosing and follow-up of patients, the recording of trial data and the analysis of results. We did not control the preclinical development of VCAR33^{AUTO}, which was conducted by the NIH, and we do not have rights under the license agreement to certain intellectual property, such as know-how, employed by the NMDP in manufacturing study product or conducting its clinical trial; however, the NMDP has permitted us to cross-reference its IND for this trial in future IND applications that we may submit with the FDA.

We believe that the combination of trem-cel followed by treatment with VCAR33^{ALLO} in the post-transplant setting, which we refer to as the VOR33 + VCAR33 Treatment System, may transform patient outcomes and offer the potential for cures for patients that have limited treatment options. The VOR33 + VCAR33 Treatment System would utilize the same healthy donor allogenic cell source for both trem-cel and VCAR33^{ALLO}. Following ongoing discussions with the FDA and alongside improved scientific understanding of the differences in T-cell sources, we plan to collect initial data on trem-cel from the VBP101 clinical trial and initial clinical data from the VCAR33^{ALLO} program prior to IND submission for the Treatment System. We believe this approach allows for a more methodical development pathway for this novel-novel treatment combination.

Since our inception in December 2015, we have devoted substantially all of our resources to raising capital, organizing and staffing our company, business and scientific planning, conducting discovery and research activities, acquiring or discovering product candidates, establishing and protecting our intellectual property portfolio, developing and progressing our product candidates and preparing for clinical trials, establishing arrangements with third parties for the manufacture of our product candidates and component materials, building out our internal clinical manufacturing facility, and providing general and administrative support for these operations. We do not have any product candidates approved for sale and have not generated any revenue from product sales.

Risks Associated with Our Business

Our business is subject to a number of risks of which you should be aware before making an investment decision. These risks are discussed more fully in the section titled "Risk Factors" immediately following this prospectus summary and under similar headings in our filings with the SEC which are incorporated by reference in this prospectus. These risks include the following:

• We have incurred significant net losses since inception. We expect to incur net losses for the foreseeable future and may never achieve or maintain profitability.

- We will need substantial additional funding. If we are unable to raise capital when needed, we would be forced to delay, reduce or eliminate our research and product development programs or future commercialization efforts.
- We have a limited operating history, have not yet completed any clinical trials and have no history of commercializing products, which may make it difficult to evaluate the success of our business to date and to assess our future viability.
- eHSCs are a novel technology that is not yet clinically validated for human use. The approaches we are taking to create eHSCs are unproven and may never lead to marketable products.
- We are substantially dependent on the success of our two most advanced product candidates, trem-cel and VCAR33. If we are unable to complete development of, obtain approval for and commercialize trem-cel or VCAR33 in a timely manner, our business will be harmed.
- We may not be successful in our efforts to identify, develop or commercialize additional product candidates. If these efforts are unsuccessful, we may never become a commercial stage company or generate any revenues.
- We have not successfully tested our product candidates in clinical trials and any favorable preclinical results are not predictive of results that may be observed in clinical trials.
- Development of a product candidate such as trem-cel, which is intended for use in combination or in sequence with an already approved therapy, will present increased complexity and more or different challenges than development of a product candidate for use as a single agent.
- If our product candidates, the delivery modes we rely on to administer them, and/or the conditioning, administration process or related procedures or treatments which may be used alongside our product candidates cause serious adverse events, undesirable side effects or unexpected characteristics, such events, side effects or characteristics could delay or prevent regulatory approval of the product candidates, limit their commercial potential or result in significant negative consequences following any potential marketing approval, even if these side effects or characteristics are unrelated to our product candidate.
- We face significant competition in an environment of rapid technological change, and there is a possibility that our competitors may achieve regulatory approval before us or develop therapies that are safer or more advanced or effective than ours, which may harm our financial condition and our ability to successfully market or commercialize our product candidates, if approved.
- Adverse public perception of genetic medicines, and of genome engineering in particular, including as a result of other trials out of our control, such as the VCAR33^{AUTO} trial currently sponsored by the NMDP, may negatively impact regulatory approval of, and/or demand for, our potential products.
- Genome engineering technology is subject to a number of challenges and risks. Because genome engineering technology is novel and the regulatory landscape that will govern our product candidates is uncertain and may change, we cannot predict the time and cost of obtaining regulatory approval, if we receive it at all, for our product candidates.
- Because we are developing product candidates using new technologies, as well as potential mechanisms of action for which there are few precedents, there is increased risk that the U.S. Food and Drug Administration, the European Medicines Agency or other regulatory authorities may not consider the endpoints of our clinical trials to provide clinically meaningful results and that these results may be difficult to analyze.

- We have initiated manufacturing at our in-house facility, but until and unless we complete the total transfer of our manufacturing capabilities in-house, we will continue to contract with third parties for the manufacture and supply of materials for development of our product candidates and advancement of our current clinical trial, as well as our research programs and preclinical studies, and we expect to continue to do so for future clinical trials and for commercialization of our product candidates. This reliance on third parties increases the risk that we will not have sufficient quantities of such materials, product candidates or any products that we may develop and commercialize, or that such supply will not be available to us at an acceptable cost, which could delay, prevent or impair our development or commercialization efforts.
- We are highly dependent on intellectual property licensed from third parties and termination of any of these licenses could result in the loss of significant rights, which would harm our business.
- We may not be successful in acquiring or in-licensing necessary rights to key technologies underlying our product candidates.
- Third-party claims of intellectual property infringement, misappropriation or other violations may prevent or delay our product discovery and development efforts and have a material adverse effect on our business.
- The COVID-19 pandemic has caused, and could continue to cause, severe disruptions in the United States, regional and global economies and could seriously harm our development efforts, increase our costs and expenses and have a material adverse effect on our business, financial condition and results of operations.
- Success in preclinical studies or clinical trials may not be indicative of results in future clinical trials, particularly for our clinical trials that involve only a small number of patients.
- If we experience significant delays or difficulties in the enrollment of patients in clinical trials, including with respect to completing a complex donor identification and screening process, the cost of developing product candidates could increase and our receipt of necessary regulatory approvals could be delayed or prevented.
- If we are unable to successfully identify patients who are likely to benefit from our product candidates or eligible donors, or experience significant delays in doing so, we may not realize the full commercial potential of our product candidates.
- Interim "top-line" and preliminary results from our clinical trials that we may announce or publish from time to time may change as more patient data become available and are subject to audit and verification procedures that could result in material changes in the final data. Investors and analysts may have difficulty analyzing our interim and preliminary results or may not consider them to be meaningful.

Company Information

We were incorporated under the laws of the State of Delaware in December 2015. Our principal executive offices are located at 100 Cambridgepark Drive, Suite 101, Cambridge, Massachusetts 02140. Our telephone number is (617) 655-6580. Our internet website address is www.vorbio.com. The information contained on our website is not incorporated by reference into this prospectus, and you should not consider any information contained on, or that can be accessed through, our website as part of this prospectus or in deciding whether to purchase our securities. The inclusion of our website address in this prospectus is only an inactive textual reference.

VOR BIOPHARMA and our Vor Biopharma logo, and our other trademarks or service marks appearing in this prospectus are our property. This prospectus and the information incorporated herein by reference contains additional trade names, trademarks and service marks of others, which are the property of their respective owners. Solely for convenience, the trademarks and trade names in this prospectus may be referred to without the $^{(m)}$ and TM symbols, but such references should not be construed as any indicator that their respective owners will not assert their rights thereto.

Implications of Being an Emerging Growth Company and a Smaller Reporting Company

We qualify as an "emerging growth company" as defined in the Jumpstart Our Business Startups Act of 2012 ("JOBS Act"). For so long as we remain an emerging growth company, we may take advantage of relief from certain reporting requirements and other burdens that are otherwise applicable generally to public companies. These provisions include:

- reduced obligations with respect to financial data, including only being required to present two years of audited financial statements, in addition to any required unaudited interim financial statements with correspondingly reduced "Management's Discussion and Analysis of Financial Condition and Results of Operations" disclosure;
- an exception from compliance with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002, as amended;
- reduced disclosure about our executive compensation arrangements in our periodic reports, proxy statements and registration statements;
- exemptions from the requirements of holding non-binding advisory votes on executive compensation or golden parachute arrangements; and
- an exemption from compliance with the requirements of the Public Company Accounting Oversight Board regarding the communication of critical audit matters in the auditor's report on financial statements.

We may take advantage of these provisions until we no longer qualify as an emerging growth company. We will cease to qualify as an emerging growth company on the date that is the earliest of: (i) December 31, 2026, (ii) the last day of the fiscal year in which we have more than \$1.235 billion in total annual gross revenues, (iii) the date on which we are deemed to be a "large accelerated filer" under the rules of the SEC, which means the market value of our common stock that is held by non-affiliates exceeds \$700 million as of the prior June 30th, or (iv) the date on which we have issued more than \$1.0 billion of non-convertible debt over the prior three-year period. We may choose to take advantage of some but not all of these reduced reporting burdens. We have taken advantage of certain reduced reporting requirements in this prospectus. Accordingly, the information contained herein may be different than you might obtain from other public companies in which you hold equity interests.

In addition, under the JOBS Act, emerging growth companies can delay adopting new or revised accounting standards until such time as those standards apply to private companies. We have elected to take advantage of the extended transition period to comply with new or revised accounting standards and to adopt certain of the reduced disclosure requirements available to emerging growth companies. As a result of the accounting standards election, we will not be subject to the same implementation timing for new or revised accounting standards as other public companies that are not emerging growth companies, which may make comparison of our financials to those of other public companies more difficult. As a result of these elections, the information that we provide in this prospectus may be different than the information you may receive from other public companies in which

you hold equity interests. In addition, it is possible that some investors will find our common stock less attractive as a result of these elections, which may result in a less active trading market for our common stock and higher volatility in our share price.

We are also a "smaller reporting company," meaning that the market value of our shares held by non-affiliates is less than \$700 million and our annual revenue was less than \$100 million during the most recently completed fiscal year. We may continue to be a smaller reporting company if either (i) the market value of our shares held by non-affiliates is less than \$250 million or (ii) our annual revenue was less than \$100 million during the most recently completed fiscal year. We may continue to be a smaller reporting company if either (i) the most recently completed fiscal year and the market value of our shares held by non-affiliates is less than \$700 million. If we are a smaller reporting company at the time we cease to be an emerging growth company, we may continue to rely on exemptions from certain disclosure requirements that are available to smaller reporting companies. Specifically, as a smaller reporting company, we may choose to present only the two most recent fiscal years of audited financial statements in our Annual Report on Form 10-K and, similar to emerging growth companies, smaller reporting companies have reduced disclosure obligations regarding executive compensation.

The Offering					
Common Stock Offered by the Selling Stockholder	11,627,907 shares				
Use of Proceeds	We will not receive any of the proceeds from the sale of the Shares in this offering. The selling stockholder will receive all of the proceeds from the sale of the Shares hereunder.				
Risk Factors	An investment in our common stock involves a high degree of risk. See the information contained in or incorporated by reference in the section titled "Risk Factors" and under similar headings in the other documents that are incorporated by reference herein, as well as the other information included in or incorporated by reference in this prospectus.				
Nasdaq Global Select Market Symbol	Our common stock is listed on The Nasdaq Global Select Market under the symbol "VOR."				

RISK FACTORS

An investment in our common stock involves a high degree of risk. Prior to making a decision about investing in our common stock, you should consider carefully the specific risk factors discussed in the sections titled "Risk Factors" contained in our most recent Annual Report on Form 10-Q, as well as any amendments thereto reflected in subsequent filings with the SEC, which are incorporated by reference into this prospectus in their entirety, together with other information in this prospectus, the documents incorporated by reference, any prospectus supplement and any free writing prospectus that we may authorize. These risks and uncertainties are not the only risks and uncertainties we face. Additional risks and uncertainties not presently known to us, or that we currently view as immaterial, may also impair our business. If any of the risks or uncertainties described in our SEC filings or any additional risks and uncertainties actually occur, our business, financial condition, results of operations and cash flow could be materially and adversely affected. In that case, the trading price of our common stock could decline and you might lose all or part of your investment.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus and the documents we have filed with the SEC that are incorporated by reference contain "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933, as amended (the "Securities Act"), and the Securities Exchange Act of 1934, as amended (the "Exchange Act"). These statements relate to future events or to our future operating or financial performance and involve known and unknown risks, uncertainties and other factors which may cause our actual results, performance or achievements to be materially different from any future results, performances or achievements expressed or implied by the forward-looking statements. Forward-looking statements may include, but are not limited to, statements about:

- the timing, progress and results of our preclinical studies and clinical trials of our product candidates, including statements regarding the timing of initiation, enrollment and completion of studies or trials and related preparatory work, the period during which the results of the trials will become available and our research and development programs;
- the timing of any submission of filings for regulatory approval of, and our ability to obtain and maintain regulatory approvals for, our product candidates for any indication;
- the impacts of the COVID-19 pandemic, which could continue to adversely impact our business, including our preclinical studies and clinical trials;
- our ability to identify patients with the diseases treated by our product candidates, and to enroll patients in trials;
- our expectations regarding the market acceptance and opportunity for and clinical utility of our product candidates, if approved for commercial use;
- our expectations regarding the scope of any approved indication for any product candidate;
- our ability to successfully commercialize our product candidates;
- our estimates of our expenses, ongoing losses, future revenue, capital requirements and our need for or ability to obtain additional funding before we can expect to generate any revenue from product sales;
- our ability to establish or maintain collaborations or strategic relationships;
- our ability to identify, recruit and retain key personnel, including executive officers and members of management;
- our reliance upon intellectual property licensed from third parties and our ability to obtain such licenses on commercially reasonable terms or at all;
- our ability to protect and enforce our intellectual property position for our product candidates, and the scope of such protection;
- our financial performance;
- the period over which we estimate our existing cash, cash equivalents and marketable securities will be sufficient to fund our future operating expenses and capital expenditure requirements;
- our competitive position and the development of and projections relating to our competitors or our industry;
- our estimated operating expenses and capital expenditure requirements;
- the impact of laws and regulations;
- our expectations regarding the time during which we will be an emerging growth company under the JOBS Act; and

• other risks and uncertainties, including those listed under the caption "Risk Factors" in our most recent Annual Report on Form 10-K, our most recent Quarterly Report on Form 10-Q and other filings we make with the SEC.

We may not actually achieve the plans, intentions or expectations disclosed in our forward-looking statements, and you should not place undue reliance on our forward-looking statements. Actual results or events could differ materially from the plans, intentions and expectations disclosed in the forward-looking statements we make. We have included important factors in the cautionary statements included in this prospectus, particularly in the section titled "Risk Factors," that we believe could cause actual results or events to differ materially from the forward-looking statements that we make. Our forward-looking statements do not reflect the potential impact of any future acquisitions, mergers, dispositions, joint ventures or investments we may make.

You should read this prospectus, together with the documents we have filed with the SEC that are incorporated by reference, any prospectus supplement and any free writing prospectus that we may authorize completely and with the understanding that our actual future results may be materially different from what we expect. We qualify all of the forward-looking statements in the foregoing documents by these cautionary statements.

USE OF PROCEEDS

We will not receive any of the proceeds from the sale of the Shares in this offering. The selling stockholder will receive all of the proceeds from the sale of the Shares hereunder.

DESCRIPTION OF CAPITAL STOCK

As of the date of this prospectus, our Amended and Restated Certificate of Incorporation ("Restated Certificate") authorizes us to issue up to 400,000,000 shares of common stock, \$0.0001 par value per share, and 10,000,000 shares of preferred stock, \$0.0001 par value per share. As of December 9, 2022, 65,649,474 shares of our common stock were outstanding and no shares of our preferred stock were outstanding.

The following summary description of our capital stock is based on the provisions of our Restated Certificate as well as our Amended and Restated Bylaws ("Bylaws"), and the applicable provisions of the Delaware General Corporation Law (the "DGCL"). This information is qualified entirely by reference to the applicable provisions of our Restated Certificate, Bylaws and the DGCL. For information on how to obtain copies of our Restated Certificate and Bylaws, which are exhibits to the registration statement of which this prospectus is a part, see "Where You Can Find Additional Information."

Common Stock

Voting Rights

Each holder of our common stock is entitled to one vote for each share on all matters submitted to a vote of the stockholders, including the election of directors. The affirmative vote of holders of at least 66^{2/3}% of the voting power of all of the then-outstanding shares of capital stock, voting as a single class, will be required to amend certain provisions of our Restated Certificate, including provisions relating to amending our Bylaws, the classified board, the size of our board, removal of directors, director liability, vacancies on our board, special meetings, stockholder notices, actions by written consent and exclusive forum.

Dividends

Subject to preferences that may be applicable to any then-outstanding preferred stock, holders of common stock are entitled to receive ratably those dividends, if any, as may be declared from time to time by our board of directors out of legally available funds.

Liquidation

In the event of our liquidation, dissolution or winding up, holders of common stock will be entitled to share ratably in the net assets legally available for distribution to stockholders after the payment of all of our debts and other liabilities and the satisfaction of any liquidation preference granted to the holders of any then-outstanding shares of preferred stock.

Rights, Preferences and Privileges

Holders of common stock have no preemptive, conversion or subscription rights and there are no redemption or sinking fund provisions applicable to the common stock. The rights, preferences and privileges of the holders of common stock are subject to, and may be adversely affected by, the right of the holders of shares of any series of preferred stock that we may designate in the future.

Registration Rights

We and some of the holders of our common stock have entered into an amended and restated investors' rights agreement. The registration rights provisions of this agreement provide those holders with demand, piggyback and Form S-3 registration rights with respect to the shares of common stock currently held by them and issuable to them upon conversion of our preferred stock in connection with our initial public offering. An aggregate of 17,489,764 shares of common stock are entitled to these registration rights. These shares are collectively referred to herein as registrable securities.

Demand Registration Rights

The holders of a majority of registrable securities then outstanding have the right to demand that we file a registration statement covering at least 40% of the registrable securities then outstanding (or a lesser percent if the aggregate offering price exceeds \$15.0 million net of certain selling expenses). We are obligated to effect at most two registrations in response to these demand registration rights. These demand registration rights are subject to specified conditions and limitations, including the right of the underwriters, if any, to limit the number of shares included in any such registration under specified circumstances. Upon such a request, we are required to effect the registration as soon as practicable, but in any event no later than 60 days after the receipt of such request.

Piggyback Registration Rights

If we propose to register any of our securities under the Securities Act either for our own account or for the account of other stockholders, the holders of registrable securities will each be entitled to notice of the registration and will be entitled to include their shares of common stock in the registration statement. These piggyback registration rights are subject to specified conditions and limitations, including the right of the underwriters to limit the number of shares included in any such registration under specified circumstances, and do not apply to a registration relating to any equity incentive plan, stock purchase or similar plan, a transaction under Rule 145 of the Securities Act, a registration on any form that does not include substantially the same information as would be required to be included in a registration statement covering the sale of the registrable securities or a registration related to common stock issued upon conversion of debt securities.

Registration on Form S-3

The holders of at least 15% of the registrable securities then outstanding are entitled to request to have such shares registered by us on a Form S-3 registration statement. These Form S-3 registration rights are subject to other specified conditions and limitations, including the condition that the anticipated aggregate offering price, net of certain selling expenses, is at least \$5.0 million. Upon receipt of this request, the holders of registrable securities will each be entitled to participate in this registration. We will not be required to effect such a registration if, within any twelve month period, we have already effected two registrations on Form S-3 for the holders of registrable securities.

Expenses of Registration

We are required to pay all expenses, including fees and expenses of one counsel to represent the selling stockholders, relating to any demand, piggyback or Form S-3 registration, other than underwriting discounts and commissions, stock transfer taxes and any additional fees of counsel for the selling stockholders, subject to specified conditions and limitations. We are not required to pay registration expenses if a demand registration request is withdrawn at the request of a majority of holders of registrable securities to be registered, unless holders of a majority of the registrable securities agree to forfeit their right to one demand registration.

The amended and restated investors' rights agreement contains customary cross-indemnification provisions, pursuant to which we are obligated to indemnify the selling stockholders in the event of material misstatements or omissions in the applicable registration statement attributable to us, and the selling stockholders are obligated to indemnify us for material misstatements or omissions in the registration statement attributable to them, subject to certain limitations.

Termination of Registration Rights

The registration rights granted under the investors' rights agreement will terminate with respect to any particular stockholder upon the earlier of (i) the closing of a deemed liquidation event, as defined in our Restated

Certificate; (ii) with respect to each stockholder, at such time such stockholder is able to sell all of its shares pursuant to Rule 144 or another similar exemption under the Securities Act during a three-month period without registration; and (iii) February 5, 2026.

Preferred Stock

Pursuant to the Restated Certificate, our board of directors have the authority without further action by our stockholders, to issue up to 10,000,000 shares of preferred stock in one or more series, to establish from time to time the number of shares to be included in each such series, to fix the rights, preferences and privileges of the shares of each wholly unissued series and any qualifications, limitations or restrictions thereon, and to increase or decrease the number of shares of such series, but not below the number of shares of such series then outstanding.

Our board of directors may authorize the issuance of preferred stock with voting or conversion rights that could adversely affect the voting power or other rights of the holders of our common stock. The purpose of authorizing our board of directors to issue preferred stock and determine its rights and preferences is to eliminate delays associated with a stockholder vote on specific issuances. The issuance of preferred stock, while providing flexibility in connection with possible acquisitions and other corporate purposes, could, among other things, have the effect of delaying, deferring or preventing a change in control of us and may adversely affect the market price of our common stock and the voting and other rights of the holders of our common stock. It is not possible to state the actual effect of the issuance of any shares of preferred stock on the rights of holders of common stock until the board of directors determines the specific rights attached to that preferred stock.

Our board of directors will fix the designations, voting powers, preferences and rights of each series, as well as the qualifications, limitations or restrictions thereof, of the preferred stock of each series that we offer under this prospectus and applicable prospectus supplements in the certificate of designation relating to that series. We will file as an exhibit to the registration statement of which this prospectus is a part, or will incorporate by reference from reports that we file with the SEC, the form of any certificate of designation that describes the terms of the series of preferred stock we are offering before the issuance of that series of preferred stock. This description will include:

- the title and stated value;
- the number of shares we are offering;
- the liquidation preference per share;
- the purchase price per share;
- the dividend rate per share, dividend period and payment dates and method of calculation for dividends;
- whether dividends will be cumulative or non-cumulative and, if cumulative, the date from which dividends will accumulate;
- our right, if any, to defer payment of dividends and the maximum length of any such deferral period;
- the procedures for any auction and remarketing, if any;
- the provisions for a sinking fund, if any;
- the provisions for redemption or repurchase, if applicable, and any restrictions on our ability to exercise those redemption and repurchase rights;
- any listing of the preferred stock on any securities exchange or market;

- whether the preferred stock will be convertible into our common stock or other securities of ours, including depositary shares and warrants, and, if applicable, the conversion period, the conversion price, or how it will be calculated, and under what circumstances it may be adjusted;
- whether the preferred stock will be exchangeable into debt securities, and, if applicable, the exchange period, the exchange price, or how it will be calculated, and under what circumstances it may be adjusted;
- voting rights, if any, of the preferred stock;
- preemption rights, if any;
- restrictions on transfer, sale or other assignment, if any;
- whether interests in the preferred stock will be represented by depositary shares;
- a discussion of any material or special United States federal income tax considerations applicable to the preferred stock;
- the relative ranking and preferences of the preferred stock as to dividend rights and rights if we liquidate, dissolve or wind up our affairs;
- any limitations on issuances of any class or series of preferred stock ranking senior to or on a parity with the series of preferred stock being issued as to dividend rights and rights if we liquidate, dissolve or wind up our affairs; and
- any other specific terms, rights, preferences, privileges, qualifications or restrictions of the preferred stock.

Vor is incorporated in Delaware. The DGCL provides that the holders of preferred stock will have the right to vote separately as a class (or, in some cases, as a series) on an amendment to our certificate of incorporation if the amendment would change the par value or, unless the certificate of incorporation provided otherwise, the number of authorized shares of the class or change the powers, preferences or special rights of the class or series so as to adversely affect the class or series, as the case may be. This right is in addition to any voting rights that may be provided for in the applicable certificate of designation.

Antitakeover Effects of Provisions of Charter Documents and Delaware Law

Section 203 of the DGCL

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

- before 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;
- upon completion 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 began, excluding for purposes of determining the voting stock outstanding, but not the outstanding voting stock owned by the interested stockholder, those shares owned (i) by persons who are directors and also officers and (ii) employee stock plans in which employee participants do not have the right to determine confidentially whether shares held subject to the plan will be tendered in a tender or exchange offer; or
- on or after such date, the business combination is approved by the board of directors and authorized at an annual or special meeting of the 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.

In general, Section 203 defines a "business combination" to include the following:

- any merger or consolidation involving the corporation or any direct or indirect majority-owned subsidiary of the corporation and the interested stockholder;
- any sale, transfer, pledge or other disposition of 10% or more of the assets of the corporation involving the interested stockholder (in one transaction or a series of transactions);
- subject to certain exceptions, any transaction that results in the issuance or transfer by the corporation or by any direct or indirect majorityowned subsidiary of the corporation of any stock of the corporation or of such subsidiary to the interested stockholder;
- any transaction involving the corporation or any direct or indirect majority-owned subsidiary of the corporation that has the effect of
 increasing the proportionate share of the stock or any class or series of the corporation beneficially owned by the interested stockholder; or
- the receipt by the interested stockholder of the benefit of any loans, advances, guarantees, pledges or other financial benefits by or through the corporation.

In general, Section 203 defines an "interested stockholder" as an entity or person who, together with the person's affiliates and associates, beneficially owns, or within three years prior to the time of determination of interested stockholder status did own, 15% or more of the outstanding voting stock of the corporation.

Restated Certificate and Bylaws

Our Restated Certificate provides for our board of directors to be divided into three classes with staggered three-year terms. Only one class of directors will be elected at each annual meeting of our stockholders, with the other classes continuing for the remainder of their respective three-year terms. Because our stockholders do not have cumulative voting rights, stockholders holding a majority of the shares of common stock outstanding will be able to elect all of our directors. Our Restated Certificate and our Bylaws also provide that directors may be removed by the stockholders only for cause upon the vote of 66^{2/3}% or more of our outstanding common stock. Furthermore, the authorized number of directors may be changed only by resolution approved by a majority of the board of directors, and vacancies and newly created directors then serving on the board, even though less than a quorum.

Under our Restated Certificate and Bylaws our stockholders do not have cumulative voting rights. Because of this, the holders of a majority of the shares of common stock entitled to vote in any election of directors can elect all of the directors standing for election, if they should so choose.

Our Restated Certificate and Bylaws also provide that all stockholder actions must be effected at a duly called meeting of stockholders and will eliminate the right of stockholders to act by written consent without a meeting. Our Bylaws also provide that only the chair of our board, Chief Executive Officer or the board of directors pursuant to a resolution adopted by a majority of the total number of authorized directors may call a special meeting of stockholders.

Our Bylaws provides that stockholders seeking to present proposals before a meeting of stockholders to nominate candidates for election as directors at a meeting of stockholders must provide timely advance notice in writing, and will specify requirements as to the form and content of a stockholder's notice.

Our Restated Certificate and Bylaws provide that the stockholders cannot amend many of the provisions described above except by a vote of 66^{2/3}% or more of our outstanding common stock.

As described in "—Preferred Stock" above, our Restated Certificate gives our board of directors the authority, without further action by our stockholders, to issue up to 10,000,000 shares of preferred stock in one or more series, with any rights, preferences and privileges as they may designate, including the right to approve an acquisition or other change in control.

The combination of these provisions will make it more difficult for our existing stockholders to replace our board of directors as well as for another party to obtain control of us by replacing our board of directors. Since our board of directors has the power to retain and discharge our officers, these provisions could also make it more difficult for existing stockholders or another party to effect a change in management. In addition, the authorization of undesignated preferred stock makes it possible for our board of directors to issue preferred stock with voting or other rights or preferences that could impede the success of any attempt to change our control.

These provisions are intended to enhance the likelihood of continued stability in the composition of our board of directors and its policies and to discourage coercive takeover practices and inadequate takeover bids. These provisions are also designed to reduce our vulnerability to hostile takeovers and to discourage certain tactics that may be used in proxy fights. However, such provisions could have the effect of discouraging others from making tender offers for our shares and may have the effect of delaying changes in our control or management. As a consequence, these provisions may also inhibit fluctuations in the market price of our stock that could result from actual or rumored takeover attempts. We believe that the benefits of these provisions, including increased protection of our potential ability to negotiate with the proponent of an unfriendly or unsolicited proposal to acquire or restructure our company, outweigh the disadvantages of discouraging takeover proposals, because negotiation of takeover proposals could result in an improvement of their terms.

Choice of Forum

Our Restated Certificate provides that the Court of Chancery of the state of Delaware will be the exclusive forum for the following types of actions or proceedings under Delaware statutory or common law:

- any derivative action or proceeding brought on our behalf;
- any action asserting a breach of fiduciary duty;
- any action asserting a claim against us arising pursuant to the DGCL, our Restated Certificate, or our Bylaws; or
- any action asserting a claim against us that is governed by the internal affairs doctrine.

The provision would not apply to suits brought to enforce a duty or liability created by the Exchange Act. Furthermore, Section 22 of the Securities Act creates concurrent jurisdiction for federal and state courts over all such Securities Act actions. Accordingly, both state and federal courts have jurisdiction to entertain such claims. To prevent having to litigate claims in multiple jurisdictions and the threat of inconsistent or contrary rulings by different courts, among other considerations, our Restated Certificate also provide that unless we consent in writing to the selection of an alternative forum, the federal district courts of the United States shall be the exclusive forum for the resolution of any complaint asserting a cause of action arising under the Securities Act.

While the Delaware courts have determined that such choice of forum provisions are facially valid, a stockholder may nevertheless seek to bring a claim in a venue other than those designated in the exclusive forum provisions. In such instance, we would expect to vigorously assert the validity and enforceability of the exclusive forum provisions of our Restated Certificate. This may require significant additional costs associated with resolving such action in other jurisdictions and there can be no assurance that the provisions will be enforced by a court in those other jurisdictions

These exclusive forum provisions 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

lawsuits against us and our directors, officers and other employees. If a court were to find either exclusive-forum provision in our Restated Certificate to be inapplicable or unenforceable in an action, we may incur further significant additional costs associated with resolving the dispute in other jurisdictions, all of which could seriously harm our business.

Our Restated Certificate further provides that the federal district courts of the United States of America will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act, subject to and contingent upon a final adjudication in the State of Delaware of the enforceability of such exclusive forum provision.

Transfer Agent and Registrar

The transfer agent and registrar for our common stock is Computershare Trust Company, N.A. The transfer agent's address is 150 Royall Street, Canton, Massachusetts 02021.

Listing on Nasdaq

Our common stock is listed on The Nasdaq Global Select Market under the trading symbol "VOR."

SELLING STOCKHOLDER

We have prepared this prospectus to allow the selling stockholder to offer and sell from time to time up to 11,627,907 shares of our common stock for its own account.

We are registering the offer and sale of the Shares to satisfy certain registration obligations that we granted the selling stockholder in connection with the purchase of the Shares. Pursuant to the securities purchase agreement between Vor and the selling stockholder dated December 7, 2022 (the "Securities Purchase Agreement"), we have agreed to prepare and file with the SEC such amendments and supplements to this prospectus, and the registration statement of which this prospectus forms a part, used in connection therewith as may be necessary to keep such registration statement continuously effective and free from any material misstatement or omission to state a material fact therein until the earlier of (i) such time as all the Shares have been resold or (ii) such time as the Shares no longer remain "registrable shares" as defined in the Securities Purchase Agreement. A share will cease to be a registrable share upon the earliest to occur of the following: (i) such share has been sold or otherwise transferred by the holder thereof pursuant to and in a manner contemplated by the registration statement of which this prospectus forms by such share relating to restrictions on transferability thereof, under the Securities Act or otherwise, is removed by Vor, (iii) such share is eligible to be sold pursuant to Rule 144 without condition or restriction, including without any limitation as to volume of sales, and without the holder complying with any method of sale requirements or notice requirements under Rule 144, and without the requirement to be in compliance with Rule 144(c)(1), or (iv) such share shall cease to be outstanding following its issuance.

The following table sets forth (i) the name of the selling stockholder, (ii) the number of shares of common stock beneficially owned by the selling stockholder, (iii) the number of shares of common stock that may be offered under this prospectus and (iv) the number of shares of common stock beneficially owned by the selling stockholder assuming all of the shares covered hereby are sold.

Beneficial ownership is determined in accordance with the rules of the SEC, and includes voting or investment power with respect to our common stock. Except as indicated by the footnotes below, we believe, based on the information furnished to us, that the selling stockholder named in the table below has sole voting and investment power with respect to all shares of common stock that they beneficially own, subject to applicable community property laws.

The selling stockholder may sell some, all or none of the Shares offered by this prospectus from time to time. We do not know how long the selling stockholder will hold the Shares covered hereby before selling them and we currently have no agreements, arrangements or understandings with the selling stockholder regarding the sale or other disposition of any Shares. The information set forth in the table below is based on 65,649,474 shares of our common stock outstanding as of December 9, 2022 and assumes the selling stockholder disposes of all of the Shares covered by this prospectus and does not acquire beneficial ownership of any additional shares of common stock. The registration of the Shares does not necessarily mean that the selling stockholder will sell all or any portion of the Shares covered by this prospectus.

As used in this prospectus, the term "selling stockholder" includes the selling stockholder listed in the table below, together with any additional selling stockholders listed in a prospectus supplement, and their donees, pledgees, assignees, transferees, distributees and successors-in-interest that receive Shares in any non-sale transfer after the date of this prospectus.

			Beneficial Ownershi	p After this Offering
	Shares of Common	Number of		· · · · · ·
	Stock Beneficially	Shares		Percent of
	Owned Prior to	Being	Number of	Outstanding
Name of Selling Stockholder	this Offering	Offered	Shares	Common Stock
RA Capital Healthcare Fund L.P. ⁽¹⁾	22,760,146	11,627,907	11,132,239	17.0%

(1) Consists of (i) 20,923,554 shares held by RA Capital Healthcare Fund L.P. ("RACHF"), (ii) 1,825,326 shares held by RA Capital Nexus Fund, L.P. ("RACNF") and (iii) 11,266 shares issuable upon exercise of stock options vested within 60 days of December 14, 2022 held by Josh Resnick, a member of Vor's board of directors, for the benefit of RA Capital Management, L.P. ("RA Capital"). RA Capital Healthcare Fund GP, LLC is the general partner of RACHF and RA Capital Nexus Fund GP, LLC is the general partner of RACHF and RA Capital Nexus Fund GP, LLC is the general partner of RACNF. The general partner of RA Capital is RA Capital Management GP, LLC, of which Dr. Peter Kolchinsky and Mr. Rajeev Shah are the controlling persons. RA Capital serves as investment adviser for RACHF and RACNF and may be deemed a beneficial owner, for purposes of Section 13(d) of the Exchange Act, of any securities of Vor held by RACHF and RACNF. RACHF and RACNF have delegated to RA Capital the sole power to vote and the sole power to dispose of all securities held in RACHF's and RACNF's portfolio, including the shares of Vor common stock reported herein. Because RACHF and RACNF have divested themselves of voting and investment power over the reported securities they hold and may not revoke that delegation on less than 61 days' notice, RACHF and RACNF disclaim beneficial ownership of the securities under Section 13(d) of the Exchange Act. As managers of RA Capital, Dr. Kolchinsky and Mr. Shah may be deemed beneficial owners, for purposes of Section 13(d) of the Exchange Act. As managers of Vor beneficially owned by RA Capital. RA Capital, Dr. Kolchinsky and Mr. Shah disclaim beneficial ownership of the securities reported herein.

PLAN OF DISTRIBUTION

We are registering the offer and sale of the Shares from time to time by the selling stockholder. We will not receive any of the proceeds from the sale by the selling stockholder of the Shares.

The term "selling stockholder" includes donees, pledgees, transferees or other successors in interest selling securities received after the date of this prospectus from the selling stockholder as a gift, pledge, partnership distribution or other transfer. The selling stockholder will act independently of us in making decisions with respect to the timing, manner and size of each sale. Such sales may be made on the principal trading market for our common stock or any other stock exchange, market or trading facility on which our common stock is traded or in private transactions. These sales may be at fixed or negotiated prices. A selling stockholder may use any one or more of the following methods when selling securities:

- ordinary brokerage transactions and transactions in which the broker dealer solicits purchasers;
- block trades in which the broker dealer will attempt to sell the common stock as agent but may position and resell a portion of the block as principal to facilitate the transaction;
- purchases by a broker dealer as principal and resale by the broker dealer for its account;
- an exchange distribution in accordance with the rules of the applicable exchange;
- privately negotiated transactions;
- settlement of short sales;
- distribution to employees, members, limited partners or stockholders of the selling stockholders;
- in transactions through broker dealers that agree with the selling stockholder to sell a specified number of such common stock at a stipulated price per security;
- through the writing or settlement of options or other hedging transactions, whether through an options exchange or otherwise;
- by pledge to secured debts and other obligations;
- delayed delivery arrangements;
- to or through underwriters or broker-dealers;
- in "at the market" offerings, as defined in Rule 415 under the Securities Act, at negotiated prices, at prices prevailing at the time of sale or at prices related to such prevailing market prices, including sales made directly on a national securities exchange or sales made through a market maker other than on an exchange or other similar offerings through sales agents;
- in privately negotiated transactions;
- in options transactions;
- a combination of any such methods of sale; or
- any other method permitted pursuant to applicable law.

The selling stockholder may also sell the shares of our common stock under Rule 144 or any other exemption from registration under the Securities Act, if available, rather than under this prospectus.

In addition, a selling stockholder that is an entity may elect to make a pro rata in-kind distribution of securities to its members, partners or stockholders pursuant to the registration statement of which this prospectus is a part by delivering a prospectus with a plan of distribution. Such members, partners or stockholders would thereby receive freely tradeable securities pursuant to the distribution through a registration statement. To the

extent a distribute is our affiliate (or to the extent otherwise required by law), we may, at our option, file a prospectus supplement in order to permit the distributes to use the prospectus to resell the securities acquired in the distribution.

Broker-dealers engaged by the selling stockholder may arrange for other brokers-dealers to participate in sales. Broker-dealers may receive commissions or discounts from the selling stockholder (or, if any broker-dealer acts as agent for the purchaser of our common stock, from the purchaser) in amounts to be negotiated, but, except as set forth in a supplement to this prospectus, in the case of an agency transaction not in excess of a customary brokerage commission in compliance with Financial Industry Regulatory Authority ("FINRA") Rule 5110; and in the case of a principal transaction a markup or markdown in compliance with FINRA Rule 2121.

To the extent required, this prospectus may be amended or supplemented from time to time to describe a specific plan of distribution. In connection with the sale of our common stock or interests therein, the selling stockholder may enter into hedging transactions with broker-dealers or other financial institutions, which may in turn engage in short sales of our common stock in the course of hedging the positions they assume. The selling stockholder may also sell our common stock short and deliver these shares to close out their short positions, or loan or pledge the securities to broker-dealers that in turn may sell these shares. The selling stockholder may also enter into option or other transactions with broker-dealers or other financial institutions or create one or more derivative securities which require the delivery to such broker-dealer or other financial institution of securities offered by this prospectus, which securities such broker-dealer or other financial institution, and, upon a default, such broker-dealer or other financial institution, may effect sales of the pledged securities pursuant to this prospectus (as supplemented or amended to reflect such transaction).

In effecting sales, broker-dealers or agents engaged by the selling stockholder may arrange for other broker-dealers to participate. Broker-dealers or agents may receive commissions, discounts or concessions from the selling stockholder in amounts to be negotiated immediately prior to the sale.

Any broker-dealers or agents that are involved in selling the securities may be deemed to be "underwriters" within the meaning of the Securities Act in connection with such sales. In such event, any commissions received by such broker-dealers or agents and any profit on the resale of the shares of our common stock purchased by them may be deemed to be underwriting commissions or discounts under the Securities Act. The selling stockholder has informed us that it does not have any written or oral agreement or understanding, directly or indirectly, with any person to distribute the shares of our common stock.

We are required to pay certain fees and expenses incurred by us incident to the registration of the shares of our common stock. We and the selling stockholder have agreed to indemnify each other against certain losses, claims, damages and liabilities, including liabilities under the Securities Act.

The resale securities will be sold only through registered or licensed brokers or dealers if required under applicable state securities laws. In addition, in certain states, the resale securities covered hereby may not be sold unless they have been registered or qualified for sale in the applicable state or an exemption from the registration or qualification requirement is available and is complied with.

Under applicable rules and regulations under the Exchange Act, any person engaged in the distribution of the resale shares of our common stock may not simultaneously engage in market making activities with respect to our common stock for the applicable restricted period, as defined in Regulation M, prior to the commencement of the distribution. In addition, the selling stockholder will be subject to applicable provisions of the Exchange Act and the rules and regulations thereunder, including Regulation M, which may limit the timing of purchases and sales of our common stock by the selling stockholder or any other person. We will make copies of this

prospectus available to the selling stockholder and have informed them of the need to deliver a copy of this prospectus to each purchaser at or prior to the time of the sale (including by compliance with Rule 172 under the Securities Act).

At the time a particular offer of securities is made, if required, a prospectus supplement will be distributed that will set forth the number of securities being offered and the terms of the offering, including the name of any underwriter, dealer or agent, the purchase price paid by any underwriter, any discount, commission and other item constituting compensation, any discount, commission or concession allowed or reallowed or paid to any dealer, and the proposed selling price to the public.

LEGAL MATTERS

Cooley LLP, New York, New York, will pass upon the validity of the shares of common stock offered hereby.

EXPERTS

The consolidated financial statements of Vor Biopharma Inc. appearing in Vor's Annual Report on Form 10-K for the year ended December 31, 2021 have been audited by Ernst & Young LLP, independent registered public accounting firm, as set forth in their report thereon, included therein, and incorporated herein by reference. Such consolidated financial statements are incorporated herein by reference in reliance upon such report given on the authority of such firm as experts in accounting and auditing.

WHERE YOU CAN FIND ADDITIONAL INFORMATION

This prospectus is part of a registration statement we filed with the SEC. This prospectus does not contain all of the information set forth in the registration statement and the exhibits to the registration statement. For further information with respect to us and the securities we are offering under this prospectus, we refer you to the registration statement and the exhibits and schedules filed as a part of the registration statement. You should rely only on the information contained in this prospectus or incorporated by reference in this prospectus. We have not authorized anyone else to provide you with different information. We are not making an offer of these securities in any state where the offer is not permitted. You should not assume that the information in this prospectus is accurate as of any date other than the date on the front page of this prospectus, regardless of the time of delivery of this prospectus or any sale of the securities offered by this prospectus.

We file annual, quarterly and current reports, proxy statements and other information with the SEC. The SEC maintains a website that contains reports, proxy statements and other information regarding issuers that file electronically with the SEC, including Vor. The address of the SEC website is www.sec.gov.

We maintain a website at www.vorbio.com. Information contained in or accessible through our website does not constitute a part of this prospectus and is not incorporated by reference in this prospectus. We have included our website address as an inactive textual reference only.

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, while information that we file later with the SEC will automatically update and supersede the information in 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 (Commission File No. 001-39979):

- our Annual Report on Form 10-K for the year ended December 31, 2021, filed with the SEC on March 14, 2022;
- our Quarterly Reports on Form 10-Q filed with the SEC on May 12, 2022, August 11, 2022 and November 10, 2022;

- our Current Reports on Form 8-K filed with the SEC on <u>April 14, 2022</u>, <u>June 17, 2022</u>, <u>December 7, 2022</u> and <u>December 7, 2022</u> (to the extent the information in such reports is filed and not furnished);
- our <u>Definitive Proxy Statement on Schedule 14A</u>, filed with the SEC on April 28, 2022 (other than the portions thereof that are furnished and not filed); and
- the description of our common stock contained in our Registration Statement on Form 8-A, filed with the SEC on February 1, 2021, including any amendments or reports filed for the purposes of updating this description.

All filings filed by us pursuant to the Exchange Act after the date of the initial filing of the registration statement of which this prospectus is a part and prior to effectiveness of the registration statement shall be deemed to be incorporated by reference into this prospectus.

We also incorporate by reference any future filings (other than current reports furnished under Item 2.02 or Item 7.01 of Form 8-K and exhibits filed on such form that are related to such items unless such Form 8-K expressly provides to the contrary) made with the SEC pursuant to Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act, including those made after the date of the initial filing of the registration statement of which this prospectus is a part and prior to effectiveness of such registration statement, until we file a post-effective amendment that indicates the termination of the offering of the shares of our common stock made by this prospectus and will become a part of this prospectus. Any statements in any such future filings will automatically be deemed to modify and supersede any information in any document we previously filed with the SEC that is incorporated or deemed to be incorporated herein by reference to the extent that statements in the later filed document modify or replace such earlier statements.

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

Vor Biopharma Inc. Attn: Investor Relations 100 Cambridgepark Drive, Suite 101 Cambridge, Massachusetts 02140 (617) 655-6580

11,627,907 Shares



Common Stock

PRELIMINARY PROSPECTUS

PART II INFORMATION NOT REQUIRED IN THE PROSPECTUS

Item 14. Other Expenses of Issuance and Distribution

The following table sets forth an estimate of the fees and expenses payable by us in connection with the sale of the securities being registered.

	Amount
SEC registration fees	\$ 8,572.53
FINRA filing fees	_
Accounting fees and expenses	—
Legal fees and expenses	
Miscellaneous fees and expenses	—
Total	\$ 8,572.53

Item 15. Indemnification of Directors and Officers

We are incorporated under the laws of the State of Delaware. Section 102 of the DGCL permits a corporation to eliminate the personal liability of directors of a corporation to the corporation or its stockholders for monetary damages for a breach of fiduciary duty as a director, except where the director breached his or her duty of loyalty, failed to act in good faith, engaged in intentional misconduct or knowingly violated a law, authorized the payment of a dividend or approved a stock repurchase in violation of Delaware corporate law or obtained an improper personal benefit.

Section 145 of the DGCL provides that a corporation has the power to indemnify a director, officer, employee or agent of the corporation and certain other persons serving at the request of the corporation in related capacities against expenses (including attorneys' fees), judgments, fines and amounts paid in settlements actually and reasonably incurred by the person in connection with an action, suit or proceeding to which he or she is or is threatened to be made a party by reason of such position, if such person acted in good faith and in a manner he or she reasonably believed to be in or not opposed to the best interests of the corporation, and, in any criminal action or proceeding, had no reasonable cause to believe his or her conduct was unlawful, except that, in the case of actions brought by or in the right of the corporation unless and only to the extent that the Court of Chancery or other adjudicating court determines that, despite the adjudication of liability but in view of all of the circumstances of the case, such person is fairly and reasonably entitled to indemnity for such expenses which the Court of Chancery or such other court shall deem proper.

As permitted by the DGCL, our Restated Certificate and Bylaws provide that: (i) we are required to indemnify our directors to the fullest extent permitted by the DGCL; (ii) we may, in our discretion, indemnify our officers and employees when determined appropriate by our board of directors; (iii) we are required, upon satisfaction of certain conditions, to advance expenses incurred by our directors in advance of the final disposition of any action or proceeding; (iv) we are permitted to secure insurance on behalf of any officer, director, employee or other agent for any liability arising out of his or her actions in that capacity regardless of whether we would otherwise be permitted to indemnify him or her under the provisions of Delaware law; and (v) we are authorized to enter into indemnification agreements with our directors, officers, employees and agents.

We have entered into agreements with our directors and executive officers that require us to indemnify them against expenses including, among other things, attorneys' fees, judgments, fines and settlement amounts incurred by any of these individuals in any action or proceeding, whether actual or threatened, to which such person may be made a party by reason of the fact that such person is or was a director or officer of us or any of our affiliates, provided such person acted in good faith and in a manner such person reasonably believed to be in, or not opposed to, our best interests. The indemnification agreements also set forth certain procedures that will apply in the event of a claim for indemnification thereunder. At present, no litigation or proceeding is pending

that involves any of our directors or officers regarding which indemnification is sought, nor are we aware of any threatened litigation that may result in claims for indemnification.

We maintain a directors' and officers' liability insurance policy. The policy insures directors and officers against unindemnified losses arising from certain wrongful acts in their capacities as directors and officers and reimburses us for those losses for which we have lawfully indemnified the directors and officers. The policy contains various exclusions.

Item 16. Exhibits

Exhibit		Incorporated by Reference			
Number	Description	Form	File Number	Exhibit	Filing Date
4.1	Amended and Restated Certificate of Incorporation of the Registrant	8-K	001-39979	3.1	February 9, 2021
4.2	Amended and Restated Bylaws of the Registrant	8-K	001-39979	3.2	February 9, 2021
5.1*	Opinion of Cooley LLP				
23.1*	Consent of Cooley LLP (included in Exhibit 5.1)				
23.2*	Consent of Ernst & Young LLP, independent registered public accounting firm				
24.1*	Power of Attorney (included on the signature page of this registration statement)				
107*	Filing Fee Table				

* Filed herewith.

Item 17. Undertakings

The undersigned registrant hereby undertakes:

(1) To file, during any period in which offers or sales are being made, a post-effective amendment to this registration statement:

(i) to include any prospectus required by Section 10(a)(3) of the Securities Act of 1933;

(ii) 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 a 20% change in the maximum aggregate offering price set forth in the "Calculation of Registration Fee" table in the effective registration statement; and

(iii) 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.

Provided, however, that paragraphs (1)(i), (1)(ii) and (1)(iii) 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 15(d) of the Securities Exchange Act of 1934 that are incorporated by reference in the registration statement, or is contained in a form of prospectus filed pursuant to Rule 424(b) that is part of the registration statement.

(2) That, for the purpose of determining any liability under the Securities Act of 1933, 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.

(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.

(4) That, for the purpose of determining liability under the Securities Act of 1933 to any purchaser:

(i) 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; and

(ii) Each prospectus required to be filed pursuant to Rule 424(b)(2), (b)(5), or (b)(7) as part of a registration statement in reliance on Rule 430B relating to an offering made pursuant to Rule 415(a)(1)(i), (vii), or (x) for the purpose of providing the information required by Section 10(a) of the Securities Act of 1933 shall be deemed to be part of and included in the registration statement as of the earlier of the date such form of prospectus is first used after effectiveness or the date of the first contract of sale of securities in the offering described in the prospectus. As provided in Rule 430B, for liability purposes of the issuer and any person that is at that date an underwriter, such date shall be deemed to be a new effective date of the registration statement relating to the securities in the registration statement to which that prospectus relates, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof. Provided, however, that no statement made in a registration statement or prospectus that is part of 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 effective date, 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 effective date.

(5) 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 (§230.430A of this chapter), 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 modify any statement that was made in the registration statement or prospectus that was part of the registration statement or prospectus that was part of the registration statement or prospectus that was made in the registration statement or prospectus that was part of the registration statement or prospectus that was made in the registration statement or prospectus that was part of the registration statement or prospectus that was part of the registration statement or prospectus that was part of the registration statement or prospectus that was part of the registration statement or prospectus that was part of 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.

(6) That, for the purpose of determining liability of the registrant under the Securities Act of 1933, each filing of the registrant's annual report pursuant to Section 13(a) or Section 15(d) of the Securities Exchange Act of 1934 (and, where applicable, each filing of an employee benefit plan's annual report pursuant to section 15(d) of the Securities Exchange Act of 1934) 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.

(7) Insofar as indemnification for liabilities arising under the Securities Act of 1933 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, 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 whether such indemnification by it is against public policy as expressed in the Securities Act of 1933 and will be governed by the final adjudication of such issue.

SIGNATURES

Pursuant to the requirements of the Securities Act of 1933, the registrant certifies that it has reasonable grounds to believe that it meets all of the requirements for filing on Form S-3 and has duly caused this registration statement to be signed on its behalf by the undersigned, thereunto duly authorized, in the City of Cambridge, Commonwealth of Massachusetts, on December 14, 2022.

VOR BIOPHARMA INC.

By: /s/ Robert Ang

Robert Ang, M.B.B.S. President and Chief Executive Officer

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each of the persons whose names appear below constitutes and appoints Robert Ang and Nathan Jorgensen, and each of them, such person's true and lawful attorney in fact and agent, with full power of substitution and re-substitution, for such person and in his or her name, place and stead, in any and all capacities, to execute any and all amendments (including post-effective amendments) to this Registration Statement (or any other registration statement for the same offering that is to be effective upon filing pursuant to Rule 462(b) under the U.S. Securities Act of 1933), and to file the same, together with all exhibits thereto, and other documents in connection therewith, with the U.S. Securities and Exchange Commission, and such other agencies, offices and persons as may be required by applicable law, granting unto said attorney in fact and agent, full power and authority to do and perform each and every act and thing requisite or necessary to be done in and about the premises, as fully to all intents and purposes as such person might or could do in person, hereby ratifying and confirming all that each said attorney-in-fact and agent may lawfully do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Act of 1933, this registration statement has been signed by the following persons in the capacities and on the dates indicated.

/s/ Robert Ang Robert Ang, M.B.B.S	<u>Title</u> President, Chief Executive Officer and Director (<i>Principal Executive Officer</i>)	Date December 14, 2022
/s/ Nathan Jorgensen Nathan Jorgensen, Ph.D.	Chief Financial Officer (Principal Financial Officer and Principal Accounting Officer)	December 14, 2022
/s/ Matthew Patterson Matthew Patterson	Chairman of the Board	December 14, 2022
/s/ Daniella Beckman Daniella Beckman	Director	December 14, 2022
/s/ David C. Lubner David C. Lubner	Director	December 14, 2022
/s/ Sven (Bill) Ante Lundberg Sven (Bill) Ante Lundberg, M.D.	Director	December 14, 2022
/s/ Kush M. Parmar Kush M. Parmar, M.D., Ph.D.	Director	December 14, 2022
/s/ Joshua Resnick Joshua Resnick, M.D.	Director	December 14, 2022



Divakar Gupta +1 212 479 6474 dgupta@cooley.com

December 14, 2022

Vor Biopharma Inc. 100 Cambridgepark Drive, Suite 101 Cambridge, Massachusetts 02140

Ladies and Gentlemen:

We have acted as counsel to Vor Biopharma Inc., a Delaware corporation (the "*Company*"), in connection with the filing of a Registration Statement on Form S-3 (the "*Registration Statement*") by the Company under the Securities Act of 1933, as amended, covering the resale by the selling stockholder of 11,627,907 shares (the "*Shares*") of the Company's common stock, \$0.0001 par value per share, acquired pursuant to a Securities Purchase Agreement, dated December 7, 2022, by and between the Company and RA Capital Healthcare Fund, L.P. (the "*Agreement*").

In connection with this opinion, we have examined and relied upon the Registration Statement and related prospectus, the Company's certificate of incorporation, and bylaws, each as currently in effect, the Agreement and such other documents, records, certificates, memoranda and other instruments as in our judgment are necessary or appropriate to enable us to render the opinion expressed below. We have assumed the genuineness of all signatures, the authenticity of all documents submitted to us as originals, the conformity to originals of all documents submitted to us as copies, the accuracy, completeness and authenticity of certificates of public officials and the due authorization, execution and delivery of all documents by all persons other than the Company where authorization, execution and delivery are prerequisites to the effectiveness thereof. As to certain factual matters, we have relied upon a certificate of an officer of the Company and have not independently verified such matters.

Our opinion is expressed only with respect to the General Corporation Law of the State of Delaware. We express no opinion to the extent that any other laws are applicable to the subject matter hereof. We are not rendering any opinion as to compliance with any federal or state antifraud law, rule or regulation relating to securities, or to the sale or issuance thereof.

On the basis of the foregoing, and in reliance thereon, we are of the opinion that the Shares are validly issued, fully paid and nonassessable.

Our opinion is limited to the matters stated herein and no opinion is implied or may be inferred beyond the matters expressly stated. Our opinion is based on these laws as in effect on the date hereof, and we disclaim any obligation to advise you of facts, circumstances, events or developments which hereafter may be brought to our attention and which may alter, affect or modify the opinion expressed herein.

We consent to the reference to our firm under the caption "Legal Matters" in the prospectus included in the Registration Statement and to the filing of this opinion as an exhibit to the Registration Statement. In giving such consent, we do not thereby admit that we are in the category of persons whose consent is required under Section 7 of the Securities Act pr 1933, as amended, or the rules and regulations of the Securities Exchange Commission thereunder.

Sincerely,

Cooley LLP

By: /s/ Divakar Gupta

Divakar Gupta

Cooley LLP 55 Hudson Yards New York, New York 10001-2157 t: (212) 479-6000 f: (212) 479-6275 cooley.com

Consent of Independent Registered Public Accounting Firm

We consent to the reference to our firm under the caption "Experts" in the Registration Statement (Form S-3) and related Preliminary Prospectus of Vor Biopharma Inc. for the registration of 11,627,907 shares of its common stock and to the incorporation by reference therein of our report dated March 14, 2022, with respect to the consolidated financial statements of Vor Biopharma Inc. included in its Annual Report (Form 10-K) for the year ended December 31, 2021, filed with the Securities and Exchange Commission.

/s/ Ernst & Young LLP

Boston, Massachusetts December 14, 2022

Calculation of Filing Fee Tables

Form S-3 (Form Type)

Vor Biopharma Inc. (Exact Name of Registrant as Specified in its Charter)

Table 1: Newly Registered Securities

	Security Type	Security Class Title	Fee Calculation Rule	Amount Registered(1)	Proposed Maximum Offering Price Per Share	Maximum Aggregate Offering Price	Fee Rate	Amount of Registration Fee
Fees to Be Paid	Equity	Common Stock, \$0.0001 par value per share	457(c)	11,627,907	\$6,69(2)	\$77,790,697.83(1)	0.0001102	\$8,572.53
	1	Total Offering Amounts				\$77,790,697.83		\$8,572.53
		Total Fees Previously Paid						—
		Total Fee Offsets						—
		Net Fees Due						\$8,572.53

(1) Represents the shares of common stock, \$0.0001 par value per share (the "common stock"), of Vor Biopharma Inc. (the "Registrant") that will be offered for resale by the selling stockholder pursuant to the prospectus to which this exhibit is attached. Pursuant to Rule 416 under the Securities Act of 1933, as amended (the "Securities Act"), the shares being registered hereunder include such indeterminate number of additional shares of common stock as may be issuable as a result of stock splits, stock dividends or similar transactions with respect to the shares being registered hereunder.

(2) This estimate is made pursuant to Rule 457(c) of the Securities Act solely for purposes of calculating the registration fee. The price per share and aggregate offering price are based upon the average of the high and low prices of the Registrant's common stock on December 9, 2022, as reported on the Nasdaq Global Select Market.