UNITED STATES
SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K

(Mark One)

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2023

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**
FOR THE TRANSITION PERIOD FROM TO

Commission File Number 001-40591

HCW Biologics Inc.

(Exact name of registrant as specified in its Charter)

Delaware	**82-5024477**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
2929 N. Commerce Parkway Miramar, Florida	**33025**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code: (954) 842–2024

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, par value $0.0001 per share	HCWB	The Nasdaq Stock Market LLC

Securities registered pursuant to Section 12(g) of the Act: **None**

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. YES ☐ NO ☒

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or 15(d) of the Act. YES ☐ NO ☒

Indicate by check mark whether the registrant: (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. YES ☒ NO ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). YES ☒ NO ☐

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

Large accelerated filer	☐	Accelerated filer	☐
Non-accelerated filer	☒	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 13(a) of the Exchange Act. ☒

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report. ☐

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements. ☐

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1(b). ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). YES ☐ NO ☒

The aggregate market value of the common stock held by non-affiliates of the registrant as of June 30, 2023, the last business day of the registrant's most recently completed second fiscal quarter, was approximately $42.8 million based on the closing price of the shares of $2.17 as reported on the Nasdaq Global Market on such date. This calculation does not reflect a determination that certain persons are affiliates of the registrant for any other purpose.

The number of shares of the registrant's common stock outstanding as of March 28, 2024 was 37,823,394.

DOCUMENTS INCORPORATED BY REFERENCE

Part III incorporates by reference certain information from the registrant's definitive proxy statement (the "Proxy Statement") relating to its 2024 Annual Meeting of Stockholders. The Proxy Statement will be filed with the United States Securities and Exchange Commission within 120 days after the end of the fiscal year to which this report relates.

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Special Note Regarding Forward-Looking Statements

This Annual Report on Form 10-K (the "Annual Report") contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Securities Exchange Act of 1934, as amended, or the Exchange Act. All statements other than statements of historical facts contained in this Annual Report, including statements regarding our future results of operations and financial position, business strategy, prospective products, product approvals, research and development costs, timing and likelihood of success of prospective products, plans and objectives of management for future operations, future capital-raising activities, adequacy of our cash resources and working capital, lingering effects of the COVID-19 pandemic on our research and development activities (including persistent staffing issues at clinical sites, as well as delays and backlog at testing facilities needed to perform IND-enabling activities), and future results of anticipated products, are forward-looking statements. These statements involve known and unknown risks, uncertainties and other important factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements.

In some cases, you can identify forward-looking statements by terms such as "may," "will," "should," "expect," "plan," "anticipate," "could," "intend," "target," "project," "contemplates," "believes," "estimates," "predicts," "potential" or "continue" or the negative of these terms or other similar expressions. The forward-looking statements in this Annual Report are only predictions. We have based these forward-looking statements largely on our current expectations and projections about future events and financial trends that we believe may affect our business, financial condition and results of operations. These forward-looking statements are subject to certain risks and uncertainties that could cause actual results to differ materially from those anticipated in the forward-looking statements. Factors that might cause such a difference include, but are not limited to, those discussed in Part II, Item 1A - "Risk Factors" of this Annual Report and in other filings we make with the Securities and Exchange Commission (the "SEC") from time to time. The events and circumstances reflected in our forward-looking statements may not be achieved or occur and actual results could differ materially from those projected in the forward-looking statements. Moreover, we operate in an evolving environment. New risk factors and uncertainties may emerge from time to time, and it is not possible for management to predict all risk factors and uncertainties. These forward-looking statements speak only as of the date hereof. Except as required by applicable law, we do not plan to publicly update or revise any forward-looking statements contained herein, whether as a result of any new information, future events, changed circumstances or otherwise.

References in this Annual Report to "we," "our," "us," "HCW Biologics," "HCWB," and the "Company" refer to HCW Biologics Inc.

HCW BIOLOGICS INC. and TOBI are trademarks of HCW Biologics Inc. All other brand names or trademarks appearing in this Annual Report are the property of their respective holders. Solely for convenience, the trademarks and trade names in this Annual Report are referred to without the ® and ™ symbols, but such references should not be construed as any indicator that their respective owners will not assert, to the fullest extent under applicable law, their rights thereto.

PART I

Item 1. Business.

Overview

HCW Biologics Inc. is a clinical-stage biopharmaceutical company focused on discovering and developing novel immunotherapies to lengthen health span by disrupting the link between chronic, low-grade inflammation and age-related diseases. We believe age-related, chronic, low-grade inflammation, or "inflammaging," is a significant contributing factor to several diseases and conditions, such as cancer, cardiovascular disease, diabetes, neurodegenerative diseases, and autoimmune diseases. The induction and retention of low-grade inflammation in an aging human body is mainly the result of the accumulation of non-proliferative but metabolically active senescent cells, which can also be caused by persistent activation of protein complexes, known as inflammasomes, in innate immune cells. These two elements share common mechanisms in promoting secretion of proinflammatory proteins and in many cases interact to drive senescence, and thus, inflammaging. Our novel approach is to reduce senescent cells and eliminate the proinflammatory factors they secrete systemically through multiple pathways. We believe our approach has the potential to fundamentally change the treatment of age-related diseases.

Senescence is a physiologic process important in promoting wound healing, tissue homeostasis, regeneration, embryogenesis, fibrosis regulation, and tumorigenesis suppression. However, accumulation of senescent cells with Senescence-Associated Phenotype ("SASP") proinflammatory factors has been implicated as a major source of chronic sterile inflammation leading to many aging-related pathologies. SASP factors, including proinflammatory cytokines, chemokines, and proteinases, drive an inflammation cycle. Senescence is considered a stress response and can be induced by a wide range of intrinsic and extrinsic insults. Over time, these insults cause normal tissue cells to enter a senescent state of irreversible growth arrest accompanied by the release of SASP factors. The inflammation cycle promoted by SASP factors also activates inflammasomes. As the first line of defense to infections or tissue injuries, the innate immune system activates inflammasomes to initiate protective immune responses. Similar to senescent cells, prolonged activation of inflammasomes promote the release of highly proinflammatory cytokines. Unresolved activation of inflammasomes due to chronic infection or persistent tissue injury leads to chronic low-grade inflammation, which perpetuates this cycle.

We have combined our deep understanding of disease-related immunology with our expertise in advanced protein engineering to develop our TOBI™ discovery platform, or Tissue factOr-Based fusIon discovery platform, for the design of category-defining immunotherapeutic drugs. Our focus is to develop protein-based immunotherapies that are administered by subcutaneous injection. We have selected two molecules as our lead product candidates: HCW9218 and HCW9302. HCW9218 is a bifunctional immunotherapeutic designed with the capabilities to neutralize transforming growth factor-β and stimulate immune cells, targeting senescent cells and the SASP factors they secrete. HCW9302 is designed to activate and expand regulatory T cells, which deactivate inflammasomes. We have chosen these product candidates because we believe they have the potential to become transformative immunotherapeutics for the treatment of a broad range of age-related diseases, and both can be administered to patients by subcutaneous injection.

Studies have shown that strategies to reduce or eliminate senescent cells can delay, prevent, and improve age-related dysfunctions, including cancer. Unfortunately, to date, there has been limited clinical success in targeting senescent cell accumulation or aberrant inflammasome activity using small molecule-based approaches. Preclinical research and preliminary results from first-in-human clinical trials indicate that our immunotherapeutic approach may achieve success for cancer indications, and many other age-related diseases and conditions. We believe our lead product candidates represent a novel immunotherapeutic approach and a clinically promising new class of senotherapeutic drugs for the treatment of age-related diseases.

HCW9218: Novel Bifunctional Immunotherapeutic with TGF-β Trap

HCW9218 is a proprietary molecule designed to treat the impact of accumulated senescent cells and the SASP factors which they secrete by eliminating senescent cells (*i.e.*, senescent cell reducing effect) and reducing SASP factors (*i.e.*, senomorphic effect). This proprietary molecule is a heterodimeric, bifunctional fusion protein complex comprised of extracellular domains of the human transforming growth factor-β ("TGF-β") receptor II, as a TGF-β trap for TGF-β neutralization, and a human interleukin ("IL")-15/IL-15 receptor α complex for immune cell stimulation. Together, the activities of these domains drive senescent cell clearance and SASP factor neutralization.

The Company believes it has demonstrated the potential to increase the efficacy of chemotherapy when HCW9218 is used in combination with chemotherapy in the treatment of cancer. Chemotherapy is the current standard-of-care treatment for most forms of cancer. However, these treatments often result in toxicity and unwanted side effects. This drives senescence and the secretion of proinflammatory SASP factors, a process resulting in therapy-induced senescence ("TIS"). One of the most aggressive, immunosuppressive SASP factors is TGF-β, well known for its role in cancer progression. Our data has shown that HCW9218 treatment reduces immunosuppressive activities in the tumor microenvironment ("TME"), and enhances immune cell infiltration and cytotoxicity in tumors to eliminate TIS cancer cells, which can improve the efficacy of chemotherapy treatments.

The Company believes it has also demonstrated the potential to boost the performance of immune checkpoint inhibitors in extensive animal testing in different "cold" tumor models when used in combination with HCW9218. While immune checkpoint inhibitors are considered a breakthrough therapy that has revolutionized the way cancer is treated, the response rates among patients remains stubbornly low in many of the most common cancer indications. The Company published a paper in October 2021 authored by our scientific research team in the peer-reviewed journal, *Molecular Therapy*, entitled "Bifunctional TGF-β trap/IL-15 Protein Complex Elicits Potent NK Cell and $CD8^+$ T Cell Immunity Against Solid Tumors," which supports these findings. The reference to our paper does not constitute incorporation by reference of the information contained in the paper.

We believe HCW9218 has unique features that allow it to boost the performance of immune checkpoint inhibitors:

- HCW9218 infiltrates into the secondary lymphoid tissues and solid tumors.
- HCW9218 activates, expands and induces tumor trafficking of progenitor exhausted stem-like and transitory $CD8^+$ T cells.
- HCW9218 induces Natural Killer ("NK") cell and $CD8^+$ T cell activation, proliferation, and infiltration into the tumor microenvironment which correlates with disease stabilization.
- HCW9218 significantly reduced blood levels of TGF-β in cancer patients in a dose-dependent manner, without causing treatment-emergent skin lesions and bleeding events previously reported with TGF-β antagonists in clinic.

For the longer-term, we believe HCW9218 may have much broader therapeutic potential beyond cancer to other age-related diseases and conditions because of its ability to promote cell-mediated mechanisms to reduce senescent cells and alleviate the proinflammatory factors they secrete. Scientists from the Company hypothesized that HCW9218 is an immunotherapeutic agent that rejuvenates a dysfunctional immune system and neutralizes TGF-β, and can act as an effective senescent-cell reducing and senomorphic drug.

HCW9302: Novel Immunotherapeutic for T_{reg} Expansion

HCW9302 is a preclinical fusion protein molecule that contains two IL-2 domains linked by an extracellular tissue factor domain. Recombinant IL-2 has an unfavorable pharmacokinetic profile limiting its therapeutic use. HCW9302 is designed to overcome the most restrictive issues of IL-2's dose-limiting toxicities. Preclinical studies demonstrated that HCW9302 exhibited a longer serum half-life and was well tolerated, offering support for the potential of HCW9302 to treat a wide variety of autoimmune and pro-inflammatory, age-related diseases.

IL-2 signaling is essential for homeostasis of T_{reg} cells. Since recombinant IL-2 has an unfavorable pharmacokinetic profile and induces cytokine release syndrome limiting its therapeutic use, our challenge was to create an immunotherapeutic with the therapeutic advantages of IL-2 but that was well tolerated. HCW9302 addresses this challenge. We found that HCW9302 exhibited a longer serum half-life with an approximately 1,000-fold higher affinity for the IL2Rα than IL-2. In addition, preclinical studies have shown HCW9302 can be administered at a dosing range that expanded and activated T_{reg} cells but not $CD4^+$ effector T cells. We believe that these studies support the clinical development of HCW9302 as a potential therapeutic agent for treatment of autoimmune and proinflammatory diseases.

Other Compounds under Development

Using our TOBI platform, we created over 30 molecules that can be administered by subcutaneous injection as well as used in adoptive cell therapy approaches. This modular and tunable technology has allowed us to generate a novel pipeline of internally-developed product candidates capable of activating and targeting desired immune responses and blocking unwanted immunosuppressive activities. We have a library of fusion molecules with cytokines, chemokines, ligands, receptors, and internally-developed single-chain antibodies.

Clinical Development Strategy

Our goal is to develop transformative immunotherapies to lengthen health span by disrupting the link between cellular senescence, chronic inflammation, and age-related diseases and conditions. Based on extensive preclinical research and human data from clinical trials, we believe that our data point toward the possibility that we have created a new class of immunotherapeutics for cancer and other age-related diseases, and beyond that to slow down or reverse the effects of aging itself.

Our clinical development strategy is a two-pronged strategy based on our two lead compounds, HCW9218 and HCW9302. HCW9218 is a clinical-stage drug candidate designed to be both a senescent-cell reducing and senomorphic drug. Multiple preclinical studies have revealed that increased normal tissue cellular senescence can promote tumor progression, creating a link between aging and cancer, including diminished health span and reduced overall survival in patients. Thus, cancer indications were selected as the gateway indication for clinical development for HCW9218. Now that clinical studies have begun, we will use the human data from these studies to inform us on the indications we will target for advancement to Phase 2 clinical trials. HCW9302 is a preclinical drug candidate designed to address chronic inflammatory responses and associated tissue destruction typical of autoimmune disease. Thus, we selected an autoimmune disease as the gateway indication for HCW9302.

Based on clinical data from the Phase 1/1b clinical trials, we have determined that we will advance clinical studies to evaluate HCW9218 in combination with standard-of-care treatments in ovarian cancer and pancreatic cancer. We entered into an agreement with UPMC to conduct an Investigator-sponsored Phase 2 clinical trial to evaluate HCW9218 in patients with metastatic advanced stage ovarian cancer in combination with neoadjuvant chemotherapy. Study enrollment is expected to begin in the first half of 2024. We are also in negotiations with the National Cancer Institute ("NCI") and other NCI-designated Comprehensive Cancer Centers as possible clinical sites for Phase 2 studies in pancreatic cancer, additional studies in ovarian cancer and studies in other difficult-to-treat cancer indications. Our ability to advance other Phase 2 clinical studies to evaluate HCW9218 depends on ensuring we have sufficient funding to complete the study, securing clinical sites and receiving authorization from the FDA to proceed.

A key component to our clinical development strategy is our focus on the most efficient, cost-effective method of administration of our drugs upon commercialization, which we believe is subcutaneous injection. The fusion protein compounds we created have demonstrated the ability to activate the immune system in vivo and ex vivo as an injectable or cell-based strategy; however, we have chosen to focus clinical development on immunotherapeutics administered by subcutaneous injection. We believe that our chosen method of administration will align with growing concerns about the costs associated with health care treatments. Our vision is to simplify administration by developing injectable treatments that can be administered in a physician's office or, in some instances, self-administered at home.

Our relationships with leading research institutions have been a major contributor to our success. We will continue to foster the relationships with the NCI, the National Institutes of Health, NCI-designated Comprehensive Cancer Centers and other world-class research organizations as collaborators, sponsors and clinical sites. These institutions bring deep experience and expertise that supports correlative studies and publication of findings that we believe will support our effort to establish our immunotherapeutics as a new class of treatment for cancer and other age-related diseases.

Out-Licensing, Cooperative Agreements and Strategic Collaborations

We continue to pursue our strategy of out-licensing certain rights outside of our focus areas, which includes our existing molecules other than our lead product candidates of HCW9218 and HCW9302, and markets such as Greater China, as further discussed under "—Out-License Programs." We plan to expand our out-licensing discussions to include marketing rights to those regions outside of our focus area. We believe the potential for cooperative agreements and collaborations is growing for HCW Biologics, since we are now a clinical-stage company with human data, peer-reviewed research publications, CMC manufacturing and issued patents on fundamental intellectual property.

We signed our first out-license agreement at the end of 2020, when we entered into an exclusive worldwide license (the "Wugen License") with Wugen, Inc. ("Wugen"), a company that specializes in cell-based therapies for cancer. Wugen licensed limited rights to develop, manufacture, and commercialize cell-based therapy treatments for cancer based on two of our internally-developed, multi-cytokine fusion protein molecules, HCW9201 and HCW9206. Wugen has created an off-the-shelf treatment called WU-NK-101 based on the licensed molecules. WU-NK-101 is Wugen's lead memory-like NK cell therapy product and is comprised of cells optimized for anti-cancer function. WU-NK-101 cells possess a unique cytokine-induced memory-like phenotype that supports enhanced anti-tumor activity, robust trafficking, superior proliferation capacity, and metabolic flexibility, all of which contribute to treatment resilience in the adverse tumor microenvironment. A Phase 1 clinical trial of WU-NK-101 for patients with relapsed or refractory (r/r) acute myelogenous leukemia ("AML") was initiated in August 2023. The FDA has also granted Orphan Drug Designation to WU-NK-101 for the treatment of AML.

Under a Cooperative Research and Development Agreement ("CRADA") entered into on December 3, 2022, NCI is collaborating with us to perform a Phase 1b/2 clinical study to evaluate the safety and tolerability of our lead product candidate, HCW9218, in patients with advanced/metastatic and chemo-refractory/chemo-resistant pancreatic cancer. The CRADA is entitled, "A Phase 1b/2 Study of HCW9218, a Bifunctional TGF-β Antagonist/IL-15 Protein Complex, for Advanced Pancreatic Cancer."

Additionally, we are exploring potential cooperative agreements with pharmaceutical companies for joint Phase 2 clinical trials to evaluate HCW9218 in cancer indications when used as an adjuvant therapy to a standard-of-care treatment. This type of arrangement would allow us to evaluate HCW9218 in combination with other cancer treatments with some assistance in offsetting the costs of a Phase 2 randomized trial. The indications we would target for study in these trials are ovarian and pancreatic cancer, although the targeted indication(s) may change as discussions continue. While we are encouraged by the interest shown by these pharma companies, there are no assurances that we will enter into cooperative arrangements for Phase 2 clinical trials to evaluate HCW9218 in combination with cancer therapies.

Pipeline: Clinical Development Update

The clinical development progress of the Company's lead immunotherapeutic programs are summarized in the table below:

HCW Biologics Pipeline

Product	Administration Route	Mechanism of Action	Indication	Discovery	IND-Enabling	Phase 1	Phase 2	Phase 3
HCW9218	*Subcutaneous Injection (In vivo)*	Immune-Cell Activation & TGF-β Neutralization	Solid Tumors[1]	*Enrollment Completed February 2024*				
			Ovarian Cancer[2]	*Initiation Phase 2 Study 1H 2024*				
			Pancreatic Cancer[3]	*Enrollment Completed February 2024*				
HCW9302		T_{reg} Expansion	Autoimmune Disorders	*IND: 1H 2024*				
HCW9201 + HCW9206[4]	*Cell-based Therapy (Ex vivo)*	NK Cell Expansion	AML	Wugen	*Clinical Readout 2H 2024*			

1. Investigator-sponsored Phase 1 clinical trial with University of Minnesota to evaluate HCW9218 in patients with chemo-refractory/chemo-resistant solid tumors, including ovarian, prostate, breast and colorectal cancers.
2. Investigator-sponsored Phase 2 clinical trial with University of Pittsburgh Medical Center with metastatic advanced stage ovarian cancer patients to evaluate HCW9218 in a combination with neoadjuvant chemotherapy.
3. Company-sponsored Phase 1b/2 clinical trial with five clinical sites, including the National Cancer Institute, to evaluate HCW9218 in patients with advanced chemo-refractory/chemo-resistant pancreatic cancer.
4. Wugen's lead clinical program, WU-NK-101, is based on molecules licensed from our Company. Wugen holds an exclusive worldwide license for two of our molecules, HCW9201 and HCW9206. The Wugen License conveys limited rights to develop cell-based therapy treatments for cancer using the licensed molecules. We have retained all other rights to HCW9201 and HCW9206, including, but not limited to, manufacturing rights and injectable rights.

Phase 1 Clinical Trial to Evaluate HCW9218 in Solid Tumors

This single-center Investigator-sponsored Phase 1 clinical trial was initiated in May 2022 and patient enrollment, dosing and safety-evaluation period for this study were completed in February 2024. In this study, the Masonic Cancer Center, University of Minnesota ("UMN") evaluated HCW9218 in patients with solid tumor cancers that progressed after at least two lines of standard-of-care treatment. Dr. Melissa A. Geller, M.D., M.S., Professor and Division Director of Gynecologic Oncology in the Department of Obstetrics, Gynecology and Women's Health at UMN, serves as a Principal Investigator of this trial. At the time that the Phase 1 study was completed in February, over 70% of patients with ovarian cancer (5/7) showed evidence of stable disease.

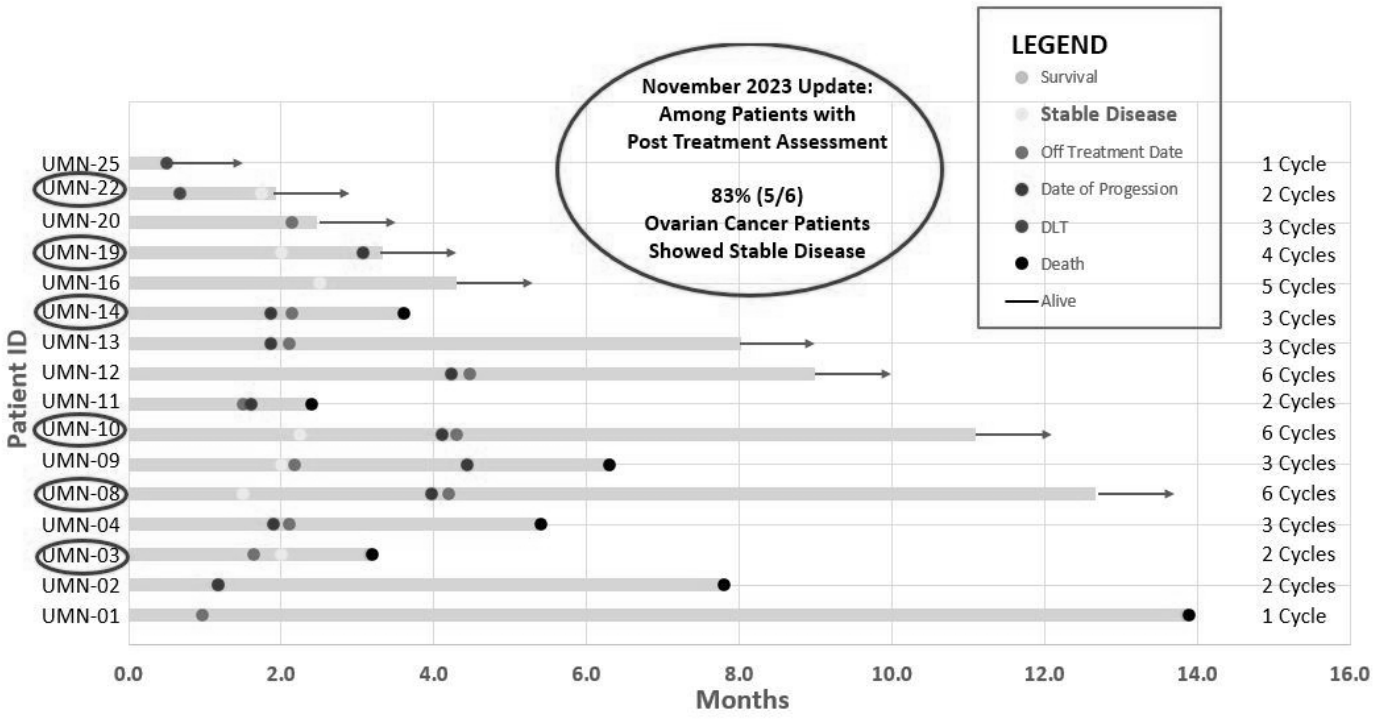
A total of 18 patients participated in this study by the end of February 2024, with at least one dose of HCW9218 administered to each participant. While two dose-limiting toxicities ("DLTs") were experienced, neither of these events triggered stopping rules and the study established Recommended Phase 2 Dose ("RP2D"). The most frequent treatment-related adverse events (at least possibly related to the study medication) were injections site reactions (100% of patients), flu-like symptoms (87% of patients) and decreased lymphocyte counts (93% of patients), all of which are consistent with previous clinical experience with IL-15-based therapies.

A clinical data readout at the 2023 Society for Immunotherapy of Cancer conference ("SITC"), was based on 15 patients who were enrolled in this study as of October 16, 2023. The findings presented at SITC included:

- HCW9218 was administered subcutaneously once every three weeks for up to six cycles at dose levels ("DL") - 0.25 mg/kg (DL1), 0.5 mg/kg (DL2), 0.8 mg/kg (DL3) or 1.2 mg/kg (DL4). The median number of cycles was three.
- 87% (13/15) of patients had >4 lines of prior therapy. Tumor types included: Ovarian (n=6), Colorectal (n=4), Rectal (n=3), and Liver (n=2).
- 53% (8/15) of patients treated with HCW9218 were evaluated in a post-treatment tumor assessment, including biopsies and scanning. Tumor types included: Ovarian (n=3), Colorectal (n=3), Rectal (n= 1) and Liver (n=1).
- 66% (2/3) of patients with ovarian cancer who underwent post-treatment assessments showed stable disease. (By November 2023, 5 out of 6 patients with ovarian cancer showed stable disease. By the end of the study in February 2024, 5 out of 7 patients with ovarian cancer showed stable disease.)
- While there were no complete or partial responses, 50% (4/8) of patients evaluated in post-treatment tumor assessments exhibited stable disease following HCW9218 treatment. Patients showed stable disease lasting over 6 months. Stable disease was observed from DL2, DL3 and DL4.
- Repeated HCW9218 administration at up to the highest planned dose level was well tolerated by patients with chemotherapy-refractory advanced solid tumors, which has provided support for the RP2D level for future studies of HCW9218.
- Analysis of patients' pre- and post-treatment blood and tumor biopsy specimens revealed that HCW9218 induced NK cell and $CD8^+$ T cell activation, proliferation, and infiltration into the tumor microenvironment which correlated with disease stabilization.
- HCW9218 significantly reduced blood levels of TGF-β in cancer patients in a dose-dependent manner, without causing treatment-emergent skin lesions or bleeding events previously reported with TGF-β antagonists in clinical studies.

In November 2023, UMN updated their assessment of disease response after treatment with HCW9218. Data continued to support evaluating HCW9218 in patients with ovarian cancer in Phase 2 clinical trials.

Preliminary Human Data Readout Phase 1 UMN Trial
Ovarian Cancer Patients
Disease Response for Patients with Post-Treatment Assessment
November 2023



Source: Masonic Cancer Center, University of Minnesota.

Phase 2 Clinical Trial to Evaluate HCW9218 in Ovarian Cancer in Combination with a Neoadjuvant Chemotherapy

We entered into an agreement with University of Pittsburgh Medical Center ("UPMC") to conduct an Investigator-sponsored Phase 2 clinical trial to evaluate HCW9218 in patients with metastatic advanced stage ovarian cancer in combination with neoadjuvant chemotherapy. Patient enrollment for this study is expected to begin in the first half of 2024. Designed as a randomized trial, the primary objectives of this study are to evaluate the safety and tolerability of HCW9218 with chemotherapy and the efficacy of the combined regimens in terms of complete pathologic response rate. In the arm of the study that relates to the evaluation of HCW9218, UPMC estimates approximately 33 patients will participate. The estimated duration of treatment is an average of 6–8 cycles of treatment (3–4 cycles prior to and after surgery), then maintenance therapy for 12 months, for a total of up to 20 months of treatment with HCW9218.

Phase 1b/2 Clinical Trial to Evaluate HCW9218 in Pancreatic Cancer

This multi-center Company-sponsored Phase 1b/2 clinical trial was initiated in October 2022 and patient enrollment, dosing and safety-evaluation period for the Phase 1b portion of the study were completed in February 2024. In this study, 15 patients have received at least one dose of HCW9218 and completed the 28-day safety evaluation period, with no DLTs. At the time that the Phase 1b portion of the study was completed in February 2024, 13% (2/15) of patients who participated in the study showed evidence of stable disease.

We are currently evaluating the safety profile of multidose HCW9218 administration at escalating dose levels. Five clinical sites participated in the Phase 1b portion of this study, including the NCI Center for Cancer Research, Medical University of South Carolina (an NCI-designated Cancer Center), Washington University in St. Louis (an NCI-designated Comprehensive Cancer Center), Cleveland Clinic (an NCI-designated Comprehensive Cancer Center) and HonorHealth Research Institute. In this study, the initial characterization of HCW9218 safety and pharmacokinetic profiles and results of correlative studies of immune responses are consistent with those observed in the Phase 1 study to evaluate HCW9218 in solid tumors.

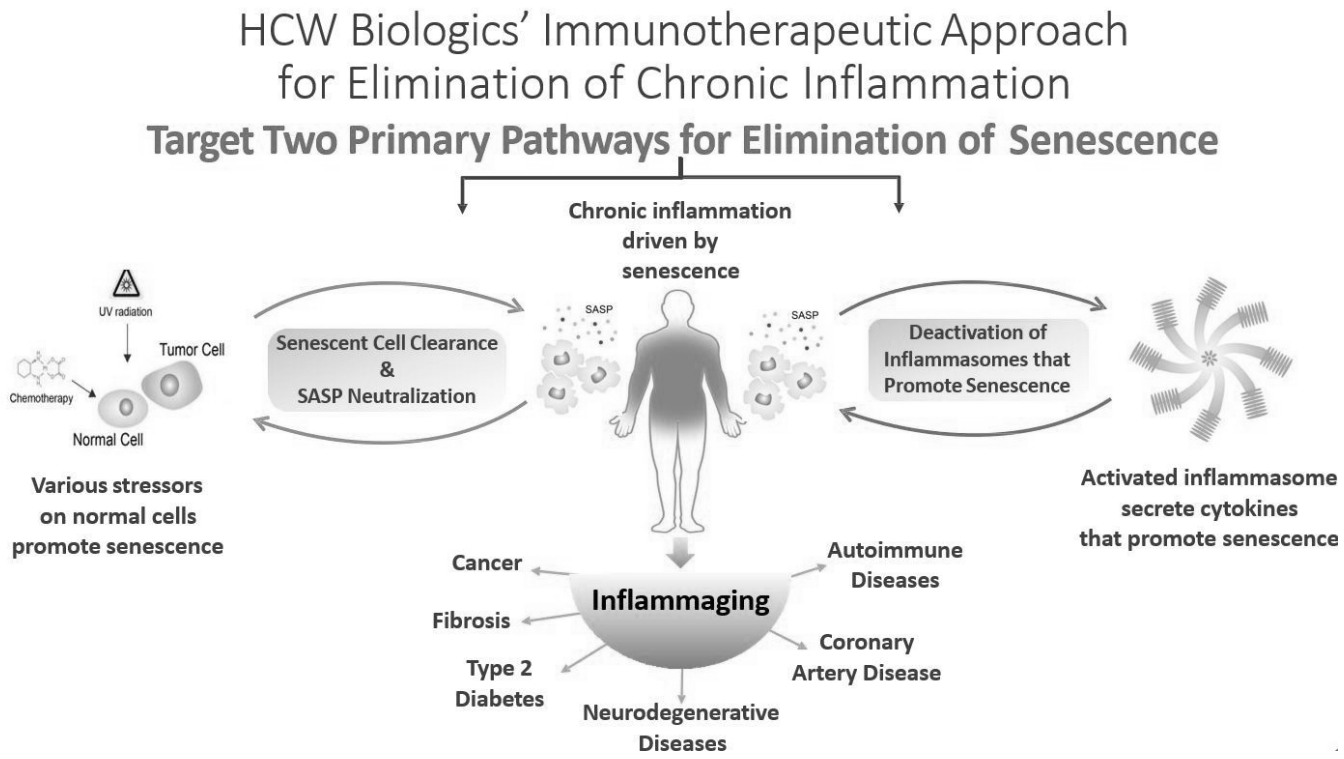
All existing clinical sites have expressed an interest in participating in the Phase 2 portion of this study. We expect the Phase 2 portion of this study will initiate in the second half of 2024. In addition, we plan to continue to operate under our existing CRADA with NCI, pursuant to which NCI and the Company agreed to collaborate to perform the Phase 2 portion of the clinical study to evaluate HCW9218 in patients with advanced/metastatic pancreatic cancer. In the Phase 2 portion of the pancreatic study, the Principal Investigator at NCI will continue to be Christine Alewine, M.D., Ph.D. Dr. Alewine is a Lasker Clinical Research Scholar at the National Institutes of Health in the Laboratory of Molecular Biology. Her research focuses on identifying new treatments for pancreatic cancer including pancreatic adenocarcinoma, adenosquamous carcinoma, and acinar cell carcinoma. Dr. Alewine is board certified in internal medicine and medical oncology.

IND Submission for HCW9302

For HCW9302, IND-enabling activities are completed and the Company plans to submit an IND to the FDA for a Phase 1b/2 clinical trial to evaluate HCW9302 in an autoimmune disorder in the first half of 2024. Our ability to evaluate HCW9302 in a clinical trial depends on completion of our toxicology studies, preparation and submission of an IND, and obtaining clearance to proceed from the FDA.

Our Approach

We believe we have an innovative strategy to treat age-related diseases. Our unique approach is to utilize our internally-developed TOBI platform to create novel multi-functional immunotherapeutics to rejuvenate the immune system. With our platform technology, we have generated product candidates that are designed to direct the immune system against solid tumors, therapy-induced senescence and the adverse side effects triggered by existing standard-of-care treatments for solid tumors and hematological cancers. We have also developed product candidates that are designed to direct the immune system against inflammation allowing for the potential to treat a wide variety of autoimmune and proinflammatory diseases. Our approach is to develop immunotherapies that reduce or eliminate the main drivers of chronic inflammation by addressing the underlying development and sustainment of these processes, as depicted in the image below:



The Science of Chronic Inflammation

While inflammation is part of the normal repair response for healing, when it becomes prolonged and persists, it is damaging and destructive. Several common molecular pathways have been identified that are associated with both aging and low-grade inflammation. Our view is that there are two primary underlying processes that drive chronic inflammation: 1) Accumulation of senescent cells and SASP factors, and 2) Activation of inflammasomes.

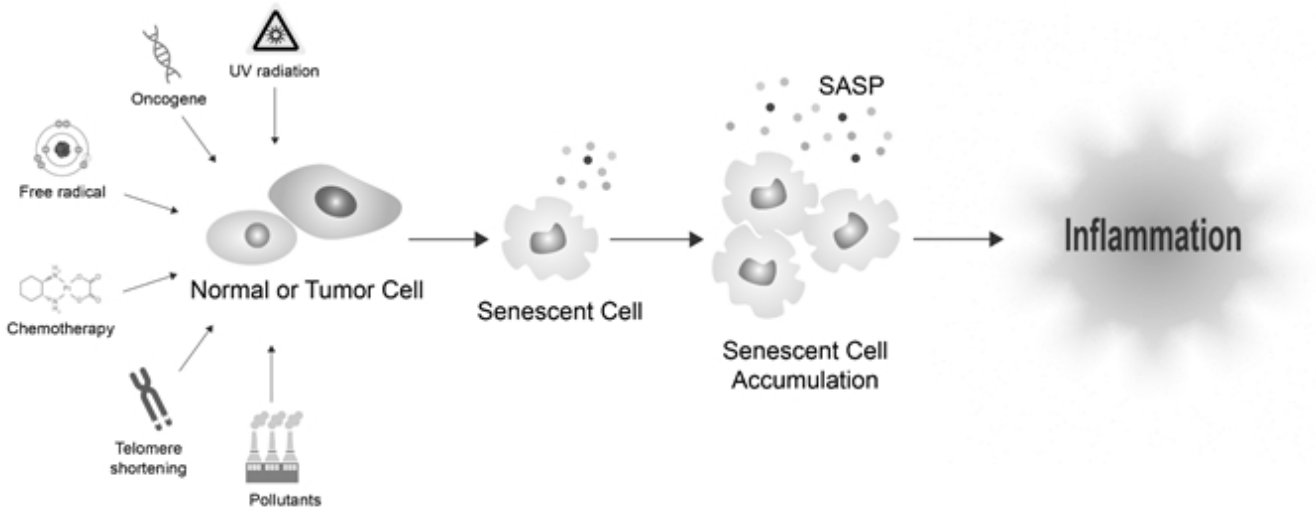
Senescence is a form of irreversible cell growth arrest accompanied by phenotypic changes, resistance to apoptosis, and activation of damage-sensing signaling pathways. Senescence is considered a stress response that can be induced by a wide range of intrinsic and extrinsic insults, including oxidative and genotoxic stress, DNA damage, telomere attrition, oncogenic activation, mitochondrial dysfunction, or chemotherapeutic agents.

Senescent cells remain metabolically active and can influence tissue hemostasis, disease, and aging through their SASP factors. Senescence is considered to be a physiologic process and is important in promoting wound healing, tissue homeostasis, regeneration, and regulation of fibrosis. Senescence also plays a role in tumor suppression. The accumulation of senescent cells, due to the aging of our immune cells, also drives aging and age-related diseases and conditions. The SASP factors can trigger chronic inflammatory responses and consequently augment chronic inflammatory conditions to promote tumor growth. The connection between senescence and aging was initially based on the observation that senescent cells accumulate in aged tissue. The use of transgenic models has enabled the detection of senescent cells systematically in many age-related disorders. Studies have demonstrated that senescent cells play an adverse role in age-related disorders.

An increasing body of evidence has shown that chemotherapy and radiation, standard-of-care anti-cancer regimens, cause the accumulation of senescent cells both in tumor and normal tissue. Paradoxically, cellular senescence protects non-dividing cancer cells by limiting the effect of chemotherapeutic drugs and radiation and contributes to chemoresistance, radiation resistance, disease relapse, and systemic side effects. Cancer chemotherapy efficacy is based on the assumption that treatment-induced apoptosis or necrosis of tumor cells results in prolonged patient survival. However, in addition to cytotoxic activity, chemotherapy also can cause tumor cells to enter a TIS state with SASP characteristics. The persistence of viable and metabolically active senescent tumor cells after chemotherapy has been attributed to worse overall survival in patients. Chemotherapy exposes a stressor to rapidly proliferating cancer cells, which drives them into senescence, triggers paracrine effects of inflammatory factors, or SASP factors, secreted by these senescent cells, and promotes epigenetic changes that induce these cells to more aggressive cancer stemness.

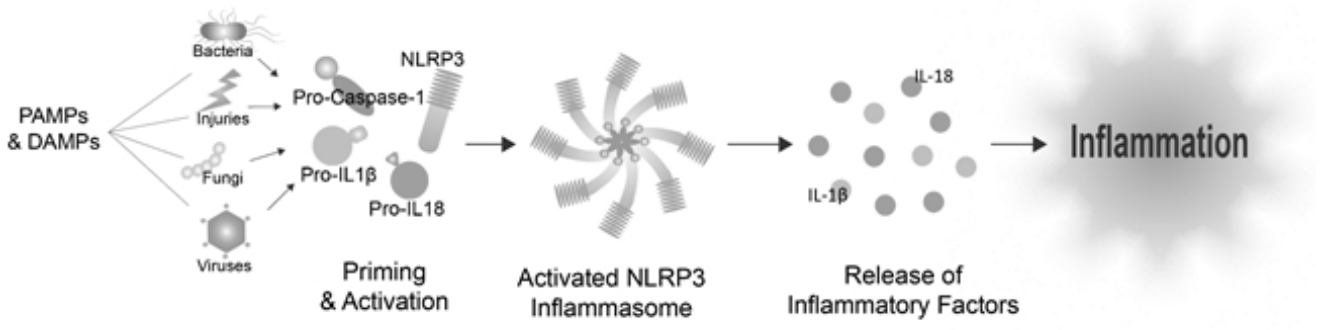
Systemic chemotherapy has also been found to elevate normal tissue senescence. Multiple studies have revealed that increased normal tissue senescent cells can promote tumor progression, creating a link between aging and cancer. Breast cancer survivors who received chemotherapy as a part of treatment have been found to have accelerated aging and increased incidence of cancer recurrence. Survivors from childhood cancers post-chemotherapy treatment also have been found to have high rates of developing secondary cancer, spinal disorders, and pulmonary diseases in adulthood. Furthermore, it is well established that clinical use of chemotherapies is associated with long-term damage to normal tissues and organs resulting from accumulation of TIS cells and proinflammatory SASP factors. Therefore, we believe that therapeutic approaches that alleviate chemotherapy-induced senescent cells and SASP factors in normal tissue may lead to a better quality of life for cancer patients.

SASP Factors Secreted by Senescent Cells Trigger Chronic Inflammatory Responses



Inflammasomes are large, multimeric protein complexes that are another contributing factor to chronic inflammation. Their assembly in innate immune cells and other cells is triggered by a variety of stimuli and culminates in the activation of Caspase-1 which then cleaves pro-IL-1β to IL-1β. To date, diverse inflammasomes have been discovered. Among the various inflammasomes identified, the nucleotide-binding oligomerization domain, leucine-rich repeat-containing receptor ("NLR") family pyrin domain-containing three NLR ("NLRP3") inflammasome is best characterized. The NLRs are recognized as the key sensors of pathogens and danger signals triggered by molecules known as PAMPs and DAMPs. The NLRP3 inflammasome has a two-step activation mechanism: "priming", which entails induction of pro-IL-1β and NLRP3, and "activation", wherein a functional inflammasome complex is assembled following recognition of PAMPs or DAMPs. The pathology of various diseases, including Alzheimer's disease, Parkinson's disease, and atherosclerosis has been linked to hyperactivation of the NLRP3 inflammasome.

Inflammatory Factors Secreted by Activated Inflammasomes Trigger Chronic Inflammatory Responses



Our Approach for the Treatment of Inflammaging

We have identified two lead product candidates that are immunotherapeutics designed to rejuvenate the immune system in order to neutralize or reverse the two primary pathways of inflammaging. Without addressing both processes, a chronic, low-grade inflammatory environment will persist, resulting in a diverse range of pathological manifestations including cancer, atherosclerosis, diabetes, and neurodegeneration.

Immune Cell Mediated Senescent Cell Clearance and Senomorphic Agent for SASP Neutralization

Senescent cells are caused when a normal cell is exposed to various stress factors, many of which are simply a part of living and aging. Other stressors are brought about by medical treatments, such as radiation and chemotherapy, resulting in TIS. The damaging part of senescent cells is that they secrete so-called SASP factors. SASP factors come in many different types, depending on the stressor and the cell type exposed to that stressor, but one thing they have in common is that they drive chronic, low-grade inflammation. For example, TGF-β is considered one of the key SASP factors that induces or accelerates and maintains a senescent phenotype in various cell types including fibroblasts, bronchial epithelial cells, and cancers in an autocrine/paracrine manner. Thus, to neutralize these pathways, a drug must be a senolytic agent that reduces senescent cells, as well as a senomorphic agent that reduces SASP factors. Current clinical efforts to counteract TIS and age-related senescent cell activity have focused on senolytic chemical drugs that selectively induce senescent cell death and senomorphic chemical drugs that reduce the secretion of SASP factors. Despite the promise of senolytics and senomorphics, their efficacy in early phase clinical studies reported to date has been limited. Further, the specificity, toxicity, and optimal treatment schedule of these pharmaceutical agents in the cancer setting have yet to be determined.

We have developed an alternative approach to reduce senescent cells using well-characterized protein immunotherapeutics including those that stimulate effector immune cells and reduce TGF-β activity. This approach is supported by our findings that TIS tumor cells upregulate NKG2D and other ligands on their surface for efficient recognition and killing by effector NK cells and $CD8^+$ T cells. Additionally, suppression of TGF-β activity enhances the anti-tumor/anti-senescent cell responses of these immune cells. HCW9218 is a unique combination of a TGF-β receptor, which neutralizes TGF-β secreted by tumors, combined with IL-15, a potent cytokine that stimulates NK and $CD8^+$ T cell proliferation and cytotoxicity. In our scientific publications, we reported that HCW9218 can activate immune cells to infiltrate into tumors to directly eliminate TIS cancer cells. This activity leads to robust anti-tumor activity of HCW9218 following docetaxel chemotherapy ("DTX") as measured by reduced melanoma tumor growth in mouse models. Therefore, TGF-β neutralization combined with activation of effector immune cells should be considered as a part of the strategy for senescent cell removal and reduction of SASP factors. For a more detailed discussion, see the Company's pivotal scientific paper entitled, "Immunotherapeutic HCW9218 Augments Anti-Tumor Activity of Chemotherapy via NK Cell-Mediated Reduction of Therapy-Induced Senescent Cells," published in *Molecular Therapy* in April 2022. The reference to our paper does not constitute incorporation by reference of the information contained in the paper.

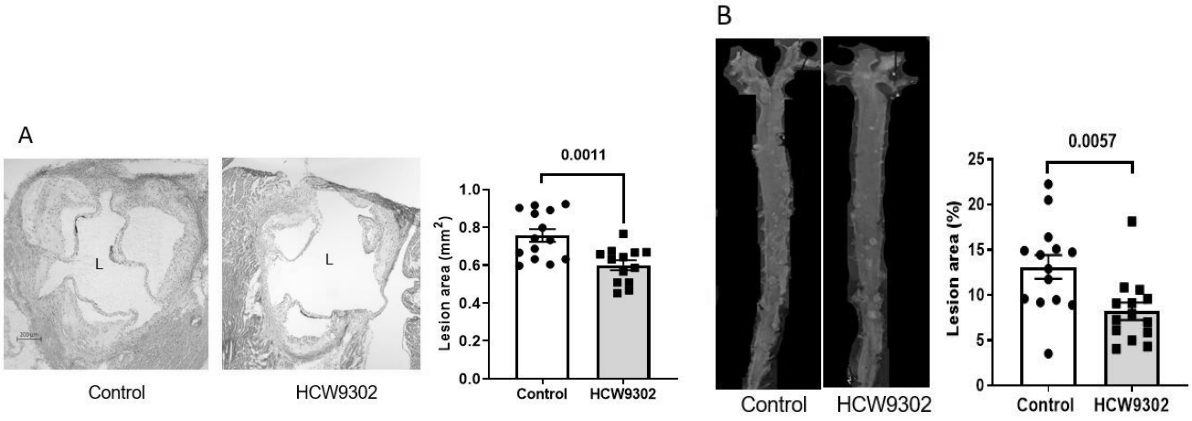
Using other animal models of age-related diseases and natural aging, we have also found that HCW9218 could act as an effective senescent-cell reducing and senomorphic drug. Specifically, in the diabetic db/db mouse models, the Company's scientists showed that subcutaneous administration of HCW9218 reduced senescent islet β cells and SASP resulting in improved gene expression related to glucose tolerance, insulin resistance, and aging index. Long-term studies in naturally-aged mice also showed that HCW9218 treatment improved the physical performance without compromising the healthspan. Stable changes were observed in the expression of inflammation and senescence-associated genes in naturally-aged mice, that appeared to 'turn back the clock'. That is, treatment with HCW9218 appeared to reverse the expression pattern of key circadian-rhythm genes, as well as genes associated with metabolism and fibrosis in the liver. The results of these studies suggest that HCW9218 could represent a novel immunotherapeutic approach and a lead example of a clinically promising new class of senotherapeutic agents targeting cellular senescence-associated diseases. For more details, see the Company's pivotal scientific paper, entitled, "Immunotherapeutic Approach to Reduce Senescent Cells and Alleviate Senescence-Associated Secretory Phenotype in Mice", published in *Aging Cell* in May 2023. The reference to our paper does not constitute incorporation by reference of the information contained in the paper.

Deactivation of Inflammasomes by Activating T_{reg} Cells

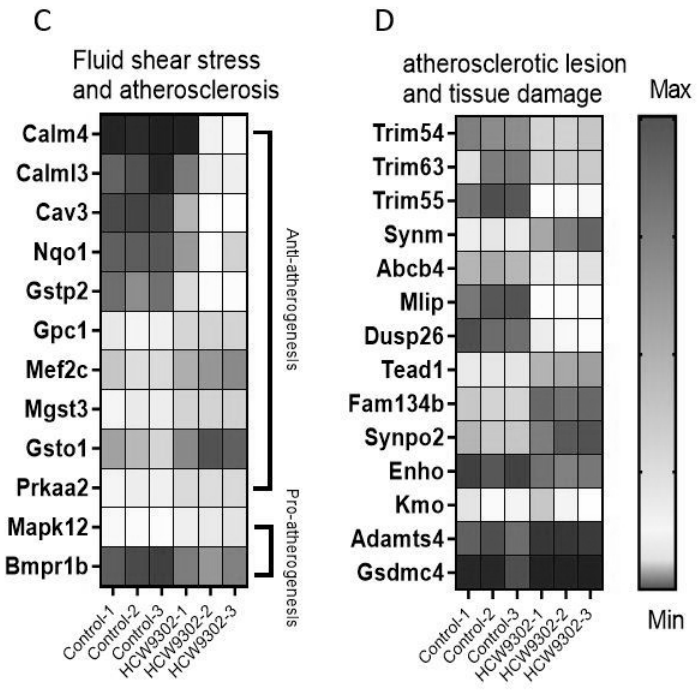
To date, therapeutic approaches to reduce aberrant inflammasome activity have focused on inhibitors of various inflammasome components (*i.e.*, NLRP3 and other NLRs, ASC, Caspase-1) and downstream mediators of inflammation (*i.e.*, IL-1β, IL-18, gasdermin D, etc.). This approach is validated based on the regulatory approval of three biologics that inhibit IL-1β activity (anakinra, a recombinant form of the naturally occurring IL-1Ra; rilonacept, a soluble chimeric Fc fusion protein of IL-1R1 and IL-1R3; and canakinumab, a humanized monoclonal antibody specific for neutralizing IL-1β). Together, these molecules are approved for treatment of cryopyrin-associated periodic syndrome, a multisystemic IL-1β–mediated disease due to a gain of function in NLRP3; rheumatoid arthritis; systemic juvenile idiopathic arthritis and other auto-inflammatory diseases. We believe there is considerable interest in other therapeutics that specifically block inflammasome activity upstream of IL-1β. However, these product candidates are still in early phase clinical testing and their bioavailability, off- and on-target toxicity, and utility profiles are still being evaluated.

Our approach is to deactivate inflammasome pathways in monocytes and macrophages through the immunosuppressive activities of T_{reg} cells induced by our immunomodulator molecules. This approach does not rely on inhibiting specific inflammasome components but rather utilizes natural processes of the immune system to attenuate and rebalance chronic self-perpetuating proinflammatory responses. In relevant animal models, we have observed encouraging results using HCW9302 to activate and expand T_{reg} cells for treatment of atherosclerosis and diabetes.

HCW9302 Reduces Atherosclerotic Plaques Induced by High Fat Diet in ApoE$^{-/-}$ Mice
Preclinical Data Showing Attenuation of Progression of Atherosclerosis



(A) Histochemical staining of aorta root sections and graphical comparisons of the atherosclerotic lesion formation ("H&E") between control and HCW9302 treated *ApoE* deficient mice fed with a Western diet ("WD"). L= lumen.
(B) En face analysis of atherosclerotic lesions in the aorta including the arch, thorax, and abdomen from control and HCW9302 treated *ApoE* deficient mice fed with a WD.
Data in **(A,B)** are expressed as mean ± SEM (n = 13-14). Statistical analysis using a 2-tailed, unpaired "t" test.



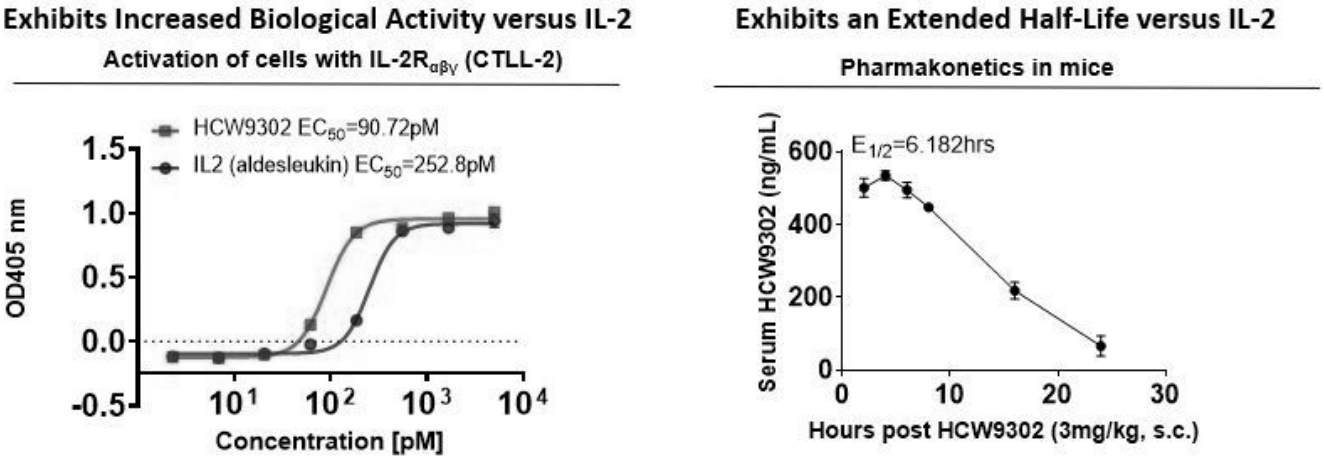
(C) Heatmap analysis of HCW9302-mediated increases of anti-atherosclerotic transcriptomes.
(D) Reduction of pro-atherosclerotic transcriptomes in aortas of *ApoE*-deficient mice.
(C,D) The Wald test was used to generate p-values and log2 fold changes for RNA-Seq analysis. Genes with an adjusted p-value < 0.05 and absolute log2 fold change > 1 were called as differentially expressed genes for each comparison.

Source: *Frontiers in Immunology*, "A Novel Interleukin-2-Based Fusion Molecule, HCW9302, Differentially Promotes Regulatory T Cell Expansion to Treat Atherosclerosis in Mice," Zhu, X., et al., January 2023. The reference to our paper does not constitute incorporation by reference of the information contained in the paper.

Nonclinical studies in nonhuman primates ("NHPs") also supported that repeated subcutaneous administration of HCW9302 induced significant proliferation and accumulation of T_{reg} cells and that HCW9302 dose levels that were well tolerated. HCW9302 treatment did not result in consistent changes in NK cell, $CD4^+$ T cell, $CD8^+$ T cell or B cell accumulation nor did it induce cytokine storm in NHPs. Subcutaneous HCW9302 exhibited a maximum serum concentration at 6 to 10 hours post-dosing and a 7- to 18-hour half-life in NHPs, considerably longer than that observed for recombinant IL-2 cytokine. We believe these findings support clinical development of HCW9302 to induce T_{reg} cell responses against pro-inflammatory/autoimmune diseases.

The two graphs below illustrate the results of characterization studies. HCW9302 exhibits increased biological activity (depicted in the graph on the left) with an extended half-life (depicted in the graph on the right), compared to recombinant human IL-2. Additionally, we found that HCW9302 exhibited an estimated 1,000-fold higher affinity for IL-2Rα (present on T_{reg} cells) in comparison to IL-2. HCW9302 could be administered to mice and NHPs at a dosing range that expanded and activated T_{reg} cells but not $CD4^+$ effector T cells. These findings indicate that HCW9302 is a more suitable immunotherapeutic for expanding and activating T_{reg} cells *in vivo* than IL-2.

HCW9302 Compared to Recombinant Human IL-2
Increased Biological Activity and Extended Half-Life
Results of Characterization Studies



Source: *Frontiers in Immunology*, "A Novel Interleukin-2-Based Fusion Molecule, HCW9302, Differentially Promotes Regulatory T Cell Expansion to Treat Atherosclerosis in Mice," Zhu, X., et al., January 2023. The reference to our paper does not constitute incorporation by reference of the information contained in the paper.

Our Strategy

Our strategy includes the following key components:

Advance clinical development of HCW9218 in cancer indications based on results of Phase 1/1b clinical trials.

- Data from the Phase 1 clinical trial to evaluate HCW9218 in solid tumors and the Phase 1b clinical trial to evaluate HCW9218 in pancreatic cancer support our choice of ovarian cancer and pancreatic cancer as indications for Phase 2 clinical studies.
- We intend to evaluate HCW9218 in combination with standard-of-care treatments for cancer, such as chemotherapy and immune checkpoint inhibitors in randomized Phase 2 studies.
- Opportunistically, we may evaluate HCW9218 in other difficult-to-treat cancer indications in Phase 2 studies if they are covered by a CRADA with NCI or NIH or are led by a sponsor with funding. These studies may involve evaluating HCW9218 in combination with treatments for indications not approved by FDA.

Begin evaluating of HCW9218 in age-related diseases beyond cancer.

- We view cancer as our gateway indication to expanding into other age-related diseases. We intend to begin to investigate other age-related diseases beyond cancer, beginning with indications in dermatology, such as senile lentigo, a harmless skin disease that typically occurs with aging.

Focus on an autoimmune indication for the IND application for our lead product candidate, HCW9302.

- With completion of the IND-enabling activities and toxicology studies required for submission of an IND, we expect to submit an IND application to the FDA to evaluate HCW9302 in an autoimmune indication in the first half of 2024. We have not yet submitted the IND, nor can we guarantee that the FDA will grant us permission to initiate clinical studies in an autoimmune disorder.

Continue to build our relationships with leading clinical research centers.

- We expect all of the clinical sites that currently participate in the Phase 1/Phase 1b clinical studies to continue to participate in Phase 2 clinical studies. Our current clinical sites represent leaders in cancer research and treatment, most of which are NCI-designated Comprehensive Cancer Centers. In the case of our pancreatic study, the lead clinical site is the NCI itself. These institutions are centers of excellences and often attract patients from large regions, nationally and internationally.

Identify financing opportunities that allow us to advance the clinical development of our lead product candidates.

- We are exploring a range of financing alternatives to fund our clinical development activities, with a preference for non-dilutive financing transactions, such as CRADAs with the NCI and the National Institutes of Health, strategic collaborations, project financing and other forms of debt financing. Out-licensing non-core assets and rights will also remain part of our financing strategy.

Explore co-development with big pharma for lead molecules after Phase 2 clinical data is available.

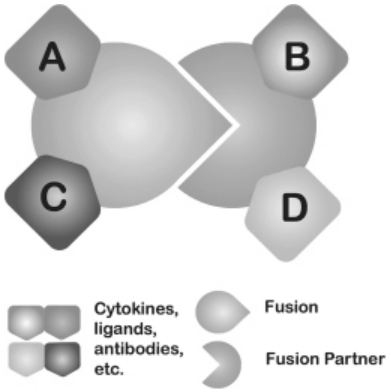
- Our primary goal is to enter a co-development deal on the best terms possible, so we are targeting to enter into a co-development deal after Phase 2 human clinical data is available.

Our Programs

Our Proprietary Tissue factOr-Based fusIon ("TOBI") Discovery Platform

Our proprietary TOBI discovery platform is a new approach to construct multi-functional fusion proteins and fusion protein complexes using a novel tissue factor ("TF") protein scaffold. The extracellular domain of human TF was selected as it has a rigid elongated structure comprised mainly of β-sheets with its N- and C-termini located at distal ends of the polypeptide, permitting genetic fusions of other protein domains without anticipated steric interference. This TF domain does not interact with the cell membrane phospholipid bilayer and, as a result, does not exhibit procoagulant activity. This TF domain is expressed at high levels by most cell types and is not expected to be immunogenic in humans. Consistent with these properties, we found that genetic fusion to the TF domain promoted increased production of difficult-to-express proteins, such as IL-15. Additionally, the TF fusion proteins could be readily purified by affinity chromatography using an anti-TF antibody and low pH elution conditions, like those used in Protein A-based affinity purification of therapeutic antibodies.

To generate multichain protein complexes, we also incorporated genetic fusions to the human IL-15 and IL-15Rα domains as shown in the figure below. When co-expressed in CHO cells, the fusion proteins form a soluble stable heterodimeric complex through high-affinity interactions between IL-15 and IL-15Rα domains. This approach offers an alternative to immunoglobulin (Fc) and other engineered protein scaffolds, which typically require introduction of multiple mutations or other non-human sequences or complicated *in vitro* assembly/purification methods to generate bi- or multi-specific complexes. Our internally-developed TOBI discovery platform was featured in an article authored by the Company and published in July 2021 in the peer-reviewed journal *Cancer Immunology Research*. The reference to our paper does not constitute incorporation by reference of the information contained in the paper.



Using the TOBI platform, we have constructed more than 30 fusion complexes comprising various cytokines, ligands, receptors, and single-chain antibodies, including disease-targeting antibodies and immune checkpoint inhibitors. The modular fusion components are carefully selected to stimulate, inhibit, and/or target specific immune responses using a knowledge-based disease-relevant strategy and in many cases, are designed to provide synergistic and balanced activities for optimal therapeutic benefit. The resulting fusion proteins are rigorously tested in state-of-the-art cell culture systems and disease-specific animal models to verify their utility for the intended clinical use and targeted indications.

TOBI also provides a scalable approach for generating large-scale current Good Manufacturing Practice ("cGMP")-grade heteromeric fusion protein complexes to support clinical applications.

HCW9218

We have used our TOBI platform to construct a proprietary, heterodimeric bifunctional fusion molecule, HCW9218, capable of immuno-stimulatory as well as anti-immunosuppressive activity. Advances in immuno-stimulatory and anti-immunosuppressive therapeutics have revolutionized cancer treatment. However, novel immunotherapeutics with these dual functions are not frequently constructed. HCW9218 is comprised of extracellular domains of the human TGF-β receptor II and a human IL-15/IL-15 receptor α complex. HCW9218 potently activates NK cells and $CD8^+$ T cells *in vitro* and *in vivo* to promote their proliferative and metabolic activities and enhances their cytotoxicity against tumor targets. This fusion complex also exhibits TGF-β neutralizing activity *in vitro* and sequestered plasma TGF-β in mice and NHP.

Pancreatic and Ovarian Cancer

We believe, based on the preliminary results of the ongoing first-in-human Phase 1/1b clinical trials, HCW9218 may have the potential to be an effective immunotherapy against difficult-to-treat solid tumor cancers that are very aggressive malignancies and refractory to other immunotherapies including immune checkpoint blockade. We are gathering data from ongoing studies in search of preliminary evidence that our approach to decreasing TGF-β levels or signaling may be able to provide clinical benefit. We intend to continue to evaluate HCW9218 in two cancer indications that are two of the most difficult-to-treat and thus deadliest of cancers:

- Pancreatic cancer has the highest mortality rate of all major cancers. Incidence rates of pancreatic cancer have gone up by around 1% each year since 2000, and the death rate has very slowly increased each year since the mid-2000s. In 2023, an estimated 64,050 Americans were diagnosed with pancreatic cancer in the United States, and more than an estimated 50,550 died from the disease. Worldwide, an estimated 495,773 people were diagnosed with pancreatic cancer and an estimated 466,000 people died from the disease in 2020. If the cancer is detected at an early stage when surgical removal of the tumor is possible, the 5-year survival rate is 42%. About 13% of people are diagnosed at this stage. If the cancer has spread to surrounding tissues or organs, the 5-year survival rate is 14%. For the 52% of people who are diagnosed after the cancer has spread to a distant part of the body, the 5-year survival rate is 3%. (See American Society of Clinical Oncology and American Cancer Society.)

- Ovarian cancer ranks 5th in cancer deaths among women in the United States, accounting for more deaths than any other cancer of the female reproductive system. Worldwide, ovarian cancer is the 7th most common cancer in women. By 2040, the number of women around the world diagnosed with ovarian cancer is projected to rise almost 42% to 445,721. The number of women dying from ovarian cancer each year is projected to increase to 313,617 an increase of over 50% from 2020. Five-year ovarian cancer survival rates vary among countries. For example, in more developed countries, current rates range from 36% to 46%. However, in some countries the figure is much lower. Overall, survival rates fall well below that of other cancers. This cancer mainly develops in older women. About half of the women who are diagnosed with ovarian cancer are aged 63 years or older. (See World Ovarian Cancer Coalition and American Cancer Society.)

HCW9302

We have employed our TOBI platform to create HCW9302, a proprietary IL-2-based fusion molecule, to expand T_{reg} cells *in vivo* and *ex vivo* as an injectable or cell-based strategy to reduce inflammation and to treat a wide variety of autoimmune and age-related diseases. T_{reg} cells are essential mediators of peripheral tolerance and the global immunoregulatory potential in hosts to self and non-self-antigens. Current research is focused on developing novel therapies to enhance T_{reg} cell functions *in vivo* through the use of cytokines and small molecule drugs to support endogenous T_{reg} cell proliferation or activation, *ex vivo* manipulated T_{reg} cells in autologous adoptive cell therapy to promote immunoregulation in settings of autoimmunity, or antigen-specific T_{reg} cells, including chimeric antigen receptor T_{reg} ("CAR-T_{reg}") cells, to strengthen tolerance in allergies. In relevant animal models, we have also observed, in our view, encouraging results using HCW9302 to activate and expand T_{reg} cells for treatment of atherosclerosis and diabetes.

Autoimmune and Proinflammatory Diseases

We have conducted extensive preclinical research on HCW9302 for deactivation of inflammasomes to temper the proinflammatory environment they create in relevant animal models, including those for atherosclerosis. Our data suggest that HCW9302 functions as a potent agent to stimulate T_{reg} cells that suppress the activity of inflammasome-bearing cells and inflammatory factors. We intend to begin clinical trials to evaluate HCW9302 in an autoimmune indication, alopecia areata.

- Alopecia areata ("AA") is a chronic, relapsing, autoimmune disorder that results from the immune system mistakenly attacking hair follicles, leading to hair loss without permanent damage to the follicles. Alopecia areata often presents as isolated, smooth, nonscarring patches of hair loss, typically on the scalp, but it can occur anywhere with hair growth. Living with AA can be associated with reduced quality of life, social functioning, and psychological well-being, along with substantial costs to patients and the health care system. Each person may have a different experience with AA. Some people may regrow hair, while others do not. Hair regrowth can be spontaneous, or it can happen following treatment. For patchy AA, the spontaneous remission rate is 30–50% in the first 6–12 months of the disease, and complete resolution is seen in up to 66% of patients within 5 years. For alopecia totalis, the rate of spontaneous remission is less than 10%. Within 20 years, 100% of patients with AA experience disease relapse. A greater incidence has been reported in females than males, especially in patients with late-onset disease, defined as age greater than 50 years. There is no cure for AA, which affects an estimated 2% of the global population. ("Alopecia Areata: An Updated Review for 2023," Journal of Cutaneous Medicine and Surgery, published June 2023; and "Alopecia Areata: Burden of Disease, Approach to Treatment, and Current Unmet Needs," Clinical, Cosmetic and Investigational Dermatology, published online March 2023.)

HCW9206

HCW9206 is a fusion protein complex created with our TOBI platform based on common gamma chain (γc) cytokines IL-7, IL-15 and IL-21, which are known to play important roles in NK cell and T cell homeostasis. We hold the rights to the injectable form of HCW9206, and ex vivo rights are licensed to Wugen. This molecule is designed to broadly activate the immune system to support expansion of NK cells and T cells *ex vivo* and *in vivo*. We are currently in the discovery stage of an initial program for HCW9206, which is to create an injectable immunotherapeutic to use as an adjuvant for adoptive cell therapy in cancer treatments. In current NK and Memory-Like-NK cell therapies, infused cells are supported *in vivo* by recombinant human IL-2. However, this approach has limitations since IL-2 can only support these infused cells for the short term and may induce T_{reg} cells toward immunosuppression. We believe our preclinical testing of HCW9206 has demonstrated that this complex can support infused NK cells for a long duration and enable NK cells to sustain cytotoxicity against tumor cells. In addition, we are currently conducting preclinical studies to investigate use of HCW9206 to enhance vaccine efficacy in different vaccine models as well as to support CAR-T cells *in vivo*.

Out-License Programs

We have internally developed over 30 immunotherapeutic molecules and plan to develop additional molecules through our TOBI platform. Our strategy is to focus on the clinical development of our lead product candidates, HCW9218 and HCW9302, as immunotherapeutics, administered by subcutaneous injection for the treatment of age-related diseases. Our strategy is to out-license marketing rights to regions and product rights not in our focus area. We expect out-licensing to provide non-dilutive financing to bolster resources available to fund our core markets and programs and possibly commercialize molecules, with the hope that our licensees achieve success through our licenses.

We established our first out-license arrangement in December 2020, when the Company entered into the Wugen License, an exclusive worldwide license agreement with Wugen for rights to develop cell therapy-based treatments using two of our internally-developed fusion protein molecules and improvements thereto, including clinical-stage and preclinical stage fusion molecules, HCW9201 and HCW9206, respectively. We believe these molecules are capable of generating highly activated cells in a short time frame and large-scale NK cell expansion without relying on feeder cells. Wugen has exercised its right to sublicense their rights for Greater China. The sublicensee is currently conducting a Phase 1 dose escalation trial with *ex vivo* cells in patients with relapsed/refractory acute myeloid leukemia ("R/R AML"). A Phase 1 clinical trial of WU-NK-101 for patients with R/R AML initiated in August 2023. This study is designed to characterize the safety, tolerability, pharmacokinetics, pharmacodynamics, immunogenicity, and preliminary anti-leukemic activity of WU-NK-101 in R/R AML. The FDA has also granted Orphan Drug Designation to WU-NK-101 for the treatment of R/R AML. WU-NK 101 is a treatment based on the Company's licensed molecules. As licensor, we have limited information rights to clinical data which we are required to treat as nonpublic confidential information. As licensee, Wugen, a private company, determines when and if clinical data readouts are disclosed to the public. Wugen presented three abstracts for clinical-stage studies and preclinical data at the American Society of Hematology conference in December 2023.

We retain manufacturing rights and other rights, including regulatory T cell-based cellular therapy and injectable rights, for licensed molecules under the terms of the Wugen License. On June 18, 2021, we entered into a master services agreement with Wugen for the supply of materials for clinical development of licensed products. Thereafter, each purchase transaction must be accompanied by a statement-of-work. We plan to enter into a commercialization supply agreement when Wugen enters its commercial stage. According to the terms of the Wugen License, Wugen will fund all future clinical development and commercialization activities for any indications utilizing the licensed molecules for cell-based therapy as covered by the Wugen License. In addition to an upfront fee which consisted of a significant equity ownership position in Wugen's common stock, we have the opportunity to receive additional payments for development and commercialization milestones as well as single-digit royalties.

Other TOBI Discovery Programs

Our discovery efforts for new product candidates are focused on characterizing and expanding our library of antibodies and fusion molecules with cytokines, chemokines, ligands, receptors, and internally-developed single-chain antibodies, including fusion domains with increased or decreased biological activity, for cancer and other age-related diseases with an emphasis on neurodegenerative, fibrotic, and autoimmune diseases. Other TOBI discovery programs are summarized in the table below.

Fusion Molecules

Name	Fusion Domains	Activity	Indications
HCW9210	IL-7, IL-15	T and NK cells stimulation	Cancer and support for cell-based products *in vivo*
HCW9228	TGRβRII tetramer	TGF-β antagonist	Pulmonary hypertension, neurodegenerative diseases and fibrotic diseases

Antibodies

Name	Target	Activity	Indications
HCW9106	Anti-CD26 scFv	Senescent cell inhibition and targeting	Inflammatory and age-related disease
HCW9107	Anti-CD36	Senescent cell inhibition and targeting	Inflammatory and age-related disease
HCW9108	Anti-CD39	T_{reg} binding, activation, inhibition, and targeting	Inflammatory and age-related disease

Manufacturing

Our product candidates include proprietary molecules that are multi-specific fusion protein complexes, such as HCW9201, HCW9206, and HCW9218; bispecific fusion protein complexes, such as HCW9302; and an internally-developed affinity ligand used in our manufacturing processes, HCW9101, for which we have generated a high-expressing cell line. We have established internally-developed manufacturing processes for producing these fusion molecules from Chinese hamster ovary ("CHO") cells at large scale in a cGMP-compliant setting.

We have a long-standing relationship with a contract manufacturing organization, EirGenix, Inc. ("EirGenix"), a third-party global contract development and cGMP manufacturer of biologics, for the manufacture of our internally-developed molecules. By the end of 2019, we successfully launched cGMP production with manufacturing runs of clinical grade materials adequate to support clinical trials. As of December 31, 2023, we successfully completed cGMP production of five molecules of our molecules, including HCW9101, HCW9201, HCW9206, HCW9218, and HCW9302. This includes the quantities of clinical grade materials required to complete the Phase 1/1b/2 clinical trials we have planned during 2024 and 2025, as well as toxicology studies. We expect manufacturing, quality control procedures, and vialing will continue for several molecules in 2024, including additional clinical and research grade materials for our licensee, Wugen.

We currently rely on EirGenix and other third-party manufacturers for the cGMP production of sufficient quantities of our drug product candidates for our clinical trials. Our management team and other internal personnel have extensive cGMP manufacturing experience which allows for seamless technology transfer our proprietary manufacturing methods, as well as the ability to manage the manufacturing and development processes conducted by third-party manufacturers. Our agreements with third-party manufacturers include confidentiality and intellectual property provisions as well as routine quality audits. However, we currently obtain our products from these manufactures on a per project basis and do not have long-term supply arrangements in place. Should any of these manufacturers become unavailable to us for any reason, we believe that there are a number of potential alternative contract manufacturers available to us on commercially reasonable terms to meet our future production requirements, although we may incur some delay and cost in qualifying and re-establishing the manufacturing processes at an alternative facility. We endeavor to mitigate this risk by maintaining an inventory of clinical material that is adequate to complete the clinical trials we expect to initiate in the next 12 months.

On August 15, 2022, we purchased a 36,000 square foot building located in Miramar, Florida. This facility will serve as our new headquarters. After refitting this building, we expect to have the capabilities for cGMP clinical drug manufacturing, storage, distribution, and quality testing. We expect to relocate to this building and complete FDA validation for this facility in the first half of 2025. We have the flexibility to complete the buildout of the manufacturing facility on a longer schedule, should we choose to delay completion. In the meantime, we will continue to manufacture clinical-grade material with third-party manufacturers. Our staff has expertise in building and running cGMP manufacturing facilities for immunotherapeutics. In addition, our manufacturing process is wholly-owned and developed by us, so we do not expect to be reliant on a third-party for manufacturing expertise or processes.

Intellectual Property

Overview

We strive to protect and enhance internally-developed technology, inventions, and improvements that are commercially important to the development of our business, including seeking, maintaining, and defending patent rights, for our internally-developed molecules and manufacturing processes. We also rely on trade secrets relating to our technology platform and on know-how, continuing technological innovation to develop, strengthen, and maintain our proprietary position in the field of inflammaging and the diseases it promotes that may be important for the development of our business.

As with other biotechnology and pharmaceutical companies, our ability to secure and maintain intellectual property protection for our product candidates, future products, and other internally-developed technologies will depend on our success in obtaining effective patent coverage and enforcing those patents if granted. However, we cannot guarantee that our pending patent applications, and any patent applications that we may in the future file, will result in the issuance of patents, or that any issued patents we have obtained or may obtain will provide sufficient proprietary protection from competitors. Any issued patents that we obtain may be challenged, invalidated, or circumvented by third parties.

In addition to patents, we also rely on trade secrets, know-how and continuing technological innovation to develop and maintain our competitive position. We seek to protect our internally-developed technology, in part, through confidentiality agreements and invention assignment agreements with our employees, consultants, scientific advisors, contractors and potential collaborators. We also rely on trade secrets relating to our manufacturing process and on know-how, continuing technological innovation and in-licensing opportunities to develop, strengthen, and maintain our proprietary position in the field of inflammaging that may be important for the development of our business. We additionally may rely on regulatory protection afforded through data exclusivity, market exclusivity, and patent term extensions, where available.

Internally-Developed Intellectual Property

As of December 31, 2023, the United States Patent and Trademark Office (the "USPTO") has granted HCW Biologics five patents, including fundamental patents that protect the underlying technology for our two lead product candidates, HCW9218 and HCW9302, as well as patents that protects the underlying technology and use of the molecule HCW9206, which is licensed to Wugen, conveying rights to develop cell-based therapies for cancer. We retain all other rights to HCW9206, including manufacturing rights. Patents that protect the underlying technology for proprietary molecules include:

- The USPTO granted U.S. Patent No. 11,401,324 to HCW Biologics on August 2, 2022. This patent contains claims for immunotherapeutic single-chain chimeric polypeptides comprising two target-binding domains on a scaffold made of a soluble tissue factor domain, supporting our lead drug candidate, HCW9302.
- The USPTO granted U.S. Patent No. 11,518,792 to HCW Biologics on December 6, 2022. This patent contains composition claims for immunotherapeutic multi-chain chimeric polypeptides, supporting our lead drug candidate, HCW9218.

As of December 31, 2023, in addition to five issued U.S. patents, we have two issued Japanese patents and 105 pending patent applications worldwide, including 19 pending U.S. utility patent applications, four pending provisional U.S. patent applications, three pending Patent Cooperation Treaty ("PCT") application, ten Hong Kong applications, and 84 total pending non-U.S. national phase patent applications and Taiwan patent applications. Our policy is to file patent applications to protect technology, inventions and improvements to inventions that are commercially important to the development of our business. We seek United States and foreign patent protection for a variety of technologies, including: our internally-developed platform, specific chimeric polypeptides developed using our platform, methods of using the chimeric polypeptides both in vivo and in cellular therapy to treat various conditions, methods for treating diseases of interest, and methods for manufacturing our products. We also intend to seek patent protection or rely upon trade secret rights to protect other technologies that may be used in combination with our products in the development of novel products or methods of use. We seek protection, in part, through confidentiality and proprietary information agreements.

Our intellectual property portfolio is continually evolving during prosecution of our applications. We own multiple families of patent applications that are directed to our TOBI platform technology and our single-chain and multi-chain chimeric polypeptides and methods of use of these polypeptides alone and in combination.

Single-Chain Chimeric Polypeptides Patent Family

This family includes patents and patent applications with claims directed to compositions of various single-chain chimeric polypeptides created using the TOBI platform. These applications also include methods of use and manufacture thereof and methods of promoting the activation and proliferation of NK cells or T cells using our single-chain chimeric polypeptides. As of December 31, 2023, this family, which includes HCW9302, includes U.S. Patent No. 11,401,324, two pending U.S. utility patent applications, one issued Japanese patent, and 11 pending patent applications filed in Europe, Australia, Canada, Israel, New Zealand, Japan, South Korea, China, Singapore, Hong Kong and Taiwan. The earliest predicted expiration date of any patent issuing from a patent application in this family is 2039.

Multi-Chain Chimeric Polypeptides Patent Family

This family includes patents and patent applications with claims directed to compositions of various multi-chain chimeric polypeptides created using the TOBI platform. These applications also include methods of use and manufacture thereof and methods of promoting the activation and proliferation of NK cells or T cells using our multi-chain chimeric polypeptides. As of December 2023, this family, which includes claims encompassing HCW9218, HCW9201, HCW9206, HCW9228, HCW9207, and HCW9212, includes U.S. Patent No. 11,518,792, seven pending U.S. utility patent applications, one issued Japanese patent, and 11 pending patent applications filed in Europe, Australia, Canada, Israel, Japan, New Zealand, South Korea, China, Singapore, Hong Kong and Taiwan. The earliest predicted expiration date of any patent issuing from a patent application in this family is 2039.

With respect to HCW9218, the composition is claimed in U.S. Patent No. 11,518,792 and 11 pending patent applications filed in Europe, Australia, Canada, Israel, Japan, New Zealand, South Korea, China, Singapore, Hong Kong and Taiwan.

With respect to HCW9201, the composition is claimed in one pending U.S. utility patent application and 11 pending patent applications filed in Europe, Australia, Canada, Israel, Japan, New Zealand, South Korea, China, Singapore, Hong Kong and Taiwan. Wugen has obtained an exclusive license to these patent applications limited to use of the licensed chimeric polypeptides in manufacturing certain cellular therapy products.

With respect to HCW9206, the composition is claimed in one pending U.S. utility patent application and 11 pending patent applications filed in Europe, Australia, Canada, Israel, Japan, New Zealand, South Korea, China, Singapore, Hong Kong and Taiwan. Wugen has obtained an exclusive license to these patent applications limited to use of the licensed polypeptides in manufacturing certain cellular therapy products.

Methods of Culturing and Methods of Expansion and Proliferation

These two families include patents and patent applications with claims directed to methods of promoting the activation and proliferation of NK cells through the use of our single-chain or multi-chain chimeric polypeptides for ex vivo cell therapy use. As of December 2023, these two families, which include methods of using HCW9201 and HCW9206, include U.S. Patent No. 11,730,762, U.S. Patent No. 11,738,052, two pending U.S. utility patent applications, and 15 pending patent applications filed in Europe, Australia, Canada, Israel, Japan, South Korea, Singapore, Hong Kong and China. The earliest predicted expiration date of any patent issuing from a patent application in the first of these two families is 2039. The earliest predicted expiration date of any patent issuing from a patent application in the second of these two families is 2040. Wugen has obtained an exclusive license to these two patent families limited to use in manufacturing certain cellular therapy products.

Treating Age Related Disorders

These four families include a patent and patent applications with claims directed to methods of killing or reducing the number of senescent cells in a subject using our single-chain or multi-chain chimeric polypeptides. As of December 2023, these four families, which include methods of using HCW9218, HCW9228 and HCW9302, include U.S. Patent No. 11,672,826, four pending U.S. utility patent applications, and 33 pending patent applications filed in Europe, Australia, Canada, Israel, Japan, Hong Kong, South Korea, New Zealand, Singapore, and China. The earliest predicted expiration date of any patent issuing from a patent application in the first of these three families is 2039. The earliest predicted expiration date of any patent issuing from a patent application in the second of these families is 2041. The earliest predicted expiration date of any patent issuing from a patent application in the third of these families is 2040. The earliest predicted expiration date of any patent issuing from a patent application in the fourth of these families is 2042.

Methods of Activating Regulatory T Cells

This family includes patent applications with claims directed to methods of promoting the activation and proliferation of Regulatory T cells through the use of our single-chain or multi-chain chimeric polypeptides for ex vivo cell therapy use. As of December 2023, this family, which includes methods of using HCW9213 and HCW9302, includes one pending U.S. utility patent application and 10 pending patent applications filed in Australia, New Zealand, Singapore, Israel, Europe, Canada, Japan, China, Hong Kong, and South Korea. The earliest predicted expiration date of any patent issuing from a patent application in this family of applications is 2041.

Antibodies

This family includes patent applications with claims directed to anti-CD26 scFv antibodies. As of December 2023, this family, which includes composition claims for HCW9106, includes one pending U.S. utility patent application and six pending patent applications filed in Australia, Canada, Europe, China, Hong Kong, and Japan. The earliest predicted expiration date of any patent issuing from a patent application in this family of applications is 2041.

The various methods of use of our chimeric polypeptides covered in our portfolio include: *ex vivo* cellular therapy use; in vivo or injectable use; methods of inducing differentiation of an immune cell into a memory or memory-like immune cell (in vitro or in vivo); methods of stimulating an immune cell (in vitro or in vivo); and methods of inducing or increasing proliferation of an immune cell (in vitro or in vivo). Indications covered in the portfolio broadly include cancers, including solid tumors and hematological cancers; age-related diseases; and infectious diseases. We are also pursuing innovative combinations of use with our chimeric polypeptides and antibodies, which include both known and internally-developed antibodies. Patents that may issue from these HCW Biologics Inc. owned applications are generally expected to expire between the years 2039 to 2041, subject to possible patent term adjustment and/or extension.

The term of individual future patents may vary based on the countries in which they are obtained. Generally, patents issued from applications filed in the United States are effective for 20 years from the earliest effective non-provisional filing date. In certain cases, a patent term can be extended to recapture a portion of the term effectively lost as a result of the FDA regulatory review period. The Hatch-Waxman Act permits a patent term extension of up to five years beyond the expiration of a U.S. patent, though the total patent term, including any extension, must not exceed 14 years following FDA approval. A U.S. patent can only be extended once, such that, if a single patent is applicable to multiple products, it can only be extended based on one product.

The term of patents outside of the United States varies in accordance with provisions of applicable local law, but typically is also 20 years from the earliest effective national filing date. Similar patent term extension provisions are available in Europe and other foreign jurisdictions to extend the term of a patent covering an approved drug. When possible, we expect to apply for patent term extensions for future patents covering our product candidates and their methods of use.

Trademarks

We have 2 registered U.S. trademarks and two pending U.S. trademark applications for our corporate name and corporate logo. We have an International Registration for the mark HCW BIOLOGICS for pharmaceutical research and development services, among other related services, in Class 42 and four national trademark applications pending therefrom with two registrations issued in the European Union and Japan. In the future, we intend to file applications for trademark registrations in connection with our Company, our product candidates, and other technologies in various jurisdictions, including the United States as the products are further developed.

Trade Secret Protection

Finally, we may rely, in some circumstances, on trade secrets to protect our technology. We seek to protect our internally-developed technology and processes, in part, by entering into confidentiality agreements with our employees, consultants, scientific advisors, and contractors. We also seek to preserve the integrity and confidentiality of our data and trade secrets by maintaining physical security of our premises and physical and electronic security of our information technology systems.

In addition to the above, we have established expertise and development capabilities focused in the areas of preclinical research and development, manufacturing and manufacturing process development, quality control, quality assurance, regulatory affairs, and clinical trial design and implementation. We believe that our focus and expertise will help us develop products based on our internally-developed intellectual property.

Contracts and Agreements

Wugen Exclusive License Agreement

In December 2020, we entered into an exclusive worldwide license agreement with Wugen, for rights to use certain HCWB fusion protein molecules to develop, manufacture, and commercialize their cellular therapy products. The term of the agreement will expire on a product-by-product and country-by-country basis, upon the later of (i) the expiration of the last-to-expire valid patent claim or (ii) ten (10) years from the first commercial sale of such product.

As consideration for the Wugen License, HCWB received shares of Wugen's common stock, which was equivalent to a 5.6% ownership interest in Wugen as of December 31, 2023. We may receive additional payments in the future, based upon the occurrence of certain development milestones. We will be eligible to receive additional payments for commercialization milestones as well as single-digit royalties for commercial sales once product sales commence.

We retained all other rights and use of the licensed molecules outside of Wugen's right to use the molecules to develop, manufacture, and commercialize cellular therapy products. Wugen's rights are limited to use of the licensed molecules in cellular therapy products, which are pharmaceutical or biological products, processes or therapies that contain or comprise cells (including without limitation, CIML NK cells or T cells) that have been engineered, modified, or otherwise manipulated *ex vivo*, but excludes regulatory T cell-based cellular therapy products. Our retained rights include use of the molecules for injectable therapy product, regulatory T cell-based cellular therapy products, and manufacturing rights to the licensed molecules. We oversee manufacturing and supply of these licensed molecules to Wugen, utilizing our internally-developed manufacturing process, under supply agreements with Wugen that have industry-standard terms. Wugen funds all future clinical development and commercialization activities for the cellular therapy treatments developed by Wugen using the licensed molecules.

Contract Research Agreements

We have certain contract research agreements with contractors that were entered during the two years ended December 31, 2023 for the (i) hybridoma development, (ii) cell line improvement, and (iii) research to support pre-clinical studies. We own all rights to the resulting intellectual property, including the antibodies, sequences, and data. To date, we have received several sequences and hybridomas from the contractors. For certain contractors, we are obligated to pay one future milestone payment upon filing and acceptance of an IND for each respective human antibody or protein from cell line; however no additional future development or financial obligations are due under these contract research agreements.

Competition

The biotechnology and pharmaceutical industries are characterized by rapidly advancing technologies, intense competition, and a strong emphasis on internally-developed products. We believe that our immunotherapeutic approach, internally-developed technology, expertise, scientific knowledge, track record in successfully developing drugs from bench to commercialization and intellectual property provide us with competitive advantages. We face potential competition from many different sources, including major pharmaceutical, specialty pharmaceutical and biotechnology companies, academic institutions, governmental agencies, and public and private research institutions. Any product candidates that we successfully develop and commercialize may compete with existing therapies and new therapies that may become available in the future.

Many of the companies we are competing against, or which we may compete against in the future, have significantly greater financial resources and expertise in research and development, manufacturing, preclinical testing, conducting clinical trials, obtaining regulatory approvals, and marketing approved products than we do. In addition, we face a constantly changing competitive landscape because of numerous mergers and acquisitions in the pharmaceutical and biotechnology industry, which will concentrate resources among a smaller number of large pharmaceutical companies. Smaller or early-stage companies may also prove to be significant competitors, particularly through collaborative arrangements and co-development deals with large and established companies. These competitors also compete with us in establishing clinical trial sites and patient registration for clinical trials necessary to advance the clinical development of our product candidates.

Although we believe our novel approach is different from most other existing or investigational therapies across the disease areas where we are focusing our development, we will need to compete (or be combined) with currently approved therapies, and potentially those currently in development if they are approved. We are aware of several marketed and investigational products in our leading disease areas, including but not limited to the products and competitors discussed below.

We compete in the segments of the pharmaceutical, biotechnology, and other related markets that develop cancer therapies. There are many other companies that have commercialized or are developing cancer therapies, including large pharmaceutical and biotechnology companies, such as AstraZeneca/MedImmune, Bristol Myers Squibb Company, Merck & Co., Novartis Pharmaceuticals, Pfizer, and Genentech, a member of The Roche Group. We face significant competition from pharmaceutical and biotechnology companies that target specific tumor-associated antigens using immune cells or other cytotoxic modalities. These generally include immune cell redirecting therapeutics (*e.g.*, T cell engagers), adoptive cellular therapies (*e.g.*, CAR-Ts), antibody drug conjugates, targeted radiopharmaceuticals, targeted immunotoxin, and targeted cancer vaccines.

With respect to our lead internally-developed product candidate, HCW9218, we are not aware of any other competing clinical-stage companies with a first-in-class immunotherapeutic that utilizes multiple mechanisms of action, including the cytokine-based activation of immune cells and neutralization of TGF-β immunosuppression.

With respect to our second lead product candidate, HCW9302, there is a growing momentum behind modulating T_{reg} cells as a potential treatment for autoimmune diseases. We are not aware of other competing clinical-stage companies with a first-in-class immunotherapeutic for deactivation of inflammasomes and reduction of inflammatory cytokines they release through the activation of T_{reg} cells.

We are aware of several other companies developing programs that utilize IL-2 for the selective expansion of T_{reg} cells, including Amgen, Nektar Therapeutics, Genentech, a member of The Roche Group, Merck & Co., Bristol Myers Squibb Company, and Celgene, a subsidiary of Bristol Myers Squibb Company. We are also aware of other companies with research or preclinical-stage programs in this area, including Synthorx, Moderna, and Xencor. We are also aware of other companies with PD-1 agonist programs for the treatment of autoimmune diseases, including AnaptysBio, Celgene, a subsidiary of Bristol Myers Squibb Company, and Eli Lilly & Company.

Numerous companies, including Kite Pharma, Novartis, Bluebird Bio, and Autolus Therapeutics, renowned for their CAR-T cell therapies in oncology, are expanding their research to explore the potential of CAR-T therapies in autoimmune diseases. For instance, Kite Pharma and Novartis are investigating CAR-T treatments for autoimmune conditions like multiple sclerosis (MS) and systemic lupus erythematosus. Similarly, Bluebird Bio is exploring CAR-T cell therapy for diseases such as sickle cell disease and beta-thalassemia, which involve autoimmune components. Autolus Therapeutics is also targeting both cancer and autoimmune diseases like multiple myeloma, acute lymphoblastic leukemia, multiple sclerosis, and systemic sclerosis with CAR-T therapies. This trend underscores a burgeoning interest in utilizing CAR-T cell therapy beyond oncology to tackle autoimmune disorders.

We could see a reduction or elimination of our commercial opportunity if our competitors develop and commercialize products that are safer, more effective, have fewer or less severe side effects, are more convenient or are less expensive than any products that we or our collaborators may develop. Our competitors also may obtain FDA or foreign regulatory approval for their products more rapidly than we may obtain approval for ours, which could result in our competitors establishing a strong market position before we or our collaborators are able to enter the market. Key product features that would affect our ability to effectively compete with other therapeutics include the efficacy, safety, and convenience of our therapeutics, the ease of use and effectiveness of any complementary diagnostics and/or companion diagnostics, and price and levels of reimbursement.

Several immune checkpoint inhibitors have been approved for the treatment of a limited number of cancer indications. There are several clinical studies underway for therapeutics to be used in combination with immune checkpoint inhibitors to broaden the number of indications and improve response rates. This market is dominated by a few companies, predominantly Merck & Co. and its product, Keytruda. The opportunity presented by the patent expiry of approved immune checkpoint inhibitors lies in the potential for increased competition and availability of generic or biosimilar versions of these drugs which may result in a loss of market exclusivity and revenue as competition. It may also incentivize innovation and the development of new formulations, combinations, or delivery methods to maintain market share and competitive advantage. The following list summarizes key immune checkpoint inhibitors along the companies that own these drugs and their patent expiration dates:

Product	**Associated Company**	**Key Patent Expiration Date**
Pembrolizumab (Keytruda)	Merck & Co	2028
Nivolumab (Opdivo)	Bristol Myers Squibb	2028
Atezolizumab (Tecentriq)	Genentech (Roche)	2024
Durvalumab (Imfinzi)	AstraZeneca	2034
Cemiplimab (Libtayo)	Regeneron Pharmaceuticals and Sanofi	2035
Avelumab (Bavencio)	Merck KGaA and Pfizer	2024

Government Regulation

Government authorities in the United States, at the federal, state, and local level, and in other countries and jurisdictions, extensively regulate, among other things, the research, development, testing, manufacture, quality control, approval, packaging, storage, recordkeeping, labeling, advertising, promotion, distribution, marketing, post-approval monitoring and reporting, and import and export of pharmaceutical products. The processes for obtaining regulatory approvals in the United States and in foreign countries and jurisdictions, along with subsequent compliance with applicable statutes and regulations and other regulatory authorities, require the expenditure of substantial time and financial resources.

FDA Approval Process

In the United States, biological products are subject to extensive regulation by the FDA. The Federal Food, Drug, and Cosmetic Act (the "FDC Act"), and other federal and state statutes and regulations, govern, among other things, the research, development, testing, manufacture, storage, recordkeeping, approval, labeling, promotion and marketing, distribution, post-approval monitoring and reporting, sampling, and import and export of pharmaceutical products. Biological products used for the prevention, treatment, or cure of a disease or condition of a human being are subject to regulation under the FDC Act, with the exception that the section of the FDC Act which governs the approval of drugs via New Drug Applications ("NDAs"), does not apply to the approval of biologics. In contrast, biologics are approved for marketing under provisions of the Public Health Service Act ("PHSA"), via a Biologics License Application ("BLA"). However, the application process and requirements for approval of BLAs are very similar to those for NDAs. Failure to comply with applicable U.S. requirements may subject a company to a variety of administrative or judicial sanctions, such as clinical hold, FDA refusal to approve pending BLAs, warning or untitled letters, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines, civil penalties, and criminal prosecution.

Biological product development for a new product in the United States typically involves preclinical laboratory and animal tests, the submission to the FDA of an IND, which must become effective before clinical testing may commence, and adequate and well-controlled clinical trials to establish the safety and effectiveness of the drug or biologic for each indication for which FDA approval is sought. Satisfaction of FDA pre-market approval requirements typically takes many years and the actual time required may vary substantially based upon the type, complexity, and novelty of the product or disease.

Preclinical tests include laboratory evaluation of product chemistry, formulation, and toxicity, as well as animal trials to assess the characteristics and potential safety and efficacy of the product. The conduct of the preclinical tests must comply with federal regulations and requirements, including Good Laboratory Practices. The results of preclinical testing are submitted to the FDA as part of an IND along with other information, including information about product chemistry, manufacturing and controls, and a proposed clinical trial protocol. Long-term preclinical tests, such as tests of reproductive toxicity and carcinogenicity in animals, may continue after the IND is submitted. A 30-day waiting period after the submission of each IND is required prior to the commencement of clinical testing in humans. If the FDA has neither commented on nor questioned the IND within this 30-day period, the clinical trial proposed in the IND may begin. Clinical trials involve the administration of the investigational drug or biologic to healthy volunteers or patients under the supervision of a qualified investigator. Clinical trials must be conducted: (i) in compliance with federal regulations; (ii) in compliance with Good Clinical Practice ("GCP"), an international standard meant to protect the rights and health of patients and to define the roles of clinical trial sponsors, administrators, and monitors; as well as (iii) under protocols detailing the objectives of the trial, the parameters to be used in monitoring safety, and the effectiveness criteria to be evaluated. Each protocol involving testing on U.S. patients and subsequent protocol amendments must be submitted to the FDA as part of the IND.

The FDA may order the temporary or permanent discontinuation of a clinical trial at any time, or impose other sanctions, if it believes that the clinical trial either is not being conducted in accordance with FDA regulations or presents an unacceptable risk to the clinical trial patients. Imposition of a clinical hold may be full or partial. The study protocol and informed consent information for patients in clinical trials must also be submitted to an institutional review board ("IRB"), for approval. The IRB will also monitor the clinical trial until completed. An IRB may also require the clinical trial at the site to be halted, either temporarily or permanently, for failure to comply with the IRB's requirements, or may impose other conditions. Additionally, some clinical trials are overseen by an independent group of qualified experts organized by the clinical trial sponsor, known as a data safety monitoring board or committee. This group provides authorization for whether a trial may move forward at designated checkpoints based on access to certain data from the trial.

Clinical trials to support BLAs for marketing approval are typically conducted in three sequential phases. In Phase 1, the initial introduction of the drug or biologic into patients, the product is tested to assess safety, dosage tolerance, metabolism, pharmacokinetics, pharmacological actions, side effects associated with drug or biologic exposure, and to obtain early evidence of a treatment effect if possible.

Phase 2 usually involves trials in a limited patient population to determine the effectiveness of the biologic for a particular indication, determine optimal dose and regimen, and to identify common adverse effects and safety risks. If a compound demonstrates evidence of effectiveness and an acceptable safety profile in Phase 2 evaluations, Phase 3 trials are undertaken to obtain additional information about clinical effects and confirm efficacy and safety in a larger number of patients, typically at geographically dispersed clinical trial sites, to permit the FDA to evaluate the overall benefit-risk relationship of the biologic and to provide adequate information for the labeling of the product.

In most cases, the FDA requires two adequate and well-controlled Phase 3 clinical trials to demonstrate the safety and efficacy of the biologic. In rare instances, a single Phase 3 trial may be sufficient when either (1) the trial is a large, multicenter trial demonstrating internal consistency and a statistically very persuasive finding of a clinically meaningful effect on mortality, irreversible morbidity or prevention of a disease with a potentially serious outcome and confirmation of the result in a second trial would be practically or ethically impossible or (2) the single trial is supported by other confirmatory evidence. Approval on the basis of a single trial may be subject to a requirement for additional post-approval studies.

These phases may overlap or be combined. For example, a Phase 1/2 clinical trial may contain both a dose-escalation stage and a dose-expansion stage, the latter of which may confirm tolerability at the recommended dose for expansion in future clinical trials (as in traditional Phase 1 clinical trials) and provide insight into the anti-tumor effects of the investigational therapy in selected subpopulation(s). Typically, during the development of oncology therapies, all subjects enrolled in Phase 1 clinical trials are disease-affected patients and, as a result, considerably more information on clinical activity may be collected during such trials than during Phase 1 clinical trials for non-oncology therapies.

In addition, the manufacturer of an investigational biologic in a Phase 2 or Phase 3 clinical trial for a serious or life-threatening disease is required to make available, such as by posting on its website, its policy on evaluating and responding to requests for expanding access to such investigational drug or biologic.

After completion of the required clinical testing, a BLA is prepared and submitted to the FDA. FDA approval of the BLA is required before marketing and distribution of the product may begin in the United States. The BLA must include the results of all preclinical, clinical, and other testing and a compilation of data relating to the product's pharmacology, chemistry, manufacture, and controls. The cost of preparing and submitting a BLA is substantial. The submission of most BLAs is additionally subject to a substantial application user fee. Under an approved BLA, the applicant is also subject to an annual program fee. These fees typically increase annually. A BLA for a biologic that has been designated as an orphan drug is not subject to an application fee, unless the BLA includes an indication for other than a rare disease or condition. The FDA has 60 days from its receipt of a BLA to determine whether the application will be filed based on the FDA's determination that it is adequately organized and sufficiently complete to permit substantive review. Once the submission is filed, the FDA begins an in-depth review. The FDA has agreed to certain performance goals to complete the review of BLAs. Most applications are classified as Standard Review products that are reviewed within ten months of the date the FDA files the BLA; applications classified as Priority Review are reviewed within six months of the date the FDA files the BLA. A BLA can be classified for Priority Review when the FDA determines the biologic has the potential to treat a serious or life-threatening condition and, if approved, would be a significant improvement in safety or effectiveness compared to available therapies. The review process for both standard and priority reviews may be extended by the FDA for three or more additional months to consider certain late-submitted information, or information intended to clarify information already provided in the BLA submission.

The FDA may also refer applications for novel biologic products, as well as biologic products that present difficult questions of safety or efficacy, to be reviewed by an advisory committee—typically a panel that includes clinicians, statisticians and other experts—for review, evaluation, and a recommendation as to whether the BLA should be approved. The FDA is not bound by the recommendation of an advisory committee, but generally follows such recommendations. Before approving a BLA, the FDA will typically inspect one or more clinical sites to assure compliance with GCP. Additionally, the FDA will inspect the facility or the facilities at which the biologic product is manufactured. The FDA will not approve the product unless compliance with cGMP is satisfactory and the BLA contains data that provide substantial evidence that the drug is safe and effective, or the biologic is safe, pure, potent, and effective, in the respective claimed indication.

After the FDA evaluates the BLA and completes any clinical and manufacturing site inspections, it issues either an approval letter or a complete response letter. A complete response letter generally outlines the deficiencies in the BLA submission and may require substantial additional testing, or information, in order for the FDA to reconsider the application for approval. If, or when, those deficiencies have been addressed to the FDA's satisfaction in a resubmission of the BLA, the FDA will issue an approval letter. The FDA has committed to reviewing such resubmissions in two or six months depending on the type of information included. An approval letter authorizes commercial marketing and distribution of the biologic with specific prescribing information for specific indications. As a condition of BLA approval, the FDA may require a risk evaluation and mitigation strategy ("REMS"), to help ensure that the benefits of the biologic outweigh the potential risks to patients. A REMS can include medication guides, communication plans for healthcare professionals, and elements to assure a product's safe use ("ETASU"). An ETASU can include, but is not limited to, special training or certification for prescribing or dispensing the product, dispensing the product only under certain circumstances, special monitoring, and the use of patient-specific registries. The requirement for a REMS can materially affect the potential market and profitability of the product. Moreover, the FDA may require substantial post-approval testing and surveillance to monitor the product's safety or efficacy.

Once granted, product approvals may be withdrawn if compliance with regulatory standards is not maintained or problems are identified following initial marketing. Changes to some of the conditions established in an approved BLA, including changes in indications, product labeling, manufacturing processes or facilities, require submission and FDA approval of a new BLA, or supplement to an approved BLA, before the change can be implemented. A BLA supplement for a new indication typically requires clinical data similar to that in the original application, and the FDA uses the same procedures and actions in reviewing BLA supplements as it does in reviewing original BLAs.

Disclosure of Clinical Trial Information

Sponsors of clinical trials of FDA regulated products, including biologics, are required to register and disclose certain clinical trial information on the website www.clinicaltrials.gov. Information related to the product, patient population, phase of investigation, study 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 as well as clinical trial design.

Expedited Development and Review Programs

Fast Track Designation and Priority Review

The FDA is required to facilitate the development, and expedite the review, of drugs or biologic products that are intended for the treatment of a serious or life-threatening disease or condition for which there is no effective treatment and which demonstrate the potential to address unmet medical needs for the condition. Fast track designation may be granted for a product that is intended to treat a serious or life-threatening disease or condition for which there is no effective treatment and preclinical or clinical data demonstrate the potential to address unmet medical needs for the condition. Fast track designation applies to both the product and the specific indication for which it is being studied.

The sponsor of an investigational biological product may request that the FDA designate the product candidate for a specific indication as a fast track product concurrent with, or after, the submission of the IND for the product candidate. FDA must determine if the product candidate qualifies for fast track designation within 60 days of receipt of the sponsor's request. For fast-track products, sponsors may have more frequent interactions with the FDA and the FDA may initiate review of sections of a fast-track product's BLA before the application is complete. This "rolling review" is available if the FDA determines, after preliminary evaluation of clinical data submitted by the sponsor, that a fast-track product may be effective. The sponsor must also provide, and the FDA must approve, a schedule for the submission of the remaining information and the sponsor must pay applicable user fees. Fast track designation may be withdrawn if the FDA believes that the designation is no longer supported by data emerging in the clinical trial process.

Priority review may be granted for products that are intended to treat a serious or life-threatening condition and, if approved, would provide a significant improvement in safety and effectiveness compared to available therapies. The FDA determines at the time of filing the BLA whether the proposed product would be a significant improvement and therefore receive a priority review designation. The FDA will attempt to direct additional resources to the evaluation of an application designated for priority review in an effort to facilitate the review.

Breakthrough Therapy Designation

The FDA is also required to expedite the development and review of applications for approval of biologics that are intended to treat a serious or life-threatening disease or condition where preliminary clinical evidence indicates that the biologic may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints. Under the breakthrough therapy program, the sponsor of a new product candidate may request that the FDA designate the product candidate for a specific indication as a breakthrough therapy concurrent with, or after, the filing of the IND for the product candidate. The FDA must determine if the product candidate qualifies for breakthrough therapy designation within 60 days of receipt of the sponsor's request. The FDA may take certain actions with respect to breakthrough therapies, including holding meetings with the sponsor throughout the development process, providing timely advice to the product sponsor regarding development and approval, involving more senior staff in the review process, assigning a cross-disciplinary project lead for the review team and taking other steps to design the clinical studies in an efficient manner.

Accelerated Approval

Accelerated approval may be granted for a product that is intended to treat a serious or life-threatening condition and that generally provides a meaningful therapeutic advantage to patients over existing treatments. A product eligible for accelerated approval may be approved 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. The accelerated approval pathway is most often used in settings in which the course of a disease is long, and an extended period of time is required to measure the intended clinical benefit of a product, even if the effect on the surrogate or intermediate clinical endpoint occurs rapidly. Thus, accelerated approval has been used extensively in the development and approval of products for treatment of a variety of cancers in which the goal of therapy is generally to improve survival or decrease morbidity and the duration of the typical disease course requires lengthy and sometimes large studies to demonstrate a clinical or survival benefit. The accelerated approval pathway is contingent on a sponsor's agreement to conduct additional post-approval confirmatory studies to verify and describe the product's clinical benefit. These confirmatory trials must be completed with due diligence and, in some cases, the FDA may require that the trial be designed, initiated, and/or fully enrolled prior to approval. Failure to conduct required post-approval studies, or to confirm a clinical benefit during post-marketing studies, would allow the FDA to withdraw the product from the market on an expedited basis. All promotional materials for product candidates approved under accelerated regulations are subject to prior review by the FDA.

The Food and Drug Omnibus Reform Act ("FDORA") was recently enacted, which included provisions related to the accelerated approval pathway. Pursuant to FDORA, the FDA is authorized to require a post-approval study to be underway prior to approval or within a specified time period following approval. FDORA also requires the FDA to specify conditions of any required post-approval study, which may include milestones such as a target date of study completion and requires sponsors to submit progress reports for required post-approval studies and any conditions required by the FDA not later than 180 days following approval and not less frequently than every 180 days thereafter until completion or termination of the study. FDORA enables the FDA to initiate enforcement action for the failure to conduct with due diligence a required post-approval study, including a failure to meet any required conditions specified by the FDA or to submit timely reports.

Regenerative Medicine Advanced Therapy Designation

The Regenerative Medicine Advanced Therapy ("RMAT") designation is an expedited program for the advancement and approval of regenerative medicine products that are intended to treat, modify, reverse, or cure a serious condition and where preliminary clinical evidence indicates the potential to address unmet medical needs for life-threatening diseases or conditions. Similar to Breakthrough Therapy designation, the RMAT allows companies developing regenerative medicine therapies to work earlier, more closely, and frequently with the FDA, and RMAT-designated products may be eligible for priority review and accelerated approval. Regenerative medicine therapies include cell therapies, therapeutic tissue engineering products, human cell and tissue products, and combination products using any such therapies or products, except for those regulated solely under section 361 of the PHSA and Title 21 of the Code of Federal Regulations Part 1271. For product candidates that have received a RMAT designation, 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.

Pediatric Information

Under the Pediatric Research Equity Act ("PREA"), BLAs or supplements to BLAs must contain data to assess the safety and effectiveness of the biological product for the claimed indications in all relevant pediatric subpopulations and to support dosing and administration for each pediatric subpopulation for which the biological product is safe and effective. The FDA may grant full or partial waivers, or deferrals, for submission of data. Unless otherwise required by regulation, the PREA does not apply to any biological product for an indication for which orphan designation has been granted except that PREA will apply to an original BLA for a new active ingredient that is orphan-designated if the drug is a molecularly targeted cancer product intended for the treatment of an adult cancer and is directed at a molecular target that the FDA determines to be substantially relevant to the growth or progression of a pediatric cancer.

The Best Pharmaceuticals for Children Act ("BPCA") provides a six-month extension of any non-patent exclusivity for a biologic if certain conditions are met. Conditions for exclusivity include the FDA's determination that information relating to the use of a new biologic in the pediatric population may produce health benefits in that population, FDA making a written request for pediatric studies, and the applicant agreeing to perform, and reporting on, the requested studies within the statutory timeframe. Applications under the BPCA are treated as priority applications.

Additional Controls for Biologics

To help reduce the increased risk of the introduction of adventitious agents, the PHSA emphasizes the importance of manufacturing controls for products whose attributes cannot be precisely defined. The PHSA also provides authority to the FDA to immediately suspend biologics 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 within the United States.

After a BLA is approved, the product may also be subject to official lot release as a condition of approval. As part of the manufacturing process, the manufacturer is required to perform certain tests on each lot of the product before it is released for distribution. If the product is subject to 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 lot manufacturing history and the results of all of the manufacturer's tests performed on the lot. The FDA may also perform certain confirmatory tests on lots of some products, such as viral vaccines, before allowing the manufacturer to release the lots for distribution. In addition, the FDA conducts laboratory research related to the regulatory standards on the safety, purity, potency, and effectiveness of biological products. After approval of a BLA, 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.

Post-Approval Requirements

Once a BLA is approved, a product will be subject to certain post-approval requirements. For instance, the FDA closely regulates the post-approval marketing and promotion of biologics, including standards and regulations for direct-to-consumer advertising, off-label promotion, industry-sponsored scientific and educational activities, and promotional activities involving the internet. Biologics may be marketed only for the approved indications and in a manner consistent with the approved labeling.

Adverse event reporting and submission of periodic reports are required following the FDA approval of a BLA. The FDA also may require post-marketing testing, known as Phase 4 testing, REMS, and surveillance to monitor the effects of an approved product, or the FDA may place conditions on an approval that could restrict the distribution or use of the product. In addition, quality control, biological product manufacture, packaging, and labeling procedures must continue to conform to cGMP after approval. Biologics manufacturers and certain of their subcontractors are required to register their establishments with the FDA and certain state agencies. Registration with the FDA subjects entities to periodic unannounced inspections by the FDA, during which the agency inspects manufacturing facilities to assess compliance with cGMPs. Accordingly, manufacturers must continue to expend time, money, and effort in the areas of production and quality control to maintain compliance with cGMPs. Regulatory authorities may withdraw product approvals or request product recalls if a company fails to comply with regulatory standards, if it encounters problems following initial marketing, or if previously unrecognized problems are subsequently discovered.

Biosimilars

The Biologics Price Competition and Innovation Act of 2009 ("BPCIA") creates an abbreviated approval pathway for biological products shown to be highly similar to or interchangeable with an FDA-licensed reference biological product. Biosimilarity sufficient to reference a prior FDA-approved product requires that there be no differences in conditions of use, route of administration, dosage form, and strength, and no clinically meaningful differences between the biological product and the reference product in terms of safety, purity, and potency. Biosimilarity must be shown through analytical trials, animal trials, and a clinical trial or trials, unless the Secretary of U.S. Department of Health and Human Services ("HHA") waives a required element. A biosimilar product may be deemed interchangeable with a previously approved product if it meets the higher hurdle of demonstrating that it can be expected to produce the same clinical results as the reference product and, for products administered multiple times, the biologic and the reference biologic may be switched after one has been previously administered without increasing safety risks or risks of diminished efficacy relative to exclusive use of the reference biologic. The first biosimilar was approved in 2015, and the first interchangeable product was approved in 2021. Complexities associated with the larger, and often more complex, structures of biological products, as well as the process by which such products are manufactured, pose significant hurdles to biosimilar product implementation, which is still being evaluated by the FDA.

A reference biologic is granted 12 years of exclusivity from the time of first licensure, or BLA approval, of the reference product, and no application for a biosimilar can be submitted for four years from the date of licensure of the reference product. The first biologic product submitted under the biosimilar abbreviated approval pathway that is determined to be interchangeable with the reference product has exclusivity against a finding of interchangeability for other biologics for the same condition of use for the lesser of (i) one year after first commercial marketing of the first interchangeable biosimilar, (ii) 18 months after the first interchangeable biosimilar is approved if there is no patent challenge, (iii) 18 months after resolution of a lawsuit over the patents of the reference biologic in favor of the first interchangeable biosimilar applicant, or (iv) 42 months after the first interchangeable biosimilar is approved if a patent lawsuit is ongoing within the 42-month period.

Other Healthcare Laws

In addition to FDA restrictions on marketing of pharmaceutical products, several other types of state and federal laws have been applied to restrict certain general business and marketing practices in the pharmaceutical industry. These laws include anti-kickback, false claims, transparency and health information privacy laws, and other healthcare laws and regulations.

The federal Anti-Kickback Statute prohibits, among other things, knowingly and willfully offering, paying, soliciting or receiving remuneration to induce, or in return for, purchasing, leasing, ordering or arranging for the purchase, lease or order of any healthcare item or service reimbursable under Medicare, Medicaid, or other federally financed healthcare programs. The Patient Protection and Affordable Care Act as amended by the Health Care and Education Reconciliation Act, collectively, the ACA, amended the intent element of the federal Anti-Kickback Statute so that a person or entity no longer needs to have actual knowledge of the statute or specific intent to violate it in order to commit a violation. This statute has been interpreted to apply to arrangements between pharmaceutical manufacturers on the one hand and prescribers, purchasers and formulary managers, among others, on the other. Although there are a number of statutory exceptions and regulatory safe harbors protecting certain common activities from prosecution or other regulatory sanctions, the exceptions and safe harbors are drawn narrowly, and practices that involve remuneration intended to induce prescribing, purchases or recommendations may be subject to scrutiny if they do not qualify for an exception or safe harbor. Additionally, the ACA amended the federal Anti-Kickback Statute such that a violation of that statute can serve as a basis for liability under the federal civil False Claims Act.

Federal civil and criminal false claims laws, including the federal civil False Claims Act, prohibit any person or entity from knowingly presenting, or causing to be presented, a false claim for payment to the federal government, or knowingly making, or causing to be made, a false statement to have a false claim paid. This includes claims made to programs where the federal government reimburses, such as Medicare and Medicaid, as well as programs where the federal government is a direct purchaser, such as when it purchases off the Federal Supply Schedule. Pharmaceutical and other healthcare companies have been prosecuted under these laws for, among other things, allegedly inflating drug prices they report to pricing services, which in turn are used by the government to set Medicare and Medicaid reimbursement rates, and for allegedly providing free product to customers with the expectation that the customers would bill federal programs for the product. In addition, certain marketing practices, including off-label promotion, may also violate false claims laws. Most states also have statutes or regulations similar to the federal Anti-Kickback Statute and civil False Claims Act, which apply to items and services reimbursed under Medicaid and other state programs, or, in several states, apply regardless of the payor.

Other federal statutes pertaining to healthcare fraud and abuse include the civil monetary penalties statute, which prohibits, among other things, the offer or payment of remuneration to a Medicaid or Medicare beneficiary that the offeror or payor knows or should know is likely to influence the beneficiary to order or receive a reimbursable item or service from a particular supplier, and the additional federal criminal statutes created by the Health Insurance Portability and Accountability Act of 1996 (“HIPAA”), which prohibit, among other things, knowingly and willfully executing or attempting to execute a scheme to defraud any healthcare benefit program or obtain by means of false or fraudulent pretenses, representations or promises any money or property owned by or under the control of any healthcare benefit program in connection with the delivery of or payment for healthcare benefits, items or services.

In addition, HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act of 2009 ("HITECH") and their respective implementing regulations, including the Final Omnibus Rule published on January 25, 2013, impose obligations on certain healthcare providers, health plans, and healthcare clearinghouses, known as covered entities, as well as their business associates and their subcontractors that perform certain services involving the storage, use or disclosure of individually identifiable health information, including mandatory contractual terms, with respect to safeguarding the privacy, security, and transmission of individually identifiable health information, and require notification to affected individuals and regulatory authorities of certain breaches of security of individually identifiable health information. HITECH increased the civil and criminal penalties that may be imposed against covered entities, business associates and possibly other persons, and gave state attorneys general new authority to file civil actions for damages or injunctions in federal courts to enforce the federal HIPAA laws and seek attorney's fees and costs associated with pursuing federal civil actions. In addition, many state laws govern the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and may not have the same effect, and often are not preempted by HIPAA.

Further, pursuant to the federal Physician Payments Sunshine Act, enacted as part of the ACA, the Centers for Medicare & Medicaid Services ("CMS"), issued a final rule that requires certain manufacturers of approved prescription drugs that are reimbursable under Medicare, Medicaid, or the Children's Health Insurance Program, with certain exceptions, to collect and annually report information on certain payments or transfers of value to physicians (defined to include doctors, dentists, optometrists, podiatrists, and chiropractors), physician assistants, certain types of advance practice nurses and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members. The reported data is made available in searchable form on a public website on an annual basis. Failure to submit required information may result in civil monetary penalties.

We may also be subject to analogous state and foreign anti-kickback and false claims laws that may apply to sales or marketing arrangements and claims involving healthcare items or services reimbursed by non-governmental third-party payors, including private insurers, or that apply regardless of payor. In addition, several states now require prescription drug companies to report certain expenses relating to the marketing and promotion of drug products and to report gifts and payments to individual healthcare practitioners in these states. Other states prohibit various marketing-related activities, such as the provision of certain kinds of gifts or meals.

Further, certain states require the posting of information relating to clinical studies and their outcomes. A growing number of states require the reporting of certain drug pricing information, including information pertaining to and justifying price increases and the price set for newly launched drugs, or to prohibit prescription drug price gouging. In addition, certain states require pharmaceutical companies to implement compliance programs and/or marketing codes. Several additional states are considering similar proposals. Certain states and local jurisdictions also require the registration of pharmaceutical sales representatives. Compliance with these laws is difficult and time consuming, and companies that do not comply with these state laws face civil penalties.

Efforts to ensure that business arrangements with third parties comply with applicable state, federal, and foreign healthcare laws and regulations involve substantial costs. If a drug company's operations are found to be in violation of any such requirements, it may be subject to significant penalties, including civil, criminal and administrative penalties, damages, fines, disgorgement, imprisonment, the curtailment or restructuring of its operations, loss of eligibility to obtain approvals from the FDA, exclusion from participation in government contracting, healthcare reimbursement or other federal or state government healthcare programs, including Medicare and Medicaid, integrity oversight and reporting obligations, imprisonment, and reputational harm. Although effective compliance programs can mitigate the risk of investigation and prosecution for violations of these laws, these risks cannot be entirely eliminated. Any action for an alleged or suspected violation can cause a drug company to incur significant legal expenses and divert management's attention from the operation of the business, even if such action is successfully defended.

Data Privacy and Security

Numerous state, federal and foreign laws, govern the collection, dissemination, use, access to, confidentiality, and security of personal information, including health-related information. In the United States, numerous federal and state laws and regulations, including state data breach notification laws, state health information privacy laws, and federal and state consumer protection laws and regulations that govern the collection, use, disclosure, and protection of health-related and other personal information could apply to our operations or the operations of our partners. For example, HIPAA, as amended by HITECH, and their respective implementing regulations, imposes privacy, security and breach notification obligations on certain health care providers, health plans, and health care clearinghouses, known as covered entities, as well as their business associates that perform certain services that involve creating, receiving, maintaining or transmitting individually identifiable health information for or on behalf of such covered entities. Entities that are found to be in violation of HIPAA may be subject to significant civil, criminal and administrative fines and penalties, and/or additional reporting and oversight obligations if required to enter into a resolution agreement and corrective action plan with HHS to settle allegations of HIPAA non-compliance. Further, entities that knowingly obtain, use, or disclose individually identifiable health information maintained by a HIPAA covered entity in a manner that is not authorized or permitted by HIPAA may be subject to criminal penalties.

Even when HIPAA does not apply, according to the FTC, violating consumers' privacy rights or failing to take appropriate steps to keep consumers' personal information secure may constitute unfair acts or practices in or affecting commerce in violation of Section 5(a) of the Federal Trade Commission Act.

In addition, certain state and non-U.S. laws, such as the General Data Protection Regulation (the "GDPR") govern the privacy and security of personal information, including health-related information, in certain circumstances. Failure to comply with these laws, where applicable, can result in the imposition of significant civil and/or criminal penalties and private litigation. For example, the California Consumer Privacy Act ("CCPA"), which went into effect on January 1, 2020, creates new data privacy obligations for covered companies and provides new privacy rights to California residents. On January 1, 2023, the California Privacy Rights Act ("CPRA"), which substantially amends the CCPA, went into effect. The CCPA and CPRA provide for unlimited civil penalties for violations, as well as a private right of action for data breaches that is expected to increase data breach litigation. Virginia's Consumer Data Protection Act, which took effect on January 1, 2023, requires businesses subject to the legislation to conduct data protection assessments in certain circumstances and requires opt-in consent from consumers to acquire and process their sensitive personal information, which includes information revealing a consumer's physical and mental health diagnosis and genetic and biometric information that can identify a consumer. Colorado enacted the Colorado Privacy Act, and Connecticut enacted the Connecticut Data Privacy Act, each of which took effect on July 1, 2023, and Utah enacted the Consumer Privacy Act, which became effective on December 31, 2023, and each of these laws may increase the complexity, variation in requirements, restrictions, and potential legal risks, and could require increased compliance costs and changes in business practices and policies. Other states have also enacted, proposed, or are considering proposing, data privacy laws, which could further complicate compliance efforts, increase our potential liability and adversely affect our business. In Europe, the GDPR went into effect in May 2018 and introduces strict requirements for processing the personal data of individuals within the European Economic Area ("EEA"). Further, recent legal developments in Europe have created complexity and compliance uncertainty regarding certain transfers of personal data from the EEA. For example, on July 16, 2020, the Court of Justice of the European Union invalidated the EU-U.S. Privacy Shield Framework (the "Privacy Shield") under which personal data could be transferred from the EEA to United States entities who had self-certified under the Privacy Shield scheme. Moreover, it is uncertain whether the standard contractual clauses will also be invalidated by the European courts or legislature.

Companies that must comply with the GDPR face increased compliance obligations and risk, including more robust regulatory enforcement of data protection requirements and potential fines for noncompliance of up to €20 million or 4% of the annual global revenues of the noncompliant company, whichever is greater. Additionally, following the United Kingdom's withdrawal from the European Union and the EEA, companies have to comply with the GDPR and the GDPR as incorporated into United Kingdom national law, the latter regime having the ability to separately fine up to the greater of £17.5 million or 4% of global turnover. The relationship between the United Kingdom and the European Union in relation to certain aspects of data protection law remains unclear, for example around how data can lawfully be transferred between each jurisdiction.

Coverage and Reimbursement

Significant uncertainty exists as to the coverage and reimbursement status of any pharmaceutical or biological product for which we obtain regulatory approval. Sales of any product, if approved, depend in part on the extent to which such product will be covered by third-party payors, such as federal, state, and foreign government healthcare programs, commercial insurance, and managed healthcare organizations, and the level of reimbursement, if any, for such product by third-party payors. Decisions regarding whether to cover any of our product candidates, if approved, the extent of coverage and amount of reimbursement to be provided are made on a plan-by-plan basis. 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 a result, the coverage determination process is often a time-consuming and costly process that will require us to provide scientific and clinical support for the use of our product candidates to each payor separately, with no assurance that coverage and adequate reimbursement will be applied consistently or obtained in the first instance.

For products administered under the supervision of a physician, obtaining coverage and adequate reimbursement may be particularly difficult because of the higher prices often associated with such drugs. Additionally, separate reimbursement for the product itself or the treatment or procedure in which the product is used may not be available, which may impact physician utilization. In addition, companion diagnostic tests require coverage and reimbursement separate and apart from the coverage and reimbursement for their companion pharmaceutical or biological products. Similar challenges to obtaining coverage and reimbursement, applicable to pharmaceutical or biological products, will apply to companion diagnostics.

In addition, the U.S. government, state legislatures and foreign governments have continued implementing cost-containment programs, including price controls, restrictions on coverage and reimbursement, and requirements for substitution of generic products. Third-party payors are increasingly challenging the prices charged for medical products and services, examining the medical necessity and reviewing the cost effectiveness of pharmaceutical or biological products, medical devices, and medical services, in addition to questioning safety and efficacy. Adoption of price controls and cost-containment measures, and adoption of more restrictive policies in jurisdictions with existing controls and measures, could further limit sales of any product that receives approval. Decreases in third-party reimbursement for any product or a decision by a third-party not to cover a product could reduce physician usage and patient demand for the product.

United States Healthcare Reform

Healthcare reforms that have been adopted, and that may be adopted in the future, could result in further reductions in coverage and levels of reimbursement for pharmaceutical products, increases in rebates payable under U.S. government rebate programs and additional downward pressure on pharmaceutical product prices. Several healthcare reform proposals recently culminated in the enactment of the Inflation Reduction Act ("IRA") in August 2022, which, among other things, allows HHS to directly negotiate the selling price of a statutorily specified number of drugs and biologics each year that CMS reimburses under Medicare Part B and Part D. Only high-expenditure single-source biologics that have been approved for at least 11 years (7 years for drugs) can be selected by CMS for negotiation, with the negotiated price taking effect two years after the selection year. Negotiations for Medicare Part D products take place in 2024 with the negotiated price taking effect in 2026, and negotiations for Medicare Part B products will begin in 2026 with the negotiated price taking effect in 2028. In August 2023, HHS announced the ten Medicare Part D drugs and biologics that it selected for negotiations. HHS will announce the negotiated maximum fair prices by September 1, 2024, and this price cap, which cannot exceed a statutory ceiling price, will go into effect on January 1, 2026. A drug or biological product that has an orphan drug designation for only one rare disease or condition will be excluded from the IRA's price negotiation requirements, but will lose that exclusion if it receives designations for more than one rare disease or condition, or if is approved for an indication that is not within that single designated rare disease or condition, unless such additional designation or such disqualifying approvals are withdrawn by the time CMS evaluates the drug for selection for negotiation. The IRA also imposes rebates on Medicare Part B and Part D drugs whose prices have increased at a rate greater than the rate of inflation. The IRA also extends enhanced subsidies for individuals purchasing health insurance coverage in ACA marketplaces through plan year 2025. The IRA permits the Secretary of HHS to implement many of these provisions through guidance, as opposed to regulation, for the initial years. Manufacturers that fail to comply with the IRA may be subject to various penalties, including significant civil monetary penalties. These provisions have been and may continue to be subject to legal challenges. For example, the provisions related to the negotiation of selling prices of high-expenditure single-source drugs and biologics have been challenged in multiple lawsuits brought by pharmaceutical manufacturers. Thus, while it is unclear how the IRA will be implemented, it will likely have a significant impact on the biopharmaceutical industry and the pricing of prescription drug products.

We expect that additional state and federal healthcare reform measures could be adopted in the future.

Other Government Regulation Outside of the United States

In addition to regulations in the United States, we are subject to a variety of regulations in other jurisdictions governing, among other things, research and development, clinical trials, testing, manufacturing, safety, efficacy, quality control, labeling, packaging, storage, record keeping, distribution, reporting, export and import, advertising, marketing, and other promotional practices involving biological products as well as authorization, approval as well as post-approval monitoring and reporting of our products. Because biologically sourced raw materials are subject to unique contamination risks, their use may be restricted in some countries.

Whether or not we obtain FDA approval for a product, we must obtain the requisite approvals from regulatory authorities in foreign countries prior to the commencement of clinical trials or marketing of the product in those countries. Certain countries outside of the United States have a similar process that requires the submission of a clinical trial application (a "CTA"), much like the IND prior to the commencement of human clinical trials.

The requirements and process governing the conduct of clinical trials, including requirements to conduct additional clinical trials, product licensing, safety reporting, post-authorization requirements, marketing and promotion, interactions with healthcare professionals, pricing, and reimbursement may vary widely from country to country. No action can be taken to market any product in a country until an appropriate approval application has been approved by the regulatory authorities in that country. The current approval process varies from country to country, and the time spent in gaining approval varies from that required for FDA approval. In certain countries, the sales price of a product must also be approved. The pricing review period often begins after market approval is granted. Even if a product is approved by a regulatory authority, satisfactory prices may not be approved for such product, which would make launch of such products commercially unfeasible in such countries.

Regulation in the European Union

Drug and Biologic Development Process

The conduct of clinical trials is currently governed by the EU Clinical Trials Directive 2001/20/EC ("Clinical Trials Directive"), and will be replaced by the EU Clinical Trials Regulation (EU) No. 536/2014 ("Clinical Trials Regulation"), once the latter comes into effect. The Clinical Trials Regulation introduces a complete overhaul of the existing regulation of clinical trials for medicinal products in the EU. Currently it is not expected to come into force before December 2021.

Under the current regime, before a clinical trial can be initiated, it must be approved in each EU Member State where there is a site at which the trial is to be conducted. The approval must be obtained from two separate entities: the National Competent Authority ("NCA"), and one or more Ethics Committees. The NCA of the EU Member States in which the clinical trial will be conducted must authorize the conduct of the trial, and the independent Ethics Committee must grant a positive opinion in relation to the conduct of the clinical trial in the relevant EU Member State before the commencement of the trial. Any substantial changes to the trial protocol or other information submitted with the clinical trial applications must be submitted to or approved by the relevant NCA and Ethics Committees. Under the current regime all suspected unexpected serious adverse reactions to the investigated drug that occur during the clinical trial must be reported to the NCA and to the Ethics Committees of the EU Member State where they occur.

A more unified procedure will apply under the new Clinical Trials Regulation. A sponsor will be able to submit a single application for approval of a clinical trial through a centralized EU clinical trials portal. One national regulatory authority (the reporting EU Member State proposed by the applicant) will take the lead in validating and evaluating the application and the other regulatory authorities will have limited involvement. If an application is rejected, it may be amended and resubmitted through the EU clinical trials portal. If an approval is issued, the sponsor may start the clinical trial in all concerned Member States. However, a concerned EU Member State may in limited circumstances declare an "opt-out" from an approval and prevent the clinical trial form being conducted in such Member State. The Clinical Trials Regulation also aims to streamline and simplify the rules on safety reporting and introduces enhanced transparency requirements such as mandatory submission of a summary of the clinical trial results to the EU Database.

Under both the current regime and the new Clinical Trials Regulation, national laws, regulations, and the applicable Good Clinical Practice and Good Laboratory Practice standards must also be respected during the conduct of the trials, including the International Council for Harmonization of Technical Requirements for Pharmaceuticals for Human Use ("ICH"), guidelines on Good Clinical Practice ("GCP"), and the ethical principles that have their origin in the Declaration of Helsinki.

During the development of a medicinal product, the European Medicines Agency ("EMA"), and national regulators within the EU provide the opportunity for dialogue and guidance on the development program, usually in the form of scientific advice. A fee is incurred with each scientific advice procedure. Advice from the EMA is typically provided based on questions concerning, for example, quality (chemistry, manufacturing, and controls testing), nonclinical testing and clinical studies, and pharmacovigilance plans and risk-management programs.

Drug Marketing Authorization

In the European Union, medicinal products, including advanced therapy medicinal products ("ATMPs"), are subject to extensive pre- and post-market regulation by regulatory authorities at both the European Union and national levels. ATMPs comprise gene therapy products, somatic cell therapy products, and tissue engineered products, which are genes, cells, or tissues that have undergone substantial manipulation and that are administered to human beings in order to cure, diagnose or prevent diseases or regenerate, repair or replace a human tissue. Pursuant to the ATMP Regulation, the Committee on Advanced Therapies ("CAT"), is responsible in conjunction with the Committee for Medicinal Products for Human Use ("CHMP") for the evaluation of ATMPs. The CHMP and CAT are also responsible for providing guidelines on ATMPs. These guidelines provide additional guidance on the factors that the EMA will consider in relation to the development and evaluation of ATMPs and include, among other things, the preclinical studies required to characterize ATMPs; the manufacturing and control information that should be submitted in a marketing authorization application; and post-approval measures required to monitor patients and evaluate the long-term efficacy and potential adverse reactions of ATMPs. Although such guidelines are not legally binding, compliance with them is often necessary to gain and maintain approval for product candidates.

In the European Union and in Iceland, Norway, and Liechtenstein (together the EEA), after completion of all required clinical testing, medicinal products may only be placed on the market after a related Marketing Authorization ("MA"), has been granted. MAs can be obtained through, amongst others, a centralized procedure, which is compulsory for certain medicinal products such as ATMPs. The centralized procedure provides for the grant of a single MA by the European Commission ("EC"), that is valid for all 27 EU Member States and, after respective national implementing decisions, in the three additional EEA Member States (Iceland, Norway, and Liechtenstein). The centralized procedure is compulsory for certain medicinal products, including medicinal products derived from biotechnological processes, orphan medicinal products, ATMPs, and products with a new active substance indicated for the treatment of AIDS, cancer, neurodegenerative disorders, diabetes, autoimmune diseases, and viral diseases. It is optional for medicinal products containing a new active substance not yet authorized in the EEA before May 20, 2004, that constitute significant therapeutic, scientific or technical innovations, or for which the grant of a MA through the centralized procedure would be in the interest of public health at the EU level. The timeframe for the evaluation of an application under the centralized procedure is 210 days, excluding clock stops. Typically, the overall process takes a year or more unless the application is eligible for an accelerated assessment.

All new marketing authorization applications must include a Risk Management Plan ("RMP"), describing the risk management system that the company will put in place and documenting measures to prevent or minimize the risks associated with the product. The regulatory authorities may also impose specific obligations as a condition of the MA. RMPs and Periodic Safety Update Reports ("PSURs") are routinely available to third parties requesting access, subject to limited redactions.

Additionally, the holder of a marketing authorization for an ATMP must put in place and maintain a system to ensure that each individual product and its starting and raw materials, including all substances coming into contact with the cells or tissues it may contain, can be traced through the sourcing, manufacturing, packaging, storage, transport, and delivery to the relevant healthcare institution where the product is used.

MAs have an initial duration of five years. The authorization may subsequently be renewed for an unlimited period unless the European Commission or the national competent authority grants only a five-year renewal.

Data and Market Exclusivity

As in the United States, the European Union also provides opportunities for market and/or data exclusivity. For example, New Chemical Entities ("NCE"), approved in the European Union generally qualify for eight years of data exclusivity and ten years of market exclusivity. Data exclusivity is the period during which another applicant cannot rely on the MA holder's pharmacological, toxicological, and clinical data in support of another MA for the purposes of submitting an application, obtaining marketing authorization or placing the product on the market. But after eight years, a generic or biosimilar product application may be submitted and generic companies may rely on the MA holder's data.

However, even if a generic or biosimilar product is authorized it cannot be placed on the market in the European Union until the expiration of the 10-year market exclusivity period. An additional non-cumulative one-year period of marketing exclusivity is possible if during the data exclusivity period (the first eight years of the 10-year marketing exclusivity period), the MA holder obtains an authorization for one or more new therapeutic indications that are deemed to bring a significant clinical benefit compared to existing therapies.

Products may not be granted data exclusivity since there is no guarantee that a product will be considered by the European Union's regulatory authorities to include an NCE. Even if a compound is considered to be an NCE and the MA applicant is able to gain the prescribed period of data exclusivity, another company nevertheless could also market another version of the medicinal product if such a company can complete a full marketing authorization application with their own complete database of pharmaceutical tests, preclinical studies, and clinical trials and obtain MA for its product.

Post-Approval Regulation

Similar to the United States, both MA holders and manufacturers of medicinal products are subject to comprehensive regulatory oversight by the EMA, the European Commission, and/or the competent regulatory authorities of the EU Member States. This oversight applies both before and after grant of manufacturing licenses and marketing authorizations. It includes control of compliance with EU good manufacturing practices rules, manufacturing authorizations, pharmacovigilance rules, and requirements governing advertising, promotion, sale, and distribution, recordkeeping, importing, and exporting of medicinal products.

Failure by us or by any of our third-party partners, including suppliers, manufacturers, and distributors to comply with EU laws and the related national laws of individual EU Member States governing the conduct of clinical trials, manufacturing approval, marketing authorization of medicinal products, and marketing of such products, both before and after grant of marketing authorization, statutory health insurance, bribery and anti-corruption, or other applicable regulatory requirements may result in administrative, civil, or criminal penalties.

These penalties could include delays or refusal to authorize the conduct of clinical trials or to grant marketing authorization, product withdrawals and recalls, product seizures, suspension, withdrawal or variation of the marketing authorization, total or partial suspension of production, distribution, manufacturing or clinical trials, operating restrictions, injunctions, suspension of licenses, fines, and criminal penalties.

The holder of a marketing authorization for a medicinal product must also comply with EU pharmacovigilance legislation and its related regulations and guidelines, which entail many requirements for conducting pharmacovigilance, or the assessment and monitoring of the safety of medicinal products. These pharmacovigilance rules can impose on holders of MAs the obligation to conduct a labor intensive collection of data regarding the risks and benefits of marketed medicinal products and to engage in ongoing assessments of those risks and benefits, including the possible requirement to conduct additional clinical studies or post-authorization safety studies to obtain further information on a medicine's safety, or to measure the effectiveness of risk-management measures, which may be time consuming and expensive and could impact our profitability. MA holders must establish and maintain a pharmacovigilance system and appoint an individual qualified person for pharmacovigilance, who is responsible for oversight of that system. Key obligations include expedited reporting of suspected serious adverse reactions and submission of PSURs in relation to medicinal products for which they hold MAs. The EMA reviews PSURs for medicinal products authorized through the centralized procedure. If the EMA has concerns that the risk benefit profile of a product has varied, it can adopt an opinion advising that the existing MA for the product be suspended, withdrawn or varied. The agency can advise that the MA holder be obliged to conduct post-authorization Phase IV safety studies. If the EC agrees with the opinion, it can adopt a decision varying the existing MA. Failure by the marketing authorization holder to fulfill the obligations for which the EC's decision provides can undermine the ongoing validity of the MA.

More generally, non-compliance with pharmacovigilance obligations can lead to the variation, suspension or withdrawal of the MA for the product or imposition of financial penalties or other enforcement measures.

Sales and Marketing Regulations

The advertising and promotion of our products is also subject to EU laws concerning promotion of medicinal products, interactions with physicians, misleading and comparative advertising and unfair commercial practices. In addition, other national legislation of individual EU Member States may apply to the advertising and promotion of medicinal products and may differ from one country to another. These laws require that promotional materials and advertising in relation to medicinal products comply with the product's Summary of Product Characteristics ("SmPC") as approved by the competent regulatory authorities.

The SmPC is the document that provides information to physicians concerning the safe and effective use of the medicinal product. It forms an intrinsic and integral part of the marketing authorization granted for the medicinal product. Promotion of a medicinal product that does not comply with the SmPC is considered to constitute off-label promotion. All advertising and promotional activities for the product must be consistent with the approved SmPC and therefore all off-label promotion is prohibited. Direct-to-consumer advertising of prescription-only medicines is also prohibited in the European Union. Violations of the rules governing the promotion of medicinal products in the European Union could be penalized by administrative measures, fines, and imprisonment. These laws may further limit or restrict the advertising and promotion of our products to the general public and may also impose limitations on its promotional activities with healthcare professionals.

Anti-Corruption Legislation

In the EU, interactions between pharmaceutical companies and physicians are also governed by strict laws, regulations, industry self-regulation codes of conduct and physicians' codes of professional conduct both at the EU level and in the individual EU Member States. The provision of benefits or advantages to physicians to induce or encourage the prescription, recommendation, endorsement, purchase, supply, order or use of medicinal products is prohibited in the European Union. The provision of benefits or advantages to physicians is also governed by the national anti-bribery laws of the EU Member States. Violation of these laws could result in substantial fines and imprisonment.

Payments made to physicians in certain EU Member States also must be publicly disclosed. Moreover, agreements with physicians must often be the subject of prior notification and approval by the physician's employer, his/her regulatory professional organization, and/or the competent authorities of the individual EU Member States. These requirements are provided in the national laws, industry codes, or professional codes of conduct, applicable in the individual EU Member States. Failure to comply with these requirements could result in reputational risk, public reprimands, administrative penalties, fines or imprisonment.

Other Markets

Following the UK's formal departure from the EU on January 31, 2020, the UK entered a transition period to last until December 31, 2020, during which time EU medicines laws will remain applicable to the UK. After the transition period however, changes may be forthcoming as the terms of the UK and EU's future relationship are negotiated. The UK Medicines and Healthcare Products Regulatory Agency has proposed that, subject to being approved by the UK Parliament, a centralized MA will automatically convert into a UK MA. However, the draft of the "Medicines and Medical Devices Bill 2019-21" currently discussed in the UK House of Lords does not contain such a provision, but would only authorize the UK government to become active in the field of legislation concerning market authorizations in relation to human medicines.

For other countries outside of the European Union, such as countries in Eastern Europe, Latin America or Asia, the requirements governing the conduct of clinical trials, product licensing, pricing, and reimbursement vary from country to country. In all cases, again, the clinical trials must be conducted in accordance with GCP and the applicable regulatory requirements and the ethical principles that have their origin in the Declaration of Helsinki.

If we fail to comply with applicable foreign regulatory requirements, we may be subject to, among other things, fines, suspension of clinical trials, suspension or withdrawal of regulatory approvals, product recalls, seizure of products, operating restrictions, and criminal prosecution.

Human Capital Management

Our approach to human capital resource management starts with our mission to discover and develop novel immunotherapies to lengthen health span by disrupting the link between chronic, low-grade inflammation and age-related diseases. Our industry exists in a complex regulatory environment. The unique demands of our industry, together with the challenges of running an enterprise focused on the discovery, development, manufacture and commercialization of innovative medicines, require talent that is highly educated and/or has significant industry experience. Additionally, for certain key functions, we require specific scientific expertise to oversee and conduct R&D activities and the complex manufacturing requirements for biopharmaceutical products.

Our human capital resources objectives include, as applicable, identifying, recruiting, retaining, incentivizing and integrating our existing and additional employees. We recognize that attracting, motivating and retaining talent at all levels is vital to our continued success. Our employees are a significant asset and we aim to create an equitable, inclusive and empowering environment in which our employees can grow and advance their careers, with the overall goal of developing, expanding and retaining our workforce to support our current pipeline and future business goals. By focusing on employee retention and engagement, we also improve our ability to support our clinical trials, our pipeline, our platform technologies, business and operations, and also protect the long-term interests of our stockholders. Our success also depends on our ability to attract, engage and retain a diverse group of employees.

Our base pay program aims to compensate management and staff members relative to the value of the contributions of their role, which takes into account the skills, knowledge and abilities required to perform each position, as well as the experience brought to the job. We also provide annual incentive programs to reward our management team and staff members in alignment with achievement of Company-wide goals that are established annually and designed to drive aspects of our strategic priorities that support and advance our strategy across our Company. Our management team and staff members are eligible for the grant of equity awards under our long-term incentive program that are designed to align the experience of these staff with that of our stockholders. All management team and staff members also participate in a regular performance measurement process that aligns pay to performance and through which they receive performance and development feedback.

Our benefit programs are also generally broad-based, promote health and overall well-being and emphasize saving for retirement. All management team and regular staff members are eligible to participate in the same core health and welfare and retirement savings plans. Other employee benefits include medical plans, health savings plan, dental plans, vacation and sick-pay plans, employee assistance programs, life and accident insurance and short and long-term disability benefits.

Our Compensation Committee provides oversight of our compensation plans, policies and programs.

As of December 31, 2023, we had 45 full-time employees, 33 of whom were engaged in research, clinical development, manufacturing, and quality control activities, and 12 of whom were engaged in administrative activities. None of our employees are represented by labor unions or covered by collective bargaining agreements. We consider our relationship with our employees to be good.

Corporate Information

We are located in Miramar, Florida and were incorporated in the state of Delaware in April 2018.

Available Information

We make available, free of charge, on or through our website (http://www.hcwbiologics.com), our annual reports on Form 10-K, quarterly reports on Form 10-Q, and current reports on Form 8-K, and amendments to those reports, filed or furnished pursuant to Sections 13(a) or Section 15(d) of the Securities Exchange Act of 1934, as amended, as soon as reasonably practicable after they have been electronically filed with, or furnished to, the SEC. References to website addresses in this report are intended to be inactive textual references only, and none of the information contained on our website is part of this report or incorporated in this report by reference.

Item 1A Risk Factors.

Our operations and financial results are subject to various risks and uncertainties, including those described below that could adversely affect our business, financial condition, results of operations, cash flows and the trading price of our common stock. It is not possible to predict or identify all such risks; our operations could also be affected by factors, events or uncertainties that are not presently known to us or that we currently do not consider to present significant risks to our operations. Therefore, while you should carefully consider the following risks, together with all of the other information in this Annual Report, including the section titled "Management's Discussion and Analysis of Financial Condition and Results of Operations," our financial statements and the related notes thereto. You should not consider the following risks to be a complete statement of all the potential risks or uncertainties we could face.

Summary of Key Risk Factors

- We have incurred significant financial losses since our inception and we expect to incur losses for the foreseeable future. We have no products approved for commercial sale and may never achieve or maintain profitability.
- There is substantial doubt regarding our ability to continue as a going concern based on our cash and cash equivalents as of December 31, 2023. We will need to raise additional funding, which may not be available on acceptable terms, if at all, to continue as a going concern and advance our current and any potential future product candidates. Failure to obtain capital when needed may force us to delay, limit or terminate our product development efforts or other operations. Raising additional capital may dilute our existing shareholders, restrict our operations or cause us to relinquish valuable rights.
- We and our Chief Executive Officer are currently involved in legal proceedings with Altor BioScience, LLC and NantCell (collectively, "Altor/NantCell") in which Altor/NantCell have alleged, among other things, a claim of trade secret misappropriation and other related claims against us and breach of contract and fiduciary duty, among other claims, against our chief executive officer in arbitration, and an adverse result could have a negative material impact on our business and operations.
- Our clinical trials may fail to demonstrate substantial evidence of the safety and efficacy of our product candidates or any future product candidates, which would prevent or delay or limit the scope of regulatory approval and commercialization.
- Preliminary, topline or interim data from our clinical trials that we announce or publish from time to time may change as more patient data becomes available and are subject to audit and verification procedures that could result in material changes in the final data.
- The development and commercialization of biopharmaceutical products is subject to extensive regulation, and the regulatory approval processes of the FDA and comparable foreign authorities are lengthy, time-consuming, and inherently unpredictable. If we are ultimately unable to obtain regulatory approval for our product candidates on a timely basis if at all, our business will be substantially harmed.
- Clinical drug development is a lengthy and expensive process with uncertain timelines and uncertain outcomes. If clinical trials of our product candidates are prolonged or delayed, we or any collaborators may be unable to obtain required regulatory approvals, and therefore be unable to commercialize our product candidates on a timely basis or at all.
- Even if our product candidates obtain regulatory approval, we will be subject to ongoing obligations and continued regulatory review, which may result in significant additional expense. Additionally, our product candidates, if approved, could be subject to labeling and other restrictions and market withdrawal and we may be subject to penalties if we fail to comply with regulatory requirements or experience unanticipated problems with our products.
- We expect to rely on patents and other intellectual property rights to protect our technology, including product candidates and our immunotherapy platform technology, the prosecution, enforcement, defense, and maintenance of which may be challenging, time-consuming and costly. Failure to defend, protect or enforce these rights adequately, and costs and expenses associated with the same, could impact our financial condition and results of operations or otherwise harm our ability to compete and impair our business.
- We rely on third parties to manufacture our product candidates. Any failure by a third-party manufacturer to produce acceptable drug substance for us or to obtain authorization from the FDA or comparable regulatory authorities may delay or impair our ability to initiate or complete our clinical trials, obtain regulatory approvals or commercialize approved products.
- Our information technology systems, or those used by our third-party contractors or consultants, may fail or suffer security breaches, which could adversely affect our business.

Risks Related to our Financial Position and Need for Additional Capital

We have incurred significant losses since our inception and we expect to incur losses for the foreseeable future. We have no products approved for commercial sale and may never achieve or maintain profitability.

Since our inception, we have devoted most of our financial resources and all of our efforts to research and development, including preclinical studies and our clinical trials, and have incurred significant operating losses. For the years ended December 31, 2022 and 2023, we reported a net loss of $14.9 million and $19.7 million, respectively. As of December 31, 2023, we had $3.6 million in cash and cash equivalents, in the balance sheet included in our audited financial statements included elsewhere in this Annual Report. From inception to December 31, 2023, we incurred cumulative net losses of $67.8 million. To date, we have financed our operations primarily through our initial public offering, or the IPO, the sale of our redeemable preferred stock, and to a lesser extent, payments received under our Wugen License for certain rights to two of our internally-developed molecules and proceeds from a Paycheck Protection Program ("PPP") loan obtained through the Coronavirus Aid, Relief, and Economic Security Act (the "CARES Act") which was forgiven. Based on our current operating plans, we believe that our cash and cash equivalents as of December 31, 2023, without considering any mitigating effects of financings that occurred after year end, will not be sufficient for the Company to continue as a going concern for at least one year from the issuance date of the financial statements appearing elsewhere in this Annual Report.

Our losses have resulted principally from expenses incurred in the research and development of our product candidates and from management and administrative costs and other expenses that we have incurred while building our business infrastructure, as well as from the significant expenses we have incurred defending ourselves in current disputes with Altor/NantCell and advancing legal expenses of Dr. Wong, each as described further below. We expect to continue to incur significant operating losses for the foreseeable future. The only revenue we have generated to date relates to our Wugen License and the clinical material supply agreement. We have not generated any revenues from product sales. We anticipate that our expenses will increase substantially as we initiate preclinical and clinical studies, scale up our manufacturing process and capabilities to support our clinical studies and grow to scale.

We have no products for which we have obtained marketing approval and have not generated any revenue from product sales. Even if we obtain marketing approval for, and are successful in commercializing, one or more of our product candidates, we expect to incur substantial additional research and development and other expenditures to develop and market additional product candidates or to expand the approved indications of any marketed product. 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.

To become and remain profitable, we must succeed in developing and eventually commercializing products that generate significant revenue. This will require us to be successful in a range of challenging activities, including completing preclinical testing and clinical trials of our product candidates, discovering and developing additional product candidates, obtaining regulatory approval for any product candidates that successfully complete clinical trials, accessing manufacturing capacity, establishing marketing capabilities, and ultimately selling any products.. We may never succeed in these activities and, even if we do, we may never generate revenue that is sufficient to achieve profitability.

There is substantial doubt about our ability to continue as a going concern. We will need to raise additional funding, which may not be available on acceptable terms, if at all to continue as a going concern and advance our product candidates. Failure to obtain capital when needed may force us to delay, limit or terminate our product development efforts or other operations. Raising additional capital may dilute our existing shareholders, restrict our operations or cause us to relinquish valuable rights.

There is substantial doubt regarding our ability to continue as a going concern based only on the cash and cash equivalents as of December 31, 2023. We continuously evaluate whether there are conditions and events, considered in the aggregate, which raise substantial doubt about our ability to continue as a going concern within one year after the date that financial statements are issued. When substantial doubt exists based on this analysis, management evaluates whether the mitigating effect of our plans to raise capital or reduce costs sufficiently alleviates substantial doubt about our ability to continue as a going concern.

We are at the clinical development stage of our Company with no commercial revenues from the products we are developing, and it is possible we will never generate revenue or profit from product sales. As of December 31, 2023, we had cash and cash equivalents of $3.6 million. Our management believes that such cash and cash equivalents will not be sufficient to fund our operating expenses and capital requirements for one year after the date the financial statements included elsewhere in this Annual Report are issued, whether or not we curtail efforts with respect to certain of our current and future product candidates. We will require significant additional funding to advance any of our product candidates beyond the short term and to sustain our operations.

We intend to seek funds through collaborations, strategic alliances, or licensing arrangements with third parties. Such agreements may adversely impact retained rights to our assets, product candidates, future revenue streams and programs, especially those that require regulatory approval.

We may also seek to raise such capital through public or private equity, royalty financing or debt financing. Raising funds in the current economic environment may be challenging, and such financing may not be available in sufficient amounts or on acceptable terms, if at all. The terms of any financing may harm existing shareholders. The issuance of additional securities, whether equity or debt, or the possibility of such issuance, may cause the market price of our shares to decline. The sale of additional equity or convertible securities may dilute the ownership of existing shareholders. Incurring debt would result in increased fixed payment obligations, and we may agree to restrictive covenants, such as limitations on our ability to incur additional debt or limitations on our ability to acquire, sell or license intellectual property rights that could impede our ability to conduct our business.

Our limited operating history may make it difficult for you to evaluate the success of our business to date and to assess our future viability.

Since our inception in 2018, we have devoted a significant portion of our resources to identifying and developing our product candidates emerging from our internally-developed immunotherapy platform technology, our other research and development efforts, building our intellectual property portfolio, raising capital, and providing general and administrative support for these operations. We have not yet demonstrated our ability to successfully complete 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 product commercialization. Additionally, we expect our financial condition and operating results to continue to fluctuate significantly from period to period due to a variety of factors, many of which are beyond our control. Consequently, any predictions you may make about our future success or viability may not be as accurate as they could be if we had a longer operating history.

We will require additional funding in order to complete development of our product candidates and commercialize our products, if approved. However, this additional financing may not be available on acceptable terms, or at all. If we are unable to raise capital when needed, we could be forced to delay, reduce, or eliminate our product development programs or commercialization efforts.

Our operations have consumed significant amounts of cash since inception. We expect our expenses to increase in connections with our ongoing activities, particularly as we continue to initiate clinical trials of, and seek marketing approval for, our product candidates. In addition, if we obtain marketing approval for any of our product candidates, we expect to incur significant commercialization expenses related to product sales, marketing, manufacturing and distribution. Accordingly, we will need to obtain substantial additional funding for our continuing operations. If we are unable to raise capital when needed or on attractive terms, we may be forced to:

- delay, limit, reduce, or terminate preclinical studies, clinical trials, or other research and development activities, or eliminate one or more of our development programs altogether;
- delay or terminate our plan to build and renovate our manufacturing facility; or
- delay, limit, reduce, or terminate our efforts to establish manufacturing capacity, establish sales and marketing capabilities or other activities that may be necessary to commercialize our product candidates, or reduce our flexibility in developing or maintaining our sales and marketing strategy.

Raising additional capital may cause dilution to our stockholders, restrict our operations or require us to relinquish rights to our technologies or product candidates.

We expect our expenses to increase in connection with our planned operations. Unless and until we can generate a substantial amount of revenue from our technologies or product candidates, we will seek to finance our future cash needs through equity offerings, royalty-based or debt financings, collaborations, licensing arrangements or other sources, or any combination of the foregoing. In addition, we may seek additional capital due to favorable market conditions or strategic considerations, even if we believe that we have sufficient funds for our current or future operating plans.

To the extent that we raise additional capital through the sale of common stock, convertible securities or other equity securities, stockholders' interests may be diluted, and the terms of these securities could include liquidation or other preferences and anti-dilution protections that could adversely affect our stockholders' rights. In addition, new debt financing, if available, may result in fixed payment obligations and may involve agreements that include restrictive covenants that further limit our ability to take specific actions, such as incurring additional debt, making capital expenditures, creating liens, redeeming stock or declaring dividends, which could adversely impact our ability to conduct our business. In addition, securing financing could require a substantial amount of time and attention from our management and may divert a disproportionate amount of their attention away from day-to-day activities, which may adversely affect their ability to oversee the development and potential future commercialization of our product candidates.

If we raise additional funds through collaborations or marketing, distribution or licensing arrangements with third parties, we may have to relinquish valuable rights to our technologies, future revenue streams or product candidates or grant licenses on terms that may not be favorable to us.

Risks Related to our Business

If we or any collaborators we work with in the future are unable to successfully develop and commercialize our product candidates, or experience significant delays in doing so, our business, financial condition, and results of operations will be materially adversely affected.

Our ability to generate product and royalty revenues, which we do not expect will occur for at least the next several years, if ever, will depend heavily on the successful development and eventual commercialization of our product candidates, which may never occur. We currently generate no revenue from sales of any products, and we may never be able to develop or commercialize a marketable product. Each of our product candidates and any future product candidates we develop will require significant clinical development, management of clinical, preclinical, and manufacturing activities, regulatory approval in multiple jurisdictions, establishing manufacturing supply, including commercial manufacturing supply, and require us to build a commercial organization and make substantial investment and significant marketing efforts before we generate any revenue from product sales. We are not permitted to market or promote any of our product candidates before we receive regulatory approval from the FDA or comparable foreign regulatory authorities, and we may never receive such regulatory approval for any of our product candidates.

If we do not successfully execute or address these matters in a timely manner or at all, we could experience significant delays or an inability to successfully develop and commercialize our product candidates, which would materially adversely affect our business, financial condition, and results of operations.

A key element of our strategy is to enter into out-licensing arrangements for certain rights to internally-developed molecules that we do not intend to develop into lead product candidates on our own or together with co-development partners. We may not be able to identify licensees, which could lower any return on our investments and increase our need for external funding.

Since we have already generated over 30 immunotherapeutic molecules, and plan to develop additional molecules, through our immunotherapy platform technology, our strategy includes funding operations in part through revenues derived from out-licensing molecules that are outside our oncological and anti-aging focus to third parties. Despite our efforts, we may be unable to enter into such licensing agreements. Supporting diligence activities conducted by potential licensors and negotiating the financial and other terms of a license agreement are long and complex processes with uncertain results, and we may fail to derive any revenues from these activities. Further, our potential licensors may develop alternative products or pursue alternative technologies either on their own or in collaboration with others, potentially resulting in our receiving no future milestone or royalty payments under any such licenses. For example, we have an exclusive worldwide license arrangement with Wugen pursuant to the development of certain cellular therapy products under which we may earn additional milestone or royalty payments, but there can be no assurance that Wugen will be successful in commercializing any products related to this license or that any such payments will ever be earned. If we fail to successfully out-license to third parties internally-developed molecules that are outside our focus areas, our revenues and return on our research and development activities would be negatively affected and we could be required to seek additional funding.

We expect to continue to expand our capabilities, and as a result, we may encounter difficulties in managing our growth, which could disrupt our operations.

As of December 31, 2023, we had 45 full-time employees. We expect to experience continued growth in the number of our employees and the scope of our operations, particularly in the areas of drug development and regulatory affairs. To manage our anticipated future growth, we must continue to implement and improve our managerial, operational, and financial systems, expand our facilities, and continue to recruit and train additional qualified personnel. Due to our limited financial resources and the limited experience of our management team in managing a public company with such anticipated growth, we may not be able to effectively manage the expansion of our operations or recruit and train additional qualified personnel. The expansion of our operations may lead to significant costs and may divert our management and business development resources. Any inability to manage growth could delay the execution of our business plans or disrupt our operations.

In addition, future growth imposes significant added responsibilities on members of management, including: identifying, recruiting, integrating, maintaining, and motivating additional employees; managing our internal development efforts effectively, including the clinical and FDA review process for our product candidates, while complying with our contractual obligations to contractors and other third parties; and improving our operational, financial and management controls, reporting systems, and procedures.

We currently rely on certain independent organizations, advisors, and consultants to provide certain services, including strategic, financial, business development services, as well as certain aspects of regulatory approval, clinical management, manufacturing, and preparation for a potential commercial launch. There can be no assurance that the services of independent organizations, advisors, and consultants will continue to be available to us on a timely basis when needed, or that we can find qualified replacements. In addition, if we are unable to effectively manage our outsourced activities or if the quality or accuracy of the services provided by consultants or contract manufacturing organizations is compromised for any reason, our clinical trials may be extended, delayed, or terminated, and we may not be able to obtain regulatory approval of our product candidates or otherwise advance our business. There can be no assurance that we will be able to manage our existing consultants or find other competent outside contractors and consultants on economically reasonable terms, or at all.

Our business and operations are subject to risks related to climate change.

The long-term effects of global climate change present risks to our business. Extreme weather or other conditions caused by climate change could adversely impact our supply chain and the operation of our business, which is geographically subject to higher incidents of climate events (such as hurricanes and other aggressive weather patterns). Such conditions could result in physical damage to our Miramar headquarters, clinical trial materials, clinical sites, or the facilities of our third-party manufacturing partners. These events could adversely affect our operations and our financial performance. The potential impacts of climate change may also include increased operating costs associated with additional regulatory requirements and investments in reducing energy, water use and greenhouse gas emissions.

Risks Related to the Development and Clinical Testing of Our Product Candidates

Our clinical trials may fail to demonstrate the safety and efficacy of our product candidates or any future product candidates, which would prevent or delay or limit the scope of regulatory approval and commercialization.

To obtain the requisite regulatory approvals to market and sell any product candidates, we must demonstrate through extensive preclinical studies and clinical trials that our investigational drug products are safe and effective for use in each targeted indication. 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 development process. Most product candidates that begin clinical trials are never approved by regulatory authorities for commercialization. We may be unable to establish clinical endpoints that applicable regulatory authorities would consider clinically meaningful, and a clinical trial can fail at any stage of testing.

Further, the process of obtaining regulatory approval is expensive, often takes many years following the commencement of clinical trials, and can vary substantially based upon the type, complexity, and novelty of the product candidates involved, as well as the target indications, patient population, and regulatory agency. Prior to obtaining approval to commercialize our product candidates and any future product candidates in the United States or abroad, we, our collaborators or our potential future collaborators must demonstrate with evidence from adequate and well-controlled clinical trials and to the satisfaction of the FDA or comparable foreign regulatory authorities, that such product candidates are safe and effective for their intended uses.

Clinical trials that we conduct may not demonstrate the efficacy and safety necessary to obtain regulatory approval to market our product candidates. In some instances, there can be significant variability in safety or efficacy results between different clinical trials of the same product 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 clinical trial protocols, and the rate of dropout among clinical trial participants. If the results of our clinical trials are inconclusive with respect to the efficacy of our product candidates, if we do not meet the clinical endpoints with statistical and clinically meaningful significance, or if there are safety concerns associated with our product candidates, we may be delayed in obtaining marketing approval, if at all. Additionally, any safety concerns observed in any one of our clinical trials, including adverse safety events in later trials that were not observed in prior trials, could limit the prospects for regulatory approval of that product candidate or other product candidates in any indications.

Even if the trials are successfully completed, clinical data are often susceptible to varying interpretations and analyses, and we cannot guarantee that the FDA or comparable foreign regulatory authorities will interpret the results as we do, and more trials could be required before we submit our product candidates for approval. We cannot guarantee that the FDA or comparable foreign regulatory authorities will view our product candidates as demonstrating substantial evidence of efficacy even if positive results are observed in clinical trials. Moreover, results acceptable to support approval in one jurisdiction may be deemed inadequate by another regulatory authority to support regulatory approval in that other jurisdiction. To the extent that the results of the trials are not satisfactory to the FDA or comparable foreign regulatory authorities for support of a marketing application, approval of our product candidates and any future product candidates may be significantly delayed, or we may be required to expend significant additional resources, which may not be available to us, to conduct additional trials in support of potential approval of our product candidates. Even if regulatory approval is secured for a product candidate, the terms of such approval may limit the scope and use of the specific product candidate, which may also limit its commercial potential.

Preliminary, topline or interim data from our clinical trials that we announce or publish from time to time may change as more patient data becomes 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 publicly disclose preliminary or topline data from our preclinical studies and clinical trials, which is based on a preliminary analysis of then-available data, and the results and related findings and conclusions are subject to change following a more comprehensive review of the data related to the particular study or trial. 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. 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. 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 previously published. As a result, topline data should be viewed with caution until the final data are available. 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 product candidate or product, and our company in general.

From time to time, we may also disclose data from planned interim analyses of our 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 and could result in volatility in the price of our common stock. Adverse differences between interim data and final data could significantly harm our business, operating results, prospects, or financial condition.

Clinical drug development is a lengthy and expensive process with uncertain timelines and uncertain outcomes. If clinical trials of our product candidates are prolonged or delayed, we or any collaborators may be unable to obtain required regulatory approvals, and therefore be unable to commercialize our product candidates on a timely basis or at all.

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. Product candidates in later stages of clinical trials may fail to produce the same results or to show the desired safety and efficacy traits despite having progressed through preclinical studies and initial clinical trials. Our future clinical trial results may not be successful.

To date, we have not completed any clinical trials required for the approval of our product candidates. We may experience delays in our clinical trials, and we do not know whether planned clinical trials will begin on time, need to be redesigned, enroll patients on time, or be completed on schedule, if at all. These clinical trials can be delayed, suspended, or terminated for a variety of reasons, including but not limited to delays in or failure to obtain regulatory authorization to commence a trial and IRB approval at each site, to reach agreement on acceptable terms with prospective clinical trial sites, or to recruit and enroll suitable patients to participate in a trial. In addition, the results of preclinical and early clinical trials of our product candidates may not be predictive of the results of our later-stage clinical trials. For example, while we may believe certain results in patients, such as stable disease, suggest encouraging clinical activity, stable disease is not considered a response for regulatory purposes in an endpoint assessing objective response rate. In addition, even if the regulatory authorities agree with the design and implementation of the clinical trials set forth in an IND or similar application, we cannot guarantee that such regulatory authorities will not change their requirements in the future. These considerations also apply to new clinical trials we may submit as amendments to existing INDs.

Clinical trials must be conducted in accordance with the FDA's and other applicable regulatory authorities' legal requirements, regulations or guidelines, and are subject to oversight by these governmental agencies and Ethics Committees or IRBs at the medical institutions where the clinical trials are conducted. We could encounter delays if a clinical trial is suspended or terminated by us, by the IRBs or Ethics Committees of the institutions in which such trials are being conducted, by the Data Review Committee or Data Safety Monitoring Board for such trial or by the FDA, or other regulatory authorities. If we experience delays in the completion of, or termination of, any clinical trial of our product candidates, the commercial prospects of our product candidates will be harmed, and our ability to generate product revenues from any of these product candidates will be delayed. In addition, any delays in completing our clinical trials will increase our costs, slow down our product candidate development and approval process, and jeopardize our ability to commence product sales and generate revenues. Significant clinical trial delays could also allow our competitors to bring products to market before we do or shorten any periods during which we have the exclusive right to commercialize our product candidates and impair our ability to commercialize our product candidates and may harm our business and results of operations.

In addition, clinical trials must be conducted with supplies of our product candidates produced under cGMP requirements and other regulations. Furthermore, we rely on clinical trial sites to ensure the proper and timely conduct of our clinical trials and while we have agreements governing their committed activities, we have limited influence over their actual performance. We depend on our collaborators and on medical institutions to conduct our clinical trials in compliance with GCP requirements. To the extent our collaborators fail to enroll participants for our clinical trials, fail to conduct the study in accordance with GCP, or are delayed for a significant time in the execution of trials, including achieving full enrollment, we may be affected by increased costs, program delays, or both, which may harm our business. In addition, clinical trials that are conducted in countries outside the United States may subject us to further delays and expenses as a result of increased shipment costs, and additional regulatory requirements, as well as expose us to risks associated with clinical investigators who are unknown to the FDA, and different standards of diagnosis, screening, and medical care.

Our lead product candidate, HCW9218, is currently being evaluated in multiple clinical trials in cancer indications. Our ability to advance HCW9218 through Phase 2 clinical trials depends on timely completion of current clinical studies, successfully meeting those studies' objectives, including dose finding and/or optimization for the Phase 2 evaluation, and obtaining FDA authorization to proceed to additional Phase 2 trials. If the FDA does not allow our Phase 2 clinical trials to proceed, we may be required to undertake additional IND-enabling activities or dose finding activities, which would result in further delay and additional costs. If we experience delays in the progression and completion of our clinical trials, or if we terminate a clinical trial prior to completion, the commercial prospects of HCW9218 could be harmed, and our ability to generate revenues from HCW9218 may be delayed. In addition, any delays in our clinical trials would require us to store material which could expose us to inventory risk, increased costs, slow down in development and approval process, as well as jeopardize our ability to commence product sales and generate revenues. Any of these occurrences may harm our business, financial condition and results of operations. In addition, many of the factors that cause, or lead to, a delay in the commencement or completion of clinical trials may also ultimately lead to the denial of regulatory approval of our product candidates.

Our other lead product candidate, HCW9302, is currently completing IND-enabling activities for an autoimmune indication. We rely on third-party providers for toxicology testing services for information required to be included in the submission of an IND. Any delays in completing toxicology studies and other IND-enabling activities will increase our costs, slow down our product candidate development and approval process, and jeopardize our ability to commence product sales and generate revenues. Significant delays in commencing clinical trials could also allow our competitors to bring products to market before we do or shorten any periods during which we have the exclusive right to commercialize our product candidates and impair our ability to commercialize our product candidates and may harm our business and results of operations.

We depend on enrollment of patients in our clinical trials for our product candidates. If we experience delays or difficulties enrolling in our clinical trials, our research and development efforts and business, financial condition, and results of operations could be materially adversely affected.

Successful and timely completion of clinical trials will require that we enroll a sufficient number of patient candidates. These trials and other trials we conduct may be subject to delays for a variety of reasons, including delays in completion of internal procedures required to open a clinical site, patient enrollment taking longer than anticipated, patient withdrawal, or adverse events. For example, there were delays in commencing clinical trials of HCW9218 as a result of the ongoing pandemic and staffing shortages at clinical sites. These types of developments could cause us to delay the trial or halt further development.

Our clinical trials will compete with other clinical trials that are in the same therapeutic areas as our product candidates, and this competition reduces the number and types of patients available to us, as some patients who might have opted to enroll in our trials may instead opt to enroll in a trial being conducted by one of our competitors. Moreover, enrolling patients in clinical trials for cancer therapies is challenging, as cancer patients will first receive the applicable standard of care. This may limit the number of eligible patients able to enroll in our clinical trials who have the potential to benefit from our drug candidates and could extend development timelines or increase costs for these programs. Patients who fail to respond positively to the standard of care treatment will be eligible for clinical trials of unapproved drug candidates. However, these patients may have either compromised immune function from prior administration of chemotherapy or an enhanced immune response from the prior administration of checkpoint inhibitors. Either of these prior treatment regimens may render our therapies less effective in clinical trials. Additionally, patients who have failed approved therapies will typically have more advanced cancer and a poorer long-term prognosis.

Patient enrollment depends on many factors, including but not limited to the size and nature of the patient population, the severity of the disease under investigation, and the availability of competing clinical trials, which may make it difficult for us to enroll enough patients to complete our clinical trials in a timely and cost-effective manner. Delays in the completion of any clinical trial of our product candidates will increase our costs, slow down our product candidate development and approval process, and delay or potentially jeopardize our ability to commence product sales and generate revenue. In addition, some of the factors that cause, or lead to, a delay in the commencement or completion of clinical trials may also ultimately lead to the denial of regulatory approval of our product candidates.

We may become exposed to costly and damaging product liability claims, either when testing our product candidates in the clinic or at the commercial stage, and our product liability insurance may not cover all damages from such claims.

We are exposed to potential product liability and professional indemnity risks that are inherent in the research, development, manufacturing, marketing, and use of pharmaceutical products. While we currently have no products that have been approved for commercial sale, the current and future use of product candidates by us and our partners in clinical trials, and the sale of any approved products in the future, may expose us to liability claims. These claims might be made by patients that use the product, healthcare providers, pharmaceutical companies, our partners, or others selling such products. Any claims against us, regardless of their merit, could be difficult and costly to defend and could materially adversely affect the market for our product candidates or any prospects for commercialization of our product candidates.

Although the clinical trial process is designed to identify and assess potential side effects, it is always possible that a drug, even after regulatory approval, may exhibit unforeseen side effects. If any of our product candidates were to cause adverse side effects during clinical trials or after approval of the product candidate, we may be exposed to substantial liabilities. Physicians and patients may not comply with any warnings that identify known potential adverse effects and patients who should not use our product candidates.

Even successful defense against product liability claims would require significant financial and management resources. Regardless of the merits or eventual outcome, liability claims may result in: decreased demand for our product candidates; 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 product candidate; and a decline in our share price.

Although we maintain adequate product liability insurance for our product candidates, it is possible that our liabilities could exceed our insurance coverage. We intend to expand our insurance coverage to include the sale of commercial products if we obtain marketing approval for any of our product candidates. However, we may be unable to maintain insurance coverage at a reasonable cost or obtain insurance coverage that will be adequate to satisfy any liability that may arise. If a successful product liability claim or series of claims is brought against us for uninsured liabilities or in excess of insured liabilities, our assets may not be sufficient to cover such claims, and our business operations could be impaired.

Risks Related to Our Regulatory Environment

The development and commercialization of biopharmaceutical products is subject to extensive regulation, and the regulatory approval processes of the FDA and comparable foreign authorities are lengthy, time-consuming, and inherently unpredictable. If we are ultimately unable to obtain regulatory approval for our product candidates on a timely basis if at all, our business will be substantially harmed.

The clinical development, manufacturing, labeling, packaging, storage, recordkeeping, advertising, promotion, export, import, marketing, distribution, adverse event reporting, including the submission of safety and other post-marketing information and reports, and other possible activities relating to our product candidates are subject to extensive regulation. In the United States, marketing approval of a biologic requires the submission of a BLA to the FDA, and we are not permitted to market any product candidate in the United States until we obtain approval from the FDA of the BLA for that product candidate. A BLA must be supported by extensive clinical and preclinical data, as well as extensive information regarding pharmacology, chemistry, manufacturing, and controls. Outside the United States, many comparable foreign regulatory authorities employ similar approval processes.

We have not previously submitted a BLA to the FDA or similar regulatory approval filings to comparable foreign authorities for any product candidate, and we cannot be certain that any of our product candidates will receive regulatory approval. Obtaining approval of a BLA can be a lengthy, expensive, and uncertain process, and as a company we have no experience with the preparation of a BLA submission or any other application for marketing approval. In addition, the FDA has the authority to require a REMS as part of a BLA or after approval, which may impose further requirements or restrictions on the distribution or use of an approved biologic, such as limiting prescribing to certain physicians or medical centers that have undergone specialized training, limiting treatment to patients who meet certain safe-use criteria and requiring treated patients to enroll in a registry. We also would not be permitted to market our product candidates in countries outside of the United States until we receive marketing approval from applicable regulatory authorities in those countries.

Our product candidates could fail to receive regulatory approval for many reasons including but not limited to flaws in trial design, dose selection, patient enrollment criteria and failure to demonstrate an acceptable risk:benefit profile. In addition, data obtained from clinical trials is susceptible to varying interpretations, and regulators may not interpret our data as favorably as we do, which may further delay, limit or prevent marketing approval. The lengthy approval process, as well as the unpredictability of future clinical trial results, may result in our failing to obtain regulatory approval to market any of our product candidates, which would significantly harm our business, results of operations, and prospects. The FDA and other regulatory authorities have substantial discretion in the approval process, and determining when or whether regulatory approval will be obtained for any of our product candidates. As a result, we may be required to conduct additional preclinical studies, alter our proposed clinical trial designs, or conduct additional clinical trials to satisfy the regulatory authorities in each of the jurisdictions in which we hope to conduct clinical trials and develop and market our products, if approved. Further, even if we believe the data collected from clinical trials of our product candidates are promising, such data may not be sufficient to support approval by the FDA or any other regulatory authority.

In addition, even if we were to obtain approval, regulatory authorities may approve any of our product candidates for fewer or more limited indications than we request, may not approve the price we intend to charge for our products, may grant approval contingent on the performance of costly post-marketing clinical trials, or may approve a product candidate with a label that does not include the labeling claims necessary or desirable for the successful commercialization of that product candidate. Any of the foregoing scenarios could materially harm the commercial prospects for our product candidates.

If we decide to pursue accelerated approval for any of our product candidates, it may not lead to a faster development or regulatory review or approval process and does not increase the likelihood that it will receive marketing approval. If we are unable to obtain approval under an accelerated pathway, we may be required to conduct additional clinical trials beyond those that we contemplate, which could increase the expense of obtaining, reduce the likelihood of obtaining and/or delay the timing of obtaining, necessary marketing approvals.

In the future, we may decide to pursue accelerated approval for one or more of our product candidates. Under the FDA's accelerated approval program, the FDA may approve a drug or biologic for a serious or life-threatening illness that provides meaningful therapeutic benefit to patients over existing treatments based upon 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. Many cancer therapies rely on accelerated approval, and the treatment landscape can change quickly as the FDA converts accelerated approvals to full approvals on the basis of successful confirmatory trials.

For drugs or biologics granted accelerated approval, post-marketing confirmatory trials are required to describe the anticipated effect on irreversible morbidity or mortality or other clinical benefit. These confirmatory trials must be completed with due diligence and, in some cases, the FDA may require that the trial be designed, initiated and/or fully enrolled prior to approval.

Moreover, the FDA may withdraw approval of any product candidate approved under the accelerated approval pathway if, for example:

- the trial or trials required to verify the predicted clinical benefit of our product candidate fail to verify such benefit or do not demonstrate sufficient clinical benefit to justify the risks associated with such product;
- other evidence demonstrates that our product candidate is not shown to be safe or effective under the conditions of use;
- we fail to conduct any required post-approval trial of our product candidate with due diligence; or
- we disseminate false or misleading promotional materials relating to the relevant product candidate.

In addition, the FDA may terminate the accelerated approval program or change the standards under which accelerated approvals are considered and granted in response to public pressure or other concerns regarding the accelerated approval program. Changes to or termination of the accelerated approval program could prevent or limit our ability to obtain accelerated approval of any of our clinical development programs. Recently, the accelerated approval pathway has come under scrutiny within the FDA and by Congress. The FDA has put increased focus on ensuring that confirmatory studies are conducted with diligence and, ultimately, that such studies confirm the benefit. For example, the FDA has convened its Oncologic Drugs Advisory Committee to review what the FDA has called dangling or delinquent accelerated approvals where confirmatory studies have not been completed or where results did not confirm benefit. In addition, the Oncology Center of Excellence has announced Project Confirm, which is an initiative to promote the transparency of outcomes related to accelerated approvals for oncology indications and provide a framework to foster discussion, research and innovation in approval and post-marketing processes, with the goal to enhance the balance.

The recent enactment of FDORA included provisions related to the accelerated approval pathway. Pursuant to FDORA, the FDA is authorized to require a post-approval study to be underway prior to approval or within a specified time period following approval. FDORA also requires the FDA to specify conditions of any required post-approval study and requires sponsors to submit progress reports for required post-approval studies and any conditions required by the FDA. FDORA enables the FDA to initiate enforcement action for the failure to conduct with due diligence a required post-approval study, including a failure to meet any required conditions specified by the FDA or to submit timely reports.

Even if our product candidates obtain regulatory approval, we will be subject to ongoing obligations and continued regulatory review, which may result in significant additional expense. Additionally, our product candidates, if approved, could be subject to labeling and other restrictions and market withdrawal and we may be subject to penalties if we fail to comply with regulatory requirements or experience unanticipated problems with our products.

If the FDA or a comparable foreign regulatory authority approves any of our product candidates, the manufacturing processes, labeling, packaging, distribution, import, export, adverse event reporting, storage, advertising, promotion, and recordkeeping for the product will be subject to extensive and ongoing regulatory requirements. These requirements include submissions of safety and other post-marketing information and reports, registration, as well as continued compliance with cGMP and GCP for any clinical trials that we conduct post-approval, all of which may result in significant expense and limit our ability to commercialize such products. In addition, any regulatory approvals that we receive for our product candidates may also be subject to limitations on the approved indicated uses for which the product may be marketed or to the conditions of approval, or contain requirements for potentially costly post-marketing testing, including Phase 4 clinical trials, and surveillance to monitor the safety and efficacy of the product candidate.

Manufacturers and manufacturers' facilities are required to comply with extensive FDA and comparable foreign regulatory authority requirements, including ensuring that quality control and manufacturing procedures conform to cGMP regulations. 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 approved marketing application. 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.

If there are changes in the application of legislation or regulatory policies, or if problems are discovered with a product or our manufacture of a product, or if we or one of our distributors, licensees or co-marketers fails to comply with regulatory requirements, the regulators could take various actions. These include issuing warning letters or untitled letters, imposing fines on us, imposing restrictions on the product or its manufacture, and requiring us to recall or remove the product from the market. The regulators could also suspend or withdraw our marketing authorizations, requiring us to conduct additional clinical trials, change our product labeling, or submit additional applications for marketing authorization. If any of these events occurs, our ability to sell such product may be impaired, and we may incur substantial additional expense to comply with regulatory requirements, which could materially adversely affect our business, financial condition, and results of operations.

In addition, if we have any product candidate approved, our product labeling, advertising, and promotion will be subject to regulatory requirements and continuing regulatory review. In the United States, the FDA and the Federal Trade Commission ("FTC"), strictly regulate the promotional claims that may be made about pharmaceutical products to ensure that any claims about such products are consistent with regulatory approvals, not misleading or false in any particular way, and adequately substantiated by clinical data. The promotion of a drug product in a manner that is false, misleading, unsubstantiated, or for unapproved (or off-label) uses may result in enforcement letters, inquiries and investigations, and civil and criminal sanctions by the FDA or the FTC. In particular, a product may not be promoted for uses that are not consistent with the uses approved by the FDA as reflected in the product's approved labeling. If we receive marketing approval for a product candidate, physicians may nevertheless prescribe it to their patients in a manner that is inconsistent with the approved label. If we are found to have promoted such off-label uses, we may become subject to significant liability. The FDA and other agencies actively enforce the laws and regulations prohibiting the promotion of off-label uses, and a company that is found to have improperly promoted off-label uses may be subject to significant sanctions and may result in false claims litigation under federal and state statutes, which can lead to consent decrees, civil monetary penalties, restitution, criminal fines and imprisonment, and exclusion from participation in Medicare, Medicaid, and other federal and state healthcare programs. The federal government has levied large civil and criminal fines against companies for alleged improper promotion and has enjoined several companies from engaging in off-label promotion. The FDA has also requested that companies enter into consent decrees or permanent injunctions under which specified promotional conduct is changed or curtailed.

If a regulatory agency discovers previously unknown problems with a product, such as adverse events of unanticipated severity or frequency, or problems with the facility where the product is manufactured, or disagrees with the promotion, marketing or labeling of a product, such regulatory agency may impose restrictions on that product or us, including requiring withdrawal of the product from the market.

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 approved. If regulatory sanctions are applied or if regulatory approval is withdrawn, the value of our company and our operating results will be adversely affected.

Moreover, the policies of the FDA and of other regulatory authorities may change and additional government regulations may be enacted that could prevent, limit, or delay regulatory approval of our product candidates. The standards that the FDA and its foreign counterparts use when regulating us require judgment and can change, which makes it difficult to predict with certainty their application. We may also encounter unexpected delays or increased costs due to new government regulations, for example, from future legislation or administrative action, or from changes in FDA policy during the period of product development, clinical trials and FDA regulatory review. It is impossible to predict whether legislative changes will be enacted, or whether FDA or foreign regulations, guidance or interpretations will be changed, or the impact of such changes, if any. For example, the Oncology Center of Excellence within the FDA has advanced Project Optimus, which is an initiative to reform the dose optimization and dose selection paradigm in oncology drug development to emphasize selection of an optimal dose, which is a dose or doses that maximizes not only the efficacy of a drug but the safety and tolerability as well. This shift from the prior approach, which generally determined the maximum tolerated dose, may require sponsors to spend additional time and resources to further explore a product candidate's dose-response relationship to facilitate optimum dose selection in a target population. Other recent Oncology Center of Excellence initiatives have included Project FrontRunner, a new initiative with a goal of developing a framework for identifying candidate drugs for initial clinical development in the earlier advanced setting rather than for treatment of patients who have received numerous prior lines of therapies or have exhausted available treatment options; Project Equity, which is an initiative to ensure that the data submitted to the FDA for approval of oncology medical products adequately reflects the demographic representation of patients for whom the medical products are intended; and Project Confirm, which is an initiative to promote the transparency of outcomes related to accelerated approvals for oncology indications and provide a framework to foster discussion, research and innovation in approval and post-marketing processes, with the goal to enhance the balance. We are considering these and other policy changes as they relate to our programs.

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

We are exposed to the risk of employee fraud or other misconduct. We cannot ensure that our compliance controls, policies, and procedures will in every instance protect us from acts committed by our employees, agents, contractors, or collaborators that would violate the laws or regulations of the jurisdictions in which we operate, including, without limitation, employment, foreign corrupt practices, trade restrictions and sanctions, environmental, competition, theft of trade secrets as well as patient privacy and other privacy laws and regulations. Misconduct by employees could include failures to comply with FDA regulations, provide accurate information to the FDA, comply with manufacturing standards we may establish, comply with federal and state healthcare fraud and abuse laws and regulations, report financial information or data accurately, or disclose unauthorized activities to us. In particular, sales, marketing, and business arrangements in the healthcare industry are subject to extensive laws and regulations intended to prevent fraud, kickbacks, self-dealing, and other abusive practices. These laws and regulations may restrict or prohibit a wide range of pricing, discounting, labeling, marketing and promotion, sales commission, customer incentive programs, and other business arrangements. Employee misconduct could also involve the improper use of information obtained in the course of clinical trials, which could result in regulatory sanctions and serious harm to our reputation. It is not always possible to identify and deter employee misconduct, 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 governmental investigations or other actions or lawsuits stemming from a failure to be in compliance with such laws or regulations.

If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a material and adverse effect on our business, financial condition, results of operations, and prospects, including the imposition of significant civil, criminal and administrative penalties, damages, monetary fines, individual imprisonment, disgorgement of profits, possible exclusion from participation in Medicare, Medicaid, and other federal healthcare programs, contractual damages, reputational harm, diminished profits and future earnings, additional reporting or oversight obligations if we become subject to a corporate integrity agreement or other agreement to resolve allegations of noncompliance with the law, and curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and pursue our strategy. Further, defending against any such actions can be costly, time-consuming, and may require significant personnel resources. Therefore, even if we are successful in defending against any such actions that may be brought against us, our business may be impaired.

Our current and future relationships with customers and third-party payors may be subject to applicable anti-kickback, fraud and abuse, transparency, health privacy, and other healthcare laws and regulations, which could expose us to significant penalties, including criminal, civil, and administrative penalties, contractual damages, reputational harm and diminished profits and future earnings.

Healthcare providers, including physicians, and third-party payors will play a primary role in the recommendation and prescription of any product candidates for which we obtain marketing approval. Our current and future arrangements with healthcare providers, third-party payors and customers may expose us to broadly applicable fraud and abuse and other healthcare laws and regulations that may constrain the business or financial arrangements and relationships through which we research, as well as, market, sell and distribute any products for which we obtain marketing approval. Restrictions under applicable federal and state healthcare laws and regulations that may be applicable to our business include the following:

- the federal Anti-Kickback Statute prohibits, among other things, persons and entities from knowingly and willfully soliciting, offering, receiving or providing remuneration, directly or indirectly, in cash or in kind, to induce or reward, or in return for, either the referral of an individual for, or the purchase, order or recommendation of, any good or service, for which payment may be made under a federal healthcare program such as Medicare and Medicaid;
- the federal civil false claims laws, including the False Claims Act, which can be enforced by civil whistleblower or qui tam actions on behalf of the government, and criminal false claims laws and the civil monetary penalties law, prohibit individuals or entities from, among other things, knowingly presenting, or causing to be presented false or fraudulent claims for payment by a federal government program, or making a false statement or record material to payment of a false claim or avoiding, decreasing or concealing an obligation to pay money to the federal government;
- HIPAA, as amended by HITECH, and their implementing regulations, impose requirements on certain covered healthcare providers, health plans, and healthcare clearinghouses as well as their respective business associates and their subcontractors that perform services for them that involve the use, or disclosure of, individually identifiable health information, relating to the privacy, security, and transmission of such individually identifiable health information;
- Analogous state laws and regulations such as state anti-kickback and false claims laws and analogous non-U.S. fraud and abuse laws and regulations, may apply to sales or marketing arrangements and claims involving healthcare items or services reimbursed by non-governmental third-party payors, including private insurers. Some state laws require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance regulations promulgated by the federal government and may require drug manufacturers to report information related to payments and other transfers of value to physicians and other healthcare providers, marketing expenditures, or drug pricing, including price increases. State and local laws require the registration of pharmaceutical sales representatives.

Efforts to ensure that our internal business processes and business arrangements with third parties will comply with applicable healthcare laws and regulations will involve substantial costs. It is possible that governmental authorities will conclude that our business practices 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 government funded healthcare programs, such as Medicare and Medicaid and other federal healthcare programs, contractual damages, reputational harm, diminished profits and future earnings, additional integrity reporting and oversight obligations, and the curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and our results of operations. If any of the physicians or other healthcare providers or entities with whom we expect to do business is found to be not in compliance with applicable laws, they may be subject to significant criminal, civil and administrative sanctions, including exclusions from government funded healthcare programs, which could have a material adverse effect on our business, results of operations, financial condition and prospects.

Current and future legislation may increase the difficulty and cost for us and any future collaborators to obtain marketing approval of and commercialize our product candidates and affect the prices we, or they, may obtain.

Existing regulatory policies may change, and additional government regulations may be enacted that could prevent, limit or delay regulatory approval of our product candidates. We cannot predict the likelihood, nature or extent of government regulation that may arise from future legislation or administrative action, either in the United States or abroad. 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 not obtain or may lose any marketing approval that we may have obtained and we may not achieve or sustain profitability.

Legislative and regulatory proposals have been made to expand post-approval requirements and restrict sales and promotional activities for pharmaceutical products. We cannot be sure whether additional legislative changes will be enacted, or whether FDA regulations, guidance or interpretations will be changed, or what the impact of such changes on the marketing approvals of our product candidates, if any, may be. In addition, increased scrutiny by the U.S. Congress of the FDA's approval process may significantly delay or prevent marketing approval, as well as subject us to more stringent product labeling and post-marketing testing and other

requirements. Furthermore, government shutdowns could also impact the ability of regulatory authorities and government agencies to function normally and support our operations. For example, the U.S. federal government has shut down repeatedly since 1980, including for a period of 35 days beginning on December 22, 2018. During a shutdown, certain regulatory authorities and agencies, such as the FDA, have had to furlough key personnel 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.

In addition, in the United States, there have been and continue to be a number of legislative initiatives to contain healthcare costs. The pharmaceutical industry has been a particular focus of these efforts and has been significantly affected by major legislative initiatives. Previously, in March 2010, the ACA was enacted, which was intended to broaden access to health insurance, reduce or constrain the growth of healthcare spending, enhance remedies against fraud and abuse, add new transparency requirements for health care and health insurance industries, impose new taxes and fees on the health industry and impose additional health policy reforms.

Healthcare reform initiatives recently culminated in the enactment of the IRA in August 2022, which, among other things, allows HHS to directly negotiate the selling price of a statutorily specified number of drugs and biologics each year that CMS reimburses under Medicare Part B and Part D. Only high-expenditure single-source drugs that have been approved for at least 11 years for single-source biologics (7 years for drugs) are eligible to be selected by CMS for negotiation, with the negotiated price taking effect two years after the selection year. Negotiations for Medicare Part D products take place in 2024 with the negotiated price taking effect in 2026, and negotiations for Medicare Part B products will begin in 2026 with the negotiated price taking effect in 2028. In August 2023, HHS announced the ten Medicare Part D drugs and biologics that it selected for negotiations. HHS will announce the negotiated maximum fair prices by September 1, 2024, and this price cap, which cannot exceed a statutory ceiling price, will go into effect on January 1, 2026. A drug or biological product that has an orphan drug designation for only one rare disease or condition will be excluded from the IRA's price negotiation requirements, but will lose that exclusion if it receives designations for more than one rare disease or condition, or if is approved for an indication that is not within that single designated rare disease or condition, unless such additional designation or such disqualifying approvals are withdrawn by the time CMS evaluates the drug for selection for negotiation. The negotiated prices will represent a significant discount from average prices to wholesalers and direct purchasers. The law also imposes rebates on Medicare Part D and Part B drugs whose prices have increased at a rate greater than the rate of inflation. The IRA also extends enhanced subsidies for individuals purchasing health insurance coverage in ACA marketplaces through plan year 2025. The IRA permits the Secretary of HHS to implement many of these provisions through guidance, as opposed to regulation, for the initial years. Manufacturers that fail to comply with the IRA may be subject to various penalties, including civil monetary penalties. These provisions may be subject to legal challenges. For example, the provisions related to the negotiation of selling prices of high-expenditure single-source drugs and biologics have been challenged in multiple lawsuits brought by pharmaceutical manufacturers. Thus, while it is unclear how the IRA will be implemented, it will likely have a significant impact on the pharmaceutical industry.

At the state level in the United States, legislatures are increasingly enacting laws and implementing regulations designed to control pharmaceutical and biologic product pricing, including price constraints, restrictions on certain product access, reporting on price increases and the introduction of high-cost drugs. In some states, laws have been enacted to encourage importation of lower cost drugs from other countries and bulk purchasing. For example, the FDA released a final rule in September 2020 providing guidance for states to build and submit plans for importing drugs from Canada, and FDA authorized the first such plan in Florida in January 2024. In addition, regional healthcare authorities and individual hospitals are increasingly using bidding procedures to determine what pharmaceutical products and which suppliers will be included in their prescription drug and other healthcare programs. This could reduce the ultimate demand for our drug products that we successfully commercialize or put pressure on our product pricing.

We expect that the ACA, the IRA, as well as 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. 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 product candidates.

Risks Related to Commercialization of Our Product Candidates

We operate in highly competitive and rapidly changing industries, which may result in others discovering, developing or commercializing competing products before or more successfully than we do.

The biotechnology and pharmaceutical industries are highly competitive and subject to significant and rapid technological change. Our success is highly dependent on our ability to discover, develop, and obtain marketing approval for new and innovative products on a cost-effective basis and to market them successfully. In doing so, we face and will continue to face intense competition

from a variety of businesses, including large pharmaceutical and biotechnology companies, academic institutions, government agencies, and other public and private research organizations. These organizations may have significantly greater resources than we do and conduct similar research, seek patent protection, and establish collaborative arrangements for research, development, manufacturing, and marketing of products that compete with our product candidates. Mergers and acquisitions in the biotechnology and pharmaceutical industries may result in even more resources being concentrated in our competitors. Competition may increase further as a result of advances in the commercial applicability of technologies and greater availability of capital for investment in these industries.

With the proliferation of new oncology drugs and therapies, we expect to face increasingly intense competition as new technologies become available. If we fail to stay at the forefront of technological change, we may be unable to compete effectively. Any product candidates that we successfully develop and commercialize will compete with existing therapies and new therapies that may become available in the future. The highly competitive nature of and rapid technological changes in the biotechnology and pharmaceutical industries could render our product candidates or our technology obsolete, less competitive or uneconomical, which could adversely impact our business, financial condition, or results of operations.

Failure to successfully identify, develop, and commercialize additional product candidates could impair our ability to grow.

Although a substantial amount of our efforts will focus on the continued preclinical and clinical testing and potential approval of our product candidates in our current pipeline, we expect to continue to innovate and potentially expand our portfolio. Because we have limited financial and managerial resources, research programs to identify product candidates may require substantial additional technical, financial and human resources, whether or not any new potential product candidates are ultimately identified. Our success may depend in part upon our ability to identify, select, and develop promising product candidates and therapeutics. We may expend resources and ultimately fail to discover and generate additional product candidates suitable for further development. All product candidates are prone to risks of failure typical of biotechnology product development, including the possibility that a product candidate may not be suitable for clinical development as a result of its harmful side effects, limited efficacy or other characteristics indicating that it is unlikely to receive approval by the FDA, the EMA, and other comparable foreign regulatory authorities and achieve market acceptance. If we do not successfully develop and commercialize new product candidates we have identified and explored, our business, prospects, financial condition, and results of operations could be adversely affected.

Even if approved, our products may not gain market acceptance, in which case we may not be able to generate product revenues, which will materially adversely affect our business, financial condition, and results of operations.

Even if the FDA or any other regulatory authority approves the marketing of any product candidates that we develop on our own or with a collaborator, physicians, healthcare providers, patients, or the medical community may not accept or use them. Additionally, the product candidates that we are developing are based on our internally-developed immunotherapy platform technology, which is a new technology. If these products do not achieve an adequate level of acceptance, we may not generate significant product revenues or any profits from operations. The degree of market acceptance of any of our product candidates will depend on a variety of factors including but not limited to the terms of any approvals and the countries in which approvals are obtained, the number and clinical profile of competing products, and the availability of coverage and adequate reimbursement from insurers for our product candidates. If our product candidates fail to gain market acceptance, our ability to generate revenues to provide a satisfactory, or any, return on our investments may be materially and adversely impacted. Even if some product candidates achieve market acceptance, the market may prove not to be large enough to allow us to generate significant revenues.

We currently have no marketing, sales, or distribution infrastructure and we intend to either establish a sales and marketing infrastructure or outsource this function to a third party. Either of these commercialization strategies carries substantial risks to us.

We currently have no marketing, sales, and distribution capabilities because all of our product candidates are still in clinical or preclinical development. If any of our product candidates are approved, we intend to either establish a sales and marketing organization with technical expertise and supporting distribution capabilities to commercialize our product candidates in a legally compliant manner, or to outsource this function to a third party. There are risks involved if we decide to establish our own sales and marketing capabilities or enter into arrangements with third parties to perform these services. To the extent that we enter into collaboration agreements with respect to marketing, sales or distribution, our product revenue may be lower than if we were to directly market or sell any approved products. Such collaborative arrangements with partners may place the commercialization of our products outside of our control and would make us subject to a number of risks including that we may not be able to control the amount or timing of resources that our collaborative partner devotes to our products or that our collaborator's willingness or ability to complete its obligations, and our obligations under our arrangements may be adversely affected by business combinations or significant changes in our collaborator's business strategy.

If we are unable to enter into these arrangements on acceptable terms or at all, we may not be able to successfully commercialize any approved products. If we are not successful in commercializing any approved products, either on our own or through collaborations with one or more third parties, our future product revenue will suffer and we may incur significant additional losses, which would have a material adverse effect on our business, financial condition, and results of operations.

Risks Related to Our Dependence on Third Parties

We rely on third parties to manufacture our product candidates. Any failure by a third-party manufacturer to produce acceptable drug substance for us or to obtain authorization from the FDA or comparable regulatory authorities may delay or impair our ability to initiate or complete our clinical trials, obtain regulatory approvals or commercialize approved products.

We do not currently own or operate any cGMP manufacturing facilities nor do we have any in-house cGMP manufacturing capabilities. We rely on third-party contract manufacturers to produce sufficient quantities of materials required for the manufacture of our product candidates for preclinical testing and clinical trials, in compliance with applicable regulatory and quality standards, and intend to do so for the commercial manufacture of our products, if approved. If we are unable to arrange for such third-party manufacturing sources, or fail to do so on commercially reasonable terms, we may not be able to successfully produce sufficient supply of product candidate or we may be delayed in doing so. Such failure or substantial delay could materially harm our business.

We rely on third parties for biological materials that are used in our discovery and development programs. These materials can be difficult to produce and occasionally have variability from the product specifications. Any disruption in the supply of these biological materials consistent with our product specifications could materially adversely affect our business. Although we have control processes and screening procedures, biological materials are susceptible to damage and contamination and may contain active pathogens. We may also have lower yields in manufacturing batches, which can increase our costs and slow our development timelines. Improper storage of these materials, by us or any third-party suppliers, may require us to destroy some of our biological raw materials or product candidates.

Reliance on third-party manufacturers entails risks to which we would not be subject if we manufactured product candidates ourselves, including reliance on the third party for regulatory compliance and quality control and assurance, volume production, the possibility of breach of the manufacturing agreement by the third party because of factors beyond our control (including a failure to synthesize and manufacture our product candidates in accordance with our product specifications), and the possibility of termination or nonrenewal of the agreement by the third party at a time that is costly or damaging to us.

In addition, the FDA and other regulatory authorities require that our product candidates be manufactured according to cGMP and similar foreign standards relating to methods, facilities, and controls used in the manufacturing, processing, and packing of the product, which are intended to ensure that biological products are safe and that they consistently meet applicable requirements and specifications.

If the FDA or a comparable foreign regulatory authority does not approve the manufacture of our product candidates at any of our proposed contract manufacturer's facilities, or if any contract manufacturer fails to maintain a compliance status acceptable to the FDA or a comparable foreign authority, we may need to find alternative manufacturing facilities, which would significantly impact our ability to develop, obtain regulatory approval for, or market our product candidates, if approved. Any discovery of problems with a product, or a manufacturing facility used by us, may result in restrictions on the product or on the manufacturing facility, including marketed product recall, suspension of manufacturing, product seizure, or a voluntary withdrawal of the drug from the market. We may have little to no control regarding the occurrence of third-party manufacturer incidents.

If we were unable to find an adequate replacement or another acceptable solution in time, our clinical trials could be delayed, or our commercial activities could be harmed. In addition, the fact that we are dependent on our collaborators, our suppliers, and other third parties for the manufacture, filling, storage, and distribution of our product candidates means that we are subject to the risk that the products may have manufacturing defects that we have limited ability to prevent or control. The sale of products containing such defects could adversely affect our business, financial condition, and results of operations. Any failure by our third-party manufacturers to comply with cGMP or failure to scale up manufacturing processes, including any failure to deliver sufficient quantities of product candidates in a timely manner, could lead to a delay in, or failure to obtain, regulatory approval of any of our product candidates.

Pharmaceutical manufacturers are also subject to extensive post-marketing oversight by the FDA and comparable regulatory authorities in the jurisdictions where the product is marketed, which include periodic unannounced and announced inspections by the FDA to assess compliance with cGMP requirements. If an FDA inspection of a manufacturer's facilities reveals conditions that the FDA determines not to comply with applicable regulatory requirements, the FDA may issue observations through a Notice of

Inspectional Observations, commonly referred to as a "Form FDA 483". If observations in the Form FDA 483 are not addressed in a timely manner and to the FDA's satisfaction, the FDA may issue a warning letter or pursue other forms of enforcement action. Any failure by one of our contract manufacturers to comply with cGMP or to provide adequate and timely corrective actions in response to deficiencies identified in a regulatory inspection could result in enforcement action that could lead to a shortage of products and harm our business, including withdrawal of approvals previously granted, seizure, injunction or other civil or criminal penalties. The failure of a manufacturer to address any concerns raised by the FDA or foreign regulators or to maintain a compliance status acceptable to the FDA or foreign regulators could also lead to the delay or withholding of product approval by the FDA or by foreign regulators or could lead to plant shutdown. Certain countries may impose additional requirements on the manufacturing of drug products or drug substances, and on manufacturers, as part of the regulatory approval process for products in such countries. The failure by our third-party manufacturers to satisfy such requirements could impact our ability to obtain or maintain approval of our products in such countries.

Supply sources could be interrupted from time to time and, if interrupted, there is no guarantee that supplies could be resumed within a reasonable time frame and at an acceptable cost or at all.

We rely on our manufacturers to purchase from third-party suppliers the materials necessary to produce our product candidates for our clinical trials. The manufacturing capabilities of our suppliers have been impacted as a result of ongoing supply chain delays, and it may not be possible for us to timely manufacture our product candidates at desired levels. Reduced supply may also lead to increased costs for materials, which can adversely impact our business and results of operations There are a limited number of suppliers for raw materials that we use to manufacture our product candidates, and there may be a need to assess alternate suppliers to prevent a possible disruption of the manufacture of the materials necessary to produce our product candidates for our clinical trials, and if approved, ultimately for commercial sale. Reductions or interruptions in any of our third-party manufacturing processes as a result of supply chain delays caused global conflicts, public health emergencies (including a resurgence of a variant of the COVID-19 pandemic or future pandemic) or other reasons could have a material adverse effect on our business, results of operations, financial condition and cash flows.

We do not have any control over the process or timing of the acquisition of the raw materials we need to produce our product candidates by our manufacturers. Moreover, we currently do not have any agreements for the commercial production of these raw materials. We cannot be sure that these suppliers will remain in business, or that they will not be purchased by one of our competitors or another company that is not interested in continuing to produce these materials for our intended purpose. In addition, the lead time needed to establish a relationship with a new supplier can be lengthy, and we may experience delays in meeting demand in the event a new supplier must be used. The time and effort to qualify a new supplier could result in additional costs, diversion of resources, or reduced manufacturing yields, any of which would negatively impact our operating results. Although we will not begin a clinical trial unless we believe we have a sufficient supply of a product candidate to complete the clinical trial, any significant delay in the supply of a product candidate, or the raw material components thereof, for an ongoing clinical trial due to the need to replace a third-party manufacturer could considerably delay completion of our clinical trials, product testing, and potential regulatory approval of our product candidates. If our manufacturers or we are unable to purchase these raw materials after regulatory approval has been obtained for our product candidates, the commercial launch of our product candidates would be delayed or there would be a shortage in supply, which would impair our ability to generate revenues from the sale of our product candidates.

We currently rely on, and expect to continue to rely on, third parties, including independent clinical investigators, to conduct our preclinical studies and clinical trials. If these third parties do not successfully carry out their contractual duties, comply with applicable regulatory requirements, or meet expected deadlines, we may not be able to obtain regulatory approval for or commercialize our product candidates and our business could be substantially harmed.

We currently rely, and expect to continue to rely on, third parties, including independent clinical investigators, to conduct our preclinical studies and clinical trials and to monitor and manage data for our preclinical and clinical programs. We will rely on these parties for execution of our preclinical studies and clinical trials, and control only certain aspects of their activities. Nevertheless, our reliance on these third parties will not relieve us of our regulatory responsibilities, and we are responsible for ensuring that each of our studies and trials is conducted in accordance with the applicable protocol, legal, regulatory, and scientific standards, including GCP requirements, which are regulations and guidelines enforced by the FDA and comparable foreign regulatory authorities for all of our products candidates in clinical development. Regulatory authorities enforce these GCP requirements through periodic inspections of trial sponsors, principal investigators, and trial sites. If we fail to comply with applicable GCP, 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. We cannot assure you that upon inspection by a given regulatory authority, such regulatory authority will determine that any of our clinical trials comply with GCP regulations. In addition, our clinical trials must be conducted with products produced under cGMP regulations. Our failure to comply with these regulations may require us to repeat clinical trials, which would delay the regulatory approval process.

Further, these investigators are not our employees and we will not be able to control, other than by contract, the amount of resources, including time, which they devote to our product candidates and clinical trials. If independent investigators fail to devote sufficient resources to the development of our product candidates, or if their performance is substandard, it may delay or compromise the prospects for approval and commercialization of any product candidates that we develop. In addition, the use of third-party service providers may require us to disclose our proprietary information to these parties, which could increase the risk that this information will be misappropriated.

There is a limited number of third-party service providers that specialize or have the expertise required to achieve our business objectives. If any of our relationships with these third-party laboratories, or clinical investigators terminate, we may not be able to enter into arrangements with alternative laboratories, or investigators or to do so in a timely manner or on commercially reasonable terms. If laboratories, or clinical investigators 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 preclinical or clinical protocols, regulatory requirements or for other reasons, our preclinical or clinical trials may be extended, delayed, or terminated, and we may not be able to obtain regulatory approval for or successfully commercialize our product candidates. As a result, our results of operations and the commercial prospects for our product candidates would be harmed, our costs could increase, and our ability to generate revenues could be delayed. Switching or adding additional laboratories or investigators involves additional cost and requires management time and focus. In addition, there is a natural transition period when a new laboratory commences work. As a result, delays occur, which can materially impact our ability to meet our desired clinical development timelines.

In addition, clinical investigators may serve as scientific advisors or consultants to us from time to time and may receive cash or equity compensation in connection with such services. If these relationships and any related compensation result in perceived or actual conflicts of interest, or the FDA concludes that the financial relationship may have affected the interpretation of the preclinical study or clinical trial, the integrity of the data generated at the applicable preclinical study or clinical trial site may be questioned and the utility of the preclinical study or clinical trial itself may be jeopardized, which could result in the delay or rejection by the FDA. Any such delay or rejection could prevent us from commercializing our clinical-stage product candidate or any future product candidates.

We may not realize the benefits of any existing or future co-development or out-licensing arrangement, and if we fail to enter into new strategic relationships, our business, financial condition, commercialization prospects, and results of operations may be materially adversely affected.

Our product development programs and the potential commercialization of our product candidates will require substantial additional cash to fund expenses. Therefore, for some of our product candidates, we may decide to enter into collaborations with pharmaceutical or biopharmaceutical companies for the development and potential commercialization of those product candidates.

We face significant competition in seeking appropriate collaborators. Collaborations are complex and time-consuming to negotiate and document. We may not be able to negotiate collaborations on acceptable terms, or at all. If our strategic collaborations do not result in the successful development and commercialization of product candidates, or if one of our collaborators terminates its agreement with us, we may not receive any future research funding or milestone or royalty payments under the collaboration. In instances where we do enter into collaborations, we could be subject to a number of risks which may materially harm our business, commercialization prospects, and financial condition. For example, we may not be able to control the amount and timing of resources that is required of us to complete our development obligations or that the collaboration partner devotes to the product development or marketing programs, the collaboration partner may experience financial difficulties, or we may be required to relinquish important rights such as marketing, distribution, and intellectual property rights.

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.

To date, we have relied on one third-party manufacturer for the cGMP production of our drug product candidates. The loss of this third-party manufacturer could negatively impact our ability to develop our product candidates and adversely affect our business.

We do not currently own any facility that may be used as our clinical-scale manufacturing and processing facility and currently rely on a single third-party vendor to manufacture supplies and process our product candidates. We have not yet caused our product candidates to be manufactured or processed on a commercial scale and may not be able to do so for any of our product candidates.

Although in the future we intend to develop our own manufacturing facility, we also intend to use third parties as part of our manufacturing process and may, in any event, never be successful in developing our own manufacturing facility.

Manufacturers of biologic products often encounter difficulties in production, particularly in scaling up or out, validating the production process, and assuring high reliability of the manufacturing process (including the absence of contamination). These problems include logistics and shipping, difficulties with production costs and yields, quality control, including stability of the product, product testing, operator error, availability of qualified personnel, as well as compliance with strictly enforced federal, state, and foreign regulations. Furthermore, if contaminants are discovered in our supply of our product candidates or in the manufacturing facilities, such manufacturing facilities may need to be closed for an extended period of time to investigate and remedy the contamination.

The lead time needed to establish relationships with new manufacturers can be lengthy, and we may experience delays in meeting demand in the event we must switch to a new manufacturer. The time and effort to qualify a new manufacturer could result in additional costs, diversion of resources, or reduced manufacturing yields, any of which would negatively impact our operating results.

Moreover, to meet anticipated demand, our third-party manufacturer may need to increase manufacturing capacity, which could involve significant challenges. This may require us and our vendor to invest substantial additional funds and hire and retain the technical personnel who have the necessary experience. Neither we nor our third-party manufacturer may successfully complete any required increase to existing manufacturing capacity in a timely manner, or at all.

Risks Related to Intellectual Property

We expect to rely on patents and other intellectual property rights to protect our technology, including product candidates and our immunotherapy platform technology, the prosecution, enforcement, defense, and maintenance of which may be challenging and costly. Failure to protect or enforce these rights adequately could harm our ability to compete and impair our business.

Our commercial success depends in part on obtaining and maintaining patents and other forms of intellectual property rights for technology related to our product candidates, including, but not limited to, our immunotherapy platform technology, product candidates, methods used to manufacture those product candidates, formulations thereof, and the methods for treating patients using those product candidates. Given that the development of our technology and product candidates is at an early stage, our intellectual property portfolio with respect to certain aspects of our technology and product candidates is also at an early stage. We seek to protect our proprietary position by filing patent applications in the United States and abroad related to our novel platform technology and product candidates that are important to our business. The patent prosecution process is expensive and time-consuming, and we may not be able to prepare, file, and prosecute all necessary or desirable patent applications at a reasonable cost or in a timely manner. In addition, during the patent prosecution process, we may receive rejections. Although we would be given an opportunity to respond to those rejections, we may be unable to overcome such rejections.

The issuance, scope, validity, enforceability, and commercial value of our current or future patent rights are highly uncertain. It is possible that we will fail to identify patentable aspects of inventions made in the course of development and commercialization activities before it is too late to obtain patent protection on them. Our pending and future patent applications may not result in the issuance of patents that protect our technology or product candidates, in whole or in part, or that effectively prevent others from commercializing competitive technologies and product candidates. The patent examination process may require us to narrow the scope of the claims of our pending and future patent applications, which may limit the scope of patent protection that may be obtained. Further, even if we obtain patents with sufficient scope to protect our technology or product candidates in their present forms, future technical changes to our technology or product candidates may render the patent coverage inadequate.

We cannot assure you that all of the potentially relevant prior art relating to our patents and patent applications has been found. If such prior art exists, it can invalidate or narrow the scope of a patent or prevent a patent from issuing from a pending patent application. Even if patents do successfully issue and even if such patents cover our product candidates, third parties have initiated or may initiate opposition, interference, re-examination, post-grant review, inter partes review, nullification, or derivation actions in court or before patent offices, or similar proceedings challenging the validity, ownership, enforceability, or scope of such patents, which may result in the patent claims being narrowed, invalidated, or held unenforceable or circumvented. For example, as described further below, we are engaged in legal proceedings with Altor/NantCell pursuant to which Altor/NantCell is seeking specific performance for assignment of and a constructive trust over certain of our patents, which if successful would materially impact our core intellectual property assets. Because patent applications in the United States and other jurisdictions are confidential for a period of time after filing, and some remain so until issued, we cannot be certain that we were the first to make the inventions claimed in our patents or pending patent applications, or that we were the first to file any patent applications related to such inventions. Our patent applications

cannot be enforced against third parties practicing the technology claimed in such applications unless and until a patent is issued from such applications, and then only to the extent the issued claims cover the technology. Furthermore, even where we have a valid and enforceable patent, we may not be able to exclude others from practicing our invention where the other party can show that it used the invention in commerce before our filing date or that the other party benefits from a compulsory license. Additionally, our competitors or other third parties may be able to evade our patent rights by developing new biologics, biosimilars, or alternative technologies or products in a non-infringing manner.

In addition, given the amount of time required for the development, testing and regulatory review of new product candidates, patents protecting such candidates might expire before or shortly after such candidates are commercialized. As a result, our intellectual property may not provide us with sufficient rights to exclude others from commercializing products similar or identical to ours. Moreover, some of our owned patent applications may in the future be co-owned with third parties. If we are unable to obtain an exclusive license to any such third-party co-owners' interest in such patents or patent applications, such co-owners may be able to license their rights to other third parties, including our competitors, and our competitors could market competing products and technology. In addition, we may need the cooperation of any such co-owners of our owned patents in order to enforce such patents against third parties, and such cooperation may not be provided to us or our licensors. Any of the foregoing could have a material adverse effect on our competitive position, business, financial conditions, results of operations and prospects.

The USPTO and various foreign governmental patent agencies require compliance with a number of procedural, documentary, fee payment, and other provisions during the patent application process. There are situations in which noncompliance can result in abandonment or lapse of a patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. In such an event, competitors might be able to enter the market earlier than would otherwise have been the case. The standards applied by the USPTO, foreign patent offices, and patent courts or other authorities in granting patents and ruling on claim scope and validity are not always applied uniformly or predictably. Patent positions of life sciences companies can be uncertain and involve complex factual, scientific, and legal questions. Changes in either patent laws or their interpretation in any jurisdiction where we seek patent protection may diminish our ability to protect our inventions, maintain and enforce our intellectual property rights, and more generally may affect the value of our intellectual property, including the narrowing of the scope of our patents and any that we may license.

Failure to protect or to obtain, maintain or extend adequate patent and other intellectual property rights could materially adversely affect our ability to develop and market our product candidates.

We may become involved in lawsuits to protect or enforce our issued patents relating to one or more of our product candidates or our internally-developed platform, which could ultimately render our patents invalid or unenforceable and adversely affect our competitive position. Intellectual property litigation or other legal proceedings could cause us to spend substantial resources and distract our personnel from their normal responsibilities.

Competitors may infringe our patents or other intellectual property that relate to our immunotherapy platform technology and product candidates, their respective methods of use, manufacture, and formulations thereof. Third parties may in the future claim that our operations infringe their intellectual property rights. To defend against such claims, protect our competitive position and counter infringement or unauthorized use, we may from time to time need to resort to litigation to enforce or defend any patents or other intellectual property rights owned or licensed by us by filing infringement claims. We may be subject to further litigation in the future, involving claims that we have misappropriated or misused other parties' trade secrets or information. To the extent we gain greater market visibility, we face a higher risk of being the subject of intellectual property infringement claims, which is not uncommon with respect to the biopharmaceutical industry.

As enforcement of intellectual property rights is difficult, unpredictable, time-consuming, and expensive, we may fail in enforcing our rights, in which case our competitors may be permitted to use our technology without being required to pay us any license fees. In addition, litigation involving our patents carries the risk that one or more of our patents will be held invalid (in whole, in part, or on a claim-by-claim basis) or held unenforceable. Such an adverse court ruling could allow third parties to commercialize our product candidates or methods, or our immunotherapy platform technology, and then compete directly with us, without payment to us.

Even if resolved in our favor, such litigation and other legal proceedings may cause us to incur significant expenses and would be likely to divert significant resources from our core business, including distracting our technical and management personnel from their normal responsibilities, and may impact our reputation. In addition, there could be public announcements of the results of hearings, motions or other interim proceedings or developments, and 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 our resources available for development activities. We may not have sufficient financial or other resources to adequately conduct such litigation or proceedings. Some of our competitors may be able to sustain the costs of such litigation or proceedings more effectively than we can because of their substantially greater financial resources. Uncertainties resulting from the initiation and continuation of patent litigation or other proceedings could have a material adverse effect on our ability to compete in the marketplace.

We and our Chief Executive Officer are currently involved in legal proceedings with Altor/NantCell, in which Altor/NantCell has alleged, among other things, a claim of trade secret misappropriation and other related claims against us and breach of contract and fiduciary duty, among other claims, against our chief executive officer in arbitration, and an adverse result could have a negative material impact on our business and operations.

On December 23, 2022, a lawsuit was filed by Altor BioScience, LLC and NantCell, Inc., collectively, Altor/NantCell, against the Company in U.S. District Court for the Southern District of Florida (the "Court"), alleging misappropriation of trade secrets under state and federal laws, inducement of breach of contract and breach of fiduciary duty, tortious interference with contractual relations, specific performance, conversion, unjust enrichment, specific performance for assignment of patents and patent applications, constructive trust, and replevin. The complaint against us is based on very similar allegations as those alleged by Altor/NantCell in an arbitration commenced in December 2022 against our Founder and Chief Executive Officer, Dr. Hing C. Wong, who was formerly employed by Altor/NantCell. Altor/NantCell alleges that Dr. Wong purportedly took Altor/ NantCell's confidential and trade-secret information and used it to form and build competing products for us.

On January 31, 2023, the Company filed a motion to compel arbitration, a motion for the stay of the litigation, and a motion to dismiss the complaint ("motion to compel"). On April 18, 2023, the U.S. District Court for the Southern District of Florida (the "Court") heard oral argument on the Company's motion to compel and ordered the parties to provide supplemental briefing by April 28, 2023. Before the Court ruled on the Company's motion to compel, on April 26, 2023, the parties stipulated that Altor/NantCell's action against the Company would be consolidated with the Altor/NantCell arbitration demand against Dr. Wong. On April 27, 2023, the Court approved the parties' stipulation and ordered the parties to arbitration. On May 1, 2023, Altor/NantCell filed a demand against the Company before JAMS. On May 3, 2023, Altor/NantCell dismissed the federal court action without prejudice and the Court ordered the case dismissed without prejudice and closed the case. Altor/NantCell's proceeding against the Company is now proceeding in arbitration before JAMS, with an arbitration hearing scheduled for May 20, 2024.

On March 26, 2024, Altor/NantCell gave notice that they are filing a complaint (the "Complaint") against the Company in the Chancery Court of the State of Delaware for the contribution of legal fees and expenses advanced to Dr. Wong, our founder and chief executive officer, in connection with the arbitration discussed above. Prior to the filing of the Complaint, Altor/NantCell had previously sought advancement from the Company and the Company agreed to advance 50% of Dr. Wong's legal fees going forward from December 2023. On January 8, 2024, Altor/NantCell reserved their right to pursue contribution against the Company for 50% of the amount Altor/NantCell sent for advancement of expenses for Dr. Wong. In the Complaint, Altor/NantCell seek 50% of the fees they have already advanced to Dr. Wong, a declaration that the Company has an obligation to contribute 50% of the advancement of Dr. Wong's expenses including 50% of Dr. Wong's expenses incurred in connection with the arbitration through final resolution of the matter, and costs and fees in bringing this action.

We have incurred and expect to continue to incur significant expenses in connection with our defense in the arbitration proceedings with Altor/NantCell. Altor/NantCell has considerable resources available to it; we, on the other hand, are a company in the early stages of our clinical trials with comparatively few resources available to us to engage in costly and protracted litigation. These claims asserted against us have been and are expected to continue to be costly to defend and could limit our ability to use some technologies in the future. They have been, and will be, time consuming, have diverted and will divert our chief executive officer's, management's and scientific personnel's attention, may be used by Altor/NantCell in an effort to generate negative publicity with our customers and investors, and may result in liability for substantial damages and reimbursements. For example, we have incurred and anticipate that we will continue to incur significant expense and substantial time in defending ourselves in the current disputes with Altor/NantCell and our advancement of legal expenses of Dr. Wong in connection therewith. There can be no assurance that we will not be required to pay damages or reimburse Altor/NantCell for the amounts they are seeking in connection with these matters. We anticipate that Altor/NantCell may continue to use options available to it through the arbitrator, including filing amended or new demands, other arbitration submissions, public statements and press releases, regardless of merit, in an attempt to disrupt our business and create uncertainty about our future prospects, which could create volatility in the trading price of our common stock or damage to our reputation.

An adverse judgment in the Altor/NantCell arbitration proceedings could require us to pay damages, attorneys' fees, costs and expenses, or result in injunctive relief, or generate negative publicity, any of which could materially adversely affect our business, financial condition, results of operations, and prospects. We may also in the future be involved with other litigation. We expect that the number of such claims may increase as our scale and the level of competition in our industry segments grows.

Intellectual property rights of third parties could adversely affect our ability to develop or commercialize our product candidates, such that we could be required to litigate or obtain licenses from third parties in order to develop or market our product candidates.

Our commercial success depends, in part, on our ability to develop, manufacture, market, and sell our product candidates or any products, if approved, without infringing or otherwise violating the intellectual property and other proprietary rights of third parties. Our competitive position may suffer if patents issued to third parties or other third-party intellectual property rights cover our methods or product candidates or elements thereof, our manufacture or uses relevant to our development plans, our product candidates or other attributes of our product candidates, or our immunotherapy platform technology. In such cases, we may not be in a position to develop or commercialize product candidates unless we successfully pursue litigation to nullify or invalidate the third-party intellectual property right concerned, which can be expensive and time-consuming, or have to enter into a license agreement with the intellectual property right holder, if available on commercially reasonable terms at all.

There is a substantial amount of intellectual property litigation in the biotechnology and pharmaceutical industries, and we may become party to, or threatened with, litigation or other adversarial proceedings regarding intellectual property rights with respect to our product candidates. Parties making claims against us may seek and obtain injunctive or other equitable relief, which could effectively block our ability to further develop and commercialize our product candidates. If we are sued for patent infringement, we would need to demonstrate that our product candidates or platform technology either do not infringe the patent claims of a relevant patent or that the patent claims are invalid or unenforceable, and we may not be able to do this. Proving invalidity may be difficult. For example, in the United States, proving invalidity in court requires a showing of clear and convincing evidence to overcome the presumption of validity enjoyed by issued patents. We may not have sufficient resources to bring these actions to a successful conclusion. If we are unable to successfully settle future claims on terms acceptable to us, we may be required to engage or continue costly, unpredictable, and time-consuming litigation and may be prevented from or experience substantial delays in marketing our product candidates.

In addition, indemnity provisions in various agreements and our corporate documents potentially expose us to substantial liability for intellectual property infringement and other claims. In the ordinary course of business, we enter into agreements that may include indemnification provisions under which we agree to indemnify them for losses suffered or incurred as a result of claims of intellectual property infringement or other liabilities relating to or arising from our clinical trials, breach of warranties or other contractual obligations. In some cases, the indemnification will continue after the termination of the applicable agreement. In addition, in accordance with our bylaws and pursuant to indemnification agreements entered into with directors, officers and certain employees, we have indemnification obligations for claims brought against these persons arising out of certain events or occurrences while they are serving at our request in such capacities. For example, our founder and chief executive officer is subject to a claim from a former employer. We agreed to advance certain defense costs and other expenses, subject to an undertaking to repay us such amounts if, and to the extent that, it is ultimately determined that he is not entitled to indemnification, and his former employer is seeking reimbursement from us for advancements it has made on his behalf. The matter is ongoing. If these matters are resolved in favor of the former employer and if we are required to indemnify our founder and chief executive officer for a loss, we may be required to make an indemnity payment. While we maintain directors' and officers' liability insurance, such insurance may not be applicable, be adequate, or cover all liabilities that we may incur. Large indemnity payments, individually or in the aggregate, could have a material impact on our financial position.

Our involvement in litigation, and in any interferences, post-grant proceedings, opposition proceedings, or other intellectual property proceedings inside and outside of the United States may divert management from focusing on business operations, and even if we are successful in these proceedings, we may incur substantial costs and the time and attention of our management and scientific personnel could be diverted in pursuing these proceedings, which could have a material adverse effect on our business and operations. In addition, 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.

We may need to obtain licenses of third-party technology that may not be available to us or are available only on commercially unreasonable terms, and which may cause us to operate our business in a more costly or otherwise adverse manner that was not anticipated.

We own and are pursuing rights to the intellectual property, including patent applications relating to our immunotherapy platform technology and our product candidates. In the future, we may be required to license technologies relating to our therapeutic research programs from additional third parties to further develop or commercialize our platform technology and product candidates. The fusion components of our product candidates may have also been the subject of research by companies that could have filed patent applications on their specific construct and therapeutic methods. There can be no assurance any such patents will not be asserted against us or that we will not need to seek licenses from such third parties. We may not be able to secure such licenses on acceptable terms, if at all, and any such litigation would be costly and time-consuming.

Should we be required to obtain licenses to any third-party technology, including any such patents required to manufacture, use, or sell our product candidates or any products, if approved, the growth of our business will likely depend in part on our ability to acquire, in-license, maintain, or use these proprietary rights. The inability to obtain any third-party license required to develop or commercialize any of our product candidates could cause us to abandon any related efforts, which could seriously harm our business and operations.

In addition, companies that perceive us to be a competitor may be unwilling to assign or license rights to us. We also may be unable to license or acquire third-party intellectual property rights on terms that would allow us to make an appropriate return on our investment. Even if we are able to obtain a license, it may be non-exclusive, thereby giving our competitors access to the same technologies licensed to us. If we are unable to successfully obtain a license to third-party intellectual property rights necessary for the development of a product candidate or program, we may have to abandon development of that product candidate or program and our business and financial condition could suffer.

We are and may become subject to claims challenging the inventorship or ownership of our patents and other intellectual property.

We generally enter into confidentiality and intellectual property assignment agreements with our employees, consultants, and contractors. These agreements generally provide that inventions conceived by the party in the course of rendering services to us will be our exclusive property. However, those agreements may not be honored and may not effectively assign intellectual property rights to us. Moreover, there may be some circumstances, where we are unable to negotiate for such ownership rights. Disputes regarding ownership or inventorship of intellectual property can also arise in other contexts, such as collaborations and sponsored research. Disputes challenging our rights in or to patents or other intellectual property, such as the lawsuit as we are currently facing in our legal proceedings with Altor/NantCell, have been and could be expensive and time consuming. If we were unsuccessful, we could lose valuable rights in intellectual property that we regard as our own. In addition, interferences, post-grant proceedings, opposition proceedings, derivation proceedings, or other intellectual property proceedings provoked by third parties or brought by us or declared by the USPTO may be necessary to determine the priority of inventions with respect to our patents or patent applications.

The failure to name the proper inventors on a patent application can result in the patents issuing thereon being unenforceable. Inventorship disputes may arise from conflicting views regarding the contributions of different individuals named as inventors, the effects of foreign laws where foreign nationals are involved in the development of the subject matter of the patent, conflicting obligations of third parties involved in developing our product candidates or as a result of questions regarding co-ownership of potential joint inventions. Litigation may be necessary to resolve these and other claims challenging inventorship and/or ownership. Alternatively, or additionally, we may enter into agreements to clarify the scope of our rights in such intellectual property. 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. Such an outcome could have a material adverse effect on our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees.

We may rely on trade secret and proprietary know-how, which can be difficult to trace and enforce and, if we are unable to protect the confidentiality of our trade secrets, our business and competitive position would be harmed.

In addition to seeking patents for some of our technology and product candidates, we may rely on trade secrets and/or confidential know-how to protect our technology, especially where patent protection is believed to be of limited value, to maintain our competitive position with respect to our research programs and product candidates. Elements of our product candidates, including processes for their preparation and manufacture, may involve proprietary know-how, information, or technology that is not covered by patents, and thus for these aspects we may consider trade secrets and know-how to be our primary intellectual property. Any disclosure, either intentional or unintentional, by our employees or by other third parties of our trade secrets or proprietary information could enable competitors to duplicate or surpass our technological achievements, thus adversely eroding our competitive position in our market. Further, monitoring unauthorized uses and disclosures is difficult, and we do not know whether the steps we have taken to protect our internally-developed technology will be effective. Enforcing a claim that a third party illegally obtained and is using trade secrets and/or confidential know-how is also expensive, time-consuming, and unpredictable.

The enforceability of confidentiality agreements may vary from jurisdiction to jurisdiction. The laws of some foreign countries do not protect proprietary rights to the same extent or in the same manner as the laws of the United States. As a result, we may encounter significant problems in protecting and defending our intellectual property both in the United States and abroad. Furthermore, if a competitor lawfully obtained or independently developed any of our trade secrets, we would have no right to prevent such competitor from using that technology or information to compete with us, which could harm our competitive position. Additionally, if the steps taken to maintain our trade secrets are deemed inadequate, we may have insufficient recourse against third parties for misappropriating the trade secret. In addition, some courts inside and outside the United States are less willing or are unwilling to protect trade secrets or other proprietary information.

Trade secrets can over time be disseminated within the biopharmaceutical industry through independent development, the publication of journal articles, and the movement of personnel skilled in the art from company to company or academic to industry scientific positions. Though our agreements with third parties typically restrict the ability of our employees, consultants, contractors, collaborators, advisors, and other third parties to publish data potentially relating to our trade secrets, our agreements may contain certain limited publication rights. Because from time to time we expect to rely on third parties in the development, manufacture, and distribution of our product candidates and provision of our services, we must, at times, share trade secrets with them. Despite employing the contractual and other security precautions described above, the need to share trade secrets 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. If any of our trade secrets were to be lawfully obtained or independently developed by a competitor or other third party, we would have no right to prevent them from using that technology or information to compete with us. If any of our trade secrets were to be disclosed to or independently developed by a competitor or other third party, our competitive position would be harmed.

In addition, our competitors may independently develop substantially equivalent trade secrets, proprietary information, or know-how and may even apply for patent protection in respect of the same. If successful in obtaining such patent protection, our competitors could limit our use of our trade secrets and/or confidential know-how. Under certain circumstances and to make it more likely that we have freedom to operate, we may also decide to publish some know-how to make it difficult for others to obtain patent rights covering such know-how, at the risk of potentially exposing our trade secrets to our competitors.

We are currently and may be in the future subject to third-party claims asserting that our employees, consultants, contractors, collaborators, or advisors have misappropriated or wrongfully used or disseminated their intellectual property, or claiming ownership of what we regard as our own intellectual property.

Many of our employees, including our senior management, were previously employed at universities or at other biopharmaceutical companies, including our competitors or potential competitors. Some of these employees executed proprietary rights, non-disclosure, and non-competition agreements in connection with such previous employment. Similarly, we work with consultants, contractors, collaborators, advisors, or other third parties who have worked with, and do currently work with, other companies, including our competitors or potential competitors, and have executed proprietary rights, non-disclosure, and non-competition agreements in connection with such other companies. Although we try to ensure that our employees, consultants, contractors, collaborators, advisors, or other third parties do not use or disclose the proprietary information or know-how of others in their work for us, we are and may become subject to claims that we or these employees or individuals that we work with have used or disclosed confidential information or intellectual property of others, including trade secrets or other proprietary information, or that we caused an individual to breach the terms of his or her non-competition or non-solicitation agreement with a current or former employer or competitor. For example, as described above, we are engaged in legal proceedings with Altor/NantCell, which alleges misappropriation of trade secrets, inducement of breach of contract and breach of fiduciary duty, among other claims against the company relating to our founder and chief executive officer's former employment with Altor/NantCell.

Litigation may be necessary to defend against these claims and, even if we are successful, could result in substantial costs and could be a distraction to management, our employees, and our routine business. If we fail in prosecuting or defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel or sustain damages. Such intellectual property rights could be awarded to a third party, and we could be required to obtain a license from such third party to develop or commercialize our technology or product candidates. Such a license may not be available on commercially reasonable terms or at all. Moreover, any such litigation or the threat thereof may adversely affect our reputation and our ability to form strategic alliances or sublicense our rights to collaborators, engage with scientific advisors or hire employees or consultants, each of which would have an adverse effect on our business, results of operations, and financial condition.

Risks Related to Data Privacy and Cybersecurity

Our information technology systems, or those used by our third-party contractors or consultants, may fail or suffer security breaches, which could adversely affect our business.

We collect and maintain information in digital form that is necessary to conduct our business, and we are dependent on our information technology systems and those of third parties to operate our business. In the ordinary course of our business, we collect, store, and transmit large amounts of confidential information, including intellectual property, proprietary business information, and personal information, and data to comply with cGMP, clinical and data integrity requirements. We have established physical, electronic, and organizational measures to safeguard and secure our systems to prevent a data compromise. We have also outsourced elements of our information technology infrastructure, and as a result a number of third-party vendors may or could have access to our confidential information. Despite the implementation of security measures, our information technology systems and data and those of our contractors and consultants are vulnerable to compromise or damage from computer hacking, malicious software, fraudulent activity, employee misconduct, human error, telecommunication and electrical failures, natural disasters, or other cybersecurity attacks or accidents. Future acquisitions could expose us to additional cybersecurity risks and vulnerabilities from any newly acquired information technology infrastructure. While we continue to make investments to improve the protection of data and information technology, there can be no assurance that our efforts will prevent service interruptions or security breaches.

Any cybersecurity incident could adversely affect our business, by leading to, for example, the loss of trade secrets or other intellectual property, demands for ransom or other forms of blackmail, or the unauthorized disclosure of personal or other sensitive information of our employees, clinical trial patients, customers, and others. Although to our knowledge we have not experienced any material cybersecurity incident to date, if such an event were to occur, it could seriously harm our development programs and our business operations. We could be subject to regulatory actions taken by governmental authorities, litigation under laws that protect the privacy of personal information, or other forms of legal proceedings, which could result in significant liabilities or penalties. Further, a cybersecurity incident may disrupt our business or damage our reputation, which could have a material adverse effect on our business, prospects, operating results, share price, stockholder value, and financial condition. We could also incur substantial remediation costs, including the costs of investigating the incident, repairing or replacing damaged systems, restoring normal business operations, implementing increased cybersecurity protections, and paying increased insurance premiums.

We face potential liability related to the privacy of health information we obtain from clinical trials sponsored by us or our collaborators, from research institutions and our collaborators, and directly from individuals.

We and our partners and vendors are subject to various federal, state, and foreign data protection laws and regulations (*i.e.*, laws and regulations that address data privacy and security). If we fail to comply with these laws and regulations, we may be subject to litigation, regulatory investigations, enforcement notices, enforcement actions, fines, and criminal or civil penalties, as well as negative publicity and a potential loss of business.

In the United States, numerous federal and state laws and regulations, including state data breach notification laws, state health information privacy laws, and federal and state consumer protection laws and regulations that govern the collection, use, disclosure, and protection of health-related and other personal information could apply to our operations or the operations of our partners. For example, most healthcare providers, including research institutions from which we or our collaborators obtain patient health information, are subject to privacy and security regulations promulgated under HIPAA, as amended HITECH. Under HIPAA, we could potentially face substantial criminal or civil penalties if we knowingly receive individually identifiable health information from a HIPAA-covered healthcare provider or research institution that has not satisfied HIPAA's requirements for disclosure of individually identifiable health information, or otherwise violate applicable HIPAA requirements related to the protection of such information. Even when HIPAA does not apply, failing to take appropriate steps to keep consumers' personal information secure may constitute a violation of the Federal Trade Commission Act.

In addition, we may maintain sensitive personally identifiable information, including health information, that we receive throughout the clinical trial process, in the course of our research collaborations, and directly from individuals (or their healthcare providers) who enroll in our patient assistance programs. As such, we may be subject to state laws (for example, the CCPA and the California Privacy Rights Act) requiring notification of affected individuals and state regulators in the event of a breach of personal information.

Our clinical trial programs and research collaborations outside the United States may implicate international data protection laws, including in Europe the GDPR. If our privacy or data security measures fail to comply with the GDPR requirements, we may be subject to litigation, regulatory investigations, enforcement notices, and/or enforcement actions requiring us to change the way we use personal data and/or fines. In addition to statutory enforcement, a personal data breach can lead to negative publicity and a potential

loss of business. Further, following the United Kingdom's withdrawal from the E.U. effective as of December 31, 2020, we have to comply with the GDPR and the GDPR as incorporated into United Kingdom national law, which may have differing requirements. If we fail to comply with United Kingdom data protection laws, we may be subject to litigation, regulatory investigations, enforcement notices, and/or enforcement actions, as well as negative publicity and a potential loss of business.

We are also subject to evolving EEA laws on data export, as we may transfer personal data from the EEA to other jurisdictions. Recent legal developments in Europe have created complexity and uncertainty regarding transfers of personal data from the EEA to the United States. For example, on July 16, 2020, the CJEU invalidated the Privacy Shield, under which personal data could be transferred from the EEA to United States entities who had self-certified under the Privacy Shield scheme. Moreover, it is uncertain whether the standard contractual clauses will also be invalidated by the European courts or legislature.

As government authorities issue further guidance on personal data export mechanisms and/or start taking enforcement action, we could suffer additional costs, complaints, and/or regulatory investigations or fines, and/or if we are otherwise unable to transfer personal data between and among countries and regions in which we operate, it could affect the manner in which we provide our services, the geographical location or segregation of our relevant systems and operations, and could adversely affect our financial results. These laws and regulations may apply, not only to us, but also to vendors that store or otherwise process data on our behalf, such as information technology vendors. If such a vendor misuses data we have provided to it, or fails to safeguard such data, we may be subject to litigation, regulatory investigations, enforcement notices, and/or enforcement actions, as well as negative publicity and a potential loss of business.

Risks Related to Ownership of Our Common Stock

Our stock price may be volatile or may decline regardless of our operating performance, resulting in substantial losses for investors.

The market price of our common stock may be highly volatile and may fluctuate substantially as a result of a variety of factors, some of which are related in complex ways. The market price of our common stock may fluctuate significantly in response to numerous factors, many of which are beyond our control, including the factors described in this "Risk Factors" section and elsewhere in this Annual Report.

In addition, the stock market in general, and the Nasdaq Stock Market, or Nasdaq, 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. Additionally, the trading prices for pharmaceutical, biopharmaceutical and biotechnology companies have been highly volatile. Also, broad market and industry factors may negatively affect the market price of our common stock, regardless of our actual operating performance.

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.

As of December 31, 2023, our executive officers, directors and their respective affiliates beneficially owned approximately 45% of our outstanding voting stock (excluding any stock options exercisable within 60 days of such date held by such persons). Additionally, in February 2024, certain of our directors and officers, in the aggregate, acquired approximately 4% of our outstanding voting stock in private placement of common stock, further increasing the beneficial ownership of these stockholders. Therefore, these stockholders have the ability to influence us through this ownership position. These stockholders may be able to determine all matters requiring stockholder approval. For example, these stockholders may be able to control 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.

We are an emerging growth company as well as a "smaller reporting company", and any decision on our part to comply only with certain reduced reporting and disclosure requirements applicable to emerging growth companies or smaller reporting companies could make our common stock less attractive to investors.

We are an "emerging growth company" as defined in the Jumpstart Our Business Startups Act of 2012, or the JOBS Act, and, for as long as we continue to be an emerging growth company, we may choose to take advantage of exemptions from various reporting requirements applicable to other public companies but not to emerging growth companies, including:

- not being required to have our independent registered public accounting firm audit our internal control over financial reporting under Section 404 of the Sarbanes-Oxley Act;
- reduced disclosure obligations regarding executive compensation in our periodic reports and annual reports on Form 10-K; and
- exemptions from the requirements of holding non-binding advisory votes on executive compensation and stockholder approval of any golden parachute payments not previously approved.

We will remain an emerging growth company until the earlier of:

- the last day of the fiscal year in which we have more than $1.235 billion in annual revenue;
- the date we qualify as a "large accelerated filer," with at least $700.0 million of equity securities held by non-affiliates;
- the date on which we have issued, in any three-year period, more than $1.0 billion in non-convertible debt securities; or
- December 31, 2026.

Additionally, we are a "smaller reporting company" as defined in Item 10(f)(1) of Regulation S-K. Smaller reporting companies may take advantage of certain reduced disclosure obligations, including, among other things, providing only two years of audited financial statements. We will remain a smaller reporting company until the last day of the fiscal year in which (i) the market value of our common stock held by non-affiliates exceeds $250 million as of the end of that year's second fiscal quarter, or (ii) our annual revenues exceeded $100 million during such completed fiscal year and the market value of our common stock held by non-affiliates exceeds $700 million as of the end of that year's second fiscal quarter.

We cannot predict if investors will find our common stock less attractive if we choose to rely on any of the exemptions afforded to emerging growth companies or smaller reporting companies. If some investors find our common stock less attractive because we rely on any of these exemptions, there may be a less active trading market for our common stock and the market price of our common stock 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 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 that 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, these audited financial statements may not be comparable to companies that comply with the new or revised accounting pronouncements as of public company effective dates.

If we fail to maintain proper and effective internal controls over financial reporting, our ability to produce accurate and timely financial statements could be impaired.

Pursuant to Section 404 of the Sarbanes-Oxley Act, our management was required to report upon the effectiveness of our internal control over financial reporting beginning with the annual report for our fiscal year ending December 31, 2022. When we lose our status as an "emerging growth company" and a "smaller reporting company," and become an "accelerated filer" or a "large accelerated filer," our independent registered public accounting firm will be required to attest to the effectiveness of our internal control over financial reporting. 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 requirements of being a reporting company under the Exchange Act, we have implemented and will continue to implement additional financial and management controls, reporting systems and procedures and we have hired and intend to continue to hire additional accounting and finance staff.

We cannot assure you that there will not be material weaknesses or significant deficiencies 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 we have a material weakness or significant deficiency 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.

Provisions in our amended and restated certificate of incorporation and our amended and restated bylaws and Delaware law might discourage, delay or prevent a change in control of our company or changes in our management and, therefore, depress the market price of our common stock.

Our amended and restated certificate of incorporation and our amended and restated bylaws contain provisions that could depress the market price of our common stock by acting to discourage, delay, or prevent a change in control of our company or changes in our management that the stockholders of our company may deem advantageous. These provisions, among other things:

- establish a staggered board of directors (the "Board") divided into three classes serving staggered three-year terms, such that not all members of the Board will be elected at one time;
- authorize our Board to issue new series of redeemable preferred stock without stockholder approval and create, subject to applicable law, a series of redeemable preferred stock with preferential rights to dividends or our assets upon liquidation, or with superior voting rights to our existing common stock;
- eliminate the ability of our stockholders to call special meetings of stockholders;
- eliminate the ability of our stockholders to fill vacancies on our Board;
- establish advance notice requirements for nominations for election to our Board or for proposing matters that can be acted upon by stockholders at our annual stockholder meetings;
- permit our Board to establish the number of directors;
- provide that our Board is expressly authorized to make, alter or repeal our amended bylaws;
- provide that stockholders can remove directors only for cause and only upon the approval of not less than 66 2/3 of all outstanding shares of our voting stock;
- require the approval of not less than 66 2/3 of all outstanding shares of our voting stock to amend our bylaws and specific provisions of our certificate of incorporation; and
- limit the jurisdictions in which certain stockholder litigation may be brought.

As a Delaware corporation, we are subject to the anti-takeover provisions of Section 203 of the Delaware General Corporation Law, which prohibits a Delaware corporation from engaging in a business combination specified in the statute with an interested stockholder (as defined in the statute) for a period of three years after the date of the transaction in which the person first becomes an interested stockholder, unless the business combination is approved in advance by a majority of the independent directors or by the holders of at least two-thirds of the outstanding disinterested shares. The application of Section 203 of the Delaware General Corporation Law could also have the effect of delaying or preventing a change of control of our company.

Our amended and restated certificate of incorporation 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, provides that, unless we consent in writing to the selection of an alternative forum, the sole and exclusive forum, to the fullest extent permitted by law, for (1) any derivative action or proceeding brought on our behalf, (2) any action asserting a breach of a fiduciary duty owed by any director, officer or other employee to us or our stockholders, (3) any action asserting a claim against us or any director, officer, or other employee arising pursuant to the Delaware General Corporation Law, (4) any action to interpret, apply, enforce, or determine the validity of our amended and restated certificate of incorporation or amended and restated bylaws, or (5) any other action asserting a claim that is governed by the internal affairs doctrine, shall be the Court of Chancery of the State of Delaware (or another state court or the federal court located within the State of Delaware if the Court of Chancery does not have or declines to accept jurisdiction), in all cases subject to the court's having jurisdiction over indispensable parties named as defendants. In addition, our amended and restated certificate of incorporation provides that the federal district courts of the United States is the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act but that the forum selection provision will not apply to claims brought to enforce a duty or liability created by the Exchange Act. Although we believe these provisions benefit us by providing increased consistency in the application of Delaware law for the specified types of actions and proceedings, the provisions may have the effect of discouraging lawsuits against us or our directors and officers. These provisions may limit an investor's ability to bring a claim in a judicial forum that it finds favorable for disputes with our company, including by increasing the cost of such lawsuits, which may discourage such

claims. Alternatively, if a court were to find the choice of 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, financial condition, and operating results. For example, under the Securities Act, federal courts have concurrent jurisdiction over all suits brought to enforce any duty or liability created by the Securities Act, and investors cannot waive compliance with the federal securities laws and the rules and regulations thereunder. Any person or entity purchasing or otherwise acquiring any interest in our shares of capital stock shall be deemed to have notice of and consented to this exclusive forum provision, but will not be deemed to have waived our compliance with the federal securities laws and the rules and regulations thereunder, or maintain profitability.

General Risk Factors

Unfavorable global economic conditions could adversely affect our business, financial condition, stock price and results of operations.

Our results of operations could be adversely affected by general conditions in the global economy and in the global financial markets. Our operations and the global economy have been impacted by increasing interest rates and inflation. Likewise, the capital and credit markets may be adversely affected by the war in the Middle East, conflict between Russia and Ukraine, and the possibility of a wider European, Middle Eastern, or global conflict, global sanctions imposed in response thereto, or an energy crisis. A severe or prolonged economic downturn, such as the global financial crisis, could result in a variety of risks to our business, including a decrease in the demand for our product candidates and in our ability to raise additional capital when needed on acceptable terms, if at all. A weak or declining economy also could strain our suppliers, possibly resulting in supply disruption, or cause our customers to delay making payments for our services. We cannot anticipate all of the ways in which the foregoing, and the current economic climate and financial market conditions generally, could adversely impact our business. Furthermore, our stock price may decline due in part to the volatility of the stock market and any general economic downturn.

Our money market or other investments or bank deposits may be subject to market, interest and credit risk that may reduce in value.

The value of our investments may decline due to increases in interest rates, downgrades of the bonds and other securities included in our money market or other investments and instability in the global financial markets that reduces the liquidity of securities included in our portfolio. In addition, we are aware of the closure of Silicon Valley Bank and appointment of the Federal Deposit Insurance Corporation as receiver. Furthermore, a possible recession, rising inflation, and the lingering effects of the COVID-19 pandemic has and may continue to adversely affect the financial markets in some or all countries worldwide. Each of these events may cause us to record charges to reduce the carrying value of our money market or other investments or sell investments for less than our acquisition cost. Although we attempt to mitigate these risks through diversification of our investments and continuous monitoring of our portfolio's overall risk profile, the value of our investments may nevertheless decline.

Our future growth and ability to compete depends on retaining our key personnel and recruiting additional qualified personnel.

Our success depends upon the continued contributions of our key management, scientific, and technical personnel, many of whom have been instrumental for us and have substantial experience with our product candidates and related technology. The loss of key managers and senior scientists could delay our research and development activities. Despite our efforts to retain valuable employees, members of our management, scientific, and development teams may terminate their employment with us on short notice. Although we have employment agreements with certain of our key employees, these employment agreements provide for at-will employment, which means that any of our employees could leave our employment at any time, with or without notice. In addition, the competition for qualified personnel in the biotechnology and pharmaceutical industries is intense, and our future success depends upon our ability to attract, retain, and motivate highly-skilled scientific, technical, and managerial employees. We face competition for personnel from other companies, universities, public and private research institutions, and other organizations. If our recruitment and retention efforts are unsuccessful in the future, it may be difficult for us to implement our business strategy, which could have a material adverse effect on our business.

Item 1B Unresolved Staff Comments.

None.

Item 1C Cybersecurity.

Risk Management

We recognize the importance of assessing, identifying, and managing material risks associated with cybersecurity threats, as such term is defined in Item 106(a) of Regulation S-K. These risks include, among other things, operational risks; intellectual property theft; fraud; extortion; harm to employees or customers; violation of privacy or security laws and other litigation and legal risk; and reputational risks.

We also maintain an incident response plan to coordinate the activities we take to protect against, detect, respond to and remediate cybersecurity incidents, as such term is defined in Item 106(a) of Regulation S-K, as well as to comply with potentially applicable legal obligations and mitigate brand and reputational damage.

We have established physical, electronic, and organizational measures to safeguard and secure our systems to prevent a data compromise. Our approach includes, among other things:

- conducting regular network and endpoint monitoring, vulnerability assessments, and penetration testing to improve our information systems, as such term is defined in Item 106(a) of Regulation S-K is scheduled on 2024 IT plan;
- requiring regular cybersecurity training programs for employees, management and directors;
- comparing our processes to standards set by the National Institute of Standards and Technology ("NIST");
- leveraging the NIST incident handling framework to help us identify, protect, detect, respond, and recover when there is an actual or potential cybersecurity incident;
- operating threat intelligence processes designed to model and research our adversaries;
- conducting regular phishing email simulations for all employees and all contractors with access to corporate email systems to enhance awareness and responsiveness to such possible threats;
- maintaining copies of production data in two separate locations;
- running a backup for our data on a daily basis and these files are held for several months;
- testing the backup and recovery systems frequently;
- employing a multi-factor authorization for employees who are working remotely, in order to mitigate risks of compromising email accounts; and
- holding an insurance policy to mitigate risks for cybersecurity incidents.

These approaches vary in maturity across our business and we work to continually improve them.

As part of the above approach and processes, we periodically engage with assessors, consultants, auditors, and other third-parties, including by annually having a third-party review our cybersecurity program to help identify areas for continued focus, improvement and/or compliance.

Our process for identifying and assessing material risks from cybersecurity threats operates alongside our broader overall risk assessment process, covering all company risks. As part of this process, appropriate HCW personnel collaborate with subject matter specialists, as necessary, to gather insights for identifying and assessing material cybersecurity threat risks, their severity, and potential mitigation.

As of December 31, 2023, we have experienced a few outages which we do not believe impacted the integrity of our data. While we continue to make investments to improve the protection of data and information technology, there can be no assurance that our efforts will prevent service interruptions or security breaches. We describe whether and how risks from identified cybersecurity threats, including as a result of any previous cybersecurity incidents, have materially affected or are reasonably likely to materially affect us, including our business strategy, results of operations, or financial condition, under the heading "Risks Related to Data Privacy and Cybersecurity" included as part of our risk factor disclosures at Item 1A of this Annual Report, which disclosures are incorporated by reference herein.

To date, we have not experienced a material cybersecurity incident and the expenses we have incurred from cybersecurity incidents were immaterial. This includes penalties and settlements, of which there were none.

Governance

Cybersecurity is an important part of our risk management processes and an area of increasing focus for our Board and management.

Our Audit Committee of our Board of Directors is responsible for the oversight of risks from cybersecurity threats. At least annually, the Audit Committee receives an overview from management of our cybersecurity threat risk management and strategy processes covering topics such as data security posture, results from third-party assessments, progress towards pre-determined risk-mitigation-related goals, our incident response plan, and material cybersecurity threat risks or incidents and developments, as well as the steps management has taken to respond to such risks. In such sessions, the Audit Committee generally receives materials including a cybersecurity scorecard and other materials indicating current and emerging cybersecurity threat risks, and describing our ability to mitigate those risks, and discusses such matters with our Operations Administrator, who is supported by Compass MSP, a leading provider of technology managed services. Members of the Audit Committee are also encouraged to regularly engage in ad hoc conversations with management on cybersecurity-related news events and discuss any updates to our cybersecurity risk management and strategy programs. Material cybersecurity threat risks may also be considered during separate Board meeting discussions.

Our cybersecurity risk management and strategy processes, which are discussed in greater detail above, are led by our Chief Executive Officer, who has founded and led several biotech companies for over 20 years, all of which have implemented systems and processes to protect sensitive clinical data and patient information. He is supported by our IT consultant, Compass MSP, a leading provider of technology managed services. Our consultant conducts a vulnerability assessment annually and tests our backup and recovery systems frequently.

These members of management are informed about and monitor the prevention, mitigation, detection, and remediation of cybersecurity incidents through their management of, and participation in, the cybersecurity risk management and strategy processes described above, including the operation of our incident response plan. If a cybersecurity incident is determined to be a material cybersecurity incident, our incident response plan and cybersecurity disclosure controls and procedures define the process to disclose such a material cybersecurity incident.

Item 2 Properties.

On August 15, 2022, we purchased a 36,000 square foot building located in Miramar, Florida, as our new headquarters. We will use the new facility for research and development laboratories and facilities for manufacturing, as well as offices for our employees, including clinical development, research, development, quality control, quality assurance, regulatory affairs, and administration. We are in the process of refitting the building for our purposes. Our relocation to the new headquarters is anticipated in the early 2025. We expect our cGMP manufacturing facility to be validated and operational in the first half of 2025. We continue to occupy approximately 12,250 square feet of space in Miramar, Florida under a lease that commenced on March 1, 2024 and expires on February 28, 2025, which we believe is sufficient to meet our current and near-term needs.

Item 3 Legal Proceedings.

From time to time, the Company is a party to or otherwise involved in legal proceedings, including suits, assessments, regulatory actions and investigations generally arising out of the normal course of business. Such proceedings can be costly, time consuming, and unpredictable. Therefore, no assurance can be given on the outcome of any proceeding or the potential impact on our results of operations or financial condition.

On December 23, 2022, a lawsuit was filed by Altor BioScience, LLC and NantCell, Inc., collectively, Altor/NantCell, against the Company in U.S. District Court for the Southern District of Florida, or the Court, alleging misappropriation of trade secrets under state and federal laws, inducement of breach of contract and breach of fiduciary duty, tortious interference with contractual relations, specific performance, conversion, unjust enrichment, specific performance for assignment of patents and patent applications, constructive trust, and replevin. The complaint against the Company is based on very similar allegations as those alleged by Altor/NantCell in an arbitration commenced in December 2022 against the Company's Founder and Chief Executive Officer, Dr. Hing C. Wong, who was formerly employed by Altor/NantCell. Altor/NantCell alleges that Dr. Wong purportedly took Altor/NantCell's confidential and trade-secret information and used it to form and build competing products for the Company. Altor/NantCell allege that each of the provisional applications that the Company has filed for relate to the use of fusion proteins, tissue factor, and other proprietary data that were developed at Altor/NantCell, while Dr. Wong was an employee of or consultant to Altor/NantCell, and

using its resources. Altor/NantCell seeks compensatory and punitive damages, attorneys' fees and costs, and equitable relief including an order requiring the Company to assign title and all rights to the Company's patents and provisional applications to Altor/NantCell.

On January 31, 2023, the Company filed a motion to compel arbitration, a motion for the stay of the litigation, and a motion to dismiss the complaint ("motion to compel"), which are currently pending before the Court. On April 18, 2023, the U.S. District Court for the Southern District of Florida (the "Court") heard oral argument on the Company's motion to compel and ordered the parties to provide supplemental briefing by April 28, 2023. Before the Court ruled on the Company's motion to compel, on April 26, 2023, the parties stipulated that Altor/NantCell's action against the Company would be consolidated with the Altor/NantCell arbitration demand against Dr. Wong. On April 27, 2023, the Court approved the parties' stipulation and ordered the parties to arbitration. On May 1, 2023, Altor/NantCell filed a demand against the Company before JAMS. On May 3, 2023, Altor/NantCell dismissed the federal court action without prejudice and the Court ordered the case dismissed without prejudice and closed the case. Altor/NantCell's proceeding against the Company is now proceeding in arbitration before JAMS, with an arbitration hearing scheduled for May 20, 2024.

In addition, on March 26, 2024, Altor/NantCell gave notice that they are filing a complaint (the "Complaint") against the Company in the Chancery Court of the State of Delaware for the contribution of legal fees and expenses advanced to Dr. Wong, our founder and chief executive officer, in connection with the arbitration discussed above. Prior to the filing of the Complaint, Altor/NantCell had previously sought advancement from the Company and the Company agreed to advance 50% of Dr. Wong's legal fees going forward from December 2023. On January 8, 2024, Altor/NantCell reserved their right to pursue contribution against the Company for 50% of the amount Altor/NantCell sent for advancement of expenses for Dr. Wong. In the Complaint, Altor/NantCell seek 50% of the fees they have already advanced to Dr. Wong, a declaration that the Company has an obligation to contribute 50% of the advancement of Dr. Wong's expenses including 50% of Dr. Wong's expenses incurred in connection with the arbitration through final resolution of the matter, and costs and fees in bringing this action.

Although adverse decisions (or settlements) may occur in the legal proceedings described above, it is not possible to reasonably estimate the possible loss or range of loss, if any, associated therewith at this time and, as such, no accrual for these matters has been recorded within our audited financial statements included elsewhere in this Annual Report. If liability is determined, it could have a material adverse effect on the Company's business, results of operations and financial condition.

Item 4 Mine Safety Disclosures.

Not applicable.

PART II

Item 5 Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities.

Market Information and Holders of our Common Stock

Our common stock is traded on The Nasdaq Global Select Market under the symbol "HCWB". As of March 15, 2024, 37,823,394 shares of the Company's common stock were issued and outstanding and were owned by approximately 2,300 holders of record. The actual number of stockholders is greater than this number of record holders and includes stockholders who are beneficial owners but whose shares are held in street name by brokers and other nominees.

Dividend Policy

We have never declared or paid any cash dividends on our common stock or any other securities. We anticipate that we will retain all available funds and any future earnings, if any, for use in the operation of our business and do not anticipate paying cash dividends in the foreseeable future. In addition, future debt instruments may materially restrict our ability to pay dividends on our common stock. Payment of future cash dividends, if any, will be at the discretion of the Board after taking into account various factors, including our financial condition, operating results, current and anticipated cash needs, the requirements of current or then-existing debt instruments and other factors the Board deems relevant.

Recent Sales of Unregistered Securities; Use of Proceeds from Registered Securities

On July 19, 2021, the SEC declared effective our registration statement on Form S-1 (File No. 333-256510), as amended, filed in connection with our initial public offering (the "IPO"). Our IPO closed on July 22, 2021, and we issued and sold 7,000,000 shares of common stock at a price to the public of $8.00 per share, for an aggregate amount of $56.0 million. The net proceeds of our IPO were $49.2 million, after deducting underwriting discounts and commissions and other offering costs. The managing underwriter of the IPO was EF Hutton. None of the underwriting discounts and commissions or offering expenses were incurred or paid, directly or indirectly, to any of our directors or officers or their associates or to persons owning 10% or more of our common stock or to any of our affiliates.

We have used the proceeds of our IPO for advancing our clinical development of our lead product candidates HCW9218 and HCW9302, establishing a manufacturing capability, as described in the final prospectus dated July 19, 2021 and filed with the SEC. There has been no material change in our use of the net proceeds from the IPO as described in our final prospectus, filed pursuant to Rule 424(b)(4) under the Securities Act with the SEC on July 21, 2022, other than the application of $7.8 million of IPO proceeds to our defense in legal matters.

Purchases of Equity Securities by the Issuer and Affiliated Purchasers

None.

Item 6 [Reserved].

Item 7 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 together with our financial statements and related notes thereto included elsewhere in this Annual Report. This discussion contains forward-looking statements that involve risk and uncertainties, such as statements of our plans, objectives, expectations, and intentions, which are based on the beliefs of our management. Our actual results could differ materially from those discussed in these forward-looking statements. Factors that could cause or contribute to such differences include, but are not limited to, those discussed in the "Risk Factors" section of this Annual Report.

Company Overview

HCW Biologics Inc. is a clinical-stage biopharmaceutical company focused on discovering and developing novel immunotherapies to lengthen health span by disrupting the link between chronic, low-grade inflammation and age-related diseases. We believe age-related, chronic, low-grade inflammation, or "inflammaging," is a significant contributing factor to several diseases and conditions, such as cancer, cardiovascular disease, diabetes, neurodegenerative diseases, and autoimmune diseases. The induction and retention of low-grade inflammation in an aging human body is mainly the result of the accumulation of non-proliferative but metabolically active senescent cells, which can also be caused by persistent activation of protein complexes, known as inflammasomes, in innate immune cells. These two elements share common mechanisms in promoting secretion of proinflammatory proteins and in many cases interact to drive senescence, and thus, inflammaging. Our novel approach is to reduce senescent cells and eliminate the proinflammatory factors they secrete systemically through multiple pathways. We believe our approach has the potential to fundamentally change the treatment of age-related diseases.

Accumulation of senescent cells with a senescence-associated proinflammatory factors has been implicated as a major source of chronic sterile inflammation leading to many aging-related pathologies. The key to the HCWB immunotherapeutic approach is elimination of senescent cells and the proinflammatory factors they secrete. Our lead product candidates address the two primary processes that promote chronic inflammation, as explained below:

HCW9218. Subcutaneous administration of our clinical-stage, lead drug candidate, HCW9218, activates NK cells, innate lymphoid group-1, and $CD8^{+}$T cells, and neutralizes TGF-β. This bifunctionality gives HCW9218 the ability to reduce senescent cells as well as eliminate senescence-associated proinflammatory factors that function as a senomorphic. HCW9218 is the basis for our cancer program.

HCW9302. Subcutaneous administration of our preclinical-stage, lead drug candidate, HCW9302, is designed to activate and expand T_{reg} cells to reduce senescence by suppressing the activity of inflammasome-bearing cells and the inflammatory factors which they secrete. HCW9302 is the basis for our autoimmune program.

Business Highlights

Financing

The Company completed the following transactions with the purpose of raising funds required to launch Phase 2 clinical studies to evaluate HCW9218 in ovarian and pancreatic cancer, continue research on expanded indications beyond cancer for HCW9218, and begin the clinical development of HCW9302:

- On February 20, 2024, we sold an aggregate of 1,785,718 shares of our common stock to certain of our officers and directors, at a purchase price of $1.40 per share, for an aggregate purchase price of $2.5 million.
- As of March 31, 2024, the Company entered into legally binding agreements to issue $10.0 million of secured notes from investors, including certain of our officers and directors as well as other investors. We received $2.0 million of funds by the issuance date of the financial statements contained elsewhere in this Annual Report.

On January 10, 2024, we exercised our right to terminate the credit agreement (the "Credit Agreement"), dated April 21, 2023 ("Closing Date"), between the Company and Prime Capital Ventures, LLC (the "Lender"). We had no borrowings under the Credit Agreement. On March 6, 2024, the Lender defaulted on its obligation to refund $5.3 million that we funded on the Closing Date to establish an interest reserve account. Actions have been taken that would benefit the creditors who have terminated their credit agreements and similarly sought to recover funds paid for an interest reserve, including receivership and legal remedies. Given the limited success that these efforts have had to date for the recovery of funds for creditors, the Company recognized a reserve for a credit loss for the full amount of $5.3 million as of December 31, 2023, which is a noncash adjustment in the accompanying

statements of cash flow, and an operating cost presented in the accompanying statements of operations. However, we intend to pursue all available remedies to recover these funds, including legal actions, receivership and insurance.

As of December 31, 2023, we held $3.6 million of cash and cash equivalents and there was substantial doubt about our ability to continue as a going concern. Since that time, we have entered into agreements to raise $12.5 million of financing, consisting of funds received and legally binding funding commitments. And, we continue with other fundraising efforts that we are targeting to complete in the next three to six months. Under the guidance of Topic 205-40 for going concern assessment, we evaluated whether we mitigated the substantial doubt over our ability to remain a going concern for the next 12 months from the issuance date of the financial statements included elsewhere in this Annual Report. If no additional financings occur after the issuance date, we believe the relevant conditions that brought about substantial doubt can be alleviated if we implement a plan that includes certain adjustments to our strategic and operating plans, such as cutting back on the number of investigative studies and Phase 2 clinical trials we initiate; reducing salaries and other spending, and limiting the amount of cash used to reduce accounts payable, as well as other adjustments to alleviate substantial doubt.

Clinical Development

- The Phase 1 clinical trial to evaluate HCW9218 in solid tumors and the Phase 1b clinical trial to evaluate HCW9218 in pancreatic cancer were completed in February 2024. In the Phase 1 study, over 70% of patients with ovarian cancer (5/7) showed evidence of stable disease. In the Phase 1b study, 13% (2/15) of patients who participated in the study showed evidence of stable disease. The studies met the primary objective to determine a RP2D.
- In February 2024, we entered into an agreement with UPMC to conduct an Investigator-sponsored Phase 2 clinical trial to evaluate HCW9218 in patients with metastatic advanced stage ovarian cancer in combination with neoadjuvant chemotherapy. Patient enrollment is expected to begin in the first half of 2024.
- In the first half of 2024, we expect to initiate a randomized Phase 2 clinical trial with NCI, operating under our existing CRADA, to evaluate HCW9218 in the treatment of advanced pancreatic cancer in combination with standard-of-care chemotherapy.
- In the coming year, we are considering expanding our clinical studies to other age-related indications beyond cancer, some of which may be secondary endpoints of studies in cancer indications. For example, we are currently evaluating a Phase 2 clinical studies in skin cancer which could give us an opportunity to evaluate HCW9218 in the treatment of senile lentigo, the age-related disease that is characterized by benign, darkened spots on the skin, as a secondary endpoint of the cancer study.
- In the coming year, we intend to have our second lead product candidate, HCW9302, enter the clinical stage of development. We are preparing an IND application to evaluate HCW9302 in an autoimmune disease, which we plan to submit in the first half of 2024. There can be no assurance that the FDA will authorize us to initiate our planned clinical trials on a timely basis, or at all. In the event we do not receive feedback on a timely basis, or we are required to change the design of our clinical protocol or address other feedback, clinical development of our products would be delayed and our costs may increase.

Scientific Publications and Conferences in 2023

- In April 2023, a poster entitled, “Bifunctional Immunotherapeutic HCW9218 Facilitates Recruitment of Immune Cells from Tumor Draining Lymph Nodes to Promote Antitumor Activity and Enhance Checkpoint Blockade Efficacy in Solid Tumors”, was presented at the 2023 Annual Meeting of the American Association of Cancer Research.
- In May 2023, a pivotal scientific paper authored by our scientific research team was published in the peer-reviewed journal, *Aging Cell*, entitled, “Immunotherapeutic Approach to Reduce Senescent Cells and Alleviate Senescence-Associated Secretory Phenotype in Mice.”
- In November 2023, there was a preliminary human data readout at the 38th Annual Meeting of the Society for Immunotherapy of Cancer conference, from the Phase 1 clinical trial to evaluate HCW9218 in patients with chemo-refractory/chemo-resistant solid tumors.

Trends and Uncertainties

Inflationary Cost Environment, Banking Crisis, Supply Chain Disruption and the Macroeconomic Environment

Our operations have been affected by many headwinds, including inflationary pressures, rising interest rates, ongoing global supply chain disruptions resulting from increased geopolitical tensions such as the war between Russia and Ukraine, the war in the Middle East, China-Taiwan relations, financial market volatility and currency movements. These headwinds, specifically the supply chain disruptions, have adversely impacted our ability to procure certain services and materials, which in some cases impacts the cost and timing of clinical trials and IND-enabling activities. In addition, we have been impacted by inflation when procuring materials required for the buildout of our new headquarters, the costs for recruiting and retaining employees and other employee-related costs. Further, rising interest rates would also increase borrowing costs to the extent that the Company takes on any additional debt. The Company uses a number of strategies to effectively navigate these issues, including product redesign, alternate sourcing, and establishing contingencies in budgeting and timelines. However, the extent and duration of such events and conditions, and resulting disruptions to our operations, are highly unpredictable.

For discussion of risks related to potential impacts of supply chain, inflation, geopolitical and macroeconomic challenges on our operations, business results and financial condition, see "Part II, Item 1A. Risk Factors" in this Annual Report.

Components of Results of Operations

Revenues

We have no products approved for commercial sale and have not generated any revenue from commercial product sales of internally-developed immunotherapeutic products for the treatment of cancer and other age-related diseases. The principal source of our revenues to date have been generated from our Wugen License and Master Services Agreement (the "MSA") with Wugen. See Note 1 to our audited financial statements included elsewhere in this Annual Report for these definitions and more information.

We derive revenue from a license agreement granting rights to Wugen to further develop and commercialize products based on two of our internally-developed molecules. Consideration under our contract included a nonrefundable upfront payment, development, regulatory and commercial milestones, and royalties based on net sales of approved products. Additionally, HCW Biologics retained manufacturing rights and has agreed to provide Wugen with clinical and research grade materials for clinical development and commercialization of licensed products under separate agreements. We assessed which activities in the Wugen License should be considered distinct performance obligations that should be accounted for separately. We develop assumptions that require judgement to determine whether the license to our intellectual property is distinct from the research and development services or participation in activities under the Wugen License.

Performance obligations relating to the granting a license and delivery of licensed product and R&D know-how were satisfied when transferred upon the execution of the Wugen License on December 24, 2020. The Company recognized revenue for the related consideration at a point in time. The revenue recognized from a transaction to supply clinical and research grade materials entered into under the MSA and covered by a Statement of Work ("SOW"), represents one performance obligation that is satisfied over time. The Company recognizes revenue generated for supply of material for clinical development using an input method based on the costs incurred relative to the total expected cost, which determines the extent of the Company's progress toward completion.

Operating Expenses

Our operating expenses are reported as research and development expenses and general and administrative expenses.

Research and Development

Our research and development expenses consist primarily of costs incurred for the development of our product candidates, which include:

- Employee-related expenses, including salaries, benefits, and stock-based compensation expense;
- Expenses related to manufacturing and materials, consisting primarily of expenses incurred in connection with CMOs, which produce cGMP materials for clinical trials on our behalf;
- Expenses associated with preclinical activities, including research and development and other IND-enabling activities;
- Expenses incurred in connection with clinical trials; and

- Other expenses, such as facilities-related expenses, direct depreciation costs for capitalized scientific equipment, and allocation for overhead.

We expense research and development costs as they are incurred. Costs for contract manufacturing are recognized based on an evaluation of the progress to completion of specific tasks using information provided to us by our vendors. Payments for these activities are based on the terms of the agreement, and the pattern of payments for goods and services will change depending on the material. Nonrefundable advance payments for goods or services to be received in the future for use in research and development activities are recorded as prepaid expenses and expensed as the related goods are delivered or the services are performed.

We expect research and development expenses to increase substantially for the foreseeable future as we continue the development of our product candidates. We cannot reasonably determine the nature, timing, and costs of the efforts that will be necessary to complete the development of, and obtain regulatory approval for, any of our product candidates. Product candidates in later stages of development generally have higher development costs than those in earlier stages. See "Risk Factors -- Risks Related to the Development and Clinical Testing of Our Product Candidates," elsewhere in this Annual Report for a discussion of some of the risks and uncertainties associated with the development and commercialization of our product candidates. Any changes in the outcome of any of these risks and uncertainties with respect to the development of our product candidates in preclinical and clinical development could mean a significant change in the costs and timing associated with the development of these product candidates. For example, if the FDA or another regulatory authority were to delay our planned start of clinical trials or require us to conduct clinical trials or other testing beyond those that we currently expect or if we experience significant delays in enrollment in any of our planned clinical trials, we could be required to expend significant additional financial resources and time on the completion of clinical development of that product candidate.

General and Administrative Expenses

General and administrative expenses consist primarily of employee-related expenses, including salaries, related benefits, and stock-based compensation expense for employees in the executive, legal, finance and accounting, human resources, and other administrative functions. General and administrative expenses also include third-party costs such as insurance costs, fees for professional services, such as legal, auditing and tax services, facilities administrative costs, and other expenses.

During the period ended December 31, 2022, Altor/NantCell, a former employer of Dr. Hing C. Wong, our Founder and Chief Executive Officer, initiated legal proceedings against Dr. Wong and the Company. On April 26, 2023, the parties stipulated that Altor/NantCell's action against the Company would be consolidated with the Altor/NantCell arbitration demand against Dr. Wong. On April 27, 2023, the U.S. District Court for the Southern District of Florida (the "Court") with jurisdiction over lawsuit against the Company approved the parties' stipulation and ordered the parties to arbitration. On May 1, 2023, Altor/NantCell filed a demand against the Company before JAMS. On May 3, 2023, Altor/NantCell dismissed the federal court action without prejudice and the Court ordered the case dismissed without prejudice and closed the case. Altor/NantCell's proceeding against the Company is now proceeding in arbitration before JAMS, with an arbitration hearing scheduled for May 20, 2024. In connection with claims brought against Dr. Wong, Altor/NantCell has advancement obligations to him for claims brought against him and is currently advancing half of Dr. Wong's legal fees while the Company advances the other half of Dr. Wong's legal fees; however, Altor/NantCell is seeking reimbursement of all the legal fees and expenses it has advanced to Dr. Wong. The Company also has incurred legal expenses on its own behalf in the period ended December 31, 2023, and we expect to continue to incur material costs and expenses in connection with defending the Company in the foregoing legal matters during the first half of 2024.

We expect general and administrative expenses incurred in the normal course of business for other purposes, such as costs for recruitment and retention of personnel, service fees for consultants, advisors and accountants, as well as costs to comply with government regulations, corporate governance, internal control over financial reporting, insurance and other requirements for a public company, to continue to increase for the foreseeable future as we scale our operations.

Interest Expense

Interest expense include interest paid on debt.

Other Income, Net

Other income, net consists of interest earned on our cash, cash equivalents, unrealized gains and losses related to our investments in U.S. government-backed securities, and other income and expenses related to non-operating activities.

Results of Operations

The following table summarizes our results of operations for the years ended December 31, 2022 and 2023:

	Years Ended December 31,	
	2022	2023
Revenues:		
Revenues	$ 6,722,090	$ 2,841,794
Cost of revenues	(4,135,712)	(2,281,434)
Net revenues	2,586,378	560,360
Operating expenses:		
Research and development	9,338,365	7,676,316
General and administrative	8,326,791	13,351,204
Reserve for credit losses	—	5,250,000
Total operating expenses	17,665,156	26,277,520
Loss from operations	(15,078,778)	(25,717,160)
Interest expense	(126,660)	(283,042)
Other (expense) income, net	304,735	1,005,925
Net loss	$ (14,900,703)	$ (24,994,277)

Revenue

In the year ended December 31, 2022, we recognized $6.7 million of revenue and cost of revenues of $4.1 million. Revenues were derived exclusively from the sale of licensed molecules to our licensee, Wugen. The licensed molecules are one of the inputs for manufacturing Wugen's products. Revenues included $1.8 million of revenue that was deferred at December 31, 2021. During 2022, we entered into SOWs with Wugen for each of the then-current and historical purchases of clinical and research grade materials under the MSA, upon which we determined all requirements for revenue recognition under Topic 606 were met for these transactions for the year ended December 31, 2022. There were no deferred revenues as of December 31, 2022.

In the year ended December 31, 2023, we recognized $2.8 million of revenue and cost of revenues of $2.3 million. Revenues were derived exclusively from the sale of licensed molecules to Wugen. Wugen limited its purchases in 2023, due primarily to changes in its clinical development program and delays in ramping up its manufacturing process. There were no deferred revenues as of December 31, 2023.

Research and Development Expenses

The following table summarizes our research and development expenses for the years ended December 31, 2022 and 2023:

	Years Ended December 31,			
	2022	2023	$ Change	% Change
Salaries, benefits and related expenses	$ 3,146,472	$ 2,940,979	$ (205,493)	(7)%
Manufacturing and materials	2,421,953	1,280,351	(1,141,602)	(47)%
Preclinical expenses	2,178,411	1,607,601	(570,810)	(26)%
Clinical trials	795,749	1,059,731	263,982	33%
Other expenses	795,780	787,654	(8,126)	(1)%
Total research and development expenses	**$ 9,338,365**	**$ 7,676,316**	**$ (1,662,049)**	(18)%

Research and development expenses decreased by $1.7 million, or 18%, from $9.4 million for the year ended December 31, 2022 to $7.7 million for the year ended December 31, 2023. This decrease was primarily attributable to decreased expenses for manufacturing and materials, preclinical expenses and performance-based bonuses.

Salaries, benefits and related expenses decreased by $205,493, or 7%, from $3.1 million for the year ended December 31, 2022 to $2.9 million for the year ended December 31, 2023. This decrease was primarily attributable to decreases of $185,651 in performance-based bonuses and $115,200 for allocation of costs from salaries, benefits and related expenses to cost of goods sold.

These decreases were partially offset by increases of $43,970 for health insurance and other benefits and $29,640 for payroll and withholding taxes.

Manufacturing and materials expenses decreased by $1.2 million, or 47%, from $2.4 million for the year ended December 31, 2022 to $1.3 million for the year ended December 31, 2023. In the year ended December 31, 2022, costs were primarily attributable to a 1,000 L GMP run for HCW9218 and completion of a 200 L cGMP run of HCW9302, including finalizing manufacturing reports, fill and finish activities. In the year ended December 31, 2023, the nature of manufacturing activities changed, as we completed a major manufacturing run for our clinical-stage molecules, HCW9218. For the year ended December 31, 2023, the costs we incurred were primarily for production activities associated with the master cell bank characterization for the high-expressing version of HCW9101 and ancillary activities such as shipping, insurance and storage.

Expenses associated with preclinical activities decreased by $570,810 or 26%, from $2.2 million for the year ended December 31, 2022 to $1.6 million for the year ended December 31, 2023. This decrease was primarily attributable to a decline in costs for completing toxicology studies related to IND-enabling activities. In the year ended December 31, 2022, expenses were related primarily to the cost of toxicology studies and experimental materials in connection with IND-enabling activities required to prepare our IND application to the FDA for permission to conduct a Phase 1b/2 clinical trial to evaluate HCW9302 in an autoimmune indication, alopecia areata. In the year ended December 31, 2023, toxicology and other IND-enabling studies were winding down, and we began the process of preparing the IND for submission, which we intend to submit in the first half of 2024. We experienced delays in completing the toxicology studies, as the service provider we engaged had a large backlog of projects due to the government-mandated shutdown during COVID-19 outbreaks.

Expenses associated with clinical trials including professional fees related to regulatory filings, increased by $263,982, or 33%, from $795,749 for the year ended December 31, 2022 to $1.1 million for the year ended December 31, 2023. We anticipate expenses related to clinical activities will increase substantially in the future, as we enter Phase 2 clinical trials to evaluate HCW9218 in ovarian and pancreatic cancer, as well as other indications. HCW9218 entered clinical stage in the first half of 2022, upon the initiation of an Investigator-sponsored Phase 1 clinical trial at the Masonic Cancer Center, University of Minnesota to evaluate HCW218 in chemo-refractory/chemo-resistant solid tumors, such as breast, ovarian, prostate and colorectal cancers. A Company-sponsored Phase 1b/2 clinical trial to evaluate HCW9218 in advanced pancreatic cancer initiated in October 2022. Both of these studies completed patient enrollment, dosing and the safety-evaluation period in February 2024.

Other expenses, which include overhead allocations, decreased by $8,126, or 1%, from $795,780 for the year ended December 31, 2022 to $787,654 for the year ended December 31, 2023. This decrease is primarily attributable to a decrease in travel and travel-related expenses.

General and Administrative Expenses

The following table summarizes our general and administrative expense for the years ended December 31, 2022 and 2023:

	Years Ended December 31,			
	2022	2023	$ Change	% Change
Salaries, benefits and related expenses	$ 3,379,264	$ 3,216,860	$ (162,404)	(5)%
Professional services	2,374,526	7,829,568	5,455,042	230%
Facilities and office expenses	408,562	634,080	225,518	55%
Depreciation	338,458	266,763	(71,695)	(21)%
Rent and occupancy expense	132,739	156,807	24,068	18%
Other expenses	1,693,242	1,247,126	(446,116)	(26)%
Total general and administrative expenses	**$ 8,326,791**	**$ 13,351,204**	**$ 5,024,413**	60%

General and administrative expenses increased by $5.0 million, or 60%, from $8.3 million for the year ended December 31, 2022 to $13.4 million for the year ended December 31, 2023. In addition, there was an increase in professional fees, primarily related to legal fees associated with the Altor/NantCell matter.

Salaries, benefits and related expenses decreased by $162,404, or 5%, from $3.4 million for the year ended December 31, 2022 to $3.2 million for the year ended December 31, 2023. The decrease was primarily due to a decrease of $343,412 related to performance-based bonuses and $119,910 related to equity awards granted to officers and executives, which were partially offset by increases of $217,894 in salaries and wages and $61,377 for health insurance and other benefits.

Professional services increased by $5.4 million, or 230%, from $2.4 million for the year ended December 31, 2022 to $7.8 million for the year ended December 31, 2023. The increase primarily consisted of a $5.0 million increase in fees for legal services related to the Altor/NantCell matter. Fees for professional services other than legal advisors, such as auditors and tax advisors, increased by $152,424 for the year ended December 31, 2023 versus the comparable period in 2022. Fees paid for consulting services, such as investor relations and public relations, decreased by $117,492 for the year ended December 31, 2023 versus the comparable period in 2022.

Facilities and office expenses increased by $225,518, or 55%, from $408,562 for the year ended December 31, 2022 to $634,080 for the year ended December 31, 2023, primarily due to increases of $147,922 in software license fees and $77,596 in costs for office services and equipment.

Other expenses decreased by $446,116, or 26%, from $1.7 million for the year ended December 31, 2022 to $1.3 million for the year ended December 31, 2023. The decrease is primarily due to a decrease of $580,486 in insurance costs associated with being a public company, partially offset by an increase of $110,412 in Delaware franchise taxes.

Reserve for credit losses

The Company recognized a Reserve for credit losses of $5.3 million, reflecting our conclusion that it was not probable that we would recover the interest reserve deposit established upon entering the credit agreement with Prime Capital Ventures (the "Lender") based on facts known as of December 31, 2023. Subsequent to December 31, 2023, the Lender defaulted on its obligation to refund the interest reserve deposit.

Interest

On August 15, 2022, we entered into a loan and security agreement with Cogent Bank to partially fund our purchase of the property we acquired on that same date. We borrowed $6.5 million under this agreement. Amounts outstanding on the term loan will accrue interest at a rate per annum equal to 5.75%. We were obligated to make interest-only payments on this loan from September 2022 through August 2023 and principal and interest payments in 47 equal monthly installments, based on a 25-year maturity schedule, commencing September 15, 2023. We paid $126,660 and $283,042 for interest on this loan for the years ended December 31, 2022 and 2023, respectively.

Other Income, Net

Other income, net increased by $701,190, from $304,735 for the year ended December 31, 2022 to $1.0 million for the year ended December 31, 2023. The increase is primarily attributable to an increase in interest earned for money market deposits and unrealized gains for investments in U.S. government-backed securities. Other income includes rental income. On August 15, 2022, the Company entered into a short-term, market-rate lease with the former owner of the building we purchased on the same date. In the year ended December 31, 2023, the lease terminated. We received rental income of $115,915 and $185,941 in the years ended December 31, 2022 and 2023, respectively.

Liquidity and Capital Resources

Sources of Liquidity

As of December 31, 2023, our principal source of liquidity was $3.6 million in cash and cash equivalents, including money market investments. While there was substantial doubt over whether the Company had sufficient capital to operate for the next twelve months based on this liquidity, some of the elements of our plans to raise additional capital were probable of being implemented and alleviated the relevant conditions causing substantial doubt over our ability to operate as a going concern. Since December 31, 2023, there have been financings for $12.5 million, consisting of funds received and legally binding funding commitments. On February 20, 2024, we completed a $2.5 million private placement of common stock in which we sold an aggregate of 1,785,718 shares to certain of our officers and directors, at a purchase price of $1.40 per share. As of March 31, 2024, we entered into an agreement to issue $10.0 million of secured notes, of which $2.0 million funded prior to filing this Annual Report. The secured notes were sold to certain of our officers and directors as well as other investors. We expect our principal sources of liquidity will continue to be our cash and cash equivalents, various non-dilutive financings such as debt and out-licensing agreements for non-core assets, as well as equity financings.

On August 15, 2022, we purchased a 36,000 square foot building located in Miramar, Florida for approximately $10.1 million, including transaction costs. A portion of the acquisition cost was funded with a $6.5 million five-year loan, secured by the building. The remainder of the purchase price was funded with cash. Amounts borrowed under the term facility have a fixed interest rate of 5.75%, with interest only payments required for the first year and 25-year amortization thereafter. There is no prepayment penalty. As of December 31, 2023, a balance of $6.4 million remains due for this obligation, $6.3 million of which is classified as a noncurrent liability included in Debt, net in the balance sheet included in the audited financial statements included elsewhere in this Annual Report. As of December 31, 2023, we were in compliance with all covenants under the loan agreement and related documents.

Our plans include other financings which we are targeting to complete in the next three to six months. However, if we are not successful in raising additional capital, management is prepared to put a plan in place that we believe will make necessary adjustments to our operations such that our cash and cash equivalents as of December 31, 2023, funds the Company received since year end, and funds the Company expects to receive from legally binding commitments obtained since year end are sufficient to meet our capital requirements and fund our operations for at least the next 12 months. In order to mitigate the relevant conditions giving rise to substantial doubt, it may be necessary to delay, reduce, or eliminate some of our product development programs, our efforts to establish manufacturing capacity, headcount and other operating costs, as well as our commercialization efforts. We have based our projections on assumptions, including our existing commitments and contingencies, that may prove to be incorrect, and we may use all of our available capital sooner than we expect.

Because of the numerous risks and uncertainties associated with the clinical development and commercialization of immunotherapeutics, we are unable to estimate the exact amount of capital requirements to pursue these activities. Our funding requirements will depend on many factors, including, but not limited to:

- timing, progress, costs, and results of our ongoing preclinical studies and clinical trials of our immunotherapeutic products;
- impact of COVID-19 on the timing and progress of our IND-enabling activities, clinical trials and our ability to identify and enroll patients;
- costs, timing, and outcome of regulatory review of our product candidates;
- number of trials required for regulatory approval;
- whether we enter into any collaboration or co-development agreements and the terms of such agreements;
- whether we raise additional funding through bank loan facilities, other debt arrangements, out-licensing or joint ventures, cooperative agreements or strategic collaborations;
- effect of competing technology and market developments;
- cost of maintaining, expanding, and enforcing our intellectual property rights;
- impact of litigation, regulatory inquiries, or investigations, as well as costs to indemnify our officers and directors against third-party claims related to our patents and other intellectual property;
- cost and timing of buildout of new headquarters, including risks of cost overruns and delays, and ability to obtain additional financing, if needed; and
- costs and timing of future commercialization activities, including product manufacturing, marketing, sales, and distribution, for any of our product candidates for which we receive regulatory approval.

A change in the outcome of any of these or other factors with respect to the clinical development and commercialization of our product candidates could significantly change the costs and timing associated with the development of that product candidate. Further, our operating plan may change, and we may need additional funds to meet operational needs and capital requirements for clinical trials and other research and development expenditures.

Summary of Statements of Cash Flows

The following table summarizes our cash flows for the years ended December 31, 2022 and 2023:

	Years Ended December 31,	
	2022	2023
Cash used in operating activities	$ (10,386,110)	$ (22,514,121)
Cash provided by investing activities	14,708,392	3,797,400
Cash provided by (used in) financing activities	6,273,397	(14,534)
Net increase (decrease) in cash and cash equivalents	**$ 10,595,679**	**$ (18,731,255)**

Operating Activities

Net cash used in operating activities was $10.4 million for the year ended December 31, 2022 and $22.5 million for the year ended December 31, 2023.

Cash used in operating activities for the year ended December 31, 2022 consisted primarily of a net loss of $14.9 million, $284,695 cash used arising from an increase in accounts receivable, and $128,246 cash used by a decrease in a lease liability. These uses were partially offset primarily by a $2.5 million cash increase arising from a decrease in prepaid expenses and other assets, a $418,208 cash increase arising from an increase in accounts payable and other liabilities, and adjustments for noncash expenses of $2.0 million, consisting of $1.1 million for stock-based compensation expense, $717,854 for depreciation and amortization expense, and $186,370 for net unrealized loss on investments.

Cash used in operating activities for the year ended December 31, 2023 consisted primarily of a net loss of $22.5 million, which includes a $5.3 million noncash charge for reserve for credit losses related to the full impairment of the interest reserve deposit. Other cash used in operating activities includes $5.3 million to establish the interest reserve account which occurred in April 2023; $1.1 million cash decrease arising from an increase in accounts receivable; and $326,742 cash decrease arising from a decrease in a lease liability. These uses were partially offset primarily by a $432,410 cash increase arising from a decrease in prepaid expenses and other assets; a $1.6 million cash increase arising from an increase in accounts payable and other liabilities; and a net increase of $7.3 million arising from adjustments for noncash expenses, consisting of $5.3 million for reserve for credit losses, $1.0 million for stock-based compensation expense, $1.1 million for depreciation and amortization expense, partially offset by a decrease of $248,445 for net unrealized gain on investments.

Investing Activities

For the year ended December 31, 2022, cash provided by investing activities was $14.7 million, consisting of proceeds for maturity of short-term investments of $25.0 million, offset by $10.0 million of cash used to purchase the property which we intend to convert to our new headquarters and manufacturing facility.

For the year ended December 31, 2023, cash provided by investment activities was $3.8 million, consisting of proceeds for maturity of short-term investments of $10.0 million, offset by $6.2 million of cash used for construction of our new headquarters and manufacturing facility.

Financing Activities

For the year ended December 31, 2022, cash provided by financing activities was $6.3 million, consisting primarily of net proceeds of issuance of debt reflecting the $6.5 million loan used to fund the purchase of the Company's new headquarters.

For the year ended December 31, 2023, cash used in financing activities was $14,534, consisting of cash used for debt repayment of $38,273, offset by cash provided by proceeds from the issuance of common stock of $23,739.

Contractual Obligations and Commitments

As of December 31, 2023, we had $28,693 of obligations remaining in the lease terms for non-cancellable operating lease agreements related to our facilities in Miramar, Florida. Effective March 1, 2022, we entered into a lease extension for our current location for a period of two years, ending February 29, 2024. On January 30, 2024, we entered into a new one-year lease for the same location, effective March 1, 2024. The remaining lease payments under the new short-term lease is $274,823.

We have commitments with a third-party manufacturing organization to supply us with clinical grade materials. As of December 31, 2023, we are under contract for obligations of $1.2 million that we expect to pay during the year ending December 31, 2024. As of December 31, 2023, we had commitments to fund $6.9 million in construction costs, related to the buildout of our new headquarters and manufacturing facility.

In the normal course of business, we enter into contracts for non-clinical studies, preclinical testing, and other services and products. These contracts generally provide for termination following a certain period after notice and therefore we believe that our non-cancellable obligations under these agreements are not material.

Cogent Loan Agreement

On August 15, 2022, we entered into a loan and security agreement with Cogent Bank to partially fund our purchase of the property that will become our new headquarters. The agreement provides for a term loan of up to $6.5 million. Amounts outstanding on the term loan will accrue interest at a fixed rate per annum equal to 5.75%. We were obligated to make interest-only payments on the term loan from September 2022 through August 2023 and principal and interest payments in 47 equal monthly installments, based on a 25-year amortization schedule, commencing September 15, 2023 followed by one final balloon payment of all remaining principal, interest and fees due on the maturity date of August 15, 2027. Our obligations under the agreement are secured by, among other things, a mortgage on our new corporate headquarters and related real property. As of December 31, 2023, $6.4 million was outstanding under the term loan and we were in compliance with all loan covenants.

Critical Accounting Policies, Significant Judgements and Use of Estimates

The audited financial statements included elsewhere in this Annual Report are prepared in conformity with accounting principles generally accepted in the United States ("U.S. GAAP"), which requires the use of estimates, judgments and assumptions that affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses in the periods presented. Our estimates are based on our historical experience and on various other factors that we believe are reasonable under the circumstances, the results of which form the basis for making judgements about the carrying value of assets and liabilities that are not readily apparent from other sources. We believe the accounting estimates employed are appropriate and the resulting balances are reasonable; however, due to the inherent uncertainties in developing estimates, actual results could differ from the original estimates, requiring adjustments to these balances in future periods. Refer to Note 1 to our audited financial statements included elsewhere in this Annual Report for our significant accounting policies related to our critical accounting estimates.

We believe that the accounting policies discussed below are critical to understanding our historical and future performance, as these policies relate to the more significant areas involving management's judgements and estimates.

Revenue Recognition

We recognize revenue under the guidance of Topic 606. To determine the appropriate amount of revenue to be recognized for arrangements determined to be within the scope of Topic 606, we perform the following five steps: (i) identification of the contract(s) with the customer, (ii) identification of the promised goods or services in the contract and determination of whether the promised goods or services are performance obligations, (iii) measurement of the transaction price, (iv) allocation of the transaction price to the performance obligations, and (v) recognition of revenue when (or as) we satisfy each performance obligation. We only apply the five-step model to contracts when it is probable that we will collect the consideration we are entitled to in exchange for the goods or services we transfer to our customer.

If all conditions are not met for revenue recognition, the Company recognizes deferred revenue. The Company's policy is to recognize deferred revenue only to the extent product release occurred after meeting specification required, product is shipped, and cash payment is received.

Fair Value Measurements

Fair value is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. FASB ASC Topic 820, Fair Value Measurements and Disclosures, establishes a fair value hierarchy for those instruments measured at fair value that distinguishes between fair value measurements based on market data (observable inputs), and those based on our own assumptions (unobservable inputs). This hierarchy maximizes the use of observable inputs and minimizes the use of unobservable inputs. The three levels of inputs used to measure fair value are as follows:

- Level 1: Observable inputs such as quoted prices in active markets;
- Level 2: Inputs, other than the quoted prices in active markets, that are observable either directly or indirectly; and
- Level 3: Unobservable inputs in which there is little or no market data, which require a reporting entity to develop its own assumptions.

Fair Value

Under the Wugen License, we received shares of common stock of Wugen on the effective date of the Wugen License. We estimated that the fair value of the stock was $1.6 million. As the common stock of Wugen is not currently publicly traded, the fair value was determined based on inputs other than a public market price. We relied primarily on the most recent third-party financing completed by Wugen. In addition, we considered the results of a third-party valuation assessment. Since our ownership interest in Wugen is less than 20% and we do not have significant influence over the operations of Wugen, we account for these securities as a cost method investment. We will carry this investment at cost less impairment, adjusted for observable price changes in orderly transactions for an identical or similar investment of the same investee. We assess the investment each reporting period to determine if an impairment has occurred. In the event that a public market becomes available for the common stock of Wugen in the future and the shares become freely tradeable, we will recognize changes in fair value according to the market price in other income in the statements of operations.

Stock-based Compensation

As described in Note 1 and Note 10 to our audited financial statements included elsewhere in this Annual Report, we maintain a stock-based compensation plan as a long-term incentive for employees, non-employees, and directors. The plan allows for grants of incentive stock options, non-qualified stock options, and other forms of equity awards. We have granted options with service-based and performance-based vesting conditions.

We measure our stock-based awards granted to employees and directors based on the estimated fair value of the option on the date of grant (grant date fair value) and recognize compensation expense over the vesting period. Compensation expense is recorded as either research and development or general and administrative expenses in the statements of operations based on the function to which the related services are provided. Forfeitures are accounted for as they occur. We estimate grant date fair value using the Black-Scholes option-pricing model.

For stock option grants with service-based vesting, stock-based compensation expense represents the portion of the grant date fair value of employee stock option grants recognized over the requisite service period of the awards on a straight-line basis, net of estimated forfeitures. For options that vest upon the achievement of performance milestones, the Company estimates fair value at the date of grant and compensation expense is recognized using the accelerated attribution method when it is determined that the performance criteria are probable of being met.

In determining the fair value of the stock-based awards, we use the Black-Scholes option-pricing model and assumptions discussed below. Each of these inputs is subjective and its determination generally requires significant judgment. These assumptions include, but are not limited to:

- *Fair Value of Common Stock*—Prior to our initial public offering, the estimated fair value of our common stock was determined by our board of directors as of the date of each option grant, with input from management, considering our most recently available third-party valuation of our common stock as well as our Board's assessment of additional objective and subjective factors that it believed were relevant and which may have changed from the date of the most recent third-party valuation to the date of the grant. Since the completion of our initial public offering on July 19, 2021, the fair value of each share of common stock underlying stock option grants is based the quoted market price on the primary stock exchange on which our common stock is traded on the day the stock award or option is granted.
- *Expected term*—The expected term of stock options is determined using the "simplified" method, whereby the expected life equals the arithmetic average of the vesting term and the original contractual term of the option due to the Company's lack of sufficient historical data.
- *Expected volatility*—Since there is no trading history for our common stock, the expected volatility was estimated based on the historical equity volatility for comparable publicly traded biotechnology companies. The comparable companies were chosen based on their similar size, stage in the life cycle or area of specialty.
- *Risk-free interest rate*—The risk-free interest rate is based on the U.S. Treasury Bond in effect at the time of grant for periods corresponding with the expected term of the exit event.
- *Dividend yield*—The expected dividend yield is 0% because the Company has not historically paid, and does not expect, for the foreseeable future, to pay a dividend on its common stock.

Income Taxes

We recognize deferred income taxes for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax basis and operating loss and tax credit carryforwards. In evaluating our valuation allowance, we consider all available positive and negative evidence, including scheduled reversals of deferred tax liabilities, projected future taxable income, tax planning strategies, and recent financial performance. Due to our lack of earnings history and uncertainties surrounding our ability to generate future taxable income, the net deferred tax assets have been fully offset by a valuation allowance.

As of December 31, 2022 and 2023, we had available federal net operating loss ("NOL") carryforwards of $31.3 million and $40.0 million, respectively. We also had available state NOLs carryforwards of approximately $32.5 million and $40.0 million, as of December 31, 2022 and 2023, respectively. The federal and state NOLs will carryforward indefinitely. The federal NOLs are available to offset 80% of taxable income for state taxes for tax years starting after 2020. In addition, we had federal research and development credits carryforwards of $720,165 and $1.3 million, as of December 31, 2022 and 2023, respectively. These credits are available to reduce future federal income taxes, if any, and carryforwards expire from 2038 through 2043 and are subject to review and possible adjustment.

Under Sections 382 and 383 of the Code, substantial changes in our ownership may limit the amount of NOL and research and development credit carryforwards that could be used annually in the future to offset taxable income. The tax benefits related to future utilization of federal and state NOL carryforwards, credit carryforwards, and other deferred tax assets may be limited or lost if cumulative changes in ownership exceeds 50% within any three-year period. We have not completed a Section 382/383 analysis under the Code regarding the limitation of NOL and credit carryforwards. If a change in ownership were to have occurred, the annual limitation may result in the expiration of NOL carryforwards and credits before utilization.

We record unrecognized tax benefits as liabilities or reduce the underlying tax attribute, as applicable, and adjust them when our judgment changes as a result of the evaluation of new information not previously available. Because of the complexity of some of these uncertainties, the ultimate resolution may result in a payment that is materially different from our current estimate of the unrecognized tax benefit liabilities. These differences will be reflected as increases or decreases to income tax expense in the period in which new information is available.

Recent Accounting Pronouncements

See Note 1 to our audited financial statements included elsewhere in this Annual Report for more information about recent accounting pronouncements.

Emerging Growth Company and Smaller Company Reporting Status

As an emerging growth company, or EGC, under the JOBS Act, we may delay the adoption of certain accounting standards until such time as those standards apply to private companies. Other exemptions and reduced reporting requirements under the JOBS Act for EGCs include presentation of only two years of audited financial statements in a registration statement for an initial public offering, or IPO, an exemption from the requirement to provide an auditor's report on internal controls over financial reporting pursuant to Section 404(b) of the Sarbanes-Oxley Act of 2002, 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 may remain classified as an EGC until the December 31, 2026, although if the market value of our common stock that is held by non-affiliates exceeds $700 million as of any June 30 before that time or if we have annual gross revenues of $1.235 billion or more in any fiscal year, we would cease to be an emerging growth company as of December 31 of the applicable year. We also would cease to be an EGC if we issue more than $1 billion of non-convertible debt over a three-year period.

We are also a "smaller reporting company," as defined in Rule 12b-2 under the Exchange Act. Similar to emerging growth companies, smaller reporting companies have reduced disclosure obligations, such as an ability to provide simplified executive compensation information and only two years of audited financial statements in an annual report on Form 10-K, with correspondingly reduced "Management's Discussion and Analysis of Financial Condition and Results of Operations" disclosure.

Item 7A Quantitative and Qualitative Disclosures About Market Risk.

We are a smaller reporting company, as defined by Rule 12b-2 under the Exchange Act and are not required to provide the information under this item.

Item 8 Financial Statements and Supplementary Data.

HCW Biologics Inc.
Index to Financial Statements

Years ended December 31, 2022 and 2023

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Board of Directors and Stockholders
HCW Biologics Inc.

Opinion on the financial statements
We have audited the accompanying balance sheets of HCW Biologics Inc. (the "Company") as of December 31, 2023 and 2022, the related statements of operations, changes in stockholders' equity, and cash flows for the years then ended, 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, 2023 and 2022, and the results of its operations and itscash flows for each of the two years in the period ended December 31, 2023, in conformity with accounting principles generally accepted in the United States of America.

Liquidity and going concern
As discussed in Note 1 to the financial statements, the Company is not profitable, has recorded negative cash flows from operations, and will need substantial capital to support its ongoing operations. Management's evaluation of the events and conditions and management's plans to mitigate these matters are also described in Note 1.

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 audit 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/ GRANT THORNTON LLP

We have served as the Company's auditor since 2019.
Miami, FL
April 1, 2024

HCW Biologics Inc.
Balance Sheets

	December 31, 2022	December 31, 2023
ASSETS		
Current assets:		
Cash and cash equivalents	$ 22,326,356	$ 3,595,101
Short-term investments	9,735,930	—
Accounts receivable, net	417,695	1,535,757
Prepaid expenses	1,394,923	1,042,413
Other current assets	196,015	230,916
Total current assets	34,070,919	6,404,187
Investments	1,599,751	1,599,751
Property, plant and equipment, net	10,804,610	20,453,184
Other assets	333,875	56,538
Total assets	$ 46,809,155	$ 28,513,660
LIABILITIES AND STOCKHOLDERS' EQUITY		
Liabilities		
Current liabilities:		
Accounts payable	$ 1,226,156	$ 6,167,223
Accrued liabilities and other current liabilities	1,730,325	2,580,402
Total current liabilities	2,956,481	8,747,625
Debt, net	6,409,893	6,304,318
Other liabilities	14,275	—
Total liabilities	9,380,649	15,051,943
Commitments and contingencies (Note 15)		
Stockholders' equity:		
Common stock:		
Common, $0.0001 par value; 250,000,000 shares authorized and 35,876,440 shares issued at December 31, 2022; 250,000,000 shares authorized and 36,025,104 shares issued at December 31, 2023	3,588	3,603
Additional paid-in capital	82,962,964	83,990,437
Accumulated deficit	(45,538,046)	(70,532,323)
Total stockholders' equity	37,428,506	13,461,717
Total liabilities and stockholders' equity	$ 46,809,155	$ 28,513,660

The accompanying notes are an integral part of these financial statements.

HCW Biologics Inc.
Statements of Operations

	Years Ended December 31,	
	2022	**2023**
Revenues:		
Revenues	$ 6,722,090	$ 2,841,794
Cost of revenues	(4,135,712)	(2,281,434)
Net revenues	2,586,378	560,360
Operating expenses:		
Research and development	9,338,365	7,676,316
General and administrative	8,326,791	13,351,204
Reserve for credit losses	—	5,250,000
Total operating expenses	17,665,156	26,277,520
Loss from operations	(15,078,778)	(25,717,160)
Interest expense	(126,660)	(283,042)
Other (expense) income, net	304,735	1,005,925
Net loss	$ (14,900,703)	$ (24,994,277)
Net loss per share, basic and diluted	$ (0.42)	$ (0.70)
Weighted average shares outstanding, basic and diluted	35,822,249	35,929,446

The accompanying notes are an integral part of these financial statements.

HCW Biologics Inc.
Statements of Changes in Stockholders' Equity

	Stockholders' Equity				
	Common Stock		Additional Paid-In Capital	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount			
Balance, December 31, 2021	35,768,264	$ 3,577	81,827,006	$ (30,637,343)	$ 51,193,240
Issuance of Common Stock upon exercise of stock options	108,176	11	15,767	—	15,778
Stock-based compensation	—	—	1,120,191	—	1,120,191
Net loss	—	—	—	(14,900,703)	(14,900,703)
Balance, December 31, 2022	**35,876,440**	**$ 3,588**	**$ 82,962,964**	**$ (45,538,046)**	**$ 37,428,506**
Issuance of Common Stock upon exercise of stock options	148,664	15	23,724	—	23,739
Stock-based compensation	—	—	1,003,749	—	1,003,749
Net loss	—	—	—	(24,994,277)	(24,994,277)
Balance, December 31, 2023	**36,025,104**	**$ 3,603**	**$ 83,990,437**	**$ (70,532,323)**	**$ 13,461,717**

The accompanying notes are an integral part of these financial statements.

HCW Biologics Inc.
Statements of Cash Flows

	Years Ended December 31,	
	2022	**2023**
Cash flows from operating activities:		
Net loss	$ (14,900,703)	$ (24,994,277)
Adjustments to reconcile net loss to net cash used in operating activities:		
Depreciation and amortization	717,854	1,135,184
Stock-based compensation	1,120,191	1,003,749
Unrealized loss (gain) on investments, net	186,370	(248,445)
Realized (gain) on investments	—	(15,625)
Changes in the carrying amount of right-of-use asset	2,089	(1,671)
Reserve for credit losses	—	5,250,000
Changes in operating assets and liabilities:		
Accounts receivable	(284,695)	(1,118,061)
Deposit for interest reserve	—	(5,250,000)
Prepaid expenses and other assets	2,482,822	432,410
Accounts payable and other liabilities	418,208	1,619,357
Operating lease liability	(128,246)	(326,742)
Net cash used in operating activities	(10,386,110)	(22,514,121)
Cash flows from investing activities:		
Purchases of property and equipment	(10,275,128)	(6,202,600)
Proceeds for sale or maturities of short-term investments	24,983,520	10,000,000
Net cash provided by investing activities	14,708,392	3,797,400
Cash flows from financing activities:		
Proceeds from issuance of common stock	15,778	23,739
Proceeds from issuance of debt, net	6,448,166	—
Offering costs	(190,547)	—
Debt repayment	—	(38,273)
Net cash provided by (used in) financing activities	6,273,397	(14,534)
Net increase (decrease) in cash and cash equivalents	10,595,679	(18,731,255)
Cash and cash equivalents at the beginning of the period	11,730,677	22,326,356
Cash and cash equivalents at the end of the period	$ 22,326,356	$ 3,595,101
Supplemental disclosure of cash flow information:		
Cash paid for interest, net of capitalized interest	$ 126,660	$ 283,042
Noncash operating, investing and financing activities:		
Operating lease liabilities arising from obtaining right-of-use assets	$ 192,686	$ —
Capital expenditures accrued, but not yet paid	$ —	$ 4,240,593
Reserve for credit losses	$ —	$ 5,250,000

The accompanying notes are an integral part of these financial statements.

HCW Biologics Inc.
Notes to the Financial Statements
December 31, 2022 and 2023

1. Organization and Summary of Significant Accounting Policies

Organization

HCW Biologics Inc. (the "Company") is a clinical-stage biopharmaceutical company focused on discovering and developing novel immunotherapies to lengthen health span by disrupting the link between chronic, low-grade inflammation and age-related diseases. The Company believes age-related low-grade chronic inflammation, or "inflammaging," is a significant contributing factor to several chronic diseases and conditions, such as cancer, cardiovascular disease, diabetes, neurodegenerative diseases, and autoimmune diseases. The Company is located in Miramar, Florida and was incorporated in the state of Delaware in April 2018.

Liquidity and Going Concern

In accordance with ASC 205-40, *Presentation of Financial Statements – Going Concern* ("Topic 205-40"), we are required to evaluate whether there are conditions and events, considered in the aggregate that raise substantial doubt about our ability to continue as a going concern for at least 12 months from the issuance date of our financial statements. This evaluation does not take into consideration the potential mitigating effect of management's plans that have not been fully implemented or are not within control of the Company as of the date the financial statements are issued. When substantial doubt exists under this methodology, management evaluates whether the mitigating effect of its plans sufficiently alleviates substantial doubt about the Company's ability to continue as a going concern. The mitigating effect of management's plans, however, is only considered if both (1) it is probable that the plans will be effectively implemented within one year after the date that the financial statements are issued, and (2) it is probable that the plans, when implemented, will mitigate the relevant conditions or events that raise substantial doubt about the entity's ability to continue as a going concern within one year after the date that the consolidated financial statements are issued.

As of December 31, 2023, the Company had not generated any revenue from commercial product sales of its internally-developed immunotherapeutic products for the treatment of cancer and other age-related diseases. In the course of its development activities, the Company has sustained operating losses and expects to continue to incur operating losses for the foreseeable future. Since inception to December 31, 2023, the Company incurred cumulative net losses of $67.8 million. As of December 31, 2023, the Company had $3.6 million in cash and cash equivalents, compared to $22.3 million as of December 31, 2022. Management expects to incur additional losses in the future to conduct product research and development and recognizes the need to raise additional capital to fully implement its business plan. As a result of these conditions substantial doubt about the Company's ability to continue as a going concern was raised.

To date, we have funded operations primarily through the sale of stock and revenues generated from the Company's exclusive worldwide license with Wugen, Inc. ("Wugen"), pursuant to which Wugen licensed limited rights to develop, manufacture, and commercialize cell therapy treatments for cancer based on two of the Company's internally-developed multi-cytokine fusion protein molecules, and its manufacturing and supply arrangement with Wugen. In the year ended December 31, 2022 and 2023, the Company recognized revenues of $6.7 million and $2.8 million, respectively, generated from the supply of clinical and research grade material to Wugen.

Under the Company's policy for its going concern assessment under Topic 205-40, future receipt of potential funding from partnerships, equity or debt issuances or other transactions is considered probable if a transaction is approved by the Board of Directors and the Company has entered into legally binding agreements. As of March 31, 2024, the Company has closed or entered into binding legal agreements for additional financings of $12.5 million. On February 20, 2024, in a $2.5 million private placement of common stock, the Company sold an aggregate of 1,785,718 shares to certain officers and directors. As of March 31, 2024, the Company entered into an agreement to issue $10.0 million of secured notes (the "Secured Notes"), of which $2.0 million funded prior to the issuance date of the accompanying financial statements. The Secured Notes were sold to certain officers and directors of the Company as well as other investors.

Management plans to pursue additional sources of capital. Future financings may be from non-dilutive funding sources such as bank or debt financing, out-licensing rights to technology or markets, cooperative agreements for clinical trials, or other business development transactions, which may include the issuance of additional equity financing and/or third-party collaboration funding. If the Company is not successful in raising additional capital, management has the intent and ability to streamline its business plan and reduce costs. The Company believes that, as a result of these plans, it has sufficient liquidity and probable financing to meet the Company's funding requirements for at least 12 months from the issuance date of the accompanying financial statements. In implementing a streamlined business plan the Company may be forced to delay, reduce, or eliminate some of its product development programs, efforts to establish manufacturing capacity, headcount and other operating costs, as well as commercialization efforts. Projections are based on assumptions, including the Company's existing commitments and contingencies, that may prove to be incorrect, and the Company may use available capital sooner than expected.

The accompanying financial statements have been prepared on a going concern basis, which contemplates the realization of assets and satisfaction of liabilities in the ordinary course of business. The financial statements do not include any adjustments relating to the recoverability and classification of recorded asset amounts or the amounts and classification of liabilities that might result from the outcome of the uncertainties described above.

Summary of Significant Accounting Policies

Basis of Presentation

The accompanying audited financial statements have been prepared in accordance with accounting principles generally accepted in the United States of America ("U.S. GAAP")

Use of Estimates

The preparation of financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that affect the reported amounts in the financial statements and accompanying notes. Management must apply significant judgment in this process. The Company evaluates its estimates and assumptions on an ongoing basis using historical experience and other factors and adjusts those estimates and assumptions when facts and circumstances dictate. Actual results could differ from estimates.

Cash and Cash Equivalents

Cash and cash equivalents consist of demand deposits at financial institutions, money market funds, and highly liquid investments with original maturities of three months or less.

Fair Value Measurements

Fair value is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. Financial Accounting Standards Board ("FASB") Accounting Standards Codification ("ASC") 820, *Fair Value Measurement* ("Topic 820"), establishes a fair value hierarchy for those instruments measured at fair value that distinguishes between fair value measurements based on market data (observable inputs) and those based on the Company's own assumptions (unobservable inputs). This hierarchy maximizes the use of observable inputs and minimizes the use of unobservable inputs. The three levels of inputs used to measure fair value are as follows:

Level 1: Observable inputs such as quoted prices in active markets;

Level 2: Inputs, other than the quoted prices in active markets, that are observable either directly or indirectly; and

Level 3: Unobservable inputs in which there is little or no market data, which require a reporting entity to develop its own assumptions.

Fair value measurements are classified based on the lowest level of input that is significant to the measurement. The Company's assessment of the significance of a particular input to the fair value measurement requires judgment, which may affect the valuation of the assets and liabilities and their placement within the fair value hierarchy levels. The determination of the fair values, as disclosed in Note 3, takes into account the market for the Company's financial assets and liabilities, the associated credit risk, and other factors as required. The Company considers active markets as those in which transactions for the assets or liabilities occur in sufficient frequency and volume to provide pricing information on an ongoing basis.

Concentration of Credit Risk and Other Risks and Uncertainties

Financial instruments that potentially subject the Company to concentrations of credit risk primarily consist of cash, cash equivalents, accounts receivable, and investments. The Company's cash and cash equivalents are deposited in accounts with financial institutions that management believes are of high credit quality. Such deposits may, at times, exceed federally insured limits. The Company has not experienced any losses on its deposits of cash and cash equivalents.

For the year ended December 31, 2023, the Company recognized revenues of $2.8 million. All of the Company's revenues were derived from the supply of clinical grade material to Wugen under the supply agreement between Wugen and the Company, as contemplated in the Wugen License. As of December 31, 2023, there was a balance of $1.5 million in accounts receivable related to sales to Wugen on the accompanying audited balance sheet, and the Company believes that collection of these amounts are probable. Since December 24, 2020, the Company holds 2,174,311 shares of Wugen common stock, which were received as consideration for the Wugen License on December 24, 2020. Currently, these shares represent a 5.6% equity ownership interest of Wugen, based on fully diluted, issued and outstanding shares as of December 31, 2023. The Company has not been able to realize any benefit from the sale of these shares, as they are not currently traded on any public market and thus have limited marketability.

The Company is highly dependent on a third-party manufacturer to supply drug products for its research and development activities of its programs, including clinical and non-clinical studies. These programs could be adversely affected by a significant interruption in the supply of such drug products. The Company has no off-balance sheet concentrations of credit risk, such as foreign currency exchange contracts, option contracts or other hedging arrangements.

Property, Plant and Equipment, Net

Property, plant and equipment are stated at cost less accumulated depreciation. Depreciation expense is calculated using the straight-line method over the estimated useful lives of the assets, which range from 3 to 39 years. Land is not subjected to the recording of depreciation expense because it has an infinite life. Leasehold improvements are amortized on a straight-line method over the shorter of the useful life of the leasehold improvement or the term of the lease. Construction-in-progress represents property and buildings under construction and consists of construction expenditures, equipment procurement, and other direct costs attributable to the construction. Construction-in-progress is not depreciated. Upon completion and ready for intended use, construction-in-progress is reclassified to the appropriate category within property, plant and equipment. Upon retirement or sale of the assets, the cost and related accumulated depreciation and amortization are removed from the balance sheet in the period in which the retirement or sale occurred, and the resulting gain or loss is recognized in the statements of operations. Repairs and maintenance are expensed as incurred. Depreciation of property, plant and equipment is calculated using the straight-line method over the estimated useful lives of the assets, as follows:

	Estimated Useful Lives
Building	39 years
Property	5 - 15 years
Laboratory equipment	5 years
Office equipment	3 years
Furniture and fixtures	7 years
Leasehold improvements	The lesser of the lease term or life of the asset

Impairment of Long-Lived Assets

Long-lived assets are reviewed for indications of possible impairment whenever events or changes in circumstances indicate that the carrying value of an asset may not be recoverable. Recoverability is measured by comparison of the carrying amounts to the future undiscounted cash flows attributable to these assets. An impairment loss is recognized to the extent an asset group is not recoverable, and the carrying amount exceeds the projected discounted future cash flows arising from these assets. Impairment losses, if any, are recognized in earnings. There were no impairment losses for any of the periods presented.

Collaborative Arrangements

When the Company enters into collaboration arrangements, it assesses whether the arrangements fall within the scope of FASB issued ASC 808, *Collaborative Arrangements,* based on whether the arrangements involve joint operating activities and whether both parties have active participation in the arrangement and are exposed to significant risks and rewards. If the payments from the collaboration partner to the Company represent consideration from a customer, such as license fees and contract research and development activities, the Company accounts for those payments within the scope of FASB issued ASC 606, *Revenue from Contracts with Customers* ("Topic 606"). However, if the Company concludes that the payments are not from a customer, for certain activities and associated payments, such as for certain collaborative research, development, manufacturing, and commercial activities, these payments are presented as a reduction of research and development expense or general and administrative expense, based on where the Company presents the underlying expense.

Revenue Recognition

The Company accounts for revenues in accordance with Accounting Standards Codification Topic 606, Revenue from Contracts with Customers ("Topic 606"). To determine revenue recognition for arrangements that fall within the scope of Topic 606, the Company performs the following five steps: (i) identify the contract(s) with a customer; (ii) identify the performance obligations in the contract; (iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when (or as) the Company satisfies a performance obligation. The Company only applies the five-step model to contracts when it is probable that it will collect the consideration it is entitled to in exchange for the goods or services transferred to the customer.

At contract inception, the Company assesses the goods or services promised within each contract, determines those that are performance obligations, and assesses whether each promised good or service is distinct. The Company then recognizes as revenue the amount of the transaction price that is allocated to the respective performance obligation when (or as) the performance obligation is satisfied. To date, the Company's revenues have been generated exclusively from the Wugen License, which consists of licenses of intellectual property, cost reimbursements, upfront signing fees, milestone payments and royalties on future licensee's product sales. In addition, the Company and Wugen have an agreement for the supply of clinical and research grade materials under which the Company also recognized revenues.

License Grants:

For out-licensing arrangements that include a grant of a license to the Company's intellectual property, the Company considers whether the license grant is distinct from the other performance obligations included in the arrangement. For licenses that are distinct, the Company recognizes revenues from nonrefundable, upfront payments and other consideration allocated to the license when the license term has begun and the Company has provided all necessary information regarding the underlying intellectual property to the customer, which generally occurs at or near the inception of the arrangement.

Milestone and Contingent Payments:

At the inception of the arrangement and at each reporting date thereafter, the Company assesses whether it should include any milestone and contingent payments or other forms of variable consideration in the transaction price using the most likely amount method. If it is probable that a significant reversal of cumulative revenue would not occur upon resolution of the uncertainty, the associated milestone value is included in the transaction price. At the end of each subsequent reporting period, the Company re-evaluates the probability of achievement of each such milestone and any related constraint and, if necessary, adjusts its estimate of the overall transaction price. Since milestone and contingent payments may become payable to the Company upon the initiation of a clinical study or filing for or receipt of regulatory approval, the Company reviews the relevant facts and circumstances to determine when the Company should update the transaction price, which may occur before the triggering event. When the Company updates the transaction price for milestone and contingent payments, the Company allocates the changes in the total transaction price to each performance obligation in the agreement on the same basis as the initial allocation. Any such adjustments are recorded on a cumulative catch-up basis in the period of adjustment, which may result in recognizing revenue for previously satisfied performance obligations in such period. The Company's licensees will generally pay milestones payments subsequent to achievement of the triggering event.

Materials Supply:

The Company provides clinical and research grade materials so that licensees may develop products based on the licensed molecules. The amounts billed are recognized as revenue as the performance obligations are satisfied by the Company, once the Company determines that a contract exists.

On June 18, 2021, the Company entered into a master services agreement ("MSA") with Wugen for the supply of materials for clinical development of licensed products. The terms set forth in the MSA were not sufficient to meet all the requirements for the Company to determine that a contract existed for a transaction. In order for a contract to exist, additional terms for each transaction require the Company to enter into a statement-of-work ("SOW") for each purchase. Each of these transactions represents a single performance obligation that is satisfied over time. The Company recognizes revenue using an input method based on the costs incurred relative to the total expected cost, which determines the extent of the Company's progress toward completion. As part of the accounting for these arrangements, the Company must develop estimates and assumptions that require judgement to determine the progress towards completion. The Company reviews its estimate of the progress toward completion based on the best information available to recognize the cumulative progress toward completion as of the end of each reporting period, and makes revisions to such estimates, if facts and circumstances change during each reporting period. Any such revisions are recorded on a cumulative catch-up basis, noting no material revisions during the year ended December 31, 2023. For each in process SOW, amounts are billed in the same quarter the costs are incurred.

On March 14, 2022, the Company entered into SOWs with Wugen for each of the then-current and historical purchases of clinical and research grade materials under the MSA. As a result, the Company determined that all requirements were met to qualify as contracts under Topic 606 for the related transactions covered by these SOWs. For the years ended December 31, 2022 and 2023, the Company recognized revenues related to sale of development supply materials to Wugen of $6.7 million and $2.8 million, respectively.

Accounts Receivable, Net

Accounts receivable is presented in accordance the current expected credit losses ("CECL") impairment model as required under Topic 326. The Company estimates a reserve for expected credit losses based on existing contractual payment terms, actual payment patterns of its customers, current and future economic and market conditions and individual customer circumstances. As of December 31, 2022 or December 31, 2023, the Company determined that a reserve for expected credit losses was not required. No accounts were written off during the periods presented..

Deferred Revenue

Deferred revenue represents amounts billed, or in certain cases, yet to be billed to the Company's customer for which the related revenues have not been recognized because one or more of the revenue recognition criteria have not been met. The current portion of deferred revenue represents the amount to be recognized within one year from the balance sheet date based on the estimated performance period of the underlying performance obligations. In the year ended December 31, 2021, there was a balance of $1.8 million in deferred revenues in the Company's balance sheet, all of which were recognized as revenue in the year ended December 31, 2022. There were no deferred revenue balances as of December 31, 2022 or 2023.

Investments

The Company holds a minority interest in Wugen. The underlying shares of common stock are not traded on any public market and thus have limited marketability. The Company does not have significant influence over the operating and financial policies of Wugen. As a result, the Company has accounted for this investment using the measurement alternative whereby the investment is recorded at cost less impairment, adjusted for observable price changes in orderly transactions for an identical or similar investment of the same investee. No impairment was recognized during the years ended December 31, 2022 and 2023.

The Company invested net proceeds of its IPO in bills and notes issued by the U.S. Treasury which are classified as trading securities. As of December 31, 2022, the Company held $9.7 million in U.S. Treasury bills included in Short-term investments in the balance sheet included in the audited financial statements. As of December 31, 2023, the Company had no Short-term investments.

Operating Leases

The Company determines if an arrangement is a lease at inception. Operating leases right of use ("ROU") assets are included in Other assets, and operating liabilities are included in Accrued liabilities and other current liabilities, and Other liabilities on the balance sheets included in the audited financial statements. ROU assets and operating lease liabilities are recognized based on the present value of the future minimum lease payments over the lease term at commencement date. As the Company's leases do not provide an implicit rate, the Company uses its incremental borrowing rate based on the information available at commencement date in determining the present value of future payments. The operating lease ROU asset also includes any lease payments made and excludes lease incentives and initial direct costs incurred. The Company has a lease agreement with lease and non-lease components, which are accounted for separately. For short-term leases with a term of one year or less, the Company uses the practical expedient and does not record an ROU asset for such short-term leases.

Research and Development Expenses

Research and development costs are expensed as incurred and include salaries, benefits, and other operating costs such as outside services, supplies and allocated overhead expenses. The Company may perform research and development for its own proprietary drug candidates and technology development or for certain third parties under collaborative arrangements. For its proprietary drug candidates and its own internal technology development programs, the Company invests its own funds without reimbursement from a third party. Where the Company performs research and development activities under a clinical joint development collaboration, it records the partner's share of collaboration expenses as a reduction to research and development expense when reimbursement amounts are due under the agreement.

The Company records an accrued expense for the estimated costs of its contract manufacturing activities performed by third parties if there is no invoice. The financial terms of these agreements are subject to negotiation, vary from contract to contract and may result in uneven payment flows to vendors. Payments under the contracts include upfront payments and milestone payments, which depend on factors such as the achievement of the completion of certain stages of the manufacturing process. For purposes of recognizing expense, the Company assesses whether the production process is sufficiently defined to be considered the delivery of a good, as evidenced by predictive or contractually required yields in the production process, or the delivery of a service, where processes and yields are developing and less certain. If the Company considers the process to be the delivery of a good, the Company recognizes the expense when the drug product is delivered, or otherwise bears risk of loss. If the Company considers the process to be the delivery of a service, the expense is recognized based on its best estimates of the contract manufacturer's progress towards completion of the stages in the contracts. The Company recognizes and amortizes upfront payments and accrues for liabilities based on the specific terms of each arrangement. Arrangements may provide upfront payments for certain stages of the arrangement and milestone payments for the completion of certain stages, and, accordingly, may result in advance payments for services that have not been completed or goods not delivered and liabilities for stages where the contract manufacturer is entitled to a milestone payment.

Advance payments for goods or services that will be used or rendered for future research and development activities are capitalized as prepaid expenses and recognized as expense as the related goods are delivered or the related services are performed. The Company bases its estimates on the best information available at the time. However, additional information may become available to the Company which may allow it to make a more accurate estimate in future periods. In this event, the Company may be required to record adjustments to research and development expenses in future periods when the actual level of activity becomes more certain. Such increases or decreases in cost are generally considered to be changes in estimates and will be reflected in research and development expenses in the period identified.

Patent Costs

Costs related to filing and pursuing patent applications are recorded as general and administrative expenses in the statement of operations and expensed as incurred, since recoverability of such expenditures is uncertain.

Stock-based Compensation

The Company measures its stock-based awards granted to employees and directors based on the estimated fair value of the option on the date of grant (grant date fair value) and recognizes compensation expense over the vesting period. Compensation expense is recorded as either research and development or general and administrative expenses in the statement of operations based on the function to which the related services are provided. Forfeitures are accounted for as they occur. The Company has granted options with service-based and performance-based vesting conditions.

The Company uses the Black-Scholes option pricing model for the respective grant to determine the grant date fair value. The Black-Scholes option pricing model requires the input of highly subjective assumptions. These variables include, but are not limited to, its stock price volatility over the term of the awards and actual and projected employee stock option exercise behaviors. Management will continue to assess the assumptions and methodologies used to calculate the estimated grant date fair value of stock-based compensation. Circumstances may change and additional data may become available over time, which could result in changes to these assumptions and methodologies and materially impact the Company's grant date fair value determination.

For stock option grants with service-based vesting, stock-based compensation expense represents the portion of the grant date fair value of employee stock option grants recognized over the requisite service period of the awards on a straight-line basis, net of estimated forfeitures. For options that vest upon the achievement of performance milestones, the Company estimates fair value at the date of grant and compensation expense is recognized using the accelerated attribution method when it is determined that the performance criteria are probable of being met.

Debt Issuance Costs

Debt issuance costs are presented in the balance sheet as a direct deduction from the carrying amount of the related debt and are amortized, using the effective interest method, as interest expense over the contractual life of the related debt.

Deferred Offering Costs

The Company defers offering costs consisting of legal, accounting and other fees and costs directly attributable to offering costs. For offerings expected to occur within 90 days, the deferred offering costs will be offset against the proceeds received upon the completion of the offering. Deferred offering costs will be recorded under Other noncurrent assets on the balance sheet. In the event an offering is terminated or the timing for completing the offering is uncertain, all of the deferred offering costs will be expensed within the Company's statement of operations in the period in which the determination is made. In the year ended December 31, 2022, the Company expensed $190,547 of deferred offering costs in connection with its $100.0 million shelf registration statement on Form S-3, including a prospectus for the issuance and sale of up to $15.5 million shares of the Company's common stock through an at-the-market program, which was declared effective by the SEC on August 26, 2022.

Income Taxes

The Company accounts for income taxes using an asset and liability approach in accordance with applicable guidance prescribed by FASB issued ASC 740, *Income Taxes* ("Topic 740"). Topic 740 requires that the deferred tax consequences of temporary differences between the amounts recorded in the financial statements and the amounts included in the federal and state income tax returns to be recognized in the balance sheet.

The Company makes judgments regarding the realizability of its deferred tax assets. The balance sheet carrying value of its deferred tax assets is based on whether the Company believes it is more likely than not that the Company will generate sufficient future taxable income to realize these deferred tax assets after consideration of all available evidence. The Company regularly reviews its deferred tax assets for recoverability considering historical profitability, projected future taxable income, the expected timing of the reversals of existing temporary differences and tax planning strategies. In assessing the need for a valuation allowance, the Company considers both positive and negative evidence related to the likelihood of realization of the deferred tax assets. The weight given to the positive and negative evidence is commensurate with the extent to which the evidence may be objectively verified. As such, it is generally difficult for positive evidence regarding projected future taxable income exclusive of reversing taxable temporary differences to outweigh objective negative evidence of recent financial reporting losses. Generally, cumulative loss in recent years is a significant piece of negative evidence that is difficult to overcome in determining that a valuation allowance is not needed.

The Company's tax positions may be subject to income tax audits. The Company recognizes the tax benefit of an uncertain tax position only if it is more likely than not that the position is sustainable upon examination by the taxing authority, based on the technical merits. The tax benefit recognized is measured as the largest amount of benefit which is more likely than not to be realized upon settlement with the taxing authority. The Company recognizes interest accrued and penalties related to unrecognized tax benefits in its tax provision. The Company evaluates uncertain tax positions on a regular basis. The evaluations are based on a number of factors, including changes in facts and circumstances, changes in tax law, correspondence with tax authorities during the course of the audit, and effective settlement of audit issues. The provision for income taxes includes the effects of any accruals that the Company believes are appropriate, as well as the related net interest and penalties. The Company had no accrual for interest or penalties on its balance sheets as of December 31, 2022 and 2023, and has not recognized interest or penalties in its statements of operations for the years ended December 31, 2022 and 2023.

Tax Credit Receivable

The Company may be eligible for research and development credits for its research and development activities, in accordance with Internal Revenue Code ("I.R.C.") § 41(c). The credits are generally available to offset income tax liabilities. As of December 31, 2022 and 2023, the outstanding payroll tax receivables is included in Other current assets in the balance sheet.

Net Loss Per Share

Basic net loss per share is calculated by dividing the net loss attributable to common stockholders by the weighted-average number of common shares outstanding for the period, without consideration of potential dilutive securities. Diluted net loss per share is computed by dividing the net loss attributable to common stockholders by the sum of the weighted average number of common shares plus the potential dilutive effects of potential dilutive securities outstanding during the period. Potential dilutive securities are excluded from diluted earnings or loss per share if the effect of such inclusion is anti-dilutive. The Company's potentially dilutive securities, which include convertible redeemable preferred stock and outstanding stock options under the 2019 Equity Incentive Plan ("2019 Plan") and the 2021 Equity Incentive Plan ("2021 Plan"), have been excluded from the computation of diluted net loss per share as they would be anti-dilutive to the net loss per share. For all periods presented, there is no difference in the number of shares used to calculate basic and diluted shares outstanding due to the Company's net loss position.

Recently Issued Accounting Pronouncements

In June 2016 the FASB issued ASU 2016-13, Measurement of Credit Losses on Financial Instruments (Topic 326). It requires the use of the current expected credit losses (CECL) impairment model for a broad scope of financial instruments, including financial assets measured at amortized cost (which includes loans, held-to-maturity debt securities and trade receivables), net investments in leases, and certain off-balance sheet credit exposures. The CECL model requires the immediate recognition of estimated expected credit losses over the life of the financial instrument. The estimate of expected credit losses considers not only historical information, but also current and future economic conditions and events. For accounts receivable, the Company estimates a reserve for expected credit losses based on existing contractual payment terms, actual payment patterns of its customers, current and future economic and market conditions and individual customer circumstances. For other asses, the measurement approach used by the Company may be based on the probability-of-default method, under which expected credit losses are determined by multiplying the probability of default (i.e., the probability the asset will default within the given time frame) by the loss given default (the percentage of the asset not expected to be collected because of default). The Company adopted CECL on January 1, 2023 on a prospective basis and it had no impact on the Company's financial statements.

In November 2023, the FASB issued ASU No. 2023-07, Improvements to Reportable Segment Disclosures (ASU 2023-07) which is intended to improve reportable segment disclosures primarily through enhanced disclosure of reportable segment expenses and requires that a public entity that has a single reportable segment provide all the disclosures required by ASU 2023-07 and all existing segment disclosures in Topic 280. The new guidance is required to be applied retrospectively to all prior periods presented in the financial statements and is effective for the Company for fiscal periods beginning after December 15, 2023 and interim periods within fiscal years beginning after December 15, 2024. The Company has one reportable segment and is evaluating the impact of the standard on the Company's financial statements.

In December 2023, the FASB issued ASU No. 2023-09, Income Taxes (Topic 740): Improvements to Income Tax Disclosures which requires significant disclosures about income taxes, primarily focused on the disclosure of income taxes paid and the rate reconciliation table. The new guidance will be applied prospectively and is effective for the Company for fiscal periods beginning after December 15, 2024. The Company is evaluating the impact of the standard on the Company's financial statements.

2. Property, Plant and Equipment, Net

Property, plant and equipment, net consists of the following:

	At December 31,	
	2022	2023
Land	$ 2,150,038	$ 2,150,038
Building	6,105,570	6,105,570
Property	1,767,231	1,767,231
Laboratory equipment	2,115,153	2,146,637
Office equipment	209,405	225,369
Furniture and fixtures	292,045	292,045
Leasehold improvements	349,976	354,276
Construction in progress	52,414	10,443,859
	$ 13,041,832	$ 23,485,025
Less: Accumulated depreciation and amortization	(2,237,222)	(3,031,841)
Property, plant and equipment, net	$ 10,804,610	$ 20,453,184

Construction in progress of $10.4 million represents direct costs of construction and equipment incurred for the Company's new research lab and manufacturing facilities, that are not ready for their intended use. Depreciation and amortization expense for the year ended December 31, 2022 was $589,608, of which $441,698 is included in research and development expenses. Depreciation and amortization expense for the year ended December 31, 2023 was $794,619, of which $541,679 is included in research and development expenses.

During the year ended December 31, 2023, the Company capitalized interest expense of $95,627, into Construction in progress.

3. Fair Value of Financial Instruments

The carrying amount of the Company's financial instruments, including cash and cash equivalents, accounts receivable, prepaid expenses and other current assets, U.S. government backed securities with maturity dates up to one year, accounts payable and accrued liabilities, are measured at approximate fair value due to their short-term maturities.

Money market funds included in cash and cash equivalents and U.S. government-backed securities are measured at fair value based on quoted prices in active markets, which are considered Level 1 inputs. No transfers between levels occurred during the periods presented. The following table presents the Company's assets which were measured at fair value at December 31, 2022 and 2023:

	At December 31, 2022:			
	Level 1	Level 2	Level 3	Total
Assets:				
Money market funds	$ 19,458,020	$ —	$ —	$ 19,458,020
Treasury notes	9,735,930	—	—	9,735,930
Total	$ 29,193,950	$ —	$ —	$ 29,193,950

	At December 31, 2023:			
	Level 1	Level 2	Level 3	Total
Assets:				
Money market funds	$ 1,626,129	$ —	$ —	$ 1,626,129
Total	$ 1,626,129	$ —	$ —	$ 1,626,129

4. Investments

In December 2020, the Company entered into the Wugen License for limited rights to develop, manufacture and commercialize cellular therapy products based on two of the Company's fusion protein molecules. As part of the consideration received for the Wugen License, the Company received shares of Wugen common stock, which were recognized at $1.6 million, the fair value of the securities as of December 24, 2020, the effective date for the Wugen License. Initial recognition was at fair value based on level 3 inputs, since there was no public market on which to trade these shares at the time they were received. The fair value was determined based primarily on the pricing and terms of a third-party financing completed by Wugen in 2020. So long as there continues to be no public market for these securities, the Company will classify this asset as a cost method investment, recorded at cost less impairment adjusted for observable market changes.

As of December 31, 2022 and 2023, Investments had a balance of $1.6 million, reflecting the investment in Wugen, which the Company continues to carry at cost since no public market exists for these securities and no impairment adjustments have been necessary since the acquisition date.

5. Accrued Liabilities and Other Current Liabilities

As of December 31, 2022, the Company had a balance of $1.7 million included in Accrued liabilities and other current liabilities in the balance sheet included in the audited financial statements, consisting of $416,000 for legal expenses, $277,500 for clinical expenses, $524,000 in bonus expenses, $134,000 in salary expenses, and $178,000 in lease liability.

As of December 31, 2023, the Company had a balance of $2.6 million included in Accrued liabilities and other current liabilities in the balance sheet included in the audited financing statements, consisting of $392,000 for construction expenses, $105,000 for manufacturing expenses, $1.1 million for legal expenses, $262,000 for clinical expenses, $365,000 in bonus expense, $160,000 for salary expenses, $119,000 for the current portion of long-term debt, $28,500 in lease liability and $68,500 of other liabilities.

6. Debt, Net

On August 15, 2022, the Company entered into a loan and security agreement (the "2022 Loan Agreement") with Cogent Bank ("Cogent"), pursuant to which it received $6.5 million in gross proceeds to purchase a building that will become the Company's new headquarters. The loan is secured by a first priority lien on the building. The Company is in compliance with all covenants as of December 31, 2023.

As of December 31, 2022, the Company had $6.5 million in gross principal outstanding in a loan under the 2022 Loan Agreement. An interest-only period is one year followed by 48 months of equal payments of principal and interest beginning on September 15, 2023 based on a 25-year amortization rate. The unamortized balance is due on August 15, 2027 (the "Maturity Date"), and bears interest at a fixed per annum rate equal to 5.75%. Upon the Maturity Date, a final payment of unamortized principal will be due. The Company has the option to prepay the outstanding balance of the loan prior to the Maturity Date without penalty. As of December 31, 2023, the current portion of $119,398 is included in Accrued liabilities and other current liabilities, and the noncurrent portion of $6.3 million is included in Debt, net in the balance sheet included in the audited financial statements.

The Company classifies the total undiscounted contractual payments that are due in the next 12 months as current. The loan was initially measured on a present value basis. An amortization schedule is used to determine how much of each payment is applied to interest and principal each period. The payment is first applied to interest, and the remainder reduces the principal balance. The table below shows the amount of maturities for each of the five years following the date of the latest balance sheet:

	Maturities per Year	
2024	$	119,398
2025		127,623
2026		135,266
2027		6,079,440
Total Debt	$	6,461,727

7. License Agreement

On December 24, 2020, the Company entered into the Wugen License transferring rights to Wugen to develop, manufacture, and commercialize certain cellular therapy products based on two of the Company's fusion protein molecules. The term of the agreement will expire on a product-by-product and country-by-country basis, upon the later of (i) ten years from the first commercial sale of the product or (ii) the expiration of the last-to-expire valid patent claim of such product. The Company concluded that Wugen is a customer and the Wugen License is a functional license under the provisions of Topic 606.

In addition to upfront fees and revenues from other transactions that took place upon entering the Wugen License, the Wugen License includes milestone payments and royalties. The Company uses judgment to determine whether milestones or other variable consideration should be included in the transaction price. For revenue-based royalties, including milestone payments based on the level of sales, the Company will include royalties in the transaction price at the later of (i) when the related sales occur, or (ii) when the performance obligation to which some or all of the royalties are allocated has been satisfied (or partially satisfied). As part of management's evaluation of the transaction price, the Company considers numerous factors, including whether the achievement of the milestones is outside of its control, contingent upon the efforts of others or subject to scientific risks of success. If the Company concludes it is probable that a significant revenue reversal would not occur, the associated milestone payment is included in the transaction price. Milestone payments that are not within its control, such as regulatory approvals, are generally not considered probable until those milestones are achieved. The Company reevaluates the transaction price, including estimated variable consideration included in the transaction price and all constrained amounts, in each reporting period and as uncertain events are resolved or other changes in circumstances occur.

8. Preferred Stock

At December 31, 2022 and December 31, 2023, the Company had 10,000,000 shares of preferred stock authorized and no shares issued.

9. Net Loss Per Share

The following table summarizes the computation of the basic and diluted net loss per share:

	Years Ended December 31,	
	2022	2023
Numerator:		
Net loss	$ (14,900,703)	$ (24,994,277)
Denominator:		
Weighted-average common shares outstanding	35,822,249	35,929,446
Net loss per share, basic and diluted	$ (0.42)	$ (0.70)

The following table summarizes the outstanding potentially dilutive securities that have been excluded in the calculation of diluted net loss per share because their inclusion would be anti-dilutive:

	At December 31,	
	2022	2023
Common stock options	1,867,458	1,779,338
Potentially dilutive securities	1,867,458	1,779,338

10. Stock-based Compensation

On June 21, 2021, the 2021 Plan was adopted by the Company's board of directors and approved by the Company's stockholders. As of the adoption date, the 2019 Plan was terminated. No terms were changed for grants previously awarded under the 2019 Plan, and the Company concluded a modification did not occur. Under the 2019 Plan, the Company primarily granted employees incentive stock options, which had a maximum term of ten years from the date of the grant. Generally, the incentive stock options granted under the 2019 Plan have a four-year, service-based vesting period. All of the options granted under the 2019 Plan had an exercise price equal to the fair value of a share of common stock on the date of the grant, according to Company policy.

The 2021 Plan permits the grant of incentive stock options, nonstatutory stock options, stock appreciation rights, restricted stock, restricted stock units, and stock bonus awards. The 2021 Plan initially reserved 3,444,343 shares of Common Stock, including the transfer of remaining shares reserved under the 2019 Plan. In addition, the number of shares reserved for issuance under the 2021 Plan will increase automatically on the first day of each fiscal year beginning with the 2022 fiscal year.

Under the 2021 Plan, the term of each stock option must be stated in the stock award agreement. In the case of an incentive stock option, the term will be ten years from the date of grant, or such shorter term as may be provided in the stock award agreement. Moreover, in the case of an incentive stock option granted to a participant who owns stock representing more than 10% of the total combined voting power of all classes of our stock or the stock of any of our affiliates, the term of the incentive stock option will be five years from the date of grant or such shorter term as may be provided in the stock award agreement. Under the 2021 Plan, the Company continues to have a policy to grant options with an exercise price equal to the fair value of a share of common stock, as determined by the closing price on NASDAQ on the grant date.

The following summarizes the Company's stock option activity for the years ended December 31, 2022 and 2023:

	Shares Issuable under Options	Weighted Average Exercise Price	Weighted Average Remaining Contract Term	Aggregate Intrinsic Value
Outstanding at December 31, 2021	1,770,739	2.96	9.0 years	$ 1,124,215
Granted	237,364	2.33		
Exercised	(108,176)	0.15		
Forfeited or cancelled	(31,441)	0.41		
Expired	(1,028)	0.21		
Outstanding at December 31, 2022	1,867,458	3.11	8.5 years	$ 671,878
Exercisable at December 31, 2022	473,686	3.06	8.3 years	$ 198,258
Outstanding at December 31, 2022	1,867,458	3.11	8.5 years	$ 671,878
Granted	91,000	1.88		
Exercised	(148,664)	0.16		
Forfeited or cancelled	(26,342)	1.86		
Expired	(4,114)	3.40		
Outstanding at December 31, 2023	1,779,338	3.31	7.7 years	$ 238,210
Exercisable at December 31, 2023	942,998	3.07	7.6 years	$ 173,385

The exercise price of the underlying stock options and the fair value of the Company's common stock for stock options as of the reporting date. The intrinsic value of stock options exercised during the years ended December 31, 2022 and 2023 was $231,301 and $202,917, respectively. The weighted-average fair value of options granted during the years ended December 31, 2022 and 2023 was $1.71 and $1.42 per share, respectively.

For stock option grants with service-based vesting, stock-based compensation expense represents the portion of the grant date fair value of employee stock option grants recognized over the requisite service period of the awards on a straight-line basis, net of estimated forfeitures. For options that vest upon the achievement of performance milestones, the Company estimates fair value at the date of grant and compensation expense is recognized using the accelerated attribution method when it is determined that the performance criteria are probable of being met.

In determining the grant date fair value of the stock-based awards, the Company uses the Black-Scholes option-pricing model and assumptions discussed below. Each of these inputs is subjective and its determination generally requires significant judgment.

Fair Value of Common Stock—Since the completion of our initial public offering on July 19, 2021, the fair value of each share of common stock underlying stock option grants is based the quoted market price on the primary stock exchange on which our common stock is traded on the day the stock award or option is granted.

Expected term—The expected term of stock options is determined using the "simplified" method, whereby the expected life equals the arithmetic average of the vesting term and the original contractual term of the option due to the Company's lack of sufficient historical data.

Expected volatility—The expected volatility was derived from the historical stock volatilities of comparable peer public companies within our industry.

Risk-free interest rate—The risk-free interest rate is based on the U.S. Treasury Bond in effect at the time of grant for periods corresponding with the expected term.

Dividend yield—The expected dividend yield is 0% because the Company has not historically paid, and does not expect, for the foreseeable future, to pay a dividend on its common stock.

For the years ended December 31, 2022 and 2023, the fair value of employee and director stock option awards was estimated at the date of grant using a Black-Scholes option-pricing model with the following assumptions:

	Years Ended December 31,	
	2022	2023
Expected term (years)	5.73	5.71
Expected volatility	88.05%	89.90%
Risk-free interest rate	3.29%	3.99%
Dividend yield	—	—
Fair value underlying common stock	$1.71	$1.42

For the year ended December 31, 2022, for options with service-based vesting conditions, the Company recognized $62,473 of employee stock-based compensation expense in research and development expenses and $1,057,718 of employee stock-based compensation in general and administrative expenses in the statement of operations included in the audited financial statements. For the year ended December 31, 2023, for options with service-based vesting conditions, the Company recognized $65,941 of employee stock-based compensation expense in research and development expenses and $937,808 of employee stock-based compensation in general and administrative expenses in the statement of operations included in the audited financial statements.

As of December 31, 2023, the Company had an aggregate of $1.8 million of unrecognized employee stock-based compensation cost for options with service-based vesting, which is expected to be recognized over a weighted average vesting period of 1.62 years.

11. Employee Benefit Plan

The Company offers a defined contribution savings plan (the "Benefit Plan") under Section 401 of the Internal Revenue Code for all eligible employees. The Benefit Plan allows for discretionary contributions which are limited to the maximum allowable for federal tax purposes. The total expense related to the discretionary payments made by the Company to the Benefit Plan for the years ended December 31, 2022 and 2023 was $171,215 and $184,214, respectively.

12. Collaborative Arrangements

The Company has certain contract research agreements with contractors that were entered during the two years ended December 31, 2023 for the (i) hybridoma development, (ii) cell line improvement, and (iii) research to support pre-clinical studies. We own all rights to the resulting intellectual property, including the antibodies, sequences, and data. For certain contractors, the Company is obligated to pay one future milestone payment upon filing and acceptance of an IND for each respective human antibody or protein from cell line; however no additional future development or financial obligations are due under these contract research agreements as of December 31, 2022 or 2023.

13. Income Taxes

The Company did not have a provision for income taxes (current or deferred tax expense) for tax years ended December 31, 2022 and 2023.

The following table summarizes the differences between the statutory federal income tax rate and the Company's effective income tax rate (percent data):

Rate Reconciliation	**2022**		**2023**	
Net Loss Before Taxes	$ (14,900,703)		$ (24,994,277)	
Benefit at statutory rate	(3,129,148)	21.00%	(5,248,798)	21.00%
State tax benefit net of federal benefit	(655,142)	4.40%	(1,027,320)	4.11%
Permanent book/tax differences	64,106	(0.43%)	31,046	(0.12%)
Other adjustments	8,545	(0.06%)	—	0.00%
R&D credit carryforward	(512,967)	3.44%	(540,777)	2.16%
Change in valuation allowance	4,224,606	(28.35%)	6,785,849	(27.15%)
Income tax expense/(benefit)	$ —	0.00%	$ —	0.00%

The tax effects of temporary differences that give rise to significant portions of the deferred tax assets and deferred tax liabilities at December 31, 2022 and 2023 are presented below:

	2022	**2023**
Deferred tax assets:		
Federal net operating loss carryforward	$ 6,569,874	$ 8,403,928
State net operating loss carryforward	1,411,041	1,738,257
Capitalized section 174 R&D expenses	2,121,015	3,872,297
Reserve for credit losses	-	1,330,613
R&D credit	720,165	1,260,942
Accrued expenses	151,255	123,408
Capitalized legal fees for patents	177,405	1,235,488
Stock-based compensation	341,038	566,396
Charitable contributions	65	65
Unrealized gain/loss	59,314	—
ROA asset	530	106
Depreciable assets	47,037	—
Total deferred tax assets	11,598,739	18,531,500
Deferred tax Liabilities:		
Unrealized gain/loss	$ —	$ (5,238)
Depreciable assets	—	(127,474)
Deferred revenue/costs	—	(14,202)
Total deferred tax liability	—	(146,914)
Net deferred tax asset	11,598,739	18,384,586
Less: valuation allowance	(11,598,739)	(18,384,586)
Net deferred tax asset (after valuation allowance)	$ —	$ —

A valuation allowance is recorded to reduce the deferred tax asset if, based on the weight of the evidence, it is more likely than not that some portion or all of the deferred tax asset will not be realized. As of December 31, 2023, after consideration of all the evidence, both positive and negative, management has determined that a valuation allowance of $18.4 million is necessary to reduce the deferred tax asset to the amount that will more likely than not be realized. During the year ended December 31, 2023, the valuation allowance increased by $6.8 million.

As of December 31, 2022 and 2023, the Company had available federal NOL carryforwards of $31.3 million and $40.0 million, respectively. The Company also has available state NOLs carryforwards of approximately $32.5 million and $40.0 million, as of December 31, 2022 and 2023, respectively. The federal and state NOLs will carryforward indefinitely. The Federal NOLs are available to offset 80% of taxable income. In addition, the Company had federal research and development credits carryforwards of $720,165 and $1.3 million, as of December 31, 2022 and 2023, respectively, to reduce future federal income taxes, if any. These carryforwards expire from 2038 through 2043 and are subject to review and possible adjustment.

Under Sections 382 and 383 of the Internal Revenue Code of 1986, as amended, (the Code), substantial changes in the Company's ownership may limit the amount of net operating loss and research and development credit carryforwards that could be used annually in the future to offset taxable income. A formal Section 382 study has not been completed to determine if an ownership change has occurred and if its net operating losses are subject to an annual limitation. Such annual limitations could affect the utilization of NOL and tax credit carryforwards in the future.

Effective for tax years beginning after December 31, 2021, Section 174 requires that research and experimental expenses ("R&E") be capitalized and amortized. The amortization period is five years for domestic expenses and 15 years for foreign expenses. Since the Company has a significant amount of expenses that fall under the definition of R&E expenses, the change can materially affect the Company's tax provision.

During the year ended December 31, 2022 and 2023, the Company analyzed its expenses and determined that expenses of $9.2 million and $9.8 million, respectively, fell within the definition of Section 174. Accordingly, these expenditures were capitalized and amortized for tax purposes. As of December 31, 2022 and 2023, the Company had $864,179 and $2.6 million, respectively, of amortization expense related to Section 174 capitalized R&E costs.

The Company's tax returns remain subject to examination by tax authorities beginning with the tax year ended December 31, 2020. However, due to NOLs and credits carried forward from prior tax years, substantially all tax years may also be subject to examination. The Company recognizes the tax benefit of an uncertain tax position only if it is more likely than not that the position is sustainable upon review by the taxing authorities based on the technical merits. The Company recognizes interest accrued and penalties for unrecognized tax benefits in its tax provision. As of December 31, 2022 and 2023, the Company had not recognized any expense related to uncertain tax position in its statement of operations.

14. Related Party Transactions

See Note 16 for disclosure of related party transactions which occurred after the balance sheet reporting date.

15. Commitments and Contingencies

Operating Leases

The Company has operating leases for approximately 12,250 square feet of space located in Miramar, Florida. The leases have a two-year term which commenced on March 1, 2022 and terminated on February 29, 2024. Upon the commencement of the leases, the Company used its incremental borrowing rate of 6.0% to determine the amounts to recognize for a ROU asset and a lease liability. There are no obligations under finance leases.

The components of the lease expense for the year ended December 31, 2023 were as follows:

	For the Year Ended December 31, 2023
Operating lease cost	$ 169,651

Supplemental cash flow information related to lease for the twelve months ended December 31, 2023 was as follows:

	For the Year Ended December 31, 2023
Cash paid for amounts included in the measurement of lease liabilities:	
Operating cash flows	$ 171,822
Right-of-use assets obtained in exchange for lease obligations:	
Operating lease	$ 162,535

As of December 31, 2023, the supplemental balance sheet information related to leases was as follows:

	As of December 31, 2023
Operating lease right-of-use assets	$ 28,061
Operating lease liabilities, current	$ 28,061

As of December 31, 2023, the remaining lease payments were as follows:

2024	$ 28,693
Total future minimum lease payments	$ 28,693

For the years ended December 31, 2022 and 2023, rent expense recognized by the Company was $187,600 and $169,700, respectively, of which $86,000 and $88,800, respectively, is included in Research and development in the statements of operations included in the audited financial statements.

Contractual Commitments

The Company has commitments with a third-party manufacturing organization to supply us with clinical grade materials. As of December 31, 2023, we are under contract for obligations of $1.2 million that we expect to pay during the year ending December 31, 2024. As of December 31, 2023, the Company had commitments to fund $6.9 million in construction costs, related to the buildout of its new headquarters and manufacturing facility.

Project Financing

On January 10, 2024, the Company exercised its right to terminate its credit agreement (the "Credit Agreement"), dated April 21, 2023, with Prime Capital Ventures, LLC (the "Lender"), as permitted under the terms of the Credit Agreement. The termination followed repeated delays in funding and related concerns. There are no borrowings under the Credit Agreement, and the Company will not incur any penalties as a result of such termination under the terms of the Agreement. Upon exercising its right to terminate the Agreement, the Company was entitled to receive the return of the $5.3 million that the Company placed on deposit to establish an interest reserve account with the Lender. Subsequent to the year ended December 31, 2023, the Lender defaulted on its obligation to return the interest reserve deposit. Given the uncertainty of when or if funds will be recovered from the Lender, the Company recognized a reserve for a credit loss for $5.3 million as of December 31, 2023. The Company intends to pursue all available remedies to recover these funds, including legal actions, receivership and insurance.

Legal Matters

From time to time, the Company is a party to or otherwise involved in legal proceedings, including suits, assessments, regulatory actions and investigations generally arising out of the normal course of business. In addition, the Company enters into agreements that may include indemnification provisions, pursuant to which the Company agrees to indemnify, hold harmless and defend the indemnified parties for losses suffered or incurred by the indemnified party. When the Company believes that the outcome of such a matter will result in a liability that is probable to be incurred and result in a potential loss, or range of loss, that can be reasonably estimated, the Company will accrue a liability and make the appropriate disclosure in the footnotes to the financial statements.

On December 23, 2022, Altor BioScience, LLC and NantCell, Inc. ("Altor/NantCell") initiated an arbitration against Dr. Hing C. Wong, the Company's Founder and Chief Executive Officer, in California alleging breach of contract and fiduciary duty, among other claims. On that same date, Altor/NantCell filed a lawsuit against the Company in federal court alleging misappropriation of trade secrets, inducement of breach of contract and breach of fiduciary duty, among other claims against the Company. On January 31, 2023, the Company filed a motion to compel arbitration, a motion for the stay of the litigation, and a motion to dismiss the complaint ("motion to compel"). On April 18, 2023, the U.S. District Court for the Southern District of Florida (the "Court") heard oral argument on the Company's motion to compel and ordered the parties to provide supplemental briefing by April 28, 2023. Before the Court ruled on the Company's motion to compel, on April 26, 2023, the parties stipulated that Altor/NantCell's action against the Company would be consolidated with the Altor/NantCell arbitration demand against Dr. Wong. On April 27, 2023, the Court approved the parties' stipulation and ordered the parties to arbitration. On May 1, 2023, Altor/NantCell filed a demand against the Company before JAMS. On May 3, 2023, Altor/NantCell dismissed the federal court action without prejudice and the Court ordered the case dismissed without prejudice and closed the case. Altor/NantCell's proceeding against the Company is now proceeding in arbitration before JAMS, with an arbitration hearing scheduled for May 20, 2024.

In addition, on March 26, 2024, Altor/NantCell gave notice that they are filing a complaint (the "Complaint") against the Company in the Chancery Court of the State of Delaware for the contribution of legal fees and expenses advanced to Dr. Wong, our founder and chief executive officer, in connection with the arbitration discussed above. Prior to the filing of the Complaint, Altor/NantCell had previously sought advancement from the Company and the Company agreed to advance 50% of Dr. Wong's legal

fees going forward from December 2023. On January 8, 2024, Altor/NantCell reserved their right to pursue contribution against the Company for 50% of the amount Altor/NantCell sent for advancement of expenses for Dr. Wong. In the Complaint, Altor/NantCell seek 50% of the fees they have already advanced to Dr. Wong, a declaration that the Company has an obligation to contribute 50% of the advancement of Dr. Wong's expenses including 50% of Dr. Wong's expenses incurred in connection with the arbitration through final resolution of the matter, and costs and fees in bringing this action.

Inflationary Cost Environment, Geopolitical Risks and Other Macroeconomic Factors

The Company's operations have been affected by many headwinds, including inflationary pressures, rising interest rates, ongoing global supply chain disruptions resulting from increased geopolitical tensions such as the war in the Middle East, the conflict between Russia and Ukraine, China-Taiwan relations, financial market volatility and currency movements. The Company has been impacted by inflation, and may continue to be so, when procuring materials required for the buildout of our new headquarters, the costs for recruiting and retaining employees and other employee-related costs. Management employs a number of strategies to effectively navigate these issues, including product redesign, alternate sourcing, and establishing contingencies in budgeting and timelines. Future developments in these and other areas present material uncertainty and risk with respect to the Company's clinical trials, IND-enabling activities, buildout of the new headquarters, as well as the Company's financial condition and results of operations. The extent and duration of such events and conditions, and resulting disruptions to our operations, are highly unpredictable.

16. Subsequent Events

Subsequent events have been evaluated through the date the financial statements were available to be issued. In addition to the required recognition or disclosure disclosed in the footnotes herein, there were also the following subsequent events after the reporting date:

On February 29, 2024, the lease on the Company's current location reached the end of its term. The Company entered a new one-year lease for the same location which commenced on March 1, 2024 and terminates on February 28, 2025. As a lease of 12 months or less in duration and qualifies for a short-term lease exemption under ASC 842-20-25-2. The Company elects to account for this lease on a straight-line basis over the lease term and will not recognize a ROU asset and a lease liability as a result. The remaining lease payments under the new short-term lease are $274,823.

On February 20, 2024, the Company completed a $2.5 million private placement of shares of common stock with certain of its officers and directors at a price of $1.40 per share. The Company issued 1,785,718 shares of common stock in connection with the offering. The shares have not been registered and will not be sold or transferred except as permitted under law and pursuant to registration or exemption therefrom. The Board of Directors and Audit Committee of the Board of Directors reviewed the transaction under the policy for Related Party Transactions and determined that the transaction was in compliance with the Company's policy.

As of March 31, 2024, the Company agreed to issue $10.0 million in secured notes to investors, including certain officers and directors. The Board of Directors and Audit Committee of the Board of Directors reviewed the transaction under the policy for Related Party Transactions and determined that the transaction was in compliance with the Company's policy.

Item 9 Changes in and Disagreements with Accountants on Accounting and Financial Disclosure.

None.

Item 9A Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our principal executive officer and our principal financial officer, evaluated, as of the end of the period covered by this Annual Report on Form 10-K, the effectiveness of our disclosure controls and procedures. Based on this evaluation of our disclosure controls and procedures as of December 31, 2023, our principal executive officer and principal financial officer concluded that our disclosure controls and procedures as of such date are effective at the reasonable assurance level.

The term "disclosure controls and procedures," as defined in Rules 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934, as amended, or the Exchange Act, means controls and other procedures of a company that are designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act are recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by us in the reports we file or submit under the Exchange Act is accumulated and communicated to our management, including our principal executive officer and principal financial officer, as appropriate to allow timely decisions regarding required disclosure. Management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives and our management necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures.

Management's Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting (as defined in Rules 13a-15(f) under the Exchange Act). Internal control over financial reporting is a process designed under the supervision and with the participation of our management, including our principal executive officer and our principal financial officer, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles in the United States.

As of December 31, 2023, our management assessed the effectiveness of our internal control over financial reporting using the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission in Internal Control-Integrated Framework. Based on this assessment, our management concluded that our internal control over financial reporting was effective as of December 31, 2023.

Attestation Report of the Independent Registered Public Accounting Firm

This Annual Report does not include an attestation report of our registered public accounting firm. For as long as we remain an "emerging growth company" as defined in Section 2(a) of the Securities Act of 1933, or the Securities Act, as modified by the Jumpstart Our Business Startups Act of 2012, we intend to take advantage of the exemption permitting us not to comply with the requirement that our independent registered public accounting firm provide an attestation on the effectiveness of our internal control over financial reporting.

Changes in Internal Control over Financial Reporting

There have been no changes in our internal control over financial reporting during the quarter ended December 31, 2023 that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Item 9B Other Information.

10b5-1 Trading Plans

During the fiscal quarter ended December 31, 2023, none of our officers or directors adopted or terminated a "Rule 10b5-1 trading arrangement" or "non-Rule 10b5-1 trading arrangement," as each term is defined in Item 408(a) of Regulation S-K.

Secured Note Financing

The following information is being included in this Item 9B in lieu of filing such information on a Current Report on Form 8-K under Item 1.01. Entry into a Material Definitive Agreement and Item 2.03. Creation of a Direct Financial Obligation or an Obligation under an Off-Balance Sheet Arrangement of a Registrant.

On March 28, 2024, we entered into a senior secured note purchase agreement (the "Note Purchase Agreement") with the Purchasers (as defined in the Note Purchase Agreement), pursuant to which we agreed to issue senior secured notes in an aggregate principal amount of $10.0 million (the "Secured Notes") to certain accredited investors, including unrelated parties as well as officers and directors of the Company, among whom were: Dr. Hing C. Wong, Founder and Chief Executive Officer, who invested $620,000; Rebecca Byam, Chief Financial Officer, who invested $220,000; and Gary M. Winer, member of our Board of Directors, who invested $50,000. The Note Purchase Agreement sets forth the terms and conditions, including representations and warranties, for our issuance and sale of the Secured Notes to the Purchasers. We issued an aggregate principal amount of $2.0 million in Secured Notes prior to the issuance of this Annual Report.

The Senior Notes bear interest at a rate of 9% per annum, payable quarterly in arrears, and mature on March 27, 2026 (the "Maturity Date"), on which date the principal balance and accrued but unpaid interest under the Secured Notes shall be due and payable. The Secured Notes may be prepaid in whole or in part at any time prior to the Maturity Date and are subject to a 5% prepayment penalty ("Premium Amount"). As a condition to entering into the Note Purchase Agreement, we, Mercedes M. Sellek, P.A. ("Escrow Agent"), and the Purchasers entered into that certain Escrow Agreement and Pledge Agreement, dated March 28, 2024, pursuant to which we agreed to pledge our equity ownership interest in Wugen, which was equivalent to a 5.6% ownership stake in that company as of December 31, 2023 (the "Pledged Collateral"), to be held and released by Escrow Agent according to the terms of the Escrow Agreement, as security for the Secured Notes.

Upon a qualifying event involving a transaction such as an acquisition, merger or initial public offering in which the Pledged Collateral can be sold or liquidated prior to the Maturity Date, subject to certain limitations (such as a threshold price per share in the case of an initial public offering), we agreed to repay all indebtedness (including accrued interest) related to the Secured Notes plus a Premium Amount (as defined in the Note Purchase Agreement). Upon an Event of Default (as defined in the Note Purchase Agreement), we will have a thirty (30) day cure period (the "Cure Period"), and if the Event of Default is not so cured at the end of the Cure Period, we are required to distribute the Pledged Collateral to the Purchasers on a *pro rata* basis, in full satisfaction of the indebtedness evidenced by the Secured Notes.

The issuance of the Secured Notes was exempt from the registration requirements of the Securities Act of 1933, as amended, in accordance with Section 4(a)(2) and/or Regulation 506 promulgated thereunder, as a transaction by an issuer not involving a public offering.

The foregoing descriptions of the Note Purchase Agreement, Senior Notes, Escrow Agreement and Pledge Agreement do not purport to be complete and are qualified in their entirety by reference to the full text of the Form of Senior Secured Note Purchase Agreement, Form of Senior Secured Promissory Note, Form of Escrow Agreement and Form of the Pledge Agreement, copies of which are filed as Exhibit 10.17, Exhibit 10.18, Exhibit 10.19 and Exhibit 10.20, respectively, to this Annual Report and are incorporated herein by reference.

Item 9C Disclosure Regarding Foreign Jurisdictions That Prevent Inspections.

Not applicable.

PART III

Item 10 Directors, Executive Officers and Corporate Governance.

The information required by this item is included under the captions "Board of Directors and Corporate Governance," "Proposal One: Director Election," "Executive Officers" and "Delinquent Section 16(a) Reports" included in our definitive Proxy Statement for the 2024 Annual Meeting of Stockholders to be filed with the SEC within 120 days after the end of the year ended December 31, 2023, and is incorporated herein by reference.

Our board of directors has adopted a Code of Conduct and Ethics applicable to all officers, directors, and employees, which is available on our website (https://investors.hcwbiologics.com/) under "Governance." We intend to satisfy the disclosure requirement under Item 5.05 of Form 8-K regarding amendment to, or waiver from, a provision of our Code of Conduct and Ethics by posting such information on the website address and location specified above.

Item 11 Executive Compensation.

The information required by this item is included under the captions "Board of Directors and Corporate Governance" and "Executive Compensation" in our definitive Proxy Statement for the 2024 Annual Meeting of Stockholders to be filed with the SEC within 120 days after the end of the year ended December 31, 2023, and is incorporated herein by reference.

Item 12 Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

The information required by this item is included under the captions "Equity Compensation Plan Information" and "Security Ownership of Certain Beneficial Owners and Management" in our definitive Proxy Statement for the 2024 Annual Meeting of Stockholders to be filed with the SEC within 120 days after the end of the year ended December 31, 2023, and is incorporated herein by reference.

Item 13 Certain Relationships and Related Transactions, and Director Independence.

The information required by this item is included under the captions "Board of Directors and Corporate Governance" and "Certain Relationships and Related Party Transactions" in our definitive Proxy Statement for the 2024 Annual Meeting of Stockholders to be filed with the SEC within 120 days after the end of the year ended December 31, 2023 and is incorporated herein by reference.

Item 14 Principal Accounting Fees and Services.

The information required by this item is included under the caption "Proposal Two: Ratification of Appointment of Independent Registered Public Accounting Firm" in our definitive Proxy Statement for the 2024 Annual Meeting of Stockholders to be filed with the SEC within 120 days after the end of the year ended December 31, 2023, and is incorporated herein by reference.

PART IV

Item 15 Exhibits, Financial Statement Schedules.

(a)(1) Financial Statements

The information concerning HCW Biologics' audited financial statements and the Report of Independent Registered Public Accounting Firm required by this Item 15(a)(1) is incorporated by reference herein to the section of this Annual Report, Item 8, titled, "Financial Statements and Supplementary Data."

(a)(2) Financial Statement Schedules

All financial statement schedules have been omitted as the information is not required under the related instructions or is not applicable or because the information required is already included in the audited financial statements or the notes to those audited financial statements.

(a)(3) Exhibits

We have filed, or incorporated into this Annual Report by reference, the exhibits listed on the accompanying Exhibit Index immediately preceding the signature page of this Annual Report.

Exhibit Index

Exhibit No.	Exhibit title	Incorporated by reference				Filed or furnished herewith
		Form	File No.	Exhibit No.	Filing date	
3.1	Amended and Restated Certificate of Incorporation	8-K	001-40591	3.1	07/26/2021	
3.2	Amended and Restated Bylaws	8-K	001-40591	3.2	07/26/2021	
4.1	Specimen Stock Certificate	S-1/A	333-256510	4.1	07/09/2021	
4.2	Description of Securities	10-K	001-40591	4.2	03/29/2022	
10.1	Form of Indemnification Agreement between HCW Biologics Inc. and each of its officers and directors.	S-1/A	333-256510	10.1	07/09/2021	
10.2+	2019 Equity Incentive Plan, as amended, and forms of agreement thereunder.	S-1	333-256510	10.2	07/09/2021	
10.3+	First Amendment to 2019 Equity Incentive Plan.	S-1	333-256510	10.3	07/09/2021	
10.4+	2021 Equity Incentive Plan and forms of agreement thereunder	S-1	333-256510	10.4	07/09/2021	
10.5+	Employment Agreement, dated July 6, 2021, between Peter Rhode and HCW Biologics Inc.	S-1	333-256510	10.6	07/09/2021	
10.6+	Employment Agreement, dated October 9, 2019, between Rebecca Byam and HCW Biologics Inc.	S-1	333-256510	10.7	07/09/2021	
10.7+	Non-Employee Director Compensation Policy.	S-1	333-256510	10.8	07/09/2021	
10.8+	Employment Agreement, dated June 18, 2021, between Dr. Hing C. Wong and HCW Biologics Inc.	S-1	333-256510	10.13	07/09/2021	
10.9+	Executive Incentive Bonus Plan	S-1	333-256510	10.11	07/09/2021	
10.10†	Exclusive License Agreement, dated December 24, 2020, between HCW Biologics Inc. and Wugen, Inc.	S-1	333-256510	10.10	07/09/2021	
10.11†	Master Services Agreement, dated March 14, 2019, between HCW Biologics Inc. and EirGenix, Inc.	S-1	333-256510	10.12	07/09/2021	
10.12†#	Purchase and Sale Agreement, by and between HCW Biologics Inc. and Wai 3300 Corporate Way, LLC, dated May 27, 2022	10-Q	001-40591	10.1	08/12/2022	
10.13	Capital on Demand™ Sales Agreement, dated August 19, 2022, by and between HCW Biologics Inc. and Jones Trading Institutional Services LLC	S-3	333-266991	1.2	08/19/2022	
10.14	Loan Agreement by and between HCW Biologics Inc. and Cogent Bank, dated August 15, 2022	10-Q	001-40591	10.1	11/07/2022	
10.15	Mortgage and Security Agreement by and between HCW Biologics Inc. and Cogent Bank, dated August 15, 2022	10-Q	001-40591	10.2	11/07/2022	
10.16	Form of Subscription Agreement, dated February 20, 2024, by and between the Company and the Subscribers party thereto	8-K	011-40591	10.1	02/22/2024	
10.17*†#	Form of Senior Secured Note Purchase Agreement, dated March 28, 2024, by and between the Company and the Purchaser party thereto					X
10.18*†#	Form of Senior Secured Promissory Note, dated March 28, 2024, by and between the Company and the Holder party thereof					X
10.19*†#	Form of Pledge Agreement, dated March 28, 2024, by and between the Company, Escrow Agent and Noteholder party thereto					X
10.20*†#	Form of Escrow Agreement, dated March 28, 2024, by and between the Company, Escrow Agent and Noteholder party thereto					X
23.1	Consent of Independent Registered Public Accounting Firm					X
31.1	Certification of Chief Executive Officer pursuant to Rules 13a-14(a) and Rule 15d-14(a) of the Exchange Act					X

31.2	Certification of Chief Financial Officer pursuant to Rules 13a-14(a) and Rule 15d-14(a) of the Exchange Act	X
32.1*	Certification of Chief Executive Officer pursuant to Rule 13a-14(b) of the Exchange Act and 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002	X
32.2*	Certification of Chief Executive Officer pursuant to Rule 13a-14(b) of the Exchange Act and 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002	X
97.1	HCW Biologics Inc. Compensation Recovery Policy	X
101.INS	Inline XBRL Instance Document	X
101.SCH	Inline XBRL Taxonomy Extension Schema Document	X
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document	X
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document	X
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document	X
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document	X
104	Cover Page Interactive Data File (embedded within the Inline XBRL document)	X

+ Indicates a management contract or compensatory plan or arrangement.

†† Certain information in this document has been excluded pursuant to Item 601(b)(10) of Regulation S-K. Such excluded information is not material and is the type of information the Registrant treats as private and confidential. The Registrant agrees to furnish supplementally such information to the SEC upon request.

Certain information in this document has been excluded pursuant to Item 601(a)(5) or (a)(6) of Regulation S-K. The Registrant agrees to furnish supplementally such information to the SEC upon request.

Item 16 Form 10-K Summary

None.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, as amended, the Registrant has duly caused this Report to be signed on its behalf by the undersigned, thereunto duly authorized**.**

HCW Biologics Inc.

Date: April 1, 2024

By: /s/ Hing C. Wong, Ph.D.
Hing C. Wong, Ph.D.
Founder and Chief Executive Officer

POWER OF ATTORNEY

Each person whose signature appears below constitutes and appoints Hing C. Wong and Rebecca Byam, and each of them, as his or her true and lawful attorney-in-fact and agent, with full power of substitution and resubstitution, for him or her and in his or her name, place and stead, in any and all capacities, to sign any and all amendments to this Annual Report on Form 10-K, and to file the same, with all exhibits thereto, and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys-in-fact and agents, and each of them, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully to all intents and purposes as he or she might or could do in person, hereby ratifying and confirming all that said attorneys-in-fact and agents, or any of them, or their or his substitutes, may lawfully do or cause to be done by virtue thereof.

Pursuant to the requirements of the Securities Exchange Act of 1934, as amended, this Report has been signed below by the following persons on behalf of the Registrant in the capacities and on the dates indicated.

Name	Title	Date
/s/ Hing C. Wong, Ph.D. **Hing C. Wong, Ph.D.**	Founder, Chief Executive Officer (Principal Executive Officer)	April 1, 2024
/s/ Rebecca Byam **Rebecca Byam**	Chief Financial Officer (Principal Financial and Accounting Officer)	April 1, 2024
/s/ Scott T. Garrett **Scott T. Garrett**	Chairperson of the Board of Directors	April 1, 2024
/s/ Lisa M. Giles **Lisa M. Giles**	Director	April 1, 2024
/s/ Rick S. Greene **Rick S. Greene**	Director	April 1, 2024
/s/ Gary M. Winer **Gary M. Winer**	Director	April 1, 2024