

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

AMENDMENT NO. 3
TO
FORM S-1
REGISTRATION STATEMENT

UNDER
THE SECURITIES ACT OF 1933

ALOPEXX, INC.

(Exact name of Registrant as specified in its charter)

Delaware
(State or other jurisdiction of
incorporation or organization)

2836
(Primary Standard Industrial
Classification Code Number)

86-3959763
(I.R.S. Employer
Identification Number)

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(617) 780-1598

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

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Approximate date of commencement of proposed sale to the public: **As soon as practicable after this Registration Statement is declared effective.**

If any of the securities being registered on this form are to be offered on a delayed or continuous basis pursuant to Rule 415 under the Securities Act of 1933, check the following box. ☒

If this form is filed to register additional securities for an offering pursuant to Rule 462(b) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. ☐

If this form is a post-effective amendment filed pursuant to Rule 462(c) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. ☐

If this form is a post-effective amendment filed pursuant to Rule 462(d) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. ☐

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 ☐
Non-accelerated filer ☒

Accelerated filer ☐
Smaller reporting company ☒
Emerging growth company ☒

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 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 which specifically states that this Registration Statement shall thereafter become effective in accordance with Section 8(a) of the Securities Act of 1933 or until the Registration Statement shall become effective on such date as the Commission, acting pursuant to said Section 8(a), may determine.

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

PRELIMINARY PROSPECTUS

SUBJECT TO COMPLETION

DATED MAY 2, 2022

Shares
Common Stock

ALOPEXX, Inc.

Alopexx, Inc.

This is a firm commitment initial public offering of shares of common stock of Alopexx, Inc. Prior to this offering, there has been no public market for our common stock. We anticipate that the initial public offering price of our shares will be between \$ and \$.

We have applied to have our common stock listed on The Nasdaq Capital Market under the symbol “ALPX”.

We are an “emerging growth company” as defined under the federal securities laws and, as such, we have elected to comply with certain reduced public company reporting requirements for this prospectus and may elect to do so in future filings.

Investing in our common stock involves a high degree of risk. Before buying any shares, you should carefully read the discussion of the material risks of investing in our common stock under the heading “Risk Factors” beginning on page 13 of this prospectus.

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

	Per Share	Total
Initial Public Offering Price	\$	\$
Underwriters Discounts and Commissions ⁽¹⁾	\$	\$
Proceeds before expenses, to us	\$	\$

(1) Underwriting discounts and commissions do not include a non-accountable expense allowance equal to % of the initial public offering price payable to the underwriters. We refer you to “Underwriting” beginning on page 160 for additional information regarding underwriters’ compensation.

We have granted a 45-day option to the underwriters to purchase up to additional shares of common stock solely to cover over-allotments, if any.

The underwriters expect to deliver the shares to purchasers on or about , 2022.

ThinkEquity

The date of this prospectus is , 2022

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Neither we nor the underwriters have authorized anyone to provide you with information other than that contained in this prospectus, or any free writing prospectus prepared by or on behalf of us or to which we have referred you. We and the underwriters take no responsibility for and can provide no assurance as to the reliability of, any other information that others may give you. We and the underwriters are offering to sell, and seeking offers to buy, common stock only in jurisdictions where offers and sales are permitted. The information contained in this prospectus, or any free writing prospectus is accurate only as of its date, regardless of its time of delivery or of any sale of shares of our common stock. Our business, financial condition, results of operations and prospects may have changed since that date.

For investors outside of the United States: We have not, and the underwriters have not, done anything that would permit this offering or possession or distribution of this prospectus in any jurisdiction where action for that purpose is required, other than the United States. Persons outside of the United States who come into possession of this prospectus must inform themselves about, and observe any restrictions relating to, the offering of the shares of common stock and the distribution of this prospectus outside of the United States.

PROSPECTUS SUMMARY

This summary highlights selected information contained elsewhere in this prospectus. 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, including the sections entitled “Risk Factors” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and our financial statements and the related notes included elsewhere in this prospectus, before making an investment decision. Our fiscal year ends on December 31 of each year. Unless the context otherwise requires, all references in this prospectus to “we,” “us,” “our,” “our company” and “Alopexx” refer to Alopexx, Inc.

Overview

We are a clinical stage biotechnology company developing novel immune therapeutics for the prevention, treatment and mitigation of bacterial, fungal, and parasitic infections that express the antigenic target poly N-acetyl glucosamine (PNAG). That target has been found on an expanding number of pathogens. While the ultimate decision on the safety and efficacy of our therapeutics will be determined by the FDA and other health authorities, it is our management’s assessment that the broad-spectrum potential of our therapeutics will allow them to be used for the prevention, treatment, and mitigation of a wide range of infections. In a first-in-man trial, our vaccine candidate, AV0328, has been shown to be well tolerated with no serious adverse events observed. It was noted to induce protective antibodies against all PNAG-expressing pathogens tested. We believe our vaccine’s broad-spectrum potential will allow it to be used for the long-term prevention of a wide range of infections including pneumococcal pneumonia, methicillin-resistant *Staphylococcus aureus* (MRSA), meningitis, and sexually transmitted diseases. Similarly, our fully human monoclonal antibody, F598, that also targets PNAG, has been shown to be well tolerated and no serious adverse events were noted in phase 1 and pilot phase 2 trials. We believe it can provide immediate protection lasting 2-3 months. We seek to establish F598 as the standard of care for preventing and ameliorating gram-negative and gram-positive bacterial infections along with fungal infections by organisms that express PNAG in patients admitted to intensive care units (ICU). Utilization of these therapeutics also has potential applicability beyond infectious diseases, including treatment of neurological conditions and cognitive decline due to inflammation.

Our Lead Programs

To date over 75 separate pathogens have been found to express PNAG, including antimicrobial resistant (AMR) microbes. PNAG is a critical factor in pathogen survival and virulence (its ability to produce disease) and is used by bacteria to adhere to tissue and prostheses and to protect microbes from host immune defenses. Targeting PNAG offers the potential of creating the first broad-spectrum, anti-infective immune therapeutics. Our lead products are:

- **Vaccine AV0328** - a synthetic PNAG vaccine. A phase 1, first-in-man trial has been completed and the vaccine was found to be well tolerated, and no serious adverse events were observed. It induced antibodies that were capable of killing a wide range of PNAG-expressing pathogens. *In vitro* efficacy in killing was noted against every pathogen tested which included over 10 different microbial species. Based on those results, Alopexx proposed to the FDA that AV0328 be developed as a complement to currently approved *Streptococcus pneumoniae* vaccines (Pneumovax and Vaxneuvance). Those vaccines, including the recently approved versions, cover at best 23 of the 100 known *Streptococcus pneumoniae* serotypes. AV0328 could provide protection against many of the remaining 80+ serotypes. Feedback from the FDA supported pursuing accelerated approval of AV0328 based on safety in vaccinated humans and utilization of a validated surrogate assay – opsonic killing mediated by the antibodies induced by the vaccine. The FDA's Accelerated Approval Program allows for earlier approval of drugs that treat serious conditions based on a surrogate endpoint. A surrogate endpoint is a marker, such as a laboratory measurement, radiographic image, physical sign or other measure that is thought to predict clinical benefit, but is not itself a measure of clinical benefit. Management believes that this points to a development path comparable to those that have led to FDA approval of other vaccines for *Streptococcus pneumoniae* infections. However, our vaccine has not been approved by the FDA and there is no guarantee that the FDA will ultimately approve the vaccine.
- **Monoclonal antibody F598** - Phase 1 and pilot phase 2 trials of F598 have been completed. The antibody was found to be well tolerated, and no serious adverse events were observed. A single infusion was noted to provide sustained serum levels for 2-3 months. Unlike vaccines which may take several weeks or longer to induce protective immunity, administration of a monoclonal antibody provides immediate protection. Therefore, the antibody will be utilized in settings where an individual is at an immediate or near-term risk of developing an infection. Hospital-associated infections are one of the major settings where this occurs. Monoclonal antibody F598 will not replace antibiotics but will instead complement and augment their efficacy and by doing so reduce the development of antibiotic resistant organisms. Use of monoclonal antibody F598 in that setting offers the potential for it to become the first broad-spectrum therapeutic antibody. We will study this in a setting where the prevalence of acquired infections is very high – intensive care units. Demonstrating that monoclonal antibody F598 can reduce the morbidity/mortality related to microbial infections in ICU patients would constitute a major health advancement. We believe it would establish administration of F598 as part of the standard of care in that setting

The immune-mediated anti-infective therapeutics being developed by Alopexx are unique. In the view of our management, no other immune therapeutics offer such broad-spectrum potential. The initial target indications being pursued will permit development of anti-PNAG therapeutics in a focused fashion and, if successful, will establish Alopexx's therapeutic platform to prevent and treat a wide range of disorders.

Our Pipeline

Alopexx Pipeline

Compound	Indication	Discovery	Pre-Clinical	Phase I	Phase II	Phase III
F598	ICU Infections					
F598	Prevention of infection after Emergency Abdominal Surgery/Abdominal Trauma					
AV0328	<i>S. pneumoniae</i> infections					
AV0328	Meningococcal infections					

As illustrated in the table above, we believe that both monoclonal antibody F598 and vaccine AV0328 can be developed for multiple indications. Beyond the initial indications detailed in this prospectus, clinical and pre-clinical data would support pursuing additional indications.

The completed phase 1 and pilot phase 2 trials of F598 justify the planned study to reduce the morbidity/mortality related to microbial infections in ICU patients. In addition, those studies can also be used to justify pursuing another indication where microbial infections are a significant concern - following emergency abdominal surgery.

A similar approach is envisioned for vaccine AV0328. While the initial focus will be as a complement to currently approved *Streptococcus pneumoniae* vaccines, serologic results in the phase 1 trial would also support developing the vaccine for meningococcal infections as well. In addition, as detailed below, ongoing pre-clinical research has noted the role of bacteria in the pathogenesis of Alzheimer's Disease and Type 1 Diabetes mellitus. Vaccination against PNAG in murine models has resulted in reduction in the development of diabetes and in other studies prevents behavioral and cognitive decline in preclinical mouse models of Alzheimer's disease. Those results support the possible utility of our vaccine in those settings as well.

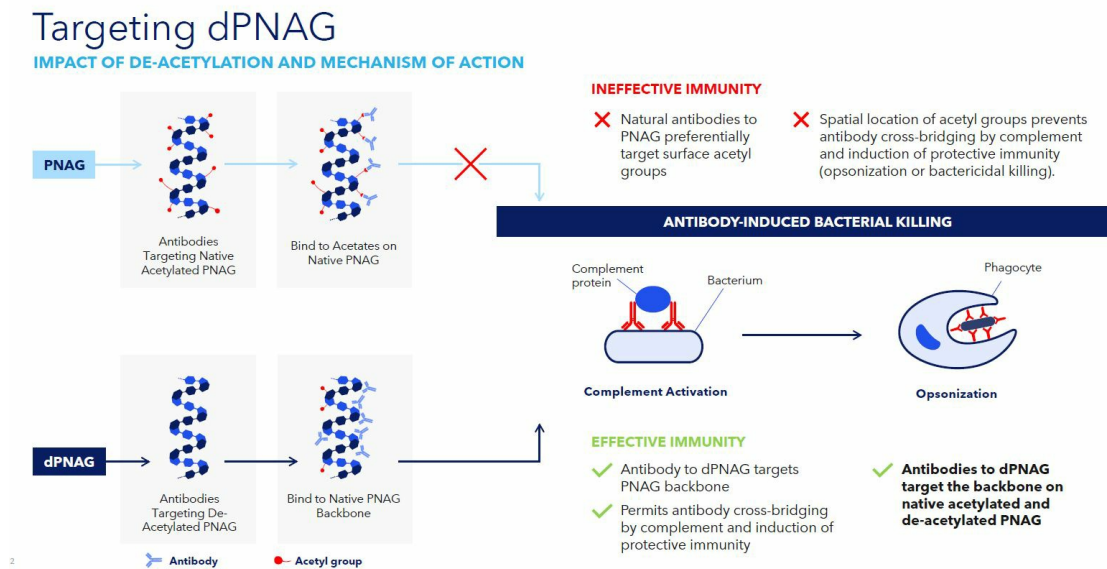
Beyond the broader indications mentioned above, use of the antibody may be effective in patients with an underlying immunodeficiency – specifically B cell deficiencies. B-cells are the immune cells that are involved with the humoral or antibody response. There are a number of conditions where patients are unable to produce a sufficient or any antibody in response to a pathogen. These disorders can be inherited (common variable Immunodeficiency, X-linked agammaglobulinemia, severe combined immunodeficiency) or associated with immunosuppressed population (cancer, transplant, treatment for autoimmune or inflammatory diseases, AIDS/HIV). In those cases, providing a fully functional antibody that could target a wide range of pathogens could treat or prevent the development of infections.

Our Science

For microbial pathogens, surface capsules, often composed of highly varied carbohydrate polymers, have been used successfully to vaccinate humans against *Streptococcus pneumoniae*, *Hemophilus influenzae type b*, *Neisseria meningitidis* and *Salmonella enterica serovar typhi*. However, efficacy is limited to the capsule types included in the vaccines. The PNAG polysaccharide is different. It has been found to be a component of the microbial surfaces of a large and expanding number of bacterial, fungal and parasitic pathogens. Beyond its wide distribution, another key component of PNAG, as a target antigen, is its critical role in virulence--the ability to cause an infection. Bacterial strains such as *S. aureus* that are genetically manipulated so they cannot produce PNAG have been found to have a significantly reduced ability to cause infections in mice. Laboratory studies have shown that loss of PNAG production decreases a given microbe's virulence. The synthesis of PNAG by all of these types of pathogens suggests an important role for this molecule in microbial biology. This indicates that PNAG could serve as a therapeutic target against many different microbes.

Natural antibodies to PNAG are common in humans and many animal species but these antibodies do not routinely have robust opsonic killing or immune protection against PNAG-producing microbes. This is due to inadequate engagement of the serum complement co-factor system that is needed for the induction of protective immunity. Thus, broad-based immunity to this antigen rarely develops naturally in human or animal populations. Naturally occurring microbial colonization or infection does not usually induce effective antibody responses to PNAG.

Alopexx's major proprietary advance was the recognition that this ineffective natural immunity was due to the high degree of acetylation of the native PNAG molecule. As illustrated in the figure below, natural PNAG has many acetyl groups on its surface. Those surface acetyl groups are responsible for inducing a natural but ineffective immune response. The acetyl groups can be removed by chemically altering PNAG. This results in a strong protective immunogen that now targets the backbone of PNAG and avoids participation from the acetyl groups. As illustrated in the figure below, targeting the backbone of PNAG leads to the induction of antibody-mediated bacterial killing. Alopexx's vaccine and antibody target the backbone on native PNAG and provide an effective immune response.



Our Market

We have performed independent commercial assessments for the initial indications that we intend to pursue use of the vaccine as a complement to currently approved *Streptococcus pneumoniae* vaccines and reducing the morbidity/mortality related to microbial infections in ICU patients for the antibody.

For the vaccine, the assumption was that AV0328 would be added as a complement to current *Streptococcus pneumoniae* vaccines. The relevant population would be the same adult and pediatric patients who currently receive approved *Streptococcus pneumoniae* vaccines, Prevnar and Pneumovax. Our initial target market segment included adults who had received existing pneumococcal vaccines and *de novo* pneumococcal vaccines and pediatric patients who receive such vaccines. The expected global revenue for the *Streptococcus pneumoniae* indication alone is expected to be over \$2 billion per year.

For the antibody the initial indication would be for the prevention and/or mitigation of hospital-associated infections in ICU patients. In the United States there are approximately 5 million ICU admissions per year (including pediatric patients). Our goal is that F598 would be added to the existing standard of care. In the market analysis we performed we considered adults discharged from the ICU with MRSA (methicillin resistant *Staphylococcus aureus*) colonization using a base case of 15%. We applied the same to the EU5 and Canada. Based on those assumptions peak sales were estimated to be \$2.3 billion per year.

If our monoclonal antibody is approved for the prevention and/or mitigation of hospital-associated infections in ICU patients, we believe it would be difficult for hospitals not to use it as part of the standard of care. Such approval would be based on the Alopexx monoclonal antibody demonstrating increased anti-infective efficacy in the ICU setting where antibiotics and anti-fungal drugs are routinely administered. Utilization of mAb F598 is unlikely to encounter the same adoption issues as the introduction and use of newer antibiotics, as it will augment prevention and treatment of infections in a clinically- and cost-effective manner. Newer antibiotics, such as those targeting AMR infections, retain their effectiveness only if they are used sparingly to avoid, as long as possible, microbial resistance to those newer agents. Because Alopexx's long-lasting, anti-infective immune therapeutics are not associated with the development of resistance and can be added to improve on the current standards of care, we believe objections to employing them will be low.

Our Strategy

The broad distribution of PNAG allows for an expansive range of microbial targets and disease indications to be targeted by Alopexx's immunotherapeutics. The products we have developed permit us to explore and develop the vaccine and monoclonal antibody to prevent or treat a wide range of disorders caused by PNAG-expressing organisms. These can be divided into two broad categories – specific microbial infections such as a Staph infection and diseases where PNAG-containing factors derived from the microbiota (microbes normally found in and on our body surfaces) have been implicated in driving disease progression. Our goal is to develop a broad-spectrum, non-antibiotic therapeutic platform for the prevention and treatment of microbial infections.

These anti-infective immune therapeutics represent a potential paradigm shift in the prevention, treatment, and amelioration of many microbial infections. In the view of our management, no other therapeutics offer such broad-spectrum potential that could target bacteria, fungi, and higher order microbial causes of infection. Anti-bacterial antibiotics and anti-fungal drugs must be administered frequently and over periods of days to months, whereas antibodies induced by the vaccine or administered as a monoclonal antibody are injected once or twice months apart and remain at high levels for 2-12 months. The Alopexx immunotherapeutics would be used in the same settings that antibiotics are used such as the intensive care unit, individuals undergoing surgery, people with suppressed immune systems and persons at high risk for microbial infections. This paradigm shift would be driven by the increased efficacy in reducing infections and costs due to effective immunity to PNAG. The Alopexx vaccine and monoclonal antibody could dramatically alter the way many infections are prevented and treated and significantly reduce reliance on antibiotics and the development of anti-microbial resistance.

The key elements of our strategic approach are the following:

- Develop vaccine AV0328 as a complement to currently approved *Streptococcus pneumoniae* vaccines (Prevnar, Pneumovax and Vaxneuvance). Feedback from the FDA has supported pursuing accelerated approval of AV0328 based on safety in vaccinated humans and utilization of a validated surrogate assay – opsonic killing mediated by the antibodies induced by the vaccine. The FDA’s Accelerated Approval Program allows for earlier approval of drugs that treat serious conditions based on a surrogate endpoint. A surrogate endpoint is a marker, such as a laboratory measurement, radiographic image, physical sign or other measure that is thought to predict clinical benefit, but is not itself a measure of clinical benefit. Management believes that this points to a development path comparable to those that have led to FDA approval of other vaccines for *Streptococcus pneumoniae* infections. However, our vaccine has not been approved by the FDA and there is no guarantee that the FDA will ultimately approve the vaccine.
- Establish monoclonal antibody F598 as the standard of care for preventing and ameliorating gram-negative and gram-positive bacterial infections along with fungal infections by organisms that express PNAG in patients admitted to ICUs.
 - We have developed a collaboration with Europe’s largest health care system which has agreed to perform a 1600 patient phase 2 ICU study. The Assistance Publique–Hôpitaux de Paris (AP-HP) is the largest hospital system in Europe and one of the largest in the world. It provides health care, teaching, research and emergency medical services in 44 hospitals and sees more than 5.8 million patient visits annually.
- Collaborate with additional organizations in the hospital consortium arena and other pharmaceutical companies to advance our candidates
- Pursue the development of AV0328 and F598 for other bacterial infectious indications
- Enhance our intellectual property portfolio
- Establish scalable production of AV0328 and F598

These anti-infective immune therapeutics represent a potential paradigm shift in the prevention, treatment, and amelioration of many causes of microbial infections. This paradigm shift would be driven by the increased efficacy in reducing infections, costs due to effective immunity to PNAG, and a shift away from antibiotics. Our vaccine and monoclonal antibody could dramatically alter the reliance on antibiotics and the development of anti-microbial resistance would be dramatically reduced.

Intellectual Property

Our patent portfolio contains 4 patent families with coverage through 2040-2042. This includes both composition of matter and use patents. We have also exclusively licensed four issued U.S. and PCT patents from Brigham and Women’s Hospital. Those patents cover the vaccine and methods of use, the F598 monoclonal antibody and variants and the methods of use of the vaccine and/or the anti-PNAG antibody. We continue to seek to maximize the scope of our patent protection for all our programs. In addition to patents, synthesis of the PNAG oligosaccharide is covered by a trade secret agreement. The F598 monoclonal antibody is produced using a proprietary master cell bank.

Our Leadership Team

We have assembled an experienced management team with deep research, development, and commercialization experience in the areas of infectious diseases, immunotherapy as well as other medical areas - oncology, endocrinology, neurology, and rare diseases. They have held academic appointments at Harvard Medical School, Yale University School of Medicine, University of Pittsburgh and others. Members of our team bring experiences from multiple biotech and pharmaceutical companies including Pfizer, Boehringer Ingelheim, Pharmacia and Eli Lilly, among others.

Our Corporate Information

Our company was re-organized in June 2021 and is located at 186 Alewife Brook Pkwy #1068, Cambridge, MA 02138. The founders have been associated with the development of our technologies since they were originally licensed from Harvard in 2006 for the monoclonal antibody and 2011 for the vaccine. Our telephone number is (617) 780-1598. Our website address is <https://www.alopexx.com>. Information contained on, or that can be accessed through, our website is not incorporated by reference in this prospectus.

Risk Factors Summary

Our business is subject to a number of risks of which you should be aware of before making an investment decision. These risks are discussed more fully in the “*Risk Factors*” section of this prospectus immediately following this prospectus summary. Some of these risks include the following:

- We are in the early stages of clinical development and have a very limited operating history and no products approved for commercial sale, which may make it difficult for you to evaluate the success of our business to date and to assess our future viability.
- We anticipate that we will continue to incur substantial net losses for the foreseeable future and may never achieve or maintain profitability. Our stock is a highly speculative investment.
- Our history of recurring losses and anticipated expenditures raises substantial doubts about our ability to continue as a going concern. Our ability to continue as a going concern requires that we obtain sufficient funding to finance our operations.
- Even after this offering, we may require substantial additional funding to finance our operations. If we are unable to raise additional capital when needed, we could be forced to delay, reduce or terminate certain of our development programs or other operations.
- Our approach to the development of our vaccine and antibody candidates is based on novel technologies that are unproven, which may expose us to unforeseen risks and makes it difficult to predict the time and cost of vaccine candidate development and time to obtain regulatory approval.
- Approvals by the FDA and EMA for existing pneumococcal vaccines, such as Prevnar 13 and Pneumovax 23, may not be indicative of what these regulators may require for approval of our vaccine. For example, we expect to use opsonophagocytic killing (OPK) titers as the primary immunogenicity surrogate endpoint for the AV0328 program in adults because Prevnar 13 was approved based on the establishment of non-inferiority of serotype-specific OPK responses relative to Pneumovax 23; however, there can be no assurance that this streamlined non-inferiority approach will be sufficient for regulatory approval or that regulators will not require field efficacy trials.

- Our business is highly dependent on the success of AV0328 and F598, both of which are in the early stages of clinical development. If we are unable to obtain approval for AV0328 or F598 and effectively commercialize them, our business would be significantly harmed.
- Our primary competitors have significantly greater resources and experience than we do, which may make it difficult for us to successfully develop our vaccine, or may result in others discovering, developing or commercializing products before or more successfully than us.
- Our business could be adversely affected by the effects of health epidemics, including the evolving effects of the COVID-19 pandemic, in regions where we or third parties on which we rely have significant manufacturing facilities, concentrations of potential clinical trial sites or other business operations. The COVID-19 pandemic could materially affect our operations as well as the business or operations of our contract manufacturer or other third parties with whom we conduct business.
- We currently rely on third-party manufacturing and supply partners, including Lonza and Glycosyn to supply raw materials and components for, and manufacture, our vaccine and antibody candidates. Our inability to have sufficient quantities of our candidates manufactured, or our failure to comply with applicable regulatory requirements or to supply sufficient quantities at acceptable quality levels or prices, or at all, would materially and adversely affect our business.
- The FDA regulatory approval process is lengthy and time-consuming, and we may experience significant delays in the clinical development and regulatory approval of our vaccine.
- If we are unable to obtain and maintain patent protection for our technology and products, or if the scope of the patent protection obtained is not sufficiently broad, we may not be able to compete effectively in our markets.
- We have identified a material weakness in our internal control over financial reporting, and the failure to remediate this material weakness may adversely affect our business, investor confidence in our company, our financial results and the market value of our common stock.

Market and Industry Data

Unless otherwise indicated, information contained in this prospectus concerning our industry, competitive position and the markets in which we operate is based on information from independent industry and research organizations, other third-party sources and management estimates. Management estimates are derived from publicly available information released by independent industry analysts and other third-party sources, as well as data from our internal research, and are based on assumptions we made upon reviewing such data, and our experience in, and knowledge of, such industry and markets, which we believe to be reasonable. In addition, projections, assumptions and estimates of the future performance of the industry in which we operate and our future performance are necessarily subject to uncertainty and risk due to a variety of factors, including those described in “*Risk Factors*” and “*Special Note Regarding Forward-Looking Statements*.” These and other factors could cause results to differ materially from those expressed in the estimates made by the independent parties and by us.

Implications of Being an Emerging Growth Company

We qualify as an “emerging growth company” as defined in the Jumpstart Our Business Startups Act, or the JOBS Act. An emerging growth company may take advantage of reduced reporting requirements that are otherwise applicable to public companies. These provisions include, but are not limited to:

- not being required to comply for a certain period of time with the auditor attestation requirements of Section 404 of the Sarbanes Oxley Act of 2002, as amended;

- reduced disclosure obligations regarding executive compensation in our periodic reports, proxy statements and registration statements; and
- exemptions from the requirements of holding a stockholder advisory vote on executive compensation and any golden parachute payments not previously approved.

We will remain an emerging growth company until the earliest of (i) the last day of our first fiscal year in which we have total annual gross revenues of \$1.07 billion or more; (ii) the last day of our fiscal year following the fifth anniversary of the completion of this offering; (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 equity securities that is held by non-affiliates exceeds \$700.0 million; and (iv) the date on which we have issued more than \$1.0 billion in non-convertible debt securities during the prior three-year period.

We have elected to take advantage of certain of the reduced disclosure obligations in the registration statement of which this prospectus is a part and may elect to take advantage of other reduced reporting requirements in future filings. In addition, the JOBS Act provides that an emerging growth company can take advantage of an extended transition period for complying with new or revised accounting standards. This provision allows an emerging growth company to delay the adoption of some accounting standards until those standards would otherwise apply to private companies. We have elected to use the extended transition period for complying with new or revised accounting standards that have different effective dates for public and private companies until the earlier of the date that we are no longer an emerging growth company, or we affirmatively and irrevocably opt out of the extended transition period provided in the JOBS Act. However, as described in Note 2 to our financial statements included elsewhere in this prospectus, we early adopted certain accounting standards, as the JOBS Act does not preclude an emerging growth company from adopting a new or revised accounting standard earlier than the time that such standard applies to private companies to the extent early adoption is permitted. As a result, the information that we provide to our stockholders may be different than you might receive from other public reporting companies in which you hold equity interests.

The Offering

Issuer	Alopetx, Inc.
Common stock offered by us	shares
Over-allotment option	shares
Common stock to be outstanding immediately after this Offering	shares (shares if the underwriters exercise their over-allotment option in full)
Use of proceeds	We estimate that the net proceeds from the sale of our common stock in this offering will be approximately \$ million (or approximately \$ million if the underwriters exercise their over-allotment option in full), based on the assumed initial public offering price of \$ per share, which is the midpoint of the estimated offering price range set forth on the cover page of this prospectus, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. The principal purposes of this offering are to increase our capitalization and financial flexibility, create a public market for our common stock, facilitate future access to the public equity markets by us, our employees and our stockholders and increase our visibility in the marketplace. We currently intend to use the net proceeds we receive from this offering to fund completion of proof-of-concept clinical trials of vaccine AV0328 and monoclonal antibody F598, including manufacturing scale-up activities, and for general corporate purposes, including working capital, operating expenses and capital expenditures. See the section entitled “Use of Proceeds” for additional information.
Risk factors	See the section entitled “Risk Factors” for additional information.
Proposed trading symbol on the Nasdaq Capital Market	“ALPX”
The number of shares of our common stock that will be outstanding after this offering is based on shares of our common stock outstanding as of , including:	
- the issuance of shares of our common stock as a result of the expected net exercise of an outstanding warrant to purchase shares of our common stock; and - the conversion into shares of our common stock of the convertible notes currently outstanding upon the closing of this offering.	
The number of shares of our common stock that will be outstanding after this offering excludes:	
- shares of our common stock issuable upon the exercise of options to purchase shares of our common stock granted after average exercise price of \$ per share; and - shares of our common stock reserved for future issuance under our 2022 Equity Incentive Plan.	, with a weighted-

Unless otherwise indicated, the information in this prospectus assumes:

- an initial public offering price of \$ per share, which is the midpoint of the estimated offering price range set forth on the cover page of this prospectus;
- no exercise of the outstanding options described above;
- the net exercise of the outstanding warrant to purchase shares of our common stock with an exercise price of \$ per share, resulting in the issuance of shares of our common stock, assuming an initial public offering price of \$ per share, which is the midpoint of the estimated offering price range set forth on the cover page of this prospectus, which warrant will terminate if not exercised prior to the completion of this offering;
- no exercise of the underwriters' option to purchase up to an additional shares of our common stock;
- assumes no exercise of the representative's warrants to be issued to the representative of the underwriters in this offering;
- the filing and effectiveness of our amended and restated certificate of incorporation and the adoption of our amended and restated bylaws, each of which will occur upon the closing of this offering; and
- the conversion into shares of our common stock of the convertible notes currently outstanding upon the closing of this offering.

Summary Financial Data

The following tables set forth our summary statements of operations data for the years ended December 31, 2021 and 2020 and our summary balance sheet data as of December 31, 2021. The statements of operations data for the years ended December 31, 2021 and 2020 have been derived from our audited financial statements included elsewhere in this prospectus. Our historical results are not necessarily indicative of the results that may be expected for any period in the future. You should read the following summary financial data together with the sections entitled "Management's Discussion and Analysis of Financial Condition and Results of Operations" and our financial statements and the related notes included elsewhere in this prospectus. The summary financial data included in this section are not intended to replace the financial statements and are qualified in their entirety by our financial statements and the related notes included elsewhere in this prospectus.

	Year Ended December 31,	
	2021	2020
Statements of Operations Data:		
Operating expenses:		
Research and development	\$ 188,617	\$ 1,352,342
General and administrative	714,792	314,006
Total operating expenses	903,409	1,666,348
Loss from operations	(903,409)	(1,666,348)
Other (expense) income, net:	(53,545)	(34,387)
Net loss	<u>\$ (956,954)</u>	<u>\$ (1,700,735)</u>
Net loss per share attributable to common stockholders, basic and diluted	(0.21)	(0.26)
Weighted-average shares outstanding used in computing net loss per share attributable to common stockholders, basic and diluted	4,468,106	6,427,908
Pro forma net loss per share, basic and diluted		
Weighted-average shares outstanding used in computing pro forma net loss per share, basic and diluted		

	December 31, 2021		
	Actual	Pro Forma(1)	Pro Forma As Adjusted(2)
Balance Sheet Data:			
Cash	\$ 40,208		
Other Current Assets	108,608		
Total assets	148,816		
Common Stock – voting	20		
Common Stock – non-voting	300		
Additional Paid in Capital	4,202,935		
Accumulated Deficit	(4,945,682)		
Total stockholders' (deficit) equity	\$ (742,427)		

- 1) The pro forma balance sheet data gives effect to the issuance of shares of our common stock as a result of the expected net exercise of an outstanding warrant to purchase shares of our common stock, assuming an initial public offering price of \$ per share.
- 2) The pro forma as adjusted column gives effect to: (i) the pro forma adjustments set forth in footnote (1) above and (ii) the sale of shares of our common stock in this offering at the assumed initial public offering price of \$ per share, the midpoint of the estimated price range set forth on the cover page of this prospectus, after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

RISK FACTORS

Investing in our common stock involves a high degree of risk. You should carefully consider the risks described below, as well as the other information in this prospectus, including our financial statements and the related notes and the section of this prospectus entitled "Management's Discussion and Analysis of Financial Condition and Results of Operations," before deciding whether to invest in our common stock. Many of the following risks and uncertainties are, and will be, exacerbated by the COVID-19 pandemic and any worsening of the global business and economic environment as a result. The occurrence of any of the events or developments described below could harm our business, financial condition, results of operations and growth prospects. In such an event, the market price of our common stock could decline, and you may lose all or part of your investment. Additional risks and uncertainties not presently known to us or that we currently deem immaterial also may impair our business operations.

Risks Related to Our Financial Position and Capital Needs

We are in the early stages of vaccine development and have a very limited operating history and no products approved for commercial sale, which may make it difficult for you to evaluate the success of our business to date and to assess our future viability.

To date, we have devoted substantially all of our resources to performing research and development, undertaking preclinical and clinical studies and enabling manufacturing activities in support of our product development efforts, hiring personnel, acquiring and developing our technology, performing business planning, establishing our intellectual property portfolio and raising capital to support and expand such activities. As an organization, we have not yet demonstrated an ability to successfully complete clinical development, obtain regulatory approvals, or conduct sales and marketing activities necessary for successful commercialization or arrange for a third party to conduct these activities on our behalf. Consequently, any predictions about our future success or viability may not be as accurate as they could be if we had a longer operating history.

Our current portfolio includes two clinical programs. We may encounter unforeseen expenses, difficulties, complications, delays and other known or unknown factors in achieving our business objectives, including with respect to our clinical candidates. We will need to transition at some point from a company with a research and development focus to a company capable of supporting commercial activities. We may not be successful in such a transition.

We have incurred significant net losses since inception and anticipate that we will continue to incur substantial net losses for the foreseeable future and may never achieve profitability.

Our stock is a highly speculative investment. We are clinical stage biotechnology company that was incorporated in June 2021. Investment in clinical stage companies and vaccine development is highly speculative because it entails substantial upfront capital expenditures and significant risk that any potential vaccine candidate will not gain regulatory approval or become commercially viable. The same challenges apply to our monoclonal antibody. We do not have any products approved for sale and have not generated any revenue from product sales. As a result, we are not profitable and have incurred losses in each year since inception. Our net losses were \$956,954 and \$1,700,735 for the years ended December 31, 2021 and 2020, respectively. As of December 31, 2021 we had an accumulated deficit of \$4,945,682.

We expect to continue to spend significant resources to fund research and development of, and seek regulatory approvals for, our vaccine and antibody candidates. We expect to incur substantial and increasing operating losses over the next several years as our research, development, manufacturing, preclinical testing and clinical trial activities increase. As a result, our accumulated deficit will also increase significantly. We may encounter unforeseen expenses, difficulties, complications, delays and other unknown factors that may adversely affect our business. The size of our future net losses will depend, in part, on the rate of future growth of our expenses and our ability to generate revenue. However, we do not expect to generate any revenue from commercial product sales unless and until we successfully complete development and obtain regulatory approval of our vaccine, which we expect will take a number of years. Our prior losses and expected future losses have had and will continue to have an adverse effect on our stockholders' equity and working capital. Even if we eventually generate revenue, we may never be profitable and, if we do achieve profitability, we may not be able to sustain or increase profitability on a quarterly or annual basis.

Our history of recurring losses and anticipated expenditures raises substantial doubts about our ability to continue as a going concern. Our ability to continue as a going concern requires that we obtain sufficient funding to finance our operations.

We have incurred operating losses to date and it is possible we may never generate sufficient cash flow from operations to operate as a going concern. We have concluded, and the report from our independent registered public accounting firm for the year ended December 31, 2021 includes an explanatory paragraph stating, that our significant working capital deficiency, recurring losses and negative cash flows from operations and required additional funding to finance our operations raise substantial doubt about our ability to continue as a going concern. If we are unable to obtain sufficient funding, we could be forced to delay, reduce or eliminate all of our research and development programs, product portfolio expansion or commercialization efforts, and our financial condition and results of operations will be materially and adversely affected and we may be unable to continue as a going concern. After the completion of this offering, future reports from our independent registered public accounting firm may also contain statements expressing substantial doubt about our ability to continue as a going concern. If we seek additional financing to fund our business activities in the future and there remains substantial doubt about our ability to continue as a going concern, investors or other financing sources may be unwilling to provide additional funding to us on commercially reasonable terms or at all.

Even after this offering, we will require substantial additional funding to finance our operations. If we are unable to raise additional capital when needed, we could be forced to delay, reduce or terminate certain of our development programs or other operations.

As of we had cash and cash equivalents of \$. We believe that the net proceeds from this offering will be approximately \$ million, based on an assumed public offering price of \$ per share, which is the midpoint of the estimated price range set forth on the cover page of this prospectus, after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us. We believe that such proceeds, together with our existing cash and cash equivalents as of the date of this prospectus, will fund our current operating plans through at least the next months from the date of this offering. However, our operating plan may change as a result of many factors currently unknown to us, and we may need to seek additional funds sooner than planned. We will need to raise additional capital before we can progress any of our vaccine into a pivotal clinical trial. We expect to finance our cash needs through public or private equity or debt financings, third-party (including government) funding and marketing and distribution arrangements, as well as other collaborations, strategic alliances and licensing arrangements or any combination of these approaches. Our ability to raise additional capital may be adversely impacted by potential worsening global economic conditions and the recent disruptions to and volatility in the credit and financial markets in the United States and worldwide, including the trading price of common stock, resulting from the ongoing COVID-19 pandemic. Our future capital requirements will depend on many factors, including:

- the timing, scope, progress, results and costs of research and development, testing, screening, manufacturing, preclinical development and clinical trials;
- the outcome, timing and cost of seeking and obtaining regulatory approvals from the U.S. Food and Drug Administration, or FDA, and comparable foreign regulatory authorities, including the potential for such authorities to require that we perform field efficacy studies for our pneumococcal conjugate vaccine, or PCV, candidates, require more studies than those that we currently expect or change their requirements regarding the data required to support a marketing application;
- the cost of building a sales force in anticipation of any product commercialization;
- the costs of future commercialization activities, including product manufacturing, marketing, sales, royalties and distribution, for our vaccine for which we receive marketing approval;
- our ability to maintain existing, and establish new, strategic collaborations, licensing or other arrangements and the financial terms of any such agreements, including the timing and amount of any future milestone, royalty or other payments due under any such agreement;
- any product liability or other lawsuits related to our products;

- the expenses needed to attract, hire and retain skilled personnel;
- the revenue, if any, received from commercial sales, or sales to foreign governments, of our vaccine for which we may receive marketing approval;
- the costs to establish, maintain, expand, enforce and defend the scope of our intellectual property portfolio, including the amount and timing of any payments we may be required to make, or that we may receive, in connection with licensing, preparing, filing, prosecuting, defending and enforcing of any patents or other intellectual property rights;
- the costs of operating as a public company; and
- the impact of the COVID-19 pandemic, which may exacerbate the magnitude of the factors discussed above.

Our ability to raise additional funds will depend on financial, economic and other factors, many of which are beyond our control. We cannot be certain that additional funding will be available on acceptable terms, or at all. We have no committed source of additional capital and if we are unable to raise additional capital in sufficient amounts or on terms acceptable to us, we may have to significantly delay, scale back or discontinue the development or commercialization of our vaccine or other research and development initiatives. Our license agreements may also be terminated if we are unable to meet the payment obligations or milestones under the agreements. We could be required to seek collaborators for our vaccine at an earlier stage than otherwise would be desirable or on terms that are less favorable than might otherwise be available or relinquish or license on unfavorable terms our rights to our vaccine in markets where we otherwise would seek to pursue development or commercialization ourselves.

Due to the significant resources required for the development of our vaccine, and depending on our ability to access capital, we may need to prioritize development of the vaccine over the antibody. Moreover, we may expend our limited resources on a program that does not yield a successful result.

Due to the significant resources required for the development of our vaccine and antibody, we may decide to pursue one program over the other. Our decisions concerning the allocation of research, development, management and financial resources toward a particular program may not lead to the development of any viable commercial product and may divert resources away from better opportunities. If we make incorrect determinations regarding the viability or market potential of our programs or misread trends in the biopharmaceutical industry our business could be seriously harmed.

Raising additional capital may cause dilution to our stockholders, including investors in this offering, restrict our operations or require us to relinquish rights to one or more of our technologies.

We may seek additional capital through a combination of public and private equity offerings, debt financings, strategic partnerships and alliances and licensing arrangements. To the extent that we raise additional capital through the sale of equity or convertible debt securities, your ownership interest will be diluted, and the terms may include liquidation or other preferences that adversely affect your rights as a stockholder. The incurrence of indebtedness would result in increased fixed payment obligations and could involve certain restrictive covenants, such as limitations on our ability to incur additional debt, limitations on our ability to acquire or license intellectual property rights and other operating restrictions that could adversely impact our ability to conduct our business. If we raise additional funds through strategic partnerships and alliances and licensing arrangements with third parties, we may have to relinquish valuable rights to our technologies, intellectual property, future revenue streams, research programs or current or future product candidates or grant licenses on terms unfavorable to us and our shareholders.

Risks Related to Our Business and Industry

Our approach to the development of our vaccine candidate is based on novel technologies that are unproven, which may expose us to unforeseen risks and makes it difficult to predict the time and cost of candidate development and obtaining regulatory approvals.

The preclinical and clinical trial requirements of the FDA, European Medicines Agency, or EMA, and other regulatory agencies and the criteria these regulators use to determine the safety and efficacy of a vaccine candidate are determined according to the type, complexity, novelty and intended use and market of the potential products. Approvals by the FDA and EMA for existing pneumococcal vaccines, such as Prevnar 13 and Pneumovax 23, may not be indicative of what these regulators may require for approval of our vaccine. Furthermore, while there have been approvals granted for both pneumococcal conjugate vaccines and meningococcal conjugate vaccines based on surrogate immune endpoints rather than field efficacy studies, we will not be able to confirm this approach's applicability for our vaccine until we complete our Phase 2 clinical development program. More generally, approvals by any regulatory agency may not be indicative of what any other regulatory agency may require for approval or what such regulatory agencies may require for approval in connection with new vaccine. Moreover, our vaccine may not perform successfully in clinical trials.

We have limited experience in the conduct of clinical trials and have never obtained approval of any product candidates and may be unable to do so successfully.

We have not yet demonstrated our ability to operate successfully including large-scale, pivotal clinical trials, obtain regulatory approvals, manufacture a commercial scale product, or arrange for a third party to do so on our behalf, or conduct sales and marketing activities necessary for successful commercialization. Commencing clinical trials is subject to finalizing the trial design based on discussions with the FDA and other regulatory authorities. Any guidance we receive from the FDA or other regulatory authorities is subject to change. These regulatory authorities could change their position, including, on the acceptability of our trial designs or the clinical endpoints selected, which may require us to complete additional clinical trials or impose stricter approval conditions than we currently expect. Successful completion of our clinical trials is a prerequisite to submitting a Biological Licensing Application or BLA, to the FDA and a Marketing Authorization Application, or MAA, to the European Medicines Agency, or EMA, for each product candidate and, consequently, the ultimate approval and commercial marketing of each product candidate. We have completed phase 1 studies with vaccine AV0328 and monoclonal antibody F598, but we do not know whether any of our future clinical trials will begin on time or ever be completed on schedule, if at all.

If we are required to conduct additional clinical trials or other testing of our product candidates beyond those that we currently contemplate, if we are unable to successfully complete clinical trials of our product candidates or other testing, if the results of these trials or tests are not positive or are only modestly positive or if there are safety concerns, we may:

- be delayed in obtaining marketing approval for our product candidates;
- not obtain marketing approval at all;
- obtain approval for indications or patient populations that are not as broad as intended or desired;
- be subject to post-marketing testing requirements; or

- have the product removed from the market after obtaining marketing approval.

If we are unable to complete development of or commercialize our vaccine or antibody or experience significant delays in doing so, our business would be materially harmed.

Our ability to achieve and sustain profitability depends on obtaining regulatory approvals for and successfully commercializing our vaccine and antibody, either alone or with third parties. We cannot guarantee that we will ever obtain regulatory approval for our vaccine or antibody. Before obtaining regulatory approval for the commercial distribution of our vaccine and antibody, we must conduct extensive clinical trials to demonstrate their safety and efficacy.

We may not have the financial resources to continue development of, or to enter into new collaborations for, a vaccine or antibody candidate if we experience any issues that delay or prevent regulatory approval of, or our ability to commercialize, our vaccine or antibody, including:

- negative or inconclusive results from our preclinical or clinical trials, leading to a decision or requirement to conduct additional preclinical testing or clinical trials or abandon a program;
- product-related adverse effects experienced by patients in our clinical trials;
- timely completion of our preclinical studies and clinical trials, including any field efficacy studies that may be required, which may be significantly slower or cost more than we currently anticipate and will depend substantially upon the performance of third-party contractors;
- delays in submitting INDs or compatible foreign applications or delays or failures in obtaining necessary approvals from regulators to commence a clinical trial, or suspension or termination of a clinical trial once commenced;
- conditions imposed by the FDA or similar foreign authorities regarding the scope or design of our clinical trials, including any requirements to perform field efficacy studies;
- delays in enrolling patients in our clinical trials;
- the availability of coverage and adequate reimbursement and pricing from third-party payors, including government authorities,
- pertaining to the vaccine, once approved, and patients' willingness to pay out-of-pocket if third-party payor reimbursement is limited or not available;
- greater than anticipated costs of our clinical trials, including chemistry, manufacturing and controls, or CMC, activities related to our clinical trials;
- harmful side effects or inability of our vaccine or antibody to meet efficacy endpoints;
- unfavorable FDA or other regulatory agency inspection and review of one or more of our clinical trial sites or our contract manufacturers' facilities;

- failure of our third-party contractors or investigators to comply with regulatory requirements or otherwise meet their obligations in a timely manner, or at all;
- the impact on the various regulatory, clinical trial or manufacturing processes as result of the COVID-19 pandemic;
- delays and changes in regulatory requirements, policy and guidelines, including the imposition of additional regulatory oversight around clinical testing generally or with respect to our technology or vaccine in particular; or
- varying interpretations of our data by the FDA and comparable foreign regulatory authorities.

In particular, while we believe our vaccine could receive regulatory approval based on well-defined surrogate immune endpoints, consistent with how other PCVs have obtained regulatory approval in the past, rather than requiring clinical field efficacy studies, there can be no assurance that the FDA or comparable foreign regulatory authorities will provide approvals on such basis.

Our inability to complete development of or commercialize our vaccine, or significant delays in doing so due to one or more of these factors, could have a material and adverse effect on our business, financial condition, results of operations and prospects.

Moreover, principal investigators for our clinical trials may serve as scientific advisors or consultants to us from time to time and receive compensation in connection with such services. Under certain circumstances, we may be required to report some of these relationships to the FDA or comparable foreign regulatory authorities. The FDA or comparable foreign regulatory authorities may conclude that a financial relationship between us and a principal investigator has created a conflict of interest or otherwise affected interpretation of the study. The FDA or comparable foreign regulatory authorities may therefore question the integrity of the data generated at the applicable clinical trial site and the utility of the clinical trial itself may be jeopardized. This could result in a delay in approval, or rejection, of our marketing applications by the FDA or comparable foreign regulatory authorities, as the case may be, and may ultimately lead to the denial of marketing approval of our vaccine.

Our business is highly dependent on the success of vaccine AV0328 and antibody F598 which are in clinical development. If we are unable to obtain approval for AV0328 and F598 and effectively commercialize them, our business would be significantly harmed.

Our business and future success depends on our ability to obtain regulatory approval of, and then successfully commercialize our vaccine and antibody. The ultimate decision on the safety and efficacy of our therapeutics will be determined by the FDA and other health authorities. Both the vaccine and antibody are in the early stages of clinical development. Both have been noted to be well tolerated, no serious adverse events have been noted and preliminary laboratory-based efficacy has been noted. However, subsequent studies may not demonstrate the safety and efficacy of our vaccine and/or antibody. Both the vaccine and antibody will require additional clinical and non-clinical development, regulatory review and approval in multiple jurisdictions, substantial investment, access to sufficient preclinical, clinical and commercial manufacturing capacity and significant marketing efforts before we can generate any revenue from product sales. We cannot provide any assurance that we will be able to successfully advance the antibody and vaccine through the development process.

The clinical and commercial success of our antibody and vaccine will depend on a number of factors, including the following:

- our ability to raise any additional required capital on acceptable terms, or at all;

- timely completion of our clinical trials, which may be significantly slower or cost more than we currently anticipate and will depend substantially upon the performance of third-party contractors;
- whether we are required by the FDA or similar foreign regulatory agencies to conduct additional clinical trials, including field efficacy studies, or other studies beyond those planned to support the approval and commercialization of our vaccine and antibody;
- acceptance of our proposed indications and primary surrogate endpoint assessments for our vaccine by the FDA and similar foreign regulatory authorities;
- our ability to demonstrate to the satisfaction of the FDA or comparable foreign regulatory authorities the safety, efficacy and acceptable risk to benefit profile of our antibody and vaccine;
- any vaccine-vaccine interference studies that may be required, particularly with the standard of care pediatric vaccine regimen;
- the prevalence, duration and severity of potential side effects or other safety issues experienced with our vaccine and antibody, if any;
- the timely receipt of necessary marketing approvals from the FDA or comparable foreign regulatory authorities;
- achieving, maintaining and, where applicable, ensuring that our third-party contractors achieve and maintain compliance with our contractual obligations and with all regulatory requirements applicable to our vaccine or any future vaccine or approved products, if any;
- obtaining and maintaining an Advisory Committee on Immunization Practices, or ACIP, preferred recommendation or comparable foreign regulatory authority's recommendation of our vaccine and the willingness of physicians, operators of clinics and patients to utilize or adopt our vaccine to prevent or treat age-associated diseases;
- the ability of third parties with whom we contract to manufacture adequate clinical study and commercial supplies of our vaccine and antibody to remain in good standing with regulatory agencies and develop, validate and maintain commercially viable manufacturing processes that are compliant with current good manufacturing practices, or cGMP;
- our ability to successfully develop a commercial strategy and thereafter commercialize our vaccine and antibody in the United States and internationally, if approved for marketing, reimbursement, sale and distribution in such countries and territories, whether alone or in collaboration with others;
- the convenience of our treatment or dosing regimen;
- acceptance by physicians, payors and patients of the benefits, safety and efficacy of our vaccine or antibody if approved, including relative to alternative and competing treatments;
- patient demand for our vaccine, if approved;
- our ability to establish and enforce intellectual property rights in and to our vaccine and antibody;
- our ability to avoid third-party patent interference, intellectual property challenges or intellectual property infringement claims; and

- the impact of the COVID-19 pandemic, which may exacerbate the magnitude of the factors discussed above.

These factors, many of which are beyond our control, could cause us to experience significant delays or an inability to obtain regulatory approvals or commercialize our vaccine and antibody. Even if regulatory approvals are obtained, we may never be able to successfully commercialize our vaccine or antibody. Accordingly, we cannot provide assurances that we will be able to generate sufficient revenue through the sale of our antibody or vaccine to continue our business or achieve profitability.

Our primary competitors have significantly greater resources and experience than we do, which may make it difficult for us to successfully develop our vaccine and antibody, or may result in others discovering, developing or commercializing products before or more successfully than us.

The vaccine market is intensely competitive and is dominated by a small number of multi-national, globally established pharmaceutical corporations with significant resources. For instance, Pfizer, Merck, GlaxoSmithKline and Sanofi together control approximately 75% of the global vaccine market. We may also face competition from many different sources, including pharmaceutical and biotechnology companies, academic institutions, governmental agencies and public and private research institutions. For example, Sanofi and SK Chemicals have partnered to develop a PCV, and Affinivax and Astellas have partnered to develop an affinity-bound pneumococcal vaccine.

Our vaccine may be viewed as competition with existing vaccines and new vaccines that may become available in the future. Many of our competitors have substantially greater financial, lobbying, technical, human and other resources than we do and may be better equipped to develop, manufacture and market technologically superior vaccines, including the potential that our competitors may develop chemical processes or utilize novel technologies for developing vaccines that may be superior to those we employ. In addition, many of these competitors have significantly greater experience than we have in undertaking preclinical testing and clinical trials of new products and in obtaining regulatory approvals, including for many vaccine franchises. Accordingly, our competitors may succeed in obtaining FDA approval or a preferred recommendation for their products. For example, Prevnar 13 obtained FDA approval for the prevention of invasive pneumococcal disease, or IPD, in infants based on non-inferior IgG antibody responses relative to Prevnar, using the surrogate immune endpoints established by the prior Prevnar field efficacy study. Pfizer is currently implementing a similar approach to development of its 20-valent PCV vaccine candidate and may have a more efficient path to regulatory approval given Pfizer's and the FDA's previous experience with Prevnar 13. For more information, see the section entitled "Business—Competition."

Many of our competitors have established distribution channels for the commercialization of their vaccine products, whereas we have no such established channels or capabilities. In addition, many competitors have greater name recognition, more extensive collaborative relationships or the ability to leverage a broader vaccine portfolio. Our commercial opportunity could be reduced or eliminated if our competitors develop and commercialize vaccines that are safer, more effective, more convenient, less expensive or with a more favorable label than any vaccine that we may develop.

As a result of these factors, our competitors may obtain regulatory approval of their products before we are able to, which may limit our ability to develop or commercialize our vaccine. Our competitors may also develop vaccines that are safer, more effective, more widely accepted or less expensive than ours, and may also be more successful than we are in manufacturing and marketing their products. These advantages could render our vaccine non-competitive before we can recover the costs of such vaccine development and commercialization.

Mergers and acquisitions in the pharmaceutical and biotechnology industries may result in even more resources being concentrated among a smaller number of our competitors. Smaller and early-stage companies may also prove to be significant competitors, particularly through collaborative arrangements with large and established companies. These third parties compete with us in recruiting and retaining qualified scientific, management and commercial personnel, establishing clinical trial sites and subject enrollment for clinical trials, as well as in acquiring technologies complementary to, or necessary for, our programs.

To date, no non-serotype-specific vaccine has received approval from the FDA or been commercialized.

Currently approved *Streptococcus pneumoniae* vaccines are serotype-specific. They have multiple components that specifically target a subset of *Streptococcus pneumoniae*. Prevnar 13 targets 13 of the 100+ known serotypes. A non-serotype specific vaccine such as AV0328 can potentially address all serotypes. While the FDA has not approved a vaccine for use that is non-serotype-specific such as Alopexx's vaccine our communications with the FDA lead us to believe that such an approach is feasible. There is no assurance that the FDA will approve our vaccine and the non-serotype-specific nature of our vaccine could make FDA approval more difficult to achieve.

Even if we obtain regulatory approval of our vaccine, the product may not gain market acceptance among regulators, advisory boards, physicians, patients, third-party payors and others in the medical community.

Even if any of our vaccine receives marketing approval, they may fail to receive recommendations for use by regulators or advisory boards that recommend vaccines, or gain market acceptance by physicians, patients, third-party payors and others in the medical community. If they do not achieve an adequate level of acceptance, we may not generate significant product revenue and may not become profitable. The degree of market acceptance of any vaccine, if approved for commercial sale, will depend on a number of factors, including but not limited to:

- receiving CDC and ACIP recommendations for use, as well as recommendations of comparable foreign regulatory and advisory bodies;
- prevalence and severity of the disease targets for which our vaccine is approved;
- physicians, hospitals, third-party payors and patients considering our vaccine as safe and effective;
- the potential and perceived advantages of our vaccine over existing vaccines, including with respect to spectrum coverage or immunogenicity;
- the prevalence and severity of any side effects;
- product labeling or product insert requirements of the FDA or comparable foreign regulatory and advisory bodies;
- limitations or warnings contained in the labeling approved by the FDA or comparable foreign regulatory and advisory bodies;
- the timing of market introduction of our vaccine as well as competitive products;
- the cost of treatment in relation to alternative treatments;

- the availability of coverage and adequate reimbursement and pricing by third-party payors, including government authorities;
- the willingness of patients to pay out-of-pocket in the absence of coverage and adequate reimbursement by third-party payors, including government authorities;
- relative convenience and ease of administration, including as compared to competitive vaccines and alternative treatments;
- the effectiveness of our sales and marketing efforts; and
- the impact of the COVID-19 pandemic, which may exacerbate the magnitude of the factors discussed above.

In the United States, the CDC and ACIP develop vaccine recommendations for both children and adults, as do similar agencies around the world. To develop its recommendations, ACIP forms working groups that gather, analyze and prepare scientific information. The ACIP also considers many of the factors above, as well as myriad additional factors such as the value of vaccination for the target population regarding the outcomes, health economic data and implementation issues. ACIP recommendations are also made within categories, such as in an age group or a specified risk group. For example, the ACIP may determine that a preferred recommendation in a smaller child population may be more economical than recommending vaccinations for a larger adult population, which could adversely impact our market opportunity. New pediatric vaccines that receive an ACIP preferred recommendation are almost universally adopted, and adult vaccines that receive a preferred recommendation are widely adopted. For example, in 2014, the ACIP voted to recommend Prevnar 13 for routine use to help protect adults aged 65 years and older against pneumococcal disease, which caused Prevnar 13 to become the standard of care along with continued use of Pneumovax 23.

ACIP can also modify its preferred recommendation. For instance, in June 2019, the ACIP voted to revise the pneumococcal vaccination guidelines and recommend Prevnar 13 for adults 65 and older based on the shared clinical decision making of the provider and patient, rather than a preferred use recommendation, which means the decision to vaccinate should be made at the individual level between health care providers and their patients. Pfizer recently noted that this revised recommendation is expected to have a negative effect on Prevnar 13 revenue for future periods.

If our vaccine is approved but fail to receive CDC and ACIP recommendations, or recommendations of other comparable foreign regulatory and advisory bodies, or achieve market acceptance among physicians, healthcare providers, patients, third-party payors or others in the medical community, we will not be able to generate significant revenue. Even if our products achieve market acceptance, we may not be able to maintain that market acceptance over time if new products or technologies are introduced that are more favorably received than our products, are more cost effective or render our products obsolete.

We currently rely on third-party manufacturing and supply partners, including Lonza and Glycosyn, to supply raw materials and components for, and manufacture, our vaccine and antibody. Our inability to have sufficient quantities of our vaccine and antibody manufactured, or our failure to comply with applicable regulatory requirements or to supply sufficient quantities at acceptable quality levels or prices, or at all, would materially and adversely affect our business.

Efficient and scalable manufacturing and supply is a vital component of our business strategy. We currently do not own or operate any manufacturing facilities. We have developed, in collaboration with third parties manufacturing processes that we believe can scale to address clinical and commercial vaccine supply. However, our assumptions as to our ability and our contract manufacturer's ability to produce vaccines at the scale needed for clinical development and commercial demand may prove to be wrong. If we encounter problems in our manufacturing processes or in our ability to scale to address commercial drug supply, our business would be materially adversely affected.

We rely on third-party contract manufacturers to manufacture preclinical and clinical trial product materials and supplies for our needs. There can be no assurance that our preclinical and clinical development product supplies will not be limited or interrupted or be of satisfactory quality or continue to be available on acceptable terms. The manufacturing facilities in which our preclinical and clinical trial product materials and supplies are made could be adversely affected by the ongoing COVID-19 pandemic, earthquakes and other natural or man-made disasters, equipment failures, labor shortages, power failures, and numerous other factors. Please see the risk factor titled *“Our business could be adversely affected by the effects of health epidemics, including the evolving effects of the COVID-19 pandemic, in regions where we or third parties on which we rely have significant manufacturing facilities, concentrations of potential clinical trial sites or other business operations. The COVID-19 pandemic could materially affect our operations, including at our headquarters in Massachusetts, as well as the business or operations of our contract manufacturer or other third parties with whom we conduct business.”*

The manufacturing process for a vaccine or antibody is subject to FDA or comparable foreign regulatory authority review. Our suppliers and manufacturers must meet applicable manufacturing requirements and undergo rigorous facility and process validation tests required by regulatory authorities in order to comply with regulatory standards, such as cGMPs. If our contract manufacturers cannot successfully manufacture material that conforms to our specifications and the strict regulatory requirements of the FDA or comparable foreign regulatory authorities, we may not be able to rely on their manufacturing facilities for the manufacture of elements of our vaccine or antibody. Moreover, we do not control the manufacturing process at our contract manufacturers and are completely dependent on them for compliance with current regulatory requirements. In the event that any of our manufacturers fails to comply with such requirements or to perform its obligations in relation to quality, timing or otherwise, or if our supply of components or other materials becomes limited or interrupted for other reasons, we may be forced to manufacture the materials ourselves or enter into an agreement with another third party, which we may not be able to do on reasonable terms, if at all. In some cases, the technical skills, raw materials or technology required to manufacture our vaccine may be unique or proprietary to the original manufacturer or supplier, and we may have difficulty applying such skills or technology or sourcing such raw materials ourselves, or in transferring such skills, technology or raw materials to another third party. These factors would increase our reliance on such manufacturer or require us to obtain a license from such manufacturer in order to enable us, or to have another third party, manufacture our vaccine. If we are required to change manufacturers for any reason, we will be required to verify that the new manufacturer maintains facilities and procedures that comply with quality standards and with all applicable regulations and guidelines, and we may be required to repeat some of the development program. The delays associated with the verification of a new manufacturer could negatively affect our ability to develop our vaccine in a timely manner or within budget.

We expect to continue to rely on third-party manufacturers and suppliers, including Lonza and Glycosyn, if we receive regulatory approval. To the extent that we have existing, or enter into future, manufacturing arrangements with third parties, we will depend on these third parties to perform their obligations in a timely manner consistent with contractual and regulatory requirements, including those related to quality control and assurance. If we are unable to obtain or maintain third-party manufacturing for our vaccine, or to do so on commercially reasonable terms, we may not be able to develop and commercialize our vaccine successfully. Our or a third party's failure to execute on our manufacturing requirements and comply with cGMPs could adversely affect our business in a number of ways, including:

- an inability to initiate or complete clinical trials of the vaccine under development;
- delay in submitting regulatory applications, or receiving regulatory approvals, for our vaccine;
- subjecting third-party manufacturing facilities to additional inspections by regulatory authorities;
- requirements to cease distribution or to recall batches of our vaccine or antibody; and in the event of approval to market and commercialize our vaccine or antibody, an inability to meet commercial demands for our products.

Additionally, we and our contract manufacturers may experience manufacturing difficulties due to limited manufacturing experience, resource constraints or as a result of labor disputes, unstable political environments, the COVID-19 pandemic or other unforeseen activities or developments. If we or our contract manufacturers were to encounter any of these difficulties, our ability to manufacture sufficient vaccine supply for our preclinical studies and clinical trials, or to provide product for patients once approved, would be jeopardized.

We or the third parties upon whom we depend may be adversely affected by natural disasters, and our business continuity and disaster recovery plans may not adequately protect us from any such serious disaster.

Any unplanned event, such as flood, fire, explosion, earthquake, extreme weather condition, medical epidemics, power shortage, telecommunication failure or other natural or man-made accidents or incidents that result in us being unable to fully utilize our facilities, or the manufacturing facilities of our third-party contract manufacturers, may have a material and adverse effect on our ability to operate our business, particularly on a daily basis, and have significant negative consequences on our financial and operating conditions. Loss of access to these facilities may result in increased costs, delays in the development of our product candidates or interruption of our business operations. Earthquakes or other natural disasters could further disrupt our operations and have a material and adverse effect on our business, financial condition, results of operations and prospects. If a natural disaster, power outage or other event were to occur that prevented us from using all or a significant portion of our headquarters, that damaged critical infrastructure, such as our research facilities or the manufacturing facilities of our third-party contract manufacturers, or that otherwise disrupted operations, it may be difficult or, in certain cases, impossible, for us to continue our business for a substantial period of time.

The disaster recovery and business continuity plans we have in place may prove inadequate in the event of a serious disaster or similar event. We may incur substantial expenses as a result of the limited nature of our disaster recovery and business continuity plans, which could have a material adverse effect on our business. As part of our risk management policy, we maintain insurance coverage at levels that we believe are appropriate for our business. However, in the event of an accident or incident at these facilities, we cannot assure you that the amounts of insurance will be sufficient to satisfy any damages and losses. If our facilities, or the manufacturing facilities of our third-party contract manufacturers, are unable to operate because of an accident or incident or for any other reason, even for a short period of time, any or all of our research and development programs may be harmed.

Our vaccine and antibody may cause undesirable side effects or have other properties, including interactions with existing vaccine regimens, or antibiotics that could halt their clinical development, prevent their regulatory approval, limit their commercial potential or result in significant negative consequences.

Adverse effects or other undesirable or unacceptable side effects caused by our vaccine or antibody could cause us or regulatory authorities to interrupt, delay or halt clinical trials and could result in a more restrictive label or the delay or denial of regulatory approval by the FDA or other comparable foreign regulatory authorities. Results of our clinical trials could reveal a high and unacceptable severity and prevalence of side effects or unexpected characteristics. In such an event, our clinical trials could be suspended or terminated, and the FDA or comparable foreign regulatory authorities could order us to cease further development of or deny approval of our antibody or vaccine. Such side effects could also affect trial recruitment or the ability of enrolled patients to complete the clinical trial or result in potential product liability claims. The data safety monitoring board may also suspend or terminate a clinical trial at any time on various grounds, including a finding that the research patients are being exposed to an unacceptable health risk. Treatment-related side effects could also affect patient recruitment or the ability of enrolled subjects to complete the trial or result in potential product liability claims. In addition, any vaccine to be approved in pediatric populations may need to undergo extensive vaccine-vaccine interference studies with the standard of care pediatric vaccine regimen. Further, to the extent field efficacy studies are required, prophylactic vaccines typically require clinical testing in thousands to tens of thousands of healthy volunteers to define an approvable benefit-risk profile. The need to show a high degree of safety and tolerability when dosing healthy individuals could result in rare and even spurious safety findings, negatively impacting a program prior to or after commercial launch. Any of these occurrences may harm our business, financial condition and prospects significantly.

Negative developments and negative public opinion of new technologies on which we rely may damage public perception of our vaccine and antibody or adversely affect our ability to conduct our business or obtain regulatory approvals for our vaccine.

Negative developments and negative public opinion of new or existing technologies on which we rely may damage public perception of our vaccine and antibody or adversely affect our ability to conduct our business or obtain regulatory approvals for our vaccine. Public perception may be influenced by claims that the vaccine or antibody are unsafe. Adverse public attitudes may negatively impact our ability to enroll patients in clinical trials. Moreover, our success will depend upon physicians specializing in our targeted diseases prescribing, and their patients being willing to receive, our vaccine or antibody in addition to the current standard of care. Any increase in negative perceptions of the technologies that we rely on may result in fewer physicians prescribing our products or may reduce the willingness of patients to utilize our products or participate in clinical trials.

We may encounter substantial delays in our clinical trials or may not be able to conduct our trials on the timelines we expect.

Clinical testing is expensive, time consuming and subject to uncertainty. We cannot guarantee that any clinical studies will be conducted as planned or completed on schedule, if at all. Even if these trials begin as planned, issues may arise that could suspend or terminate such clinical trials. A failure of one or more clinical studies can occur at any stage of testing, and our future clinical studies may not be successful. Events that may prevent successful or timely completion of clinical development include:

- inability to generate sufficient preclinical, toxicology or other in vivo or in vitro data to support the initiation of clinical trials;
- delays in sufficiently developing, characterizing or controlling a manufacturing process suitable for advanced clinical trials;
- delays in reaching a consensus with regulatory agencies on study design;

- delays in reaching agreement on acceptable terms with prospective contract research organizations, or CROs, and clinical study sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and clinical study sites;
- delays in obtaining required institutional review board, or IRB, approval at each clinical study site;
- imposition of a temporary or permanent clinical hold by regulatory agencies for a number of reasons, including after review of an IND application or amendment, or equivalent application or amendment; as a result of a new safety finding that presents unreasonable risk to clinical trial participants; a negative finding from an inspection of our clinical study operations or study sites;
- developments on trials conducted by competitors for related technology that raises FDA concerns about risk to patients of the technology broadly; or if the FDA finds that the investigational protocol or plan is clearly deficient to meet its stated objectives;
- disruptions caused by the COVID-19 pandemic may increase the likelihood that we encounter such difficulties or delays in initiating, enrolling, conducting or completing our planned clinical trials;
- delays in adding a sufficient number of trial sites and recruiting suitable patients to participate in our clinical trials;
- failure by our CROs, other third parties or us to adhere to clinical study requirements;
- failure to perform in accordance with the FDA's good clinical practice, or GCP, requirements or applicable regulatory guidelines in other jurisdictions;
- transfer of manufacturing processes to any new CMO or our own manufacturing facilities or any other development or commercialization partner;
- delays in having patients complete participation in a study or return for post-injection follow-up;
- patients dropping out of a study;
- occurrence of side effects associated with our vaccine or antibody that are viewed to outweigh their potential benefits;
- changes in regulatory requirements and guidance that require amending or submitting new clinical protocols;
- changes in the standard of care on which a clinical development plan was based, which may require new or additional trials;
- the cost of clinical trials being greater than we anticipate;
- clinical studies producing negative or inconclusive results, which may result in our deciding, or regulators requiring us, to conduct additional clinical studies or abandon product development programs;
- delays or failure to secure supply agreements with suitable raw material suppliers, or any failures by suppliers to meet our quantity or quality requirements for necessary raw materials; and

- delays in manufacturing, testing, releasing, validating or importing/exporting sufficient stable quantities of drug for use in clinical studies or the inability to do any of the foregoing.

Any inability to successfully complete preclinical and clinical development could result in additional costs to us or impair our ability to generate revenue. In addition, if we make manufacturing or formulation changes, we may be required to or we may elect to conduct additional studies to bridge our modified vaccine or antibody to earlier versions. Clinical trial delays could also shorten any periods during which our products have patent protection and may allow our competitors to bring products to market before we do, which could impair our ability to successfully commercialize our vaccine or antibody and may harm our business and results of operations.

If we encounter difficulties enrolling patients in any clinical trials we may conduct, including any field efficacy trials that may be required, our clinical development activities could be delayed or otherwise adversely affected.

We may experience difficulties in patient enrollment in any clinical trials we may conduct for a variety of reasons. The timely completion of clinical trials in accordance with their protocols depends, among other things, on our ability to enroll a sufficient number of patients who remain in the study until its conclusion. The enrollment of patients depends on many factors, including:

- the patient eligibility and exclusion criteria defined in the protocol;
- the severity and difficulty of diagnosing the disease under investigation;
- the size of the patient population required for analysis of the trial's primary endpoints;
- the proximity of patients to study sites;
- the design of the trial;
- our ability to recruit clinical trial investigators with the appropriate competencies and experience;
- our ability to obtain and maintain patient consents;
- the referral practices of physicians;
- the ability to monitor patients adequately during and after treatment; and
- the risk that patients enrolled in clinical trials will drop out of the trials before the injection of our vaccine or trial completion.

To the extent we are required to conduct any field efficacy studies for the vaccine, enrollment of a sufficient number of patients may require additional time and resources given widespread vaccination rates in the United States, particularly in the pediatric population. As a result, we may be required to conduct any such trials outside the United States, which could cause additional complexity and delay. Delays in patient enrollment may result in increased costs or may affect the timing or outcome of any clinical trials we may conduct, which could prevent completion of these trials and adversely affect our ability to advance the development of our vaccine.

Interim topline and preliminary data from our clinical trials that we 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.

From time to time, we may publish interim topline or preliminary data from our preclinical or clinical trials. Interim data from clinical trials that we may complete are subject to the risk that one or more of the clinical outcomes may materially change as patient enrollment continues and more patient data become available. We also make assumptions, estimations, calculations and conclusions as part of our analyses of data, and we may not have received or had the opportunity to fully and carefully evaluate all data when we publish such data. As a result, the topline results that we report may differ from future results of the same studies, or different conclusions or considerations may qualify such results once additional data have been received and fully evaluated. Preliminary or topline data also remain subject to audit and verification procedures that may result in the final data being materially different from the preliminary data we may publish. As a result, interim and preliminary data should be viewed with caution until the final data are available. Adverse differences between preliminary or interim data and final data could significantly harm our business prospects. Further, others, including regulatory agencies, may not accept or agree with our assumptions, estimates, calculations, conclusions or analyses or may interpret or weigh the importance of data differently, which could impact the value of the particular program, the approvability or commercialization of the particular vaccine candidate and our company in general. In addition, the information we choose to publicly disclose regarding a particular study or clinical trial is based on what is typically extensive information, and you or others may not agree with what we determine is the material or otherwise appropriate information to include in our disclosure. Any information we determine not to disclose may ultimately be deemed significant by you or others with respect to future decisions, conclusions, views, activities or otherwise regarding a particular vaccine candidate or our business. If the topline data that we report differ from final results, or if others, including regulatory authorities, disagree with the conclusions reached, our ability to obtain approval for, and commercialize, vaccine may be harmed, which could significantly harm our business prospects.

We might not receive Fast Track designation for AV0328 and F598, and even if we do, such designation may not actually lead to a faster development or regulatory review or approval process.

If a drug is intended for the treatment of a serious condition and nonclinical or clinical data demonstrate the potential to address an unmet medical need for this condition, a drug sponsor may qualify for FDA Fast Track designation. We have submitted an application for Fast Track designation for AV0328 and F598. The FDA has broad discretion whether to grant this designation, and we may not receive it. Moreover, even if we receive Fast Track designation, Fast Track designation does not ensure that we will receive marketing approval or that approval will be granted within any particular time frame. We may not experience a faster development or regulatory review or approval process with Fast Track designation compared to conventional FDA procedures. In addition, the FDA may withdraw Fast Track designation if it believes that the designation is no longer supported by data from our clinical development program. Fast Track designation alone does not guarantee qualification for the FDA's priority review procedures.

We may seek a Breakthrough Therapy designation for AV0328 or F598, but we might not receive such designation, and even if we do, such designation may not lead to a faster development or regulatory review or approval process.

We may seek a Breakthrough Therapy designation for AV0328 or F598 if future results support such designation. A Breakthrough Therapy is defined as a drug that is intended, alone or in combination with one or more other drugs, to treat a serious condition, and preliminary clinical evidence indicates that the drug may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. For drugs that have been designated as breakthrough therapies, interaction and communication between the FDA and the sponsor of the trial can help to identify the most efficient path for clinical development while minimizing the number of patients placed in ineffective control regimens. Drugs designated as breakthrough therapies by the FDA may also be eligible for priority review if supported by clinical data at the time the NDA is submitted to the FDA. Designation as a Breakthrough Therapy is within the discretion of the FDA. Accordingly, even if we believe that AV0328 or F598 meets the criteria for designation as a Breakthrough Therapy, the FDA may disagree and instead determine not to make such designation. Even if we receive Breakthrough Therapy designation, the receipt of such designation may not result in a faster development or regulatory review, or approval process compared to drugs considered for approval under conventional FDA procedures and does not assure ultimate approval by the FDA. In addition, even if AV0328 or F598 qualifies as a breakthrough therapy, the FDA may later decide that it no longer meets the conditions for qualification or decide that the time period for FDA review or approval will not be shortened.

We may conduct certain of our clinical trials for our product candidates outside of the United States. However, the FDA and other foreign equivalents may not accept data from such trials, in which case its development plans will be delayed, which could materially harm its business.

We may choose to conduct one or more of our clinical trials for our product candidates outside the United States. For example, for our anticipated Phase 2 trial of antibody F598, we are evaluating conducting these trials outside the United States, including potentially in France. Although the FDA may accept data from clinical trials conducted outside the United States, acceptance of these data is subject to certain conditions imposed by the FDA. In cases where data from foreign clinical trials are intended to serve as the basis for marketing approval in the United States, the FDA will not approve the application on the basis of foreign data alone unless (i) those data are applicable to the U.S. population and U.S. medical practice; (ii) the studies were performed by clinical investigators of recognized competence; and (iii) the data are considered valid without the need for an on-site inspection by the FDA or, if the FDA considers such an inspection to be necessary, the FDA is able to validate the data through an on-site inspection or other appropriate means. Additionally, the FDA's clinical trial requirements, including sufficient size of patient populations and statistical powering, must be met. For studies that are conducted only at sites outside of the United States and not subject to an IND, the FDA requires the clinical trial to have been conducted in accordance with GCPs, and the FDA must be able to validate the data from the clinical trial through an on-site inspection if it deems such inspection necessary. For such studies not subject to an IND, the FDA generally does not provide advance comments on the clinical protocols for the studies, and therefore there is an additional potential risk that the FDA could determine that the study design or protocol for a non-U.S. clinical trial was inadequate, which could require us to conduct additional clinical trials. There can be no assurance the FDA will accept data from clinical trials conducted outside of the United States. If the FDA does not accept data from our clinical trials of our product candidates, it would likely result in the need for additional clinical trials, which would be costly and time consuming and delay or permanently halt our development of our product candidates.

Many foreign regulatory bodies have similar approval requirements. In addition, such foreign trials would be subject to the applicable local laws of the foreign jurisdictions where the trials are conducted. There can be no assurance that the FDA or any similar foreign regulatory authority will accept data from trials conducted outside of the United States or the applicable jurisdiction. If the FDA or any similar foreign regulatory authority does not accept such data, it would result in the need for additional trials, which would be costly and time-consuming and delay aspects of Our business plan, and which may result in our product candidates not receiving approval or clearance for commercialization in the applicable jurisdiction or permanently halt our development of our product candidates.

Conducting clinical trials outside the United States also exposes us to additional risks, including risks associated with:

- additional foreign regulatory requirements;
- foreign exchange fluctuations;
- compliance with foreign manufacturing, customs, shipment and storage requirements;
- cultural differences in medical practice and clinical research; and
- diminished protection of intellectual property in some countries.

We currently have no marketing and sales organization, and as an organization have no experience in marketing products.

If we are unable to establish marketing and sales capabilities or enter into agreements with third parties to market and sell our vaccine, we may not be able to generate product revenue. We currently have no sales, marketing or distribution capabilities and as an organization have no experience in marketing products. If we develop an in-house marketing organization and sales force, we will require significant capital expenditures, management resources and time, and we will have to compete with other pharmaceutical and biotechnology companies to recruit, hire, train and retain marketing and sales personnel.

If we are unable or decide not to establish internal sales, marketing and distribution capabilities, we will pursue collaborative arrangements regarding the sales and marketing of our products; however, there can be no assurance that we will be able to establish or maintain such collaborative arrangements, or if we are able to do so, that they will have effective sales forces. Any revenue we receive will depend upon the efforts of such third parties, which may not be successful. We may have little or no control over the marketing and sales efforts of such third parties and our revenue from product sales may be lower than if we had commercialized our vaccine ourselves. We also face competition in our search for third parties to assist us with the sales and marketing efforts of our vaccine.

There can be no assurance that we will be able to develop in-house sales and distribution capabilities or establish or maintain relationships with third-party collaborators to commercialize any product that receives regulatory approval in the United States or overseas. If we are unable to develop in-house sales and distribution capabilities or enter into relationships with third-party collaborators on acceptable terms or at all, we may not be able to successfully commercialize our products. If we are not successful in commercializing our products or any future products, either on our own or through arrangements with one or more third parties, we may not be able to generate any future product revenue and we would incur significant additional losses.

A variety of risks associated with potentially conducting research and clinical trials abroad and marketing our vaccine internationally could materially adversely affect our business.

As we pursue approval and commercialization for our vaccine overseas and conduct CMC and other operations overseas, we will be subject to additional risks related to operating in foreign countries, including:

- differing regulatory requirements in foreign countries;

- unexpected changes in tariffs, trade barriers, price and exchange controls and other regulatory requirements;
- increased difficulties in managing the logistics and transportation of storing and shipping vaccines abroad;
- import and export requirements and restrictions;
- economic weakness, including inflation, or political instability in particular foreign economies and markets;
- compliance with tax, employment, immigration and labor laws for employees living or traveling abroad;
- foreign taxes, including withholding of payroll taxes;
- foreign currency fluctuations, which could result in increased operating expenses and reduced revenue, and other obligations incident to doing business in another country;
- difficulties staffing and managing foreign operations;
- workforce uncertainty in countries where labor unrest is more common than in the United States;
- differing payor reimbursement regimes, governmental payors or patient self-pay systems and price controls;
- potential liability under the U.S. Foreign Corrupt Practices Act of 1977, as amended, or comparable foreign regulations;
- challenges enforcing our contractual and intellectual property rights, especially in those foreign countries that do not respect and protect
- intellectual property rights to the same extent as the United States;
- production shortages resulting from any events affecting raw material supply or manufacturing capabilities abroad; and
- business interruptions resulting from geo-political actions, including war and terrorism.

These and other risks associated with our international operations and our collaborations with Lonza, based in Switzerland and Glycosyn, based in New Zealand, may materially adversely affect our ability to attain or maintain profitable operations.

We are highly dependent on our key personnel, and if we are not able to retain these members of our management team or recruit and retain highly qualified personnel, we may not be able to successfully implement our business strategy.

Our ability to compete in the highly competitive biotechnology and pharmaceutical industries depends upon our ability to attract and retain highly qualified managerial, scientific and medical personnel. We are highly dependent on our management, scientific and medical personnel, including our President, Chief Executive Officer and co-founder. The loss of the services of any of our executive officers, other key employees and other scientific and medical advisors, and our inability to find suitable replacements could result in delays in product development and harm our business. We conduct substantially all of our operations at our facilities in the Boston Area. This region is headquarters to many other biopharmaceutical companies and many academic and research institutions. Competition for skilled personnel in our market is intense and may limit our ability to hire and retain highly qualified personnel on acceptable terms or at all.

We depend on a sole source supplier for a critical vaccine component; the inability to obtain this component as required, with favorable purchase terms, could harm our business.

We currently source a key component of our vaccine from one supplier. Supply shortages for this particular component can delay vaccine production. This could cause us to experience a delay in clinical trials, reduction in sales, increased inventory levels and costs, and could adversely affect relationships with existing and prospective customers. In the past, we have secured sufficient allocations of the component. If we are unable to procure this necessary component under favorable purchase terms from this supplier, including at favorable prices and with the order lead-times needed, our results of operations could suffer.

Obtaining and maintaining regulatory approval of our vaccine in one jurisdiction does not mean that we will be successful in obtaining regulatory approval of our vaccine in other jurisdictions.

Obtaining and maintaining regulatory approval of our vaccine in one jurisdiction does not guarantee that we will be able to obtain or maintain regulatory approval in any other jurisdiction, while a failure or delay in obtaining regulatory approval in one jurisdiction may have a negative effect on the regulatory approval process in others. For example, even if the FDA grants marketing approval of a vaccine candidate, comparable regulatory authorities in foreign jurisdictions must also approve the manufacturing, marketing and promotion of the vaccine candidate in those countries. Approval procedures vary among jurisdictions and can involve requirements and administrative review periods different from, and greater than, those in the United States, including additional preclinical studies or clinical trials as clinical studies conducted in one jurisdiction may not be accepted by regulatory authorities in other jurisdictions. In many jurisdictions outside the United States, a vaccine or antibody must be approved for reimbursement before it can be approved for sale in that jurisdiction. In some cases, the price that we intend to charge for our products is also subject to approval.

We may also submit marketing applications in other countries. Regulatory authorities in jurisdictions outside of the United States have requirements for approval with which we must comply prior to marketing in those jurisdictions. Obtaining foreign regulatory approvals and compliance with foreign regulatory requirements could result in significant delays, difficulties and costs for us and could delay or prevent the introduction of our products in certain countries. If we fail to comply with the regulatory requirements in international markets and/or receive applicable marketing approvals, our target market will be reduced and our ability to realize the full market potential of our vaccine or antibody will be harmed.

We may form or seek strategic alliances or enter into additional licensing arrangements in the future, and we may not realize the benefits of such alliances or licensing arrangements.

We may form or seek strategic alliances, create joint ventures or collaborations or enter into additional licensing arrangements with third parties that we believe will complement or augment our discovery, development and commercialization efforts with respect to our vaccine and any future vaccine that we may seek to develop. Any of these relationships may require us to incur non-recurring and other charges, increase our near and long-term expenditures, issue securities that dilute our existing stockholders or disrupt our management and business. In addition, we face significant competition in seeking appropriate strategic partners, and the negotiation process is time-consuming and complex. Moreover, we may not be successful in our efforts to establish a strategic partnership or other alternative arrangements for our vaccine because they may be deemed to be at too early of a stage of development for collaborative effort, and third parties may not view our vaccine as having the requisite potential to demonstrate safety and efficacy. Any delays in entering into new strategic partnership agreements related to our vaccine could delay the development and commercialization of our vaccine in certain geographies for certain indications, which would harm our business prospects, financial condition and results of operations.

If we license products or businesses, we may not be able to realize the benefit of such transactions if we are unable to successfully integrate them with our existing operations and company culture. We cannot be certain that, following a strategic transaction or license, we will achieve the results, revenue or specific net income that justifies such transaction.

Revenue from any “catch up” opportunity may decline over time as more of the patient population is vaccinated

Even if we obtain approval to serve as a “catch up” or booster to those adults who have previously received Pneumovax 23 or a lower valent PCV, previous vaccines with a “catch up” opportunity have seen sales decline over time after a high initial capture rate as the number of individuals who remain unvaccinated with the new vaccine, and eligible for “catch up” opportunities, declines. Such decline could adversely affect our revenue over time.

Our internal computer systems, or those used by our CROs or other contractors or consultants, may fail or suffer security breaches.

Despite the implementation of security measures, our internal computer systems and the systems of our CROs, contractors and consultants are vulnerable to damage from computer viruses and unauthorized access. Additionally, the increased usage of computers operated on home networks due to the shelter-in-place or similar restrictions related to the COVID-19 pandemic may make our systems more susceptible to security breaches. While we have not experienced any such material system failure or security breach to date, if such an event were to occur and cause interruptions in our operations, it could result in a material disruption of our development programs and our business operations. For example, the loss of clinical trial data from future clinical trials could result in delays in our regulatory approval efforts and significantly increase our costs to recover or reproduce the data. To the extent that any disruption or security breach were to result in a loss of, or damage to, our data or applications, or inappropriate disclosure of confidential or proprietary information, we could incur liability and the further development and commercialization of our vaccine could be delayed.

We may be unable to adequately protect our information systems from cyberattacks, which could result in the disclosure of confidential or proprietary information, including personal data, damage our reputation, and subject us to significant financial and legal exposure.

We rely on information technology systems that we or our third-party providers operate to process, transmit and store electronic information in our day-to-day operations. In connection with our product discovery efforts, we may collect and use a variety of personal data, such as name, mailing address, email addresses, phone number and clinical trial information. A successful cyberattack could result in the theft or destruction of intellectual property, data or other misappropriation of assets, or otherwise compromise our confidential or proprietary information and disrupt our operations. Cyberattacks are increasing in their frequency, sophistication and intensity, and have become increasingly difficult to detect. Cyberattacks could include wrongful conduct by hostile foreign governments, industrial espionage, wire fraud and other forms of cyber fraud, the deployment of harmful malware, denial-of-service, social engineering fraud or other means to threaten data security, confidentiality, integrity and availability. A successful cyberattack could cause serious negative consequences for us, including, without limitation, the disruption of operations, the misappropriation of confidential business information, including financial information, trade secrets, financial loss and the disclosure of corporate strategic plans. Although we devote resources to protect our information systems, we realize that cyberattacks are a threat, and there can be no assurance that our efforts will prevent information security breaches that would result in business, legal, financial or reputational harm to us, or would have a material adverse effect on our results of operations and financial condition. Any failure to prevent or mitigate security breaches or improper access to, use of, or disclosure of our clinical data or patients’ personal data could result in significant liability under state (e.g., state breach notification laws), federal (e.g., HIPAA, as amended by HITECH), and international law (e.g., the European Union, or EU, General Data Protection Regulation, or GDPR) and may cause a material adverse impact to our reputation, affect our ability to use collected data, conduct new studies and potentially disrupt our business.

We rely on our third-party providers to implement effective security measures and identify and correct for any such failures, deficiencies or breaches. We also rely on our employees and consultants to safeguard their security credentials and follow our policies and procedures regarding use and access of computers and other devices that may contain our sensitive information. If we or our third-party providers fail to maintain or protect our information technology systems and data integrity effectively or fail to anticipate, plan for or manage significant disruptions to our information technology systems, we or our third-party providers could have difficulty preventing, detecting and controlling such cyber-attacks and any such attacks could result in losses described above as well as disputes with physicians, patients and our partners, regulatory sanctions or penalties, increases in operating expenses, expenses or lost revenues or other adverse consequences, any of which could have a material adverse effect on our business, results of operations, financial condition, prospects and cash flows. Any failure by such third parties to prevent or mitigate security breaches or improper access to or disclosure of such information could have similarly adverse consequences for us. If we are unable to prevent or mitigate the impact of such security or data privacy breaches, we could be exposed to litigation and governmental investigations, which could lead to a potential disruption to our business.

Our business could be adversely affected by the effects of health epidemics, including the evolving effects of the COVID-19 pandemic, in regions where we or third parties on which we rely have significant manufacturing facilities, concentrations of potential clinical trial sites or other business operations. The COVID-19 pandemic could materially affect our operations, including at our headquarters in the Massachusetts area.

Health epidemics in regions where we have concentrations of potential clinical trial sites or other business operations could adversely affect our business, including by causing significant disruption in the operations of our contract manufacturer and other third parties upon whom we rely. For example, the COVID-19 pandemic has presented a substantial public health and economic challenge around the world and is affecting employees, patients, communities and business operations, as well as the U.S. economy and financial markets.

If product liability lawsuits are brought against us, we may incur substantial liabilities and may be required to limit commercialization of our vaccine and antibody.

We face an inherent risk of product liability as a result of the clinical testing of our vaccine and will face an even greater risk if we commercialize any products. For example, we may be sued if our vaccine or antibody cause or are perceived to cause injury or are found to be otherwise unsuitable during clinical testing, manufacturing, marketing or sale. Any such product liability claims may include allegations of defects in manufacturing, defects in design, a failure to warn of dangers inherent in the product, negligence, strict liability or a breach of warranties. Claims could also be asserted under state consumer protection acts. If we cannot successfully defend ourselves against product liability claims, we may incur substantial liabilities or be required to limit commercialization of our vaccine. Even successful defense would require significant financial and management resources. Regardless of the merits or eventual outcome, liability claims may result in:

- decreased demand for our vaccine;
- injury to our reputation;
- withdrawal of clinical trial participants;
- initiation of investigations by regulators;
- costs to defend the related litigation;
- a diversion of management's time and our resources;
- substantial monetary awards to trial participants or patients;
- product recalls, withdrawals or labeling, marketing or promotional restrictions;
- loss of revenue;
- exhaustion of any available insurance and our capital resources;
- the inability to commercialize any vaccine candidate; and
- a decline in our share price.

Our inability to obtain sufficient product liability insurance at an acceptable cost to protect against potential product liability claims could prevent or inhibit the commercialization of products we develop, alone or with corporate collaborators. Our insurance policies may also have various exclusions, and we may be subject to a product liability claim for which we have no coverage. Assuming we obtain clinical trial insurance for our clinical trials, we may have to pay amounts awarded by a court or negotiated in a settlement that exceed our coverage limitations or that are not covered by our insurance, and we may not have, or be able to obtain, sufficient capital to pay such amounts. Even if our agreements with any future corporate collaborators entitle us to indemnification against losses, such indemnification may not be available or adequate should any claim arise.

Unstable market and economic conditions may have serious adverse consequences on our business, financial condition and stock price.

The global credit and financial markets have experienced extreme volatility and disruptions in the past several years, including most recently as a result of the COVID-19 pandemic. Such volatility and disruptions have caused and may continue to cause severely diminished liquidity and credit availability, declines in consumer confidence, declines in economic growth, increases in unemployment rates and uncertainty about economic stability. There can be no assurance that further deterioration in credit and financial markets and confidence in economic conditions will not occur. Our general business strategy may be adversely affected by any such economic downturn, volatile business environment or continued unpredictable and unstable market conditions. If the current equity and credit markets deteriorate, it may make any necessary debt or equity financing more difficult, more costly and more dilutive. Failure to secure any necessary financing in a timely manner and on favorable terms could have a material adverse effect on our growth strategy, financial performance and stock price and could require us to delay or abandon clinical development plans. In addition, there is a risk that one or more of our current service providers, manufacturers and other partners may not survive an economic downturn, which could directly affect our ability to attain our operating goals on schedule and on budget.

Our employees, principal investigators, consultants and commercial partners may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements and insider trading.

We are exposed to the risk of fraud or other misconduct by our employees, principal investigators, consultants and commercial partners. Misconduct by these parties could include intentional failures, reckless and/or negligent conduct or unauthorized activities that violates (i) the laws and regulations of the FDA and other regulatory authorities, including those laws requiring the reporting of true, complete and accurate information to such authorities, (ii) manufacturing standards, (iii) federal and state data privacy, security, fraud and abuse and other healthcare laws and regulations in the United States and abroad and (iv) laws that require the true, complete and accurate reporting of financial information or data.

In particular, sales, marketing and business arrangements in the healthcare industry are subject to extensive laws and regulations intended to prevent fraud, misconduct, kickbacks, self-dealing and other abusive practices. These laws and regulations restrict or prohibit a wide range of pricing, discounting, marketing and promotion, sales commission, customer incentive programs and other business arrangements. Such misconduct also could involve the improper use of individually identifiable information, including, without limitation, information obtained in the course of clinical trials, creating fraudulent data in our preclinical studies or clinical trials or illegal misappropriation of drug product, which could result in regulatory sanctions and cause serious harm to our reputation.

It is not always possible to identify and deter misconduct by employees and other third parties, and the precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from government investigations or other actions or lawsuits stemming from a failure to comply with these laws or regulations. Additionally, we are subject to the risk that a person or government could allege such fraud or other misconduct, even if none occurred. Any action against us for violation of these laws, even if we successfully defend against it, could cause us to incur significant legal expenses and divert our management's attention from the operation of our business. If any such actions are instituted against us and we are not successful in defending ourselves or asserting our rights, those actions could result in significant civil, criminal and administrative penalties, damages, fines, disgorgement, imprisonment, exclusion from participating in government-funded healthcare programs, such as Medicare and Medicaid, additional reporting requirements and oversight if we become subject to a corporate integrity agreement or similar agreement to resolve allegations of noncompliance with these laws, contractual damages, reputational harm and the curtailment or restructuring of our operations, any of which could have a negative impact on our business, financial condition, results of operations and prospects. The shifting compliance environment and the need to build and maintain robust and expandable systems to comply with multiple jurisdictions with different compliance and/or reporting requirements increases the possibility that a healthcare company may run afoul of one or more of the requirements.

The Tax Cuts and Jobs Act, or the Tax Act, could adversely affect our business and financial condition.

In December 2017, the Tax Act was signed into law. The Tax Act, among other things, contains significant changes to corporate taxation, including (i) reduction of the corporate tax rate from a top marginal rate of 35% to a flat rate of 21%, (ii) limitation of the tax deduction for interest expense to 30% of adjusted earnings (with certain exceptions, including for certain small businesses), (iii) limitation of the deduction for post-2017 net operating losses, or NOLs, to 80% of current-year taxable income and elimination of net operating loss carrybacks for post-2017 NOLs, (iv) immediate deductions for certain new investments instead of deductions for depreciation expense over time and (v) modifying or repealing many business deductions and credits (including reducing the business tax credit for certain clinical testing expenses incurred in the testing of certain drugs for rare diseases or conditions generally referred to as "orphan drugs").

We continue to examine the impact the Tax Act may have on our business. Notwithstanding the reduction in the corporate income tax rate, the overall impact of the Tax Act is uncertain and our business, financial condition, results of operations and prospects could be adversely affected. We urge our stockholders, including purchasers of common stock in this offering, to consult with their legal and tax advisors with respect to the Tax Act and the tax consequences of investing in our common stock. Our ability to utilize our net operating loss carryforwards and certain other tax attributes may be limited. We have incurred substantial losses since inception and do not expect to become profitable in the near future, if ever.

The Tax Act, among other things, includes changes to U.S. federal tax rates and the rules governing NOL carryforwards. For federal NOLs arising in tax years beginning after December 31, 2017, the Tax Act limits a taxpayer's ability to utilize NOL carryforwards to 80% of taxable income. In addition, federal NOLs arising in tax years beginning after December 31, 2017 can be carried forward indefinitely, but carryback is generally prohibited. Deferred tax assets for NOLs will need to be measured at the applicable tax rate in effect when the NOL is expected to be utilized. The new limitation on use of NOLs may significantly impact our ability to utilize our NOLs to offset taxable income in the future. Our insurance policies may be inadequate and potentially expose us to unrecoverable risks. Although we intend to maintain product liability insurance coverage, such insurance may not be adequate to cover all liabilities that we may incur. We anticipate that we will need to increase our insurance coverage each time we commence a clinical trial and if we successfully commercialize any vaccine candidate. Insurance availability, coverage terms and pricing continue to vary with market conditions. We endeavor to obtain appropriate insurance coverage for insurable risks that we identify; however, we may fail to correctly anticipate or quantify insurable risks, we may not be able to obtain appropriate insurance coverage and insurers may not respond as we intend to cover insurable events that may occur. Conditions in the insurance markets relating to nearly all areas of traditional corporate insurance change rapidly and may result in higher premium costs, higher policy deductibles and lower coverage limits. For some risks, we may not have or maintain insurance coverage because of cost or availability.

Risks Related to Our Reliance on Third Parties

We rely and will continue to rely on third parties to conduct our preclinical studies and clinical trials. If these third parties do not successfully carry out their contractual duties or meet expected deadlines, we may not be able to obtain regulatory approval of or commercialize our vaccine.

We currently do not have the ability to independently conduct preclinical or clinical studies that comply with the regulatory requirements known as good laboratory practices and GCP. The FDA and regulatory authorities in other jurisdictions require us to comply with GCP requirements for conducting, monitoring, recording and reporting the results of clinical trials, in order to ensure that the data and results are scientifically credible and accurate and that the trial subjects are adequately informed of the potential risks of participating in clinical trials. We rely on independent investigators and collaborators, such as universities, medical institutions, CROs and strategic partners to conduct our preclinical and clinical trials under agreements with us.

We will need to negotiate budgets and contracts with CROs and study sites, which may result in delays to our development timelines and increased costs. We will rely heavily on these third parties over the course of our clinical trials, and we control only certain aspects of their activities. Nevertheless, we are responsible for ensuring that each of our studies is conducted in accordance with applicable protocol and legal, regulatory and scientific standards, and our reliance on third parties does not relieve us of our regulatory responsibilities. We and these third parties are required to comply with GCPs, which are regulations and guidelines enforced by the FDA and comparable foreign regulatory authorities for vaccine in clinical development. Regulatory authorities enforce these GCPs through periodic inspections of trial sponsors, principal investigators and trial sites. If we or any of these third parties fail to comply with applicable GCP regulations, the clinical data generated in our clinical trials may be deemed unreliable, and the FDA or comparable foreign regulatory authorities may require us to perform additional clinical trials before approving our marketing applications. There can be no assurance that, upon inspection, such regulatory authorities will determine that any of our clinical trials comply with the GCP regulations. In addition, our clinical trials must be conducted with biologic product produced under cGMPs and will require a large number of test patients. Our failure or any failure by these third parties to comply with these regulations or to recruit a sufficient number of patients may require us to repeat clinical trials, which would delay the regulatory approval process. Moreover, our business may be implicated if any of these third parties violates federal or state fraud and abuse or false claims laws and regulations or healthcare privacy and security laws.

Any third parties conducting our preclinical studies and clinical trials will not be our employees and, except for remedies available to us under our agreements with such third parties, we cannot control whether or not they devote sufficient time and resources to our programs. These third parties may also have relationships with other commercial entities, including our competitors, for whom they may also be conducting clinical trials or other drug development activities, which could affect their performance on our behalf. If these third parties do not successfully carry out their contractual duties or obligations or meet expected deadlines, if they need to be replaced or if the quality or accuracy of the clinical data they obtain is compromised due to the failure to adhere to our clinical protocols or regulatory requirements or for other reasons, our clinical trials may be extended, delayed or terminated and we may not be able to complete development of, obtain regulatory approval of or successfully commercialize our vaccine. As a result, our financial results and the commercial prospects for our vaccine would be harmed, our costs could increase and our ability to generate revenue could be delayed.

If any of our relationships with trial sites or any CRO that we may use in the future terminates, we may not be able to enter into arrangements with alternative trial sites or CROs or do so on commercially reasonable terms. Switching or adding third parties to conduct our clinical trials involves substantial cost and requires extensive management time and focus. In addition, there is a natural transition period when a new third party commences work. As a result, delays occur, which can materially impact our ability to meet our desired clinical development timelines.

We rely on third parties, including Glycosyn and Lonza, to supply raw materials and manufacture our preclinical and clinical product supplies of our vaccine, and expect to rely on third parties to supply raw materials and produce and process our vaccine, if approved. The loss of these suppliers or their failure to comply with applicable regulatory requirements or provide us with sufficient quantities at acceptable quality levels or prices, or at all, would materially and adversely affect our business.

We do not have nor do we plan to build or acquire the infrastructure or capability internally to manufacture supplies for our vaccine and antibody or the materials necessary to produce our vaccine for use in the conduct of our preclinical studies or clinical trials, and we lack the internal resources and the capability to manufacture any of our vaccine on a preclinical, clinical or commercial scale. We have entered into an agreement with Glycosyn to supply us the key component of our vaccine (the oligosaccharide) use in manufacturing non-clinical and clinical supplies. We have engaged Lonza to perform manufacturing process development and clinical manufacture and supply of the antibody. We also engaged Lonza to perform manufacturing process development and clinical manufacture and supply of F598 drug product. Our agreements with Lonza are denominated in Swiss Francs. Fluctuations in the exchange rate for Swiss Francs may increase our costs and affect our operating results.

In addition, our anticipated reliance on a limited number of third-party suppliers and manufacturers exposes us to the following risks:

- We may be unable to identify manufacturers on acceptable terms or at all because the number of potential manufacturers is limited and the FDA may have questions regarding any replacement contractor. This may require new testing and regulatory interactions. In addition, a new manufacturer would have to be educated in, or develop substantially equivalent processes for, production of our products after receipt of FDA questions, if any.
- Our third-party suppliers and manufacturers might be unable to timely formulate and manufacture or supply raw materials for our vaccine or produce the quantity and quality required to meet our clinical and commercial needs, if any.
- Contract manufacturers may not be able to execute our manufacturing procedures appropriately.
- Our future contract manufacturers may not perform as agreed or may not remain in the contract manufacturing business for the time required to supply our clinical trials or to successfully produce, store and distribute our products.
- Manufacturers are subject to ongoing periodic unannounced inspection by the FDA, the Drug Enforcement Administration and corresponding state agencies to ensure strict compliance with cGMP and other government regulations and corresponding foreign standards. We do not have control over third-party manufacturers' compliance with these regulations and standards.
- We may not own, or may have to share, the intellectual property rights to any improvements made by our third-party manufacturers in the manufacturing process for our products.
- Our third-party suppliers and manufacturers could breach or terminate their agreement with us.

Each of these risks could delay our clinical trials, the approval, if any, of our vaccine by the FDA or the commercialization of our antibody and vaccine or result in higher costs or deprive us of potential product revenue. In addition, we will rely on third parties to perform release tests on our vaccine prior to delivery to patients. If these tests are not appropriately done and test data are not reliable, patients could be put at risk of serious harm.

If we or our third-party suppliers use hazardous, non-hazardous, biological or other materials in a manner that causes injury or violates applicable law, we may be liable for damages.

Our research and development activities involve the controlled use of potentially hazardous substances, including chemical and biological materials. We and our suppliers are subject to federal, state and local laws and regulations in the United States governing the use, manufacture, storage, handling and disposal of medical and hazardous materials. Although we believe that we and our suppliers' procedures for using, handling, storing and disposing of these materials comply with legally prescribed standards, we and our suppliers cannot completely eliminate the risk of contamination or injury resulting from medical or hazardous materials. As a result of any such contamination or injury, we may incur liability or local, city, state or federal authorities may curtail the use of these materials and interrupt our business operations. In the event of an accident, we could be held liable for damages or penalized with fines, and the liability could exceed our resources. We do not have any insurance for liabilities arising from medical or hazardous materials. Compliance with applicable environmental laws and regulations is expensive, and current or future environmental regulations may impair our research, development and production efforts, which could harm our business prospects, financial condition or results of operations.

Risks Related to Government Regulation

The FDA regulatory approval process is lengthy and time-consuming, and we may experience significant delays in the clinical development and regulatory approval

The research, testing, manufacturing, labeling, approval, selling, import, export, marketing and distribution of drug products, including biologics such as conjugate vaccines, are subject to extensive regulation by the FDA and other regulatory authorities in the United States. We expect that our vaccine and antibody candidates will be regulated by the FDA as biologics. We are not permitted to market any biological drug product in the United States until we receive approval of a Biologics License Application, or BLA, from the FDA. We have not previously submitted a BLA to the FDA, or similar approval filings to comparable foreign regulatory authorities. A BLA must include extensive preclinical and clinical data and supporting information to establish the vaccine candidate's safety and effectiveness for each desired indication. Further, because our vaccine that are subject to regulation as biological drug products, we will need to demonstrate that they are safe, pure and potent for use in their target indications. The BLA must also include significant information regarding the CMC for the product, including with respect to chain of identity and chain of custody of the product.

Clinical testing is expensive and can take many years to complete, and its outcome is inherently uncertain. Failure can occur at any time during the clinical trial process. The results of preclinical studies of our vaccine may not be predictive of the results of early-stage or later-stage clinical trials, and results of early clinical trials of our vaccine may not be predictive of the results of later-stage clinical trials. The results of clinical trials in one set of patients or disease indications may not be indicative of those obtained in another. In some instances, there can be significant variability in safety or efficacy results between different clinical trials of the same vaccine candidate due to numerous factors, including changes in trial procedures set forth in protocols, differences in the size and type of the patient populations, changes in and adherence to the dosing regimen and other clinical trial protocols and the rate of dropout among clinical trial participants. Vaccine or antibody candidates in later stages of clinical trials may fail to show the desired safety and efficacy profile despite having progressed through preclinical studies and initial clinical trials. A number of companies in the biopharmaceutical industry have suffered significant setbacks in advanced clinical trials due to lack of efficacy or unacceptable safety issues, notwithstanding promising results in earlier trials. Most drugs that begin clinical trials are never approved by regulatory authorities for commercialization. In addition, even if such clinical trials are successfully completed, we cannot guarantee that the FDA or foreign regulatory authorities will interpret the results as we do, and more trials could be required before we submit a BLA or other marketing application.

We may also experience delays in completing planned clinical trials for a variety of reasons, including delays related to:

- obtaining regulatory authorization to begin a trial, if applicable;
- the availability of financial resources to commence and complete the planned trials;
- reaching agreement on acceptable terms with prospective CROs and clinical trial sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and trial sites;
- obtaining approval at each clinical trial site by an independent IRB;

- recruiting suitable patients to participate in and complete a trial;
- clinical trial sites deviating from trial protocol or dropping out of a trial;
- addressing any safety concerns that arise during the course of a trial;
- adding new clinical trial sites; or
- manufacturing sufficient quantities of qualified materials under cGMPs and applying them on a patient-by-patient basis for use in clinical trials.

We could also encounter delays if physicians encounter unresolved ethical issues associated with enrolling patients in clinical trials of our vaccine or antibody in lieu of using existing therapies that have established safety and efficacy profiles. Further, a clinical trial may be suspended or terminated by us, the IRBs for the institutions in which such trials are being conducted or by the FDA or other regulatory authorities due to a number of factors, including failure to conduct the clinical trial in accordance with regulatory requirements or our clinical protocols, inspection of the clinical trial operations or trial site by the FDA or other regulatory authorities resulting in the imposition of a clinical hold, unforeseen safety issues or adverse side effects, failure to demonstrate a benefit from using a vaccine candidate, changes in governmental regulations or administrative actions, lack of adequate funding to continue the clinical trial or based on a recommendation by the data safety monitoring board. If we experience termination of, or delays in the completion of, any clinical trial of our vaccine, the commercial prospects for our vaccine will be harmed, and our ability to generate product revenue will be delayed. In addition, any delays in completing our clinical trials will increase our costs, slow down our product development and approval process and jeopardize our ability to commence product sales and generate revenue. Many of the factors that cause, or lead to, a delay in the commencement or completion of clinical trials may ultimately lead to the denial of regulatory approval of our vaccine.

The FDA may disagree with our regulatory plan, and we may fail to obtain regulatory approval of our vaccine and antibody.

The general approach for FDA approval of a new biologic or drug is for the sponsor to provide dispositive data from two Phase 3 clinical trials of the relevant biologic or drug in the relevant patient population. Phase 3 clinical trials typically involve hundreds of patients, have significant costs and are time consuming. Based on or discussions with the FDA we believe our current clinical development approach will be positively received. But there can be no assurance that this approach will be sufficient for regulatory approval or that regulators will not require field efficacy trials.

We intend to seek accelerated approval from the FDA for our vaccine and antibody and, if granted, the FDA may require us to perform post-marketing studies as a condition of approval to verify and describe the predicted effect on irreversible morbidity or mortality or other clinical endpoints. If the results from such post-marketing studies are not positive or otherwise fail to show the predicted effect, the drug or biologic may be subject to expedited withdrawal procedures by the FDA. In addition, the standard of care may change with the approval of new products in the same disease areas that we are studying. This may result in the FDA or other regulatory agencies requesting additional studies to show that our vaccine candidate is non-inferior or superior to the new products.

Our clinical trial results may also not support approval. In addition, our vaccine and antibody could fail to receive regulatory approval for many reasons, including the following:

- the FDA or comparable foreign regulatory authorities may disagree with the design or implementation of our clinical trials;
- we may be unable to demonstrate to the satisfaction of the FDA or comparable foreign regulatory authorities that our vaccine and antibody are safe and effective for any of their proposed disease areas;
- the results of clinical trials may not meet the level of statistical significance required by the FDA or comparable foreign regulatory authorities for approval;
- we may be unable to demonstrate that our vaccine's clinical and other benefits outweigh their safety risks;
- any vaccine to be approved in pediatric populations may need to undergo extensive vaccine-vaccine interference studies with the standard of care pediatric vaccine regimen;
- the need to perform superiority or field efficacy trials, which can be larger, longer and more costly, if an existing vaccine is approved for a disease indication;
- the FDA or comparable foreign regulatory authorities may disagree with our interpretation of data from preclinical studies or clinical trials;
- the data collected from clinical trials of our vaccine may not be sufficient to the satisfaction of the FDA or comparable foreign regulatory authorities to support the submission of a BLA or other comparable submission in foreign jurisdictions or to obtain regulatory approval in the United States or elsewhere;
- the FDA or comparable foreign regulatory authorities will inspect the commercial manufacturing facilities we may utilize and may not approve such facilities; and
- the approval policies or regulations of the FDA or comparable foreign regulatory authorities may significantly change in a manner rendering our clinical data insufficient for approval.

Even if we receive regulatory approval of our vaccine or antibody, we will be subject to ongoing regulatory obligations and continued regulatory review, which may result in significant additional expense, and we may be subject to penalties if we fail to comply with regulatory requirements or experience unanticipated problems with our immune therapeutics.

Any regulatory approvals that we receive for our vaccine and antibody may also be subject to limitations on the approved indicated uses for which a product may be marketed or to the conditions of approval, or contain requirements for potentially costly post-marketing testing, including post-marketing clinical trials, and surveillance to monitor the safety and efficacy.

In addition, if the FDA or a comparable foreign regulatory authority approves our vaccine or antibody the manufacturing processes, labeling, packaging, distribution, adverse event reporting, conduct of post-marketing studies, storage, sampling, advertising, promotion, import, export and recordkeeping for our vaccine will be subject to extensive and ongoing regulatory requirements. These requirements include submissions of safety and other post-marketing information and reports, registration and continued compliance with cGMPs and GCPs for any clinical trials that we conduct post-approval. As such, we and our contract manufacturers will be subject to continual review and inspections to assess compliance with cGMP and adherence to commitments made in any BLA, other marketing application and previous responses to inspectional observations. Accordingly, we and others with whom we work must continue to expend time, money and effort in all areas of regulatory compliance, including manufacturing, production and quality control. In addition, the FDA could require us to conduct another study to obtain additional safety or biomarker information. Further, we will be required to comply with FDA promotion and advertising rules, which include, among others, standards for direct-to-consumer advertising, restrictions on promoting products for uses or in patient populations that are not described in the product's approved uses (known as "off-label use"), limitations on industry-sponsored scientific and educational activities and requirements for promotional activities involving the internet and social media. Later discovery of previously unknown problems with our vaccine, including side effects of unanticipated severity or frequency, or with our third-party suppliers or manufacturing processes, or failure to comply with regulatory requirements, may result in revisions to the approved labeling to add new safety information; imposition of post-market studies or clinical trials to assess new safety risks; or imposition of distribution or other restrictions. Other potential consequences include, among other things:

- restrictions on the marketing or manufacturing of our vaccine, withdrawal of the product from the market or voluntary or mandatory product recalls;
- fines, warning letters or holds on clinical trials;
- refusal by the FDA to approve pending applications or supplements to approved applications filed by us or suspension or revocation of regulatory approvals;
- product seizure or detention, or refusal to permit the import or export of our vaccine; and
- injunctions or the imposition of civil or criminal penalties.

The FDA's and other regulatory authorities' policies may change, and additional government regulations may be enacted that could prevent, limit or delay regulatory approval of our vaccine or antibody. We cannot predict the likelihood, nature or extent of government regulation that may arise from future legislation or administrative or executive action, either in the United States or abroad. For example, certain policies of the Trump administration may impact our business and industry. Namely, the Trump administration took several executive actions, including the issuance of a number of Executive Orders, that could impose significant burdens on, or otherwise materially delay, the FDA's ability to engage in routine oversight activities such as implementing statutes through rulemaking, issuance of guidance and review and approval of marketing applications. It is difficult to predict how these orders will be implemented, and the extent to which they will impact the FDA's ability to exercise its regulatory authority. If these executive actions impose restrictions on the FDA's ability to engage in oversight and implementation activities in the normal course, our business may be negatively impacted. If we are slow or unable to adapt to changes in existing requirements or the adoption of new requirements or policies, or if we are not able to maintain regulatory compliance, we may lose any marketing approval that we may have obtained, and we may not achieve or sustain profitability.

Any government investigation of alleged violations of law could require us to expend significant time and resources in response and could generate negative publicity. Any failure to comply with ongoing regulatory requirements may significantly and adversely affect our ability to commercialize and generate revenue from our products. If regulatory sanctions are applied or if regulatory approval is withdrawn, the value of our company and our operating results will be adversely affected.

We expect the vaccine and antibody we develop will be regulated as biological products, or biologics, and therefore they may be subject to competition sooner than anticipated.

The Biologics Price Competition and Innovation Act of 2009, or BPCIA, was enacted as part of the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act of 2010, or collectively, ACA, to establish an abbreviated pathway for the approval of biosimilar and interchangeable biological products. The regulatory pathway establishes legal authority for the FDA to review and approve biosimilar biologics, including the possible designation of a biosimilar as “interchangeable” based on its similarity to an approved biologic. Under the BPCIA, an application for a biosimilar product cannot be approved by the FDA until twelve years after the reference product was approved under a BLA. The law is complex and is still being interpreted and implemented by the FDA. As a result, its ultimate impact, implementation and meaning are subject to uncertainty. While it is uncertain when such processes intended to implement the BPCIA may be fully adopted by the FDA, any such processes could have a material adverse effect on the future commercial prospects for our biological products.

We believe that if the vaccine and antibody we develop is approved in the United States as a biological product under a BLA should qualify for the twelve-year period of exclusivity. However, there is a risk that this exclusivity could be shortened due to congressional action or otherwise, or that the FDA will not consider the subject vaccine to be reference products for competing products, potentially creating the opportunity for generic competition sooner than anticipated. Moreover, the extent to which a biosimilar, once approved, will be substituted for any one of the reference products in a way that is similar to traditional generic substitution for non-biological products is not yet clear, and will depend on a number of marketplace and regulatory factors that are still developing.

Our relationships with customers, physicians and third-party payors are subject, directly or indirectly, to federal and state healthcare fraud and abuse laws, health information privacy and security laws and other healthcare laws and regulations. If we or our employees, independent contractors, consultants, commercial partners and vendors violate these laws, we could face substantial penalties.

Healthcare providers, physicians and third-party payors in the United States and elsewhere will play a primary role in the recommendation and prescription of any vaccine for which we obtain marketing approval. Our current and future arrangements with healthcare professionals, principal investigators, consultants, customers and third-party payors subject us to various federal and state fraud and abuse laws and other healthcare laws. These laws may constrain the business or financial arrangements and relationships through which we conduct our operations, including how we research, market, sell and distribute our vaccine, if approved. Such laws include:

- the U.S. federal Anti-Kickback Statute, which prohibits, among other things, persons or entities from knowingly and willfully soliciting, offering, receiving or providing any remuneration (including any kickback, bribe or certain rebate), directly or indirectly, overtly or covertly, in cash or in kind, to induce or reward, or in return for, either the referral of an individual for, or the purchase, lease, order or recommendation of, any good, facility, item or service, for which payment may be made, in whole or in part, under any U.S. federal healthcare program, such as Medicare and Medicaid. A person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;
- the U.S. federal civil and criminal false claims laws, including the civil False Claims Act, which can be enforced through civil whistleblower or qui tam actions, and civil monetary penalties laws, which prohibit, among other things, individuals or entities from knowingly presenting, or causing to be presented, to the U.S. federal government, claims for payment or approval that are false or fraudulent, knowingly making, using or causing to be made or used, a false record or statement material to a false or fraudulent claim, or from knowingly making a false statement to avoid, decrease or conceal an obligation to pay money to the U.S. federal government. Pharmaceutical manufacturers can cause false claims to be presented to the U.S. federal government by engaging in impermissible marketing practices, such as the off-label promotion of a product for an indication for which it has not received FDA approval. In addition, the government may assert that a claim including items and services resulting from a violation of the U.S. federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the civil False Claims Act;

- the Health Insurance Portability and Accountability Act of 1996, or HIPAA, which prohibits, among other things, knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program, or knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statement, in connection with the delivery of, or payment for, healthcare benefits, items or services. Similar to the U.S. federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the healthcare fraud statute implemented under HIPAA or specific intent to violate it in order to have committed a violation;
- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act, or HITECH, and its implementing regulations, which also impose certain obligations, including mandatory contractual terms, with respect to safeguarding the privacy and security of individually identifiable health information of covered entities subject to the rule, including health plans, healthcare clearinghouses and certain healthcare providers as well as their business associates, independent contractors of a covered entity that perform certain services involving the use or disclosure of individually identifiable health information for or on their behalf;
- the Federal Food Drug or Cosmetic Act, which prohibits, among other things, the adulteration or misbranding of drugs, biologics and medical devices;
- the U.S. Physician Payments Sunshine Act and its implementing regulations, which require certain manufacturers of drugs, devices, biologics and medical supplies that are reimbursable under Medicare, Medicaid or the Children's Health Insurance Program, with specific exceptions, to report annually to the Centers for Medicare and Medicaid Services, or CMS, information related to certain payments and other transfers of value to physicians (defined to include doctors, dentists, optometrists, podiatrists and chiropractors) and teaching hospitals, as well as ownership and investment interests held by the physicians described above and their immediate family members;
- analogous U.S. state laws and regulations, including: state anti-kickback and false claims laws, which may apply to our business practices, including but not limited to, research, distribution, sales and marketing arrangements and claims involving healthcare items or services reimbursed by any third-party payor, including private insurers; state laws that require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the U.S. federal government, or otherwise restrict payments that may be made to healthcare providers and other potential referral sources; state laws and regulations that require drug manufacturers to file reports relating to pricing and marketing information, which require tracking gifts and other remuneration and items of value provided to healthcare professionals and entities; state and local laws requiring the registration of pharmaceutical sales representatives; and state laws governing the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts; and
- similar healthcare laws and regulations in the EU and other jurisdictions, including reporting requirements detailing interactions with and payments to healthcare providers and laws governing the privacy and security of certain protected information, such as the General Data Protection Regulation, or GDPR, which imposes obligations and restrictions on the collection and use of personal data relating to individuals located in the EU (including health data).

We may also be subject to other laws, such as the U.S. Foreign Corrupt Practices Act of 1977, as amended, which prohibit, among other things, U.S. companies and their employees and agents from authorizing, promising, offering or providing, directly or indirectly, corrupt or improper payments or anything else of value to foreign government officials, employees of public international organizations and foreign government owned or affiliated entities, candidates for foreign political office and foreign political parties or officials thereof, as well as federal consumer protection and unfair competition laws, which broadly regulate marketplace activities and activities that potentially harm consumers.

Ensuring that our internal operations and business arrangements with third parties comply with applicable healthcare laws and regulations will likely be costly. It is possible that governmental authorities will conclude that our business practices, including our relationships with physicians and other healthcare providers, some of whom are compensated in the form of stock options for consulting services provided, may not comply with current or future statutes, regulations or case law involving applicable fraud and abuse or other healthcare laws and regulations. If our operations are found to be in violation of any of these laws or any other governmental regulations that may apply to us, we may be subject to significant civil, criminal and administrative penalties, damages, fines, disgorgement, imprisonment, exclusion from participating in government-funded healthcare programs, such as Medicare and Medicaid, additional reporting requirements and oversight if we become subject to a corporate integrity agreement or similar agreement to resolve allegations of noncompliance with these laws, contractual damages, reputational harm and the curtailment or restructuring of our operations.

Even if resolved in our favor, litigation or other legal proceedings relating to healthcare laws and regulations may cause us to incur significant expenses and could distract our technical and management personnel from their normal responsibilities. In addition, there could be public announcements of the results of hearings, motions or other interim proceedings or developments. If securities analysts or investors perceive these results to be negative, it could have a substantial adverse effect on the price of our common stock. Such litigation or proceedings could substantially increase our operating losses and reduce the resources available for development, manufacturing, sales, marketing or distribution activities. Uncertainties resulting from the initiation and continuation of litigation or other proceedings relating to applicable healthcare laws and regulations could have an adverse effect on our ability to compete in the marketplace. In addition, if the physicians or other providers or entities with whom we expect to do business are found not to be in compliance with applicable laws, they may be subject to significant criminal, civil or administrative sanctions, including exclusions from government-funded healthcare programs.

Insurance Coverage and reimbursement rates may be limited or unavailable in certain market segments for our vaccine and antibody, which could make it difficult for us to sell our therapeutics, if approved, profitably.

Successful sales of our vaccine and antibody, if approved, depend on the availability of coverage and adequate reimbursement from third-party payors including governmental healthcare programs, such as Medicare and Medicaid, managed care organizations and commercial payors, among others. Significant uncertainty exists as to the coverage and reimbursement status of any vaccine for which we obtain regulatory approval. Patients who receive vaccines and antibodies generally rely on third-party payors to reimburse all or part of the costs associated with their treatment. Obtaining coverage and adequate reimbursement from third-party payors is critical to new product acceptance. Third-party payors decide which drugs and treatments they will cover and the amount of reimbursement. Reimbursement by a third-party payor may depend upon a number of factors, including, but not limited to, the third-party payor's determination that use of a product is:

- a covered benefit under its health plan;

- safe, effective and medically necessary;
- appropriate for the specific patient;
- cost-effective; and
- neither experimental nor investigational.

Obtaining coverage and reimbursement of a product from a government or other third-party payor is a time-consuming and costly process that could require us to provide to the payor supporting scientific, clinical and cost-effectiveness data for the use of our products. Even if we obtain coverage for a given product, if the resulting reimbursement rates are insufficient, hospitals may not approve our product for use in their facility or third-party payors may require co-payments that patients find unacceptably high. Patients are unlikely to use our vaccine unless coverage is provided, and reimbursement is adequate to cover a significant portion of the cost of our vaccine and antibody. Separate reimbursement for the product itself may or may not be available. Instead, the hospital or administering physician may be reimbursed only for administering the product. Further, from time to time, CMS revises the reimbursement systems used to reimburse health care providers, including the Medicare Physician Fee Schedule and Outpatient Prospective Payment System, which may result in reduced Medicare payments. In some cases, private third-party payors rely on all or portions of Medicare payment systems to determine payment rates.

Changes to government healthcare programs that reduce payments under these programs may negatively impact payments from third-party payers and reduce the willingness of physicians to use our vaccine. Certain ACA marketplace and other private payor plans are required to include coverage for certain preventative services, including vaccinations recommended by the ACIP without cost share obligations (i.e., co-payments, deductibles or co-insurance) for plan members. Children through 18 years of age without other health insurance coverage may be eligible to receive such vaccinations free-of-charge through the CDC's Vaccines for Children program. For Medicare beneficiaries, vaccines may be covered under either the Part B program or Part D depending on several criteria, including the type of vaccine and the beneficiary's coverage eligibility. If our vaccine, once approved, are covered only under the Part D program, physicians may be less willing to use our products because of the claims adjudication costs and time related to the claims adjudication process and collection of co-payments associated with the Part D program.

In the United States, no uniform policy of coverage and reimbursement for products exists among third-party payors. Therefore, coverage and reimbursement for products can differ significantly from payor to payor. Further, one payor's determination to provide coverage for a product does not assure that other payors will also provide coverage for the product.

Adequate third-party reimbursement may not be available to enable us to maintain price levels sufficient to realize an appropriate return on our investment in product development. We intend to seek approval to market our vaccine and antibody in both the United States and in selected foreign jurisdictions. If we obtain approval in one or more foreign jurisdictions for our vaccine and antibody, we will be subject to rules and regulations in those jurisdictions. In some foreign countries, particularly those in Europe, the pricing of biologics is subject to governmental control. In these countries, pricing negotiations with governmental authorities can take considerable time after obtaining marketing approval of a vaccine candidate. Some of these countries may require the completion of clinical trials that compare the cost-effectiveness of a particular vaccine to currently available vaccines. Other member states allow companies to fix their own prices for medicines but monitor and control company profits. The downward pressure on health care costs has become very intense. As a result, increasingly high barriers are being erected to the entry of new products. In addition, in some countries, cross-border imports from low-priced markets exert a commercial pressure on pricing within a country.

The marketability of any vaccine for which we receive regulatory approval for commercial sale may suffer if government and other third-party payors fail to provide coverage and adequate reimbursement. We expect downward pressure on pharmaceutical pricing to continue. Further, coverage policies and third-party reimbursement rates may change at any time. Even if favorable coverage and reimbursement status is attained for one or more products for which we receive regulatory approval, less favorable coverage policies and reimbursement rates may be implemented in the future. Healthcare legislative reform measures may have a negative impact on our business, financial condition, results of operations and prospects. In the United States and some foreign jurisdictions, there have been, and we expect there will continue to be, several legislative and regulatory changes and proposed changes regarding the healthcare system that could prevent or delay marketing approval of vaccine, restrict or regulate post-approval activities and affect our ability to profitably sell any vaccine for which we obtain marketing approval. In particular, there have been and continue to be a number of initiatives at the U.S. federal and state levels that seek to reduce healthcare costs and improve the quality of healthcare. For example, in March 2010, the ACA was passed, which substantially changed the way healthcare is financed by both governmental and private payors in the United States. Among the provisions of the ACA, those of greatest importance to the pharmaceutical and biotechnology industries include:

- an annual, non-deductible fee on any entity that manufactures or imports certain branded prescription drugs and biologic agents, which is apportioned among these entities according to their market share in certain government healthcare programs;
- a Medicare Part D coverage gap discount program, in which manufacturers must agree to offer point-of-sale discounts off negotiated prices of applicable brand drugs to eligible beneficiaries during their coverage gap period, as a condition for the manufacturer's outpatient drugs to be covered under Medicare Part D;
- an increase in the statutory minimum rebates a manufacturer must pay under the Medicaid Drug Rebate Program to 23.1% and 13.0% of the average manufacturer price for branded and generic drugs, respectively;
- a methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for drugs that are inhaled, infused, instilled, implanted or injected;
- extension of a manufacturer's Medicaid rebate liability to covered drugs dispensed to individuals who are enrolled in Medicaid managed care organizations;
- expansion of eligibility criteria for Medicaid programs by, among other things, allowing states to offer Medicaid coverage to certain individuals with income at or below 133% of the federal poverty level, thereby potentially increasing a manufacturer's Medicaid rebate liability;
- expansion of the entities eligible for discounts under the Public Health Service pharmaceutical pricing program;
- a requirement that certain ACA marketplace and other private payor plans include coverage for preventative services, including vaccinations recommended by the ACIP without cost share obligations (i.e., co-payments, deductibles or co-insurance) for plan members;

- a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in and conduct comparative clinical effectiveness research, along with funding for such research; and
- establishment of a Center for Medicare Innovation at the CMS to test innovative payment and service delivery models to lower Medicare and Medicaid spending, potentially including prescription drug spending.

There have been executive, judicial and Congressional challenges to the ACA. For example, the Tax Act included a provision that repealed, effective January 1, 2019, the tax-based shared responsibility payment imposed by the ACA on certain individuals who fail to maintain qualifying health coverage for all or part of a year, which is commonly referred to as the “individual mandate.” On June 17, 2021, the United States Supreme Court dismissed a challenge on procedural grounds that argued the ACA is unconstitutional in its entirety because the “individual mandate” was repealed by Congress. Thus, the ACA will remain in effect in its current form. Moreover, prior to the United States Supreme Court ruling, on January 28, 2021, President Biden issued an executive order that initiated a special enrollment period for purposes of obtaining health insurance coverage through the ACA marketplace, which began on February 15, 2021 and remained open through August 15, 2021. The executive order also instructed certain governmental agencies to review and reconsider their existing policies and rules that limit access to healthcare, including among others, reexamining Medicaid demonstration projects and waiver programs that include work requirements, and policies that create unnecessary barriers to obtaining access to health insurance coverage through Medicaid or the ACA. It is possible that the ACA will be subject to judicial or Congressional challenges in the future. It is unclear how any such challenges, other litigation, and the healthcare reform measures of the Biden administration will impact the ACA.

Other legislative changes have been proposed and adopted in the United States since the ACA was enacted. These changes include aggregate reductions to Medicare payments to providers of 2% per fiscal year pursuant to the Budget Control Act of 2011, which began in 2013 and, due to subsequent legislative amendments to the statute, including the BBA, will remain in effect through 2030 unless additional Congressional action is taken. COVID-19 pandemic relief support legislation suspended the 2% Medicare sequester from May 1, 2020 through December 31, 2021. The American Taxpayer Relief Act of 2012, among other things, further reduced Medicare payments to several types of providers, including hospitals and cancer treatment centers, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. In addition, Congress is considering additional healthcare reform measures as a part of the budget reconciliation process. In addition, Congress is considering additional healthcare reform measures as a part of the budget reconciliation process.

Additional changes that may affect our business include the expansion of new programs such as Medicare payment for performance initiatives for physicians under the Medicare Access and CHIP Reauthorization Act of 2015, or MACRA, which ended the use of the statutory formula for clinician payment and established a quality payment incentive program, also referred to as the Quality Payment Program. This program provides clinicians with two ways to participate, including through the Advanced Alternative Payment Models, or APMs, and the Merit-based Incentive Payment System, or MIPS. In November 2019, CMS issued a final rule finalizing the changes to the Quality Payment Program. At this time, the full impact of the introduction of the Medicare quality payment program on overall physician reimbursement remains unclear. Any reduction in reimbursement from Medicare or other government programs may result in a similar reduction in payments from private payors.

Further, in the United States there has been heightened governmental scrutiny over the manner in which manufacturers set prices for their marketed products, which has resulted in several Congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to drug and biological product pricing, reduce the cost of prescription drugs and biological products under government payor programs and review the relationship between pricing and manufacturer patient programs. At the federal level, the Trump administration used several means to propose or implement drug pricing reform, including through federal budget proposals, executive orders and policy initiatives. For example, on July 24, 2020 and September 13, 2020, the Trump administration announced several executive orders related to prescription drug pricing that attempt to implement several of the administration's proposals. The FDA also released a final rule, effective November 30, 2020, implementing a portion of the importation executive order providing guidance for states to build and submit importation plans for drugs from Canada. Further, on November 20, 2020, the Department of Health and Human Services, or HHS, finalized a regulation removing safe harbor protection for price reductions from pharmaceutical manufacturers to plan sponsors under Part D, either directly or through pharmacy benefit managers, unless the price reduction is required by law. The implementation of the rule has been delayed by the Biden administration from January 1, 2022 to January 1, 2023 in response to ongoing litigation. The rule also creates a new safe harbor for price reductions reflected at the point-of-sale, as well as a new safe harbor for certain fixed fee arrangements between pharmacy benefit managers and manufacturers, the implementation of which have also been delayed until January 1, 2023. On November 20, 2020, CMS issued an interim final rule implementing President Trump's Most Favored Nation executive order, which would tie Medicare Part B payments for certain physician-administered drugs to the lowest price paid in other economically advanced countries, effective January 1, 2021. As a result of litigation challenging the Most Favored Nation model, on August 10, 2021, CMS published a proposed rule that seeks to rescind the Most Favored Nation Model interim final rule. In July 2021, the Biden administration released an executive order, "Promoting Competition in the American Economy," with multiple provisions aimed at prescription drugs. In response to Biden's executive order, on September 9, 2021, HHS released a Comprehensive Plan for Addressing High Drug Prices that outlines principles for drug pricing reform and sets out a variety of potential legislative policies that Congress could pursue as well as potential administrative actions HHS can take to advance these principles. No legislation or administrative actions have been finalized to implement these principles. At the state level, legislatures have increasingly passed legislation and implemented regulations designed to control pharmaceutical and biological product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures and, in some cases, designed to encourage importation from other countries and bulk purchasing. In addition, regional healthcare authorities and individual hospitals are increasingly using bidding procedures to determine which drugs, biological products and suppliers will be included in their healthcare programs. Furthermore, there has been increased interest by third-party payors and governmental authorities in reference pricing systems and publication of discounts and list prices.

We expect that additional U.S. federal healthcare reform measures will be adopted in the future, any of which could limit the amounts that the U.S. federal government will pay for healthcare products and services, which could result in reduced demand for our current or any future vaccine or additional pricing pressures. Further, it is possible that additional governmental action is taken in response to the ongoing COVID-19 pandemic. We cannot predict the likelihood, nature or extent of government regulation that may arise from future legislation or administrative action in the United States or any other jurisdiction. If we or any third parties we may engage are slow or unable to adapt to changes in existing or new requirements or policies, or if we or such third parties are not able to maintain regulatory compliance, our current or any future vaccine we may develop may lose any regulatory approval that may have been obtained and we may not achieve or sustain profitability.

We expect that these and other healthcare reform measures that may be adopted in the future may result in more rigorous coverage criteria and in additional downward pressure on the price that we receive for any approved product, which could have an adverse effect on demand for our vaccine and antibody. Any reduction in reimbursement from Medicare or other government programs may result in a similar reduction in payments from private payors. The implementation of cost containment measures or other healthcare reforms may prevent us from being able to generate revenue, attain profitability or commercialize our products. For additional information on healthcare reform, see the section entitled "Business—Government Regulation."

Changes in funding for the FDA and other government agencies could hinder our ability to hire and retain key leadership and other personnel, or otherwise prevent new products and services from being developed or commercialized in a timely manner, which could negatively impact our business.

The ability of the FDA to review and approve new products can be affected by a variety of factors, including government budget and funding levels, ability to hire and retain key personnel and accept the payment of user fees and statutory, regulatory and policy changes. Average review times at the agency have fluctuated in recent years as a result. In addition, government funding of other government agencies that fund research and development activities is subject to the political process, which is inherently fluid and unpredictable.

Disruptions at the FDA and other agencies may also slow the time necessary for new drugs to be reviewed and/or approved by necessary government agencies, which would adversely affect our business. For example, over the last several years, including for 35 days beginning on December 22, 2018, the U.S. government has shut down several times and certain regulatory agencies, such as the FDA, have had to furlough critical FDA employees and stop critical activities. If a prolonged government shutdown occurs, it could significantly impact the ability of the FDA to timely review and process our regulatory submissions, which could have a material adverse effect on our business.

Separately, in response to the global COVID-19 pandemic, on March 10, 2020, the FDA announced its intention to postpone most foreign inspections of manufacturing facilities and products through April 2020, and subsequently, on July 10, 2020, the FDA announced its intention to restart routine pre-announced surveillance inspections of domestic manufacturing facilities. Regulatory authorities outside the United States may adopt similar restrictions or other policy measures in response to the COVID-19 pandemic. If a prolonged government shutdown occurs, or if global health concerns continue to prevent the FDA or other regulatory authorities from conducting their regular inspections, reviews, or other regulatory activities, it could significantly impact the ability of the FDA or other regulatory authorities to timely review and process our regulatory submissions, which could have a material adverse effect on our business.

We are subject to increasingly stringent and rapidly changing laws and regulations related to privacy and data security. The restrictions and costs imposed by these requirements, or our actual or perceived failure to comply with them, could harm our reputation, subject us to significant fines and liability, and adversely affect our business.

We are subject to or affected by numerous evolving federal, state and foreign laws and regulations, as well as policies, contracts and other obligations governing the collection, use, disclosure, retention, and security of personal data. The global data protection landscape is rapidly evolving, and implementation standards and enforcement practices are likely to remain uncertain for the foreseeable future. This landscape may create uncertainty in our business, result in liability or impose additional costs on us. These laws and regulations are subject to differing interpretations and may be inconsistent among jurisdictions, and guidance on implementation and compliance practices are often updated or otherwise revised. The cost of compliance with these laws and regulations is high and is likely to increase in the future. Our failure or perceived failure to comply with these laws and regulations could result in negative publicity, diversion of management time and effort, an inability to process personal data or to operate in certain jurisdictions, restrictions on our operations and legal action against us by governmental entities or others. In many jurisdictions, enforcement actions and consequences for noncompliance are rising.

For example, HIPAA, as amended by HITECH, imposes requirements relating to the privacy and security of individually identifiable health information on health plans, healthcare clearinghouses and certain healthcare providers, and their respective contractors and their covered subcontractors that perform services for them involving individually identifiable health information. Additionally, certain states have adopted healthcare privacy and security laws and regulations comparable to HIPAA, some of which may be more stringent than HIPAA. In the event we fail to properly maintain the privacy and security of individually identifiable health information governed by HIPAA or comparable state laws, and significant or we are responsible for an unauthorized disclosure or security breach of such information, we could be subject to enforcement action under HIPAA or comparable state laws, civil and criminal penalties, and fines.

We are also subject to a growing body of privacy, data security and data protection laws outside of the United States. For example, the EU has adopted the GDPR, which went into effect in May 2018 and introduced strict requirements for processing personal data. Among other obligations under the GDPR, we are required to give more detailed disclosures about how we collect, use and share personal data; contractually commit to data protection measures in our contracts with clients; maintain adequate data security measures; notify regulators and affected individuals of certain personal data breaches; meet extensive privacy governance and documentation requirements; and honor individuals' expanded data protection rights, including their rights to access, correct and delete their personal data. The processing of sensitive personal data, such as health data information, may impose heightened compliance burdens under the GDPR and is a subject of active interest among regulators. Companies that violate the GDPR can face private litigation, regulatory enforcement action, prohibitions on data processing and fines of up to the greater of 20 million Euros or 4% of their worldwide annual revenue.

European data protection laws, including the GDPR, generally restrict the transfer of personal data from Europe, including the European Economic Area, United Kingdom and Switzerland, to the United States and most other countries unless the parties to the transfer have implemented specific safeguards to protect the transferred personal data. Historically, to comply with these restrictions, we have generally relied on the Standard Contractual Clauses for personal data transfers approved by the European Commission. However, a July 2020 decision of the EU's highest court called into question whether the Standard Contractual Clauses can lawfully be used for transfers of personal data from the EU to the United States and most other non-EU countries. Authorities in Switzerland may similarly question the viability of the Standard Contractual Clauses as a mechanism for the lawful transfer of personal data from those countries to the United States or other countries. Further, the UK's decision to leave the EU, often referred to as Brexit, and ongoing developments in the UK have created uncertainty regarding data protection regulation in the UK. Following December 31, 2020, and the expiry of transitional arrangements between the UK and EU, the data protection obligations of the GDPR continue to apply to UK-related Processing of personal data in substantially unvaried form under the so-called 'UK GDPR'. However, going forward, there is increasing risk for divergence in application, interpretation and enforcement of the data protection laws as between the UK and EEA. Furthermore, the relationship between the UK and the EEA in relation to certain aspects of data protection law remains uncertain. For example, it is unclear whether transfers of personal data from the EEA to the UK will be permitted to take place on the basis of a future adequacy decision of the European Commission, or whether a 'transfer mechanism' such as the Standard Contractual Clauses will be required. If we are unable to lawfully transfer personal data from Europe via the Standard Contractual clauses or an alternative mechanism, we will face increased exposure to regulatory actions, substantial fines, and injunctions against processing personal information from Europe, and we may be required to increase our data processing capabilities in Europe at significant expense. Inability to import personal information from Europe may also restrict our clinical trials activities in Europe and limit our ability to collaborate with contract research organizations, service providers, contractors and other companies subject to European data protection laws. Additionally, other countries outside of Europe have enacted or are considering enacting similar cross-border data transfer restrictions and laws requiring local data residency, which could increase the cost and complexity of operating our business.

Domestic privacy and data security laws beyond HIPAA and other healthcare privacy laws are also changing rapidly and becoming more complex. For example, California recently enacted the CCPA, which took effect on January 1, 2020. The CCPA gives California residents expanded rights to access and delete their personal information, opt-out of certain personal information sharing, and receive detailed information about how their personal information is used, among others. The CCPA also requires covered businesses to provide detailed privacy notices to California residents and respond to requests from California residents to exercise their rights under the CCPA to access, delete and opt-out of certain sharing of personal information. The CCPA provides for civil penalties for violations, as well as a private right of action for data breaches that is expected to increase data breach litigation. Although there are limited exemptions for clinical trial data, the CCPA may increase our compliance costs and potential liability. Some observers have noted that the CCPA could mark the beginning of a trend toward more stringent privacy legislation in the U.S. In addition, it is anticipated that the CCPA will be expanded on January 1, 2023, when the California Privacy Rights Act of 2020, or CPRA, becomes operative. The CPRA will, among other things, give California residents the ability to limit use of certain sensitive personal information, further restrict the use of cross-contextual advertising, establish restrictions on the retention of personal information, expand the types of data breaches subject to the CCPA's private right of action, provide for increased penalties for CPRA violations concerning California residents under the age of 16, and establish a new California Privacy Protection Agency to implement and enforce the new law. Although there are limited exemptions for clinical trial data under the CCPA, the CCPA and other similar laws could impact our business activities depending on how it is interpreted.

If any of our product candidates are approved for marketing and we are found to have improperly promoted off-label uses, or if physicians misuse our products or use our products off-label, we may become subject to prohibitions on the sale or marketing of our products, product liability claims and significant fines, penalties and sanctions, and our brand and reputation could be harmed.

If any of our product candidates are approved and we are found to have improperly promoted off-label uses of those products, we may become subject to significant liability. The FDA and other regulatory agencies strictly regulate the promotional claims that may be made about approved prescription drug products. In particular, while the FDA permits the dissemination of truthful and non-misleading information about an approved product, a manufacturer may not promote a product for uses that are not approved by the FDA. If we are found to have promoted such off-label uses, we may become subject to significant liability. The federal government has levied large civil and criminal fines against companies for alleged improper promotion of regulated products for off-label uses and has enjoined several companies from engaging in off-label promotion. The FDA has also requested that companies enter into consent decrees, corporate integrity agreements or permanent injunctions under which specified promotional conduct must be changed or curtailed. If we cannot successfully manage the promotion of our product candidates, if approved, we could become subject to significant liability, which would materially adversely affect our business and financial condition.

Risks Related to Our Intellectual Property

If we are unable to obtain and maintain patent protection for our technology and products, or if the scope of the patent protection obtained is not sufficiently broad, we may not be able to compete effectively in our markets.

We rely upon a combination of patents, trade secret protection and confidentiality agreements to protect the intellectual property related to our vaccine and monoclonal antibody development programs. Our success depends in large part on our ability to obtain and maintain patent protection in the United States and other countries with respect to AV0328, F598 and any future candidates, as well as methods of making our vaccine and antibody and components thereof. We seek to protect our proprietary position by filing patent applications in the United States and abroad related to our development programs. The patent prosecution process is expensive and time-consuming, and we may not be able to file and prosecute all necessary or desirable patent applications at a reasonable cost or in a timely manner.

The patents and patent applications that we own or in-license may fail to result in issued patents with claims that protect AV0328, F598 or any future candidate in the United States or in other foreign countries. There is no assurance that all of the potentially relevant prior art relating to our patents and patent applications has been found, which can prevent a patent from issuing from a pending patent application or be used to invalidate a patent. Even if patents do successfully issue and even if such patents cover AV0328, F598 or any future candidate, third parties may challenge their validity, enforceability or scope, which may result in such patents being narrowed, invalidated or held unenforceable. Any successful opposition to these patents or any other patents owned by or licensed to us could deprive us of rights necessary for the successful commercialization of any vaccine or companion diagnostic that we may develop. Further, if we encounter delays in regulatory approvals, the period of time during which we could market a vaccine candidate under patent protection could be reduced.

If the patent applications we hold or have in-licensed with respect to our development programs and vaccine fail to issue, if their breadth or strength of protection is threatened, or if they fail to provide meaningful exclusivity for AV0328, F598 or any future candidate, it could dissuade companies from collaborating with us to develop vaccine and threaten our ability to commercialize future therapies. Any such outcome could have a materially adverse effect on our business.

The patent position of biotechnology and pharmaceutical companies generally is highly uncertain, involves complex legal and factual questions and has been and will continue to be the subject of litigation and new legislation. In addition, the laws of foreign countries may not protect our rights to the same extent as the laws of the United States. For example, many countries restrict the patentability of methods of treatment of the human body. Publications of discoveries in scientific literature often lag behind the actual discoveries, and patent applications in the United States and other jurisdictions are typically not published until 18 months after filing, or in some cases not at all. Therefore, we cannot know with certainty whether we were the first to make the inventions claimed in our owned or licensed patents or pending patent applications, or that we were the first to file for patent protection of such inventions.

As a result of these and other factors, the issuance, scope, validity, enforceability and commercial value of our patent rights are highly uncertain. Our pending and future patent applications may not result in patents being issued which protect our technology or products, in whole or in part, or which effectively prevent others from commercializing competitive technologies and products. Changes in either the patent laws or interpretation of the patent laws in the United States and other countries may diminish the value of our patents or narrow the scope of our patent protection.

Moreover, we may be subject to a third-party pre-issuance submission of prior art to the U.S. Patent and Trademark Office, or the USPTO, or become involved in opposition, derivation, reexamination, inter partes review, post-grant review or interference proceedings challenging our patent rights or the patent rights of others. The costs of defending our patents or enforcing our proprietary rights in post-issuance administrative proceedings and litigation can be substantial and the outcome can be uncertain. An adverse determination in any such submission, proceeding or litigation could reduce the scope of, or invalidate, our patent rights, allow third parties to commercialize our technology or products and compete directly with us, without payment to us, or result in our inability to manufacture or commercialize products without infringing third-party patent rights. In addition, if the breadth or strength of protection provided by our patents and patent applications is threatened, it could dissuade companies from collaborating with us to license, develop or commercialize current or future vaccine.

The issuance of a patent is not conclusive as to its inventorship, scope, validity or enforceability, and our owned and licensed patents may be challenged in the courts or patent offices in the United States and abroad. Such challenges may result in loss of exclusivity or freedom to operate or in patent claims being narrowed, invalidated or held unenforceable, in whole or in part, which could limit our ability to stop others from using or commercializing similar or identical technology and products, or limit the duration of the patent protection of our technology and products. Generally, issued patents are granted a term of 20 years from the earliest claimed non-provisional filing date. In certain instances, patent term can be adjusted to recapture a portion of delay by the USPTO in examining the patent application (patent term adjustment) or extended to account for term effectively lost as a result of the FDA regulatory review period (patent term extension), or both. The scope of patent protection may also be limited. Without patent protection for our current or future vaccine, we may be open to competition from generic versions of such products. Given the amount of time required for the development, testing and regulatory review of new vaccine, patents protecting such candidates might expire before or shortly after such candidates are commercialized. As a result, our owned and licensed patent portfolio may not provide us with sufficient rights to exclude others from commercializing products similar or identical to ours.

If we fail to comply with our obligations under any license, collaboration or other agreements, we may be required to pay damages and could lose intellectual property rights that are necessary for developing and protecting our vaccine.

We have licensed certain intellectual property rights related our PNAG platform from Brigham and Women's Hospital. If, for any reason, these agreements are terminated or we otherwise lose those rights, it could adversely affect our business. These agreements impose, various development, commercialization, funding, milestone, royalty, diligence, sublicensing, insurance, patent prosecution and enforcement or other obligations on us and may affect future collaboration agreements. If we breach any material obligations, or use the intellectual property licensed to us in an unauthorized manner, we may be required to pay damages and the licensor(s) may have the right to terminate the license, which could result in us being unable to develop, manufacture and sell products that are covered by the licensed technology or enable a competitor to gain access to the licensed technology.

Obtaining and maintaining our patent protection depends on compliance with various procedural, document submission, fee payment and other requirements imposed by governmental patent agencies, and our patent protection could be reduced or eliminated for noncompliance with these requirements.

Periodic maintenance fees on any issued patent are due to be paid to the USPTO and other foreign patent agencies in several stages over the lifetime of the patent. The USPTO and various foreign national or international patent agencies require compliance with a number of procedural, documentary, fee payment and other similar provisions during the patent application process. There are situations in which noncompliance can result in abandonment or lapse of the patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. Noncompliance events that could result in abandonment or lapse of patent rights include, but are not limited to, failure to timely file national and regional stage patent applications based on our international patent application, failure to respond to official actions within prescribed time limits, non-payment of fees and failure to properly legalize and submit formal documents. If we or our licensors fail to maintain the patents and patent applications covering PNAG, our vaccine, antibody or any future candidate, our competitors might be able to enter the market, which would have an adverse effect on our business.

Third-party claims or litigation alleging infringement of patents or other proprietary rights or seeking to invalidate our patents or other proprietary rights, may delay or prevent the development and commercialization of our vaccine, antibody and any future candidate.

Our commercial success depends in part on our avoiding infringement and other violations of the patents and proprietary rights of third parties. There is a substantial amount of litigation, both within and outside the United States, involving patent and other intellectual property rights in the biotechnology and pharmaceutical industries, including patent infringement lawsuits, interferences, derivation and administrative law proceedings, inter partes review and post-grant review before the USPTO, as well as oppositions and similar processes in foreign jurisdictions. Numerous U.S. and foreign issued patents and pending patent applications, which are owned by third parties, exist in the fields in which we and our collaborators are developing vaccine and monoclonal antibody candidates. As the biotechnology and pharmaceutical industries expand and more patents are issued, and as we gain greater visibility and market exposure as a public company, the risk increases that our vaccine or other business activities may be subject to claims of infringement of the patent and other proprietary rights of third parties. Third parties may assert that we are infringing their patents or employing their proprietary technology without authorization.

Also, there may be third-party patents or patent applications with claims to materials, formulations, methods of manufacture or methods for treatment related to the use or manufacture of our vaccine. Because patent applications can take many years to issue, there may be currently pending patent applications which may later result in issued patents that our vaccine may infringe. In addition, third parties may obtain patent rights in the future and claim that use of our technologies infringes upon rights. If any third-party patents were held by a court of competent jurisdiction to cover the manufacturing process of our vaccine, any molecules formed during the manufacturing process or any final product itself, the holders of any such patents may be able to block our ability to commercialize such vaccine candidate unless we obtained a license under the applicable patents, or until such patents expire. Similarly, if any third-party patent were held by a court of competent jurisdiction to cover aspects of our formulations, processes for manufacture or methods of use, including combination therapy, the holders of any such patent may be able to block our ability to develop and commercialize the applicable vaccine candidate unless we obtained a license or until such patent expires. In either case, such a license may not be available on commercially reasonable terms or at all. In addition, we may be subject to claims that we are infringing other intellectual property rights, such as trademarks or copyrights, or misappropriating the trade secrets of others, and to the extent that our employees, consultants or contractors use intellectual property or proprietary information owned by others in their work for us, disputes may arise as to the rights in related or resulting know-how and inventions.

Parties making claims against us may obtain injunctive or other equitable relief, which could effectively block our ability to further develop and commercialize one or more of our therapeutics. Defense of these claims, regardless of their merit, would involve substantial litigation expense and would be a substantial diversion of employee resources from our business. In the event of a successful infringement or other intellectual property claim against us, we may have to pay substantial damages, including treble damages and attorneys' fees for willful infringement, obtain one or more licenses from third parties, pay royalties or redesign our affected products, which may be impossible or require substantial time and monetary expenditure. We cannot predict whether any such license would be available at all or whether it would be available on commercially reasonable terms.

Furthermore, as the vaccine patent landscape is crowded and highly competitive, even in the absence of litigation we may need to obtain licenses from third parties to advance our research or allow commercialization of our vaccine, and we have done so from time to time. We may fail to obtain any of these licenses at a reasonable cost or on reasonable terms, if at all. In that event, we would be unable to further develop and commercialize one or more of our therapeutics, which could harm our business significantly. We cannot provide any assurances that third-party patents do not exist which might be enforced against vaccine resulting in either an injunction prohibiting our sales, or, with respect to our sales, an obligation on our part to pay royalties or other forms of compensation to third parties.

We may become involved in lawsuits to protect or enforce our patents, the patents of our licensors or our other intellectual property rights, which could be expensive, time consuming and unsuccessful.

Competitors may infringe or otherwise violate our patents, the patents of our licensors or our other intellectual property rights. To counter infringement or unauthorized use, we may be required to file legal claims, which can be expensive and time-consuming. In addition, in an infringement proceeding, a court may decide that a patent of ours or our licensors is not valid or is unenforceable or may refuse to stop the other party from using the technology at issue on the grounds that our patents do not cover the technology in question. An adverse result in any litigation or defense proceedings could put one or more of our patents at risk of being invalidated or interpreted narrowly and could put our patent applications at risk of not issuing. The initiation of a claim against a third party may also cause the third party to bring counter claims against us such as claims asserting that our patents are invalid or unenforceable. In patent litigation in the United States, defendant counterclaims alleging invalidity or unenforceability are commonplace. Grounds for a validity challenge could be an alleged failure to meet any of several statutory requirements, including lack of novelty, obviousness, non-enablement or lack of statutory subject matter. Grounds for an unenforceability assertion could be an allegation that someone connected with prosecution of the patent withheld relevant material information from the USPTO, or made a materially misleading statement, during prosecution. Third parties may also raise similar validity claims before the USPTO in post-grant proceedings such as *ex parte* reexaminations, inter-partes review or post-grant review, or oppositions or similar proceedings outside the United States, in parallel with litigation or even outside the context of litigation. The outcome following legal assertions of invalidity and unenforceability is unpredictable. We cannot be certain that there is no invalidating prior art, of which we and the patent examiner were unaware during prosecution. For the patents and patent applications that we have licensed, we may have limited or no right to participate in the defense of any licensed patents against challenge by a third party. If a defendant were to prevail on a legal assertion of invalidity or unenforceability, we would lose at least part, and perhaps all, of any future patent protection on our current or future vaccine. Such a loss of patent protection could harm our business.

We may not be able to prevent, alone or with our licensors, misappropriation of our intellectual property rights, particularly in countries where the laws may not protect those rights as fully as in the United States. Our business could be harmed if in litigation the prevailing party does not offer us a license on commercially reasonable terms. Any litigation or other proceedings to enforce our intellectual property rights may fail, and even if successful, may result in substantial costs and distract our management and other employees.

Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation. There could also be public announcements of the results of hearings, motions or other interim proceedings or developments. If securities analysts or investors perceive these results to be negative, it could have an adverse effect on the price of our common shares.

Changes in U.S. patent law or the patent law of other countries or jurisdictions could diminish the value of patents in general, thereby impairing our ability to protect our products.

The United States has enacted and implemented wide-ranging patent reform legislation. The U.S. Supreme Court has ruled on several patent cases in recent years, either narrowing the scope of patent protection available in certain circumstances or weakening the rights of patent owners in certain situations. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents, once obtained. Depending on actions by the U.S. Congress, the federal courts and the USPTO, the laws and regulations governing patents could change in unpredictable ways that would weaken our ability to obtain new patents or to enforce patents that we have licensed or that we might obtain in the future. Similarly, changes in patent law and regulations in other countries or jurisdictions or changes in the governmental bodies that enforce them or changes in how the relevant governmental authority enforces patent laws or regulations may weaken our ability to obtain new patents or to enforce patents that we have licensed or that we may obtain in the future.

Any trademarks we may obtain may be infringed or successfully challenged, resulting in harm to our business

We expect to rely on trademarks as one means to distinguish our vaccine from those approved for marketing from the products of our competitors. We have not yet selected trademarks for our vaccine and have not yet begun the process of applying to register trademarks for our current or any future vaccine. Once we select trademarks and apply to register them, our trademark applications may not be approved. Third parties may oppose our trademark applications or otherwise challenge our use of the trademarks. In the event that our trademarks are successfully challenged, we could be forced to rebrand our products, which could result in loss of brand recognition and could require us to devote resources to advertising and marketing new brands. Our competitors may infringe our trademarks, and we may not have adequate resources to enforce our trademarks. In addition, any proprietary name we propose to use with our current or any other vaccine candidate in the United States must be approved by the FDA, regardless of whether we have registered it, or applied to register it, as a trademark. The FDA typically conducts a review of proposed product names, including an evaluation of the potential for confusion with other product names. If the FDA objects to any of our proposed proprietary product names, we may be required to expend significant additional resources in an effort to identify a suitable proprietary product name that would qualify under applicable trademark laws, not infringe the existing rights of third parties and be acceptable to the FDA.

We may not be able to protect our intellectual property rights throughout the world, which could impair our business

Filing, prosecuting and defending patents covering our current vaccine and any future vaccine candidate throughout the world would be prohibitively expensive. Competitors may use our technologies in jurisdictions where we have not obtained patent protection to develop their own products and, further, may export otherwise infringing products to territories where we may obtain patent protection, but where patent enforcement is not as strong as that in the United States. These products may compete with our products in jurisdictions where we do not have any issued or licensed patents and any future patent claims, or other intellectual property rights may not be effective or sufficient to prevent them from so competing.

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

Because we expect to rely on third parties to manufacture AV0328 and F598 and any future candidates, and we expect to collaborate with third parties on the development of our current and future therapeutics, we must, at times, share trade secrets with them. We also conduct joint research and development programs that may require us to share trade secrets under the terms of our research and development partnerships or similar agreements. We seek to protect our proprietary technology in part by entering into confidentiality agreements and, if applicable, material transfer agreements, consulting agreements or other similar agreements with our advisors, employees, third-party contractors and consultants prior to beginning research or disclosing proprietary information. These agreements typically limit the rights of the third parties to use or disclose our confidential information, including our trade secrets. Despite the contractual provisions employed when working with third parties, the need to share trade secrets and other confidential information increases the risk that such trade secrets become known by our competitors, are inadvertently incorporated into the technology of others or are disclosed or used in violation of these agreements. Given that our proprietary position is based, in part, on our know-how and trade secrets, a competitor's discovery of our trade secrets or other unauthorized use or disclosure would impair our competitive position and may have an adverse effect on our business and results of operations. Further, disputes may arise under these agreements regarding inventorship or ownership of proprietary information generated during research and development.

In addition, these agreements typically restrict the ability of our advisors, employees, third-party contractors and consultants to publish data potentially relating to our trade secrets, although our agreements may contain certain limited publication rights. Despite our efforts to protect our trade secrets, our competitors may discover our trade secrets, either through breach of our agreements with third parties, independent development or publication of information by any of our third-party collaborators. A competitor's discovery of our trade secrets would impair our competitive position and have an adverse impact on our business.

We may be subject to claims that our employees, consultants or independent contractors have wrongfully used or disclosed confidential information of their former employers or other third parties.

We employ individuals who were previously employed at other biotechnology or pharmaceutical companies. Although we seek to protect our ownership of intellectual property rights by ensuring that our agreements with our employees, collaborators and other third parties with whom we do business include provisions requiring such parties to assign rights in inventions to us, we may be subject to claims that we or our employees, consultants or independent contractors have inadvertently or otherwise used or disclosed confidential information of our employees' former employers or other third parties. We may also be subject to claims that former employers or other third parties have an ownership interest in our patents. Litigation may be necessary to defend against these claims. There is no guarantee of success in defending these claims, and if we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights, such as exclusive ownership of, or right to use, valuable intellectual property. Even if we are successful, litigation could result in substantial cost and be a distraction to our management and other employees.

Risks Related to This Offering and Ownership of Our Common Stock

We do not know whether an active, liquid and orderly trading market will develop for our common stock or what the market price of our common stock will be and as a result it may be difficult for you to sell your shares of our common stock.

Prior to this offering there has been no public market for shares of our common stock. An active trading market for our shares may never develop or be sustained following this offering. You may not be able to sell your shares quickly or at the market price if trading in shares of our common stock is not active. The initial public offering price for our common stock will be determined through negotiations with the underwriters, and the negotiated price may not be indicative of the market price of the common stock after the offering. As a result of these and other factors, you may be unable to resell your shares of our common stock at or above the initial public offering price. Further, an inactive market may also impair our ability to raise capital by selling shares of our common stock and may impair our ability to enter into strategic partnerships or acquire companies or products by using our shares of common stock as consideration.

The price of our stock may be volatile, and you could lose all or part of your investment.

The trading price of our common stock following this offering is likely to be highly volatile and could be subject to wide fluctuations in response to various factors, some of which are beyond our control, including limited trading volume. In particular, the COVID-19 pandemic has further heightened the volatility of the stock market for biopharmaceutical companies. In addition to the factors discussed in this “Risk Factors” section and elsewhere in this prospectus, these factors include:

- the commencement, enrollment or results of our planned or future preclinical studies or clinical trials of our vaccine and those of our competitors;
- regulatory or legal developments in the United States and abroad;
- the success of competitive vaccines or technologies;
- the recruitment or departure of key personnel;
- developments or disputes concerning patent applications, issued patents or other proprietary rights;
- the level of expenses related to our vaccine or preclinical and clinical development programs;
- the results of our efforts to develop additional vaccine;
- actual or anticipated changes in estimates as to financial results, development timelines or recommendations or reports by securities analysts;
- the level of expenses and capital investment related to manufacturing out vaccine;
- our inability to obtain or delays in obtaining adequate supply for any approved vaccine candidate;
- significant lawsuits, including patent or stockholder litigation;
- variations in our financial results or those of companies perceived to be similar to us;
- changes in the structure of healthcare payment systems, including coverage and adequate reimbursement for any approved vaccine or monoclonal antibody;
- general economic, political and market conditions and overall fluctuations in the financial markets in the United States and abroad; and
- investors’ general perception of us and our business.

In addition, the stock market in general, and the Nasdaq Capital Market and biopharmaceutical companies in particular, have experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of these companies, including very recently in connection with the ongoing COVID-19 pandemic, which has resulted in decreased stock prices for many companies. Broad market and industry factors may negatively affect the market price of our common stock, regardless of our actual operating performance. In the past, securities class action litigation has often been instituted against companies following periods of volatility in the market price of a company’s securities. If the market price of our common stock after this offering does not exceed the initial public offering price, you may not realize any return on your investment in us and may lose some or all of your investment. In the past, securities class action litigation has often been instituted against companies following periods of volatility in the market price of a company’s securities. This type of litigation, if instituted, could result in substantial costs and a diversion of management’s attention and resources, which would harm our business, operating results or financial condition.

Our financial condition and results of operations may fluctuate from quarter to quarter and year to year, which makes them difficult to predict.

We expect our financial condition and results of operations to fluctuate from quarter to quarter and year to year due to a variety of factors, many of which are beyond our control. Accordingly, you should not rely upon the results of any quarterly or annual periods as indications of future operating performance.

We do not intend to pay dividends on our common stock so any returns will be limited to the value of our stock.

We currently anticipate that we will retain future earnings for the development, operation and expansion of our business and do not anticipate declaring or paying any cash dividends for the foreseeable future. Furthermore, future debt or other financing arrangements may contain terms prohibiting or limiting the amount of dividends that may be declared or paid on our common stock. Any return to stockholders will therefore be limited to the appreciation of their stock.

Our principal stockholders and management own a significant percentage of our stock and will be able to exert significant control over matters subject to stockholder approval, which will limit your ability to influence corporate matters and could delay or prevent a change in corporate control.

Prior to this offering, our executive officers, directors and 5% stockholders beneficially owned approximately 100% of our voting stock as of December 31, 2021 and, upon the closing of this offering, that same group will continue to beneficially own a significant percentage of our outstanding voting stock. Accordingly, even after this offering, these stockholders will have the ability to influence us through this ownership position and significantly affect the outcome of all matters requiring stockholder approval. For example, these stockholders may be able to significantly affect the outcome of elections of directors, amendments of our organizational documents or approval of any merger, sale of assets or other major corporate transaction. This may prevent or discourage unsolicited acquisition proposals or offers for our common stock that you may feel are in your best interest as one of our stockholders. In addition, these stockholders acquired their shares of common stock for substantially less than the price of the shares of common stock being acquired in this offering, and these stockholders may have interests, with respect to their common stock, that are different from those of investors in this offering and the concentration of voting power among these stockholders may have an adverse effect on the price of our common stock.

If you purchase our common stock in this offering, you will incur immediate and substantial dilution in the book value of your shares.

You will suffer immediate and substantial dilution in the net tangible book value of the common stock you purchase in this offering. The initial public offering price is substantially higher than the pro forma as adjusted net tangible book value per share of our common stock. Investors purchasing common stock in this offering will pay a price per share that substantially exceeds the pro forma as adjusted book value of our tangible assets after subtracting our liabilities. Based on the assumed initial public offering price of \$ per share, which is the midpoint of the estimated price range set forth on the cover page of this prospectus, you will experience immediate dilution of \$ per share, representing the difference between our pro forma as adjusted net tangible book value per share after this offering and the initial public offering price per share. After this offering, we will also have outstanding options and a warrant to purchase common stock with exercise prices lower than the initial public offering price. To the extent these outstanding options or warrant are exercised, there will be further dilution to investors in this offering. See the section entitled “Dilution” for additional information.

We are an emerging growth company, and we cannot be certain if the reduced reporting requirements applicable to emerging growth companies will make our common stock less attractive to investors.

We are an emerging growth company, as defined in the Jumpstart Our Business Startups Act, or JOBS Act, enacted in April 2012. For as long as we continue to be an emerging growth company, we may take advantage of exemptions from various reporting requirements that are applicable to other public companies that are not emerging growth companies, including reduced disclosure obligations regarding executive compensation in this prospectus and our periodic reports and proxy statements and exemptions from the requirements of holding nonbinding advisory votes on executive compensation and stockholder approval of any golden parachute payments not previously approved. We could be an emerging growth company for up to five years following the year in which we complete this offering, although circumstances could cause us to lose that status earlier. We will remain an emerging growth company until the earlier of (1) the last day of the fiscal year (a) following the fifth anniversary of the completion of this offering, (b) in which we have total annual gross revenue of at least \$1.07 billion or (c) in which we are deemed to be a large accelerated filer, which requires the market value of our common stock that is held by non-affiliates to exceed \$700 million as of the prior June 30th, and (2) the date on which we have issued more than \$1 billion in non-convertible debt during the prior three-year period.

Even after we no longer qualify as an emerging growth company, we may still qualify as a “smaller reporting company” which would allow us to take advantage of many of the same exemptions from disclosure requirements including not being required to comply for a period of time with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002, as amended, or Sarbanes-Oxley Act, and reduced disclosure obligations regarding executive compensation in this prospectus and our periodic reports and proxy statements. We cannot predict if investors will find our common stock less attractive because we may rely on these exemptions. If some investors find our common stock less attractive as a result, there may be a less active trading market for our common stock and our stock price may be more volatile.

Under the JOBS Act, emerging growth companies can also delay adopting new or revised accounting standards until such time as those standards apply to private companies. We have elected to use this extended transition period for complying with new or revised accounting standards that have different effective dates for public and private companies until the earlier of the date we (i) are no longer an emerging growth company or (ii) affirmatively and irrevocably opt out of the extended transition period provided in the JOBS Act. As a result, our financial statements may not be comparable to companies that comply with new or revised accounting pronouncements as of public company effective dates.

As a public company, we will be subject to more stringent federal and state law requirements.

As a public company, we will be subject to the reporting requirements of the Securities Exchange Act of 1934, as amended, or the Exchange Act, the Sarbanes-Oxley Act, the Dodd-Frank Wall Street Reform and Consumer Protection Act, the listing requirements of The Nasdaq Stock Market LLC, or Nasdaq, and other applicable securities rules and regulations. Despite reforms made possible by the JOBS Act, compliance with these rules and regulations will nonetheless increase our legal and financial compliance costs, make some activities more difficult, time-consuming or costly and increase demand on our systems and resources, particularly after we are no longer an emerging growth company. The Exchange Act requires, among other things, that we file annual, quarterly and current reports with respect to our business and operating results.

As a result of disclosure of information in this prospectus and in filings required of a public company, our business and financial condition will become more visible, which we believe may result in threatened or actual litigation, including by competitors and other third parties. If such claims are successful, our business, results of operations, financial condition and prospects could be harmed, and even if the claims do not result in litigation or are resolved in our favor, these claims, and the time and resources necessary to resolve them, could divert the resources of our management and adversely affect our brand and reputation, business, results of operations, financial condition and prospects. We also expect that being a public company and the associated rules and regulations will make it more expensive for us to obtain director and officer liability insurance, and we may be required to accept reduced coverage or incur substantially higher costs to obtain adequate coverage. These factors could also make it more difficult for us to attract and retain qualified members of our board of directors, particularly to serve on our audit committee and compensation committee, and qualified executive officers.

We will incur significant increased costs as a result of operating as a public company, and our management will be required to devote substantial time to new compliance initiatives.

As a public company, and particularly after we are no longer an emerging growth company, we will incur significant legal, accounting, investor relations and other expenses that we did not incur as a private company. In addition, the Sarbanes-Oxley Act and rules subsequently implemented by the SEC and Nasdaq have imposed various requirements on public companies, including establishment and maintenance of effective disclosure and financial controls and corporate governance practices. Stockholder activism, the current political environment and the current high level of U.S. government intervention and regulatory reform may also lead to substantial new regulations and disclosure obligations, which may in turn lead to additional compliance costs and impact the manner in which we operate our business in ways we do not currently anticipate. Our management and other personnel will need to devote a substantial amount of time to comply with these requirements. Moreover, these requirements will increase our legal and financial compliance costs and will make some activities more time-consuming and costly. For example, we expect that these rules and regulations may make it more difficult and more expensive for us to obtain director and officer liability insurance. We cannot predict or estimate the amount or timing of additional costs we may incur to respond to these requirements.

We may not be able to satisfy listing requirements of the Nasdaq Capital Market or obtain or maintain a listing of our common stock on the Nasdaq Capital Market.

If our common stock is listed on the Nasdaq Capital Market, we must meet certain financial and liquidity criteria to maintain such listing. If we violate the Nasdaq Capital Market listing requirements, our common stock may be delisted. If we fail to meet any of the Nasdaq Capital Market's listing standards, our common stock may be delisted. In addition, our board of directors may determine that the cost of maintaining our listing on a national securities exchange outweighs the benefits of such listing. A delisting of our common stock from the Nasdaq Capital Market may materially impair our stockholders' ability to buy and sell our common stock and could have an adverse effect on the market price of, and the efficiency of the trading market for, our common stock. The delisting of our common stock could significantly impair our ability to raise capital and the value of your investment.

If we fail to maintain proper and effective internal control over financial reporting, our ability to produce accurate and timely financial statements could be impaired, investors may lose confidence in our financial reporting and the trading price of our common stock may decline.

Pursuant to Section 404 of the Sarbanes-Oxley Act, we will be required to furnish a report by our management on our internal control over financial reporting, including an attestation report on internal control over financial reporting issued by our independent registered public accounting firm. However, while we remain an emerging growth company, we will not be required to include an attestation report on internal control over financial reporting issued by our independent registered public accounting firm. The rules governing the standards that must be met for management to assess our internal control over financial reporting are complex and require significant documentation, testing and possible remediation. To comply with the Sarbanes-Oxley Act, the requirements of being a reporting company under the Exchange Act and any complex accounting rules in the future, we may need to upgrade our information technology systems; implement additional financial and management controls, reporting systems and procedures; and hire additional accounting and finance staff. We are currently in the process of hiring additional accounting and finance staff as we grow our business. To date, we have had limited financial and accounting personnel to fully execute our accounting processes and address our internal control over financial reporting. If we are unable to hire the additional accounting and finance staff necessary to comply with these requirements, we may need to retain additional outside consultants. If we or, if required, our auditors, are unable to conclude that our internal control over financial reporting is effective, investors may lose confidence in our financial reporting and the trading price of our common stock may decline.

There can be no assurance that there will not be material weaknesses in our internal control over financial reporting in the future. Any failure to maintain internal control over financial reporting could severely inhibit our ability to accurately report our financial condition, results of operations or cash flows. If we are unable to conclude that our internal control over financial reporting is effective, or if our independent registered public accounting firm determines that we have a material weakness in our internal control over financial reporting, investors may lose confidence in the accuracy and completeness of our financial reports, the market price of our common stock could decline and we could be subject to sanctions or investigations by Nasdaq, the SEC or other regulatory authorities. Failure to remedy any material weakness in our internal control over financial reporting, or to implement or maintain other effective control systems required of public companies, could also restrict our future access to the capital markets. We believe that any disclosure controls and procedures or internal controls and procedures, no matter how well-conceived and operated, can provide only reasonable, not absolute, assurance that the objectives of the control system are met. These inherent limitations include the realities that judgments in decision-making can be faulty, and that breakdowns can occur because of simple error or mistake. For example, our directors or executive officers could inadvertently fail to disclose a new relationship or arrangement causing us to fail to make a required related party transaction disclosure. Additionally, controls can be circumvented by the individual acts of some persons, by collusion of two or more people or by an unauthorized override of the controls. Accordingly, because of the inherent limitations in our control system, misstatements due to error or fraud may occur and not be detected.

We have identified a material weakness in our internal control over financial reporting, and the failure to remediate this material weakness may adversely affect our business, investor confidence in our company, our financial results and the market value of our common stock.

A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of our annual or interim financial statements will not be prevented or detected on a timely basis. The material weakness we identified related to the lack of maintaining a sufficient complement of personnel commensurate with the accounting and financial reporting requirements in order to have adequate segregation of key duties and responsibilities, which affected the operation of controls over the recording of journal entries and the reconciliation of key accounts. This material weakness did not result in a material misstatement to the financial statements. We are in the process of implementing measures designed to improve internal control over financial reporting to remediate the control deficiencies that led to our material weakness by, among other things, hiring qualified personnel with appropriate expertise to perform specific functions, and designing and implementing improved processes and internal controls.

While we believe the remedial efforts we are taking and will take will improve our internal controls and address the underlying causes of the material weakness, we cannot be certain that these steps will be sufficient to remediate the control deficiencies that led to our material weakness in our internal controls over financial reporting or prevent future material weaknesses or control deficiencies from occurring. While we will work to remediate the material weakness as timely and efficiently as possible, at this time we cannot provide an estimate of costs expected to be incurred in connection with the implementation of our remediation actions, nor can we provide an estimate of the time it will take to complete our remediation actions. Neither our management nor an independent registered public accounting firm has performed an evaluation of our internal controls over financial reporting in accordance with the provisions of the Sarbanes-Oxley Act because no such evaluation has been required.

If we fail to effectively remediate the material weakness in our internal controls over financial reporting described above, we may be unable to accurately or timely report our financial condition or results of operations. Such failure may adversely affect our business, investor confidence in our company, our financial condition and the market value of our common stock.

We are not currently required to comply with SEC rules that implement Section 404 of the Sarbanes-Oxley Act and are therefore not required to make a formal assessment of the effectiveness of our internal controls over financial reporting for that purpose. Upon becoming a public company, we will be required to comply with the SEC's rules implementing Sections 302 and 404 of the Sarbanes-Oxley Act, which will require management to certify financial and other information in our quarterly and annual reports and provide an annual management report on the effectiveness of internal controls over financial reporting. Although we will be required to disclose changes that have materially affected, or are reasonably likely to materially affect, our internal controls over financial reporting on a quarterly basis, we will not be required to make our first annual assessment of our internal controls over financial reporting pursuant to Section 404 until at least our second annual report required to be filed with the SEC, and we will not be required to have our independent registered public accounting firm formally assess our internal controls for as long as we remain an "emerging growth company" as defined in the JOBS Act.

When formally evaluating our internal controls over financial reporting, we may identify material weaknesses that we may not be able to remediate in time to meet the applicable deadline imposed upon us for compliance with the requirements of Section 404 of the Sarbanes-Oxley Act. In addition, if we fail to achieve and maintain the adequacy of our internal controls, as such standards are modified, supplemented or amended from time to time, we may not be able to ensure that we can conclude on an ongoing basis that we have effective internal controls over financial reporting in accordance with Section 404 of the Sarbanes-Oxley Act. We cannot be certain as to the timing of completion of our evaluation, testing and any remediation actions or the impact of the same on our operations. If we are not able to implement the requirements of Section 404 of the Sarbanes-Oxley Act in a timely manner or with adequate compliance, our independent registered public accounting firm may issue an adverse opinion due to ineffective internal controls over financial reporting, and we may be subject to sanctions or investigation by regulatory authorities, such as the SEC. As a result, there could be a negative reaction in the financial markets due to a loss of confidence in the reliability of our financial statements. Any such action could have a significant and adverse effect on our business and reputation, which could negatively affect our results of operations or cash flows. In addition, we may be required to incur additional costs in improving our internal control system and the hiring of additional personnel.

Our reported financial results may be adversely affected by changes in accounting principles generally accepted in the United States.

Generally accepted accounting principles in the United States are subject to interpretation by the Financial Accounting Standards Board, the SEC and various bodies formed to promulgate and interpret appropriate accounting principles. A change in these principles or interpretations could have a significant effect on our reported financial results, may retroactively affect previously reported results, could cause unexpected financial reporting fluctuations and may require us to make costly changes to our operational processes and accounting systems.

Sales of a substantial number of shares of our common stock by our existing stockholders in the public market could cause our stock price to fall.

If our existing stockholders sell, or indicate an intention to sell, substantial amounts of our common stock in the public market after the lock-up and other legal restrictions on resale discussed in this prospectus lapse, the trading price of our common stock could decline. Based on shares of common stock outstanding as of _____, upon the closing of this offering we will have outstanding a total of _____ shares of common stock. Of these shares, only the shares of common stock sold in this offering by us, plus any shares sold upon exercise of the underwriters' option to purchase additional shares, will be freely tradable without restriction in the public market immediately following this offering. The underwriters, however, may, in their sole discretion, permit our officers, directors and other stockholders who are subject to these lock-up agreements to sell shares prior to the expiration of the lock-up agreements.

We expect that the lock-up agreements pertaining to this offering will expire 180 days from the date of this prospectus. In addition, shares of common stock that are either subject to outstanding options or reserved for future issuance under our Equity Incentive Plan will become eligible for sale in the public market to the extent permitted by the provisions of various vesting schedules, the lock-up agreements and Rule 144 and Rule 701 under the Securities Act of 1933, as amended, or the Securities Act. If these additional shares of common stock are sold, or if it is perceived that they will be sold, in the public market, the trading price of our common stock could decline.

We have broad discretion in the use of the net proceeds from this offering and may not use them effectively

Our management will have broad discretion in the application of the net proceeds from this offering, including for any of the purposes described in the section entitled "Use of Proceeds," and you will not have the opportunity as part of your investment decision to assess whether the net proceeds are being used appropriately. Because of the number and variability of factors that will determine our use of the net proceeds from this offering, their ultimate use may vary substantially from their currently intended use. Our management might not apply our net proceeds in ways that ultimately increase the value of your investment. The failure by our management to apply these funds effectively could harm our business. Pending their use, we may invest the net proceeds from this offering in short- and intermediate-term, interest-bearing instruments, certificates of deposit or direct or guaranteed obligations of the U.S. government. These investments may not yield a favorable return to our stockholders. If we do not invest or apply the net proceeds from this offering in ways that enhance stockholder value, we may fail to achieve expected financial results, which could cause our stock price to decline.

Provisions in our corporate charter documents and under Delaware law could make an acquisition of us, which may be beneficial to our stockholders, more difficult and may prevent attempts by our stockholders to replace or remove our current management.

Provisions in our amended and restated certificate of incorporation and amended and restated bylaws that will become effective upon the closing of this offering may discourage, delay or prevent a merger, acquisition or other change in control of us that stockholders may consider favorable, including transactions in which you might otherwise receive a premium for your shares. These provisions also could limit the price that investors might be willing to pay in the future for shares of our common stock, thereby depressing the market price of our common stock. In addition, because our board of directors is responsible for appointing the members of our management team, these provisions may frustrate or prevent any attempts by our stockholders to replace or remove our current management by making it more difficult for stockholders to replace members of our board of directors. Among other things, these provisions:

- establish a classified board of directors such that not all members of the board are elected at one time;
- allow the authorized number of our directors to be changed only by resolution of our board of directors;
- limit the manner in which stockholders can remove directors from the board;
- establish advance notice requirements for stockholder proposals that can be acted on at stockholder meetings and nominations to our board of directors;
- require that stockholder actions must be effected at a duly called stockholder meeting and prohibit actions by our stockholders by written consent;
- prohibit our stockholders from calling a special meeting of our stockholders;
- authorize our board of directors to issue preferred stock without stockholder approval, which could be used to institute a stockholder rights plan, or so-called “poison pill,” that would work to dilute the stock ownership of a potential hostile acquirer, effectively preventing acquisitions that have not been approved by our board of directors; and
- require the approval of the holders of at least 66 2/3% of the votes that all our stockholders would be entitled to cast to amend or repeal certain provisions of our charter or bylaws.

Moreover, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, or DGCL, which prohibits a person who owns 15% or more of our outstanding voting stock from merging or combining with us for a period of three years after the date of the transaction in which the person acquired 15% or more of our outstanding voting stock, unless the merger or combination is approved in a prescribed manner. These provisions could discourage potential acquisition proposals and could delay or prevent a change in control transaction. They could also have the effect of discouraging others from making tender offers for our common stock, including transactions that may be your best interests. These provisions may also prevent changes in our management or limit the price that investors are willing to pay for our stock.

Claims for indemnification by our directors and officers may reduce our available funds to satisfy successful third-party claims against us and may reduce the amount of money available to us.

Our amended and restated certificate of incorporation and amended and restated bylaws that will become effective upon the closing of this offering will provide that we will indemnify our directors and officers, in each case, to the fullest extent permitted by Delaware law. Delaware law provides that directors of a corporation will not be personally liable for monetary damages for any breach of fiduciary duties as directors, except liability for:

- any breach of the director’s duty of loyalty to the corporation or its stockholders;

- any act or omission not in good faith or that involves intentional misconduct or a knowing violation of law;
- unlawful payments of dividends or unlawful stock repurchases or redemptions; or
- any transaction from which the director derived an improper personal benefit.

Such limitation of liability does not apply to liabilities arising under federal securities laws and does not affect the availability of equitable remedies such as injunctive relief or rescission.

Our amended and restated bylaws that will be in effect upon the closing of this offering will provide that we are required to indemnify our directors and officers to the fullest extent permitted by Delaware law and may indemnify our other employees and agents. Our amended and restated bylaws will also provide that, on satisfaction of certain conditions, we will advance expenses incurred by a director or officer in advance of the final disposition of any action or proceeding, and permit us 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. We have entered and expect to continue to enter into agreements to indemnify our directors and executive officers. With certain exceptions, these agreements provide for indemnification for related expenses, including attorneys' fees, judgments, fines and settlement amounts incurred by any of these individuals in connection with any action, proceeding or investigation. We believe that these amended and restated certificate of incorporation and amended and restated bylaws provisions and indemnification agreements are necessary to attract and retain qualified persons as directors and officers.

While we maintain directors' and officers' liability insurance, such insurance may not be adequate to cover all liabilities that we may incur, which may reduce our available funds to satisfy third-party claims and may adversely impact our cash position.

Our amended and restated certificate of incorporation that will become effective upon the closing of this offering provides that the Court of Chancery of the State of Delaware will be the exclusive forum for substantially all disputes between us and our stockholders, which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us or our directors, officers or employees.

Our amended and restated certificate of incorporation will provide that the Court of Chancery of the State of Delaware (or, in the event that the Court of Chancery does not have jurisdiction, the federal district court for the District of Delaware or other state courts of the State of Delaware) is 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 or proceeding asserting a claim of breach of a fiduciary duty owed by any of our current or former directors, officers or other employees to us or our stockholders;
- any action or proceeding asserting a claim against us or any of our current or former directors, officers or other employees, arising out of or pursuant to any provision of the DGCL, our certificate of incorporation or our bylaws;
- any action or proceeding to interpret, apply, enforce or determine the validity of our certificate of incorporation or our bylaws; and

- any action asserting a claim against us by any of our directors, officers or other employees governed by the internal affairs doctrine.

This provision would not apply to suits brought to enforce a duty or liability created by the Exchange Act or any other claim for which the U.S. federal courts have exclusive jurisdiction. In addition, our amended and restated certificate of incorporation will provide that the federal district court for the District of Delaware will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act.

Section 22 of the Securities Act creates concurrent jurisdiction for federal and state courts over all claims brought to enforce any duty or liability created by the Securities Act or the rules and regulations thereunder. Our decision to adopt a federal forum provision for suits arising under federal securities laws in our amended and restated certificate of incorporation followed a decision by the Supreme Court of the State of Delaware holding that such provisions are facially valid under Delaware law. However, such provision may not be enforceable under Section 22 of the Securities Act, and it may be possible for us to be sued in applicable state and local courts notwithstanding such provision.

Section 27 of the Exchange Act creates exclusive federal jurisdiction over all claims brought to enforce any duty or liability created by the Exchange Act or the rules and regulations thereunder. Accordingly, actions by our stockholders to enforce any duty or liability created by the Exchange Act or the rules and regulations thereunder must be brought in federal court. Our stockholders will not be deemed to have waived our compliance with the federal securities laws and the regulations promulgated thereunder.

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 these types of lawsuits. Furthermore, the enforceability of similar choice of forum provisions in other companies' certificates of incorporation has been challenged in legal proceedings, and it is possible that a court could find these types of provisions to be inapplicable or unenforceable. 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, and there can be no assurance that such provisions will be enforced by a court in those other jurisdictions. If a court were to find the exclusive-forum provision contained in our amended and restated certificate of incorporation to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving such action in other jurisdictions, which could harm our business.

If securities or industry analysts do not publish research or publish inaccurate or unfavorable research about our business, our stock price and trading volume could decline.

The trading market for our common stock will depend in part on the research and reports that securities or industry analysts publish about us or our business. Securities and industry analysts do not currently, and may never, publish research on our company. If no securities or industry analysts commence coverage of our company, the trading price for our stock would likely be negatively impacted. In the event securities or industry analysts initiate coverage, if one or more of the analysts who covers us downgrades our stock or publishes inaccurate or unfavorable research about our business, our stock price may decline. If one or more of these analysts ceases coverage of our company or fails to publish reports on us regularly, demand for our stock could decrease, which might cause our stock price and trading volume to decline.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus contains forward-looking statements about us and our industry that involve substantial risks and uncertainties. All statements other than statements of historical facts contained in this prospectus, including statements regarding our future results of operations or financial condition, business strategy and plans and objectives of management for future operations, including our statements regarding the benefits and timing of the roll-out of new technology, are forward-looking statements. In some cases, you can identify forward-looking statements because they contain words such as “anticipate,” “believe,” “contemplate,” “continue,” “could,” “estimate,” “expect,” “intend,” “may,” “plan,” “potential,” “predict,” “project,” “should,” “target,” “will” or “would” or the negative of these words or other similar terms or expressions. Forward-looking statements in this prospectus include, but are not limited to, statements about:

- our use of the net proceeds from this offering;
- our expectations regarding the potential benefits, spectrum coverage and immunogenicity of our vaccine;
- our expectations regarding our preclinical study results potentially being predictive of clinical study results;
- our belief that our vaccine could receive regulatory approval based on a demonstration of efficacy using well-defined surrogate immune endpoints rather than requiring clinical field efficacy studies;
- the timing of the initiation, progress and expected results of our preclinical studies, clinical trials and our research and development programs;
- our ability to advance our vaccine and antibody and successfully complete clinical trials;
- the commercialization of our vaccine and antibody, if approved;
- estimates of our total addressable market, future revenue, expenses, capital requirements and our needs for additional financing;
- our ability to compete effectively with existing competitors and new market entrants;
- our ability to establish and maintain intellectual property protection for our products or avoid claims of infringement;
- our manufacturing capabilities and the scalable nature of our manufacturing process;
- potential effects of extensive government regulation;
- the pricing, coverage and reimbursement of our vaccine and antibody, if approved;
- our ability and the ability of our third-party contract manufacturers to operate and continue operations in light of the COVID-19 pandemic;
- our ability to hire and retain key personnel;
- our ability to obtain additional financing in this or future offerings;

- the volatility of the trading price of our common stock; and
- our expectation regarding the time during which we will be an emerging growth company under the JOBS Act.

You should not rely on forward-looking statements as predictions of future events. We have based the forward-looking statements contained in this prospectus primarily on our current expectations and projections about future events and trends that we believe may affect our business, financial condition and operating results. The outcome of the events described in these forward-looking statements is subject to risks, uncertainties and other factors described in the section entitled “Risk Factors” and elsewhere in this prospectus. Moreover, we operate in a very competitive and rapidly changing environment. New risks and uncertainties emerge from time to time, and it is not possible for us to predict all risks and uncertainties that could have an impact on the forward-looking statements contained in this prospectus. The results, events and circumstances reflected in the forward-looking statements may not be achieved or occur, and actual results, events or circumstances could differ materially from those described in the forward-looking statements.

In addition, statements that “we believe” and similar statements reflect our beliefs and opinions on the relevant subject. These statements are based on information available to us as of the date of this prospectus. While we believe that information provides a reasonable basis for these statements, that information may be limited or incomplete. Our statements should not be read to indicate that we have conducted an exhaustive inquiry into, or review of, all relevant information. These statements are inherently uncertain, and investors are cautioned not to unduly rely on these statements.

The forward-looking statements made in this prospectus relate only to events as of the date on which the statements are made. We undertake no obligation to update any forward-looking statements made in this prospectus to reflect events or circumstances after the date of this prospectus or to reflect new information or the occurrence of unanticipated events, except as required by law. 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. Our forward-looking statements do not reflect the potential impact of any future acquisitions, mergers, dispositions, joint ventures or investments.

USE OF PROCEEDS

We estimate that we will receive net proceeds from this offering of approximately \$ million (or approximately \$ million if the underwriters exercise their option to purchase additional shares in full), based on the assumed initial public offering price of \$ per share of common stock, which is the midpoint of the estimated offering price range set forth on the cover page of this prospectus, after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

Each \$1.00 increase (decrease) in the assumed initial public offering price of \$ per share of common stock, which is the midpoint of the estimated offering price range set forth on the cover page of this prospectus, would increase (decrease) the net proceeds to us from this offering by approximately \$ million, assuming the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. Similarly, each increase (decrease) of 100,000 shares in the number of shares of common stock offered by us would increase (decrease) the net proceeds to us from this offering by approximately \$ million, assuming the assumed initial public offering price of \$ per share of common stock remains the same, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

The principal purposes of this offering are to increase our capitalization and financial flexibility, create a public market for our common stock, facilitate future access to the public equity markets by us, our employees and our stockholders and increase our visibility in the marketplace. We currently intend to use the net proceeds we receive from this offering, together with our existing cash and cash equivalents, as follows:

- approximately \$5.5 million to initiate a proof-of-concept trial of vaccine AV0328, including manufacturing, and correlative laboratory studies
- approximately \$4.5 million to initiate a proof-of-concept trial of our monoclonal antibody in ICU patients
- the remainder for general corporate purposes, including working capital, operating expenses and capital expenditures, as well as potential expansion of our research pipeline.

This expected use of the net proceeds from this offering represents our intentions based on our current plans and business conditions, which could change in the future as our plans and business conditions evolve. Further, due to the uncertainties inherent in the vaccine development process, it is difficult to estimate with certainty the exact amounts of the net proceeds from this offering that may be used for the above purposes. We cannot specify with certainty all of the particular uses for the remaining net proceeds to us from this offering. We may also use a portion of the net proceeds for acquisitions or strategic investments in complementary businesses, products, services or technologies. However, we do not have agreements or commitments to enter into any such acquisitions or investments at this time. We will have broad discretion over how to use the net proceeds to us from this offering, and our investors will be relying on the judgment of our management regarding the application of the net proceeds of this offering. The amounts and timing of our expenditures will depend upon numerous factors including the results of our research and development efforts, the timing and success of preclinical studies and any clinical trials we may commence in the future, the timing of regulatory submissions, and the amount of cash obtained through any future collaborations.

We estimate that the net proceeds from this offering, together with our current cash and cash equivalents, will be sufficient for us to fund our operating expenses and capital expenditure requirements through at least the next 12 months. The expected net proceeds from this offering, together with our cash and cash equivalents, will not be sufficient for us to fund a pivotal clinical trial for any of our candidates, and we will need to raise additional capital to complete the development and commercialization of our vaccine. We expect to finance our cash needs through public or private equity or debt financings, government or other third-party funding, collaborations, strategic alliances and licensing arrangements, or a combination of these sources. We have based these estimates on assumptions that may prove to be incorrect, and we could expend our available capital resources at a rate greater than we currently expect.

We intend to invest the net proceeds to us from this offering that are not used as described above in short- and intermediate-term, interest-bearing obligations, investment-grade instruments, certificates of deposit or direct or guaranteed obligations of the U.S. government.

DIVIDEND POLICY

We have never declared or paid cash dividends on our capital stock. We currently intend to retain all available funds and future earnings, if any, to fund the development and expansion of our business, and we do not anticipate paying any cash dividends in the foreseeable future. Any future determination regarding the declaration and payment of dividends will be at the discretion of our board of directors and will depend on then-existing conditions, including our financial condition, operating results, contractual restrictions, capital requirements, business prospects and other factors our board of directors may deem relevant. In addition, we may enter into agreements in the future that could contain restrictions on payments of cash dividends.

CAPITALIZATION

The following unaudited table sets forth our cash and cash equivalents, total capitalization and indebtedness at December 31, 2021:

- on an actual basis;
- on a pro forma basis to reflect the (i) the automatic conversion of all outstanding convertible notes to purchase _____ shares of common stock, and (ii) the exercise of warrants to purchase _____ shares of common stock; and
- on a pro forma as adjusted basis to give further effect to the sale and issuance by us of _____ shares of our common stock in this offering, at the assumed initial public offering price of \$ _____ per share, which is the midpoint of the estimated offering price range set forth on the cover page of this prospectus, after deducting underwriting discounts and commissions and estimated offering expenses payable by us.

You should read the following table together with our financial statements and the related notes appearing at the end of this prospectus and the “Summary Financial Data,” “Management’s Discussion & Analysis of Financial Condition and Results of Operations” and “Description of Capital Stock” sections of this prospectus.

	Actual	Pro Forma	Pro Forma As Adjusted
Cash and cash equivalents	\$ 40,208	\$ —	\$ —
Accrued interest – related party	3,112	—	—
Convertible notes payable – related party	200,000	—	—
Stockholders’ deficit			
Preferred stock - \$0.001 par value; 3,000,000 shares authorized, no shares issued and outstanding	—	—	—
Common stock - \$0.0001 par value; 1,000,000 shares authorized and 200,000 shares issued and outstanding	20	—	—
Common Stock – Non-voting, \$0.0001 par value, 5,000,000 shares authorized, and 3,000,000 shares issued and outstanding	300	—	—
Additional paid-in capital	4,202,935	—	—
Accumulated deficit	(4,945,682)	—	—
Total stockholders’ deficit	(742,427)	—	—
Total Capitalization	\$ (539, 315)	\$ —	\$ —

DILUTION

If you invest in our common stock in this offering, your ownership interest will be immediately diluted to the extent of the difference between the initial public offering price per share and the pro forma as adjusted net tangible book value (deficit) per share of our common stock after this offering. The net tangible book value (deficit) of our common stock as of December 31, 2021 was \$(850 thousand), or \$(0.27) per share. Our historical net tangible book value (deficit) represents the amount of our total tangible assets less our total liabilities. Historical net tangible book value (deficit) per share represents historical net tangible book value (deficit) divided by the number of shares of our common stock outstanding as of December 31, 2021.

The pro forma net tangible book value (deficit) of our common stock as of December 31, 2021 was \$ million, or \$ per share, after giving effect to issuance of shares of our common stock as a result of the expected net exercise of an outstanding warrant to purchase shares of common stock.

After giving further effect to the receipt of the net proceeds from our sale of shares of common stock in this offering at an assumed public offering price of \$ per share, after deducting underwriting discounts and commissions and estimated offering expenses payable by us, our pro forma as adjusted net tangible book value (deficit) as of December 31, 2021, would have been \$ million, or \$ per share. This represents an immediate increase in pro forma net tangible book value (deficit) of \$ per share to our existing stockholders and an immediate dilution of \$ per share to investors purchasing common stock in this offering.

Dilution per share to investors participating in this offering is determined by subtracting as adjusted net tangible book value (deficit) per share after this offering from the initial public offering price per share paid by investors participating in this offering. The following table illustrates this dilution (without giving effect to any exercise by the underwriters of their option to purchase additional shares):

Assumed public offering price per share	\$
Pro forma net tangible book value (deficit) per share as of December 31, 2021	\$ (0.27)
Increase in pro forma net tangible book value (deficit) per share attributable to this offering	
Pro forma as adjusted net tangible book value (deficit) per share after this offering	
Dilution in pro forma net tangible book value (deficit) per share in this offering	\$

The dilution information discussed above is illustrative and will change based on the actual initial public offering price and other terms of this offering determined at pricing. If the underwriters exercise their option to purchase additional shares in full, our pro forma as adjusted net tangible book value (deficit) per share after this offering would be approximately \$ per share, and the dilution in pro forma as adjusted net tangible book value (deficit) per share to new investors participating in this offering would be \$ per share.

A \$1.00 increase (decrease) in the assumed initial public offering price of \$ per share, the midpoint of the price range set forth on the cover page of this prospectus, would increase (decrease) the pro forma as adjusted net tangible book value (deficit) by \$ per share and the dilution to investors participating in this offering by \$ per share, assuming the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same and after deducting estimated underwriting discounts and commissions and estimated expenses payable by us.

Similarly, each increase (decrease) of 100,000 shares in the number of shares offered by us in this offering would increase (decrease) the pro forma as adjusted net tangible book value (deficit) by \$ per share and the dilution to investors participating in this offering by \$ per share, assuming the assumed initial public offering price of \$ per share, the midpoint of the price range set forth on the cover page of this prospectus, remains the same, and after deducting estimated underwriting discounts and commissions and estimated expenses payable by us.

The following table summarizes, on an as adjusted basis as of December 31, 2021, the differences between the number of shares of common stock purchased from us, the total cash consideration and the average price per share paid to us by existing stockholders and by new investors purchasing shares in this offering at the assumed initial public offering price of \$ per share, the midpoint of the price range set forth on the cover of this prospectus before deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. As the table shows, new investors purchasing shares of common stock in this offering will pay an average price per share substantially higher than our existing investors paid.

	Shares Purchased		Total Consideration		Average Price Per Share
	Number	Percent	Amount	Percent	
Existing stockholders		%	\$	%	
New investors participating in this offering					
Total		%	\$	%	

If the underwriters exercise their option to purchase additional shares in full, the number of shares of common stock held by existing stockholders will be reduced to % of the total number of shares of common stock to be outstanding after this offering, and the number of shares of common stock held by investors participating in this offering will be further increased to % of the total number of shares of common stock to be outstanding after this offering.

MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

You should read the following discussion and analysis of our financial condition and results of operations in conjunction with our financial statements and related notes and other financial information included elsewhere in this prospectus. This discussion and analysis and other parts of this prospectus contain forward-looking statements based upon our current plans and expectations that involve risks, uncertainties and assumptions, such as statements regarding our plans, objectives, expectations, intentions and beliefs. Our actual results and the timing of events could differ materially from those anticipated in these forward-looking statements as a result of various factors, including those set forth under the section entitled "Risk Factors" and elsewhere in this prospectus. You should carefully read the "Risk Factors" section of this prospectus to gain an understanding of the important factors that could cause actual results to differ materially from our forward-looking statements. Please also see the section entitled "Special Note Regarding Forward-Looking Statements."

Overview

Alopexx, Inc., ("Alopexx" or the "Company") is a corporation organized and existing under the laws of the State of Delaware. Our executive office is located at 186 Alewife Brook Pkwy #1068, Cambridge, MA 02138, telephone 617-780-1598, www.alopexx.com.

Alopexx, Inc., is a clinical stage biotechnology company focusing on developing novel, broad-spectrum immune-mediated therapeutics for the prevention and treatment of a wide range of bacterial, fungal and parasitic microbial infections.

Technology and Patents

Alopexx has developed two immune therapeutics directed at PNAG – a monoclonal antibody and a vaccine. The potential efficacy of these immune therapeutics has been evaluated in studies of 14 pathogens in 20 animal models of infection. In all of those infection models a positive therapeutic effect was observed in preventing or treating infections. Whether the efficacy noted in animal models will be observed in humans remains to be determined. While the ultimate decision on the safety and efficacy of our therapeutics will be determined by the FDA and other health authorities, it is our management's assessment that the broad-spectrum potential of our therapeutics will allow them to be used for the prevention, treatment, and mitigation of a wide range of infections. Both therapeutics are now in human clinical trials in which, in our management's assessment, they have been found to be well-tolerated. Our therapeutics are:

- **Monoclonal antibody F598** - Phase 1 and pilot phase 2 trials of F598 have been completed. The antibody was found to be well tolerated, and no serious adverse events were observed. A single infusion was noted to provide sustained serum levels for 2-3 months. Unlike vaccines which may take several weeks or longer to induce protective immunity, administration of a monoclonal antibody provides immediate protection. Therefore, the antibody will be utilized in settings where an individual is at an immediate or near-term risk of developing an infection. Hospital-associated infections are one of the major settings where this occurs. Monoclonal antibody F598 will not replace antibiotics but will instead complement and augment their efficacy and by doing so reduce the development of antibiotic resistant organisms. Use of monoclonal antibody F598 in that setting offers the potential for it to become the first broad-spectrum therapeutic antibody. We will study this in a setting where the prevalence of acquired infections is very high – intensive care units. Demonstrating that monoclonal antibody F598 can reduce the morbidity/mortality related to microbial infections in ICU patients would constitute a major health advancement. We believe it would establish administration of F598 as part of the standard of care in that setting.
- **Vaccine AV0328** - a synthetic PNAG vaccine. A phase 1, first-in-man trial has been completed and the vaccine was found to be well-tolerated with only minor and transient injection site reactions observed. It induced antibodies that were capable, in laboratory studies, of killing a wide range of PNAG-expressing pathogens. *In vitro* efficacy in killing was noted against every pathogen tested which included over 10 different microbial species. While these do not assure that ultimate safety and efficacy of the vaccine it prompted, Alopexx will propose to the FDA that AV0328 be developed as a complement to currently approved *Streptococcus pneumoniae* vaccines (Prevnar and Pneumovax). Those vaccines, including the recently approved versions, cover at best 23 of the 100 known *Streptococcus pneumoniae* serotypes. AV0328 could provide protection against many of the remaining 80+ serotypes. Feedback from the FDA supported pursuing accelerated approval of AV0328 based on safety in vaccinated humans and utilization of a validated surrogate assay – opsonic killing mediated by the antibodies induced by the vaccine. The FDA's Accelerated Approval Program allows for earlier approval of drugs that treat serious conditions based on a surrogate endpoint. A surrogate endpoint is a marker, such as a laboratory measurement, radiographic image, physical sign or other measure that is thought to predict clinical benefit but is not itself a measure of clinical benefit. Management believes that this points to a development path comparable to those that have led to FDA approval of other vaccines for *Streptococcus pneumoniae* infections. However, the FDA has not yet approved the vaccine and there is no guarantee that the FDA will ultimately approve the vaccine.

The technology for both the vaccine and antibody is licensed from Brigham and Women's Hospital. Alopexx has full rights to all uses and indications pursuant to those licenses.

Our patent portfolio contains 4 patent families with coverage through 2040. This includes both composition of matter and use patents. We continue to seek to maximize the scope of our patent protection for all our programs. In addition to patents, synthesis of the PNAG oligosaccharide is covered by a trade secret agreement. The F598 monoclonal antibody is produced using a proprietary master cell bank.

Key Relationships and Business Development

Dr. Daniel Vlock is the CEO of newly formed Alopexx, Inc. He was appointed CEO of the prior company, OneBioPharma, Inc. on November 17, 2020. He brings extensive pharmaceutical industry and academic experience in pharmaceutical drug development. Previously as CEO of Alopexx Pharmaceuticals and Alopexx Vaccine he and his co-founder Dr. Gerald Pier developed F598, a human monoclonal antibody directed against *S. aureus*. Vaccine AV0328 was also developed by Drs. Vlock and Pier. Dr. Vlock has held senior-level medical and research positions at GPC Biotech, Inc., Pharmacia Corporation, Ethicon Endo-Surgery (a subsidiary of Johnson & Johnson Company), and Boehringer Ingelheim Pharmaceuticals, Inc., where he was involved in the development of numerous oncology drugs, medical devices and drug-device combinations. While at Pharmacia he ran the Celebrex Oncology Group. While at other companies he ran programs which successfully developed and introduced monoclonal antibodies into clinical trials.

Thomas T. Thomas was appointed as CFO on August 30, 2021. Since November 2016, he has served as an Independent Director of Opiant Pharmaceuticals (NASDAQ: OPNT), where he is Chairman of the Audit Committee and serves as a member of the Compensation Committee. He has over 30 years of experience as a financial executive, consultant and entrepreneur in biotechnology, packaged goods, wine production, financial services and non-profit organizations. He is the former Interim Chief Executive Officer of the Stupski Foundation (2009 – 2010). He joined the foundation in 2009 as its Chief Financial Officer and in 2010 was promoted to Chief Operating Officer and subsequently asked to serve as the Foundation's interim CEO. Prior to joining the Stupski Foundation, Thomas spent twelve years (1994 – 2006) at Genentech, Inc, a biopharmaceutical company, in various financial roles serving as the company's Corporate Treasurer from 2001 through 2006. His executive responsibilities included Treasury Operations and Investments, Corporate Finance, Global Procurement, Enterprise Risk Management and Insurance, Business Continuity and Real Estate. As Treasurer, he led Genentech's Corporate Investment Program, implemented and led an Enterprise Risk Management program to holistically assess and mitigate company risks, partnered with Business Development in the financing of Genentech's Drug Collaborations and also executed large corporate transactions in support of Genentech's growth, including the \$2 billion Global Public Debt Offering and the financing and construction of Genentech's 870 thousand sq. ft. South Campus Research Center expansion.

Dr. Gerald Pier is our Chief Scientific Officer. His research interests focus on the definition of protective immune mechanisms relevant to microbial infections that can lead to the development of vaccines and passive immunotherapies, along with basic studies on mechanisms whereby bacterial pathogens cause infections. His laboratory was responsible for the development and pre-clinical assessment of both the vaccine targeting PNAG and monoclonal antibody F598, the antibody being developed by Alopexx. He has over 330 peer-reviewed publications and more than 30 patents. He has had multiple successful partnerships with pharmaceutical companies that were an outgrowth of his research. His laboratory developed the synthetic PNAG-conjugate vaccine that Alopexx has brought to Phase 1 trials and has produced panels of fully human monoclonal antibodies derived originally from circulating B cells of vaccinated or infected individuals. These have been in phase 1 and 2 trials for use in passive therapy against *Pseudomonas aeruginosa* and the broad range of pathogens that express the PNAG antigen.

Christine de los Reyes has served as our Chief Business Officer since June 2021. She has over 30 years of pharmaceutical experience and most recently was founder and Managing Director of Biotech Partnering Solutions, a business development consulting firm that advises life science companies on partnering strategy, search for potential partners, coordination of technical evaluation and due diligence, deal structure and transaction negotiation. In this capacity, she has had numerous clients and executed several licensing transactions. Christine also spent 12 years on the advisory board of the Neurotechnology Industry Organization, a non-profit trade association that represents companies involved in neuroscience, academic neuroscience research centers and brain-illness advocacy groups.

Company History

Alopexx has undergone a significant reorganization over the past year in anticipation of the IPO. This has been a culmination of a number of events over the past 3 years. Briefly, until 2019 monoclonal antibody F598 and vaccine AV0328 were licensed to Alopexx Pharmaceuticals, LLC and Alopexx Vaccine, LLC. Dr. Daniel Vlock was CEO of both of those entities. The research and development performed by those entities was responsible for bringing both the antibody and vaccine into clinical trials. A proprietary process for the vaccine's synthesis was developed and a first-in-man trial successfully completed. Plans for a phase 2 program and interactions with the FDA were initiated. Funding for these companies was funded solely by a high-net-worth U.S. family (the "Family Office") with ties to the Vlock family.

In late 2017, the Family Office made a decision to exit from a large number of investments, including the Alopexx F598 antibody and AV0328 vaccine programs.

For the F598 antibody and AV0328 vaccine an outside development group was engaged to continue the programs. To permit that group to independently pursue development it was elected to have both assets assigned to a new entity founded March 23, 2019 – OneBioPharma, Inc (OBP). The licenses from Brigham and Women's Hospital for human use of the vaccine and antibody were assigned to OBP. After 18 months the parties then-responsible for OBPs activities resigned from the company and board.

The Family Office remained committed to its desire to exit from the programs as part of their global strategy. Rather than close the programs entirely, the Family Office appointed Daniel Vlock as CEO of the newly re-named Alopexx, Inc. (formerly known as OneBioPharma) on November 17, 2020. The equity portion held by the Family Office was transferred to the new CEO in December 2020. The Family Office relinquished all rights and ownership.

To streamline and simplify equity ownership a cash-out merger occurred on June 14, 2021 and the intellectual property (among other assets) of the vaccine and antibody were merged into a new entity – OneBioPharma Acquisition Corp – which was subsequently renamed Alopexx, Inc.

Path Forward

Alopexx's goal is to develop a broad-spectrum, non-antibiotic therapeutic platform for the treatment and prevention of microbial infections. These immune therapeutics offer the promise of greatly limiting the burden of bacterial infections in the world and reliance on antibiotics and the development of antimicrobial resistance.

Based on Phase 1 results Alopexx proposed to the FDA that AV0328 be developed as a complement to currently approved *Streptococcus pneumoniae* vaccines (Pneumovax and Vaxneuvance). Those vaccines, including the recently approved versions, cover at best 23 of the 100 known *Streptococcus pneumoniae* serotypes. AV0328 could provide protection against the remaining 80+ serotypes. Feedback from the FDA supported pursuing accelerated approval of AV0328 based on safety in vaccinated humans and utilization of a validated surrogate assay – opsonic killing mediated by the antibodies induced by the vaccine. The FDA's Accelerated Approval Program allows for earlier approval of drugs that treat serious conditions based on a surrogate endpoint. A surrogate endpoint is a marker, such as a laboratory measurement, radiographic image, physical sign or other measure that is thought to predict clinical benefit, but is not itself a measure of clinical benefit. Management believes that this points to a development path comparable to those that have led to FDA approval of other vaccines for *Streptococcus pneumoniae* infections. However, our vaccine has not been approved by the FDA and there is no guarantee that the FDA will ultimately approve the vaccine.

Unlike vaccines that may take several weeks or longer to induce protective immunity, administration of a monoclonal antibody F598 provides immediate protection. Therefore, the antibody can be utilized in settings where an individual is at an immediate or near-term risk of developing an infection. Hospital-associated infections are one of the major settings where this occurs. This will not replace antibiotics but will instead complement and augment their efficacy and by doing so reduce the development of antibiotic resistant organisms. Use of monoclonal antibody F598 in that setting offers the potential for it to become the first broad-spectrum therapeutic antibody. We will study this in a setting where the prevalence of acquired infections is very high – intensive care units. Demonstrating that monoclonal antibody F598 can reduce the morbidity/mortality related to microbial infections in ICU patients would constitute a major health advancement. It would establish administration of F598 as part of the standard of care in that setting.

In the view of Alopexx's management, the immune-mediated anti-infective therapeutics being developed by Alopexx are unique. No other immune therapeutics offer such broad-spectrum potential. The initial target indications being pursued will permit development of anti-PNAG therapeutics in a focused fashion and, if successful, can establish Alopexx's therapeutic platform to prevent and treat a wide range of disorders.

Results of operations for the years ended December 31, 2021 and 2020

	For the Years Ended	
	December 31, 2021	December 31, 2020
OPERATING EXPENSES:		
Research and development	\$ 188,617	\$ 1,352,342
General and administrative	714,792	314,006
TOTAL OPERATING EXPENSES	903,409	1,666,348
LOSS FROM OPERATIONS	(903,409)	(1,666,348)
Interest expense, net	(53,545)	(34,387)
NET LOSS BEFORE INCOME TAX	(956,954)	(1,700,735)
Income tax expense	—	—
NET LOSS	\$ (956,954)	\$ (1,700,735)
Loss per common share – basic and diluted	(0.21)	(0.26)
Weighted Average common shares outstanding – basic and diluted	4,468,106	6,427,908

Research and Development

This category includes costs incurred mainly for development activities and clinical trials. Research and development expenses decreased approximately \$1.16 million from 2020, in which \$485 thousand was related to consultants, \$343 thousand was related to legal fees, and \$190 thousand was related to payroll, all of which were not incurred during the fiscal year 2021. In 2020, we incurred \$221 thousand in expenses from Phase 1 clinical trials and IP fees, as compared to \$165 thousand in IP fees in 2021. Similarly, in 2020, we incurred storage and warehousing costs of \$115 thousand as compared to \$23 thousand in 2021. Costs incurred in the year ended December 31, 2021 and December 31, 2020 were largely related to the development and clinical trials of the vaccine AV0328 and the monoclonal therapeutic F598. Starting in 2020 but continuing through the fiscal year 2021, we went through a reorganization to encourage future financing that resulted in us downsizing our operations to reduce costs and preserve cash. Expenses during 2020 largely related to the development and clinical trials of the vaccine AV0328 and the monoclonal therapeutic F598, while expenses during 2021 largely related to costs associated with maintaining an active license with the licensor.

General and Administrative Expense

General and administrative expense ("G&A") included only general and administrative expenses in both 2021 and 2020 as the company currently has no sales or selling expenses. General and Administrative expenses were approximately \$350 thousand higher in 2021 relative to 2020 due to a \$350 thousand increase in legal and accounting fees from costs incurred preparing for the public offering.

Interest (expense) Income, net

Interest expense, net is primarily interest expense related to the notes payable and convertible notes payable used to fund the Company's operations in 2020 and 2021. Interest expense increased from approximately \$37 thousand in 2020 to approximately \$54 thousand during the year ended December 31, 2021. The increase in interest expenses was due to higher average outstanding debt in 2021 compared to 2020.

Net Loss

Net Loss for year ended December 31, 2021 was approximately \$957 thousand, a decrease of approximately \$744 thousand from the approximately \$1.7 million incurred during the year ended December 31, 2020. The decrease in the loss was largely due to a reduction of available funds for operations, as our major shareholder and financier decided to exit from its investment in us. The decrease in net loss from 2020 to 2021 is directly correlated to the decrease in research and development (see above). As we are going through our reorganization, we had limited its expenses on research and development in order to preserve cash flow.

Liquidity and Capital Resources

Overview

Our liquidity requirements are primarily to fund our business operations, including capital expenditures and working capital requirements. Our primary sources of liquidity are additional capital investment and debt.

The source, timing and availability of any future financing will depend principally upon market conditions, and, more specifically, on the progress of our clinical development program. Funding may not be available when needed, at all, or on terms acceptable to us. Lack of necessary funds may require us to, among other things, delay, scale back or eliminate expenses including some or all of our planned development, including our clinical trials. These factors, among others, raise substantial doubt about our ability to continue as a going concern.

Cash Flow Analysis

The Company had cash of approximately \$40 thousand at December 31, 2021 compared to approximately \$20 thousand as of December 31, 2020.

Cash Flows From Operating Activities

Cash used in operating activities during the year ended December 31, 2021 was \$281 thousand. Cash used in operations consisted of the net loss of approximately \$957 thousand for the year ended 2021, and an increase of accounts payable and accrued expenses of approximately \$687 thousand, which is a direct result of increase legal and consulting fees incurred as a result of our registration statement and related compliance expense. Additionally, during 2021 we experienced a decrease of \$43 thousand in other current assets, accrued interest-related party of \$54 thousand, and an increase in deferred offering costs of approximately \$107 thousand.

Cash used in operating activities during the year ended December 31, 2020 was \$2.075 million. This consisted of a net loss of \$1.701 million, a decrease in accounts payable and accrued expenses of \$368 thousand, an increase in other current assets of \$43 thousand, net with an increase in accrued interest-related party of \$37 thousand.

Cash Flows From Financing Activities

Cash provided by financing activities during the year ended December 31, 2021 was \$301 thousand. This consisted of proceeds from capital contribution from a related party of \$99 thousand, proceeds from issuance of common stock of \$12 thousand, net with payments for the repurchase and retirement of common shares of \$10 thousand, as well \$200,000 in proceeds from the issuance of convertible notes payable – related party.

Cash provided by financing activities during the year ended December 31, 2020 was \$800 thousand. This consisted of proceeds from convertible notes payable – related party of \$600 thousand and proceeds from notes payable – related party of \$200 thousand.

Certain Significant Relationships

Brigham and Women's Hospital

The initial discovery and development of our PNAG therapeutic platform came out of Dr. Gerald Pier's laboratory at Brigham and Women's Hospital and Harvard Medical School. Dr. Pier is a co-founder of Alopexx. Alopexx has a licensing agreement with Brigham and Women's Hospital (BWH). Under this license, we received an exclusive, worldwide, royalty bearing license relating to development, utilization and commercialization of all therapeutics and diagnostics targeting PNAG. In consideration for the licenses granted under the agreement, we must pay BWH annual license fees prior to the first commercial sale of a licensed product that range in the mid-five-digit to low six-digit figures, and a low single digit royalty on net sales of licensed products beginning with the first commercial sale of a licensed product in any country during the term of the agreement. In the event we commercialize a product in the therapeutic space, we are also required to make certain drug-approval regulatory and commercialization milestone payments to BWH of up to a low seven-digit figure in the aggregate for licensed products. In the event we sublicense any of the licensed intellectual property, we must pay BWH a percentage of any sublicense income received by us, which on a going-forward basis will be in the low double digits. The aggregate milestone payments under the 2 patent license agreements are up to \$2,325,000 and \$1,850,000 for vaccine AV0328 and antibody F598 respectively for a total of \$4,175,000.

Components of Results of Operations

Operating Expenses

Research and Development

Research and development expenses represent costs incurred in performing research, development and manufacturing activities in support of our own product development efforts and include personnel-related costs (such as salaries, employee benefits and stock-based compensation) for our personnel in research and development functions; costs related to acquiring, developing and manufacturing supplies for preclinical studies, clinical trials and other studies, including fees paid to contract manufacturing organizations; costs and expenses related to agreements with contract research organizations, investigative sites and consultants to conduct non-clinical and preclinical studies and clinical trials; professional and consulting services costs; research and development consumables costs; laboratory supplies and equipment costs; and facility and other allocated costs.

Research and development expenses are expensed as incurred. Non-refundable advance payments for services that will be used or rendered for future research and development activities are recorded as prepaid expenses and recognized as expenses as the related services are performed.

We expect our research and development expenses to increase substantially in absolute dollars for the foreseeable future as we advance our candidates through clinical trials and pursue regulatory approval.

The process of conducting the necessary preclinical and clinical research to obtain regulatory approval is costly and time-consuming. The actual probability of success may be affected by a variety of factors, including the safety and efficacy of our therapeutic candidates, early clinical data, investment in our clinical programs, competition, manufacturing capability and commercial viability. We may never succeed in achieving regulatory approval for any of our therapeutic candidates. As a result of the uncertainties discussed above, we are unable to determine the duration and completion costs of our research and development projects or if, when and to what extent we will generate revenue from the commercialization and sale of our immune therapeutics.

Our clinical development costs may vary significantly based on factors such as:

- the costs and timing of our CMC activities, including fulfilling GMP-related standards and compliance;
- the cost of clinical trials being greater than we anticipate;
- changes in the standard of care on which a clinical development plan was based, which may require new or additional trials;
- the number of sites included in the trials;
- the countries in which the trials are conducted;
- delays in adding a sufficient number of trial sites and recruiting suitable patients to participate in our clinical trials;
- the number of patients that participate in the trials;
- the number of doses that patients receive;
- patients dropping out of a study;
- potential additional safety monitoring requested by regulatory agencies;
- the duration of patient participation in the trials and follow-up;
- the cost and timing of manufacturing our vaccine and antibody;
- the phase of development of our vaccine and antibody; and
- the efficacy and safety profile of our vaccine and antibody.

Future Funding Requirements

Our primary uses of cash are to fund our operations, which consist primarily of research and development expenditures related to our programs and, to a lesser extent, general and administrative expenditures. We anticipate that we will continue to incur significant expenses for the foreseeable future as we continue to advance our therapeutic candidates, expand our corporate infrastructure, including the costs associated with being a public company, further our research and development initiatives for our vaccine, scale our laboratory and manufacturing operations, and incur marketing costs associated with potential commercialization. We are subject to all of the risks typically related to the development of new drug candidates, and we may encounter unforeseen expenses, difficulties, complications, delays and other unknown factors that may adversely affect our business. We anticipate that we will need substantial additional funding in connection with our continuing operations.

We believe that our existing cash and cash equivalents as of the date of this prospectus, together with the net proceeds from this offering, will fund our current operating plans through at least the next 36 months from the date of this offering. However, we will need to raise additional capital prior to commencing pivotal trials for our vaccine and antibody. Until we can generate a sufficient amount of revenue from the commercialization of our vaccine and antibody or from collaboration agreements with third parties, if ever, we expect to finance our future cash needs through public or private equity or debt financings, third-party (including government) funding and marketing and distribution arrangements, as well as other collaborations, strategic alliances and licensing arrangements, or any combination of these approaches. The sale of equity or convertible debt securities may result in dilution to our stockholders, and, in the case of preferred equity securities or convertible debt, those securities could provide for rights, preferences or privileges senior to those of our common stock. Debt financings may subject us to covenant limitations or restrictions on our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends. Our ability to raise additional funds may be adversely impacted by deteriorating global economic conditions and the recent disruptions to and volatility in the credit and financial markets in the United States and worldwide resulting from the ongoing COVID-19 pandemic. There can be no assurance that we will be successful in acquiring additional funding at levels sufficient to fund our operations or on terms favorable or acceptable to us. If we are unable to obtain adequate financing when needed or on terms favorable or acceptable to us, we may be forced to delay, reduce the scope of or eliminate one or more of our research and development programs.

Our future capital requirements will depend on many factors, including:

- the timing, scope, progress, results and costs of research and development, testing, screening, manufacturing, preclinical and non-clinical
- studies and clinical trials, including any impacts related to the COVID-19 pandemic;
- the outcome, timing and cost of seeking and obtaining regulatory approvals from the FDA and comparable foreign regulatory authorities, including the potential for such authorities to require that we perform field efficacy studies for our vaccine, require more studies than those that we currently expect or change their requirements regarding the data required to support a marketing application;
- the cost of building a sales force in anticipation of any product commercialization;
- the costs of future commercialization activities, including product manufacturing, marketing, sales, royalties and distribution, for any of our vaccine for which we receive marketing approval;
- our ability to maintain existing, and establish new, strategic collaborations, licensing or other arrangements and the financial terms of any such agreements, including the timing and amount of any future milestone, royalty or other payments due under any such agreement;
- any product liability or other lawsuits related to our products;
- the expenses needed to attract, hire and retain skilled personnel;
- the revenue, if any, received from commercial sales, or sales to foreign governments, of our vaccine for which we may receive marketing approval; and

- the costs to establish, maintain, expand, enforce and defend the scope of our intellectual property portfolio, including the amount and timing of any payments we may be required to make, or that we may receive, in connection with licensing, preparing, filing, prosecuting, defending and enforcing our patents or other intellectual property rights.

A change in the outcome of any of these or other variables could significantly change the costs and timing associated with the development of our therapeutics. Furthermore, our operating plans may change in the future, and we may need additional funds to meet operational needs and capital requirements associated with such change.

Legal Contingencies

From time to time, we may become involved in legal proceedings arising from the ordinary course of business. We record a liability for such matters when it is probable that future losses will be incurred and that such losses can be reasonably estimated. Significant judgment by us is required to determine both probability and the estimated amount.

Off-Balance Sheet Arrangements

During the periods presented we did not have, nor do we currently have, any off-balance sheet arrangements as defined in the rules and regulations of the SEC.

Critical Accounting Policies and Significant Judgments and Estimates

Our management's discussion and analysis of our financial condition and results of operations are based on our financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States of America. The preparation of these financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, and expenses and the disclosure of contingent assets and liabilities in our financial statements. On an ongoing basis, we evaluate our estimates and judgments, including those related to accrued expenses and stock-based compensation. We base our estimates on historical experience, known trends and events and various other factors that are believed to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

While our significant accounting policies are described in more detail in Note 2 to our financial statements included elsewhere in this prospectus, we believe the following accounting policies and estimates to be most critical to the judgments and estimates used in the preparation of our financial statements.

Accrued Research and Development Expenses

We have entered into various agreements with contract manufacturing organizations, or CMOs, and may enter into contracts with clinical research organizations, or CROs, in the future. As part of the process of preparing our financial statements, we are required to estimate our accrued research and development expenses as of each balance sheet date. This process involves reviewing open contracts and purchase orders, communicating with our personnel and third parties to identify services that have been performed on our behalf and estimating the level of service performed and the associated cost incurred for the service when we have not yet been invoiced or otherwise notified of the actual cost. We make estimates of our accrued research and development expenses as of each balance sheet date based on facts and circumstances known to us at that time. We periodically confirm the accuracy of our estimates with the service providers and make adjustments, if necessary. The significant estimates in our accrued research and development expenses include the costs incurred for services performed by our vendors in connection with research and development activities for which we have not yet been invoiced.

We accrue for costs related to research and development activities based on our estimates of the services received and efforts expended pursuant to quotes and contracts with vendors, including CMOs, that conduct research and development on our behalf. The financial terms of these agreements are subject to negotiation, vary from contract to contract and may result in uneven payment flows. There may be instances in which payments made to our vendors will exceed the level of services provided and result in a prepayment of the research and development expense. Advance payments for goods and services that will be used in future research and development activities are expensed when the activity has been performed or when the goods have been services that will be used in future research and development activities are expensed when the activity has been performed or when the goods have been received. We make significant judgments and estimates in determining accrued research and development liabilities as of each reporting period based on the estimated time period over which services will be performed and the level of effort to be expended. If the actual timing of the performance of services or the level of effort varies from our estimate, we adjust the accrual or prepaid expense accordingly.

Although we do not expect our estimates to be materially different from amounts actually incurred, if our estimates of the status and timing of services performed differ from the actual status and timing of services performed, it could result in us reporting amounts that are too high or too low in any particular period. To date, there have been no material differences between our estimates of such expenses and the amounts actually incurred.

Stock-Based Compensation Expense

Stock-based compensation expense represents the cost of the grant date fair value of equity awards recognized over the requisite service period of the awards (usually the vesting period) on a straight-line basis. We estimate the fair value of equity awards using the Black-Scholes option pricing model and recognize forfeitures as they occur. Estimating the fair value of equity awards as of the grant date using valuation models, such as the Black-Scholes option pricing model, is affected by assumptions regarding a number of variables, including:

- *Fair Value of Common Stock*—See the subsection entitled “—Common Stock Valuations” for more information.
- *Expected Term*—Expected term represents the period that our stock-based awards are expected to be outstanding. For employee options, the expected term is calculated using the simplified method where there is insufficient historical data about exercise patterns and post-vesting employment termination behavior. The simplified method is based on the vesting period and the contractual term for each grant, or for each vesting-tranche for awards with graded vesting. The mid-point between the vesting date and the maximum contractual expiration date is used as the expected term under this method. For awards with multiple vesting-tranches, the time from grant until the mid-points for each of the tranches may be averaged to provide an overall expected term. The expected term for options issued to nonemployees is the remaining contractual term.
- *Expected Volatility*—Expected volatility is estimated from the average historical volatilities of publicly traded companies within the life sciences industry that are considered to be comparable to our business over a period approximately equal to the expected term for employees’ options and the remaining contractual life for non-employees’ options. We will continue to apply this process until a sufficient amount of historical information regarding the volatility of our own stock price becomes available.

- **Expected Dividend**—We have not paid and do not anticipate paying any dividends in the near future. Accordingly, we have estimated the dividend yield to be zero.
- **Risk-Free Interest Rate**—The risk-free interest rate is based on the U.S. Treasury yield in effect at the time of grant for zero-coupon notes with remaining terms corresponding with the expected term of the option.

Changes in the assumptions can materially affect the fair value and ultimately how much stock-based compensation expense is recognized. These inputs are subjective and generally require significant analysis and judgment to develop.

Common Stock Valuations

We are required to estimate the fair value of the common stock underlying our equity awards when performing fair value calculations. The fair value of the common stock underlying our equity awards will be approved on each grant date by our board of directors. The fair value of our common stock will be determined by management, considering input from independent third-party valuation analyses. All options to purchase shares of our common stock are intended to be granted with an exercise price per share no less than the fair value per share of our common stock underlying those options on the date of grant, based on the information known to us on the date of grant. In the absence of a public trading market for our common stock, on each grant date we develop an estimate of the fair value of our common stock in order to determine an exercise price for the option grants. Our determinations of the fair value of our common stock were made using methodologies, approaches and assumptions consistent with the American Institute of Certified Public Accountants Accounting and Valuation Guide: Valuation of Privately Held Company Equity Securities Issued as Compensation, or the Practice Aid. Because our common stock shares are not publicly traded, estimating their fair values can be highly complex and subjective.

Management will consider various objective and subjective factors to determine the fair value of our common stock, including:

- valuations of our common stock performed with the assistance of independent third-party valuation specialists;
- our stage of development and business strategy, including the status of research and development efforts of our vaccine, and the material risks related to our business and industry;
- our results of operations and financial position, including our levels of available capital resources;
- the valuation of publicly traded companies in the life sciences and biotechnology sectors, as well as recently completed mergers and acquisitions of peer companies;
- the lack of marketability of our common stock;

- the likelihood of achieving a liquidity event for the holders of our common stock, such as an initial public offering or a sale of our company, given prevailing market conditions;
- trends and developments in our industry; and
- external market conditions affecting the life sciences and biotechnology industry sectors.

The Practice Aid prescribes several valuation approaches for setting the value of an enterprise, such as the cost, income and market approaches, and various methodologies for allocating the value of an enterprise to its common stock. The cost approach establishes the value of an enterprise based on the cost of reproducing or replacing the property less depreciation and functional or economic obsolescence, if present. The income approach establishes the value of an enterprise based on the present value of future cash flows that are reasonably reflective of our future operations, discounting to the present value with an appropriate risk adjusted discount rate or capitalization rate. The market approach is based on the assumption that the value of an asset is equal to the value of a substitute asset with the same characteristics.

Following the completion of this offering, the fair value of our common stock will be based on the closing quoted market price of our common stock as reported on the date of grant on the primary stock exchange on which our common stock is traded. Estimating the fair value of our common stock will not be necessary to determine the fair values of new awards once the underlying shares begin trading.

Quantitative and Qualitative Disclosures About Market Risk

Interest Rate Risk

Our cash and cash equivalents as of December 31, 2021 of approximately \$40 thousand consisted of readily available checking and money market funds. Our primary exposure to market risk is interest rate sensitivity, which is affected by changes in the general level of U.S. interest rates. However, because of the nature of the instruments in our portfolio, a sudden change in market interest rates would not be expected to have a material impact on our financial condition or results of operations. We believe that our exposure to interest rate risks is not significant and that a hypothetical 10% movement in market interest rates would not have a significant impact on the total value of our portfolio or our interest income. In addition, we do not believe that our cash and cash equivalents have significant risk of default or illiquidity.

Foreign Currency Risk

We may be exposed to market risk related to changes in foreign currency exchange rates, mainly relating to our contract with Lonza, our CMO in the UK. We have also entered into a limited number of contracts with other parties with payments denominated in foreign currencies. Payments under these contracts are made in foreign currencies and are subject to fluctuations in foreign currency rates. We do not currently have a formal program in place to hedge foreign currency risks. To date, foreign currency transaction gains and losses have not been material to our financial statements. A 10% increase or decrease in current exchange rates would not have a material effect on our financial results. As our foreign currency risk increases in the future, we will evaluate alternative strategies, including hedging, to mitigate our foreign currency exposure.

Effects of Inflation

Inflation generally affects us by increasing our cost of labor and research and development contract costs. We do not believe inflation had a material effect on our results of operations during the periods presented.

Emerging Growth Company Status

We are an emerging growth company, as defined in the Jumpstart Our Business Startups Act, or the JOBS Act. Under the JOBS Act, emerging growth companies can delay the adoption of new or revised accounting standards issued subsequent to the enactment of the JOBS Act until such time as those standards apply to private companies. Other exemptions and reduced reporting requirements under the JOBS Act for emerging growth companies include presentation of only two years of audited financial statements in a registration statement for an initial public offering, an exemption from the requirement to provide an auditor's report on internal controls over financial reporting pursuant to Section 404 of the Sarbanes-Oxley Act of 2002, as

amended, an exemption from any requirement that may be adopted by the Public Company Accounting Oversight Board regarding mandatory audit firm rotation and less extensive disclosure about our executive compensation arrangements. We have elected to use the extended transition period for complying with new or revised accounting standards that have different effective dates for public and private companies until the earlier of the date that (i) we are no longer an emerging growth company or (ii) we affirmatively and irrevocably opt out of the extended transition period provided in the JOBS Act. However as described in Note 3 to our financial statements included elsewhere in this prospectus, we early adopted certain accounting standards, as the JOBS Act does not preclude an emerging growth company from adopting a new or revised accounting standard earlier than the time that such standard applies to private companies to the extent early adoption is permitted. As a result, our financial statements may not be comparable to companies that comply with the new or revised accounting pronouncements as of public company effective dates.

We will remain an emerging growth company until the earliest of (i) the last day of our first fiscal year in which we have total annual gross revenues of \$1.07 billion or more, (ii) the last day of our fiscal year following the fifth anniversary of the completion of this offering, (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 equity securities that is held by non-affiliates exceeds \$700.0 million as of the prior June 30th and (iv) the date on which we have issued more than \$1.0 billion in non-convertible debt securities during the prior three-year period.

Recently Adopted Accounting Pronouncements

See Note 2 to our financial statements included elsewhere in this prospectus for more information.

Internal Control Over Financial Reporting

The process of improving our internal controls has required and will continue to require us to expend significant resources to design, implement and maintain a system of internal controls that is adequate to satisfy our reporting obligations as a public company. There can be no assurance that any actions we take will be completely successful. We will continue to evaluate the effectiveness of our disclosure controls and procedures and internal control over financial reporting on an ongoing basis.

We have not begun testing or documenting our internal control procedures in order to comply with the requirements of Section 404 of SOX. Section 404(a) requires annual management assessments of the effectiveness of our internal control over financial reporting and Section 404(b) requires a report by our independent auditors addressing these assessments. We must comply with Section 404(a) immediately and we must comply with Section 404(b) no later than the time we file our annual report for fiscal 2026 with the SEC, assuming we complete this offering in the current period. As part of this process, we may identify specific internal controls as being deficient. We anticipate retaining additional personnel to assist us in complying with our Section 404 obligations. We are currently evaluating whether such personnel will be retained as consultants or as our employees.

However, based on this evaluation, our principal executive officer and principal financial and accounting officer have concluded that during the period covered by this report, our disclosure controls and procedures were not effective due to a material weakness over timely review of financial reporting. To address material weakness, management has devoted, and plans to continue to devote, significant effort and resources to the remediation and improvement of its internal control over financial reporting and to provide processes and controls over the internal communications within the Company, financial advisors and independent registered public accounting firm.

Overview

We are a clinical stage biotechnology company focusing on developing novel, broad-spectrum immune-mediated therapeutics for the prevention, treatment and mitigation of a wide range of bacterial, fungal and parasitic microbial infections. The target of our therapeutics, Poly *N*-acetyl glucosamine or PNAG, is a conserved molecule expressed on the surface of a wide range of non-viral microbes. The target of Alopexx's therapeutics was identified by Dr. Gerald Pier and his team at Harvard Medical School and Brigham and Women's Hospital. He is a co-founder and Chief Scientific Officer of our company.

Conventional immune-mediated therapeutics for infectious diseases are highly specific. Current approaches target a component or antigen that is unique to a subset of the microbial species causing an infection. The pneumococcal vaccine Prevnar 13 provides protection against only 13 of the 100+ known subsets or serotypes of the microbe that causes that infection. To broaden that coverage, the conventional approach has been to include additional serotype-specific components into newer vaccines, e.g., Prevnar-20.1 That approach is limited in that a multi-component serotype-specific vaccine cannot hope to contain the over 100 serotype-specific antigens to provide full protection. In addition, while current vaccines have reduced the incidence of the specific strains, infections caused by non-vaccine serotypes have increased, reducing the net effectiveness of the vaccine. This is a phenomenon known as serotype replacement.

There are other limitations associated with developing and utilizing a multi-component serotype-specific vaccine. Incorporation of additional serotypes into a single vaccine formulation has been noted to lower immune (or opsonic) titers elicited by Prevnar 20 compared to Prevnar 13. This was also observed in infants when the immune titers elicited by Prevnar 13 were compared to Prevnar 7. Adding to the challenge of developing new serotype-specific vaccines has been the recognition that serotype replacement is not occurring uniformly. A recent report noted that the efficacy of current serotype-specific vaccines has resulted in the rise of a diverse and less uniform number and distribution of serotypes that may not be as effectively addressed by newer serotype-specific vaccines. Taken as whole it points to the limitations and complexity of providing broad spectrum coverage by adding more serotype-specific components.

An alternative approach would be utilization of a single antigen that is common to most if not all pneumococcal and potentially many other microbial infections – a non-serotype specific vaccine. PNAG offers that promise. It is a surface polysaccharide produced by major bacterial and fungal species, and protozoan parasites. Over 75 microbes have been found to express PNAG, including anti-microbial resistant organisms. This suggests that PNAG could serve as a therapeutic target against many different microbes.

Alopexx has developed two immune therapeutics directed at PNAG – a monoclonal antibody and a vaccine. The potential efficacy of these immune therapeutics has been evaluated in studies of 14 pathogens in 20 animal models of infection. In all of those infection models a positive therapeutic effect was observed in preventing or treating infections. Whether the efficacy noted in animal models will be observed in humans remains to be determined. While the ultimate decision on the safety and efficacy of our therapeutics will be determined by the FDA and other health authorities, it is our management's assessment that the broad-spectrum potential of our therapeutics will allow them to be used for the prevention, treatment, and mitigation of a wide range of infections. Both therapeutics are now in human clinical trials in which, in our management's assessment, they have been found to be well-tolerated. Our therapeutics are:

- **Vaccine AV0328** - a synthetic PNAG vaccine. A phase 1, first-in-man trial has been completed and the vaccine was found to be well tolerated, and no serious adverse events were observed. It induced antibodies that were capable of killing a wide range of PNAG-expressing pathogens. In vitro efficacy in killing was noted against every pathogen tested which included over 10 different microbial species. Based on those results, Alopexx proposed to the FDA that AV0328 be developed as a complement to currently approved *Streptococcus pneumoniae* vaccines (Prevnar, Pneumovax and Vaxneuvance). Those vaccines, including the recently approved versions, cover at best 23 of the 100 known *Streptococcus pneumoniae* serotypes. AV0328 could provide protection against many of the remaining 80+ serotypes. Feedback from the FDA supported pursuing accelerated approval of AV0328 based on safety in vaccinated humans and utilization of a validated surrogate assay – opsonic killing mediated by the antibodies induced by the vaccine. The FDA's Accelerated Approval Program allows for earlier approval of drugs that treat serious conditions based on a surrogate endpoint. A surrogate endpoint is a marker, such as a laboratory measurement, radiographic image, physical sign or other measure that is thought to predict clinical benefit but is not itself a measure of clinical benefit. Management believes that this points to a development path comparable to those that have led to FDA approval of other vaccines for *Streptococcus pneumoniae* infections. However, the FDA has not yet approved the vaccine and there is no guarantee that the FDA will ultimately approve the vaccine.
- **Monoclonal antibody F598** - Phase 1 and pilot phase 2 trials of F598 have been completed. The antibody was found to be well tolerated, and no serious adverse events were observed. A single infusion was noted to provide sustained serum levels for 2-3 months. Unlike vaccines which may take several weeks or longer to induce protective immunity, administration of a monoclonal antibody provides immediate protection. Therefore, the antibody will be utilized in settings where an individual is at an immediate or near-term risk of developing an infection. Hospital-associated infections are one of the major settings where this occurs. Monoclonal antibody F598 will not replace antibiotics but will instead complement and augment their efficacy and by doing so reduce the development of antibiotic resistant organisms. Use of monoclonal antibody F598 in that setting offers the potential for it to become the first broad-spectrum therapeutic antibody. We will study this in a setting where the prevalence of acquired infections is very high – intensive care units. Demonstrating that monoclonal antibody F598 can reduce the morbidity/mortality related to microbial infections in ICU patients would constitute a major health advancement. We believe it would establish administration of F598 as part of the standard of care in that setting

The Problem

Infections caused by bacteria, fungi and parasites continue to be a major cause of death and disability worldwide. The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) found that pneumonia or bronchiolitis are leading causes of mortality and morbidity worldwide. Nearly 2.38 million deaths resulted from lower respiratory infections in 2016, making these infections the sixth leading cause of mortality for all ages and the leading cause of death among children younger than 5 years. *Streptococcus pneumoniae*, an initial focus of the Company, is the leading cause of pneumonia mortality globally. The World Health Organization (WHO) estimates that *Streptococcus pneumoniae* kills close to half a million children under 5 years old worldwide every year with most of these deaths occurring in developing countries.

The discovery of antibiotics had a major impact on human and animal health. As has been widely reported in the public media (such as ABC News), antibiotics, along with vaccines, are widely considered to be among the greatest health advances in human history. Following their introduction in the 1940's the world witnessed a decrease in many bacterial infections -- so much so that a belief commonly held by many senior scientists, was that antibiotics could effectively control every important infectious disease. Others were less optimistic, including the discoverer of penicillin, Alexander Fleming, who in 1945 predicted the development of resistant organisms. Unfortunately, Fleming's fears have been borne out and less than a century since their introduction the benefits of antibiotics are facing a crisis. The overuse of antibiotics in healthcare and agriculture, as well as inappropriate waste management and environmental transmission, have led to substantially increased antimicrobial resistance according to the New England Journal of Medicine. It is estimated by the CDC that resistance to a specific antibiotic takes an average of 1 year to emerge after it becomes commercially available. The risk of anti-microbial resistance has been prominently featured in the lay press as well such as Time Magazine and the Economist.

In the United States in 2015 it was estimated that more than 2 million people suffered from anti-microbial resistant (AMR) infections and about 23,000 died as a direct result of these infections. In the European Union, taking data from 2007, it has been estimated that AMR infections cause about 25,000 deaths annually and generate an overall cost of about €1500 million per year. In the United States the CDC estimates that U.S. costs of AMR are \$55 billion per year, of which \$20 billion is attributed to healthcare and \$35 billion is attributed to loss of productivity. More broadly, a report commissioned by the UK Government and the Wellcome Trust estimated that by 2050 the cumulative cost to global economic output could be \$100 trillion. The global death toll from AMR infections, estimated to be at least 700,000 annually, is expected to reach into the millions by 2050. In 2022, the first detailed analysis estimating the worldwide burden of AMR in 204 countries and territories was reported in The Lancet. That analysis found a far higher incidence of AMR-related deaths than had been previously reported. The analysis found an estimated 4.95 million deaths associated with bacterial AMR in 2019, including 1.27 million deaths attributable to bacterial AMR. Compared with all underlying causes of death, they found that AMR was the third leading cause of death after ischemic heart disease and stroke.

The Solution

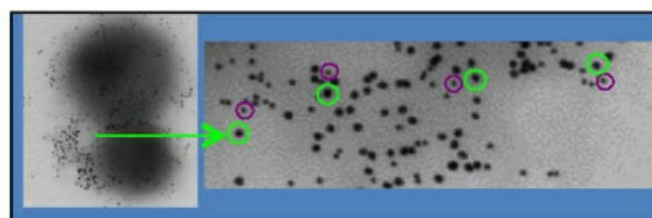
Given the rise in AMR infections there is an urgent need to develop anti-microbial therapeutics that will not lead to selection for resistance. We have developed two immune therapeutics capable of preventing and treating microbial infections without the use of antibiotics, including AMR organisms. Alopexx has developed a vaccine and monoclonal antibody capable of targeting a wide range of microbial infections. Unlike antibiotics, immune therapeutics are not associated with the development of resistance as they make use of the host's innate immune system to clear the microbes, without putting pressure on the pathogen to survive in a hostile environment. Antibodies remain within the host and are therefore not like antibiotics excreted into the environment at low levels that promote the development of antimicrobial resistance.

PNAG - a unique broad spectrum anti-microbial target

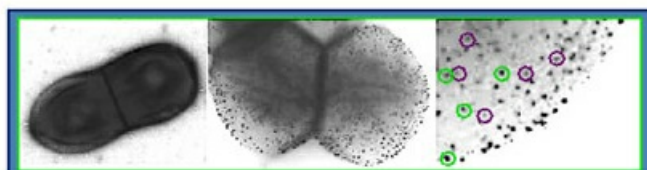
The products comprising Alopexx's therapeutics were developed by Dr. Gerald Pier and his team at Harvard Medical School and Brigham and Women's Hospital. PNAG has been identified by a large number of independent investigators as a conserved surface polysaccharide produced by major bacterial and fungal species, and protozoan parasites. For bacterial pathogens, surface capsules, often composed of highly varied carbohydrate polymers, have been used successfully to vaccinate humans against *Streptococcus pneumoniae*, *Hemophilus influenzae* type b, *Neisseria meningitidis* and *Salmonella enterica* serovar Typhi. However, efficacy is limited to the capsule types included in vaccines or targeted by monoclonal antibodies. Over the past several years the occurrence of the β -1 $\rightarrow$ 6-linked PNAG polysaccharide has been discovered to be a component of the bacterial surfaces of many bacterial, fungal and other eukaryotic pathogens. The synthesis of PNAG by all of these pathogens suggests an important role for this molecule in microbial biology.

PNAG co-localizes on the microbial surface with other capsular antigens that have been shown to be effective vaccine targets. As shown in the photomicrographs below, PNAG is spatially located in the same area as *N. meningitidis* capsular antigens serogroup A and *S. pneumoniae* serogroup 19A.

Co-localization with Capsular Antigens



N. Meningitidis serogroup A
Anti-PNAG + Anti- Serogroup A



S. pneumoniae serogroup 19A
Anti-PNAG + Anti- Serogroup 19A



N. meningitidis serogroup A and *S. pneumoniae* serotype 19 cells were reacted with either mouse IgG antibody specific to the respective capsule or human monoclonal antibody to PNAG and then further reacted with anti-mouse IgG conjugated to 10 nm gold particles or anti-human IgG conjugated to 15 nm gold particles. Electron microscopy was used to detect the antibody-labeled antigens.

PNAG has been shown in many cases to be a critical factor for pathogen survival and virulence. This suggests that it could serve as a therapeutic target against many different microbes. As summarized in the table below, positive detection of expression of PNAG has been obtained with over 75 distinct species of microbes, encompassing Gram-positive and Gram-negative bacteria, spirochetes such as those causing Lyme disease, fungi, protozoan parasites such as those causing trichomonas, malaria, leishmaniasis and toxoplasmosis and filarial worms that cause heartworm in dogs and filariasis in humans.

Among strains within species tested for PNAG expression, we detected the antigen among 100% of 50 strains of *Staphylococcus aureus*, 100% of 12 strains of *Neisseria* spp. including representatives of all capsular serotypes of *N. meningitidis*, 100% of 36 strains of *Streptococcus pneumoniae*, and 100% of 38 strains of different species of antibiotic-resistant Gram-negative bacteria. Only among a minority of isolates of *E. coli* have we found some strains not expressing PNAG (5 of 30 negative) and expression of PNAG by clinical isolates of *Staphylococcus epidermidis*, a cause of device-related infection, has been reported by multiple groups to range from 30%-60%. Among common causes of infection that we have tested, only *Pseudomonas aeruginosa* and *Proteus mirabilis* did not express PNAG. Overall, close to 250 distinct microbial strains have been analyzed for PNAG expression with >90% positive for antigen production.

● <i>Staphylococcus aureus</i> including MRSA ● <i>Staphylococcus epidermidis</i> and other coagulase-negative staphylococci ● <i>Escherichia coli</i> including 0157 and other <i>Shiga-toxin</i> producers ● <i>Ammonifex degensii</i> ● <i>Bordetella pertussis</i> ● <i>Bordetella parapertussis</i> ● <i>Bordetella bronchiseptica</i> ● <i>Burkholderia cenocepacia</i> ● <i>Enterobacter</i> spp. ● <i>Enterococcus faecalis</i> ● <i>Klebsiella</i> spp. ● <i>Shigella</i> spp. ● <i>Staphylococcus pseudintermedius</i> ● <i>Stenotrophomonas maltophilia</i> ● <i>Babesia bovis</i> ● <i>Bacteroides fragilis</i> ● <i>Borrelia burgdorferi</i> ● <i>Brucella abortus</i> ● <i>Brucella melitensis</i> ● <i>Brugia malayi</i> ● <i>Burkholderia mallei</i> ● <i>Burkholderia pseudomallei</i> ● <i>Clostridium difficile</i> ● <i>Campylobacter jejuni</i> ● <i>Chlamydia trachomatis</i>	● <i>Coxiella burnetii</i> ● <i>Cutibacterium (Propionibacterium) acnes</i> ● <i>Dirofilaria immitis</i> ● <i>Ehrlichia canis</i> ● <i>Ehrlichia chaffeensis</i> ● <i>Francisella tularensis</i> ● Fungal pathogens ● <i>Candida albicans</i> ● <i>Cryptococcus neoformans</i> ● <i>Cryptococcus gattii</i> ● <i>Aspergillus fumigatus</i> ● <i>Aspergillus flavus</i> ● <i>Fusarium solani</i> ● <i>Yersinia pestis</i> ● <i>Aggregatibacter actinomycetemcomitans</i> ● <i>Actinobacillus pleuropneumoniae</i> ● <i>Acinetobacter baumannii</i> ● <i>Vibrio parahemolyticus</i> ● <i>Bacillus subtilis</i> ● <i>Streptomyces coelicolor</i> ● <i>Yersinia enterocolitica</i> ● <i>Yersinia pseudotuberculosis</i> ● <i>Salmonella enterica</i> serovar Typhi ● <i>Salmonella enterica</i> (multiple serovars) ● <i>Streptococcus pyogenes</i> Group A streptococci) ● <i>Streptococcus agalactiae</i> (Group B streptococcus)	● <i>Streptococcus pneumoniae</i> ● <i>Vibrio cholerae</i> ● <i>Fusobacterium nucleatum</i> ● <i>Helicobacter pylori</i> ● <i>Hemophilus ducreyi</i> ● <i>Hemophilus influenzae</i> ● <i>Hemophilus parvus</i> ● <i>Leptospira interrogans</i> ● <i>Listeria monocytogenes</i> ● <i>Mannheimia haemolytica</i> ● <i>Mycobacterium avium</i> and other NTB ● <i>Mycobacterium tuberculosis</i> ● <i>Neisseria gonorrhoeae</i> ● <i>Neisseria meningitidis</i> ● <i>Plasmodium species</i> ● <i>Rhodococcus equi</i> ● <i>Streptococcus equi</i> ● <i>Streptococcus pyogenes</i> ● <i>Streptococcus suis</i> ● <i>Streptococcus uberis</i> ● <i>Theileria equi</i> ● <i>Toxoplasma cruzi</i> ● <i>Trypanosoma cruzi</i> ● <i>Trichomonas vaginalis</i> ● <i>Tritrichomonas foetus</i>
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PNAG Has a Critical Role in Bacterial Virulence

Beyond its wide distribution, another key component of PNAG as a target antigen is its critical role in bacterial virulence. Studies in Dr. Pier's laboratory have shown that laboratory-created mutant variants of *S. aureus* that cannot produce PNAG have a significantly reduced ability to cause infections in mice. Laboratory studies with other bacterial species have similarly shown that loss of PNAG production decreases a given microbe's virulence. The broad expression of PNAG among such a diverse range of microbes strongly implicates PNAG as critical factor for basic microbial biology and thus the existence of strong selective pressures to maintain PNAG as an essential component of microbial cell survival.

PNAG is not expressed in mammalian tissues

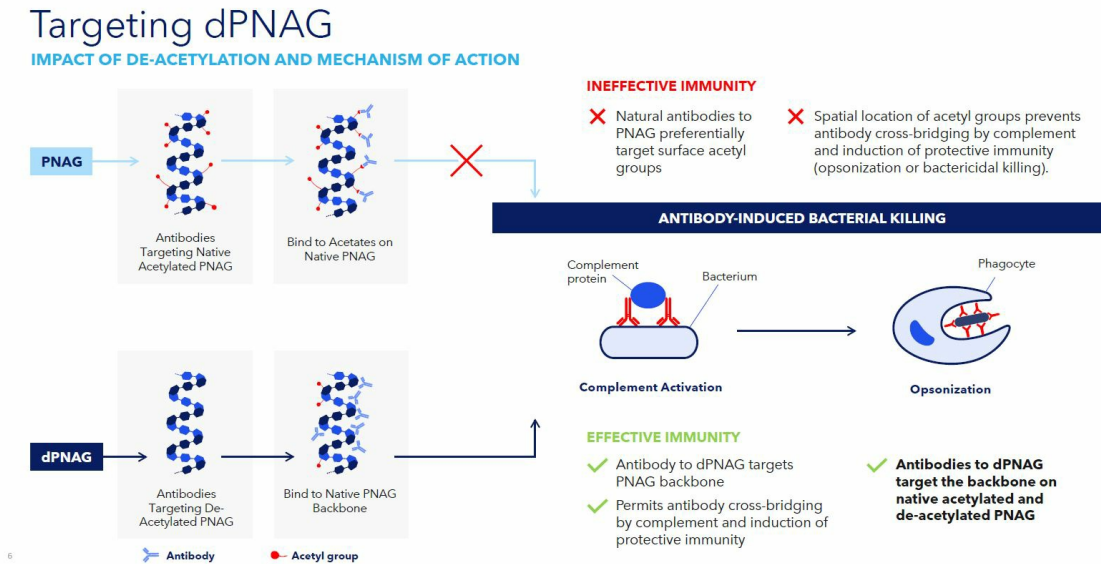
PNAG has not, to date, been described to occur in mammalian species. Therefore, immune targeting of PNAG is not expected to cross react with human tissue or organs. Immunohistochemistry studies of the binding of monoclonal antibody F598 to human and non-human primate tissues, were performed using frozen normal human and cynomolgus monkey tissue specimens to identify any cross-reactivity with normal tissue and therefore evaluate whether any potential off-target binding might occur. In a panel of 32 cynomolgus and 33 human normal tissues from three separate donors, there was no F598-specific reactivity detected, indicating that F598 has little to no potential for off-target binding. This is supported by clinical studies of monoclonal antibody F598 in humans and vaccine AV0328 in multiple animal species and humans where no significant adverse effects were noted.

Natural antibody to PNAG is common but does not provide immune protection

Natural antibody to PNAG is common in humans and many animal species but these antibodies do not routinely have robust opsonic killing or immune protection against PNAG-producing microbes. Those natural antibodies are unable to fully engage the host innate serum complement co-factor system which is needed for optimal protective immunity. Thus, broad-based immunity to this antigen rarely develops naturally in human or animal populations. Microbial colonization or infection does not usually induce effective antibody responses to PNAG. As detailed below, a key advance in the development of Alopexx's immune therapeutics has been the recognition of the role acetylation plays in preventing the induction of protective immunity.

The Role of Acetylation of PNAG in Immune Evasion and Antibody Responses

Alopexx's major proprietary advance was the recognition that this ineffective natural immunity was due to the high degree of acetylation of the native PNAG molecule. As illustrated in the figure below, natural PNAG has many acetyl groups on its surface. Those surface acetyl groups are responsible for inducing a natural but ineffective immune response. The acetyl groups can be removed by chemically altering PNAG. This results in a strong protective immunogen that now targets the backbone of PNAG and avoids participation from the acetyl groups. As illustrated in the lower figure, targeting the backbone of PNAG leads to the induction of antibody-mediated bacterial killing. Alopexx's vaccine and antibody target the backbone on native PNAG and provide an effective immune response.



Investigations have shown that the functional antibodies that target the PNAG backbone are able to bind to the native, acetylated molecule. Antibodies raised to deacetylated PNAG (which we will collectively refer to as dPNAG) and the fully human immunoglobulin G1 monoclonal antibody that binds to both native and poorly acetylated glycoforms of PNAG, mediate complement-dependent opsonic and microbial killing. They have been found to protect against local and/or systemic infections by a wide array of bacterial and fungal agents.

***In Vivo* Efficacy Studies targeting dPNAG**

A summary of the protective immunity targeting PNAG in 20 different animal models is shown in the table below. These data suggest that a dPNAG vaccine or monoclonal antibody could be used to protect against a broad range of pathogens that produce surface PNAG.

***In Vivo* Efficacy Studies**

Pathogen	Infection Model	Animal
<i>S. aureus</i>	• Lethal peritonitis • Bacteremia • Skin infection • Corneal Keratitis • Lethal systemic infection	Mouse
<i>E. coli</i>	• Lethal peritonitis • Oral infection with Shiga-toxin producing strains	
<i>Burkholderia</i>	• Lethal peritonitis	
<i>A. baumannii</i>	• Bacteremia • Pneumonia	
<i>N. meningitidis</i> serogroup B	• Neonatal infection	
<i>N. gonorrhoeae</i>	• Conjunctivitis	
<i>S. pyogenes</i>	• Lethal infections	
<i>L. monocytogenes</i>	• Lethal infections	
<i>S. pneumoniae</i>	• Pneumonia • Corneal infections	
<i>K. pneumoniae</i>	• Pneumonia	
<i>C. albicans</i>	• Keratitis	
<i>P. berghei</i>	• Malaria	Horse
<i>R. equi</i>	• Pneumonia	
<i>S. aureus</i>	• Mastitis • Lethal infection	Sheep
<i>A. pleuropneumoniae</i>	• Pneumonia	Pig

Therapeutic Potential and Initial Indications

As summarized in the table below, the broad distribution of PNAG allows for an expansive range of targets and indications to be pursued. These immune therapeutics will be effective whether or not the microbe is resistant to antibiotics. A key aspect of the company's plan is to initially focus on areas we believe have an increased potential for regulatory approval. Success there would justify and support pursuit of several other indications.

As is detailed in the sections that follow, we plan to initially focus on two indications - prevention of infections caused by *S. pneumoniae* for vaccine AV0328 and ICU infections for monoclonal antibody F598. However, the data generated in pre-clinical studies and the completed phase 1 and 2 trials supports pursuit of other indications as well. That is reflected in the developmental pipeline figure where the status of other indications is illustrated. The rationale for those additional indications is briefly mentioned below.

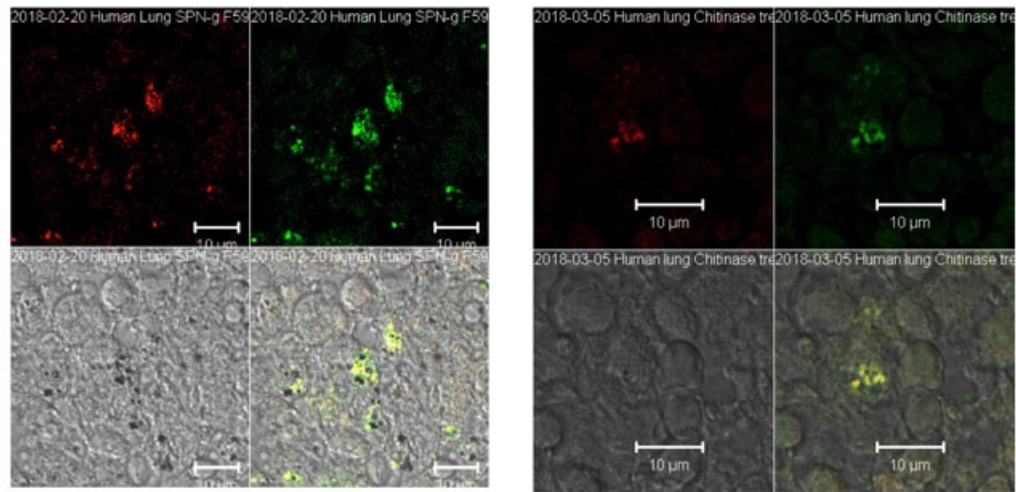
Of note, there is growing evidence to suggest that PNAG-positive microbes may be critical factors in a wide range of diseases not usually associated with infections. Ineffective removal of PNAG-expressing microbes or their fragments can contribute to the development of diabetes, Alzheimer's disease and other chronic debilitating conditions. There are an increasing number of conditions where an infection has been identified as the initial trigger for inflammation and associated tissue destruction. While not the initial focus of the Company, these are areas that have great future potential.

	Setting	Relevant Diseases/Rationale
Infectious Diseases	Expansion of existing vaccines	• Pneumococcal pneumonia • Meningitis
	Antibiotic resistant organisms	World Health Organization identified threat organisms • 12 families of bacteria that pose the greatest threat to human health Antibody could be combined with antibiotics to treat these resistant infections
	Prevention in high-risk populations	Use of the monoclonal antibody could reduce development of infections in multiple high-risk settings • ICU patients • Emergency abdominal surgery • Neonatal infections • Burn patients • Trauma patients
	Sexually Transmitted Diseases	• Gonorrhea • Chlamydia
	Chronic and Difficult to treat Infections	• Chronic Lyme disease • Recurrent urinary tract infections • Eye infections • Prosthetic joint infections
Diseases where alterations in the microbiome or prior infection have been implicated	• Alzheimer's Disease • Graft vs Host Disease • Traumatic brain injury • Diabetes • Cancer	Strong preliminary data has implicated PNAG-positive microbes in the development of a wide range of chronic diseases, associated with inflammation and tissue injury. Many tumors harbor PNAG-positive microbes making microbial antigens potential anti-tumor antigens

PNAG Expression and S. pneumoniae

PNAG expression has been evaluated in 36 *S. pneumoniae* serotypes. One-hundred percent of serotypes evaluated have been found to express PNAG. This includes serotypes contained in PREVNAR13 (PCV13), PREVNAR20 (PCV20) and PNEUMOVAX23 (PPSV23). Consistent with our results with other pathogens, we expect that the majority of remaining pneumococcal serotypes will be positive as well. We have further sought to confirm the relevance of PNAG expression by examining tissues from patients infected with *S. pneumoniae*. As can be seen in the photomicrographs below, confocal microscopy of a lung section from one patient with a positive *S. pneumoniae* lung culture demonstrated PNAG expression during this human infection (shown in green). Staining with an anti-*S. pneumoniae* antibody (shown in red) confirmed that PNAG was located on the bacteria. This demonstrates that PNAG expression occurs in infected human lung tissue and points to its likely relevance as a therapeutic target in pneumococcal pneumonia.

Demonstration of PNAG Expression on S.pneumoniae Infected Human Lung Tissue



Confocal microscopy of human lung sections from two patients with a positive *S. pneumoniae* lung culture to assess PNAG expression *in vivo*. Formalin fixed, paraffin-embedded tissue sections were deparaffinized. Samples were incubated with either 5.2 ug/ml of F598 (antibody to PNAG) conjugated to Alexa Fluor 568 (red) or anti-*S. pneumoniae* conjugated to FITC (green) for 4 hours at room temp in 0.5% BSA/PBS pH 7.4. Samples were washed and mounted for confocal microscopic analysis. A higher magnification is shown in the right photomicrograph demonstrating binding to individual *S. pneumoniae* diplococci.

Upper left	Anti PNAG monoclonal antibody (Red)
Upper right	<i>S. pneumoniae</i> specific antibody (Green)
Lower left	Phase contrast
Lower right	Composite of red & green channels showing co-localization (yellow)

Preclinical Proof of Concept Studies

Several preclinical models, summarized below, have been used to demonstrate proof of concept for protection induced by vaccine AV0328 and monoclonal antibody F598:

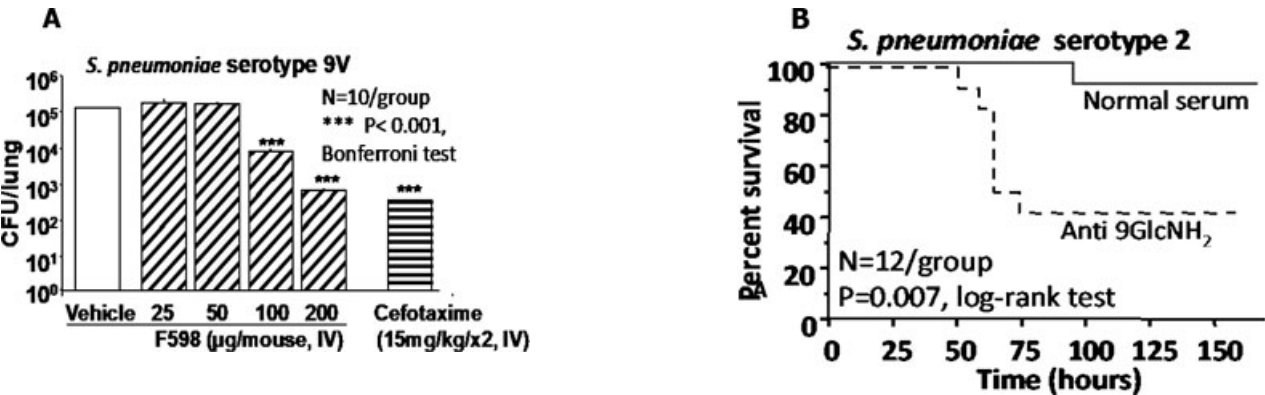
- Rabbits vaccinated with AV0328 and assayed for *in vitro* opsonizing antibodies
- Monoclonal antibodies administered to mice who were subsequently challenged with *S. pneumoniae*
- Pigs vaccinated and challenged with a species-relevant pulmonary pathogen *Actinobacillus pleuropneumoniae*
- Maternal transfer of immunity by horses vaccinated with AV0328 to foals challenged with a species-relevant pulmonary pathogen *Rhodococcus equi*.

The data from these diverse models, including infections leading to serious lung disease, consistently show high-level protection by antibody to PNAG, and are highly supportive of the likely efficacy of vaccine AV0328 in preventing pneumococcal disease in humans.

Protection Against *S. pneumoniae*-Induced Pneumonia

In a *S. pneumoniae* lung infection model, the monoclonal antibody to PNAG, F598, was administered intravenously to mice 4 hours before bacterial challenge and reduced the recovered bacterial levels in a dose-dependent manner. As illustrated below, protection was observed starting from 25 µg/mouse (~0.8 mg/kg) with a maximum effect at 200 µg/mouse (~7 mg/kg). At 200 µg/mouse, the effect of F598 on bacterial load reduction was comparable to curative treatment with 30 mg/kg of a standard antibiotic, cefotaxime, administered following the bacterial infection.

Protection Against *S. pneumoniae*-Induced Lung Infection by Anti-PNAG Monoclonal Antibody F598



A: Colony-forming units of *S. pneumoniae* serotype 9V recovered 24 hours after infection of mice treated with either vehicle (PBS), varying doses of monoclonal antibody F598 to PNAG, or cefotaxime. Overall ANOVA P value<0.001.

B: Survival of CBA/N mice infected intranasally with *S. pneumoniae* serotype 2 following injection of 0.2 ml of either non-immune or PNAG-immune antisera raised in rabbits immunized with the 9GlcNH₂-TT vaccine

Note: The p-values cited here refer to statistical significance for this pre-clinical study. p-values are widely used in both the social and natural sciences to quantify the statistical significance of observed results. A small number as is reported here is an indication that the observed results did not occur by random chance. These p-values refer to the results of this experiment alone. A separate statistical analysis plan will need to be developed and approved by the FDA for the clinical studies that will be used to support regulatory approval.

***Rhodococcus equi* Infection in Horses**

R. equi is a Gram-positive coccobacillus that is an important cause of pneumonia in foals. The organism is commonly found in dry and dusty soil and is also a causative agent of infection in other domesticated animals. The frequency of foal infection can reach near 60% on some breeding farms. It is an intracellular parasite that mimics human disease caused by *Mycobacterium tuberculosis* (TB). Its close association with TB suggests that it may be a good model for that disease.

Alopexx is collaborating with Dr. Noah Cohen, Professor of Veterinary Medicine in the Department of Large Animal Clinical Sciences at Texas A&M to study the vaccine's efficacy in protecting foals from an intra-bronchial challenge with *R. equi*. As foals are primarily susceptible to infection early in life, pregnant mares were immunized 3 and 6 weeks prior to parturition with AV0328 (the same vaccine used in human trials) plus 10% Specol adjuvant. This resulted in the transfer of maternal antibodies to the foal via the colostrum (horses do not have transplacental transfer of maternal antibody – transfer is via colostrum during the first 48 hours of life).

Two studies were performed during the annual foaling seasons in 2015 and 2016. Combining the results, 11/12 or 92% of immune foals remained healthy and did not develop any signs of pneumonia due to *R. equi* infection, whereas 6 of 7 non-immune foals became infected and developed signs of severe pneumonia requiring treatment with azithromycin (P = 0.0017; Fisher's exact test; Protected fraction=84% (95% C.I. 42% to 97%, Koopman asymptotic score analysis).

An additional study was conducted in 2017 wherein horse foals were transfused on day 1 of life with 2 liters of either a normal horse plasma or anti-PNAG hyperimmune plasma, prepared from adult horse sera via immunization with the 5GlcNH₂-TT vaccine AV0328. Transfusion was followed by an intrabronchial challenge on day 28 with live *R. equi*. 100% protection was seen in 5 foals receiving the PNAG-hyperimmune plasma, whereas all 4 foals receiving normal horse plasma were clinically diagnosed with *R. equi* pneumonia.

In total, 16 of 17 horse foals receiving antibodies to PNAG by either passive colostral transfer or hyperimmune plasma infusion were protected against *R. equi* pneumonia following challenge, whereas 10 of 11 controls became ill (P<0.0001, Fisher's exact test, protected fraction 90%, (95% C.I. 59%-98%, Koopman asymptotic score).

Our Other Programs

Prevention of meningococcal infections

Meningococcal disease is caused by the bacterium *Neisseria meningitidis*. According to the Centers for Disease Control and Prevention (CDC), 1,000 to 2,600 people contract meningococcal disease each year in the United States. According to the CDC, one in 10 of these cases results in death and may also cause serious health problems in 11 to 19 percent of survivors such as loss of limbs, deafness, nervous system problems, mental retardation, seizures and strokes. While rare it is highly contagious. The majority of U.S. states have mandated immunization for populations at risk - infants, people with certain medical conditions, college freshmen living in dorms, and teenagers, according to the NCSL. Because of the rarity and severity of the disease approval of meningococcal vaccines are based on serologic assays – the serum bactericidal assay (SBA). Six serogroups account for most disease cases worldwide. As shown in the table below, while there are several vaccines approved in the United States none covers all six serogroups. Serologic results from the clinical phase 1 study (See “*Summary of In Vitro Activity*” on page 103) have shown vaccination with AV0328 to induce bactericidal killing as measured by SBA of all six serogroups and could either complement or replace current vaccines.

Vaccine	Company	Serogroup					
		A	B	C	W135	X	Y
Menactra	Sanofi	X		X	X		X
Menomune	Sanofi	X		X	X		X
Menveo	GSK	X		X	X		X
Bexsero	GSK		X				
Trumenba	Pfizer		X				
AV0328	Alopexx	X	X	X	X	X	X

Prevention of Infections following Emergency Abdominal Surgery

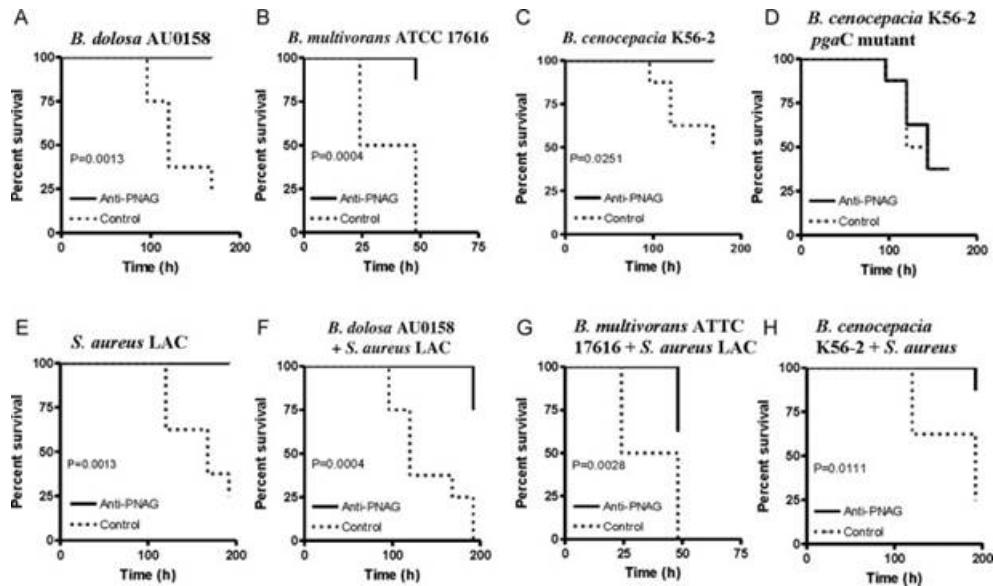
Rationale

Preoperative antibiotics for elective abdominal operations are essential in decreasing surgical site infections (SSIs) such that the timely and appropriate administration of antimicrobials is a well-established standard of care. However, their role in emergency surgery for intestinal perforation is controversial. The incidence of SSIs and other infections following hollow viscus injury is high. As noted in numerous publications, despite perioperative antimicrobial administration, an infection rate ranging from 4% to 31% has been observed and the extended use of antibiotics in this setting has not reduced the incidence of post-operative infections. It has been postulated that microscopic leakage of gastrointestinal contents continues for a period of time following surgical repair. That would be consistent with the observation, in one study published in the World Journal of Surgery, that the mean time to develop a surgical site infection was 9.8 days following surgery. Under those circumstances a short course of antibiotics would not prevent those infections. At the same time, it is not advisable to have patients receive a prolonged exposure to antibiotics as that would lead to the development of resistant infections and other toxicities associated with those drugs.

Use of mAb F598

An alternative therapy, such as F598, could provide prolonged protection without the sequelae associated prolonged antibiotic exposure. This is based on several observations and preclinical studies performed in the laboratory of Dr. Gerald Pier, a co-founder of Alopexx. To begin, the major causative organisms associated with SSIs have been noted to be Enterobacteriaceae that have been isolated from both surgical and non-surgical sites of infection. These include *Escherichia coli*, *Enterobacter cloacae*, and *Klebsiella pneumoniae*, all of which have been found to express PNAG.

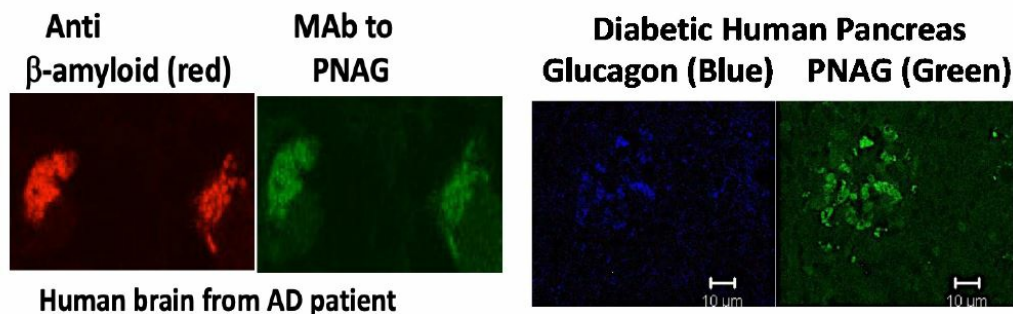
Beyond the high incidence of PNAG-expressing pathogens associated with SSIs, mAb F598 has been noted to prevent intra-abdominal infections. In studies performed in Dr. Pier's laboratory and as illustrated in the figure below, antibodies against PNAG were able to protect against infections caused by a number of pathogens in a lethal peritonitis model including methicillin-resistant *S. aureus* and a number of other PNAG-expressing pathogens. The peritonitis model used is consistent with what occurs following abdominal trauma where microbes residing within the GI tract contaminate the abdominal or peritoneal cavity. Based on these results it is management's belief that administration of mAb F598 at the time of emergency abdominal surgery may prevent the development of infections following emergency abdominal surgery.



Antibodies to PNAG protect against lethal peritonitis from PNAG-producing *Burkholderia cepacia* complex (BCC) even during coinfection with methicillin-resistant *Staphylococcus aureus* Note: The p-values cited here refer to statistical significance for this pre-clinical study. p-values are widely used in both the social and natural sciences to quantify the statistical significance of observed results. A small number as is reported here is an indication that the observed results did not occur by random chance. These p-values refer to the results of this experiment alone. A separate statistical analysis plan will need to be developed and approved by the FDA for the clinical studies that will be used to support regulatory approval.

PNAG in the development of chronic diseases – the role of sterile inflammation and potential role in the development of Alzheimer’s Disease (AD) and Type 1 Diabetes (T1D)

We have been investigating the role of PNAG-containing microbial cells and fragments in chronic debilitating conditions not usually thought to be associated with an infectious cause. We have found that PNAG is present in the brains of patients with Alzheimer’s disease (AD) and pancreas of individuals with type 1 diabetes (T1D), despite the fact that viable microbial pathogens cannot usually be isolated or grown from those tissues. While viable pathogens cannot routinely be detected, there is clear evidence of inflammation associated with disease progression. Those observations are shown in the photomicrographs below, where PNAG fragments were found in patients with AD to co-localize with b-amyloid, the main component of the amyloid plaques found in the brains of individuals with Alzheimer’s disease. PNAG deposits were not observed in brains of individuals who did not have AD. We have observed a similar association of PNAG-positive microbial fragments and destroyed insulin-producing beta cells in the pancreas of individuals with T1D, while pancreata from non-diabetic human have no detectable PNAG via immunohistochemical analysis. The presence of glucagon identifies a destroyed islet in the diabetic pancreas.



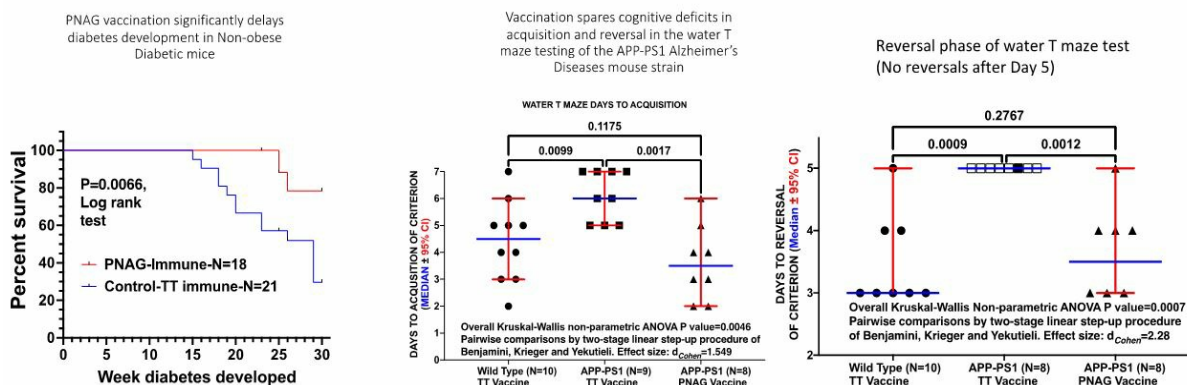
These observations led us to hypothesize that an unrecognized causative factor in these diseases is inflammation resulting from the persistence of undegraded microbial cells or fragments in affected tissues instead of viable microorganisms themselves. These nonviable, undegraded microbial remnants persist in tissues and act as an inflammatory nidus of chronic inflammation. This might lead to sterile inflammation, a form of pathogen-free inflammation.

It seems likely that the source of these PNAG-containing fragments occurs following disruption of nasal, oral, skin, GI and blood-brain barriers, which results in microbes or microbial fragments, known as extracellular vesicles, from the host’s own microbiota entering the bloodstream. The loss of barrier function may be due to a fall, trauma, environmental exposure, medications, or aging. The escaping microbes or fragments are usually degraded and disposed of by host defenses. However, in association with genetic, environmental and other factors such as changes in the host microbiota, these microbes or microbial fragments are not effectively disposed of and can remain in tissues and contribute to inflammation and associated tissue destruction.

Impact of Targeting PNAG in the prevention of AD and T1D

If PNAG-containing fragments are a causative factor in the development of AD and T1D then targeting PNAG via immunotherapeutic interventions may reduce incidence or severity of those diseases. To test this hypothesis, studies were performed in mouse models of diabetes and Alzheimer’s Disease. For the diabetes study, the AV0328 vaccine was provided to Dr. Aleksandar Kostis, Assistant Professor at Harvard Medical School and the Joslin Diabetes Center, for use in a mouse diabetes model. Vaccination against PNAG resulted in a drastic reduction in diabetes incidence from 70% of 21 controls to 17% of 18 PNAG-immune mice (as published at diabetesjournals.org). Similarly, Dr. Pier’s laboratory has shown that immunization against the PNAG antigen prevents behavioral and cognitive decline in preclinical mouse models of Alzheimer’s disease (as published at alzjournals.onlinelibrary.wiley.com).

Those observations in T1D and AD are illustrated in the figures below.



Left – Delay in the development of diabetes in non-obese diabetic mice immunized with vaccine AV0328.

Middle and Right – Sparing on cognitive deficits in APP-PS1 Alzheimer Disease mice following vaccination with AV0328 as measured by the water T maze.

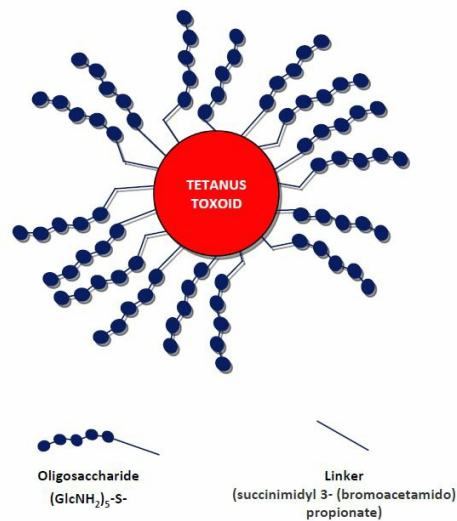
Note: The p-values cited here refer to statistical significance for this pre-clinical study. p-values are widely used in both the social and natural sciences to quantify the statistical significance of observed results. A small number as is reported here is an indication that the observed results did not occur by random chance. These p-values refer to the results of this experiment alone. A separate statistical analysis plan will need to be developed and approved by the FDA for the clinical studies that will be used to support regulatory approval.

It is management’s belief that our vaccine may be capable of inducing antibodies that recognize these PNAG-containing microbial cells and fragments and, by binding to them, engage the host’s immune system to effectively clear PNAG-containing microbial fragments. Under these conditions, progression of symptoms associated with tissue destruction in diseases like Alzheimer’s and T1D can be prevented. While not the initial focus of the company, it points to the broad promise these therapeutics offer. Dr. Pier’s laboratory was recently awarded a grant from the Cure Alzheimer’s Fund to explore the relationship between immunity to PNAG and the development of Alzheimer’s Disease in additional mouse models.

Vaccine AV0328

AV0328 is a novel vaccine candidate comprised of a synthetic pentamer of the oligosaccharide β 1-6-glucosamine [(GlcNH₂)₅] conjugated to tetanus toxoid (TT) protein through a linker. The conjugate vaccine induces antibodies to the glucosamine backbone of naturally occurring PNAG.

5-mer Synthetic Glucosamine Oligosaccharide Conjugated to Tetanus Toxoid



Phase 1 Clinical Studies

A Phase 1 clinical study evaluating the safety, tolerability, pharmacodynamics and preliminary efficacy of AV0328 in 16 healthy volunteers has been completed. As assessed by the management, AV0328 was found to be well-tolerated with only minor and transient injection site reactions observed. At the two highest doses, clear increases were noted in antibody titers against PNAG, as well as a positive indication of a major correlate of protective immunity, complement activation and binding of C1q to the PNAG antigen. As can be seen below, sera from subjects immunized with AV0328 resulted in the killing of 100% of PNAG-positive microbial species and strains tested.

Summary of In Vitro Activity

Microbe	Strain	Assay	Outcome	Microbe	Strain	Assay	Outcome
<i>N. gonorrhoeae</i>	UNC25A	SBA	POS	<i>S. pneumoniae</i>	TIGR 4 (4)	OPA	POS
	442089		POS		Spn 6B (6B)		POS
	15253		POS		246 (14)		POS
	H041		POS		EF3030 (19F)	Pneumovax Serotype	POS
	CTR-SPAIN		POS		11865 (9V)		POS
<i>N. meningitidis</i> Serogroup A	Z2087	SBA	POS		Spn 212 (22F)	Neither	POS
<i>N. meningitidis</i> Serogroup B	B16B6		POS		Spn 255 (31B)		POS
	M2996		POS		Spn 080 (8)		POS
	NMB		POS	<i>S. aureus</i>	MN8 (CP8)	OPA	POS
	H44/76		POS	MRSA	USA300 (No CP)	OPA	POS
<i>N. meningitidis</i> Serogroup C	M981	SBA	POS		USA100 (CP5)		POS
	M992		POS		Sanger 256 (CP8)		POS
	89-1		POS	<i>E. coli</i>	NDM1	OPA	POS
	W171		POS		MCR1		POS
<i>N. meningitidis</i> Serogroup W	BF	SBA	POS	<i>K. pneumoniae</i>	KPN NDM 1	OPA	POS
<i>N. meningitidis</i> Serogroup Y	Y2220		POS		KPN-KPC		POS
<i>A. baumannii</i>	S1	SBA	POS	<i>S. Typhi</i>	TY2	OPA	POS
<i>C. albicans</i>	SC5314	OPA	POS				

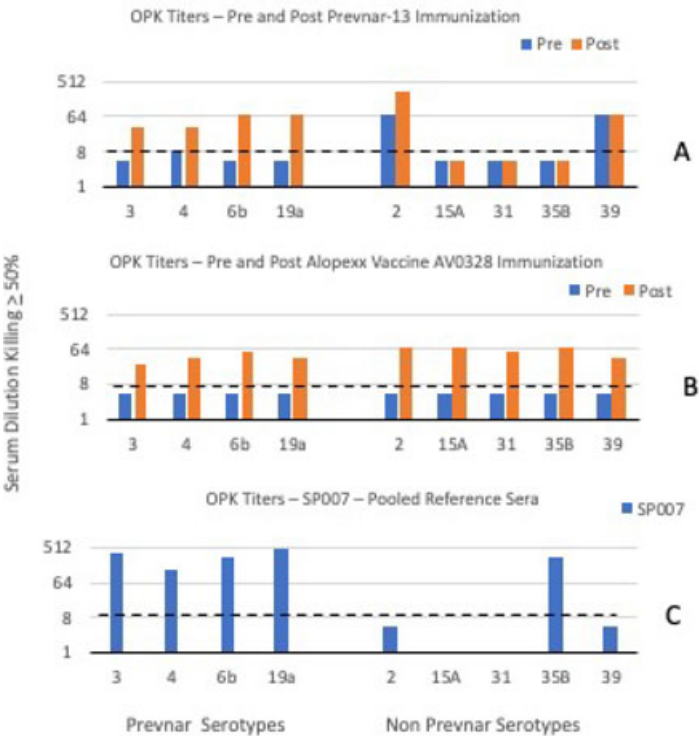
SBA – Serum bactericidal assay

OPA – Opsonophagocytic killing

POS – at least 4 fold increase in titer in all subjects tested

We also sought to compare the immune response induced to AV0328 with those elicited by immunization with Plevnar 13 against Plevnar and non-Plevnar *S. pneumoniae* serotypes. As shown in the 3 figures below, OPK activity was measured before and after Plevnar immunization (Fig A) and AV0328 immunization (Fig B). Results with a pooled reference sera SP007 are shown in Figure C. As SP007 is a pooled reference sera there is no pre-immunization sera. Based on the accepted titer threshold (see dotted line in figures) of 1:8 killing $\geq 50\%$ of the bacterial cells, indicative of protection, AV0328 was able to induce protective levels of antibody as reflected in the opsonic killing titers against all tested *S. pneumoniae* serotypes.

There was activity by SP007 against one non-Plevnar serotype. The Plevnar-vaccinated human also had pre-existing antibody to two non-Plevnar serotypes. We think this may reflect prior exposure of individuals whose sera was used to make the standard serum pool and the vaccinated individual to those serotypes as opposed to cross reactivity.



Comparing maximum OPK titers from vaccines targeting different antigens must be viewed cautiously. Antigen expression can vary significantly *in vitro* depending on growth conditions, the serotype and other factors. Nor does the ratio of antigen expression *in vitro* reflect what occurs in an infected individual where one antigen may be more highly expressed. What is more relevant, in an *in vitro* OPK assay, is achieving a consistent titer at or above the protective threshold against all serotypes. By that definition AV0328 demonstrated consistent killing against all *S. pneumoniae* serotypes tested (as well as multiple other microbes). As PNAG is likely expressed on the vast majority *S. pneumoniae* serotypes we anticipate we will be able to achieve broad spectrum protective immunity.

Initial indication for the Use of Vaccine AV0328 - Prevention of Pneumococcal Disease

The current vaccine standard of care for pneumococcal disease includes the combination of Merck's Pneumovax 23 and Pfizer's Prevnar 13 for adults, and Pfizer's Prevnar 13 for infants. Pneumovax 23 is a polysaccharide vaccine that protects against 23 strains of pneumococcus but is not thought to protect against pneumonia, provides only transient protection against bacteremia in adults and is not effective in children under two years of age. Prevnar 13 is a pneumococcal conjugate polysaccharide vaccine (PCV) that protects against only 13 strains of pneumococcus, but offers significantly better immunogenicity, protects against pneumonia and is suitable for both adults and infants. Routine immunization with PCVs has been effective in dramatically lowering the incidence of invasive pneumococcal disease (IPD) in both adults and children in the United States and other industrialized nations.

Both Prevnar 13 and Pneumovax 23 are serotype-specific and require combining 13 or 23 components into a single vaccine. However, there are over 100 pneumococcal strains and as current vaccines have reduced the incidence of the specific strains, covered strains that are not covered by existing vaccines are increasing in prevalence. While the overall incidence of IPD has not changed, infections caused by non-vaccine serotypes has reduced the net effectiveness of the vaccines for both vaccinated and unvaccinated adult individuals in countries with high vaccine coverage. This is a phenomenon known as serotype replacement.

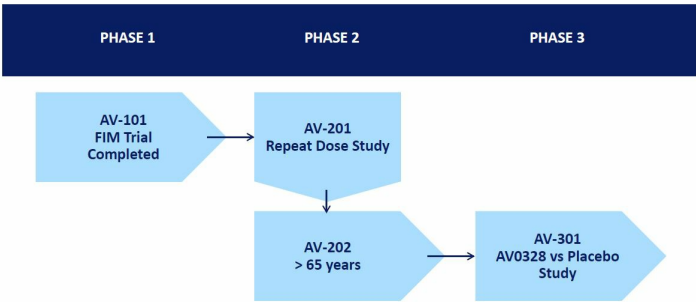
Efforts to improve the current standard of care vaccines have focused on expanding the number of serotypes covered by serotype-specific vaccines. The 15-valent (Merck), 20-valent (Pfizer) vaccines have recently been approved. Twenty-four-valent (Affinivax) and 30-valent (VaxCytel) vaccines are in development. The problem with all of those approaches is that they will inevitably lead to serotype replacement and the rise of infections not covered by those newer vaccines.

Adding to the challenge of developing new serotype-specific vaccines has been the recognition that serotype replacement is not occurring uniformly. The serotypes selected for inclusion in the 7- and then 13 valent vaccines were based on their high prevalence in the US and Europe. However, a recent report has noted that the efficacy of current serotype-specific vaccines has resulted in the rise of a diverse and less uniform number and distribution of serotypes that may not be as effectively addressed by newer serotype-specific vaccines. The authors noted that although there are common emerging serotypes between countries and within age groups, there has not been a dominating serotype following the introduction of Prevnar as there was before. They conclude that continuing reliance on serotype-specific vaccines may require different vaccine serotype formulations for different locations, as well as distinct vaccine serotype formulations that attempt to anticipate and prevent the next expected serotype replacement.

PNAG has been noted to be expressed by 100% of the 36 pneumococcal strains tested to date. That includes all serotypes contained in Pneumovax and the recently approved Prevnar 20. As detailed previously, of the close to 250 distinct microbial strains that have been analyzed for PNAG expression >90% were positive. Consistent with our results with other pathogens, we expect that the majority of remaining pneumococcal serotypes will be positive as well. AV0328 has the potential to be a single, non-serotype specific, polysaccharide vaccine capable of covering most if not all serotypes. In management’s opinion no other currently available serotype-specific pneumococcal vaccine or any others in development are capable of offering this degree of coverage.

This broad-spectrum potential has led us to follow a unique regulatory approval approach. As an initial indication we plan to have AV0328 serve as a complementary vaccine that can expand coverage to many of the remaining 80+ *S. pneumoniae* serotypes not covered by current vaccines. This approach could also apply to many of the newer pneumococcal vaccines under development. Most critically, we have been in contact with the FDA where we proposed this complementary approach. Feedback from the FDA has been supportive of the utilization of AV0328 as a complementary vaccine. In addition, the FDA supported pursuing accelerated approval of AV0328 based on safety and utilization of a validated surrogate assay – opsonic killing mediated by antibodies induced by AV0328. The FDA’s Accelerated Approval Program allows for earlier approval of drugs that treat serious conditions based on a surrogate endpoint. A surrogate endpoint is a marker, such as a laboratory measurement, radiographic image, physical sign or other measure that is thought to predict clinical benefit, but is not itself a measure of clinical benefit. Management believes that this points to a development path comparable to those that have led to FDA approval of other vaccines for *Streptococcus pneumoniae* infections. However, the FDA has not yet approved our vaccine and there is no guarantee that the FDA will ultimately the vaccine.

Below is a schema of the overall clinical development of AV0328 in adults for the prevention of pneumococcal disease. We anticipate that the trial can be initiated in the fourth quarter of 2022 and completed 12 months later. The duration of the trial is less due to patient accrual than the time needed to assess the durability of the immune response to the vaccine.



As can be seen in the figure, following the completed phase 1 trial, two phase 2 studies are envisioned. AV-201 is a repeat dose trial in healthy volunteers that seeks to confirm and optimize the dose and schedule of AV0328. In parallel with that trial, we plan on performing a study in adults > 65 years old – the population that would receive the vaccine. Each of those trial would involve ~ 100 subjects and should accrue quite quickly as they are healthy volunteer studies. They will each take about a year to complete as we will need to follow the subjects to assess the duration of protection. The efficacy end point will not need to rely on reduction in pneumococcal infections but, as we have discussed with the FDA, will employ a surrogate endpoint (opsonic killing) similar to what is used by other pneumococcal vaccines.

The results of those studies will be a major inflection point. Assuming that we continue to the same degree of safety and efficacy we would then plan to mount a phase 3 registration trial in adults along with supportive studies that would permit utilization of the vaccine in infants and children. It should be noted that because we will be seeking use of AV0328 as a complementarity vaccine, there is no need to compare our results with currently available vaccines.

Although we believe that our vaccine has the potential to be widely adopted, we have not received regulatory approval. In order to obtain regulatory approval and commercialize our vaccine, the U.S. Food and Drug Administration, or FDA, European Medicines Agency, or EMA, or other regulatory agencies will need to determine that our vaccine are safe and effective. Obtaining such approval will require that we successfully complete additional studies and there can be no assurance that the results of such studies will be similar to our earlier studies. As such, we may not obtain regulatory approval for our vaccine.

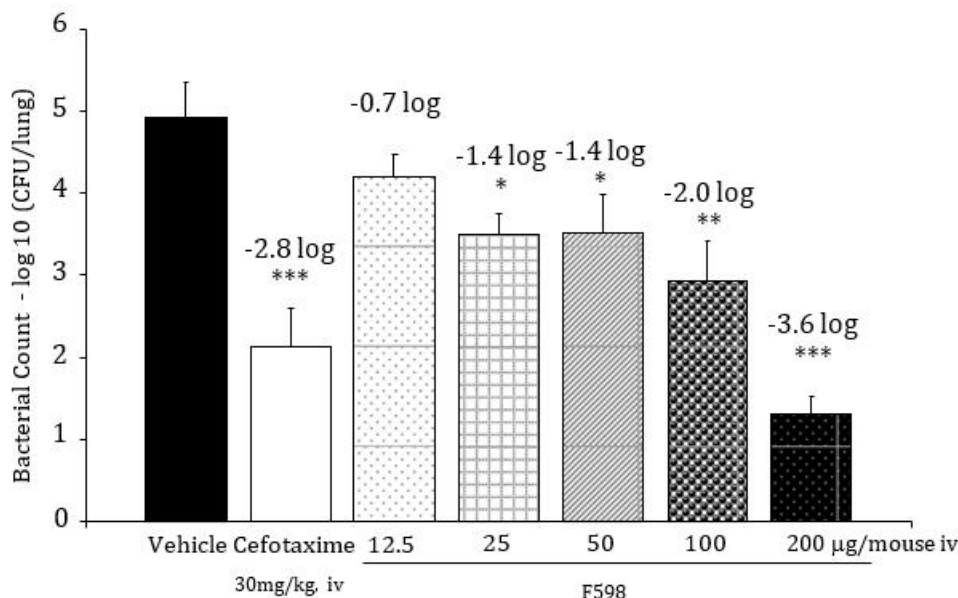
Manufacturing and Supply – Vaccine AV0328

Unlike any other vaccine, the immunogenic component for PNAG in AV0328 is chemically synthesized. This offers a major advantage in that we are not reliant on isolating the key vaccine component from a variable microbial source. We have partnered with Glycosyn, Inc., a New Zealand-based company with expertise in carbohydrate synthesis, to produce the key antigen component of the vaccine – the carbohydrate oligosaccharide. They have developed a scalable manufacturing process capable of producing supplies sufficient for clinical development and commercialization. Beyond the patent portfolio, we have built synthesis of the vaccine is also covered by a trade secret agreement that prevents publication of the multi-step process used to synthesize our proprietary antigen.

The other key component is a protein carrier to which the carbohydrate is linked. This is a well-established process to augment the immune response to the antigen. Prevnar-13 is a pneumococcal conjugate polysaccharide vaccine or PCV which uses a similar approach. In our case, we have found that tetanus toxoid can serve as an excellent protein carrier. As tetanus toxoid is routinely administered to people to prevent tetanus it has a well-established safety profile and is readily available. Taken as a whole, we believe our vaccine can be produced at a cost of <\$0.50/dose – far lower than any other vaccine in development.

Monoclonal Antibody F598

F598 is a fully human IgG1 monoclonal antibody selected for its ability to target PNAG. While no assurances exist we can duplicate these results in man, animal studies administration of monoclonal antibody F598 has been shown reduce the impact of microbial challenges in several models, using a number of different microbes, as measured by reductions in mortality or the development of pneumonia, peritonitis, corneal infection and other evidence of a local or systemic infection. As can be seen in the figure below, F598 administered intravenously 4 hours before intranasal bacterial challenge with *S. pneumoniae* (10^8 cfu/mouse), dose-dependently prevented the development of infection in mice. A significant effect was observed starting from 25 μ g/mouse (~0.8 mg/kg) with a maximum effect at 200 μ g/mouse (~7 mg/kg). At 200 μ g/mouse, the effect of F598 on bacterial load reduction was comparable to curative treatment with 30 mg/kg of a standard antibiotic, cefotaxime, administered following the bacterial load.



Results are expressed as the mean $\pm$ SEM, n = 6-8 animals per group, comparison versus vehicle group

* p < 0.001 (student's t-test)

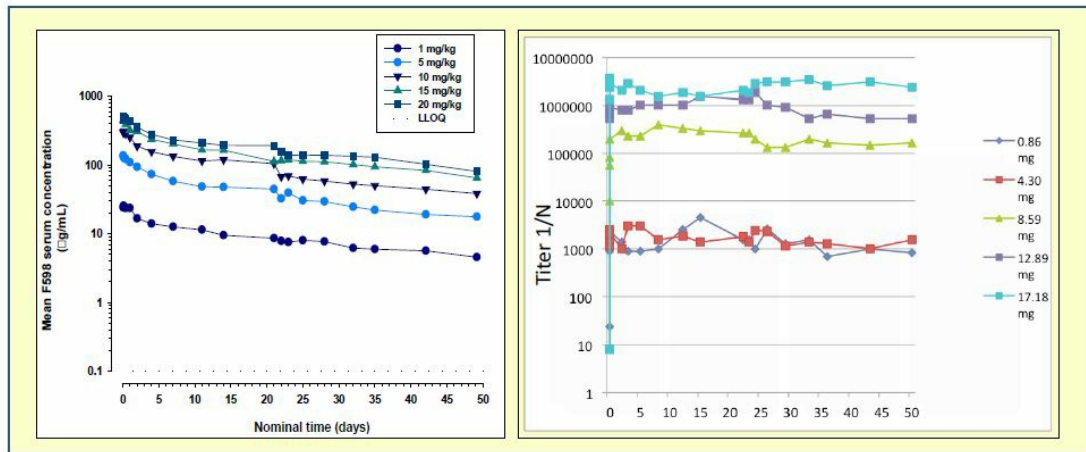
** p < 0.05 (one-way ANOVA followed by Dunnett's adjustment)

*** p < 0.001 (one-way ANOVA followed by Dunnett's adjustment)

Note: The p-values cited here refer to statistical significance for this pre-clinical study, and such values will not be used to justify regulatory approval by the FDA or other regulatory authorities.

Clinical Experience with F598

A Phase 1 trial of F598 was performed by Alopexx. In that study, a single infusion of F598 was administered to 20 healthy adults. Pharmacokinetic analysis showed long elimination half-lives (~20-30 days), low systemic clearance, a low volume of distribution and a dose-dependent increase in serum monoclonal antibody levels. No relevant immunogenicity related to study compound (as measured by detection of antibodies against F598 in human serum) was observed. Overall, the antibody was found to be well tolerated, and no serious adverse events were observed. As shown below, dose-dependent and high levels of functional activity of the antibody as measured by opsonophagocytic assays against *S. aureus* were maintained at all doses up to Day 50, the last time point in the study. This suggests that single administration of F598 could provide protection for a prolonged period of time.



Because of concerns that the antibody might elicit an untoward inflammatory response, a pilot study was performed in patients with an active infection. F598 was administered to individuals with latent and newly diagnosed tuberculosis. This was a phase 2 open-label trial to evaluate the safety, tolerability and early bactericidal activity of F598 in adults with latent tuberculosis or newly diagnosed, smear-positive pulmonary tuberculosis. A total of 25 subjects received a single infusion of F598. No serious or unexpected adverse events were observed in any of the participants. The short duration (2 weeks) of the study precluded observation of bactericidal activity however, it did demonstrate that F598 could be administered to individuals with a documented, active infection.

Prevention of Hospital-Acquired Infections

Unlike vaccines which may take several weeks or longer to induce protective immunity administration of a monoclonal antibody provides immediate protection. In previous studies we have found that F598 is not only well tolerated but has a long half-life which may provide protection for 2-3 months after a single administration. Therefore, the antibody will be utilized in settings where an individual is at an immediate or near-term risk of developing an infection. Healthcare associated infections are one of the major settings where this occurs.

In 2007, the Centers for Disease Control and Prevention estimated that roughly 1.7 million Healthcare-Associated infections, from all types of microorganisms, including bacteria and fungi combined, cause or contribute to 99,000 deaths each year in the United States (see also a study by Kievers in 2002). A follow-up analysis in 2016 noted that while the overall incidence of infection had fallen from 4% to 3.2% there was no change in pneumonia and gastrointestinal infections. Hospital-acquired or nosocomial infections can cause severe pneumonia and infections of the urinary tract, bloodstream and other parts of the body. Many types display antimicrobial resistance, which can complicate treatment.

While overall hospital-acquired infections are relatively uncommon, that is not the case in intensive care units (ICUs). Although ICUs account for fewer than 10 percent of total beds in most hospitals, more than 20 percent of all nosocomial infections are acquired in ICUs. ICU-acquired infections account for substantial morbidity, mortality, and expense. Infections and sepsis are the leading cause of death in noncardiac ICUs and account for 40 percent of all ICU expenditures. Despite the advances in modern medicine and intensive care, the incidence of sepsis in intensive care units (ICUs) continues to rise. In a 2006 international study of 1265 ICUs, (EPIC II) 60 percent of ICU patients at the time of survey were considered infected, with infection being a strong independent predictor for mortality. The risks of infection in general and with a resistant pathogen, in particular, increased with the length of patient stay in the ICU. These results have recently been updated and in 2017 a survey of 1150 centers in 88 countries (EPIC III) it was found that 54% of ICU patients had a suspected or proven infection, including 22% with an ICU-acquired infection. Infection rates remained high whether or not the ICU was located in a low (57.8%) or high (50.2%) income country or geographically (North America 47.7%, Western Europe 50.7%, Asia/Middle East 60.1%).

In an effort to reduce the incidence of HAIs, in 2008 Medicare initiated the Hospital-Acquired Condition (HAC) Reduction Program. Under the program the Centers for Medicare and Medicaid Services’ (CMS’) reduced overall Medicare payments for hospitals that rank in the worst-performing quartile of all hospitals on measures of hospital-acquired conditions, including HAIs. The hope was that financial penalties would encourage hospitals to initiate programs that would reduce the incidence of HAIs. Because Medicare relies on hospitals to self-report infection rates, the HAC policy may have affected a hospital’s incentive to identify and report the exact origin of infections in a manner that increases reimbursement or avoids financial penalties. This may have an impact on therapies seeking to treat documented HAIs as it would require hospitals to report those infections and risk financial penalties.

Utilization of monoclonal antibody F598 should not be affected by that issue. As detailed below F598 will be employed upon admission to an intensive care unit as a means to prevent or ameliorate any subsequent HAIs. It would be consistent with Medicare’s goal to reduce HAIs and would not require a hospital to identify an HAI in advance of administering the antibody.

PNAG is produced by many pathogens causing hospital-acquired infections. The table below shows the gram-positive bacteria, gram-negative bacteria and fungi, listed by the CDC, as associated with HAIs. As can be seen with the exception of *Pseudomonas aeruginosa* all tested organisms express PNAG (*Clostridium sordellii* has not been tested).

Organism	PNAG Expression
<i>Acinetobacter</i>	Positive
<i>Burkholderia cepacia</i>	Positive
<i>Candida auris</i>	Positive
<i>Clostridioides difficile</i>	Positive
<i>Clostridium sordellii</i>	NT
<i>Enterobacterales</i> (carbapenem-resistance)	Positive
ESBL-producing <i>Enterobacterales</i> (extended-spectrum β -lactamase-producing)	Positive
<i>Escherichia coli</i>	Positive
<i>Klebsiella pneumoniae</i>	Positive
Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA)	Positive
Non-tuberculous <i>Mycobacteria</i> (NTM)	Positive
<i>Pseudomonas aeruginosa</i>	Negative
<i>Staphylococcus aureus</i>	Positive
<i>Mycobacteria tuberculosis</i> (TB)	Positive
Vancomycin-intermediate <i>Staphylococcus aureus</i>	Positive
Vancomycin-resistant <i>Staphylococcus aureus</i>	Positive
Vancomycin-resistant <i>Enterococci</i> (VRE)	Positive

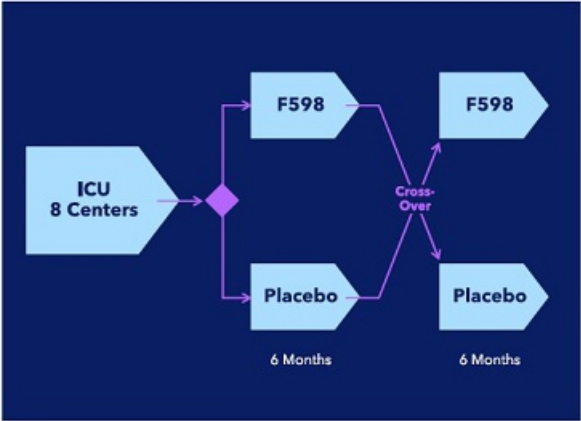
Use of monoclonal antibody F598 offers the potential for it to become the first broad-spectrum therapeutic antibody for microbial infections. To pursue this, we propose to study this in a setting where the prevalence of acquired infections is very high – intensive care units. Demonstrating that monoclonal antibody F598 can reduce the morbidity/mortality related to microbial infections in ICU patients would constitute a major health advancement. Administration of F598 in that setting could become the part of the standard of care.

Alopecx is uniquely positioned to perform a large proof-of-concept study in this setting. We have developed a collaboration with Europe’s largest health care system, which has agreed to perform a 1,600-patient phase 2 intensive care unit study. The Assistance Publique–Hôpitaux de Paris (AP-HP) is the largest hospital system in Europe and one of the largest in the world. It provides healthcare, teaching, research and emergency medical services in 44 hospitals and sees more than 5.8 million patient visits annually. The impetus for this collaboration has been our relationship with Professor Dr. David Skurnik. Dr. Skurnik was a member of Dr. Pier’s laboratory at Harvard Medical School from 2007-2017 where he studied the clinical and microbiological diagnosis and management of bacterial infections and sepsis and the emergence and dissemination of antibiotic resistance. He was also closely involved in the development and evaluation of Alopecx’s PNAG immune therapeutics. Dr. Skurnik became Professor of Medicine at the Necker Hospital, part of the AP-HP system. Dr. Skurnik was able to obtain the commitment and collaboration of eight AP-HP hospitals to perform the ICU study outlined below as an institutional investigation. As a consequence, the clinical cost of performing this 1,600-patient study is estimated to be approximately \$4 million – a fraction of what an industry-sponsored trial would cost. Beyond the cost savings, this represents the strong interest of the consortium to test this important hypothesis, which can be viewed as an endorsement of the promise and potential of Alopecx’s anti-infective immune therapeutics.

While it would be possible to perform this study in the United States, the collaboration with Dr. Skurnik and his relationship with AP-HP are major reasons to perform the study in Paris. We adhere to Good Clinical Practice (GCP) guidelines in all of our trials. GCP is an international quality standard, which governments can then transpose into regulations for clinical trials involving human subjects. GCP follows the International Council for Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH) and enforces tight guidelines on ethical aspects of clinical research.

We anticipate that a positive result in this phase 2 proof-of-concept trial will not be sufficient for regulatory approval and that a confirmatory, company-sponsored registration study will be required. A positive result in this study would justify performing a confirmatory, company-sponsored registration study that will involve medical centers in the United States. Should that confirmatory trial be positive it will be used to seek regulatory approval.

The figure below illustrates the study design that has been endorsed by our collaborators in Paris. In this study it is the institution not the individual patient that will be randomized and the overall impact on morbidity and mortality will be assessed. The study has received initial approval by their institutions and can be quickly initiated. Patients entering the ICU will receive either F598 or a placebo in addition to the standard of care. To control for variations in different ICU settings, at the end of six months, there will be a cross-over so ICUs that had received F598 will receive placebo and vice versa. We will then observe patients for a reduction in morbidity and mortality due to infections caused by microbes that express PNAG. We anticipate that the trial can be initiated in the first quarter of 2023 and completed 18 months later. The duration of the trial is less due to patient accrual, which with eight participating ICUs should be fairly rapid, than the need to match the time at which the cross-over occurs to control for seasonal variations in ICU admissions.



Manufacturing and Supply – Monoclonal Antibody F598

We have strategically aligned with our contract manufacturer, Lonza Ltd., or Lonza, a globally recognized contract development and manufacturing organization based in Switzerland. We have developed a robust cell line capable of producing the antibody at a commercial scale. The cell line is able to produce our antibody at a scale and cost equivalent or better than other commercially available Monoclonal antibodies. Antibodies produced using this cell line have already been used in clinical trials.

Our Strategy

The key elements of our strategy are:

- Advance vaccine AV0328 and monoclonal antibody F598 through key proof-of-concept clinical trials.
- Create a long-lasting franchise by offering the broadest-spectrum vaccine available for prevention of a wide range of microbial infections
- Establish monoclonal antibody F598 as part of the standard of care in preventing and treating microbial infections in individuals at immediate risk (i.e., ICU patients)
- Explore utilization of the vaccine and antibody in medical indication not classically thought to be associated with microbial infections – diabetes, Alzheimer’s Disease, cancer and other conditions.

- Continue to build a robust intellectual property portfolio.

Competition

Vaccine AV0238

The global vaccine market is highly concentrated among a small number of multinational pharmaceutical companies. Pfizer, Merck, GlaxoSmithKline and Sanofi together control approximately 75% of the global vaccine market. Other pharmaceutical and biotechnology companies, academic institutions, governmental agencies and public and private research institutions are also working towards new solutions given the continuing global unmet need.

Within the current pneumococcal vaccine market, Pfizer, Merck and GlaxoSmithKline dominate. Global sales of these three products were approximately \$7.45B, with Pfizer's Prevnar 13, Merck's Pneumovax 23 and GlaxoSmithKline's Synflorix representing approximately 78%, 15% and 7%, respectively, of these sales. While Prevnar 13 covers fewer pneumococcal strains than Pneumovax 23, it delivers a stronger and more durable immune response than Pneumovax 23. Prevnar 13 is the current standard of care in children and the first vaccine offered under the current standard of care in adults.

Existing vaccine makers, as well as new entrants, are competing to develop the next generation of pneumococcal vaccines. Both Pfizer and Merck have pneumococcal vaccine candidates that have recently been approved and could surpass the performance of Prevnar 13. Pfizer's PF-06482077 is a 20-valent vaccine while Merck's V114 is a 15-valent vaccine. Sanofi and SK Chemicals have partnered to develop a pneumococcal vaccine. Separately, Affinivax and Astellas have partnered to develop an affinity-bound pneumococcal vaccine that includes 24 pneumococcal serotypes. VaxCytex is developing 24- and 30-valent vaccines utilizing their proprietary conjugate platform.

To our knowledge, there is only one other company that is developing a universal pneumococcal vaccine. ImmBio's PnuBioVax seeks to target heat shock proteins as a universal pneumococcal vaccine. Vaccines targeting a protein that do not include a toxoid component have never been shown to be effective in a randomized clinical trial. Every human vaccine that has been licensed on the basis of clinical trial data target surface carbohydrates, as does the PNAG vaccine. Because we are seeking to develop AV0328 as a complement to serotype-specific specific vaccines, none of them would preclude addition of our vaccine to the current or future standard of care.

As mentioned above we believe AV0328 can be produced at a cost of less than \$0.50 per dose. As noted below in our market analysis we assumed a price of \$60 per dose, which is considerably lower than the current average price of Prevnar, which is \$211.86. This will facilitate our ability to add our vaccine to current or future serotype-specific vaccines whose cost is far greater than AV0328. The table below summarizes the current price of approved vaccines for pneumococcal disease and meningitis and has been taken into consideration as part of the initial market analysis discussed below.

Vaccine	Price/Dose	
	CDC	Private Sector
Prevnar 13	\$ 137.22	\$ 226.43
Prevnar 20	\$ 173.69	\$ 249.00
Pneumovax 23	\$ 74.50	\$ 117.08
Vaxneuvance	\$ 149.90	\$ 216.09
Bexero	\$ 111.40	\$ 191.75
Menactra	\$ 80.73	\$ 134.77

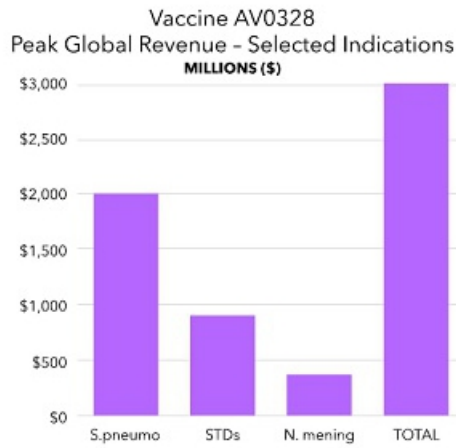
CDC Vaccine Price List March 2022

Monoclonal Antibody F598

There have been two monoclonal antibodies approved for the treatment of bacterial infections and both target toxins and do not have anti-bacterial effects – Anthim to prevent inhalational anthrax and bezlotoxumab for *Clostridioides difficile* infections. There are 14 anti-microbial monoclonal antibodies in development. All but one targets a specific organism. One monoclonal antibody, TRL1068 (Trellis Bioscience), targets bacterial biofilms but in pre-clinical trials it is ineffective unless used with antibiotics. While not a competitor, monoclonal antibodies targeting respiratory syncytial virus and more recently COVID-19 have been shown to be effective and points to potential utility of F598 against microbial infections.

Initial Market Analysis

We have performed independent commercial assessments for the initial indications we intend to pursue – use of the vaccine as a complement to currently approved *Streptococcus pneumoniae* vaccines and use of the mAb to reduce the morbidity/mortality related to microbial infections in ICU patients. We also explored the market potential for 2 other indications for our vaccine – prevention of *Neisseria meningitidis* systemic infection and for sexually transmitted diseases (STDs) as shown on the chart below.



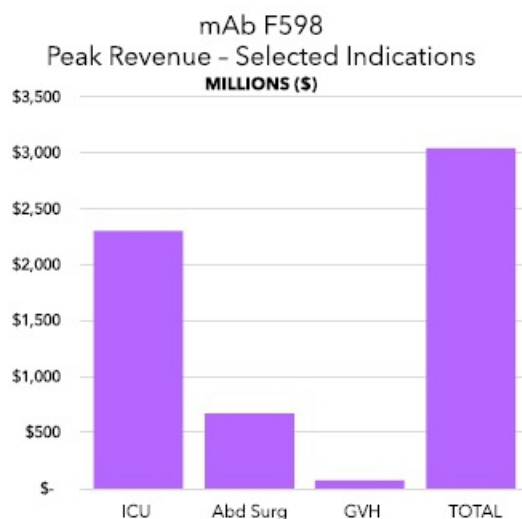
For our vaccine, the assumption was that AV0328 would be added as a complement to current *Streptococcus pneumoniae* vaccines. The relevant population would be the same adult and pediatric patients who currently receive approved *Streptococcus pneumoniae* vaccines. We evaluated Prevnar data for our model since it is currently the most widely used pneumococcal vaccine.

For this analysis the initial target market segment included adults who had received existing Prevnar vaccines as well *as de novo* Prevnar vaccines and pediatric patients who would receive Prevnar as part of their standard vaccination schedule. Our base case assumed a peak market share of 60% and 65% of Prevnar vaccinations in pediatric and adults over 65, respectively. We also assumed a price of \$60 per dose, which is considerably lower than the current private sector price of Prevnar 13, which is \$226.43. Based on these key assumptions the peak expected global revenue for the *Streptococcus pneumoniae* indication alone is expected to be over \$2.0 billion per year.

For sexually treated diseases, gonorrhea and chlamydia, we assumed a peak annual vaccination rate in existing sexually-active adults between 18-34 years old of 3%, cumulatively reaching 40% over 10 years and a peak annual vaccination rate of 40% of the incoming cohort of 18-year-olds, ramping up linearly from 10% at launch over 7 years.

The potential meningococcus pediatric segment is almost completely cannibalized by the pre-existing *S. pneumoniae* indication, as this segment would not need to be treated twice. In freshman students we assumed a peak annual vaccination rate of 40% will be achieved, ramping up linearly from launch over 7 years. For at-risk adults (nurses, physicians, military new recruits) a peak annual vaccination rate of 5% will be achieved, also ramping up linearly from launch over 7 years.

For both the sexually transmitted diseases and the meningococcus indications we assumed a price of \$60 per dose.



Intellectual Property

Our success depends in part on our ability to obtain and maintain intellectual property protection for our products and technology. We use a variety of intellectual property protection strategies, including patents, trade secrets and other methods of protecting proprietary information.

As of December 31, 2021, our owned patents and patent applications, if issued, are expected to expire between 2040 and 2042, in each case without taking into account any possible patent term adjustments or extensions and assuming payment of all appropriate maintenance, renewal, annuity, or other governmental fees.

Such patent portfolio owned by us includes:

- A pending PCT application directed to PNAG composition of matter featuring high oligo loading.
- An issued U.S. patent and pending PCT and U.S. applications directed to low contaminant PNAG composition
- An issued U.S. and pending U.S. application directed to treating biofilm
- A pending PCT application directed to a method of combination therapy with antibody plus PNAG vaccine

We exclusively license four issued U.S. and PCT patents from BWH, as of December 31, 2021. These patents cover the vaccine and methods of use thereof, the F598 monoclonal antibody and variants thereof and the methods of use of the vaccine and/or the anti-PNAG antibody. Our in-licensed patents are expected to expire between 2025 and 2033, in each case without taking into account any possible patent term adjustments or extensions and assuming payment of all appropriate maintenance, renewal, annuity, or other governmental fees.

For further information on the license agreement with BWH, see the section titled “*Business — License Agreements.*”

We intend to pursue additional intellectual property protection to the extent we believe it would be beneficial and cost-effective. Our ability to stop third parties from making, using, selling, offering to sell, importing, or otherwise commercializing any of our patented inventions, either directly or indirectly, will depend in part on our success in obtaining, defending, and enforcing patent claims that cover our technology, inventions, and improvements. With respect to both our owned and in-licensed intellectual property, we cannot provide any assurance that any of our current or future patent applications will result in the issuance of patents in any particular jurisdiction, or that any of our current or future issued patents will effectively protect any of our products or technology from infringement or prevent others from commercializing infringing products or technology. Even if our pending patent applications are granted as issued patents, those patents may be challenged, circumvented, or invalidated by third parties. Consequently, we may not obtain or maintain adequate patent protection for any of our products or technologies.

In addition to our reliance on patent protection for our inventions, products, and technologies, we also rely on trade secrets, know-how, confidentiality agreements and continuing technological innovation to develop and maintain our competitive position. For example, some elements of manufacturing processes, analytics techniques, and processes, are based on unpatented trade secrets and know-how that are not publicly disclosed. Although we take steps to protect our proprietary information and trade secrets, including through contractual means with our employees, advisors and consultants, these agreements may be breached, and we may not have adequate remedies for any breach. In addition, third parties may independently develop substantially equivalent proprietary information and techniques or otherwise gain access to our trade secrets or disclose our technology. As a result, we may not be able to meaningfully protect our trade secrets. For further discussion of the risks relating to intellectual property, see the section titled “*Risk factors—Risks Related to our Intellectual Property.*”

In December 2007 and March 2012, we entered into exclusive patent license agreements with BWH, pursuant to which we obtained an exclusive, royalty-bearing, sublicensable (with approval from BWH) license to certain U.S. and foreign patents related to the vaccine and methods of use thereof, the F598 monoclonal antibody and variants thereof and the methods of use of the vaccine and/or the anti-PNAG antibody. We may sublicense the patent rights licensed under the agreement subject to certain conditions, including obtaining the review and approval by BWH of such sublicense and any such sublicense must be consistent with and subject to the terms of the agreement.

Under the agreements, we must pay BWH combined annual license fees of \$165,000. Total expense incurred under the Licenses to BWH by the Company from 2019 through the end of the 2021 fiscal year is \$625,000. Combined regulatory milestone payments of \$675,000 will be due following initiation of phase 2 and 3 clinical studies and submission of an NDA. In the event we commercialize a product in the therapeutic space, we are also required to make certain drug-approval regulatory and commercialization milestone payments to BWH totaling \$3,500,000. In the event we sublicense any of the licensed intellectual property, we must pay BWH a percentage of any sublicense income received by us, which on a going-forward basis will be in the low double digits. Royalty payments in the low single digits will be paid on net sales. Aggregate milestone payments under the two patent license agreements are up to \$2,325,000 and \$1,850,000 for vaccine AV0328 and antibody F598, respectively, for a total of \$4,175,000.

Under the terms of the agreement, we are required to use commercially reasonable efforts to develop and commercialize the licensed products, including in accordance with certain developmental, funding, regulatory and commercialization milestones. BWH controls the prosecution, maintenance and enforcement of all licensed patents and patent applications under the agreement. Subject to an applicable cure period, BWH may terminate the agreement if we fail to comply with applicable payments or diligence obligations or upon a breach of our obligation under the agreement, or for certain insolvency-related events.

Unless earlier terminated, the agreement continues until the expiration of the last to expire patent right licensed under the agreement. Subject to an applicable cure period, BWH may terminate the agreement if we fail to comply with applicable payments or diligence obligations or upon a breach of our obligation under the agreement, or for certain insolvency-related events.

Other Partners

In addition to those listed above, we seek to partner with various academic, governmental and public or private research institutions as needed to advance the discovery or development of our therapeutics.

Coverage and Reimbursement

Sales of our products in the United States will depend, in part, on the extent to which the costs of the products are covered by third-party payors, such as government health programs, commercial insurance and managed health care organizations. The process for determining whether a third-party payor will provide coverage for a pharmaceutical or biological product is typically separate from the process for setting the price of such a product or for establishing the reimbursement rate that the payor will pay for the product once coverage is approved. As a result, a third-party payor's decision to provide coverage for a pharmaceutical or biological product does not imply that the reimbursement rate will be adequate. Certain ACA marketplace and other private payor plans are required to include coverage for certain preventative services, including vaccinations recommended by the ACIP without cost share obligations (i.e., co-payments, deductibles or co-insurance) for plan members. Children through 18 years of age without other health insurance coverage may be eligible to receive such vaccinations free-of-charge through the CDC's Vaccines for Children program. For Medicare beneficiaries, vaccines may be covered under either the Part B program or Part D depending on several criteria, including the type of vaccine and the beneficiary's coverage eligibility. If our vaccine, once approved, are covered only under the Part D program, physicians may be less willing to use our products because of the claims adjudication costs and time related to the claims adjudication process and collection of co-payments associated with the Part D program.

Further, no uniform policy for coverage and reimbursement exists in the United States, and coverage and reimbursement can differ significantly from payor to payor. Third-party payors often rely upon Medicare coverage policy and payment limitations in setting their own reimbursement rates, but also have their own methods and approval process apart from Medicare determinations. As such, one third-party payor's decision to cover a particular medical product or service does not ensure that other payors will also provide coverage for the medical product or service or will provide coverage at an adequate reimbursement rate.

Government Regulation

Government authorities in the United States, at the federal, state and local level, and other countries extensively regulate, among other things, the research, development, testing, safety, effectiveness, manufacture, quality control, approval, post-approval monitoring and reporting, labeling, packaging, storage, record-keeping, promotion, advertising, distribution, marketing and export and import of products such as those we are developing. A new biological product must be licensed by the FDA through the approval of a Biologics License Application, or BLA, before it may be legally marketed in the United States.

In the United States, pharmaceutical products are regulated by the FDA under the Federal Food, Drug and Cosmetic Act and other laws, including, in the case of biologics, the Public Health Service Act, or PHS Act. We expect our products to be regulated by the FDA as biologics and to be reviewed by the FDA's Center for Biologics Evaluation and Research.

We anticipate our vaccine and antibody will require the submission of a BLA and approval by the FDA before being marketed in the United States. Failure to comply with FDA requirements, both before and after product approval, may subject us or our partners, contract manufacturers and suppliers to administrative or judicial sanctions, including FDA refusal to approve applications, warning letters, product recalls, product seizures, total or partial suspension of production or distribution, fines and/or criminal prosecution.

The steps required before a biologic may be approved for marketing of an indication in the United States generally include:

- completion of preclinical laboratory tests, animal studies, formulation studies conducted in accordance with good laboratory practices and other applicable regulations;
- submission to the FDA of an IND application, which must be active before human clinical trial commencement;
- approval by an institutional review board, or IRB, or ethics committee at each clinical site before a clinical trial is commenced;
- completion of adequate and well-controlled human clinical trials in accordance with good clinical practice, or GCP, requirements to establish that the biological product is "safe, pure and potent," which is analogous to the safety and efficacy approval standard for a chemical drug product for its intended use;
- preparation and submission to the FDA of a BLA for marketing approval that includes substantive evidence of safety, purity and potency from results of nonclinical testing and clinical trials;
- a determination by the FDA within 60 days of its receipt of a BLA to file the application for review;
- satisfactory completion of an FDA pre-approval inspection of the manufacturing facility or facilities at which the product is produced to assess compliance with applicable current good manufacturing practices, or cGMPs, to assure that the facilities, methods and controls are adequate to preserve the products identity, strength, quality and purity;

- potential FDA audit of the nonclinical and clinical trial sites that generated the data in support of the BLA; and
- FDA review of the BLA and issuance of a biologics license, which is the approval necessary to market a vaccine.

Before conducting studies in humans, laboratory evaluation of product chemistry, toxicity and formulation, as well as animal studies to assess the potential safety and efficacy of the biologic candidate, must be conducted. Preclinical toxicology studies in animals must be conducted in compliance with FDA regulations.

The results of the preclinical tests, together with manufacturing information, known as CMC, and analytical data, are submitted to the FDA as part of an IND application. Some preclinical testing may continue even after the IND application is submitted. In addition to including the results of the preclinical testing, the IND application will also include a protocol detailing, among other things, the objectives of the clinical trial, the parameters to be used in monitoring safety and the effectiveness criteria to be evaluated if the first phase or phases of the clinical trial lend themselves to an efficacy determination. The IND application will automatically become effective 30 days after receipt by the FDA unless the FDA within the 30-day time period places the IND application on clinical hold because of safety concerns about the vaccine candidate or the conduct of the trial described in the clinical protocol included in the IND application. The IND application sponsor and the FDA must resolve any outstanding concerns before clinical trials can begin. Submission of an IND application therefore may or may not result in FDA authorization to begin a clinical trial.

All clinical trials for new drugs and biologics must be conducted under the supervision of one or more qualified principal investigators in accordance with GCPs, which include the requirement that all research subjects provide their informed consent for their participation in any clinical trial. They must be conducted under protocols detailing, among other things, the objectives of the applicable phase of the trial, dosing procedures, research subject selection, exclusion criteria and the safety and effectiveness criteria to be evaluated. Each protocol must be submitted to the FDA as part of the IND application, and progress reports detailing the status of the clinical trials must be submitted to the FDA annually. Sponsors must also report to the FDA within specified timeframes, serious and unexpected adverse reactions, any clinically significant increase in the rate of a serious suspected adverse reaction over that listed in the protocol or investigator's brochure or any findings from other studies or animal or in vitro testing that suggest a significant risk in humans exposed to the vaccine candidate. An IRB at each institution participating in the clinical trial must review and approve the protocol before a clinical trial commences at that institution, approve the information regarding the trial and the consent form that must be provided to each research subject or the subject's legal representative and monitor the trial until completed.

Clinical trials are typically conducted in three sequential phases, but the phases may overlap, and different trials may be initiated with the same candidate within the same phase of development in similar or differing patient populations.

- Phase 1: Clinical trials may be conducted in a limited number of patients or healthy volunteers, as appropriate. The vaccine or antibody is initially tested for safety and immunogenicity.

- Phase 2: The vaccine or antibody is evaluated in a limited patient population to identify possible adverse effects and safety risks, to preliminarily evaluate the efficacy of the product for specific targeted diseases and to determine dosage tolerance, optimal dosage and dosing schedule.
- Phase 3: Clinical trials are undertaken to further evaluate dosage, clinical efficacy, potency and safety in an expanded patient population at geographically dispersed clinical trial sites. These clinical trials are intended to establish the overall risk/benefit ratio of the product and provide an adequate basis for product labeling.

In some cases, the FDA may require, or companies may voluntarily pursue, additional clinical trials after a product is approved to gain more information about the product. These so-called Phase 4 studies may also be made a condition to approval of the BLA. These clinical trials are used to gain additional experience from the treatment of patients in the intended therapeutic indication, particularly for long-term safety follow-up.

During all phases of clinical development, regulatory agencies require extensive monitoring and auditing of all clinical activities, clinical data and clinical trial investigators. Annual progress reports detailing the results of the clinical trials must be submitted to the FDA. Written IND application safety reports must be promptly submitted to the FDA and the investigators for serious and unexpected adverse events, any findings from other studies, tests in laboratory animals or in vitro testing that suggest a significant risk for human subjects or any clinically relevant increase in the rate of a serious suspected adverse reaction over that listed in the protocol or investigator brochure. The sponsor must submit an IND application safety report within 15 calendar days after the sponsor determines that the information qualifies for reporting. The sponsor also must notify the FDA of any unexpected fatal or life-threatening suspected adverse reaction within seven calendar days after the sponsor's initial receipt of the information. Phase 1, Phase 2 and Phase 3 clinical trials may not be completed successfully within any specified period, if at all. The FDA or the sponsor or its data safety monitoring board may suspend a clinical trial at any time on various grounds, including a finding that the research subjects or patients are being exposed to an unacceptable health risk. Similarly, an IRB can suspend or terminate approval of a clinical trial at its institution if the clinical trial is not being conducted in accordance with the IRB's requirements or if the biological product has been associated with unexpected serious harm to patients.

Assuming successful completion of all required testing in accordance with applicable regulatory requirements, the results of the preclinical studies and clinical trials, together with other detailed information, including information on the manufacture and composition of the vaccine candidate, are submitted to the FDA as part of a BLA requesting approval to market the vaccine candidate for a proposed indication or indications. The BLA must include all relevant data available from preclinical and clinical trials, including negative or ambiguous results as well as positive findings, together with detailed information relating to the product's CMC and proposed labeling, among other things. Under the Prescription Drug User Fee Act, the fees payable to the FDA for reviewing a BLA, as well as annual program user fees for approved products, can be substantial but are subject to certain limited deferrals, waivers and reductions that may be available. Additionally, no user fees are assessed on BLAs for products designated as orphan drugs, unless the product also includes a non-orphan indication. Each BLA submitted to the FDA for approval is reviewed for administrative completeness and reviewability within 60 days following receipt by the FDA of the application. If the BLA is found complete, the FDA will file the BLA, triggering a full review of the application. The FDA may refuse to file any BLA that it deems incomplete or not properly reviewable at the time of submission. The FDA's established goal is to review 90% of priority BLAs within six months after the application is accepted for filing and 90% of standard BLAs within 10 months of the acceptance date, whereupon a review decision is to be made. Priority review will direct overall attention and resources to the evaluation of applications for products that, if approved, would be significant improvements in the safety or effectiveness of the treatment, diagnosis or prevention of serious conditions. In both standard and priority reviews, the review process is often significantly extended by FDA requests for additional information or clarification. The FDA reviews a BLA to determine, among other things, whether a product is safe, pure and potent and the facility in which it is manufactured, processed, packed or held meets standards designed to assure the product's continued safety, purity and potency. The FDA may also convene an advisory committee to provide clinical insight on application review questions. The FDA is not bound by recommendations of an advisory committee, but it considers such recommendations when making decisions regarding approval.

Before approving a BLA, the FDA will typically inspect the facility or facilities where the product is manufactured. The FDA will not approve an application unless it determines that the manufacturing processes and facilities are in compliance with cGMP and adequate to assure consistent production of the product within required specifications. Additionally, before approving a BLA, the FDA will typically inspect one or more clinical sites to assure compliance with GCP. If the FDA determines that the application, manufacturing process or manufacturing facilities are not acceptable, it will outline the deficiencies in the submission and often will request additional testing or information. Notwithstanding the submission of any requested additional information, the FDA ultimately may decide that the application does not satisfy the regulatory criteria for approval.

After the FDA evaluates a BLA and conducts inspections of manufacturing facilities where the investigational product and/or its drug substance will be produced, the FDA may issue an approval letter or a Complete Response Letter. An approval letter authorizes commercial marketing of the product with specific prescribing information for specific indications. A Complete Response Letter will describe all of the deficiencies that the FDA has identified in the BLA, except that where the FDA determines that the data supporting the application are inadequate to support approval, the FDA may issue the Complete Response Letter without first conducting required inspections, testing submitted product lots and/or reviewing proposed labeling. In issuing the Complete Response Letter, the FDA may recommend actions that the applicant might take to place the BLA in condition for approval, including requests for additional information or clarification. The FDA may delay or refuse approval of a BLA if applicable regulatory criteria are not satisfied, require additional testing or information and/or require post-marketing testing and surveillance to monitor the safety or efficacy of a product.

If a product is approved, the approval may impose limitations on the uses for which the product may be marketed, may require that warning statements be included in the product labeling, may require that additional studies be conducted following approval as a condition of the approval and may impose restrictions and conditions on product distribution, prescribing or dispensing in the form of a Risk Evaluation and Mitigation Strategy, or REMS, or otherwise limit the scope of any approval. A REMS is a safety strategy to manage a known or potential serious risk associated with a medicine and to enable patients to have continued access to such medicines by managing their safe use, and could include medication guides, physician communication plans or elements to assure safe use, such as restricted distribution methods, patient registries and other risk minimization tools. The FDA also may condition approval on, among other things, changes to proposed labeling or the development of adequate controls and specifications. In most cases, the FDA must approve a BLA supplement or a new BLA before a product may be marketed for other uses or before specific manufacturing or other changes may be made to the approved product. As a condition of approval, the FDA may also require one or more Phase 4 post-market studies and surveillance to further assess and monitor the product's safety and effectiveness after commercialization and may limit further marketing of the product based on the results of these post-marketing studies. Also, product approvals may be withdrawn if compliance with regulatory standards is not maintained or if safety or manufacturing problems occur following initial marketing. In addition, new government requirements may be established that could delay or prevent regulatory approval of our vaccine under development.

Both before and after the FDA approves a product, the manufacturer and the holder or holders of the BLA for the product are subject to comprehensive regulatory oversight. For example, quality control and manufacturing procedures must conform, on an ongoing basis, to cGMP requirements, and the FDA periodically inspects manufacturing facilities to assess compliance with cGMPs. Accordingly, manufacturers must continue to spend time, money and effort to maintain cGMP compliance.

Post-Approval Requirements

Any drug products manufactured or distributed by us or our partners pursuant to FDA approvals will be subject to pervasive and continuing regulation by the FDA, including, among other things, record-keeping requirements, reporting of adverse experiences with the drug, providing the FDA with updated safety and efficacy information, distribution requirements, complying with individual electronic records and signature requirements and complying with FDA promotion and advertising requirements. Once approval is granted, the FDA may withdraw the approval if compliance with regulatory standards is not maintained or if problems occur after the product reaches the market. After approval, most changes to the approved product, such as adding new indications, specific manufacturing changes and additional labeling claims, are subject to further FDA review and approval. Biologic manufacturers, their subcontractors and other entities involved in the manufacture and distribution of approved drugs are required to register their establishments with the FDA and certain state agencies and are subject to periodic unannounced inspections by the FDA and certain state agencies for compliance with cGMP regulations and other laws and regulations. Changes to the manufacturing process are strictly regulated and, depending on the significance of the change, may require prior FDA approval before being implemented. FDA regulations also require investigation and correction of any deviations from cGMP and impose reporting requirements upon us and any third-party manufacturers that we may decide to use. Accordingly, manufacturers must continue to expend time, money and effort in the area of production and quality control to maintain compliance with cGMP and other aspects of regulatory compliance.

Discovery of previously unknown problems, including adverse events of unanticipated severity or frequency, or the failure to comply with the applicable regulatory requirements may result in restrictions on the marketing of a product or withdrawal of the product from the market as well as possible civil or criminal sanctions. Failure to comply with the applicable U.S. requirements at any time during the product development process, approval process or after approval, may subject an applicant or manufacturer to administrative or judicial civil or criminal sanctions and adverse publicity. FDA sanctions could include refusal to approve pending applications, withdrawal or suspension of an approval or license, clinical holds, warning or untitled letters, product recalls, product seizures, safety alerts, Dear Healthcare Provider letters, total or partial suspension of production or distribution, injunctions, fines, refusals of government contracts, mandated corrective advertising or communications with doctors, debarment, restitution, disgorgement of profits, consent decrees or civil or criminal penalties.

The FDA strictly regulates labeling, advertising, promotion and other types of information on products that are placed on the market and imposes requirements and restrictions on drug manufacturers, such as those related to direct-to-consumer advertising, the prohibition on promoting products for uses or inpatient populations that are not described in the product's approved labeling (known as "off-label use"), industry-sponsored scientific and educational activities and promotional activities involving the internet. Failure to comply with these requirements can result in, among other things, adverse publicity, warning letters, corrective advertising and potential civil and criminal penalties. Physicians may prescribe legally available products for uses that are not described in the product's labeling and that differ from those tested by us and approved by the FDA. Such off-label uses are common across medical specialties. Physicians may believe that such off-label uses are the best treatment for many patients in varied circumstances. The FDA does not regulate the behavior of physicians in their choice of treatments. The FDA does, however, restrict the manufacturer's communications on the subject of off-label use of their products.

Disclosure of Clinical Trial Information

Sponsors of clinical trials of FDA-regulated products, including biological products, are required to register and disclose certain clinical trial information on clinicaltrials.gov. Information related to the product, patient population, phase of the investigation, trial sites and investigators and other aspects of the clinical trial is then made public as part of the registration. Sponsors are also obligated to discuss the results of their clinical trials after completion. Disclosure of the results of these trials can be delayed in certain circumstances for up to two years after the date of completion of the trial. Competitors may use this publicly available information to gain knowledge regarding the progress of development programs.

Additional Controls for Biologics

To help reduce the increased risk of the introduction of adventitious agents, the PHS Act emphasizes the importance of manufacturing controls for products whose attributes cannot be precisely defined. The PHS Act also provides authority to the FDA to immediately suspend licenses in situations where there exists a danger to public health, to prepare or procure products in the event of shortages and critical public health needs, and to authorize the creation and enforcement of regulations to prevent the introduction or spread of communicable diseases in the United States and between states.

After a BLA is approved, the product will also be subject to official lot release as a condition of approval. As part of the manufacturing process, the manufacturer is required to perform specific tests on each lot of the product before it is released for distribution. If the product is subject to an official release by the FDA, the manufacturer submits samples of each lot of product to the FDA together with a release protocol showing a summary of the history of the manufacture of the lot and the results of all the manufacturer's tests performed on the lot. The FDA may also perform specific confirmatory tests on lots of some products, such as vaccines, before releasing the lots for distribution by the manufacturer. In addition, the FDA conducts laboratory research related to the regulatory standards on the safety, purity, potency and effectiveness of biological products. As with drugs, after approval of biologics, manufacturers must address any safety issues that arise, are subject to recalls or a halt in manufacturing and are subject to periodic inspection after approval.

Expedited Development and Review Programs

A sponsor may seek approval of its vaccine candidate under programs designed to accelerate the FDA's review and approval of new drugs and biological products that meet certain criteria. Specifically, new drugs and biological products are eligible for fast-track designation if they are intended to treat a serious or life-threatening disease or condition and demonstrate the potential to address unmet medical needs for the disease or condition. For a fast-track product, the FDA may consider sections of the BLA for review on a rolling basis before the complete application is submitted, if the sponsor provides a schedule for the submission of the sections of the application, the FDA agrees to accept sections of the application and determines that the schedule is acceptable, and the sponsor pays any required user fees upon submission of the first section of the application. A fast-track designated vaccine candidate may also qualify for priority review, under which the FDA sets the target date for FDA action on the BLA at six months after the FDA accepts the application for filing. Priority review is granted when there is evidence that the proposed product would be a significant improvement in the safety or effectiveness of the treatment, diagnosis or prevention of a serious disease or condition. If criteria are not met for priority review, the application is subject to the standard FDA review period of 10 months after FDA accepts the application for filing. Priority review designation does not change the scientific/medical standard for approval or the quality of evidence necessary to support approval.

Under the accelerated approval program, the FDA may approve a BLA on the basis of either a surrogate endpoint that is reasonably likely to predict clinical benefit, or on a clinical endpoint that can be measured earlier than irreversible morbidity or mortality, that is reasonably likely to predict an effect on irreversible morbidity or mortality or other clinical benefit, taking into account the severity, rarity or prevalence of the condition and the availability or lack of alternative treatments. Post-marketing studies or completion of ongoing studies after marketing approval are generally required to verify the biologic's clinical benefit in relationship to the surrogate endpoint or ultimate outcome in relationship to the clinical benefit. In addition, the FDA currently requires as a condition for accelerated approval pre-approval of promotional materials, which could adversely impact the timing of the commercial launch of the product. FDA may withdraw approval of a drug or indication approved under accelerated approval if, for example, the confirmatory trial fails to verify the predicted clinical benefit of the product.

In addition, a sponsor may seek FDA designation of its vaccine candidate as a breakthrough therapy if the vaccine candidate is intended to treat a serious or life-threatening disease or condition and preliminary clinical evidence indicates that the therapy may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. If the FDA designates a product as a breakthrough therapy, it may take actions appropriate to expedite the development and review of the application, which may include holding meetings with the sponsor and the review team throughout the development of the therapy; providing timely advice to, and interactive communication with, the sponsor regarding the development of the drug to ensure that the development program to gather the nonclinical and clinical data necessary for approval is as efficient as practicable; involving senior managers and experienced review staff, as appropriate, in a collaborative, cross disciplinary review; assigning a cross-disciplinary project lead for the FDA review team to facilitate an efficient review of the development program and to serve as a scientific liaison between the review team and the sponsor; and considering alternative clinical trial designs when scientifically appropriate, which may result in smaller trials or more efficient trials that require less time to complete and may minimize the number of patients exposed to a potentially less efficacious treatment. Breakthrough therapy designation comes with all of the benefits of fast-track designation.

Even if a drug or biologic qualifies for one or more of these programs, the FDA may later decide that the drug no longer meets the conditions for qualification or that the time period for FDA review or approval will be shortened.

Biosimilars and Exclusivity

The Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act of 2010, or collectively, ACA, includes a subtitle called the Biologics Price Competition and Innovation Act of 2009, or BPCIA, which created an abbreviated approval pathway for biological products that are biosimilar to or interchangeable with an FDA-licensed reference biological product. The FDA has issued several guidance documents outlining an approach to review and approval of biosimilars. Biosimilarity, which requires that there be no clinically meaningful differences between the biological product and the reference product in terms of safety, purity and potency, can be shown through analytical studies, animal studies and a clinical trial or trials. Interchangeability requires that a product is biosimilar to the reference product and the product must demonstrate that it can be expected to produce the same clinical results as the reference product in any given patient and, for products that are administered multiple times to an individual, the biologic and the reference biologic may be alternated or switched after one has been previously administered without increasing safety risks or risks of diminished efficacy relative to exclusive use of the reference biologic. However, complexities associated with the larger, and often more complex, structures of biological products, as well as the processes by which such products are manufactured, pose significant hurdles to implementation of the abbreviated approval pathway that are still being worked out by the FDA.

Under the BPCIA, an application for a biosimilar product may not be submitted to the FDA until four years following the date that the reference product was first licensed by the FDA. In addition, the approval of a biosimilar product may not be made effective by the FDA until 12 years from the date on which the reference product was first licensed. During this 12-year period of exclusivity, another company may still market a competing version of the reference product if the FDA approves a full BLA for the competing product containing that applicant's own preclinical data and data from adequate and well-controlled clinical trials to demonstrate the safety, purity and potency of its product. The BPCIA also created certain exclusivity periods for biosimilars approved as interchangeable products. A biological product can also obtain pediatric market exclusivity in the United States. Pediatric exclusivity, if granted, adds six months to existing exclusivity periods and patent terms. This six-month exclusivity, which runs from the end of other exclusivity protection or patent term, may be granted based on the voluntary completion of a pediatric study in accordance with an FDA-issued "Written Request" for such a study.

The BPCIA is complex and continues to be interpreted and implemented by the FDA. In addition, government proposals have sought to reduce the 12-year reference product exclusivity period. Other aspects of the BPCIA, some of which may impact the BPCIA exclusivity provisions, have also been the subject of recent litigation. As a result, the ultimate impact and implementation of the BPCIA are subject to significant uncertainty.

United States Healthcare Reform

In the United States, there has been and continues to be, several legislative and regulatory changes and proposed changes regarding the healthcare system that could, among other things, prevent or delay marketing approval, restrict or regulate post-approval activities and affect the profitable sales of our vaccine and monoclonal antibody.

Among policymakers and payors in the United States, there is significant interest in promoting changes in healthcare systems with the stated goals of containing healthcare costs, improving quality and/or expanding access. In the United States, the pharmaceutical industry has been a particular focus of these efforts and has been significantly affected by major legislative initiatives. For example, in March 2010, the ACA was passed, which substantially changed the way healthcare is financed by both the government and private insurers and significantly impacts the U.S. pharmaceutical industry. The ACA, among other things: (1) increased the minimum Medicaid rebates owed by manufacturers under the Medicaid Drug Rebate Program and extended the rebate program to individuals enrolled in Medicaid managed care organizations; (2) created a new methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for certain drugs and biologics that are inhaled, infused, instilled, implanted or injected; (3) established an annual, nondeductible fee on any entity that manufactures or imports certain specified branded prescription drugs and biologic agents apportioned among these entities according to their market share in specific government healthcare programs; (4) expanded the eligibility criteria for Medicaid programs; (5) created a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research; (6) created a new Medicare Part D coverage gap discount program, in which manufacturers must now agree to offer 70% point-of-sale discounts off negotiated prices of applicable brand drugs to eligible beneficiaries during their coverage gap period, as a condition for the manufacturer's outpatient drugs to be covered under Medicare Part D; and (7) established a Center for Medicare & Medicaid Innovation at the Centers for Medicare & Medicaid Services, or CMS, to test innovative payment and service delivery models to lower Medicare and Medicaid spending, potentially including prescription drugs.

There have been judicial and political challenges to certain aspects of the ACA. By way of example, the Tax Cuts and Jobs Act of 2017, or the Tax Act, was signed into law and included a provision repealing, effective January 1, 2019, the tax-based shared responsibility payment imposed by the ACA on specific individuals who fail to maintain qualifying health coverage for all or part of a year that is commonly referred to as the “individual mandate.” The Bipartisan Budget Act of 2018, among other things, amends the ACA, effective January 1, 2019, to close the coverage gap in most Medicare drug plans, commonly referred to as the “donut hole.” On December 14, 2018, a U.S. District Court Judge in the Northern District of Texas, ruled that the individual mandate is a critical and inseparable feature of the ACA, and therefore, because it was repealed as part of the Tax Act, the remaining provisions of the ACA are invalid as well. Additionally, on December 18, 2019, the U.S. Court of Appeals for the 5th Circuit upheld the District Court ruling that the individual mandate was unconstitutional and remanded the case back to the District Court to determine whether the remaining provisions of the ACA are invalid as well. The U.S. Supreme Court is currently reviewing this case, although it is unclear when a decision will be made. Although the U.S. Supreme Court has yet ruled on the constitutionality of the ACA, on January 28, 2021, President Biden issued an executive order to initiate a special enrollment period from February 15, 2021, through May 15, 2021 for purposes of obtaining health insurance coverage through the ACA marketplace. The executive order also instructs certain governmental agencies to review and reconsider their existing policies and rules that limit access to healthcare, including among others, reexamining Medicaid demonstration projects and waiver programs that include work requirements, and policies that create unnecessary barriers to obtaining access to health insurance coverage through Medicaid or the ACA. It is also unclear how the Supreme Court ruling, other such litigation and the healthcare reform measures of the Biden administration will impact the ACA and our business.

Other legislative changes have been proposed and adopted since the ACA was enacted. For example, on August 2, 2011, the Budget Control Act of 2011 was signed into law, which, among other things, resulted in aggregate reductions of Medicare payments to providers of 2% per fiscal year, which went into effect on April 1, 2013 and, due to subsequent legislative amendments to the statute, will remain in effect through 2030 unless additional Congressional action is taken. On January 2, 2013, the American Taxpayer Relief Act of 2012 was signed into law, which, among other things, reduced Medicare payments to several providers, including hospitals, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years.

Moreover, there has recently been heightened governmental scrutiny over the manner in which manufacturers set prices for their marketed products, which has resulted in several Congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to product pricing, review the relationship between pricing and manufacturer patient programs and reform government program reimbursement methodologies for drug products. At the federal level, the Trump administration used several means to propose or implement drug pricing reform, including through federal budget proposals, executive orders and policy initiatives. For example, on July 24, 2020 and September 13, 2020, President Trump announced several executive orders related to prescription drug pricing that seek to implement several of the administration’s proposals. As a result, the FDA also released a final rule on September 24, 2020 providing guidance for states to build and submit importation plans for drugs from Canada. Further, on November 20, 2020, HHS finalized a regulation removing safe harbor protection for price reductions from pharmaceutical manufacturers to plan sponsors under Part D, either directly or through pharmacy benefit managers, unless the price reduction is required by law. The implementation of the rule has been delayed by the Biden administration from January 1, 2022 to January 1, 2023 in response to ongoing litigation. The rule also creates a new safe harbor for price reductions reflected at the point-of-sale, as well as a safe harbor for certain fixed fee arrangements between pharmacy benefit managers and manufacturers, the implementation of which have also been delayed pending review by the Biden administration until March 22, 2021. On November 20, 2020, CMS issued an interim final rule implementing President Trump’s Most Favored Nation executive order, which would tie Medicare Part B payments for certain physician-administered drugs to the lowest price paid in other economically advanced countries, effective January 1, 2021. On December 28, 2020, the United States District Court in Northern California issued a nationwide preliminary injunction against implementation of the interim final rule. However, it is unclear whether the Biden administration will work to reverse these measures or pursue similar policy initiatives. At the state level, legislatures have increasingly passed legislation and implemented regulations designed to control pharmaceutical product pricing, including price or patient reimbursement constraints, discounts, restrictions on specific product access and marketing cost disclosure and transparency measures and, in some cases, designed to encourage importation from other countries and bulk purchasing. Further, it is possible that additional government action is taken in response to the COVID-19 pandemic.

Federal and state healthcare laws and regulations restrict certain business practices in the biopharmaceutical industry, including anti-kickback and false claims laws and regulations, data privacy and security laws and regulations and transparency laws and regulations.

The federal Anti-Kickback Statute prohibits, among other things, individuals or entities from knowingly and willfully offering, paying, soliciting or receiving remuneration, directly or indirectly, overtly or covertly, in cash or in-kind to induce or in return for purchasing, leasing, ordering or arranging for or recommending the purchase, lease or order of any item or service reimbursable under Medicare, Medicaid or other federal healthcare programs. A person or entity does not need to have actual knowledge of this statute or specific intent to violate it in order to have committed a violation.

The federal civil and criminal false claims laws, including the civil False Claims Act, and civil monetary penalties laws, prohibit, among other things, any individual or entity from knowingly presenting, or causing to be presented, a false claim for payment to the federal government or knowingly making, using or causing to be made or used a false record or statement material to a false or fraudulent claim to the federal government. Private individuals, commonly known as “whistleblowers,” can bring civil False Claims Act qui tam actions, on behalf of the government and such individuals and may share in amounts paid by the entity to the government in recovery or settlement. In addition, the government may assert that a claim including items or services resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the civil False Claims Act.

The federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, created additional federal civil and criminal statutes that prohibit, among other things, knowingly and willfully executing a scheme to defraud any healthcare benefit program. Similar to the federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation. In addition, HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act, and their implementing regulations, imposes specific requirements relating to the privacy, security and transmission of protected health information on HIPAA covered entities, which include certain healthcare providers, health plans and healthcare clearinghouses and their business associates and covered subcontractors who conduct certain activities for or on their behalf involving protected health information on their behalf.

The federal Physician Payments Sunshine Act requires certain manufacturers of drugs, devices, biologics and medical supplies for which payment is available under Medicare, Medicaid or the Children’s Health Insurance Program, with specific exceptions, to report annually to CMS information related to payments or other transfers of value made to physicians (defined to include doctors, dentists, optometrists, podiatrists and chiropractors) and teaching hospitals, and applicable manufacturers and applicable group purchasing organizations to report annually to CMS ownership and investment interests held by physicians and their immediate family members. Beginning in 2022, applicable manufacturers also will be required to report payments or other transfers of value made to physician assistants, nurse practitioners, clinical nurse specialists, certified registered nurse anesthetists, anesthesiologist assistants and certified nurse midwives during the previous year.

Similar state, local and foreign healthcare laws and regulations may also restrict business practices in the pharmaceutical industry, such as state anti-kickback and false claims laws, which may apply to business practices, including but not limited to, research, distribution, sales and marketing arrangements and claims involving healthcare items or services reimbursed by non-governmental third-party payors, including private insurers, or by patients themselves; state laws that require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the federal government, or otherwise restrict payments that may be made to healthcare providers and other potential referral sources; state laws and regulations that require drug manufacturers to file reports relating to pricing and marketing information or which require tracking gifts and other remuneration and items of value provided to physicians, other healthcare providers and entities; state and local laws that require the registration of pharmaceutical sales representatives; and state and local laws governing the privacy and security of health information in some circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts.

Efforts to ensure compliance with applicable healthcare laws and regulations can involve substantial costs. Violations of healthcare laws can result in significant penalties, including the imposition of significant civil, criminal and administrative penalties, damages, monetary fines, disgorgement, individual imprisonment, possible exclusion from participation in Medicare, Medicaid and other U.S. healthcare programs, integrity oversight and reporting obligations, contractual damages, reputational harm, diminished profits and future earnings and curtailment or restructuring of operations.

Foreign Regulation

In addition to regulations in the United States, we expect to be subject to a variety of foreign regulations governing clinical trials and commercial sales and distribution of our vaccine. Whether or not we obtain FDA approval for a vaccine candidate, we must obtain approval from the comparable regulatory authorities of foreign countries or economic areas, such as the European Union, before we may commence clinical trials or market products in those countries or areas. The approval process and requirements governing the conduct of clinical trials, product licensing, pricing and reimbursement vary greatly from place to place, and the time may be longer or shorter than that required for FDA approval.

Certain countries outside of the United States have a process that requires the submission of a clinical trial application, much like an IND prior to the commencement of human clinical trials. In Europe, for example, a clinical trial application, or CTA, must be submitted to the competent national health authority and to independent ethics committees in each country in which a company intends to conduct clinical trials. Once the CTA is approved in accordance with a country's requirements, clinical trial development may proceed in that country. In all cases, the clinical trials must be conducted in accordance with GCPs and other applicable regulatory requirements.

The requirements and process governing the conduct of clinical trials, product licensing, pricing and reimbursement vary from country to country. In all cases, the clinical trials are conducted in accordance with GCP and the applicable regulatory requirements and the ethical principles that have their origin in the Declaration of Helsinki.

Under European Union regulatory systems, a company may submit marketing authorization applications either under a centralized or decentralized procedure. The centralized procedure is compulsory for medicinal products produced by biotechnology or those medicinal products containing new active substances for specific indications such as the treatment of AIDS, cancer, neurodegenerative disorders, diabetes, viral diseases and designated orphan medicines, and optional for other medicines which are highly innovative. Under the centralized procedure, a marketing application is submitted to the European Medicines Agency, or EMA, where it will be evaluated by the Committee for Medicinal Products for Human Use, and a favorable opinion typically results in the grant by the European Commission of a single marketing authorization that is valid for all European Union member states within 67 days of receipt of the opinion. The initial marketing authorization is valid for five years, but once renewed is usually valid for an unlimited period.

To market a medicinal product in the European Economic Area, or EEA, (which is comprised of the 28 Member States of the EU plus Norway, Iceland and Liechtenstein), we must obtain a Marketing Authorization, or MA. There are two types of marketing authorizations:

- The Community MA, which is issued by the European Commission through the Centralized Procedure, based on the opinion of the Committee for Medicinal Products for Human Use of the EMA, and which is valid throughout the entire territory of the European Economic Area, or EEA. The Centralized Procedure is mandatory for certain types of products, such as biotechnology medicinal products, orphan medicinal products, advanced therapy products and medicinal products containing a new active substance indicated for the treatment certain diseases, such as AIDS, cancer, neurodegenerative disorders, diabetes, autoimmune and viral diseases. The Centralized Procedure is optional for products containing a new active substance not yet authorized in the EEA, or for products that constitute a significant therapeutic, scientific or technical innovation or which are in the interest of public health in the EU; and
- National MAs, which are issued by the competent authorities of the Member States of the EEA and only cover their respective territory, are available for products not falling within the mandatory scope of the Centralized Procedure. Where a product has already been authorized for marketing in a Member State of the EEA, this National MA can be recognized in another Member State through the Mutual Recognition Procedure. If the product has not received a National MA in any Member State at the time of application, it can be approved simultaneously in the various Member States through the Decentralized Procedure.

Under the above-described procedures, before granting the MA, the EMA, or the competent authorities of the Member States of the EEA make an assessment of the risk-benefit balance of the product on the basis of scientific criteria concerning its quality, safety and efficacy. If we fail to comply with applicable foreign regulatory requirements, we may be subject to, among other things, fines, suspension or withdrawal of regulatory approvals, product recalls, seizure of products, operating restrictions and criminal prosecution.

Additional Regulation

We are also subject to regulation under the Occupational Safety and Health Act, the Environmental Protection Act, the Toxic Substances Control Act, the Resource Conservation and Recovery Act and other present and potential federal, state or local regulations. These and other laws govern our use, handling and disposal of various biological and chemical substances used in, and waste generated by our operations. Our research and development involve the controlled use of hazardous materials, chemicals, bacteria and viruses. Although we believe that our safety procedures for handling and disposing of such materials comply with the standards prescribed by state and federal regulations, the risk of accidental contamination or injury from these materials cannot be completely eliminated. In the event of such an accident, we could be held liable for any damages that result and any such liability could exceed our resources.

There have been a number of federal and state proposals during the last few years regarding the pricing of pharmaceutical and biological products, government control and other changes to the healthcare system of the United States. It is uncertain what legislative proposals will be adopted or what actions federal, state or private payers for medical goods and services may take in response to any healthcare reform proposals or legislation. We cannot predict the effect medical, or healthcare reforms may have on our business, and no assurance can be given that any such reforms will not have a material adverse effect.

Privacy and Data Protection Laws

We are also subject to laws and regulations in non-U.S. countries covering data privacy and the protection of health-related and other personal information. EU member states and other jurisdictions have adopted data protection laws and regulations, which impose significant compliance obligations. Laws and regulations in these jurisdictions apply broadly to the collection, use, storage, disclosure, processing and security of personal information that identifies or may be used to identify an individual, such as names, contact information and sensitive personal data such as health data. These laws and regulations are subject to frequent revisions and differing interpretations and have generally become more stringent over time.

As of May 25, 2018, Regulation 2016/676, known as the General Data Protection Regulation, or GDPR, replaced the Data Protection Directive with respect to the processing of personal data in the European Union. The GDPR imposes many requirements for controllers and processors of personal data, including, for example, higher standards for obtaining consent from individuals to process their personal data, more robust disclosures to individuals and a strengthened individual data rights regime, shortened timelines for data breach notifications, limitations on retention and secondary use of information, increased requirements pertaining to health data and pseudonymized (i.e., key-coded) data and additional obligations when we contract third-party processors in connection with the processing of the personal data. The GDPR allows EU member states to make new laws and regulations further limiting the processing of genetic, biometric, or health data. Failure to comply with the requirements of GDPR and the applicable national data protection laws of the EU member states may result in fines of up to €20,000,000 or up to 4% of the total worldwide annual turnover of the preceding financial year, whichever is higher, and other administrative penalties.

Employees and Human Capital

We currently have three officers and do not intend to have any full-time employees prior to the completion of the IPO. Members of our management team intend to devote as much of their time as they deem reasonably necessary to our affairs. The management team works with the Compensation Committee to design and implement incentive compensation programs that are designed to allow Alopexx to attract, develop and retain personnel. We currently do not have any full-time officers or employees dedicated solely to human resources.

Properties and Facilities

We currently maintain our executive offices at 186 Alewife Brook Pkwy #1068, Cambridge, MA 02138, and our telephone number is 617-780-1598. We consider our current office space adequate for our current operations.

Legal Proceedings

We are not currently subject to any legal proceedings. From time to time, we may be involved in legal proceedings or subject to claims incident to the ordinary course of business. Regardless of the outcome, such proceedings or claims can have an adverse impact on us because of defense and settlement costs, diversion of resources and other factors, and there can be no assurances that favorable outcomes will be obtained.

MANAGEMENT

Directors, Director Nominees and Executive Officers

Our directors, director nominees and officers are as follows:

Name	Age	Position
Executive Officers		
Daniel R Vlock, MD	69	President, Chief Executive Officer and Director
Thomas T. Thomas	64	Chief Financial Officer
Gerald B. Pier, PhD	70	Chief Scientific Officer
William W. Chin, MD	74	Senior Strategic Advisor, Director
Christine de los Reyes, PharmD, MBA	68	Chief Business Officer, Chief Commercialization Officer
Non-Employee Directors		
Gail H. Cassell, PhD	75	Director Nominee
Richard Cohen ¹	70	Director Nominee
Peter Honig, MD, MPH	65	Director Nominee
Ann MacDougall ^{2, 3}	68	Director Nominee
Peter J. Werth	83	Director

(1) Chair of the audit committee.

(2) Chair of the compensation committee.

(3) Chair of the nominating and governance committee.

Executive Officers and Directors

Daniel R. Vlock, MD – Co-Founder, Chief Executive Officer, Board Member

Dr. Vlock brings extensive pharmaceutical industry and academic experience in pharmaceutical drug development. As CEO of Alopexx Pharmaceuticals (founded in 2006), he and co-founder Dr. Gerald Pier developed F598, a human monoclonal antibody directed against *S. aureus*. Vaccine AV0328 was also developed by Drs. Vlock and Pier. Dr. Vlock has held his current position in Alopexx since 2021 and he has held similar positions in Alopexx's predecessor companies.

Previously, Dr. Vlock held senior-level medical and research positions at GPC Biotech, Inc. (2004 to 2005), Pharmacia Corporation (2002 to 2004), Ethicon Endo-Surgery (1999 to 2002) (a subsidiary of Johnson & Johnson Company), and Boehringer Ingelheim Pharmaceuticals, Inc. (1996 to 1999), where he was involved in the development of numerous oncology drugs, medical devices and drug-device combinations. While at Pharmacia he ran the Celebrex Oncology Group. While at other companies he ran programs which successfully developed and introduced monoclonal antibodies into clinical trials. Prior to moving to industry, Dr. Vlock was on the faculty at Harvard Medical School, University of Pittsburgh School of Medicine and Yale University School of Medicine, where he led laboratory and clinical programs in tumor immunology.

Dr. Vlock received his A.B. from Cornell University and an M.D. from Baylor College of Medicine. He completed a research fellowship in clinical immunology at Baylor College of Medicine, an internship and medical residency at Temple University Hospital and a senior medical residency and fellowship in medical oncology at Yale New Haven Hospital.

Dr. Vlock's qualifications to serve on the board include his (i) familiarity with the Company and its business; (ii) experience in the industry, and (iii) his academic experience in medicine, immunotherapy and clinical studies .

Thomas T. Thomas – Chief Financial Officer

Thomas T. Thomas, our CFO, has over 30 years of experience as a financial executive, consultant and entrepreneur in biotechnology, packaged goods, wine production, financial services and non-profit organizations. Since 2016, Thomas has served as an Independent Director on the Board of Opiant Pharmaceuticals (NASDAQ: OPNT) as Chairman of the Audit Committee and as a member of the Compensation Committee and has served on its Nomination and Governance Committee. He is the former Interim Chief Executive Officer of the Stupski Foundation (2009 to 2010). He joined the foundation in 2009 as its Chief Financial Officer and in 2010 was promoted to Chief Operating Officer and subsequently asked to serve as the Foundation's interim CEO.

Prior to joining the Stupski Foundation, Thomas spent twelve years (1994 to 2006) at Genentech, Inc, a bio-pharmaceutical company, in various financial roles serving as the company's Corporate Treasurer from 2001 through 2006. His executive responsibilities included Treasury Operations and Investments, Corporate Finance, Global Procurement, Enterprise Risk Management and Insurance, Business Continuity and Real Estate. As Treasurer, he led Genentech's Corporate Investment Program, implemented and led an Enterprise Risk Management program to holistically assess and mitigate company risks, partnered with Business Development in the financing of Genentech's Drug Collaborations and also executed large corporate transactions in support of Genentech's growth, including a \$2 billion global public debt offering and the financing and construction of Genentech's 870,000 sq. ft. South Campus Research Center Expansion.

Earlier in his career, Thomas was a Manager of Financial Strategy with Del Monte Foods from 1990 to 1994, and he began his career at GE Capital Corporation from 1988 to 1989, as an Analyst in the Corporate Finance Group, which focused on leveraged buyouts and bankruptcy financing for public and private corporations.

From 2018 – 2021, Thomas served on the Board of Advisors for Symthera, LTD, a private preclinical biotechnology company. Thomas has also served on the boards of the Cancer Prevention Institute of California, San Francisco Security Analysts and Hospitality House. Since 2013, has served as a Mentor in the Ivy Exec Mentor Network.

Thomas is a Chartered Financial Analyst (CFA). He received his MBA from the University of Cincinnati College of Business, where he was a Graduate Fellow, and he has a Bachelor of Music in Voice Performance from the University of Cincinnati College-Conservatory of Music.

Gerald B. Pier, PhD – Co-Founder, Chief Scientific Officer, Chair Scientific Advisory Board

Dr. Pier's research interests focus on the definition of protective immune mechanisms relevant to microbial infections that can lead to the development of vaccines and passive immunotherapies, along with basic studies on mechanisms whereby bacterial pathogens cause infections. His laboratory was responsible for the development and pre-clinical assessment of both the vaccine targeting PNAG and monoclonal antibody F598, the antibody being developed by Alopexx. Dr. Pier has held his current position in Alopexx since 2021 and he has held similar positions in Alopexx's predecessor companies.

He has over 330 peer-reviewed publications and more than 30 patents. He has had multiple successful partnerships with pharmaceutical companies that were an outgrowth of his research. His laboratory developed the synthetic PNAG-conjugate vaccine that Alopexx has brought to Phase 1 trials and has produced panels of fully human monoclonal antibodies derived originally from circulating B cells of vaccinated or infected individuals. These have been in phase 1 and 2 trials for use in passive therapy against *Pseudomonas aeruginosa* and the broad range of pathogens that express the PNAG antigen.

Dr. Pier received his B.S. from University of the Pacific and a Ph.D. in Microbiology from the University of California, Berkeley. After completing a post-doctoral Fellowship in Infectious Diseases at Walter Reed Army Institute of Research in 1978 he joined the faculty at Harvard Medical School, where he currently is a Professor of Medicine in the fields of Microbiology and Immunology.

William Chin, MD – Strategic Advisor and Director

Dr. Chin is the Bertarelli Professor of Translational Medical Science and Professor of Medicine Emeritus at Harvard Medical School. He is currently advising a number of startup biotech companies and serves on the Boards of Regency Pharmaceuticals and Deck Therapeutics. Dr. Chin has been a Director of Alopexx since June 2021.

He was EVP, Science and Regulatory Advocacy, and CMO at the Pharmaceutical Research and Manufacturers of America (PhRMA) (2013 to 2018), where he led PhRMA's efforts in science and regulatory advocacy in the drug discovery and development ecosystem. Prior to PhRMA, he was the Executive Dean for Research at Harvard Medical School (2010 to 2013). Before that, he was at Eli Lilly and Company, last as Senior Vice President for Discovery Research and Clinical Investigation.

Dr. Chin is a Harvard-trained endocrinologist and longstanding faculty member with an extensive bibliography of over 300 papers, chapters and books. During his more than 25 years on the Harvard Medical School faculty, he was Chief of the Genetics Division in the Department of Medicine at the Brigham and Women's Hospital, a Howard Hughes Medical Institute investigator and Professor of Medicine.

As a pioneering molecular endocrinologist, Dr. Chin embraced the early use of emerging DNA technology to make important discoveries regarding the structure, function and regulation of hormone genes. He has been honored with numerous awards for research, mentorship and leadership. He received his A.B. in chemistry from Columbia University and his M.D. from Harvard Medical School.

Dr. Chin's qualifications to serve on the board include his (i) domain expertise and (ii) management experience in both industry and academics.

Christine de los Reyes, Pharm.D. – CBO/CCO

Christine de los Reyes has over 30 years of pharmaceutical experience and most recently was founder and Managing Director of Biotech Partnering Solutions (2007 to present), a business development consulting firm that advises life science companies on partnering strategy, search for potential partners, coordination of technical evaluation and due diligence, deal structure and transaction negotiation. In this capacity, she has had numerous clients and executed several licensing transactions. Christine also spent 12 years on the advisory board of the Neurotechnology Industry Organization, a non-profit trade association that represents companies involved in neuroscience, academic neuroscience research centers and brain-illness advocacy groups. Dr. Reyes has been the Chief Business Officer/Chief Commercial Officer for Alopexx since June 2021.

Prior to starting her own company, she was Executive Director of Licensing & Development at Pfizer (1995 to 2007), where she spent twelve years in its business development group with a focus on in-licensing in several therapeutic areas including neuroscience, infectious diseases, immunology, dermatology, and ophthalmology. Christine also held senior positions in Pfizer's US and International medical and marketing groups for six years.

Prior to working at Pfizer, she was an Associate Professor at The University of Texas, College of Pharmacy.

Ms. de los Reyes received her Doctorate in Clinical Pharmacy at the University of Texas, her MBA at St. Joseph's University and a Bachelor of Science at Wayne State University.

Peter J. Werth – Director

Mr. Werth is Founder and CEO of ChemWerth Inc., a privately held Connecticut-based corporation founded in 1982. ChemWerth Inc. is a full-service generic drug development and supply company providing high quality Active Pharmaceutical Ingredients to regulated markets worldwide. Through exclusive development and partnerships with API manufacturers, ChemWerth Inc. provides expertise in product selection and development, analytical and regulatory services, and strong project management to ensure the highest standards of quality.

Mr. Werth began his career working on the chemical side of the generic drug business in 1975 in the areas of Research and Development as well as Sales and Marketing. From 1965 to 1975, he worked in Research and Development for Upjohn Pharmaceuticals, now Pfizer. Prior to starting ChemWerth he was with Ganes Chemicals, a subsidiary of Siegfried Chemicals, where he was Vice President of Sales and Marketing for their U.S. operations.

Mr. Werth envisioned the ability to develop and implement a successful business model for project selection, which he believed was the heart of a successful generic company. Following this business model, ChemWerth has successfully introduced over 130 generic APIs.

Mr. Werth earned a BS degree in Chemistry and Math from Fort Hays State University and a MS degree in Organic Chemistry from Stanford University.

Mr. Werth's qualifications to serve on the board include his extensive industry experience, particularly relating to drug product development and implementation.

Director Nominees

Four additional individuals have agreed to serve on our board of directors as independent directors following the completion of this offering.

Gail H. Cassell, Ph.D., D.Sc. (Hon.) - Director Nominee

Dr. Cassell is Senior Lecturer, Department of Global Health and Social Medicine, Harvard Medical School. She is a member of the National Academy of Medicine (NAM) of the National Academy of Sciences, served two terms on the governing board and founded the Forum on Drug Discovery, Development and Translation. She is former Vice President for Scientific Affairs and Distinguished Lilly Research Scholar of Infectious Diseases and former Vice President for Infectious Diseases Drug Discovery and Development of Eli Lilly and Company. Prior to moving to Lilly in 1997, Dr. Cassell was the Charles H. McCauley Professor and Chair of the Department of Microbiology at the University of Alabama Schools of Medicine and Dentistry at Birmingham, a department which ranked first in research funding from the National Institutes of Health (NIH) during the decade of her leadership. She obtained her B.S. from the University of Alabama in Tuscaloosa and in 1993 was selected by that institution as one of the top 31 female graduates of the Centennial following the admission of the first female to the University in 1893. She obtained her Ph.D. in Microbiology from the University of Alabama at Birmingham and was selected as its 2003 Distinguished Alumnus. She is a past President of the American Society for Microbiology and is currently serving her second elected term on the Board of Governors of the American Academy of Microbiology.

Dr. Cassell is an elected lifetime member of the U.S. Council on Foreign Relations. She was named to the original Board of Scientific Councilors of the Center for Infectious Diseases, Centers for Disease Control (CDC) and served as Chair of the Board. She has served on the Advisory Board of the Director of NIH, Director of CDC, and the Secretary of Health and Human Services Advisory Council of Public Health Preparedness, the Food and Drug Administration's (FDA) Science Board, the Advisory Committee to the Commissioner. She was a member of the NIH Science Management Board and Advisory Councils of the National Institute of Allergy and Infectious Diseases and the Fogarty International Center of NIH. For two decades she was a member of the Steering Committee of the U.S.-Japan Cooperative Medical Sciences Program responsible for advising the respective governments on joint research agendas, (U.S. State Department/Japan Ministry of Foreign Affairs). She was instrumental in establishment of the U.S./Russia Cooperative Medical Sciences and Training Program under the Bilateral Presidential Commission in 2009 which was a collaboration involving NIH, the US National Academy of Sciences, the Russian Academy of Sciences, and the Russian Academy of Medical Sciences. In 2012, the American Society for Microbiology and the Federation of European Microbiology Societies established the Mäkelä-Cassell Exchange Program for pioneering international engagement for young scientists.

She has served on several editorial boards of scientific journals and has authored over 350 articles and book chapters. She has received national and international awards for her research in infectious diseases, including: two honorary degrees; the CDC Honor Award in Public Health for exceptional leadership and contributions in the development and implementation of CDC's Emerging Infectious Disease Plan 1997; a Citation from the FDA Commissioner for her role as Chair of the review of science and technology at the FDA and the Report FDA: Science and Mission at Risk 2008.

Dr. Cassell's qualifications to serve on the board include (i) her scientific expertise in microbiology and (ii) extensive industry and business experience in developing anti-infectives.

Richard Cohen – Director Nominee

Mr. Cohen has been the President of Richard M Cohen Consultants since 1996, a company providing financial consulting services to both public and private companies. From March 2012 to July 2015, he was the Founder and Managing Partner of Chord Advisors, a firm providing outsourced CFO services to both public and private companies. From May 2012 to August 2013, he was the Interim CEO and member of the Board of Directors of CorMedix Inc. (NYSE: CRMD) a biotech firm developing a catheter lock solution and its successful obtaining of a CE mark in Europe. From July 2008 to August 2012, Mr. Cohen was a member of the Board and Chair of the Audit Committee of Rodman and Renshaw, a publicly traded (NASDAQ: RODM) investment banking firm.

From 2006 to the present, he is a member of the Board and the Chair of the Audit Committee of privately held Helix BioMedix currently developing a topical cream to combat skin lesions and cancers in young children. From September 2018 to the present, Mr. Cohen is member of the Board and Audit Chair for Ondas a publicly traded cyber security firm. Mr. Cohen holds a BS with honors from the University of Pennsylvania (Wharton), an MBA from Stanford University and a CPA from New York State.

Mr. Cohen's qualifications to serve on the board include (i) his extensive CFO services experience and (ii) extensive experience serving as a director and Audit Chair of other publicly traded companies.

Peter Honig, MD, MPH - Director Nominee

Dr. Honig is an experienced leader in the strategic and tactical aspects of drug and vaccine development with expertise in clinical pharmacology, clinical program and clinical trial design, compliance, medical product safety, and medical product regulation. He joined Pfizer in 2014, recently retired from Pfizer in mid-2021, and assumed responsibility for Worldwide Safety and Regulatory Affairs. Since 2019, he also had responsibility for the Pfizer China and Japan drug development organizations. Prior to joining Pfizer, he held senior leadership positions at AstraZeneca and Merck Research Laboratories including oversight for clinical operations and preclinical drug safety.

Prior to joining industry, Dr. Honig founded and was the first Director of the Office of Drug Safety in the Food and Drug Administration's (FDA) Center for Drug Evaluation and Research (CDER). Dr. Honig joined CDER as a medical officer in the Division of Oncology and Pulmonary Drug Products in 1993 and held a supervisory position in the Office of New Drugs.

Dr. Honig has been the PhRMA representative to the International Conference on Harmonization (ICH) Steering Committee since 2003 and, past member of the MedDRA Management Board, and current co-chair of the ICH New Topics Selection Subcommittee. He was a member of the Executive Steering Committee of the FNIH Biomarkers Consortium and is currently a on the DIA Board of Directors.

He received his baccalaureate, medical and public health degrees from Columbia University in New York. He has postgraduate training and is board-certified in internal medicine and clinical pharmacology and has authored numerous peer reviewed publications and book chapters. Dr. Honig has been an Associate Editor of Clinical Pharmacology and Therapeutics since 2010.

Dr. Honig's qualifications to serve on the board include his extensive regulatory and drug safety experience in the approval multiple drugs.

Ann MacDougall, JD – Director Nominee

Ms. MacDougall has more than 20 years of service with public and private boards as member, advisor and executive management.

Previously, she served as a PwC partner (1994 - 2007), including as US General Counsel and member of the 10-person US Management Committee. After a stint in Paris as PwC's Global Deputy General Counsel, she shifted her focus away from law, first as Chief Operating Officer of Acumen Fund (2007 - 2012), a global impact investment fund focused on goods and services for low-income consumers, then as President of Encore.org (2014 - 2017), a national non-profit that promotes second act careers.

Currently she serves as a board director of Opiant Pharmaceuticals, Inc. (NASDAQ: OPNT), a public company focused on addiction and overdose, where she chairs the Compensation Committee, serves on the Governance and Nominations Committee and has served on the Audit Committee. She is also on the board of Atmos XR, a private IOT technology company. In 2020, she completed her service as Interim Chair of the Board at Progenics Pharmaceuticals, Inc., a public company focused on cancer detection and diagnosis. She is an advisor to Nuvo Assets Inc, a rare earths and metals company and is on the Investment Committee of the Builders Fund.

In her volunteer capacity, Ann serves on the Audit Committee of the Lycée Français de New York and as board member and Governance Committee chair of Strong Minds, a non-profit tackling mental illness in Africa. She is on the Advisory Boards of Global Citizen Year, a U.S. education non-profit, Equality Now, a global women's rights non-organization, The Harvard Advanced Leadership Coalition, and the Global Leadership Council of the World Research Institute, a sustainability research group working with governments and large companies across the world.

Ms. MacDougall's qualifications to serve on the board include (i) her management, operational, governance, Environment, Social and Governance and legal experience and (ii) her prior experience on the boards and governance, audit and compensation committees/pharmaceutical companies.

Number and Terms of Office of Officers and Directors

Upon the effectiveness of the registration statement of which this prospectus forms a part, we expect that our board of directors will consist of seven members. Our board of directors will be divided into three classes with only one class of directors being elected in each year and each class (except for those directors appointed prior to our first annual meeting of stockholders) serving a three-year term. The term of office of the first class of directors, consisting of William Chin, will expire at our first annual meeting of stockholders. The term of office of the second class of directors, consisting of Peter Werth, Richard Cohen and Gail Cassell will expire at the second annual meeting of stockholders. The term of office of the third class of directors, consisting of Daniel Vlock, Peter Honig and Ann MacDougall will expire at the third annual meeting of stockholders.

In accordance with Nasdaq corporate governance requirements, we are not required to hold an annual meeting until one year after our first fiscal year end following our listing on Nasdaq. Subject to any other special rights applicable to the stockholders, any vacancies on our board of directors may be filled by the affirmative vote of a majority of the directors present or by a majority of the holders of our founder shares.

Our officers are appointed by the board of directors and serve at the discretion of the board of directors, rather than for specific terms of office. Our board of directors is authorized to appoint persons to the offices set forth in our bylaws as it deems appropriate. Our bylaws will provide that our officers may consist of a Chief Executive Officer, a President, a Chief Financial Officer, Vice Presidents, a Secretary, Assistant Secretaries, a Treasurer, Assistant Treasurers and such other offices as may be determined by the board of directors.

We expect that any additional directorships resulting from an increase in the number of directors will be distributed among the three classes. The division of our board of directors into multiple classes with staggered terms may delay or prevent a change of our management or a change in control.

Director Independence

Upon completion of this offering, our independent directors will be the following:

Name	Position
Gail H. Cassell, PhD	Director Nominee
Richard Cohen	Director Nominee, Audit Committee Chair
Peter Honig, MD, MPH	Director Nominee
Ann MacDougall	Director Nominee, Compensation Committee Chair, Nominating and Corporate Governance Committee Chair

Nasdaq listing standards require that a majority of our board of directors be independent. An "independent director" is defined generally as a person other than an officer or employee of the company or its subsidiaries or any other individual having a relationship which in the opinion of the company's board of directors, would interfere with the director's exercise of independent judgment in carrying out the responsibilities of a director. Our audit committee will be entirely composed of independent directors meeting Nasdaq's additional requirements applicable to members of the audit committee. Our independent directors will have regularly scheduled meetings at which only independent directors are present.

Executive Officer and Director Compensation

After the completion of this offering, directors or members of our management team may be paid consulting or management fees or other compensation.

We are not party to any agreements with our executive officers and directors that provide for benefits upon termination of employment.

Committees of the Board of Directors

Our board of directors will have two standing committees: an audit committee and a compensation committee. Subject to phase-in rules and a limited exception, Nasdaq rules and Rule 10A-3 of the Exchange Act require that the audit committee of a listed company be comprised solely of independent directors, and Nasdaq rules require that the compensation committee of a listed company be comprised solely of independent directors.

Audit Committee

Upon the effectiveness of the registration statement of which this prospectus forms a part, we will establish an audit committee of the board of directors. Under the Nasdaq listing standards and applicable SEC rules, we are required to have at least three members of the audit committee, all of whom must be independent. Our audit committee will be chaired by Richard Cohen and its other members will be Ann MacDougall and Peter Honig. Our board of directors will confirm that audit committee members are independent under the Nasdaq listing standards and applicable SEC rules.

Each member of the audit committee will be financially literate. Mr. Cohen qualifies as an “audit committee financial expert” as defined in applicable SEC rules and has accounting or related financial management expertise. We will adopt an audit committee charter, which will detail the purpose and principal functions of the audit committee, including:

- assisting board oversight of (1) the integrity of our financial statements, (2) our compliance with legal and regulatory requirements, (3) our independent auditor’s qualifications and independence, and (4) the performance of our internal audit function and independent auditors;
- reviewing the appointment, compensation, retention, replacement, and oversight of the work of the independent auditors and any other independent registered public accounting firm engaged by us;
- pre-approving all audit and non-audit services to be provided by the independent auditors or any other registered public accounting firm engaged by us, and establishing pre-approval policies and procedures;
- reviewing and discussing with the independent auditors all relationships the auditors have with us in order to evaluate their continued independence;
- setting clear hiring policies for employees or former employees of the independent auditors;
- setting clear policies for audit partner rotation in compliance with applicable laws and regulations;
- obtaining and reviewing a report, at least annually, from the independent auditors describing (1) the independent auditor’s internal quality-control procedures and (2) any material issues raised by the most recent internal quality-control review, or peer review, of the audit firm, or by any inquiry or investigation by governmental or professional authorities, within the preceding five years respecting one or more independent audits carried out by the firm and any steps taken to deal with such issues;

- meeting to review and discuss our annual audited financial statements and quarterly financial statements with management and the independent auditor, including reviewing our specific disclosures under “Management’s Discussion and Analysis of Financial Condition and Results of Operations”;
- reviewing and approving any related party transaction required to be disclosed pursuant to Item 404 of Regulation S-K promulgated by the SEC prior to us entering into such transaction; and
- reviewing with management, the independent auditors, and our legal advisors, as appropriate, any legal, regulatory or compliance matters, including any correspondence with regulators or government agencies and any employee complaints or published reports that raise material issues regarding our financial statements or accounting policies and any significant changes in accounting standards or rules promulgated by the Financial Accounting Standards Board, the SEC or other regulatory authorities.

Compensation Committee

Upon the effectiveness of the registration statement of which this prospectus forms a part, we will establish a compensation committee of the board of directors. Under the Nasdaq listing standards and applicable SEC rules, we are required to have at least two members of the compensation committee, all of whom must be independent. The Chair of our compensation committee will initially be Ann MacDougall, and the other members will be Richard Cohen and William Chin. Our board of directors will determine that all of our compensation committee members are independent under the Nasdaq listing standards and applicable SEC rules.

We will adopt a compensation committee charter, which will detail the purpose and responsibility of the compensation committee, including:

- reviewing and approving on an annual basis the corporate goals and objectives relevant to our Chief Executive Officer’s compensation, evaluating our Chief Executive Officer’s performance in light of such goals and objectives and determining and approving the remuneration (if any) of our Chief Executive Officer based on such evaluation;
- reviewing and making recommendations to our board of directors with respect to (or approving, if such authority is so delegated by our board of directors) the compensation, and any incentive-compensation and equity-based plans that are subject to board approval of all of our other officers;
- reviewing our executive compensation policies and plans;
- implementing and administering our incentive compensation equity-based remuneration plans;
- assisting management in complying with our proxy statement and annual report disclosure requirements;
- approving all special perquisites, special cash payments and other special compensation and benefit arrangements for our officers and employees;
- producing a report on executive compensation to be included in our annual proxy statement; and
- reviewing, evaluating and recommending changes, if appropriate, to the remuneration for directors.

The charter will also provide that the compensation committee may, in its sole discretion, retain or obtain the advice of a compensation consultant, independent legal counsel or other adviser and will be directly responsible for the appointment, compensation and oversight of the work of any such adviser.

However, before engaging or receiving advice from a compensation consultant, external legal counsel or any other adviser, the compensation committee will consider the independence of each such adviser, including the factors required by Nasdaq and the SEC.

Nominating and Governance Committee

Our nominating and corporate governance committee will consist of three members. The chair of our nominating and corporate governance committee will be Ann MacDougall, and the other members will be Richard Cohen and Gail Cassell. Our board of directors has determined that each member of the nominating and corporate governance committee is independent under the listing standards of Nasdaq.

Specific responsibilities of our nominating and corporate governance committee include:

- identifying and evaluating candidates, including the nomination of incumbent directors for reelection and nominees recommended by stockholders, to serve on our board of directors;
- considering and making recommendations to our board of directors regarding the composition and chairmanship of the committees of our board of directors;
- developing and making recommendations to our board of directors regarding corporate governance guidelines and matters; and
- overseeing periodic evaluations of the board of directors' performance, including committees of the board of directors.

We have not formally established any specific, minimum qualifications that must be met or skills that are necessary for directors to possess. In general, in identifying and evaluating nominees for director, the committee considers educational background, diversity of professional experience, knowledge of our business, integrity, professional reputation, independence, wisdom, and the ability to represent the best interests of our stockholders.

Our nominating and corporate governance committee will operate under a written charter, to be effective prior to the closing of this offering, that satisfies the applicable listing standards of Nasdaq.

Code of Business Conduct and Ethics

We have adopted a code of business conduct and ethics that applies to our directors, officers and employees, including our principal executive officer, principal financial officer, principal accounting officer or controller or persons performing similar functions. Upon the closing of this offering, our code of business conduct and ethics will be available under the Corporate Governance section of our website at <https://www.alopoexx.com>. In addition, we intend to post on our website all disclosures that are required by law or the listing standards of Nasdaq concerning any amendments to, or waivers from, any provision of the code. The reference to our website address does not constitute incorporation by reference of the information contained at or available through our website, and you should not consider it to be a part of this prospectus.

EXECUTIVE COMPENSATION

Executive officers have not received any employment compensation to date. Following this offering, the Compensation Committee will determine compensation for our principal executive officer and the next two most highly compensated executive officers based on published industry norms.

Corporate Incentive Bonus Plan

We will develop a Corporate Incentive Bonus Plan that provides for the opportunity to earn cash bonuses based on performance against corporate and department goals, subject to the approval of our board of directors or a committee of our board of directors. Each of our named executive officers' target bonus is expressed as a percentage of base salary that can be achieved by meeting corporate goals at target level.

Employment Agreements

We will enter into an employment agreement or offer letter with each of our named executive officers. In addition, each of our named executive officers has executed our standard proprietary information and invention assignment agreement. Any potential payments and benefits due upon a termination of employment or change in control are described and quantified below in the subsection entitled "—Potential Payments upon Termination or Change in Control."

General

Regardless of the manner in which a named executive officer's service terminates, our employment agreements will provide that each named executive officer will be entitled to receive amounts earned during his or her term of service, including unpaid salary and unused vacation.

Equity Awards

From time to time, we may grant equity awards to, or enter into employment or consulting agreements with, certain key employees, including our named executive officers, that provide for accelerated vesting of equity awards in the event such key employee's employment was involuntarily terminated under certain circumstances.

Executive Change in Control and Severance Agreements

In connection with the completion of this offering, we will enter into Executive Change in Control and Severance Agreements with our named executive officers. The agreements provide for severance benefits upon a termination of employment by the Company without "cause" or by the executive for "good reason," each as defined in the agreements, each of which we refer to as a qualifying termination. The severance benefits vary depending on whether the qualifying termination occurs during the period three months prior to and twelve months after a "change in control," as defined in the agreements, which we refer to as the change in control period, or at a time other than during the change in control period.

In the event of a qualifying termination other than during the change in control period, the executive will receive a lump sum severance payment equal to the sum of (a) a number of months of base salary (b) a pro rata target bonus for the year of termination and (c) any bonus earned but not yet paid with respect to the year preceding the qualifying termination. The executive will also receive payment of COBRA premiums for the number of months in the severance period. Receipt of severance benefits is contingent upon the executive entering into a release of claims and allowing it to become effective.

In the event of a qualifying termination during the change in control period, the executive will receive a lump sum severance payment equal to the sum of (a) a number of months of base salary, (b) a multiple of the executive's target bonus for the year of termination and (c) any bonus earned but not yet paid with respect to the year preceding the qualifying termination. The executive will also receive payment of COBRA premiums for the number of months in the severance period and full vesting of all time-based equity awards. The vesting of performance-based equity awards will be based on the provisions of such awards, and we have not yet granted any performance-based equity awards. Receipt of severance benefits is contingent upon the executive entering into a release of claims and allowing it to become effective.

Other Compensation and Benefits

All of our current named executive officers will be eligible to participate in our employee benefit plans, including our medical, dental, vision, life, disability and accidental death and dismemberment insurance plans, in each case on the same basis as all of our other employees. We pay the premiums for the life, disability, accidental death and dismemberment insurance for all of our employees, including our named executive officers. We generally do not provide perquisites or personal benefits to our named executive officers.

Employee Benefit and Stock Plans

The Board will develop equity incentive plans and 401(k) plans, as summarized below. The Plan will provide for the grant of incentive stock options, or ISOs, within the meaning of Section 422 of the Internal Revenue Code, or the Code, to employees, including employees of any parent or subsidiary, and for the grant of non-statutory stock options, or NSOs, stock appreciation rights, restricted stock awards, restricted stock unit awards, performance awards and other forms of awards to employees, directors and consultants, including employees and consultants of our affiliates.

Authorized Shares. Initially, the maximum number of shares of our common stock that may be issued under our Plan after it becomes effective will not exceed shares of our common stock, which is the sum of (i) new shares, plus (ii) an additional number of shares not to exceed.

Plan Administration. Our board of directors, or a duly authorized committee of our board of directors, will administer our Plan and is referred to as the "plan administrator" herein. Our board of directors may also delegate to one or more of our officers the authority to (i) designate employees (other than officers) to receive specified stock awards and (ii) determine the number of shares subject to such stock awards. Under our Plan, our board of directors has the authority to determine award recipients, grant dates, the numbers and types of stock awards to be granted, the applicable fair market value, and the provisions of each stock award, including the period of exercisability and the vesting schedule applicable to a stock award.

Stock Options. ISOs and NSOs are granted under stock option agreements adopted by the plan administrator. The plan administrator determines the exercise price for stock options, within the terms and conditions of the Plan, provided that the exercise price of a stock option generally cannot be less than 100% of the fair market value of our common stock on the date of grant. Options granted under the Plan vest at the rate specified in the stock option agreement as determined by the plan administrator.

The plan administrator determines the term of stock options granted under the Plan, up to a maximum of 10 years. Unless the terms of an option holder's stock option agreement, or other written agreement between us and the recipient approved by the plan administrator, provide otherwise, if an option holder's service relationship with us or any of our affiliates ceases for any reason other than disability, death or cause, the option holder may generally exercise any vested options for a period of three months following the cessation of service. This period may be extended in the event that exercise of the option is prohibited by applicable securities laws. If an option holder's service relationship with us or any of our affiliates ceases due to death, or an option holder dies within a certain period following cessation of service, the option holder or a beneficiary may generally exercise any vested options for a period of 18 months following the date of death. If an option holder's service relationship with us or any of our affiliates ceases due to disability, the option holder may generally exercise any vested options for a period of 12 months following the cessation of service. In the event of a termination for cause, options generally terminate upon the termination date. In no event may an option be exercised beyond the expiration of its term.

Acceptable consideration for the purchase of common stock issued upon the exercise of a stock option will be determined by the plan administrator and may include (i) cash, check, bank draft or money order, (ii) a broker-assisted cashless exercise, (iii) the tender of shares of our common stock previously owned by the option holder, (iv) a net exercise of the option if it is an NSO or (v) other legal consideration approved by the plan administrator.

Unless the plan administrator provides otherwise, options or stock appreciation rights generally are not transferable except by will or the laws of descent and distribution. Subject to approval of the plan administrator or a duly authorized officer, an option may be transferred pursuant to a domestic relations order, official marital settlement agreement or other divorce or separation instrument.

Tax Limitations on ISOs. The aggregate fair market value, determined at the time of grant, of our common stock with respect to ISOs that are exercisable for the first time by an award holder during any calendar year under all of our stock plans may not exceed \$100,000. Options or portions thereof that exceed such limit will generally be treated as NSOs. No ISO may be granted to any person who, at the time of the grant, owns or is deemed to own stock possessing more than 10% of our total combined voting power or that of any of our parent or subsidiary corporations unless (i) the option exercise price is at least 110% of the fair market value of the stock subject to the option on the date of grant and (ii) the term of the ISO does not exceed five years from the date of grant.

Restricted Stock Unit Awards. Restricted stock unit awards are granted under restricted stock unit award agreements adopted by the plan administrator. Restricted stock unit awards may be granted in consideration for any form of legal consideration that may be acceptable to our board of directors and permissible under applicable law. A restricted stock unit award may be settled by cash, delivery of stock, a combination of cash and stock as deemed appropriate by the plan administrator or in any other form of consideration set forth in the restricted stock unit award agreement. Additionally, dividend equivalents may be credited in respect of shares covered by a restricted stock unit award. Except as otherwise provided in the applicable award agreement, or other written agreement between us and the recipient approved by the plan administrator, restricted stock unit awards that have not vested will be forfeited once the participant's continuous service ends for any reason.

Restricted Stock Awards. Restricted stock awards are granted under restricted stock award agreements adopted by the plan administrator. A restricted stock award may be awarded in consideration for cash, check, bank draft or money order, past or future services to us or any other form of legal consideration that may be acceptable to our board of directors and permissible under applicable law. The plan administrator determines the terms and conditions of restricted stock awards, including vesting and forfeiture terms. If a participant's service relationship with us ends for any reason, we may receive any or all of the shares of common stock held by the participant that have not vested as of the date the participant terminates service with us through a forfeiture condition or a repurchase right.

Stock Appreciation Rights. Stock appreciation rights are granted under stock appreciation right agreements adopted by the plan administrator. The plan administrator determines the purchase price or strike price for a stock appreciation right, which generally cannot be less than 100% of the fair market value of our common stock on the date of grant. A stock appreciation right granted under the Plan vests at the rate specified in the stock appreciation right agreement as determined by the plan administrator. Stock appreciation rights may be settled in cash or shares of common stock or in any other form of payment as determined by the Board and specified in the stock appreciation right agreement.

The plan administrator determines the term of stock appreciation rights granted under the Plan, up to a maximum of 10 years. If a participant's service relationship with us or any of our affiliates ceases for any reason other than cause, disability or death, the participant may generally exercise any vested stock appreciation right for a period of three months following the cessation of service. This period may be further extended in the event that exercise of the stock appreciation right following such a termination of service is prohibited by applicable securities laws. If a participant's service relationship with us, or any of our affiliates, ceases due to disability or death, or a participant dies within a certain period following cessation of service, the participant or a beneficiary may generally exercise any vested stock appreciation right for a period of 12 months in the event of disability and 18 months in the event of death. In the event of a termination for cause, stock appreciation rights generally terminate immediately upon the occurrence of the event giving rise to the termination of the individual for cause. In no event may a stock appreciation right be exercised beyond the expiration of its term.

Performance Awards. The Plan permits the grant of performance awards that may be settled in stock, cash or other property. Performance awards may be structured so that the stock or cash will be issued or paid only following the achievement of certain pre-established performance goals during a designated performance period. Performance awards that are settled in cash or other property are not required to be valued in whole or in part by reference to, or otherwise based on, the common stock.

The performance goals may be based on any measure of performance selected by the board of directors. The performance goals may be based on company-wide performance or performance of one or more business units, divisions, affiliates or business segments, and may be either absolute or relative to the performance of one or more comparable companies or the performance of one or more relevant indices. Unless specified otherwise by the board of directors at the time the performance award is granted, the board will appropriately make adjustments in the method of calculating the attainment of performance goals as follows: (i) to exclude restructuring and/or other nonrecurring charges; (ii) to exclude exchange rate effects; (iii) to exclude the effects of changes to generally accepted accounting principles; (iv) to exclude the effects of any statutory adjustments to corporate tax rates; (v) to exclude the effects of items that are "unusual" in nature or occur "infrequently" as determined under generally accepted accounting principles; (vi) to exclude the dilutive effects of acquisitions or joint ventures; (vii) to assume that any portion of our business which is divested achieved performance objectives at targeted levels during the balance of a performance period following such divestiture; (viii) to exclude the effect of any change in the outstanding shares of our common stock by reason of any stock dividend or split, stock repurchase, reorganization, recapitalization, merger, consolidation, spin-off, combination or exchange of shares or other similar corporate change or any distributions to common stockholders other than regular cash dividends; (ix) to exclude the effects of stock based compensation and the award of bonuses under our bonus plans; (x) to exclude costs incurred in connection with potential acquisitions or divestitures that are required to be expensed under generally accepted accounting principles; and (xi) to exclude the goodwill and intangible asset impairment charges that are required to be recorded under generally accepted accounting principles.

Other Stock Awards. The plan administrator may grant other awards based in whole or in part by reference to our common stock. The plan administrator will set the number of shares under the stock award (or cash equivalent) and all other terms and conditions of such awards.

Non-Employee Director Compensation Limit. The aggregate value of all compensation granted or paid to any non-employee director with respect to any calendar year, including awards granted and cash fees paid by us to such non-employee director, will not exceed \$ in total value; provided that such amount will increase to \$ for the first year for newly appointed or elected non-employee directors.

Changes to Capital Structure. In the event there is a specified type of change in our capital structure, such as a stock split, reverse stock split or recapitalization, appropriate adjustments will be made to (i) the class and maximum number of shares reserved for issuance under the Plan, (ii) the class and maximum number of shares by which the share reserve may increase automatically each year, (iii) the class and maximum number of shares that may be issued on the exercise of ISOs and (iv) the class and number of shares and exercise price, strike price or purchase price, if applicable, of all outstanding stock awards.

Corporate Transactions. The following applies to stock awards under the Plan in the event of a corporate transaction (as defined in the Plan), unless otherwise provided in a participant's stock award agreement or other written agreement with us or one of our affiliates or unless otherwise expressly provided by the plan administrator at the time of grant.

In the event of a corporate transaction, any stock awards outstanding under the Plan may be assumed, continued or substituted for by any surviving or acquiring corporation (or its parent company), and any reacquisition or repurchase rights held by us with respect to the stock award may be assigned to the successor (or its parent company). If the surviving or acquiring corporation (or its parent company) does not assume, continue or substitute for such stock awards, then (i) with respect to any such stock awards that are held by participants whose continuous service has not terminated prior to the effective time of the corporate transaction, or current participants, the vesting (and exercisability, if applicable) of such stock awards will be accelerated in full to a date prior to the effective time of the corporate transaction (contingent upon the effectiveness of the corporate transaction), and such stock awards will terminate if not exercised (if applicable) at or prior to the effective time of the corporate transaction, and any reacquisition or repurchase rights held by us with respect to such stock awards will lapse (contingent upon the effectiveness of the corporate transaction), and (ii) any such stock awards that are held by persons other than current participants will terminate if not exercised (if applicable) prior to the effective time of the corporate transaction, except that any reacquisition or repurchase rights held by us with respect to such stock awards will not terminate and may continue to be exercised notwithstanding the corporate transaction.

In the event a stock award will terminate if not exercised prior to the effective time of a corporate transaction, the plan administrator may provide, in its sole discretion, that the holder of such stock award may not exercise such stock award but instead will receive a payment equal in value to the excess (if any) of (i) the per share amount payable to holders of common stock in connection with the corporate transaction over (ii) any per share exercise price payable by such holder, if applicable. In addition, any escrow, holdback, earn out or similar provisions in the definitive agreement for the corporate transaction may apply to such payment to the same extent and in the same manner as such provisions apply to the holders of common stock.

Change in Control. Awards granted under the Plan may be subject to acceleration of vesting and exercisability upon or after a change in control (as defined in the Plan) as may be provided in the applicable stock award agreement or in any other written agreement between us or any affiliate and the participant, but in the absence of such provision, no such acceleration will automatically occur.

Plan Amendment or Termination. Our board of directors has the authority to amend, suspend or terminate our Plan, provided that such action does not materially impair the existing rights of any participant without such participant's written consent. Certain material amendments also require the approval of our stockholders. No ISOs may be granted after the tenth anniversary of the date our board of directors adopts our Plan. No stock awards may be granted under our Plan while it is suspended or after it is terminated.

Non-Employee Director Compensation

No compensation has been paid to current and prospective Directors. The table below sets forth the planned compensation to be paid to our directors following completion of the offering. The dollar amount of the stock options will be determined at the offering.

Director Compensation

Position	Fees	Option Awards
Director	\$30,000	4,000 shares
Audit Committee Chair	\$15,000	—
Compensation Committee Chair	\$10,000	—
Governance Committee Chair	\$8,000	—

Expenses

We will reimburse each eligible non-employee director for ordinary, necessary and reasonable out-of-pocket travel expenses to cover in-person attendance at and participation in meetings of our board of directors and any committee of the board.

CERTAIN RELATIONSHIPS AND RELATED PERSON TRANSACTIONS

Other than compensation arrangements for our directors and executive officers, which are described elsewhere in this prospectus, below we describe transactions since January 1, 2019 and each currently proposed transaction in which:

- we have been or are to be a participant;
- the amounts involved exceeded or will exceed \$120,000; and
- any of our directors, executive officers or holders of more than 5% of our outstanding capital stock, or any immediate family member of, or person sharing the household with, any of these individuals or entities, had or will have a direct or indirect material interest.

On March 6, 2020, the Company and the majority shareholder, KLP OBP, LLC (“KLP”), a related party through common ownership, entered into a convertible loan agreement, in which the Company received \$600,000. The note bore interest at rate of 7% per annum. At December 31, 2020, there was accrued interest of \$34,521. As of December 31, 2020, the outstanding principal balance was \$600,000. The note was convertible into shares of preferred stock at a conversion price of 85% of the per share offering price of a *qualified financing event* which the agreement defines as “a transaction or series of transactions with the principal purpose of raising capital pursuant to the which the Company issues and sells shares of its preferred stock for aggregate gross proceeds of at least \$20,000,000 (excluding all proceeds from the incurrence of indebtedness, including the Notes, that is convertible into such preferred stock, or otherwise canceled in consideration for the issuance of such preferred stock). Management evaluated the accounting guidance for embedded conversion features and ultimately determined that the embedded conversion feature did not require to be bifurcated under ASC Topic 815 Derivatives and Hedging and therefore, the convertible debt instrument is accounted for as a single liability measured at amortized cost. On December 23, 2021, the Company and KLP entered into a contribution agreement and effectively forgave the principal and interest related to this loan for no consideration. As a result, the Company recognized a capital contribution to additional paid-in capital on the statements of equity in the amount of \$675,255.

In three congruent installments during the year ended December 31, 2020, on August 4, 2020, October 5, 2020 and November 11, 2020, KLP loaned the Company \$100,000, \$25,000 and \$75,000, respectively, for an aggregate of \$200,000. All three loans bore interest at a rate of 5% per annum. At December 31, 2020, there was accrued interest of \$2,842. As of December 31, 2020, the outstanding principal balance on the notes was \$200,000. On December 23, 2021, the Company and KLP entered into a contribution agreement and effectively forgave the principal and interest related to these loans for no consideration. As a result, the Company recognized a capital contribution to additional paid-in capital on the statements of equity in the amount of \$212,541.

On October 25, 2021, the Company and a shareholder, Werth Family Investment Associates, LLC, entered into a convertible loan agreement, in which we received \$200,000. The note bears interest at rate of 8% per annum and is payable in full on October 20, 2023. At December 31, 2021, there was accrued interest of \$3,112. As of December 31, 2021, the outstanding principal balance was \$200,000. The note is convertible into shares of common stock at a conversion price of 75% of the per share offering price of a qualified financing event which the agreement defines as a transaction or series of transactions with the principal purpose of raising capital pursuant to which we issue and sell shares of our common stock for aggregate gross proceeds of at least \$10 million (excluding all proceeds from the incurrence of indebtedness, including the notes, that is convertible into such common stock, or otherwise canceled in consideration for the issuance of such common stock). We expect this note to be converted into shares of our common stock upon completion of this offering.

On January 5, 2022, the Company entered into a convertible note agreement with Sandra Vlock, sister-in-law to Daniel Vlock, our CEO and majority shareholder, in which the Company received \$100,000 in cash proceeds. The note bears interest at a rate of 5% per annum and is set to mature one year from its commencement date. The note is automatically converted into the Company’s voting common stock at 75% of the purchase price of a future financing of \$10 million prior to the first-year anniversary of the agreement or \$5 million after the first year anniversary of the agreement. We expect this note to be converted into shares of our common stock upon completion of this offering.

On February 17, 2022, the Company entered into a convertible note agreement, with Daniel Vlock, our CEO and majority shareholder, in which the Company received \$200,000 in cash proceeds. The note bears interest at a rate of 5% per annum and is set to mature one year from its commencement date. The note is automatically converted into the Company’s voting common stock at 75% of the purchase price of a future financing of \$10 million prior to the first-year anniversary of the agreement or \$5 million after the first year of the agreement. We expect this note to be converted into shares of our common stock upon completion of this offering.

On March 24, 2022, the Company entered into a convertible note agreement, with Daniel Vlock, our CEO and majority shareholder, in which the Company received \$200,000 in cash proceeds. The note bears interest at a rate of 5% per annum and is set to mature one year from its commencement date. The note is automatically converted into the Company’s voting common stock at 75% of the purchase price of a future financing of \$10 million prior to the first-year anniversary of the agreement or \$5 million after the first year of the agreement. We expect this note to be converted into shares of our common stock upon completion of this offering.

PRINCIPAL STOCKHOLDERS

The following table sets forth information with respect to the beneficial ownership of our capital stock as of _____, as adjusted to reflect the sale of our common stock offered by us in this offering assuming no exercise of the underwriters' option to purchase additional shares, for:

- each of our named executive officers;
- each of our directors;
- all of our executive officers and directors as a group; and
- each person or group of affiliated persons known by us to beneficially own more than 5% of our common stock.

We have determined beneficial ownership in accordance with the rules and regulations of the SEC, and the information is not necessarily indicative of beneficial ownership for any other purpose. Except as indicated by the footnotes below, we believe, based on information furnished to us, that the persons and entities named in the table below have sole voting and sole investment power with respect to all shares that they beneficially own, subject to applicable community property laws.

The beneficial ownership of our common stock prior to the offering is based on 3,200,000 shares of common stock issued and outstanding as of _____. Applicable percentage ownership after the offering is based on _____ shares of common stock outstanding immediately after the closing of this offering, assuming no exercise by the underwriters of their option to purchase additional shares. In computing the number of shares beneficially owned by a person and the percentage ownership of such person, we deemed to be outstanding all shares subject to conversion from convertible notes upon the completion of the offering and options held by the person that are currently exercisable, or exercisable within 60 days of _____. However, except as described above, we did not deem such shares outstanding for the purpose of computing the percentage ownership of any other person.

We believe, based on information provided to us, that each of the stockholders listed below has sole voting and investment power with respect to the shares beneficially owned by the stockholder unless noted otherwise, subject to community property laws where applicable.

Name and Address of Beneficial Owners ⁽¹⁾	Shares Beneficially Owned Before Offering		Shares Beneficially Owned After Offering	
	Number of Shares	Percentage	Number of Shares	Percentage
5% Stockholders:				
Daniel Vlock ⁽²⁾⁽⁴⁾	2,740,605	85.64%	(4)	
Peter Werth ⁽³⁾⁽⁴⁾	369,395	11.54%	(4)	
Director, Executive Officers and Director Nominees:				
Daniel Vlock ⁽²⁾	2,740,605	85.64%	(4)	
Gerald Pier	90,000	2.81%	(5)	
Thomas Thomas	—	—	(5)	
Christine de los Reyes	—	—	(5)	
William Chin	—	—	(5)	
Gail Cassell	—	—	(5)	
Richard Cohen	—	—	(5)	
Peter Honig	—	—	(5)	
Ann MacDougall	—	—	(5)	
All Directors, Executive Officers and Director Nominees as a group (9 persons)	2,830,605	88.46%		

(1) Unless otherwise noted, the business address of each of the following entities or individuals is 186 Alewife Brook Pkwy #1068, Cambridge, Massachusetts 02138.

(2) Consists of (i) 110,000 shares owned directly by Dr. Vlock and (ii) 2,630,605 shares owned through KLP OBP LLC owned by Dr. Vlock and three family members in which Dr. Vlock has dispositive power.

(3) The business address of Peter Werth is 1764 Litchfield Turnpike, Suite 202, Woodbridge, CT 06525.

(4) The number of shares owned includes the total shares owned before the offering plus the number of shares issued upon conversion of the convertible notes held.

(5) The number of shares owned upon issuance from the Company's 2022 Equity Plan after completion of this offering. The Company expects to issue up to 800,000 options that are exercisable into shares of common stock to its management (including directors) from the Company's 2022 Equity Plan after completion of this offering, that will result in approximately 3,585,295 shares owned by its management (including directors).

DESCRIPTION OF CAPITAL STOCK

General

The following description of our capital stock and certain provisions of our amended and restated certificate of incorporation and amended and restated bylaws, which will each become effective upon the closing of this offering, are summaries. You should also refer to our amended and restated certificate of incorporation, our amended and restated bylaws and our amended and restated investors' rights agreement, each of which are filed as exhibits to the registration statement of which this prospectus is a part.

Upon the closing of this offering, our authorized capital stock will consist of 110,000,000 shares, all with a par value of \$0.001 per share, of which:

- 100,000,000 shares are designated as common stock; and
- 10,000,000 shares are designated as preferred stock.

Common Stock

As of _____ there were _____ shares of our common stock outstanding and held of record by _____ stockholders, assuming the conversion of all outstanding warrants into shares of common stock, which will automatically occur upon the closing of this offering.

Holders of our common stock are entitled to one vote for each share held on all matters submitted to a vote of stockholders, including the election of directors, and do not have cumulative voting rights. 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 by the board of directors out of legally available funds. In the event of our liquidation, dissolution or winding up, the holders of common stock will be entitled to share ratably in the assets legally available for distribution to stockholders after the payment of or provision for all of our debts and other liabilities, subject to the prior rights of any preferred stock then outstanding. Holders of common stock have no preemptive or conversion rights or other subscription rights and there are no redemption or sinking funds provisions applicable to the common stock. All outstanding shares of common stock are, and the common stock to be outstanding upon the closing of this offering will be, duly authorized, validly issued, fully paid and nonassessable. All authorized but unissued shares of our common stock will be available for issuance by our board of directors without any further stockholder action, except as required by the listing standards of Nasdaq. The rights, preferences and privileges of holders of common stock are subject to and may be adversely affected by the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future.

Options

As of _____ we had outstanding options under our equity compensation plans to purchase an aggregate of _____ shares of our common stock with a weighted-average exercise price of \$ _____ per share.

Warrants

As of _____, we had outstanding one warrant to purchase an aggregate of up to _____ shares of our common stock with an exercise price of \$ _____ per share.

The above warrant has a net exercise provision under which the holder may, in lieu of payment of the exercise price in cash, surrender the warrant and receive a net amount of shares based on the fair market value of our common stock at the time of the net exercise of the warrant after deduction of the aggregate exercise price. The warrant also contains provisions for the adjustment of the exercise price and the aggregate number of shares issuable upon the exercise of the warrant in the event of stock dividends, stock splits, reorganizations and reclassifications and consolidations. The above warrant will be automatically net exercised immediately prior to the closing of this offering unless the holder of the warrant elects to allow the warrant to expire unexercised.

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

Some provisions of Delaware law, our amended and restated certificate of incorporation and our amended and restated bylaws contain or will contain provisions that could make the following transactions more difficult: an acquisition of us by means of a tender offer; an acquisition of us by means of a proxy contest or otherwise; or the removal of our incumbent officers and directors. It is possible that these provisions could make it more difficult to accomplish or could deter transactions that stockholders may otherwise consider to be in their best interest or in our best interests, including transactions which provide for payment of a premium over the market price for our shares.

These provisions, summarized below, are intended to discourage coercive takeover practices and inadequate takeover bids. These provisions are also designed to encourage persons seeking to acquire control of us to first negotiate with our board of directors. We believe that the benefits of the increased protection of our potential ability to negotiate with the proponent of an unfriendly or unsolicited proposal to acquire or restructure us outweigh the disadvantages of discouraging these proposals because negotiation of these proposals could result in an improvement of their terms.

Stockholder Meetings

Our amended and restated bylaws will provide that a special meeting of stockholders may be called only by our chairman of the board, chief executive officer or president, or by a resolution adopted by a majority of our board of directors.

Requirements for Advance Notification of Stockholder Nominations and Proposals

Our amended and restated bylaws will establish advance notice procedures with respect to stockholder proposals to be brought before a stockholder meeting and the nomination of candidates for election as directors, other than nominations made by or at the direction of the board of directors or a committee of the board of directors.

Elimination of Stockholder Action by Written Consent

Our amended and restated certificate of incorporation and amended and restated bylaws will eliminate the right of stockholders to act by written consent without a meeting.

Staggered Board

Our board of directors will be divided into three classes. The directors in each class will serve for a three-year term, one class being elected each year by our stockholders. For more information on the classified board, see the section entitled “Management—Composition of Our Board of Directors.” This system of electing and removing directors may tend to discourage a third party from making a tender offer or otherwise attempting to obtain control of us, because it generally makes it more difficult for stockholders to replace a majority of the directors.

Removal of Directors

Our amended and restated certificate of incorporation will provide that no member of our board of directors may be removed from office by our stockholders except for cause and, in addition to any other vote required by law, upon the approval of not less than two thirds of the total voting power of all of our outstanding voting stock then entitled to vote in the election of directors.

Stockholders Not Entitled to Cumulative Voting

Our amended and restated certificate of incorporation will not permit stockholders to cumulate their votes in the election of directors. Accordingly, the holders of a majority of the outstanding shares of our common stock entitled to vote in any election of directors can elect all of the directors standing for election, if they choose, other than any directors that holders of our preferred stock, if any, may be entitled to elect.

Delaware Anti-Takeover Statute

We are subject to Section 203 of the DGCL, which prohibits persons deemed to be “interested stockholders” from engaging in a “business combination” with a publicly held Delaware corporation for three years following the date these persons become interested stockholders unless the business combination is, or the transaction in which the person became an interested stockholder was, approved in a prescribed manner or another prescribed exception applies. Generally, an “interested stockholder” is a person who, together with affiliates and associates, owns, or within three years prior to the determination of interested stockholder status did own, 15% or more of a corporation’s voting stock. Generally, a “business combination” includes a merger, asset or stock sale, or other transaction resulting in a financial benefit to the interested stockholder. The existence of this provision may have an anti-takeover effect with respect to transactions not approved in advance by the board of directors.

Choice of Forum

Our amended and restated certificate of incorporation will provide that, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware (or, in the event that the Court of Chancery does not have jurisdiction, the federal district court for the District of Delaware or other state courts of the State of Delaware) will be the exclusive forum for the following types of actions or proceedings under Delaware statutory or common law: (i) any derivative action or proceeding brought on our behalf; (ii) any action or proceeding asserting a claim of breach of a fiduciary duty owed by any of our current or former directors, officers, or employees to us or our stockholders; (iii) any action or proceeding asserting a claim against us or any of our current or former directors, officers or employees arising pursuant to any provision of the DGCL or our certificate of incorporation or bylaws; (iv) any action or proceeding to interpret, apply, enforce or determine the validity of our certificate of incorporation or bylaws; (v) any action or proceeding as to which the DGCL confers jurisdiction to the Court of Chancery of the State of Delaware; or (vi) any action asserting a claim against us or any of our current or former directors, officers or employees governed by the internal affairs doctrine. This provision would not apply to suits brought to enforce a duty or liability created by the Exchange Act or any other claim for which the U.S. federal courts have exclusive jurisdiction. Our amended and restated certificate of incorporation 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.

Our amended and restated certificate of incorporation will also provide that any person or entity purchasing or otherwise acquiring any interest in shares of our capital stock will be deemed to have notice of and to have consented to these choice of forum provisions. While the Delaware courts have determined that such choice of forum provisions are facially valid, it is possible that a court of law in another jurisdiction could rule that the choice of forum provisions to be contained in our amended and restated certificate of incorporation are inapplicable or unenforceable if they are challenged in a proceeding or otherwise. If a court were to find the choice of forum provision that will be contained in our amended and restated certificate of incorporation to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving such action in other jurisdictions.

Amendment of Charter Provisions

The amendment of any of the above provisions would require approval by holders of at least two-thirds of the total voting power of all of our outstanding voting stock.

The provisions of Delaware law, our amended and restated certificate of incorporation and our amended and restated bylaws could have the effect of discouraging others from attempting hostile takeovers and, as a consequence, they may also inhibit temporary fluctuations in the market price of our common stock that often result from actual or rumored hostile takeover attempts. These provisions may also have the effect of preventing changes in the composition of our board and management. It is possible that these provisions could make it more difficult to accomplish transactions that stockholders may otherwise deem to be in their best interests.

Transfer Agent and Registrar

The transfer agent and registrar for our common stock upon the closing of this offering will be . The transfer agent and registrar's address is .

Exchange Listing

Our common stock is currently not listed on any securities exchange. We intend to apply to have our common stock listed on the Nasdaq Capital Market under the symbol "ALPX".

SHARES ELIGIBLE FOR FUTURE SALE

Prior to this offering, there has been no public market for our common stock. Future sales of substantial amounts of common stock in the public market, or the perception that such sales may occur, could adversely affect the market price of our common stock. Although we intend to apply to have our common stock listed on Nasdaq, we cannot assure you that there will be an active public market for our common stock.

Following the closing of this offering, based on the number of shares of our common stock outstanding as of _____ and assuming (i) the issuance of shares of common stock in this offering, and (ii) the issuance of shares of our common stock as a result of the expected net exercise of an outstanding warrant to purchase _____ shares of our common stock and (iii) no exercise of the underwriters' option to purchase additional shares, we will have an aggregate of approximately _____ shares of common stock outstanding.

Of these shares, all shares of common stock sold in this offering will be freely tradable without restriction or further registration under the Securities Act, except for any shares of common stock purchased by our "affiliates," as that term is defined in Rule 144 under the Securities Act. Shares purchased by our affiliates would be subject to the Rule 144 resale restrictions described below, other than the holding period requirement.

The remaining shares of common stock outstanding after this offering will be "restricted securities," as that term is defined in Rule 144 under the Securities Act. These restricted securities are eligible for public sale only if they are registered under the Securities Act or if they qualify for an exemption from registration under Rule 144 or Rule 701 under the Securities Act, each of which is summarized below. We expect that all of these shares will be subject to a 180-day lock-up period under the lock-up and market stand-off agreements described below.

We may issue shares of common stock from time to time as consideration for future acquisitions, investments or other corporate purposes. In the event any such acquisition, investment or other transaction is significant, the number of shares of common stock that we may issue may also be significant. We may also grant registration rights covering those shares of common stock issued in connection with any such acquisition, investment or other transaction.

In addition, shares of common stock that are either subject to outstanding options or warrants or reserved for future issuance under our equity incentive plans will become eligible for sale in the public market to the extent permitted by the provisions of various vesting schedules, the lock-up agreements described below and Rules 144 and 701 under the Securities Act.

Lock-Up Agreements

We, along with our directors, executive officers and all of our other stockholders and option holders, have agreed with the underwriters that for a period of 365 days with respect to us, our directors and executive officers and 180 days with respect to all of our other stockholders and option holders, after the date of this prospectus, subject to specified exceptions as detailed further in the section entitled “Underwriting,” we or they will not, except with the prior written consent of ThinkEquity offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to sale of, or otherwise dispose of or transfer any shares of common stock or any securities convertible into or exercisable or exchangeable for shares of common stock, request or demand that we file a registration statement related to our common stock or enter into any swap or other agreement that transfers to another, in whole or in part, directly or indirectly, the economic consequence of ownership of the common stock. All of our stockholders are subject to a market stand-off agreement with us which imposes similar restrictions.

Upon the expiration of the lock-up period, substantially all of the shares subject to such lock-up restrictions will become eligible for sale, subject to the limitations discussed above.

Rule 144

In general, under Rule 144 as currently in effect, once we have been subject to public company reporting requirements of Section 13 or Section 15(d) of the Exchange Act for at least 90 days, an eligible stockholder is entitled to sell such shares without complying with the manner of sale, volume limitation or notice provisions of Rule 144, subject to compliance with the public information requirements of Rule 144. To be an eligible stockholder under Rule 144, such stockholder must not be deemed to have been one of our affiliates for purposes of the Securities Act at any time during the 90 days preceding a sale and must have beneficially owned the shares proposed to be sold for at least six months, including the holding period of any prior owner other than our affiliates. If such a person has beneficially owned the shares proposed to be sold for at least one year, including the holding period of any prior owner other than our affiliates, then such person is entitled to sell such shares without complying with any of the requirements of Rule 144, subject to the expiration of the lock-up agreements described above.

In general, under Rule 144, as currently in effect, our affiliates or persons selling shares on behalf of our affiliates are entitled to sell shares on expiration of the lock-up agreements described above. Beginning 90 days after the date of this prospectus, within any three-month period, such stockholders may sell a number of shares that does not exceed the greater of:

- 1% of the number of shares of our common stock then outstanding, which will equal approximately shares immediately after this offering; or
- the average weekly trading volume in our common stock on Nasdaq during the four calendar weeks preceding the filing of a notice on Form 144 with respect to such sale.

Sales under Rule 144 by our affiliates or persons selling shares on behalf of our affiliates are also subject to certain manner of sale provisions and notice requirements and to the availability of current public information about us. Notwithstanding the availability of Rule 144, the holders of substantially all of our restricted securities have entered into lock-up agreements as referenced above and their restricted securities will become eligible for sale (subject to the above limitations under Rule 144) upon the expiration of the restrictions set forth in those agreements.

Rule 701

Rule 701 generally allows a stockholder who was issued shares under a written compensatory plan or contract and who is not deemed to have been an affiliate of our company during the immediately preceding 90 days, to sell these shares in reliance on Rule 144, but without being required to comply with the public information, holding period, volume limitation or notice provisions of Rule 144. Rule 701 also permits affiliates of our company to sell their Rule 701 shares under Rule 144 without complying with the holding period requirements of Rule 144. All holders of Rule 701 shares, however, are required by that rule to wait until 90 days after the date of this prospectus before selling those shares under Rule 701, subject to the expiration of the lock-up agreements described above.

Form S-8 Registration Statement

We intend to file one or more registration statements on Form S-8 under the Securities Act to register all shares of common stock subject to issuance under the 2022 Plan. We expect to file the registration statement covering shares offered pursuant to the 2022 Plan shortly after the date of this prospectus, permitting the resale of such shares by non-affiliates in the public market without restriction under the Securities Act and the sale by affiliates in the public market subject to compliance with the resale provisions of Rule 144.

MATERIAL U.S. FEDERAL INCOME TAX CONSEQUENCES TO NON-U.S. HOLDERS OF OUR COMMON STOCK

The following summary describes the material U.S. federal income tax consequences of the acquisition, ownership, and disposition of our common stock acquired in this offering by Non-U.S. Holders (as defined below). This discussion is not a complete analysis of all potential U.S. federal income tax consequences relating thereto, and does not deal with foreign, state and local consequences that may be relevant to Non-U.S. Holders in light of their particular circumstances, nor does it address U.S. federal tax consequences (such as gift and estate taxes) other than income taxes. Special rules different from those described below may apply to certain Non-U.S. Holders that are subject to special treatment under the Internal Revenue Code of 1986, as amended, or the Code, such as financial institutions, insurance companies, tax-exempt organizations, broker-dealers and traders in securities, U.S. expatriates, “controlled foreign corporations,” “passive foreign investment companies,” corporations that accumulate earnings to avoid U.S. federal income tax, corporations organized outside of the United States, any state thereof or the District of Columbia that are nonetheless treated as U.S. taxpayers for U.S. federal income tax purposes, persons that hold our common stock as part of a “straddle,” “hedge,” “conversion transaction,” “synthetic security” or integrated investment or other risk reduction strategy, persons who acquire our common stock through the exercise of an option or otherwise as compensation, persons subject to the alternative minimum tax or federal Medicare contribution tax on net investment income, persons subject to special tax accounting rules under Section 451(b) of the Code, “qualified foreign pension funds” as defined in Section 897(l)(2) of the Code and entities all of the interests of which are held by qualified foreign pension funds, partnerships and other pass-through entities or arrangements, and investors in such passthrough entities or arrangements. Such Non-U.S. Holders are urged to consult their own tax advisors to determine the U.S. federal, state, local and other tax consequences that may be relevant to them. Furthermore, the discussion below is based upon the provisions of the Code, and Treasury Regulations, rulings and judicial decisions thereunder as of the date hereof, and such authorities may be repealed, revoked, or modified, perhaps retroactively, so as to result in U.S. federal income tax consequences different from those discussed below. We have not requested a ruling from the U.S. Internal Revenue Service, or the IRS, with respect to the statements made and the conclusions reached in the following summary, and there can be no assurance that the IRS will agree with such statements and conclusions. This discussion assumes that the Non-U.S. Holder holds our common stock as a “capital asset” within the meaning of Section 1221 of the Code (generally, property held for investment).

This discussion is for informational purposes only and is not tax advice. Persons considering the purchase of our common stock pursuant to this offering should consult their own tax advisors concerning the U.S. federal income, estate, and other tax consequences of acquiring, owning and disposing of our common stock in light of their particular situations as well as any consequences arising under the laws of any other taxing jurisdiction, including any state, local or foreign tax consequences.

For the purposes of this discussion, a “Non-U.S. Holder” is, for U.S. federal income tax purposes, a beneficial owner of common stock that is neither a U.S. Holder, nor a partnership (or other entity treated as a partnership for U.S. federal income tax purposes regardless of its place of organization or formation). A “U.S. Holder” means a beneficial owner of our common stock that is for U.S. federal income tax purposes any of the following:

- an individual who is a citizen or resident of the United States;
- a corporation or other entity treated as a corporation for U.S. federal income tax purposes created or organized in or under the laws of the U.S., any state thereof or the District of Columbia;
- an estate the income of which is subject to U.S. federal income taxation regardless of its source; or

- a trust if it (i) is subject to the primary supervision of a court within the U.S. and one or more U.S. persons have the authority to control all substantial decisions of the trust or (ii) has a valid election in effect under applicable U.S. Treasury regulations to be treated as a U.S. person.

As described in the section entitled “Dividend Policy,” we have never declared or paid any cash dividends on our capital stock and do not anticipate paying any cash dividends in the foreseeable future. Distributions, if any, made on our common stock to a Non-U.S. Holder to the extent made out of our current or accumulated earnings and profits (as determined under U.S. federal income tax principles) generally will constitute dividends for U.S. tax purposes and will be subject to withholding tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty, subject to the discussions below regarding effectively connected income, backup withholding, and foreign accounts. To obtain a reduced rate of withholding under a treaty, a Non-U.S. Holder generally will be required to provide us with a properly executed IRS Form W-8BEN (in the case of individuals) or IRS Form W-8BEN-E (in the case of entities), or other appropriate form, certifying the Non-U.S. Holder’s entitlement to benefits under that treaty. This certification must be provided to us or our paying agent prior to the payment of dividends and must be updated periodically. In the case of a Non-U.S. Holder that is an entity, Treasury Regulations and the relevant tax treaty provide rules to determine whether, for purposes of determining the applicability of a tax treaty, dividends will be treated as paid to the entity or to those holding an interest in that entity. If a Non-U.S. Holder holds stock through a financial institution or other agent acting on the holder’s behalf, the holder will be required to provide appropriate documentation to such agent. The holder’s agent will then be required to provide certification to us or our paying agent, either directly or through other intermediaries. If you are eligible for a reduced rate of U.S. federal withholding tax under an income tax treaty and you do not timely file the required certification, you may be able to obtain a refund or credit of any excess amounts withheld by timely filing an appropriate claim for a refund with the IRS.

We generally are not required to withhold tax on dividends paid to a Non-U.S. Holder that are effectively connected with the Non-U.S. Holder’s conduct of a trade or business within the United States (and, if required by an applicable income tax treaty, are attributable to a permanent establishment or fixed base that such holder maintains in the United States) if a properly executed IRS Form W-8ECI, stating that the dividends are so connected, is furnished to us (or, if stock is held through a financial institution or other agent, to such agent). In general, such effectively connected dividends will be subject to U.S. federal income tax, on a net income basis at the regular rates applicable to U.S. residents. A corporate Non-U.S. Holder receiving effectively connected dividends may also be subject to an additional “branch profits tax,” which is imposed, under certain circumstances, at a rate of 30% (or such lower rate as may be specified by an applicable treaty) on the corporate Non-U.S. Holder’s effectively connected earnings and profits, subject to certain adjustments. Non-U.S. Holders should consult their tax advisors regarding any applicable income tax treaties that may provide for different rules.

To the extent distributions on our common stock, if any, exceed our current and accumulated earnings and profits, they will first reduce the Non-U.S. Holder’s adjusted basis in our common stock, but not below zero, and then will be treated as gain to the extent of any excess amount distributed, and taxed in the same manner as gain realized from a sale or other disposition of common stock as described in the next section.

Gain on Disposition of Our Common Stock

Subject to the discussions below regarding backup withholding and foreign accounts, a Non-U.S. Holder generally will not be subject to U.S. federal income tax with respect to gain realized on a sale or other disposition of our common stock unless (i) the gain is effectively connected with a trade or business of such holder in the United States (and, if required by an applicable income tax treaty, is attributable to a permanent establishment or fixed base that such holder maintains in the United States), (ii) the Non-U.S. Holder is a nonresident alien individual and is present in the United States for 183 or more days in the taxable year of the disposition and certain other conditions are met, or (iii) we are or have been a “United States real property holding corporation” within the meaning of Code Section 897(c)(2) at any time within the shorter of the five-year period preceding such disposition or such holder’s holding period. In general, we would be a United States real property holding corporation if our interests in U.S. real estate comprise (by fair market value) at least half of our business assets. We believe that we have not been and we are not, and do not anticipate becoming, a United States real property holding corporation. Even if we are treated as a United States real property holding corporation, gain realized by a Non-U.S. Holder on a disposition of our common stock will not be subject to U.S. federal income tax so long as (1) the Non-U.S. Holder owned, directly, or indirectly and constructively, no more than 5% of our common stock at all times within the shorter of (A) the five-year period preceding the disposition or (B) the holder’s holding period and (2) our common stock is regularly traded on an established securities market. There can be no assurance that our common stock will continue to qualify as regularly traded on an established securities market. If any gain on your disposition is taxable because we are a United States real property holding corporation and your ownership of our common stock exceeds 5%, you will be taxed on such disposition generally in the manner as gain that is effectively connected with the conduct of a U.S. trade or business (subject to the provisions under an applicable income tax treaty), except that the branch profits tax generally will not apply.

If you are a Non-U.S. Holder described in (i) above, you will be required to pay tax on the net gain derived from the sale at regular U.S. federal income tax rates, and corporate Non-U.S. Holders described in (a) above may be subject to the additional branch profits tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty. Gain described in (ii) above will be subject to U.S. federal income tax at a flat 30% rate or such lower rate as may be specified by an applicable income tax treaty, which gain may be offset by certain U.S.-source capital losses (even though you are not considered a resident of the United States), provided that the Non-U.S. Holder has timely filed U.S. federal income tax returns with respect to such losses.

Information Reporting Requirements and Backup Withholding

Generally, we must report information to the IRS with respect to any dividends we pay on our common stock (even if the payments are exempt from withholding), including the amount of any such dividends, the name and address of the recipient, and the amount, if any, of tax withheld. A similar report is sent to the holder to whom any such dividends are paid. Pursuant to tax treaties or certain other agreements, the IRS may make its reports available to tax authorities in the recipient’s country of residence.

Dividends paid by us (or our paying agents) to a Non-U.S. Holder may also be subject to U.S. backup withholding. U.S. backup withholding generally will not apply to a Non-U.S. Holder who provides a properly executed IRS Form W-8BEN, IRS Form W-8BEN-E, or IRS Form W-ECI, or otherwise establishes an exemption. Notwithstanding the foregoing, backup withholding may apply if the payor has actual knowledge, or reason to know, that the holder is a U.S. person who is not an exempt recipient.

U.S. information reporting and backup withholding requirements generally will apply to the proceeds of a disposition of our common stock effected by or through a U.S. office of any broker, U.S. or foreign, except that information reporting and such requirements may be avoided if the holder provides a properly executed IRS Form W-8BEN or IRS Form W-8BEN-E or otherwise meets documentary evidence requirements for establishing non-U.S. person status or otherwise establishes an exemption. Generally, U.S. information reporting and backup withholding requirements will not apply to a payment of disposition proceeds to a Non-U.S. Holder where the transaction is effected outside the United States through a non-U.S. office of a non-U.S. broker. Information reporting and backup withholding requirements may, however, apply to a payment of disposition proceeds if the broker has actual knowledge, or reason to know, that the holder is, in fact, a U.S. person. For information reporting purposes, certain brokers with substantial U.S. ownership or operations will generally be treated in a manner similar to U.S. brokers.

Backup withholding is not an additional tax. Any amounts withheld under the backup withholding rules may be credited against the tax liability of persons subject to backup withholding, provided that the required information is timely furnished to the IRS.

Foreign Accounts

Sections 1471 through 1474 of the Code (commonly referred to as FATCA) impose a U.S. federal withholding tax of 30% on certain payments, including dividends paid on, and, subject to the proposed Treasury Regulations discussed below, the gross proceeds of a disposition of, our common stock paid to a foreign financial institution (as specifically defined by applicable rules) unless such institution enters into an agreement with the U.S. government to withhold on certain payments and to collect and provide to the U.S. tax authorities identifying information regarding certain U.S. account holders of such institution (which includes certain equity holders of such institution, as well as certain account holders that are foreign entities with U.S. owners). FATCA also generally imposes a federal withholding tax of 30% on certain payments, including dividends paid on, and, subject to the proposed Treasury Regulations discussed below, the gross proceeds of a disposition of, our common stock to a non-financial foreign entity unless such entity provides the withholding agent with either a certification that it does not have any substantial direct or indirect U.S. owners or provides information regarding substantial direct and indirect U.S. owners of the entity. An intergovernmental agreement between the United States and an applicable foreign country may modify those requirements. The withholding tax described above will not apply if the foreign financial institution or non-financial foreign entity otherwise qualifies for an exemption from the rules.

The U.S. Treasury Department recently released proposed regulations which, if finalized in their present form, would eliminate the federal withholding tax of 30% applicable to the gross proceeds of a disposition of our common stock. In its preamble to such proposed regulations, the U.S. Treasury Department stated that taxpayers may generally rely on the proposed regulations until final regulations are issued. Holders are encouraged to consult with their own tax advisors regarding the possible implications of FATCA on their investment in our common stock.

EACH PROSPECTIVE INVESTOR SHOULD CONSULT ITS OWN TAX ADVISOR REGARDING THE TAX CONSEQUENCES OF PURCHASING, HOLDING, AND DISPOSING OF OUR COMMON STOCK, INCLUDING THE CONSEQUENCES OF ANY RECENT OR PROPOSED CHANGE IN APPLICABLE LAW.

UNDERWRITING

We have entered into an underwriting agreement, dated _____, 2022, with ThinkEquity LLC, acting as the sole book-running manager (sometimes referred to as the “Representative”). Subject to the terms and conditions of the underwriting agreement, each of the underwriters named below have agreed to purchase, and we have agreed to sell to it, the number of shares of common stock listed next to its name at the public offering price, less the underwriting discounts and commissions, as set forth on the cover page of this prospectus and as indicated below:

Underwriters	Number of Shares
ThinkEquity LLC	
Total	

The underwriting agreement provides that the obligations of the underwriters to pay for and accept delivery of the shares of common stock offered by this prospectus are subject to various conditions and representations and warranties, including the approval of certain legal matters by its counsel and other conditions specified in the underwriting agreement. The shares of common stock are offered by the underwriters, subject to prior sale, when, as and if issued to and accepted by the underwriters. The underwriters reserve the right to withdraw, cancel or modify the offer to the public and to reject orders in whole or in part. The underwriters are obligated to take and pay for all of the shares of common stock offered by this prospectus if any such shares are taken.

We have agreed to indemnify the underwriters and certain of their affiliates and controlling persons (within the meaning of Section 15 of the Securities Act or Section 20 of the Exchange Act), among others, against specified liabilities, including liabilities under the Securities Act, and to contribute to payments the underwriters may be required to make in respect thereof.

Discounts and Commissions

The underwriters propose to offer the shares of common stock directly to the public at the public offering price set forth on the cover page of this prospectus. After the offering to the public, the offering price and other selling terms may be changed by the underwriters without changing the proceeds we will receive from the underwriters.

The following table summarizes the public offering price, underwriting commissions and proceeds before expenses to us. The underwriting commissions are 7.0% of the public offering price. We have paid a \$50,000 advance to the Representative, which shall be applied against actual out-of-pocket-accountable expenses, and which will be returned to us to the extent such out-of-pocket accountable expenses are not actually incurred in accordance with FINRA Rule 5110(g)(4)(A).

	Per Share	Total Without Over-Allotment Option	Total With Full Over- Allotment Option
Public offering price	\$	\$	\$
Underwriting discount (7.0%)	\$	\$	\$
Proceeds, before expenses, to us	\$	\$	\$

We have agreed to pay a non-accountable expense allowance to the underwriters equal to 1% of the public offering price. Our total estimated expenses of the offering, including registration, filing and listing fees, printing fees and legal and accounting expenses, but excluding underwriting discounts and commissions, are approximately \$

. We have also agreed to reimburse the underwriters for certain expenses incurred in connection with this offering pursuant to the underwriting agreement, including certain legal fees, up to an aggregate of \$212,500.

Over-Allotment Option

We have granted a 45-day option to the Representative to purchase up to additional shares of common stock from us solely to cover over-allotments, if any, at the public offering price less underwriting discounts and commissions.

Representative's Warrants

Upon closing of this offering, we have agreed to issue to the Representative, or its designees, as compensation warrants to purchase a number of shares of common stock equal to 5% of the aggregate number of shares of common stock sold in this offering (the "Representative's Warrants"). The Representative's Warrants will be exercisable at a per share exercise price equal to 125% of the public offering price per share in this offering. The Representative's Warrants are exercisable at any time and from time to time, in whole or in part, during the four and one-half year period commencing 180 days from the effective date of the registration statement of which this prospectus is a part.

The Representative's Warrants have been deemed compensation by FINRA and are therefore subject to a 180-day lock-up pursuant to FINRA Rule 5110(e)(1). The Representative (or permitted assignees under Rule 5110(e)(2)) will not sell, transfer, assign, pledge, or hypothecate these warrants or the securities underlying these warrants, nor will they engage in any hedging, short sale, derivative, put, or call transaction that would result in the effective economic disposition of the warrants or the underlying securities for a period of 180 days from the effective date of the registration statement. In addition, the warrants provide for registration rights upon request, in certain cases. The one-time demand registration right provided will not be greater than five years from the effective date of the registration statement in compliance with FINRA Rule 5110(g)(8)(C). The unlimited piggyback registration right provided will not be greater than seven years from the effective date of the registration statement in compliance with FINRA Rule 5110(g)(8)(D). We will bear all fees and expenses attendant to registering the securities issuable on exercise of the warrants other than underwriting commissions incurred and payable by the holders. The exercise price and number of shares issuable upon exercise of the warrants may be adjusted in certain circumstances including in the event of a stock dividend or our recapitalization, reorganization, merger or consolidation. However, the warrant exercise price or underlying shares will not be adjusted for issuances of shares of common stock at a price below the warrant exercise price.

Discretionary Accounts

The underwriters do not intend to confirm sales of the securities offered hereby to any accounts over which they have discretionary authority.

Lock-Up Agreements

We, along with our directors, executive officers and all of our other stockholders and option holders, have agreed pursuant to “lock-up” agreements not to, or are subject to other restrictions so that they may not, without the prior written consent of the Representative, directly or indirectly, offer to sell, sell, pledge or otherwise transfer or dispose of any of shares of (or enter into any transaction or device that is designed to, or could be expected to, result in the transfer or disposition by any person at any time in the future of) our common stock, enter into any swap or other derivatives transaction that transfers to another, in whole or in part, any of the economic benefits or risks of ownership of shares of our common stock, make any demand for or exercise any right or cause to be filed a registration statement, including any amendments thereto, with respect to the registration of any shares of common stock or securities convertible into or exercisable or exchangeable for shares of common stock or any other of our securities or publicly disclose the intention to do any of the foregoing, subject to customary exceptions, for, with respect to the Company, executive officers and directors a period of 365 days from the date of this prospectus, and with respect to our 5% and greater stockholders, a period of 180 days from the date of this prospectus.

Right of First Refusal

We have granted the Representative a right of first refusal, for a period of twenty-four (24) months from the closing of the offering, to act as sole and exclusive investment banker, book-runner, financial advisor, underwriter and/or placement agent, at the Representative’s sole and exclusive discretion, for each and every future public and private equity and debt offering, including all of our equity linked financings (each, a “Subject Transaction”), or any successor (or any of our subsidiaries), on terms and conditions customary to the Representative for such Subject Transactions.

Nasdaq Capital Market

We have applied to have our shares of common stock listed on the Nasdaq Capital Market under the symbol “ALPX”. Our application might not be approved and the consummation of this offering is contingent upon such approval.

Price Stabilization, Short Positions and Penalty Bids

In order to facilitate the offering of our securities, the underwriters may engage in transactions that stabilize, maintain or otherwise affect the price of our securities. In connection with the offering, the underwriters may purchase and sell our securities in the open market. These transactions may include short sales, purchases on the open market to cover positions created by short sales and stabilizing transactions. Short sales involve the sale by the underwriters of a greater number of shares of securities than they are required to purchase in the offering. “Covered” short sales are sales made in an amount not greater than the underwriters’ option to purchase additional shares of securities in the offering. The underwriters may close out any covered short position by either exercising the over-allotment option to purchase shares or purchasing shares in the open market. In determining the source of shares of securities to close out the covered short position, the underwriters will consider, among other things, the price of shares available for purchase in the open market as compared to the price at which they may purchase shares through the over-allotment option to purchase shares. “Naked” short sales are sales in excess of the over-allotment option to purchase shares. The underwriters must close out any naked short position by purchasing securities in the open market. A naked short position is more likely to be created if the underwriters are concerned that there may be downward pressure on the price of our securities in the open market after pricing that could adversely affect investors who purchase in the offering. Stabilizing transactions consist of various bids for or purchases of shares of securities made by the underwriters in the open market before the completion of the offering.

Similar to other purchase transactions, the underwriters' purchases to cover the syndicate short sales may have the effect of raising or maintaining the market price of our securities or preventing or retarding a decline in the market price of our securities. As result, the price of our securities may be higher than the price that might otherwise exist in the open market.

The underwriters make no representation or prediction as to the direction or magnitude of any effect that the transactions described above may have on the price of our securities. In addition, neither we nor the underwriters make any representation that the underwriters will engage in these transactions or that these transactions, once commenced, will not be discontinued without notice.

Electronic Offer, Sale and Distribution of Securities

A prospectus in electronic format may be made available on the websites maintained by the underwriters or selling group members, if any, participating in the offering. The underwriters may agree to allocate a number of shares of securities to underwriters and selling group members for sale to their online brokerage account holders. Internet distributions will be allocated by the underwriter and selling group members that may make internet distributions on the same basis as other allocations. Other than the prospectus in electronic format, the information on any underwriter's website and any information contained in any other website maintained by an underwriter is not part of this prospectus or the registration statement of which this prospectus forms a part.

Other Relationships

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

Pricing of the Offering

The public offering price was determined by negotiations between us and the Representative. Among the factors considered in determining the public offering price were our future prospects and those of our industry in general, our sales, earnings and certain other financial and operating information in recent periods, and the price-earnings ratios, price-sales ratios, market prices of securities, and certain financial and operating information of companies engaged in activities similar to ours. Neither we nor the underwriters can assure investors that an active trading market for the shares will develop or that, after the offering, the shares will trade in the public market at or above the public offering price.

Offer Restrictions Outside the United States

Other than in the United States, no action has been taken by us or the underwriters that would permit a public offering of the securities offered by this prospectus in any jurisdiction where action for that purpose is required. The securities offered by this prospectus may not be offered or sold, directly or indirectly, nor may this prospectus or any other offering material or advertisements in connection with the offer and sale of any such securities be distributed or published in any jurisdiction, except under circumstances that will result in compliance with the applicable rules and regulations of that jurisdiction. Persons into whose possession this prospectus comes are advised to inform themselves about and to observe any restrictions relating to the offering and the distribution of this prospectus. This prospectus does not constitute an offer to sell or a solicitation of an offer to buy any securities offered by this prospectus in any jurisdiction in which such an offer or a solicitation is unlawful.

Canada

The securities may be sold in Canada only to purchasers purchasing, or deemed to be purchasing, as principal that are accredited investors, as defined in National Instrument 45-106 Prospectus Exemptions or subsection 73.3(1) of the Securities Act (Ontario), and are permitted clients, as defined in National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations. Any resale of the securities must be made in accordance with an exemption from, or in a transaction not subject to, the prospectus requirements of applicable securities laws. Securities legislation in certain provinces or territories of Canada may provide a purchaser with remedies for rescission or damages if this prospectus (including any amendment thereto) contains a misrepresentation, provided that the remedies for rescission or damages are exercised by the purchaser within the time limit prescribed by the securities legislation of the purchaser's province or territory. The purchaser should refer to any applicable provisions of the securities legislation of the purchaser's province or territory for particulars of these rights or consult with a legal advisor.

China

The information in this document does not constitute a public offer of the securities, whether by way of sale or subscription, in the People's Republic of China (excluding, for purposes of this paragraph, Hong Kong Special Administrative Region, Macau Special Administrative Region and Taiwan). The securities may not be offered or sold directly or indirectly in the PRC to legal or natural persons other than directly to "qualified domestic institutional investors."

European Economic Area — Belgium, Germany, Luxembourg and Netherlands

The information in this document has been prepared on the basis that all offers of securities will be made pursuant to an exemption under the Directive 2003/71/EC ("Prospectus Directive"), as implemented in Member States of the European Economic Area (each, a "Relevant Member State"), from the requirement to produce a prospectus for offers of securities.

An offer to the public of securities has not been made, and may not be made, in a Relevant Member State except pursuant to one of the following exemptions under the Prospectus Directive as implemented in that Relevant Member State:

- to legal entities that are authorized or regulated to operate in the financial markets or, if not so authorized or regulated, whose corporate purpose is solely to invest in securities;
- to any legal entity that has two or more of (i) an average of at least 250 employees during its last fiscal year; (ii) a total balance sheet of more than €43,000,000 (as shown on its last annual unconsolidated or consolidated financial statements) and (iii) an annual net turnover of more than €50,000,000 (as shown on its last annual unconsolidated or consolidated financial statements);
- to fewer than 100 natural or legal persons (other than qualified investors within the meaning of Article 2(1)(e) of the Prospectus Directive) subject to obtaining the prior consent of the Company or any underwriter for any such offer; or

- in any other circumstances falling within Article 3(2) of the Prospectus Directive, provided that no such offer of securities shall result in a requirement for the publication by the Company of a prospectus pursuant to Article 3 of the Prospectus Directive.

Hong Kong

Neither the information in this document nor any other document relating to the offer has been delivered for registration to the Registrar of Companies in Hong Kong, and its contents have not been reviewed or approved by any regulatory authority in Hong Kong, nor have we been authorized by the Securities and Futures Commission in Hong Kong. This document does not constitute an offer or invitation to the public in Hong Kong to acquire shares. Accordingly, unless permitted by the securities laws of Hong Kong, no person may issue or have in its possession for the purpose of issue, this document or any advertisement, invitation or document relating to the shares, whether in Hong Kong or elsewhere, which is directed at, or the contents of which are likely to be accessed or read by, the public in Hong Kong other than in relation to shares which are intended to be disposed of only to persons outside Hong Kong or only to “professional investors” (as such term is defined in the Securities and Futures Ordinance (Cap. 571 of the Laws of Hong Kong) (“SFO”) and the subsidiary legislation made thereunder) or in circumstances which do not result in this document being a “prospectus” as defined in the Companies (Winding Up and Miscellaneous Provisions) Ordinance of Hong Kong (Cap. 32 of the Laws of Hong Kong) (the “CO”) or which do not constitute an offer or an invitation to the public for the purposes of the SFO or the CO. The offer of the shares is personal to the person to whom this document has been delivered by or on behalf of our company, and a subscription for shares will only be accepted from such person. No person to whom a copy of this document is issued may issue, circulate or distribute this document in Hong Kong or make or give a copy of this document to any other person. You are advised to exercise caution in relation to the offer. If you are in any doubt about any of the contents of this document, you should obtain independent professional advice. No document may be distributed, published or reproduced (in whole or in part), disclosed by or to any other person in Hong Kong or to any person to whom the offer of sale of the shares would be a breach of the CO or SFO.

Israel

The securities offered by this prospectus have not been approved or disapproved by the Israeli Securities Authority (the “ISA”), nor have such securities been registered for sale in Israel. The shares may not be offered or sold, directly or indirectly, to the public in Israel, absent the publication of a prospectus. The ISA has not issued permits, approvals or licenses in connection with the offering or publishing the prospectus; nor has it authenticated the details included herein, confirmed their reliability or completeness, or rendered an opinion as to the quality of the securities being offered. Any resale in Israel, directly or indirectly, to the public of the securities offered by this prospectus is subject to restrictions on transferability and must be effected only in compliance with the Israeli securities laws and regulations.

United Kingdom

Neither the information in this document nor any other document relating to the offer has been delivered for approval to the Financial Services Authority in the United Kingdom and no prospectus (within the meaning of section 85 of the Financial Services and Markets Act 2000, as amended (“FSMA”)) has been published or is intended to be published in respect of the securities. This document is issued on a confidential basis to “qualified investors” (within the meaning of section 86(7) of FSMA) in the United Kingdom, and the securities may not be offered or sold in the United Kingdom by means of this document, any accompanying letter or any other document, except in circumstances which do not require the publication of a prospectus pursuant to section 86(1) FSMA. This document should not be distributed, published or reproduced, in whole or in part, nor may its contents be disclosed by recipients to any other person in the United Kingdom.

Any invitation or inducement to engage in investment activity (within the meaning of section 21 of FSMA) received in connection with the issue or sale of the securities has only been communicated or caused to be communicated and will only be communicated or caused to be communicated in the United Kingdom in circumstances in which section 21(1) of FSMA does not apply to our Company.

In the United Kingdom, this document is being distributed only to, and is directed at, persons (i) who have professional experience in matters relating to investments falling within Article 19(5) (investment professionals) of the Financial Services and Markets Act 2000 (Financial Promotions) Order 2005 (“FPO”), (ii) who fall within the categories of persons referred to in Article 49(2)(a) to (d) (high net worth companies, unincorporated associations, etc.) of the FPO or (iii) to whom it may otherwise be lawfully communicated (together “relevant persons”). The investments to which this document relates are available only to, and any invitation, offer or agreement to purchase will be engaged in only with, relevant persons. Any person who is not a relevant person should not act or rely on this document or any of its contents.

LEGAL MATTERS

The validity of the shares of common stock being offered by this prospectus will be passed upon for us by McElroy, Deutsch Mulvaney & Carpenter LLP, Rochester, New York. Nelson Mullins Riley & Scarborough LLP, Raleigh, North Carolina, is acting as counsel to the underwriters.

EXPERTS

The financial statements of Alopexx, Inc. as of December 31, 2021 and 2020 and for the years then ended included in this prospectus have been audited by Marcum LLP, an independent registered public accounting firm, as set forth in their report thereon (which contains an explanatory paragraph relating to substantial doubt about the ability of Alopexx, Inc. to continue as a going concern as described in Note 1 to the financial statements) appearing elsewhere in this prospectus, and are included in reliance on such report given on the authority of such firm as experts in accounting and auditing.

WHERE YOU CAN FIND MORE INFORMATION

We have filed with the SEC a registration statement on Form S-1, including exhibits and schedules, under the Securities Act, with respect to the shares of common stock being offered by this prospectus. This prospectus, which constitutes part of the registration statement, does not contain all of the information in the registration statement and its exhibits. For further information with respect to us and the common stock offered by this prospectus, we refer you to the registration statement and its exhibits. Statements contained in this prospectus as to the contents of any contract or any other document referred to are not necessarily complete, and in each instance, we refer you to the copy of the contract or other document filed as an exhibit to the registration statement. Each of these statements is qualified in all respects by this reference.

You can read our SEC filings, including the registration statement, over the Internet at the SEC's website at www.sec.gov.

Upon the closing of this offering, we will be subject to the information reporting requirements of the Securities Exchange Act and we will file reports, proxy statements and other information with the SEC. These reports, proxy statements and other information will be available for inspection at the web site of the SEC referred to above. We also maintain a website at <https://www.alopexx.com>, at which, following the closing of this offering, you may access these materials free of charge as soon as reasonably practicable after they are electronically filed with, or furnished to, the SEC. Information contained on or accessible through our website is not a part of this prospectus, and the inclusion of our website address in this prospectus is an inactive textual reference only.

ALOPEXX, INC.

FINANCIAL STATEMENTS

FOR THE YEARS ENDED DECEMBER 31, 2021 AND 2020

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Shareholders and Board of Directors of
Alopexx, Inc.

Opinion on the Financial Statements

We have audited the accompanying balance sheets of Alopexx, Inc. (the “Company”) as of December 31, 2021 and 2020, the related statements of operations, stockholders’ deficit and cash flows for each of the two years in the period ended December 31, 2021, and the related notes (collectively referred to as the “financial statements”). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2021 and 2020, and the results of its operations and its cash flows for each of the two years in the period ended December 31, 2021, in conformity with accounting principles generally accepted in the United States of America.

Explanatory Paragraph – Going Concern

The accompanying financial statements have been prepared assuming that the Company will continue as a going concern. As more fully described in Note 1, the Company has a significant working capital deficiency, has incurred significant losses and needs to raise additional funds to meet its obligations and sustain its operations. These conditions raise substantial doubt about the Company’s ability to continue as a going concern. Management’s plans in regard to these matters are also described in Note 1. The financial statements do not include any adjustments that might result from the outcome of this uncertainty.

Basis for Opinion

These financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the Company’s financial statements based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (“PCAOB”) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits, we are required to obtain an understanding of internal control over financial reporting but not for the purpose of expressing an opinion on the effectiveness of the Company’s internal control over financial reporting. Accordingly, we express no such opinion.

Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ Marcum LLP

Marcum LLP

We have served as the Company’s auditor since 2021.

Hartford, CT

March 4, 2022, except for Note 10, to which the date is April 7, 2022.

**ALOPEXX, INC.
BALANCE SHEETS**

	December 31, 2021	December 31, 2020
ASSETS		
Current assets:		
Cash	\$ 40,208	\$ 19,764
Other current assets	1,099	44,426
Deferred offering costs	107,509	—
Total current assets	<u>148,816</u>	<u>64,190</u>
TOTAL ASSETS	<u><u>\$ 148,816</u></u>	<u><u>\$ 64,190</u></u>
LIABILITIES AND STOCKHOLDERS' DEFICIT		
CURRENT LIABILITIES:		
Account payable and accrued expenses	688,131	296,577
Accrued interest – related party	3,112	37,363
Notes payable – related parties	—	200,000
Total current liabilities	<u>691,243</u>	<u>533,940</u>
LONG TERM LIABILITIES		
Convertible notes payable – related parties	200,000	600,000
Total long term Liabilities	<u>200,000</u>	<u>600,000</u>
TOTAL LIABILITIES	<u><u>\$ 891,243</u></u>	<u><u>\$ 1,133,940</u></u>
STOCKHOLDERS' DEFICIT:		
Preferred Stock, \$.001 par value – 3,000,000 shares authorized, no shares issued and outstanding	—	—
Common Stock, \$.0001 par value - 1,000,000 and 10,000,000 shares authorized at December 31, 2021 and 2020, respectively, 200,000 and 3,427,908 shares issued and outstanding at December 31, 2021 and December 31, 2020, respectively	20	343
Common Stock - Non-voting, \$.0001 par value - 5,000,000 shares authorized, and 3,000,000 shares issued and outstanding	300	300
Additional paid-in capital	4,202,935	2,918,335
Accumulated deficit	(4,945,682)	(3,988,728)
TOTAL STOCKHOLDERS' DEFICIT	<u>(742,427)</u>	<u>(1,069,750)</u>
TOTAL LIABILITIES AND STOCKHOLDERS' DEFICIT	<u><u>\$ 148,816</u></u>	<u><u>\$ 64,190</u></u>

The accompanying notes are an integral part of these financial statements

ALOPEXX, INC.
STATEMENTS OF OPERATIONS

	For the Years Ended	
	December 31, 2021	December 31, 2020
OPERATING COSTS AND EXPENSES:		
Research and development	\$ 188,617	\$ 1,352,342
General and administrative	714,792	314,006
TOTAL OPERATING EXPENSES	<u>903,409</u>	<u>1,666,348</u>
LOSS FROM OPERATIONS	(903,409)	(1,666,348)
Interest Expense, net	<u>(53,545)</u>	<u>(34,387)</u>
NET LOSS BEFORE INCOME TAX	<u>(956,954)</u>	<u>(1,700,735)</u>
Income tax expense	—	—
NET LOSS	<u>\$ (956,954)</u>	<u>\$ (1,700,735)</u>
Loss per common share – basic and diluted	<u>(0.21)</u>	<u>\$ (0.26)</u>
Weighted average common shares outstanding – basic and diluted	<u>4,468,106</u>	<u>6,427,908</u>

The accompanying notes are an integral part of these financial statements

ALOPEXX, INC.
STATEMENT OF CHANGES IN STOCKHOLDERS' DEFICIT
FOR THE YEARS ENDED DECEMBER 31, 2021 AND 2020

	<u>Common Stock</u>		<u>Common Stock – non-voting</u>		<u>Additional Paid-in Capital</u>	<u>Accumulated Deficit</u>	<u>Total Stockholders' Equity (Deficit)</u>
	<u>Shares</u>	<u>Amount</u>	<u>Shares</u>	<u>Amount</u>			
Balance as of January 1, 2020	3,427,908	\$ 343	3,000,000	\$ 300	\$ 2,918,335	\$ (2,287,993)	\$ 630,985
Net loss	—	—	—	—	—	(1,700,735)	(1,700,735)
Balance as of December 31, 2020	<u>3,427,908</u>	<u>\$ 343</u>	<u>3,000,000</u>	<u>\$ 300</u>	<u>\$ 2,918,335</u>	<u>\$ (3,988,728)</u>	<u>\$ (1,069,750)</u>
Contribution from related party	—	—	—	—	394,490	—	394,490
Issuance of common stock	200,000	20	—	—	11,980	—	12,000
Repurchase and retirement of common shares	(3,427,908)	(343)	—	—	(9,666)	—	(10,009)
Contribution of principal and interest of related party debt	—	—	—	—	887,796	—	887,796
Net loss	—	—	—	—	—	(956,954)	(956,954)
Balance as of December 31, 2021	<u>200,000</u>	<u>\$ 20</u>	<u>3,000,000</u>	<u>\$ 300</u>	<u>\$ 4,202,935</u>	<u>\$ (4,945,682)</u>	<u>\$ (742,427)</u>

The accompanying notes are an integral part of these financial statement

ALOPEXX, INC.
STATEMENTS OF CASH FLOWS

	For the Years Ended,	
	December 31, 2021	December 31, 2020
CASH FLOWS FROM OPERATING ACTIVITIES:		
Net Loss	\$ (956,954)	\$ (1,700,735)
Reconciliation of net loss to net cash used in operating activities		
Accrued interest – related party	53,545	37,363
Changes in operating assets and liabilities:		
Deferred offering costs	(107,509)	—
Other current assets	43,327	(43,008)
Accounts payable and accrued expenses	686,554	(368,171)
NET CASH USED IN OPERATING ACTIVITIES	(281,037)	(2,074,551)
CASH FLOWS FROM FINANCING ACTIVITIES:		
Sale from issuance of common stock	12,000	—
Repurchase and retirement of common shares	(10,009)	—
Proceeds from capital contribution from related party	99,490	—
Proceeds from notes payable – related party	—	200,000
Proceeds from convertible notes payable – related party	200,000	600,000
NET CASH PROVIDED BY FINANCING ACTIVITIES:	301,481	800,000
Net change in cash	20,444	(1,274,551)
Cash, beginning of year	19,764	1,294,315
Cash, end of year	\$ 40,208	\$ 19,764
SUPPLEMENTAL CASH FLOW INFORMATION:		
Cash paid for taxes	\$ —	\$ —
Cash paid for interest	\$ —	\$ —
NON-CASH INVESTING AND FINANCING ACTIVITIES:		
Contribution of principal and interest of related party debt	\$ 887,796	\$ —
Contribution from related party for accrued expenses	\$ 295,000	\$ —

The accompanying notes are an integral part of these financial statements

ALOPEXX, INC.
NOTES TO FINANCIAL STATEMENTS
FOR THE YEARS ENDED DECEMBER 31, 2021 AND 2020

Note 1 Nature of Operations and Going Concern

Alopexx, Inc., (formerly OBP Acquisition, Inc.) (the “Company” or “Alopexx”), headquartered in Cambridge, Massachusetts, was incorporated in the state of Delaware in May 2021. On May 25, 2021, the Company entered into a Merger Agreement (the “Merger”) with Alopexx, Inc. (formerly One Biopharma Inc.) (“OBP”), a related party under common control, and pursuant to the Merger, the shareholders of OBP’s common stock received \$2.92 for every 1,000 common shares. These shares were repurchased by Alopexx and retired. Additionally, on a one-to-one share basis, OBP’s Preferred Stock was converted into one share of Alopexx’s non-voting common stock. The Company has retroactively reflected the capitalization in the balance sheets and statements of stockholders’ deficit.

The Company was formed as a clinical stage biotechnology company for the purpose of developing novel, broad-spectrum immune-mediated therapeutics for the prevention and treatment of a wide range of bacterial, fungal, and parasitic microbial infections. The Vaccine AV0328 (the “Vaccine”) and MAF598 Antibody (the “Antibody”) was therapeutics developed to target Poly B-acetyl glucosamine (“PNAG”) found in a wide range of pathogens.

As a result of the Merger, the acquisition transaction was accounted for as a common control transaction in accordance with the Financial Accounting Standards Board (“FASB”) (Accounting Standard Codification (“ASC”) 805-50, Business Combinations – Common control transactions). The Company evaluated the guidance contained in ASC 805-50 with respect to the combinations among entities or businesses under common control and concluded that since the majority shareholders of the Company and OBP are the same, this was a common control transaction and did not result in a change in control at the ultimate parent or the controlling shareholder level.

Going Concern and Management’s Plan

Since inception, the Company has incurred significant losses from operations and has not generated positive cash flows from operations. In addition, at December 31, 2021, the Company does not have any revenue stream to support its cost structure. The accompanying financial statements have been prepared in conformity with accounting principles generally accepted in the United States of America (“U.S. GAAP”), which contemplates continuation of the Company as a going concern. The Company has experienced losses and negative cash flows from operations since inception on December 12, 2018, and has an accumulated deficit of approximately \$4.9 and \$4.0 million as of December 31, 2021 and 2020, respectively. As of December 31, 2021, the Company had working capital deficiency of approximately \$542,000, and as of December 31, 2020, the Company had working capital of approximately \$470,000.

The Company’s loss from operations has been funded with the proceeds of equity financings and notes payables from related parties. We expect to operate at a loss for the foreseeable future while we execute our business plan to obtain regulatory approval and commercially launch the product in the United States and foreign jurisdictions. We have limited capital resources and operations have been funded by the proceeds of equity offerings and related party debt. We will require additional financing to implement our business plan. We believe that we have access to capital resources through the sale of equity securities, however, we have not secured any commitments for new financing at this time. These factors, among others, raise substantial doubt about the Company’s ability to continue as a going concern over the next 12 months from the issuance date of these financial statements. The financial statements do not include any adjustments that might result from this uncertainty.

COVID-19

There have been outbreaks in several countries, including the United States, of the highly transmissible and pathogenic coronavirus (“COVID-19”). The outbreak of such COVID-19 resulted in a widespread health crisis that adversely affected general commercial activity and the economies and financial markets of many countries, including the United States. Although to date, the Company has not been adversely affected by COVID-19, the measures taken by the governments of countries affected could adversely affect the Company’s business, financial condition, and results of operations.

Note 2 - Significant Accounting Policies

Use of Estimates

The preparation of financial statements in accordance with accounting principles generally accepted in the United States of America (“U.S. GAAP”) and applicable rules and regulations of the Securities and Exchange Commission (“SEC”), involves the use of estimates and assumptions that affect the recorded amounts of assets and liabilities as of the date of the financial statements and the reported amounts of revenue and expenses during the reporting period. Significant estimates include the accounts payable and accrued expenses, equity related transactions and deferred taxes. Actual results may differ substantially from these estimates.

Cash and Cash Equivalents

The Company considers liquid investments with an original maturity of three months or less to be cash equivalents. As of December 31, 2021, the Company holds all of its cash with one financial institution. Such funds are insured by the Federal Deposit Insurance Corporation (“FDIC”) up to \$250,000. Cash balances could exceed insured amounts at any given time; however, the Company has not experienced any such losses. At December 31, 2021 and December 31, 2020, there were no cash equivalents.

Deferred Offering Costs

Deferred offering costs consist of underwriting, legal, accounting and other expenses incurred through the balance sheet date that are directly related to a future offering and that will be charged to shareholders’ deficit upon the completion of such offering. Should the offering prove to be unsuccessful, these deferred costs, as well as additional expenses incurred, will be charged to operations. As of December 31, 2021, the Company capitalized deferred offering costs of \$107,509.

Fair Value Measurements

The carrying amount of the Company’s financial instruments classified as current assets and current liabilities approximate fair values based on the short-term nature of the accounts.

Convertible Debt and Derivative Financial Instruments

The Company accounts for convertible debt in accordance with the accounting standards and assesses whether embedded conversion options are required to be bifurcated under ASC 815.

The Company evaluates its financial instruments to determine if such instruments are derivatives or contain features that qualify as embedded derivatives in accordance with ASC Topic 815, “Derivatives and Hedging”. For derivative financial instruments that are accounted for as liabilities, the derivative instrument is initially recorded at its fair value on the grant date and is then re-valued at each reporting date, with changes in the fair value reported in the statements of operations. The classification of derivative instruments, including whether such instruments should be recorded as liabilities or as equity, is evaluated at the end of each reporting period. Derivative liabilities are classified in the balance sheet as current or non-current based on whether net-cash settlement or conversion of the instrument could be required within 12 months of the balance sheet date.

Stock Based Compensation

Stock-based compensation expense is recorded for all option grants and awards of non-vested stock and recognized in the financial statements based on the grant date fair value of the awards granted. Stock-based compensation is recognized as expense over the requisite service period, which generally represents the vesting period. The Company calculates the fair value of stock options using the Black-Scholes option-pricing model at grant date. There were no options granted during the years ended December 31, 2021, and 2020 and no options outstanding at December 31, 2021 and 2020.

Emerging Growth Company

The Company is an “emerging growth company,” as defined in Section 2(a) of the Securities Act of 1933, as amended (the “Securities Act”), as modified by the Jumpstart Our Business Startups Act of 2012, as amended (the “JOBS Act”), and it may take advantage of certain exemptions from various reporting requirements that are applicable to other public companies that are not emerging growth companies including, but not limited to, not being required to comply with the independent registered public accounting firm attestation requirements of Section 404 of the Sarbanes-Oxley Act, reduced disclosure obligations regarding executive compensation in its periodic reports and proxy statements, and exemptions from the requirements of holding a nonbinding advisory vote on executive compensation and shareholder approval of any golden parachute payments not previously approved.

Further, Section 102(b)(1) of the JOBS Act exempts emerging growth companies from being required to comply with new or revised financial accounting standards until private companies (that is, those that have not had a Securities Act registration statement declared effective or do not have a class of securities registered under the Exchange Act) are required to comply with the new or revised financial accounting standards. The JOBS Act provides that a company can elect to opt out of the extended transition period and comply with the requirements that apply to non-emerging growth companies but any such election to opt out is irrevocable. The Company has elected not to opt out of such extended transition period which means that when a standard is issued or revised and it has different application dates for public or private companies, the Company, as an emerging growth company, can adopt the new or revised standard at the time private companies adopt the new or revised standard. This may make comparison of the Company's financial statements with another public company which is neither an emerging growth company nor an emerging growth company which has opted out of using the extended transition period difficult or impossible because of the potential differences in accounting standards used.

Research and Development Costs and Clinical Trial Expenses

The Company expenses the cost of research and development as incurred. Research and development expenses comprise costs incurred in performing research and development activities, including clinical trial costs, manufacturing costs for both clinical and pre-clinical materials as well as other contracted services, license fees, and other external costs. Research and development costs include costs directly attributable to the conduct of research and development programs, including the cost of services provided by outside contractors, the cost of manufacturing drugs for use in research, preclinical development costs, consulting costs, and costs related to FDA submissions and clinical trials. All costs associated with research and development are expensed as incurred.

Earnings per Share

The computation of basic earnings per common share is based on the weighted average number of shares outstanding during the period. The computation of diluted earnings per common share is based on the weighted average number of shares outstanding during the period plus the weighted average common stock equivalents which would arise from the exercise of stock options, warrants, convertible notes and other rights during the period. For the years ended December 31, 2021, and 2020, due to the net loss during the period, the inclusion of any common stock equivalents would be anti-dilutive and therefore, basic and dilutive weighted average shares were equivalent.

Income Taxes

Deferred tax assets and liabilities are computed based upon the difference between the financial statement and income tax basis of assets and liabilities using the enacted marginal tax rate applicable when the related asset or liability is expected to be realized or settled. Deferred income tax expenses or benefits are based on the changes in the asset or liability each period. If available evidence suggests that it is more likely than not that all or a portion of the deferred tax assets will not be realized, a valuation allowance is required to reduce the deferred tax assets to the amount that is more likely than not to be realized. Future changes in the valuation allowance are included in the provision for deferred income taxes in the period of change.

Deferred income taxes may arise from temporary differences resulting from income and expense items reported for financial accounting and tax purposes in different periods. Deferred taxes are classified as current or non-current, depending on the classification of assets and liabilities to which they relate. Deferred taxes arising from temporary differences that are not related to an asset or liability are classified as current or non-current depending on the periods in which the temporary differences are expected to reverse.

The Company applies a more-likely-than-not recognition threshold for all tax uncertainties, which allows the recognition of those tax benefits that have a greater than fifty percent likelihood of being sustained upon examination by the taxing authorities. The Company has not incurred any interest and penalties, however when incurred in potential future period, the Company will include in income tax expense in the accompanying statements of operations in the period they become determinable.

Segment Information

The Company has a single operating and reportable segment. The Company's chief operating decision maker is its Chief Executive Officer, who reviews financial information presented on a consolidated basis for purposes of making operating decisions, assessing financial performance, and allocating resources. The Company does not have significant long-lived assets, does not generate revenue and does not have any operations outside of the United States.

Recent Accounting Pronouncements

From time to time, new accounting pronouncements are issued by the Financial Accounting Standards Board (“FASB”) or other standard setting bodies that the Company adopts as of the specified effective date. Unless otherwise discussed, the Company does not believe that the impact of recently issued standards that are not yet effective will have a material impact on its financial position or results of operations upon adoption.

In August 2020, the FASB issued ASU 2020-06, *Accounting for Convertible Instruments and Contracts in an Entity’s Own Equity*, as part of its overall simplification initiative to reduce costs and complexity of applying accounting standards while maintaining or improving the usefulness of the information provided to users of financial statements. Among other changes, the new guidance removes from GAAP separation models for convertible debt that require the convertible debt to be separated into a debt and equity component, unless the conversion feature is required to be bifurcated and accounted for as a derivative or the debt is issued at a substantial premium. As a result, after adopting the guidance, entities will no longer separately present such embedded conversion features in equity and will instead account for the convertible debt wholly as debt. The new guidance also requires use of the “if-converted” method when calculating the dilutive impact of convertible debt on earnings per share, which is consistent with the Company’s current accounting treatment under the current guidance. The guidance is effective for financial statements issued for fiscal years beginning after December 15, 2021, and interim periods within those fiscal years, with early adoption permitted, but only at the beginning of the fiscal year. As of December 31, 2021, the Company adopted ASU 2020-06 and noted it did not have a material impact on its financial position, results of operations and disclosures.

In December 2019, the FASB issued ASU No. 2019-12, *Income Taxes (Topic 740): Simplifying the Accounting for Income Taxes* (“ASU 2019-12”), which is intended to simplify various aspects related to accounting for income taxes. ASU 2019-12 removes certain exceptions to the general principles in Topic 740 and clarifies and amends existing guidance to improve consistent application. This guidance is effective for fiscal years and interim periods within those fiscal years beginning after December 15, 2020, with early adoption permitted. The Company adopted this standard and there was no impact on its financial position and results of operations as a result of this adoption.

Note 3 – License Agreements

In May 2019, the Company entered into assignment agreements for two exclusive patent license agreements (AV0238 Vaccine and F598 Antibody) with Brigham and Women’s Hospital (BWH). Pursuant to the assignment, the Company obtained an exclusive, royalty-bearing, sublicensable (with approval from BWH) license to certain U.S. and foreign patents related to the vaccine and methods of use thereof, the F598 monoclonal antibody and variants thereof and the methods of use of the vaccine and/or the anti-PNAG antibody. The Company may sublicense the patent rights licensed under the agreement subject to certain conditions, including obtaining the review and approval by BWH of such sublicense and any such sublicense must be consistent with and subject to the terms of the agreement.

In consideration for the licenses granted under the agreement, the Company must pay BWH annual license fees prior to the first commercial sale of a licensed product that range in the mid-five-digit figures to low six-digit figures, and a low single digit royalty on net sales of licensed products beginning with the first commercial sale of a licensed product in any country during the term of the agreement. In the event the Company commercializes a product in the therapeutic space, the Company is also required to make certain drug-approval regulatory and commercialization milestone payments to BWH of up to a low seven-digit figure in the aggregate for licensed products. In the event the Company sublicenses any of the licensed intellectual property, the Company must pay BWH a percentage of any sublicense income received by the Company, which on a going-forward basis will be in the low double digits.

Under the terms of the agreement, the Company is required to use commercially reasonable efforts to develop and commercialize the licensed products, including in accordance to certain developmental, funding, regulatory and commercialization milestones. BWH controls the prosecution, maintenance and enforcement of all licensed patents and patent applications under the agreement. Subject to an applicable cure period, BWH may terminate the agreements if we fail to comply with applicable payments or diligence obligations or upon a breach of our obligations under the agreement, or for certain insolvency-related events.

Unless earlier terminated, the agreement continues until the expiration of the last to expire patent right licensed under the agreement which ranges from 2025 to 2033. Subject to an applicable cure period, BWH may terminate the agreement if the Company fails to comply with applicable payments or diligence obligations or upon a breach of our obligation under the agreement, or for certain insolvency-related events.

Note 4 – Accounts Payable and Accrued Expenses

Accrued expenses consist of the following:

	As of	
	December 31, 2021	December 31, 2020
Research and Development Consultants	\$ 25,512	\$ —
Executives Consultant Fees	48,489	—
Business Development Consultants	150,000	—
Accounting and Legal Fees	272,421	—
Board of Director Fees	26,709	—
Accrued License Fees – Alopexx Pharmaceuticals	100,000	130,000
Accrued License Fees – Alopexx Vaccine	65,000	165,000
Miscellaneous Taxes and Fees	—	1,577
Total	\$ 688,131	\$ 296,577

Note 5 – Debt

Convertible Notes Payable – Related Parties

On March 6, 2020, the Company and the majority shareholder, KLP OBP, LLC (“KLP”), a related party through common ownership entered into a convertible loan agreement, in which the Company received \$600,000. The note bore interest at rate of 7% per annum. At December 31, 2020, there was accrued interest of \$34,521. As of December 31, 2020, the outstanding principal balance was \$600,000. The note was convertible into shares of preferred stock at a conversion price of 85% of the per share offering price of a *qualified financing event* which the agreement defines as “a transaction or series of transactions with the principal purpose of raising capital pursuant to the which the Company issues and sells shares of its preferred stock for aggregate gross proceeds of at least \$20,000,000 (excluding all proceeds from the incurrence of indebtedness, including the Notes, that is convertible into such preferred stock, or otherwise canceled in consideration for the issuance of such preferred stock). Management evaluated the accounting guidance for embedded conversion features and ultimately determined that the embedded conversion feature did not require to be bifurcated under ASC Topic 815 Derivatives and Hedging and therefore, the convertible debt instrument is accounted for as a single liability measured at amortized cost. On December 23, 2021, the Company and KLP entered into a contribution agreement and effectively forgave the principal and interest related to this loan for no consideration. As a result, the Company recognized a capital contribution to additional paid-in capital on the statements of equity in the amount of \$675,255.

On October 25, 2021, the Company and shareholder, Werth Family Investment Associates, LLC, entered into a convertible loan agreement, in which the Company received \$200,000. The note bears interest at rate of 8% per annum and is payable in full on October 20, 2023. At December 31, 2021 and December 31, 2020, there was accrued interest of \$3,112 and \$0, respectively. As of December 31, 2021 and December 31, 2020, the outstanding principal balance was \$200,000 and \$0, respectively. The note is convertible into shares of common stock at a conversion price of 75% of the per share offering price of a *next equity financing event* which the agreement defines as “a sale by the Company of its shares in an initial public offering from which the Company receives gross proceeds of not less than \$25,000,000 and in the event such initial public offering does not occur before the first anniversary, the next equity financing means the sale by the Company of its Shares in a public or private offering from which the Company receives gross proceeds of not less than \$5,000,000.” Management evaluated the accounting guidance for embedded conversion features and ultimately determined that the embedded conversion feature did not require to be bifurcated under ASC Topic 815 Derivatives and Hedging and therefore, the convertible debt instrument is accounted for as a single liability measured at amortized cost.

Notes Payable – Related Parties

In three congruent installments during the year ended December 31, 2020, August 4th, October 5th and November 11th, KLP loaned the Company \$100,000, \$25,000 and \$75,000, respectively, for an aggregate of \$200,000. All three loans bore interest at a rate of 5% per annum. At December 31, 2020, there was accrued interest of \$2,842. As of December 31, 2020, the outstanding principal balance on the notes was \$200,000. On December 23, 2021, the Company and KLP entered into a contribution agreement and effectively forgave the principal and interest related to these loans for no consideration. As a result, the Company recognized a capital contribution to additional paid-in capital on the statements of equity in the amount of \$212,541.

Note 6 - Contractual Obligations, Commitments and Contingencies

Legal

Periodically, the Company reviews the status of any significant matters that exist and assesses its potential financial exposure. If the potential loss from any claim or legal claim is considered probable and the amount can be estimated, the Company accrues a liability for the estimated loss. Legal proceedings are subject to uncertainties, and the outcomes are difficult to predict. Because of such uncertainties, accruals are based on the best information available at the time. As additional information becomes available, the Company reassesses the potential liability related to pending claims and litigation. As of December 31, 2021 and December 31, 2020, there are no pending claims or litigation that could materially affect the Company results going forward.

Note 7 – Stockholders’ Deficit

Recapitalization

As disclosed in Note 1, on May 25, 2021, the Company entered into a Merger Agreement (the “Merger”) with Alopexx, Inc. (formerly One Biopharma Inc.) (“OBP”), a related party under common control, and pursuant to the Merger, the shareholders of OBP’s common stock received \$2.92 for every 1,000 common shares. The 3,427,908 OBP common shares were purchased for total consideration of \$10,009. These shares were retired after the purchase. In addition, the recapitalized Company decreased the amount of authorized shares from 10,000,000 to 1,000,000 subsequent to this transaction.

Additionally, in connection with the Merger in May 2021, on a one-to-one share basis, OBP’s 3,000,000 Series A Preferred Stock was converted into 3,000,000 shares of Alopexx’s non-voting common stock. There were no additional adjustments recorded to accumulated deficit or additional paid-in capital as a result of the Merger. The Company has retroactively reflected the capitalization in the balance sheets, statements of operations, statements of stockholders’ deficit and cash flows.

In the event of any voluntary or involuntary liquidation, the stockholders of shares of Common Stock then outstanding (irrespective of whether they are shares of Voting Common Stock or Non-Voting Common Stock) shall be entitled to be paid out ratably after any preferential payments on any outstanding shares of Preferred Stock, if applicable.

Preferred Stock

The Company’s Certificate of Incorporation provides that the Company is authorized to issue 3,000,000 shares of Preferred Stock, \$0.0001 par value per share. As of December 31, 2021 and 2020, there was no Preferred Stock issued or outstanding.

Non – Voting Common Stock

The Company’s Certificate of Incorporation provides that the Company is authorized to issue 5,000,000 shares of Non-Voting Common Stock, \$0.0001 par value per share. As of December 31, 2021, there were 3,000,000 shares of Non-Voting Common Stock issued and outstanding.

Common Stock

The Company’s Certificate of Incorporation provides that the Company is authorized to issue 1,000,000 shares of Voting Common Stock, \$0.0001 par value per share at December 31, 2021 and 10,000,000 shares authorized at December 31, 2020.

As discussed above, in conjunction with the Merger, the 3,427,908 OBP common shares were purchased for total consideration of \$10,009. These shares were retired after the purchase.

During the year ended December 31, 2021, the Company issued 200,000 shares to two shareholders at a purchase price of \$0.06 per share in exchange for \$12,000 in proceeds. As of December 31, 2021, there were 200,000 shares issued and outstanding.

Contribution from Related Party

During 2021, a related party of the Company contributed \$394,490 for no consideration and consisted of \$99,490 of cash and \$295,000 of a contribution related to payments of accrued expenses related to license fees. These contributions were recorded as capital contributions from related party to additional paid-in capital on the statements of equity.

Contribution of Principal and Interest of Related Party Debt

As described above, the Company and KLP entered into a contribution agreement that effectively forgave the related party convertible notes payable and term notes payable. The total amount was treated as a capital contribution from related party for no consideration and consisted of \$800,000 in principal and \$87,796 (see Note 5).

Equity Compensation Plan

In April 2019, OBP established an equity incentive plan, under which 131,181 shares of common stock was reserved for issuance to employees, non-employee directors and consultants. The 2019 Equity Incentive plan is set to expire on April 11, 2029, ten years after its adoption. As of December 31, 2021 and December 31, 2020, there are no shares issued or outstanding as part of the equity incentive plan.

Note 8 – Related Parties

Convertible Notes Payable – Related Parties

On March 6, 2020, the Company and the majority shareholder, KLP OBP, LLC (“KLP”), a related party through common ownership entered into a convertible loan agreement, in which the Company received \$600,000. The note bore interest at rate of 7% per annum. At December 31, 2020, there was accrued interest of \$34,521. As of December 31, 2020, the outstanding principal balance was \$600,000. The note was convertible into shares of preferred stock at a conversion price of 85% of the per share offering price of a *qualified financing event* which the agreement defines as “a transaction or series of transactions with the principal purpose of raising capital pursuant to the which the Company issues and sells shares of its preferred stock for aggregate gross proceeds of at least \$20,000,000 (excluding all proceeds from the incurrence of indebtedness, including the Notes, that is convertible into such preferred stock, or otherwise canceled in consideration for the issuance of such preferred stock). Management evaluated the accounting guidance for embedded conversion features and ultimately determined that the embedded conversion feature did not require to be bifurcated under ASC Topic 815 Derivatives and Hedging and therefore, the convertible debt instrument is accounted for as a single liability measured at amortized cost. On December 23, 2021, the Company and KLP entered into a contribution agreement and effectively forgave the principal and interest related to this loan for no consideration. As a result, the Company recognized a capital contribution to additional paid-in capital on the statements of equity in the amount of \$675,255.

On October 25, 2021, the Company and shareholder, Werth Family Investment Associates, LLC, entered into a convertible loan agreement, in which the Company received \$200,000. The note bears interest at rate of 8% per annum and is payable in full on October 20, 2023. At December 31, 2021 and December 31, 2020, there was accrued interest of \$3,112 and \$0, respectively. As of December 31, 2021 and December 31, 2020, the outstanding principal balance was \$200,000 and \$0, respectively. The note is convertible into shares of common stock at a conversion price of 75% of the per share offering price of a *next equity financing event* which the agreement defines as “a sale by the Company of its shares in an initial public offering from which the Company receives gross proceeds of not less than \$25,000,000 and in the event such initial public offering does not occur before the first anniversary, the next equity financing means the sale by the Company of its Shares in a public or private offering from which the Company receives gross proceeds of not less than \$5,000,000.” Management evaluated the accounting guidance for embedded conversion features and ultimately determined that the embedded conversion feature did not require to be bifurcated under ASC Topic 815 Derivatives and Hedging and therefore, the convertible debt instrument is accounted for as a single liability measured at amortized cost.

Notes Payable – Related Parties

In three congruent installments during the year ended December 31, 2020, August 4th, October 5th and November 11th, KLP loaned the Company \$100,000, \$25,000 and \$75,000, respectively, for an aggregate of \$200,000. All three loans bore interest at a rate of 5% per annum. At December 31, 2020, there was accrued interest of \$2,842. As of December 31, 2020, the outstanding principal balance on the notes was \$200,000. On December 23, 2021, the Company and KLP entered into a contribution agreement and effectively forgave the principal and interest related to these loans for no consideration. As a result, the Company recognized a capital contribution to additional paid-in capital on the statements of equity in the amount of \$212,541.

Contribution from Related Party

During 2021, a related party of the Company contributed \$394,490 for no consideration and consisted of \$99,490 of cash and \$295,000 of a contribution related to payments of accrued expenses related to license fees. These contributions were recorded as capital contributions from related party to additional paid-in capital on the statements of equity.

Note 9 – Income Taxes

At December 31, 2021, the Company has approximately \$4,770,000 of operating loss carryforwards for federal and \$4,821,000 of operating loss carryforwards for Massachusetts state tax purposes that may be applied against future taxable income. None of the federal net operating losses will expire, however the federal net operating losses are subject to 80% of taxable income, and the Massachusetts net operating losses will begin to expire in the year 2038 if not utilized prior to that date. There is no provision for income taxes because the Company has historically incurred operating losses and maintains a full valuation allowance against its net deferred tax assets. The valuation allowance increased by approximately \$292,000 and \$589,000 during the years 2021 and 2020 respectively. The deferred tax assets are approximately \$1,548,000 and \$1,256,000 at December 31, 2021 and 2020, respectively.

A reconciliation of the statutory U.S. Federal rate to the Company's effective tax rate is as follows:

	December 31,	
	2021	2020
Federal income tax benefit at statutory rate	21.00%	21.00%
State income tax, net of federal benefits	6.23%	6.09%
Research & development credits	3.81%	8.61%
Permanent items	(0.51)%	(1.07)%
Change in valuation allowance	(30.53)%	(34.63)%
Provision from income taxes	—%	—%

The tax effect of temporary differences that gave rise to significant portion of the deferred tax assets / (liabilities) were as follows:

	December 31,	
	2021	2020
Net Operating loss carryforwards - Federal	\$ 1,001,656	\$ 806,264
Net Operating loss carryforwards - State	304,708	245,282
Research and development credits	232,224	195,722
Accrued Liabilities	9,761	8,910
Depreciation and Amortization	(99)	(99)
Valuation allowance	(1,548,250)	(1,256,079)
Net deferred tax assets	\$ —	\$ —

In assessing the realizability of deferred tax assets, management considers whether it is more likely than not that some portion or all of the deferred tax asset will not be realized. The Company's ability to realize its deferred tax assets depends upon the generation of sufficient future taxable income to allow for the utilization of the deductible temporary difference carryforwards. At this time, based on current facts and circumstances, management believes that is not likely that the Company will realize the benefits for its deferred tax assets, and a valuation allowance has been recorded on the same.

The Company does not have any recorded unrecognized tax benefit for uncertain tax positions as of December 31, 2021 and 2020.

Note 10 - Subsequent Events

The Company has completed an evaluation of all subsequent events through March 4, 2022 the date the financial statements were issued. Except as described below, the Company has concluded that no subsequent event has occurred that requires disclosure.

On January 5, 2022, the Company entered into two convertible note agreements, including with a related party, in which the Company received \$150,000 in cash proceeds. The notes bear interest at a rate of 5% per annum and are set to mature one year from their commencement dates. The notes are automatically converted into the Company's voting common stock at 75% of the purchase price of a future financing of \$25 million prior to the first-year anniversary of the agreement or \$5 million after the first year of the agreement.

On February 17, 2022, the Company entered into a convertible note agreement with a related party, in which the Company received \$200,000 in cash proceeds. The note bears interest at a rate of 5% per annum and is set to mature one year from its commencement date. The note is automatically converted into the Company's voting common stock at 75% of the purchase price of a future financing of \$25 million prior to the first-year anniversary of the agreement or \$5 million after the first year of the agreement.

In February 2022, the Company amended the four outstanding convertible notes payable agreements with a total principal balance of \$550,000 to decrease the automatic conversion threshold. Subsequent to this amendment, the notes are automatically converted into the Company's voting common stock at 75% of the purchase price of a future financing of \$10 million prior to the first-year anniversary of the agreement or \$5 million after the first year of the original agreement.

On March 24, 2022, the Company entered into a convertible note agreement with a related party, in which the Company received \$200,000 in cash proceeds. The note bears interest at a rate of 5% per annum and is set to mature one year from its commencement date. The note is automatically converted into the Company's voting common stock at 75% of the purchase price of a future financing of \$10 million prior to the first-year anniversary of the agreement or \$5 million after the first year of the agreement.

Shares of Common Stock

ALOPEXX, Inc.

Alopexx, Inc.

PRELIMINARY PROSPECTUS

ThinkEquity

, 2022

Through and including _____, 2022 (25 days after the date of this prospectus), all dealers that effect transactions in our common stock, whether or not participating in this offering, may be required to deliver a prospectus. This delivery requirement is in addition to the dealer's obligation to deliver a prospectus when acting as an underwriter and with respect to unsold allotments or subscriptions.

PART II

INFORMATION NOT REQUIRED IN PROSPECTUS

Item 13. Other Expenses of Issuance and Distribution

The following table sets forth the costs and expenses, other than the underwriting discounts and commissions, payable by the registrant in connection with the sale of common stock being registered. All amounts are estimates except for the SEC registration fee, the Financial Industry Regulatory Authority, or FINRA, filing fee and Nasdaq listing fee.

Item	Amount to be paid
SEC registration fee	\$ 1,699
FINRA filing fee	*
Nasdaq filing fee	*
Printing fees and expenses	*
Legal fees and expenses	*
Accounting fees and expenses	*
Underwriter's expenses	*
Transfer agent's fees and expenses	*
Miscellaneous fees and expenses	*
Total	\$ *

* To be provided by amendment.

Item 14. Indemnification of Directors and Officers

Section 145 of the DGCL, or Section 145, provides that a Delaware corporation may indemnify any person who was, is or is threatened to be made, party to any threatened, pending or completed action, suit or proceeding, whether civil, criminal, administrative or investigative (other than an action by or in the right of such corporation), by reason of the fact that such person is or was an officer, director, employee or agent of such corporation or is or was serving at the request of such corporation as a director, officer, employee or agent of another corporation or enterprise. The indemnity may include expenses (including attorneys' fees), judgments, fines and amounts paid in settlement actually and reasonably incurred by such person in connection with such action, suit or proceeding, provided such person acted in good faith and in a manner he reasonably believed to be in or not opposed to the corporation's best interests and, with respect to any criminal action or proceeding, had no reasonable cause to believe that his or her conduct was illegal. A Delaware corporation may indemnify any persons who are, were or are a party to any threatened, pending or completed action or suit by or in the right of the corporation by reason of the fact that such person is or was a director, officer, employee or agent of another corporation or enterprise. The indemnity may include expenses (including attorneys' fees) actually and reasonably incurred by such person in connection with the defense or settlement of such action or suit, provided such person acted in good faith and in a manner he reasonably believed to be in or not opposed to the corporation's best interests, provided that no indemnification is permitted without judicial approval if the officer, director, employee or agent is adjudged to be liable to the corporation. Where an officer or director is successful on the merits or otherwise in the defense of any action referred to above, the corporation must indemnify him against the expenses which such officer or director has actually and reasonably incurred.

Section 145 further authorizes a corporation to purchase and maintain insurance on behalf of any person who is or was a director, officer, employee or agent of the corporation or is or was serving at the request of the corporation as a director, officer, employee or agent of another corporation or enterprise, against any liability asserted against him and incurred by him in any such capacity, or arising out of his or her status as such, whether or not the corporation would otherwise have the power to indemnify him under Section 145.

Our bylaws provide that we must indemnify our directors and officers to the fullest extent permitted by the DGCL and must indemnify against all expenses, liability, and loss incurred in investigating, defending or participating in such proceedings.

As of the date of the effectiveness of this registration statement, we have entered into separate indemnification agreements with each of our directors and executive officers. Each indemnification agreement provides, among other things, for indemnification to the fullest extent permitted by law and our bylaws against any and all expenses, judgments, fines, penalties and amounts paid in settlement of any claim. The indemnification agreements provide for the advancement or payment of all expenses to the indemnitee.

Item 15. Recent Sales of Unregistered Securities

On October 25, 2021, the Company entered into a convertible note agreement with a related party in which the Company received \$200,000 in cash proceeds. The note bears interest at a rate of 5% per annum and is set to mature one year from its commencement date. The note is automatically converted into the Company's voting common stock at 75% of the purchase price of a future financing of \$10 million prior to the first-year anniversary of the agreement or \$5 million after the first-year anniversary of the agreement.

On January 5, 2022, the Company entered into two convertible note agreements, including with a related party, for which the Company received \$150,000 in cash proceeds. The notes bear interest at a rate of 5% per annum and are set to mature one year from their commencement dates. The notes are automatically converted into the Company's voting common stock at 75% of the purchase price of a future financing of \$10 million prior to the first-year anniversary of the agreement or \$5 million after the first year anniversary of the agreement.

On February 17, 2022, the Company entered into a convertible note agreement with a related party, in which the Company received \$200,000 in cash proceeds. The note bears interest at a rate of 5% per annum and is set to mature one year from its commencement date. The note is automatically converted into the Company's voting common stock at 75% of the purchase price of a future financing of \$10 million prior to the first-year anniversary of the agreement or \$5 million after the first year of the agreement.

On March 24, 2022, the Company entered into a convertible note agreement with a related party, in which the Company received \$200,000 in cash proceeds. The note bears interest at a rate of 5% per annum and is set to mature one year from its commencement date. The note is automatically converted into the Company's voting common stock at 75% of the purchase price of a future financing of \$10 million prior to the first-year anniversary of the agreement or \$5 million after the first year of the agreement.

These issuances were made in reliance upon Section 4(a)(2) of the Securities Act of 1933, as amended, and Regulation D, Rule 506(d), and did not involve any underwriters, underwriting discounts or commissions, or any public offering. The persons and entities who received such securities have represented their intention to acquire these securities for investment only and not with a view to or for sale in connection with any distribution thereof, and appropriate legends are be affixed to all share certificates issued. All recipients have adequate access through their relationship with us to information about us.

Item 16. Exhibits and Financial Statement Schedules)

(a) Exhibits

- | | |
|---------------------------|--|
| 1.1* | Form of Underwriting Agreement. |
| 3.1 ** | Certificate of Incorporation of the Registrant as currently in effect. |
| 3.2 ** | Form of Amended and Restated Certificate of Incorporation of Registrant, to be in effect prior to the completion of this offering. |
| 3.3 ** | Bylaws of the Registrant, as currently in effect. |
| 3.4* | Form of Amended and Restated Bylaws of the Registrant, to be in effect prior to the completion of this offering. |
| 4.1* | Specimen Common Stock Certificate. |
| 5.1* | Opinion of McElroy, Deutsch Mulvaney & Carpenter LLP. |
| 10.1** | 2022 Equity Plan and form of award agreements thereunder. |
| 10.2* | Form of Indemnification Agreement between the Registrant and each of its executive officers. |
| 10.3* | Form of Indemnification Agreement between the Registrant and each of its directors. |
| 10.4 ** # | Exclusive Patent License Agreement dated as of December 4, 2007, by and between Alopexx Pharmaceuticals, LLC and The Brigham and Women's Hospital, Inc., as amended on November 30, 2009, January 27, 2010, and March 6, 2015. |
| 10.5 ** # | Amendment No. 5 to Exclusive Patent License Agreement dated as of February 2, 2022, by and between Alopexx, Inc. and The Brigham and Women's Hospital, Inc. |
| 10.6 ** # | Exclusive Patent License Agreement dated as of March 2, 2012, by and between Alopexx Vaccine, LLC and The Brigham and Women's Hospital, Inc. as amended on April 9, 2019. |
| 10.7 ** # | Amendment No. 2 to the Exclusive Patent License Agreement by and between Alopexx, Inc. and Brigham and Women's Hospital, Inc. dated as of February 2, 2022. |
| 23.1 | Consent of Marcum LLP |
| 23.2* | Consent of McElroy, Deutsch Mulvaney & Carpenter LLP (included in Exhibit 5.1) |
| 99.1** | Consents of Director Nominees |
| 107.1 ** | Filing Fee Table |

* To be filed by amendment.

Certain confidential information contained in this agreement has been omitted because it is not material and would be competitively harmful if publicly disclosed.

** Previously filed.

Item 17. Undertakings

(a) 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, as amended (the "Securities Act");

(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 Securities and Exchange Commission (the "Commission") pursuant to Rule 424(b) if, in the aggregate, the changes in volume and price represent no more than 20% change in the maximum aggregate offering price set forth in the "Calculation of Registration Fee" table in the effective registration statement;

(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 (a)(1)(i), (ii), and (iii) of this section do not apply if the information required to be included in a post-effective amendment by those paragraphs is contained in reports filed with or furnished to the Commission by the registrant pursuant to section 13 or section 15(d) of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), that are incorporated by reference in the registration statement.

(2) That, for the purpose of determining any liability under the Securities Act, each such post-effective amendment shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial *bona fide* offering thereof.

(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 to any purchaser: If the registrant is subject to Rule 430C (§230.430C of this chapter), 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 prospectus that is part of the registration statement will, as to a purchaser with a time of contract of sale prior to such first use, supersede or modify any statement that was made in the registration statement or prospectus that was part of the registration statement or made in any such document immediately prior to such date of first use.

(5) That, for the purpose of determining liability of the registrant under the Securities Act to any purchaser in the initial distribution of the securities, the undersigned registrant undertakes that in a primary offering of securities of the undersigned registrant pursuant to this registration statement, regardless of the underwriting method used to sell the securities to the purchaser, if the securities are offered or sold to such purchaser by means of any of the following communications, the undersigned registrant will be a seller to the purchaser and will be considered to offer or sell such securities to such purchaser:

(i) Any preliminary prospectus or prospectus of the undersigned registrant relating to the offering required to be filed pursuant to Rule 424 (§230.424 of this chapter);

(ii) Any free writing prospectus relating to the offering prepared by or on behalf of the undersigned registrant or used or referred to by the undersigned registrant;

(iii) The portion of any other free writing prospectus relating to the offering containing material information about the undersigned registrant or its securities provided by or on behalf of the undersigned registrant; and

(iv) Any other communication that is an offer in the offering made by the undersigned registrant to the purchaser.

(b) 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 SEC such indemnification is against public policy as expressed in the 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 Act and will be governed by the final adjudication of such issue.

(c) The undersigned Registrant hereby undertakes that:

(1) For purposes of determining any liability under the Securities Act of 1933, the information omitted from the form of prospectus filed as part of this registration statement in reliance upon Rule 430A and contained in a form of prospectus filed by the Registrant pursuant to Rule 424(b)(1) or (4) or 497(h) under the Securities Act shall be deemed to be part of this registration statement as of the time it was declared effective.

(2) For the purpose of determining any liability under the Securities Act of 1933, each post-effective amendment that contains a form of prospectus shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof.

Signatures

Pursuant to the requirements of the Securities Act of 1933, as amended, the Registrant has duly caused this Registration Statement on Form S-1 to be signed on its behalf by the undersigned, thereunto duly authorized, in Cambridge, Massachusetts, on May 2, 2022.

ALOPEXX, INC.

By: /s/ Daniel R. Vlock

Name: Daniel R. Vlock

Title: President and Chief Executive Officer

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints Daniel R. Vlock his/her true and lawful attorney-in-fact and agent with full power of substitution and re-substitution, for him/her and in his name, place and stead, in any and all capacities to sign any or all amendments (including, without limitation, post-effective amendments) to this Registration Statement, any related Registration Statement filed pursuant to Rule 462(b) under the Securities Act of 1933, as amended, and any or all pre- or post-effective amendments thereto, and to file the same, with all exhibits thereto, and all other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorney-in-fact and agent, full power and authority to do and perform each and every act and thing requisite and necessary to be done in and about the premises, as fully for all intents and purposes as he or she might or could do in person, hereby ratifying and confirming that said attorney-in-fact and agent, or any substitute or substitutes for him, may lawfully do or cause to be done by virtue hereof. Pursuant to the requirements of the Securities Act of 1933, as amended, the following persons in the capacities and on the dates indicated have signed this Registration Statement below.

Signature	Title	Date
<u>/s/ Daniel R. Vlock</u> Daniel R. Vlock	President, Chief Executive Officer and Director (Principal Executive Officer)	May 2, 2022
<u>/s/ Thomas T. Thomas</u> Thomas T. Thomas	Chief Financial Officer (Principal Financial and Accounting Officer)	May 2, 2022
<u>/s/ Peter J. Werth</u> Peter J. Werth	Director	May 2, 2022



INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM'S CONSENT

We consent to the inclusion in this Registration Statement of Alopexx, Inc. on Form S-1 (File No. 333-263328) of our report dated March 4, 2022, except for Note 10, to which the date is April 7, 2022, which includes an explanatory paragraph as to the Company's ability to continue as a going concern, with respect to our audits of the financial statements of Alopexx, Inc. as of December 31, 2021 and 2020 and for the years then ended, which report appears in the Prospectus, which is part of this Registration Statement. We also consent to the reference to our Firm under the heading "Experts" in such Prospectus.

/s/ Marcum LLP

Marcum LLP
Hartford, CT
May 2, 2022
