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, 2022

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 No.: 001-34705

Codexis, Inc.

(Exact name of registrant as specified in its charter)

Delaware	**71-0872999**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
200 Penobscot Drive, Redwood City, California	**94063**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code: (650) 421-8100

Securities Registered Pursuant to Section 12(b) of the A:

Title of Each Class:	Trading Symbols(s):	Name of Each Exchange on which Registered:
Common Stock, par value $0.0001 per share	CDXS	The Nasdaq Global Select Market

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 Section 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, a smaller reporting company, or emerging growth company. See the definitions of "large accelerated filer, "accelerated filer" and "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 Act). Yes ☐ No ☒

The aggregate market value of voting and non-voting common stock held by non-affiliates of Codexis as of June 30, 2022 was approximately $383.8 million based upon the closing price reported for such date on the Nasdaq Global Select Market.

As of February 22, 2023, there were 65,946,807 shares of the registrant's Common Stock, par value $0.0001 per share, outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's Definitive Proxy Statement to be filed with the Commission pursuant to Regulation 14A in connection with the registrant's 2023 Annual Meeting of Stockholders (the "Proxy Statement"), to be filed subsequent to the date hereof, are incorporated by reference into Part III of this Report. Such Definitive Proxy Statement will be filed with the Securities and Exchange Commission not later than 120 days after the conclusion of the registrant's fiscal year ended December 31, 2022. Except with respect to information specifically incorporated by reference in this Form 10-K, the Proxy Statement is not deemed to be filed as part of this Form 10-K.

Codexis, Inc.
Annual Report on Form 10-K
For The Year Ended December 31, 2022

INDEX

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

The following discussion and analysis should be read in conjunction with our audited Consolidated Financial Statements and the related Notes that appear elsewhere in this Annual Report on Form 10-K. This Annual Report on Form 10-K contains "forward-looking statements" within the meaning of Section 21E of the Securities Exchange Act of 1934, as amended ("the Exchange Act"), particularly in Part I, Item 1: "Business," Part I, Item 1A: "Risk Factors" and Part 2, Item 7: "Management's Discussion and Analysis of Financial Condition and Results of Operations." These statements are often identified by the use of words such as "may," "will," "expect," "believe," "anticipate," "intend," "could," "should," "estimate" or "continue," and similar expressions or variations. All statements other than statements of historical fact could be deemed forward-looking, including, but not limited to: any projections of financial information or performance; any statements about historical results that may suggest trends for our business; any statements of the plans, strategies, and objectives of management for future operations; any statements of expectation or belief regarding future events, technology developments, our products and product candidates, product sales, revenues, expenses, liquidity, cash flow, market growth rates or enforceability of our intellectual property rights and related litigation expenses; and any statements of assumptions underlying any of the foregoing. Such forward-looking statements are subject to risks, uncertainties and other factors that could cause actual results and the timing of certain events to differ materially from future results expressed or implied by such forward-looking statements. Accordingly, we caution you not to place undue reliance on these statements. For a discussion of some of the factors that could cause actual results to differ materially from our forward-looking statements, see the discussion on risk factors that appear in Part I, Item 1A: "Risk Factors" of this Annual Report on Form 10-K and other risks and uncertainties detailed in this and our other reports and filings with the Securities and Exchange Commission ("SEC"). The forward-looking statements in this Annual Report on Form 10-K represent our views as of the date of this Annual Report on Form 10-K. We anticipate that subsequent events and developments will cause our views to change. However, while we may elect to update these forward-looking statements at some point in the future, we have no current intention of doing so except to the extent required by applicable law. You should, therefore, not rely on these forward-looking statements as representing our views as of any date subsequent to the date of this Annual Report on Form 10-K.

PART I

ITEM 1. BUSINESS

COMPANY OVERVIEW

We are a leading enzyme engineering company leveraging our proprietary CodeEvolver® technology platform to discover, develop and enhance novel, high performance enzymes and other classes of proteins. Enzymes are naturally occurring biological molecules critical to almost all biochemical reactions that sustain life. They can be precisely engineered and optimized for specific functions, and to have particular characteristics, such as an ability to survive environments in which natural enzymes cannot, or to perform (bio)chemical transformations different than those for which they naturally evolved. The capacity to enhance the properties and performance of enzymes has led to pivotal improvements across three healthcare industry pillars: pharmaceutical manufacturing, life sciences, and biotherapeutics. The enzymes we produce solve for real-world challenges associated with small molecule pharmaceuticals manufacturing, nucleic acid synthesis and genomic sequencing, and – as biotherapeutic candidates – they have the potential to treat challenging diseases. Our unique enzymes drive improvements such as higher yields, reduced energy usage and waste generation, improved efficiency in manufacturing, greater sensitivity in genomic and diagnostic applications, and potentially more efficacious therapeutics.

Our novel biotherapeutics business includes a diverse pipeline of product candidates in clinical and preclinical development. Our initial biotherapeutic product candidates include enzymes that are orally administered for function in the gastrointestinal tract ("GI"), such as our partnered product candidates CDX-7108 for the treatment of exocrine pancreatic insufficiency and CDX-6114 for the treatment of phenylketonuria, which are both in Phase 1 clinical trials. We have also engineered a series of transgenes that code for enzymes that may be used as gene therapies to treat rare lysosomal storage disorders with our partner Takeda, such as Fabry Disease and Pompe Disease, as well as a blood factor disorder.

Our performance enzymes business consists primarily of two focus areas: i) biocatalysts for the sustainable manufacturing of pharmaceuticals and ii) enzymes for life science applications, including genomic sequencing and nucleic acid synthesis. In our pharmaceutical manufacturing business, we utilize our CodeEvolver® platform to develop optimized enzymes that are used by some of the world's largest pharmaceutical companies to reduce their costs and improve the efficiency and productivity of their manufacturing processes for some small molecule therapeutics. In life science markets, we use our platform technology to develop enzymes for customers using next generation sequencing ("NGS"), a parallel sequencing technology used to identify genomic information in the study of biological systems, and PCR/qPCR for in vitro molecular diagnostic and molecular biology research applications, as well as for synthesis of nucleic acids such as DNA/RNA.

History and Core Technology

We are a pioneer in harnessing computational technologies to drive biology advancements. Since 2002, we have made substantial investments in the development of our proprietary CodeEvolver® technology platform, the primary source of our competitive advantage for both our performance enzymes and biotherapeutics businesses. The CodeEvolver® platform has the power to transform the performance of an enzyme, tailoring it for a specific application and/or process. Using powerful machine learning tools and sophisticated molecular, cellular, and bioanalytical workflows, we design and screen libraries of thousands of variants in high throughput every two to four weeks on each project, sequencing every variant and correlating its sequence with its performance in a highly application-relevant screen. Content-rich libraries screened under real-world conditions can yield dense and valuable datasets, when data-mined effectively, and multiple parameters can be optimized in parallel. The resulting evolved variants often have a combination of enhanced properties, such as increased activity, specificity, and stability under desired conditions, or improved expression in the production host. These enhanced properties provide differentiated technical performance in the target application and can provide our customers increased value in the commercial deployment of their products.

Novel Biotherapeutics

We are developing a diverse pipeline of product candidates in our novel biotherapeutics business. These product candidates, which are in clinical and preclinical development, range from orally delivered enzymes to engineered transgenes for delivery as gene therapies that have the potential to address a range of diseases with high unmet patient need. Each of our product candidates is discovered utilizing our proprietary CodeEvolver® protein engineering platform.

Our Partnered Oral Enzyme Programs

CDX-7108 for the treatment of exocrine pancreatic insufficiency

Under a Strategic Collaboration Agreement with Nestlé Health Science ("Nestlé SCA"), we have collaboratively developed CDX-7108, a potent lipase intended for use as a pancreatic enzyme replacement therapy ("PERT"). PERT is used to treat pancreatic exocrine insufficiency. There are multiple causes of pancreatic exocrine insufficiency including chronic pancreatitis, cystic fibrosis and pancreatic cancer. We estimate there are approximately 190,000 patients in the United States and the market for current therapies is greater than $2.5 billion globally. Although existing therapies are reasonably effective at delivering amylase and protease activity, achieving adequate levels of lipase activity is challenging due to patient compliance and pill burden often leading patients to experience continued symptoms associated with fat malabsorption. CDX-7108 has been specifically engineered for increased potency as a lipase and also to remain stable in acidic conditions such as those encountered in the stomach. The goal is to study whether this combination of properties will deliver adequate lipase activity with a less burdensome dosing schedule. Under the Nestlé SCA, we and Nestlé Health Science are also working on the development of engineered amylase and protease enzymes for possible use with CDX-7108. Nestlé Health Science is currently dosing patients in a Phase 1b three-party study. The first two parts of the study evaluated the safety, tolerability, and pharmacokinetics ("PK") of escalating single and multiple oral doses of CDX-7108 in 48 healthy adult subjects, with no safety issues noted. The third part of the study is evaluating the pharmacodynamics of a single dose of oral CDX-7108 in six enrolled patients with exocrine pancreatic insufficiency ("EPI"). An interim analysis conducted in January 2023 of five patients who had completed the study at the time showed a clear indication of improved lipid absorption when patients are administered CDX-7108 versus placebo, which we believe supports a path forward together with Nestlé Health Science to further develop CDX-7108, with the potential for the initiation of a Phase 2 study in early 2024.

CDX-6114 for the treatment of phenylketonuria

We internally developed CDX-6114, an enzyme we engineered to be orally administrated for the treatment of phenylketonuria ("PKU") in humans. PKU, one of the most common inborn errors of metabolism ("IEMs"), is a metabolic disorder in which the enzyme that converts the essential amino acid phenylalanine into tyrosine is deficient. As a result, phenylalanine accumulates to toxic levels in the brain, causing serious neurological problems including intellectual disability, seizures and cognitive and behavioral problems. To avoid toxic levels of phenylalanine in their blood, individuals with PKU must follow a strict, life-long diet that is low in phenylalanine and supplement their diet with a synthetic phenylalanine-free protein supplements to provide them with sufficient nutrients. Maintaining a strict, life-long diet can be challenging for individuals with PKU. There are an estimated 50,000 patients with PKU in the developed world.

We have partnered with Nestlé Health Science under a Global Development, Option and License Agreement ("Nestlé License Agreement") to further develop CDX-6114. In February 2019, Nestlé Health Science exercised its option under the Nestlé License Agreement to obtain an exclusive license to develop and commercialize CDX-6114. Nestlé Health Science is currently optimizing the formulation of CDX-6114 to improve performance and we expect Nestlé Health Science to announce an IND filing and clinical trial initiation in 2023. If this collaboration can successfully demonstrate benefit in PKU patients with CDX-6114, this will inform our decisions around the oral enzyme approach to several other IEMs.

Our Wholly-owned Oral Enzyme Programs

In the past we have also worked on internal programs to develop orally administrable enzyme substitution therapy candidates for the treatment of homocystinuria ("HCU") and Maple Syrup Urine Disease ("MSUD"), that we are now considering partnering options for pursuing further development. In addition, we have a program to develop orally administrable enzyme substitution therapy candidates for the treatment of Celiac Disease ("CD").

Gene Therapy

We have also used CodeEvolver® to engineer transgenes that encode for enzymes which may improve targeting and expression within the body when administered as gene therapies, offering potentially improved therapeutic benefit as compared to current options.

Our Partnered Gene Therapy Programs

Our first significant program involving engineered transgenes commenced in March 2020 when we entered into a Strategic Collaboration and License Agreement ("Takeda Agreement") with Shire Human Genetic Therapies, Inc., a wholly-owned subsidiary of Takeda Pharmaceutical Co. Ltd. ("Takeda") pursuant to which we are collaborating to research and develop transgenes for use in gene therapy delivery technology for rare lysosomal storage disorders such as Fabry Disease, Pompe Disease, a blood factor disorder, and another lysosomal storage disorder. In March 2020, we received a one-time, non-refundable cash payment of $8.5 million. Of these programs, the Fabry disease program is the most advanced, with a lead candidate identified in investigational new drug ("IND") enabling activities. We have also provided sequences to Takeda for the Pompe program and await updates on preclinical testing and potential IND enabling activities. In May 2021, Takeda elected to exercise their option to initiate an additional program for a certain undisclosed rare genetic disorder and we received the option exercise fee during the third quarter of 2021.

In addition to our partnered gene therapy programs, we continue to explore the possible application of our CodeEvolver® technology to develop therapeutic options for devastating diseases as well as to develop and test our own proprietary gene therapy delivery mechanisms.

Performance Enzymes

Our performance enzymes business consists primarily of two focus areas, pharmaceutical manufacturing and life science products.

Pharmaceutical Manufacturing

We believe the pharmaceutical industry represents a significant market opportunity for our performance enzymes as pharmaceutical companies are in constant search of new drugs to offer to their customers and are under significant competitive pressure both to reduce costs and to increase the speed to market for their products. To address these pressures, pharmaceutical companies are driven to identify reliable, cost effective and sustainable manufacturing processes to produce both their new drug candidates and their existing products, while not impacting drug safety and efficacy. Cost reduction is increasingly important to drug developers (known as innovators) closer to their product launch and during the commercial stage of the product, which can last a decade or more. In addition, cost pressures further intensify as innovators lose their patent exclusivities and begin to experience competition from manufacturers of generic versions of their products.

Our pharmaceutical manufacturing customers, which include many large global pharmaceutical companies, partner with us to develop optimized enzymes for use as biocatalysts, meeting precisely defined criteria, with the goal of lowering costs and improving the efficiency, productivity and sustainability of their manufacturing processes by: improving productivity, yield and purity; using water as a primary solvent; eliminating hazardous inputs; enabling the use of simple equipment and reducing the need for capital expenditure; reducing energy requirements; reducing the generation of chemical byproducts or waste; and reducing the need for late-stage purifications.

As of December 31, 2022, we are selling biocatalysts to pharmaceutical manufacturers for 18 therapeutic drugs that are currently approved for commercial sales.

Of particular note for 2022, in July 2022 we announced that we and Pfizer had entered into an agreement to supply Pfizer with CDX-616, a proprietary high performance enzyme used to manufacture a critical intermediate for nirmatrelvir, an active pharmaceutical ingredient in PAXLOVID™, Pfizer's antiviral therapeutic, which is currently authorized for emergency use by the FDA for the treatment of mild-to-moderate COVID-19 in people at high risk of progression to severe illness and authorized or approved by other regulatory authorities across the globe. While we have generated significant revenue from supplying CDX-616 to Pfizer, there is no future binding commitment for them to purchase any particular quantity or quantities of CDX-616 from us.

We regularly sell biocatalysts, at multi-kilograms to metric tons per annum scale, that have already been engineered, scaled up, and installed in a customer's commercial process. For example, in addition to Pfizer, we sell biocatalysts to Merck for their manufacture of sitagliptin, the active ingredient in JANUVIA®, to Urovant and Kyorin for the manufacture of vibregon, the active ingredient in Urovant's GEMTESA™ and Kyorin's BEOVA®, products for the treatment of overactive bladder, as well as supporting other products and customers for which public disclosures have not been made.

In addition to these larger volumes of biocatalysts that are sold for our customers' ongoing commercial requirements, we also sell lesser quantities of enzymes for use in a customer's developmental, qualification or regulatory approval operations. As of December 31, 2022, 18 drug candidates currently in Phase 2 and Phase 3 clinical trials use enzymes engineered using CodeEvolver® technology (either by Codexis or by our platform licensing partners) in their chemistry, manufacturing and control processes. This pipeline of potential approvals reinforces our confidence in our ability to continue to grow this business over time.

Finally, we also sell even smaller quantities of enzymes (typically grams to multi-kilograms scale) to customers for experimental, testing and qualification purposes, or as part of an enzyme engineering project.

In addition to the sale of biocatalysts, we also offer research and development partnerships to our customers. These research and development activities are typically governed by collaboration agreements, which often contain research fee payments and intellectual property provisions, under which we screen and/or engineer biocatalysts for customers in connection with their process development efforts. In these collaborations, we typically receive consideration in the form of one or more of the following: upfront payments, milestone payments, payments for screening and engineering, with other exclusive supply of enzyme or licensing fees and royalties as the customer's product commercializes.

We also have licensed our CodeEvolver® enzyme engineering technology platform to pharmaceutical companies to help them develop custom-designed enzymes that are highly optimized for efficient manufacturing processes. To date, we have entered into platform technology licensing agreements with each of GlaxoSmithKline Intellectual Property Development Limited, a subsidiary of GlaxoSmithKline plc ("GSK"), Merck, Sharp & Dohme ("Merck") and Novartis Pharma AG ("Novartis").

Life Sciences

We also apply our CodeEvolver® technology to develop enzymes for customers using NGS and PCR/qPCR for *in vitro* molecular diagnostic and molecular biology research applications, as well DNA/RNA synthesis applications. We view these as attractive markets in which Codexis' technology and products can deliver a strong competitive advantage – in part because manipulation of nucleic acids by enzymes (be it "reading" or "writing") is at the core of these markets and our technology has the proven ability to create enzymes which are stable to the workflow and/or supply chain demands or – importantly – which are less biased in the nucleic acids they are able to sequence or synthesis, which can be of significant benefit in various applications.

In December 2019, we entered into a license agreement to provide Roche Sequencing Solutions, Inc. ("Roche") with an improved DNA ligase (EvoT4™ DNA ligase) for NGS library prep, which continues to progress towards commercialization in new NGS kits.

In June 2020, we entered into a co-marketing and enzyme supply collaboration agreement with Alphazyme LLC for the production and co-marketing of enzymes for life science applications. Since then, this collaboration has enabled the commercialization of Codex® HiFi DNA Polymerase, Codex® HiFi Hot Start DNA Polymerase, Codex® HiFi Hot Start 2X NGS Mix, Codex® HiCap RNA Polymerase, Codex® HiFi UL DNA Polymerase, and Codex® HiTemp Reverse Transcriptase. Development of other novel enzymes for life science applications continues.

Also, in June 2020, we entered into a Master Collaboration and Research Agreement with Molecular Assemblies, Inc. ("MAI") (the "MAI Agreement") pursuant to which we are leveraging our CodeEvolver® platform technology to improve the DNA polymerase enzymes that are critical for enzymatic DNA synthesis. At that time, we purchased $1.0 million in MAI's Series A financing and John Nicols, the Codexis' then President and CEO, and current director, joined MAI's board of directors. In April 2021, Codexis invested an additional $0.6 million in MAI's Series A financing and, in September 2021, Codexis invested an additional $7.0 million in MAI's Series B financing. As of December 31, 2022, we currently hold 5,443,734 shares of MAI Series A preferred stock and 12,848,635 shares of MAI Series B preferred stock. In April 2022, we and MAI announced that, using our CodeEvolver® platform technology, we had developed a novel, engineered terminal deoxynucleotidyl transferase ("TdT") enzyme which would enable MAI's Fully Enzymatic Synthesis™ ("FES™") technology that produces highly pure, sequence-specific DNA on demand. In August 2022, we and MAI announced that we had entered into a Commercial License and Enzyme Supply Agreement with MAI (the "MAI Supply Agreement") under which Codexis shall manufacture and sell the TdT enzyme to MAI for use in native DNA synthesis. In connection with the execution of the MAI Supply Agreement, we received a milestone payment of $1.0 million in the form of an additional 1,587,049 shares of Series B preferred stock pursuant to the MAI Agreement.

In March 2022, we announced the initiation of a strategic partnership with seqWell Inc., a developer of transformative library preparation products for demanding genomics plan application, which included an investment to accelerate the commercialization of seqWell's genomics workflow solutions. Codexis and seqWell plan to collaborate on using our CodeEvolver® platform technology for enzyme optimization with seqWell's growing portfolio of genomics workflow and library preparation products. As part of this partnership, we led seqWell's Series C financing with a $5.0 million investment.

OUR STRATEGY

Our strategy is to grow our revenues, profits, and stockholder value by leveraging our CodeEvolver® enzyme engineering technology platform in the following ways:

- *Creating and advancing novel biotherapeutic drug candidates.* We intend to continue to pursue opportunities to apply our protein engineering capabilities to the creation and development of novel biotherapeutic drug candidates. In addition, we intend to extend our biotherapeutics pipeline by developing, with our partner Takeda and developing internally, novel gene therapies and transgene products.
- *Growing our pharmaceutical manufacturing business.* We intend to continue to pursue opportunities in the pharmaceutical market to use our enzymes to reduce the costs for manufacturing small molecule drugs. We intend to increase the number of pharmaceutical customers and processes that utilize and benefit from our novel, cost-saving enzyme biocatalyst solutions.
- *Developing high-performance enzymes for use in life science applications and nucleic acid synthesis*. We intend to offer high-performance enzymes to customers using NGS and PCR/qPCR for *in vitro* molecular diagnostic applications and to enable the future of enzymatic nucleic acid synthesis.

Strategic Collaborations

Biotherapeutics

Nestlé Health Science

In October 2017, we entered into the Nestlé License Agreement with Nestlé Health Science pursuant to which we granted to Nestlé Health Science, under certain of our patent rights and know-how: (i) an option to obtain an exclusive, worldwide, royalty-bearing, sublicensable license to develop and commercialize certain products (each, a "Product") based on CDX-6114 and our other therapeutic enzyme product candidates covered by specified patent applications for the treatment of hyperphenylalaninaemia ("HPA") (also referred to as PKU), and (ii) an exclusive right of first negotiation (the "Right of First Negotiation") for a period of five years to obtain an exclusive worldwide license to develop and commercialize up to two enzymes discovered by us for use in the field of the prevention, diagnosis, treatment and management of inborn errors of amino acid metabolism. We are not under any obligation to undertake any research and development activities relating to inborn errors of amino acid metabolism. HPA is a medical condition characterized by elevated concentrations of the amino acid phenylalanine in the blood. PKU can result in severe HPA.

In February 2019, Nestlé Health Science exercised its option to obtain an exclusive, worldwide, royalty-bearing, sub-licensable license for the global development and commercialization of CDX-6114 for the management of PKU. Upon exercising its option, Nestlé Health Science assumed all responsibilities for future clinical development and commercialization of CDX-6114, with the exception of the completion of an extension study, CDX-6114-004, which was substantially completed in the fourth quarter of 2019. The parties established a patent committee to discuss strategies and coordinate activities for the patents related to CDX-6114 and product containing CDX-6114, and we will jointly own all inventions and information that result from each party's activities performed under the Nestlé License Agreement. The Nestlé License Agreement also contains customary representations and warranties by the parties, intellectual property protection provisions, certain indemnification rights in favor of each party and customary confidentiality provisions and limitations of liability.

We are also eligible to receive payments from Nestlé Health Science under the Nestlé License Agreement that include (i) development and approval milestones of up to $85.0 million, (ii) sales-based milestones of up to $250.0 million in the aggregate, which aggregate amount is achievable if net sales exceed $1.0 billion in a single year, and (iii) tiered royalties, at percentages ranging from the mid-single digits to low double-digits, of net sales of products.

In October 2017, we entered into the Nestlé SCA pursuant to which we and Nestlé Health Science are collaborating to leverage the CodeEvolver® enzyme engineering technology platform to develop novel enzymes for Nestlé Health Science's established Consumer Care and Medical Nutrition business areas. The term of the Nestlé SCA has been extended through December 2023 with automatic renewal through December 2024.

In January 2020, we entered into the Nestlé development agreement (the "Nestlé DA") pursuant to which we and Nestlé Health Science are collaborating to advance CDX-7108 into preclinical and early clinical studies. CDX-7108 is the lead candidate discovered under the Nestlé SCA targeting exocrine pancreatic insufficiency. The term of the Nestlé DA has been extended through December 2023 with automatic renewal through December 2024.

Shire Human Genetic Therapies/Takeda Pharmaceutical

In March 2020, we entered into the Takeda Agreement with Takeda pursuant to which we are collaborating to research and develop protein sequences for use in gene therapy products for certain diseases (each, a "Field") in accordance with each applicable program plan (each, a "Program Plan"). On execution of the Takeda Agreement, we received an upfront nonrefundable cash payment of $8.5 million and we initiated activities under three Program Plans for Fabry Disease, Pompe Disease, and an unnamed blood factor disorder, respectively (the "Initial Programs"). We are primarily responsible for the research and development of protein sequences under the Program Plans (the "Protein Sequences") and we are eligible to earn up to $10.5 million of research and development fees and preclinical milestone payments for the Initial Programs. We will own all rights to the protein sequences and corresponding nucleic acid sequences and related intellectual property rights and Takeda will own all rights to products and related intellectual property rights. In May 2021, Takeda elected to exercise their option to initiate an additional (fourth) program for a certain undisclosed rare genetic disorder; as a result, we received the option exercise fee during the third quarter of 2021. We are also eligible to receive up to $3.4 million of research and development fees and preclinical milestone payments for the fourth program under the Takeda Agreement.

We granted to Takeda an exclusive, worldwide, royalty-bearing, sublicensable license to use the protein sequences and their corresponding nucleic acid sequences to develop, manufacture and commercialize the applicable products in the applicable Field. We also granted to Takeda a limited non-exclusive, worldwide, sublicensable license (a) to research the protein sequences within or outside the applicable Fields and (b) to research the products outside of the applicable Fields, which such rights exclude Takeda's right to perform any IND-enabling activities. The licenses to research the Protein Sequences expire after a pre-determined period of time.

The term of the Takeda Agreement begins on the effective date of the Takeda Agreement and continues on a product-by-product and country-by-country basis, until the expiration of Takeda's obligation to pay royalties to the Company with respect to that product in that country. The Takeda Agreement expires in its entirety upon the expiration of Takeda's obligation to pay royalties to the Company with respect to the products in all countries worldwide. Subject to the terms of the Takeda Agreement, and after the first anniversary of the Effective Date with respect to the Initial Programs or after the first anniversary of confirmation of the applicable Program Plan by the parties with respect to the Additional/Option Programs, Takeda may terminate a Program upon specified prior written notice to the Company. Subject to the terms of the Takeda Agreement, Takeda may terminate the Takeda Agreement, at will, on a product-by-product basis upon specified prior written notice to the Company and the Takeda Agreement in its entirety upon specified prior written notice to the Company. Subject to the terms of the Takeda Agreement, Takeda may terminate the Takeda Agreement on a product-by-product basis for safety reasons upon specified prior written notice to the Company. Either party may terminate the Takeda Agreement for an uncured material breach by the other party, or the other party's insolvency or bankruptcy. Pursuant to the Takeda Agreement, we are eligible to receive other payments that include (i) clinical development and commercialization-based milestones, per target gene, of up to $104.0 million and (ii) tiered royalty payments based on net sales of applicable products at percentages ranging from the mid-single digits to low single-digits.

Licensing Our CodeEvolver® Enzyme Engineering Technology Platform

GlaxoSmithKline

We entered into our first CodeEvolver® enzyme engineering Platform Technology Transfer, Collaboration and License Agreement ("GSK CodeEvolver® Agreement") in July 2014 with GlaxoSmithKline Intellectual Property Development Limited, a subsidiary of GSK, pursuant to which we granted GSK a non-exclusive, worldwide license to use our CodeEvolver® enzyme engineering technology platform in the field of human healthcare for its internal development purposes.

Under the GSK CodeEvolver® Agreement, we licensed and transferred our certain patents, patent applications and know-how from our CodeEvolver® enzyme engineering technology platform to GSK, completing the transfer in April 2016. Under this agreement, we have the potential to receive contingent payments that range from $5.75 million to $38.5 million per project based on GSK's successful application of the licensed technology. We are also eligible to receive royalties based on net sales, if any, of a limited set of products developed by GSK using our CodeEvolver® enzyme engineering technology platform.

The term of the GSK CodeEvolver® Agreement continues, unless earlier terminated, until the expiration of all payment obligations under the GSK CodeEvolver® Agreement. GSK can terminate the GSK CodeEvolver® Agreement by providing 90 days written notice to us.

In 2019, we received a $2.0 million milestone payment on the advancement of an enzyme developed by GSK using our CodeEvolver® enzyme engineering platform technology. In 2021, we received two additional milestone payments from GSK under the GSK CodeEvolver® Agreement.

Merck

In August 2015, we entered into a CodeEvolver® Platform Technology Transfer and License Agreement (the "Merck CodeEvolver® Agreement") with Merck. The Merck CodeEvolver® Agreement allows Merck to use our proprietary CodeEvolver® enzyme engineering platform technology in the field of human and animal healthcare.

Under the terms of the Merck CodeEvolver® Agreement, we granted to Merck an exclusive license under certain patents, patent applications and know-how from our CodeEvolver® enzyme engineering technology platform for the research, development and manufacture of novel enzymes for use by Merck in the chemical synthesis of therapeutic products owned or controlled by Merck ("Merck Exclusive Field") and a non-exclusive worldwide license to use the CodeEvolver® enzyme engineering technology platform to research, develop and manufacture novel enzymes for use by Merck in its internal research programs ("Merck Non-Exclusive Field").

Under the terms of the Merck CodeEvolver® Agreement, Merck paid us upfront technology transfer and license fees and milestone payments over the technology transfer period of 15 months from August 2015. We also have the potential to receive product-related payments of up to $15.0 million for each active pharmaceutical ingredient ("API") that is manufactured by Merck using one or more enzymes that have been developed or are in development using the CodeEvolver® enzyme engineering technology platform during the 10-year period that begins on the conclusion of the 15-month technology transfer period. These product-related payments, if any, will be paid by Merck to us for each quarter that Merck manufactures API using a CodeEvolver®-developed enzyme. The payments will be based on the total volume of API produced using the CodeEvolver®-developed enzyme.

In September 2016, we completed the full transfer of the engineering platform technology. In October 2018, we entered into an amendment to the Merck CodeEvolver® Agreement whereby we amended certain licensing provisions and one exhibit. In January 2019, we entered into an amendment to the Merck CodeEvolver® Agreement whereby we installed certain CodeEvolver® enzyme engineering technology upgrades into Merck's platform license installation. We maintained those upgrades for a multi-year term that expired in January 2022.

Novartis

In May 2019, we entered into a Platform Technology Transfer and License Agreement (the "Novartis CodeEvolver® Agreement") with Novartis. The Novartis CodeEvolver® Agreement allows Novartis to use our proprietary CodeEvolver® enzyme engineering platform technology in the field of human healthcare.

Under the terms of the Novartis CodeEvolver® Agreement, Codexis granted to Novartis a worldwide license to use certain patents, patent applications and know-how from our CodeEvolver® enzyme engineering technology platform to research, develop and manufacture novel enzymes for use by or on behalf of Novartis as biocatalysts in the chemical synthesis of small molecule and bioconjugate APIs. The license is exclusive for the research, development and manufacture of novel enzymes for use by Novartis as biocatalysts in the chemical synthesis of API owned or controlled by Novartis ("Novartis Exclusive Field") and non-exclusive license for the research, development and manufacture of novel enzymes for use by Novartis in the chemical synthesis of API not owned or controlled by Novartis or any third party ("Novartis Non-Exclusive Field").

In July 2021, we announced the completion of the technology transfer period during which we transferred our proprietary CodeEvolver® platform technology to Novartis (the "Technology Transfer Period").

Pursuant to the Novartis CodeEvolver® Agreement, we received an upfront payment of $5.0 million shortly after the effective date. We completed the second technology milestone transfer under the agreement and received a milestone payment of $4.0 million in 2020. We have also received an aggregate of $5.0 million for the completion of the third technology transfer milestone in 2021.

In consideration for the continued disclosure and license of improvements to the technology and materials during a multi-year period that began on the conclusion of the Technology Transfer Period ("Improvements Term"), Novartis will pay us annual payments over four years which amount to an additional $8.0 million in aggregate. We also have the potential to receive quantity-dependent, usage payments for each API that is manufactured by Novartis using one or more enzymes that have been developed or are in development using the CodeEvolver® platform technology during the period that began on the conclusion of the Technology Transfer Period and ends on the expiration date of the last to expire licensed patent. These product-related usage payments, if any, will be paid by Novartis to Codexis for each quarter that Novartis manufactures API using a CodeEvolver®-developed enzyme.

The licenses to Novartis are granted under patents, patent applications and know-how that Codexis owns or controls as of the effective date and that cover the CodeEvolver® platform technology. Any improvements to the CodeEvolver® platform technology during the Technology Transfer Period will also be included in the license grants from Codexis to Novartis.

INTELLECTUAL PROPERTY

Our success depends in large part on our ability to protect our proprietary technology, products and services under patent, copyright, trademark and trade secret laws. We also rely heavily on confidentiality and non-disclosure and other contractual agreements for further protection of our proprietary technology, products and services. Protection of our proprietary rights, titles and interests is important for us to offer our customers and partners proprietary technology, products and services that are not available from our competitors, and to exclude our competitors from practicing technology that we have developed or exclusively licensed from other parties. For example, our ability to successfully supply innovator pharmaceutical manufacturers as customers depends on our ability to supply proprietary enzymes or methods for making pharmaceutical intermediates or APIs that are not available from our competitors. Likewise, in the generic pharmaceutical area, protection of our proprietary technology, products and services directed to our enzymes and methods of producing pharmaceutical products, through patent or trade secret laws or other legal protections is important for us and our customers to maintain a lower cost production advantage over competitors.

As of December 31, 2022, we owned or controlled approximately 2,090 issued patents and pending patent applications in the United States and in various foreign jurisdictions, many of which are directed to our enabling technologies and specific methods and products that support our business in the pharmaceutical markets. In addition, our portfolio includes patents and pending patent applications that support our businesses in the biotherapeutics, molecular diagnostics, food and other markets. Our patents and pending patent applications, if issued, have terms that expire between 2023 and approximately 2043. Our United States ("U.S.") patents and pending patent applications directed to the CodeEvolver® proprietary enabling technology platform developed internally by us have terms that expire between 2029 and approximately 2034. It is possible that some U.S. patents and patent applications (if issued) may be entitled to patent term extensions and/or patent term adjustments, which would extend the protection beyond these expiration dates. It is also possible that some patents and patent applications (if issued) in other jurisdictions will be entitled to additional patent term. Our current intellectual property rights also include patents, trademarks, copyrights, software and certain assumed contracts that we acquired from Maxygen, Inc. ("Maxygen") in October 2010, which are associated with directed evolution technology, known as the MolecularBreeding™ technology platform developed by Maxygen. The intellectual property rights and other related assets that we acquired from Maxygen continue to be subject to existing exclusive and non-exclusive license rights granted by Maxygen to third parties. We continue to file new patent applications, for which terms generally extend 20 years from the non-provisional filing date in the United States.

As of December 31, 2022, we owned approximately 100 trademark registrations in the United States and foreign jurisdictions, as well as many common law trademarks. These include, but are not limited to: Codexis®, Codex®, CodeEvolver®, Mosaic®, Sage®, Microcyp®, MCYP®, ProSAR®, Unlock the Power of Proteins®, the Codexis Protein Engineering Experts® logo, Strategist®, Continuity®, Ameli®, Forager®, Analogene®, Harvester®, Atoms®, Riptide®, APS® and a Codexis design mark (i.e., the stylized Codexis logo).

COMPETITION

We face differing forms of competition in the biotherapeutics, pharmaceutical manufacturing and life sciences markets, as set forth below.

Biotherapeutics

There are other companies that participate in the biotherapeutics market generally and the PKU market specifically. Many of these companies are large, successful and well-capitalized. BioMarin Pharmaceutical Inc. ("BioMarin") and Daiichi Sankyo Company market Kuvan® in the United States, Europe and Japan for the treatment of a certain type of PKU. In addition, BioMarin had gained FDA approval in May 2018 and began the commercial sales of Palynziq®, an injectable enzyme substitution therapy to address different options for care in the treatment of PKU. Subsequently in May 2019, BioMarin obtained marketing authorization for Palynziq® from the European Commission. Several companies, including Synlogic, Homology Medicines and Rubius have reported clinical efforts to develop biotherapeutic candidates for PKU. Beyond targeting PKU, Takeda, Genzyme / Sanofi S.A., BioMarin, and other companies market or are actively developing enzyme therapeutics. There are numerous companies that are developing other forms of therapeutics, such as small molecules, gene therapy, as well as therapies based on gene editing, which could compete with biotherapeutics.

There are several companies developing or marketing pancreatic enzyme replacement therapies (PERTs) for the treatment of exocrine pancreatic insufficiency (EPI). Approved products derived from porcine pancreas and taken orally with meals include: Creon® (marketed by Abbvie in the US, and by Abbott in the EU, China, Taiwan, Japan, and India), Zenpep® (marketed by Nestlé in the US and EU), Pancreaze® (marketed by Vivus in the US), and Pertzye® (marketed by Chiesi in the US). There are also companies developing recombinant PERTs for treating EPI. First Wave Biopharma is presently testing a recombinant lipase enzyme, adrulipase, in Phase 2 clinical trials. There are also therapies in pre-clinical development for EPI treatment, including SNSP003 (developed by Synspira Therapeutics), a combination of purified lipase, amylase, and protease, in collaboration with the Cystic Fibrosis Foundation. Current marketed PERT therapies as well as potential future PERT therapies in development could compete with CDX-7108.

Performance Enzyme

Pharmaceutical Manufacturing

We market our biocatalyst products and services to manufacturers of small molecule pharmaceutical intermediates and APIs. Our primary competitors in that market are companies marketing either conventional, non-enzymatic catalysts or alternative biocatalyst products and services, or from full service contract development and manufacturing service providers ("CDMOs") offering conventional chemistry approaches to the production of APIs. We also sometimes face competition from existing in-house technologies (both biocatalysts and conventional chemistries) within our client and potential client companies. The principal methods of competition and competitive differentiation in this market are price, product quality and performance, including manufacturing yield, safety and environmental benefits and speed of delivery of product. Pharmaceutical manufacturers that use biocatalytic processes can face competition from manufacturers that use more conventional processes and/or manufacturers that are based in regions (such as India and China) with lower regulatory, safety and environmental costs.

We also compete with companies developing and marketing conventional catalysts including, for example, Solvias AG, BASF, Johnson-Matthey and Takasago International Corporation.

The market for supplying enzymes for use in pharmaceutical manufacturing is quite fragmented. There is competition from large industrial enzyme companies, as well as subsidiaries of larger contract research/contract manufacturing organizations, such as Royal DSM N.V. ("DSM"), Cambrex Corporation, Lonza, WuXi STA and Almac Group Ltd. Some fermentation pathway design companies, such as Zymergen, which was acquired by Gingko BioWorks, and Amyris, whose traditional focus has been to design microorganisms that express small molecule chemicals, could extend into designing organisms that express enzymes. There is also competition in the enzyme customization and optimization area from several smaller companies, such as BRAIN AG, Arzeda, c-LEcta GmbH and evoxx technologies GmbH.

The market for the manufacture and supply of APIs and intermediates is large, with many established companies. These companies include many of our large innovator and generic pharmaceutical customers, such as Merck, GSK, Novartis, Pfizer Inc. ("Pfizer"), Bristol-Myers Squibb Company ("Bristol-Myers"), KYORIN Pharmaceutical Co., Ltd. ("Kyorin"), Urovant Sciences GmbH ("Urovant"), and Teva Pharmaceutical Industries Limited ("Teva"), which have significant internal research and development efforts directed at developing processes to manufacture APIs and intermediates for use in their drug product manufacturing. There is also a large network of contract (development &) manufacturing organizations ("C(D)MOs") servicing the innovator companies with supply of APIs and/or intermediates, These C(D)MOs include Cambrex Corporation, Lonza, WuXi STA and Almac Group Ltd, among many others. The processes used by these companies (both C(D)MOs and innovators) include classical organic chemistry reactions, chemo-catalytic reactions, biocatalytic reactions or combinations thereof. Our biocatalyst-based manufacturing processes must compete effectively on cost and efficiency with these internally developed routes.

We believe that our principal advantage is our ability to rapidly deliver customized biocatalysts for existing and new intermediates and APIs in the pharmaceutical manufacturing market. This capability has allowed us to create a breadth of biocatalysts with improved performance characteristics including, for example, better activity, stability, and activity on a range of substrates, compared to traditional chemistry-based manufacturing processes and naturally occurring (and thus not optimized) biocatalysts. We believe that our CodeEvolver® enzyme engineering platform technology provides substantially superior results, in shorter time frames, than companies offering competing biocatalyst development services.

Life Sciences

Our Life Sciences business is focused in two key areas, nucleic acid manufacturing and genomics. We supply engineered enzymes and custom services to manufacturers of messenger RNA ("mRNA"), small interfering RNA ("RNAi"), antisense oligonucleotides ("ASOs"), and other RNA-based molecules as well as manufacturers of next generation sequencing ("NGS") workflows and kits, *in vitro* diagnostics ("IVD"), and molecular diagnostic assays. Several of our competitors, such as ThermoFisher Scientific, Roche Diagnostics (a division of Roche Holding AG), New England Biolabs ("NEB"), and QIAGEN group offer a wide diversity of products across the life sciences market, including products that support multiple applications in RNA manufacturing and genomics. We also compete with companies that are more focused on offering products and services for RNA manufacturing, such as Aldevron (a Danaher company) as well as companies focused on providing enzymes and services to genomic sequencing applications, such as Promega Corporation and Watchmaker Genomics. The life science industry has seen great technological leaps since the introduction of enzymes into laboratory and clinical workflows and we recognize the importance of enzymes in this market and the need for purpose-fit, robust, and highly active enzymes that are made possible with our core technology.

Other

Core Technology

We are a leader in the field of enzyme engineering to create novel enzymes. Each of our segments rely on our core technology. We are aware that other companies, organizations and persons have developed technologies that appear to have some similarities to our patented proprietary technologies. For example, we are aware that other companies, including Zymergen, which was acquired by Gingko Bioworks, Amyris, Absci and Amicus Therapeutics have alternative methods for obtaining and generating genetic diversity or use mutagenesis techniques to produce genetic diversity. In addition, academic institutions such as the California Institute of Technology, the Max Planck Institute and the Austrian Centre of Industrial Biotechnology are also working in this field. This field is highly competitive with companies and academic and research institutions actively seeking to develop technologies that could be competitive with our technologies.

Technological developments by others may result in our products and technologies, as well as products manufactured by our customers using our biocatalysts, becoming obsolete. We monitor publications and patents that relate to directed molecular evolution to be aware of developments in the field and evaluate appropriate courses of action in relation to these developments.

Many of our competitors have substantially greater manufacturing, financial, research and development, personnel and marketing resources than we do. As a result, our competitors may be able to develop competing and/or superior technologies and processes, and compete more aggressively and sustain that competition over a longer period of time than we could. Our technologies and products may be rendered obsolete or uneconomical by technological advances or entirely different approaches developed by one or more of our competitors.

We initially commercialized our CodeEvolver® enzyme engineering technology platform and products in the manufacture of small molecule pharmaceuticals, which remains a primary business focus. Our customers, which include many large, global pharmaceutical companies, use our technology, products and services in their process development and in manufacturing. Additionally, we have licensed our proprietary CodeEvolver® enzyme engineering technology platform to global pharmaceutical companies enabling them to use this technology, in house, to engineer enzymes for their own businesses.

OPERATIONS

Our corporate headquarters are located in Redwood City, California and provide general administrative support to our business and are the center of our research, development and business operations. We have limited internal manufacturing capacity at our headquarters in Redwood City. We expect to rely on third-party manufacturers for commercial production of our biocatalysts for the foreseeable future. Our in-house manufacturing is dedicated to producing both Codex® biocatalyst panels and kits and enzymes for use by our customers in pilot scale and clinical production. We also supply initial commercial quantities of biocatalysts for use by our collaborators to produce pharmaceutical intermediates and manufacture biocatalysts that we sell. In the first quarter of 2021, we entered into an arrangement to lease a facility in San Carlos, California to serve as an additional office and research and development laboratory space which we occupied beginning December 2021. Please see Note 15, “Segment, Geographical and Other Revenue Information” in the Notes to the Consolidated Financial Statements set forth in Item 8 of this Annual Report on Form 10-K for a description of our revenues and long-lived assets both within and outside of the United States, and with respect to the San Carlos facility, please see Note 13, “Commitments and Contingencies” in the Notes to our Consolidated Financial Statements set forth in Item 8 of this Annual Report on Form 10-K.

Our research and development operations include efforts directed towards engineering biocatalysts, bioprocess development, cellular engineering, biocatalyst screening, metabolites, strain improvement, fermentation development and process engineering. We conduct enzyme evolution, enzyme production development, microbial bioprocess development, cellular engineering, microbial evolution and process engineering evaluations and design primarily at our headquarters in Redwood City, California. Manufacturing of our enzymes is conducted primarily in four locations, at our in-house facility in Redwood City, California and at third-party contract manufacturing organizations, Lactosan GmbH & Co. KG (“Lactosan”) in Kapfenberg, Austria, ACS Dobfar S.p.A. ("ACSD") (formerly known as DPhar S.p.A.) in Anagni, Italy, and Alphazyme LLC ("Alphazyme") in Florida, United States. Generally, we perform smaller scale manufacturing in-house and outsource the larger scale manufacturing, representing a large percentage of our production of novel enzymes, to contract manufacturing organizations.

GOVERNMENT REGULATION

In the United States, the FDA extensively regulates, among other things, the research, development, testing, manufacture, quality control, import, export, safety, effectiveness, labeling, packaging, storage, distribution, record keeping, approval, advertising, promotion, marketing, post-approval monitoring, and post-approval reporting of drug and biologic products under the Federal Food, Drug and Cosmetic Act, its implementing regulations and other laws, including, in the case of biologics, the Public Health Service Act. Our biotherapeutic product candidates are subject to regulation by the FDA as biologics. Biologics require the submission of a biologics license application (“BLA”) and licensure, which constitutes approval, by the FDA before being marketed in the United States. We, along with third-party contractors and our collaborators, will be required to navigate the various preclinical, clinical and commercial approval requirements of the governing regulatory agencies of the countries in which we wish to conduct studies or seek approval or licensure of our product candidates. The process of obtaining regulatory approvals and the subsequent compliance with applicable federal, state, local and foreign statutes and regulations require the expenditure of substantial time and financial resources.

The process required by the FDA before a biologic product may be marketed in the United States generally involves the following:

- completion of preclinical laboratory tests and animal studies performed in accordance with the FDA’s good laboratory practice (“GLP”) regulations;
- submission to the FDA of an IND, which must become effective before clinical trials in the United States may begin;
- approval by an institutional review board (“IRB”), or ethics committee at each clinical site before the trial is commenced;
- performance of adequate and well-controlled human clinical trials to establish the safety and potency of the product candidate for each proposed indication, conducted in accordance with the FDA’s good clinical practice (“GCP”) regulations;
- preparation and submission to the FDA of a BLA after completion of all pivotal clinical trials:
- satisfactory completion of an FDA Advisory Committee review, if applicable;
- a determination by the FDA within 60 days of its receipt of a BLA to file the application for review;
- satisfactory completion of an FDA inspection of the manufacturing facility or facilities at which the product is produced to assess compliance with current good manufacturing practice (“cGMP”) regulations and to assure that the facilities, methods and controls are adequate to preserve the biological product’s continued safety, purity and potency, and of selected clinical investigation sites to assess compliance with Good Clinical Practices, or GCPs; and

- FDA review and approval of the BLA prior to any commercial marketing, sale or distribution of the product.

Preclinical and Clinical Trials

Once a product candidate is identified for development, it enters the preclinical testing stage. Preclinical studies include laboratory evaluations of drug chemistry, formulation and stability, as well as studies to evaluate toxicity in animals, which must be conducted in accordance with GLP requirements. The results of preclinical studies, together with manufacturing information and analytical data, are submitted to the FDA as part of an IND. An IND is a request for authorization from the FDA to administer an investigational new drug to humans. The central focus of an IND submission is on the general investigational plan and the protocol(s) for clinical studies. The IND automatically becomes effective 30 days after receipt by the FDA, unless the FDA, within the 30-day time period, raises concerns or questions about the conduct of the clinical trial, including concerns that human research subjects will be exposed to unreasonable health risks, and imposes a clinical hold. In such a case, the IND sponsor and the FDA must resolve any outstanding concerns before the clinical trial can begin.

A separate submission to an existing IND must also be made for each successive clinical trial conducted during product development, and the FDA must grant permission, either explicitly or implicitly by not objecting, before each clinical trial can begin. Progress reports detailing the results of the clinical trials, among other information, must be submitted at least annually to the FDA and written IND safety reports must be submitted to the FDA and the investigators for serious and unexpected suspected adverse events, findings from other studies or animal or *in vitro* testing that suggest a significant risk for human subjects and any clinically important increase in the rate of a serious suspected adverse reaction over that listed in the protocol or investigator brochure.

Clinical trials involve the administration of the product candidate to human subjects under the supervision of qualified investigators in accordance with GCPs, which include the requirement that all research subjects provide their informed consent for their participation in any clinical study. Clinical trials are conducted under protocols detailing, among other things, the objectives of the clinical trial and the parameters and criteria to be used in monitoring safety and evaluating effectiveness. Each protocol must be submitted to the FDA as part of the IND. An independent IRB for each investigator site proposing to participate in a clinical trial must also review and approve the clinical trial and its informed consent form before it can begin at that site, and the IRB must monitor the clinical trial until it is completed. The FDA, the IRB, or the sponsor may suspend or discontinue a clinical trial at any time on various grounds, including a finding that the subjects are being exposed to an unacceptable health risk or that the trial is unlikely to meet its stated objectives. Some studies also include oversight by an independent group of qualified experts organized by the clinical study sponsor, known as a data safety monitoring board, which provides authorization for whether or not a study may move forward at designated check points based on access to certain data from the study and may halt the clinical trial if it determines that there is an unacceptable safety risk for subjects or other grounds, such as no demonstration of efficacy. There are also requirements governing the reporting of ongoing clinical studies and clinical study results to public registries.

For purposes of BLA approval, clinical trials are typically conducted in three sequential phases, which may overlap or be combined.

- *Phase 1* - Phase 1 clinical trials involve initial introduction of the investigational product into healthy human subjects or patients with the target disease or condition. These studies are typically designed to test the safety, dosage tolerance, absorption, metabolism and distribution of the investigational product in humans, the side effects associated with increasing doses, and, if possible, to gain early evidence of effectiveness.
- *Phase 2* - Phase 2 clinical trials typically involve administration of the investigational product to a limited patient population with a specified disease or condition to evaluate the preliminary efficacy, optimal dosage and dosing schedule and to identify possible adverse side effects and safety risks.
- *Phase 3* - Phase 3 clinical trials typically involve administration of the investigational product to an expanded patient population to further evaluate dosage, to provide statistically significant evidence of clinical efficacy and to further test for safety, generally at multiple geographically dispersed clinical trial sites. These clinical trials are intended to establish the overall risk/benefit ratio of the investigational product and to provide an adequate basis for product approval and physician labeling.

In some cases, the FDA may condition approval of a BLA on the sponsor's agreement to conduct additional clinical trials to further assess the biologic's safety and effectiveness after BLA approval. Such post-approval clinical trials are typically referred to as Phase 4 clinical trials. Concurrent with clinical trials, companies usually complete additional animal studies and must also develop additional information about the chemistry and physical characteristics of the biologic and finalize a process for manufacturing the biologic in commercial quantities in accordance with cGMP requirements. The manufacturing process must be capable of consistently producing quality batches of the product candidate and manufacturers must develop, among other things, methods for testing the identity, strength, quality and purity of the final biological product. Additionally, appropriate packaging must be selected and tested and stability studies must be conducted to demonstrate that the product candidate does not undergo unacceptable deterioration over its shelf life.

Although most clinical research performed in the United States in support of a BLA must be authorized in advance by the FDA, under the IND regulations and procedures described above, there are certain circumstances under which clinical trials can be conducted without submission of an IND. For example, a sponsor who wishes to conduct a clinical trial outside the United States may, but need not, obtain FDA authorization to conduct the clinical trial under an IND.

BLA Submission and FDA Review

Assuming successful completion of all required testing in accordance with all applicable regulatory requirements, the results of preclinical studies and clinical trials, together with other detailed information, including extensive manufacturing information and information on the composition of the biologic, are submitted to the FDA in the form of a BLA requesting approval to market the biologic for one or more specified indications. The BLA must include all relevant data available from preclinical and clinical studies, including negative or ambiguous results as well as positive findings, together with detailed information relating to the product's chemistry, manufacturing, controls, and proposed labeling, among other things. Data can come from company-sponsored clinical studies intended to test the safety and effectiveness of a use of the product, or from a number of alternative sources, including studies initiated by investigators. The submission of a BLA requires payment of a substantial user fee unless a waiver is granted. Each BLA submitted to the FDA is reviewed for administrative completeness and reviewability within 60 days of the FDA's receipt of the application. If the BLA is found to be complete, the FDA will file the BLA, triggering a full substantive review of the application. The FDA may refuse to file any BLA that it deems incomplete or not properly reviewable at the time of submission.

Once a BLA has been accepted for filing under the Prescription Drug User Fee Act, the FDA has a goal of reviewing BLAs within ten months of the 60-day filing date for BLAs designated for standard review or six months for priority review, but the overall timeframe is often extended by FDA requests for additional information or clarification. The FDA reviews a BLA to determine, among other things, whether the biological product is safe, pure and potent and whether the facility or facilities in which it is manufactured meet standards designed to assure the product's continued safety, purity and potency. The FDA may refer the application to an advisory committee for review, evaluation and recommendation as to whether the application should be approved. The FDA is not bound by the recommendation of an advisory committee, but it generally follows such recommendations.

Before approving a BLA, the FDA will inspect the facility or the facilities at which the biologic product is manufactured, and will not license the product unless cGMP compliance is satisfactory. The FDA may also inspect the sites at which the clinical trials were conducted to assess their compliance with GCP requirements, and will not license the biologic unless compliance with such requirements is satisfactory. If the FDA determines that the application, manufacturing process or manufacturing facilities are not acceptable, it will outline the deficiencies in the submission and often will request additional testing or information. Notwithstanding the submission of any requested additional information, the FDA ultimately may decide that the application does not satisfy the regulatory criteria for approval.

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

If regulatory approval of a product is granted, such approval will be granted for particular indications and may entail limitations on the indicated uses for which such product may be marketed. For example, the FDA may approve the BLA with a Risk Evaluation and Mitigation Strategy ("REMS"), to ensure the benefits of the product outweigh its risks. A REMS is a safety strategy implemented to manage a known or potential serious risk associated with a product and to enable patients to have continued access to such medicines by managing their safe use, and could include medication guides, physician communication plans, or elements to assure safe use, such as restricted distribution methods, patient registries and other risk minimization tools. The FDA also may condition approval on, among other things, changes to proposed labeling or the development of adequate controls and specifications. Once approved, the FDA may withdraw the product approval if compliance with pre- and post-marketing requirements is not maintained or if problems occur after the product reaches the marketplace. The FDA may require one or more Phase 4 post-market studies and surveillance to further assess and monitor the product's safety and effectiveness after commercialization, and may limit further marketing of the product based on the results of these post-marketing studies.

Expedited Development and Review Programs

The FDA maintains several programs intended to facilitate and expedite development and review of new drugs and biologics designed to address unmet medical needs in the treatment of serious or life-threatening diseases or conditions.

For example, a product candidate is eligible for Fast Track designation if it is intended to treat a serious or life-threatening disease or condition and demonstrates the potential to address unmet medical needs for such disease or condition. Fast Track designation applies to the combination of the product candidate and the specific indication for which it is being studied. Fast Track designation provides increased opportunities for sponsor meetings with the FDA during preclinical and clinical development, in addition to the potential for rolling review once a marketing application is filed, meaning that the FDA may review portions of the marketing application before the sponsor submits the complete application, if the sponsor provides a schedule for the submission of the sections of the BLA, the FDA agrees to accept sections of the BLA and determines that the schedule is acceptable, and the sponsor pays any required user fees upon submission of the first section of the BLA.

In addition, a product candidate may be eligible for Breakthrough Therapy designation if it is intended to treat a serious or life-threatening disease or condition and preliminary clinical evidence indicates that the product candidate may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. Breakthrough Therapy designation provides all the features of Fast Track designation in addition to intensive guidance on an efficient development program beginning as early as Phase 1, and FDA organizational commitment to expedited development, including involvement of senior managers and experienced review staff in a cross-disciplinary review, where appropriate.

Any product candidate submitted to the FDA for approval, including a product candidate with Fast Track or Breakthrough Therapy designation, may also be eligible for additional FDA programs intended to expedite the review process, including Priority Review designation and Accelerated Approval. A BLA is eligible for Priority Review if the product candidate is designed to treat a serious or life-threatening disease or condition, and if approved, would provide a significant improvement in safety or effectiveness in the treatment, diagnosis or prevention of a serious disease or condition.

Additionally, product candidates studied for their safety and effectiveness in treating serious or life-threatening diseases or conditions may receive Accelerated Approval if they can be shown to have an effect on a surrogate endpoint that is reasonably likely to predict clinical benefit, or an effect on a clinical endpoint that can be measured earlier than an effect on irreversible morbidity or mortality which 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. As a condition of accelerated approval, the FDA will generally require the sponsor to perform adequate and well-controlled post-marketing clinical studies to verify and describe the anticipated effect on irreversible morbidity or mortality or other clinical benefit. Products receiving accelerated approval may be subject to expedited withdrawal procedures if the sponsor fails to conduct the required post-marketing studies or if such studies fail to verify the predicted clinical benefit. In addition, the FDA currently requires as a condition for accelerated approval pre-approval of promotional materials, which could adversely impact the timing of the commercial launch of the product.

Fast Track designation, Breakthrough Therapy designation, Priority Review designation and Accelerated Approval do not change the standards for approval but may expedite the development or review process. Even if a product qualifies for one or more of these programs, the FDA may later decide that the product no longer meets the conditions for qualification or decide that the time period for FDA review or approval will not be shortened.

Orphan Drug Designation and Exclusivity

Under the Orphan Drug Act, the FDA may grant orphan designation to a drug or biologic intended to treat a rare disease or condition, defined as a disease or condition with a patient population of fewer than 200,000 individuals in the United States, or a patient population greater than 200,000 individuals in the United States and when there is no reasonable expectation that the cost of developing and making available the drug or biologic in the United States will be recovered from sales in the United States for that drug or biologic. Orphan drug designation must be requested before submitting a BLA. After the FDA grants orphan drug designation, the generic identity of the therapeutic agent and its potential orphan use are disclosed publicly by the FDA.

If a product candidate that has orphan drug designation subsequently receives the first FDA approval for a particular active ingredient for the disease for which it has such designation, the product is entitled to orphan product exclusivity, which means that the FDA may not approve any other applications, including a full BLA, to market the same biologic for the same disease or condition for seven years, except in limited circumstances, such as a showing of clinical superiority to the product with orphan drug exclusivity or if the FDA finds that the holder of the orphan drug exclusivity has not shown that it can assure the availability of sufficient quantities of the orphan drug to meet the needs of patients with the disease or condition for which the drug was designated. Orphan drug exclusivity does not prevent the FDA from approving a different drug or biologic for the same disease or condition, or the same drug or biologic for a different disease or condition. Among the other benefits of orphan drug designation are tax credits for certain research and a waiver of the BLA application user fee.

A designated orphan drug many not receive orphan drug exclusivity if it is approved for a use that is broader than the disease or condition for which it received orphan designation. In addition, orphan drug exclusive marketing rights in the United States may be lost if the FDA later determines that the request for designation was materially defective or, as noted above, if a second applicant demonstrates that its product is clinically superior to the approved product with orphan exclusivity or the manufacturer of the approved product is unable to assure sufficient quantities of the product to meet the needs of patients with the rare disease or condition.

Emergency Use Authorization

The Commissioner of the FDA, under delegated authority from the Secretary of HHS may, under certain circumstances in connection with a declared public health emergency, allow for the marketing of a product that does not otherwise comply with FDA regulations by issuing an EUA for such product. Before an EUA may be issued by HHS, the Secretary must declare an emergency based a determination that public health emergency exists that effects or has the significant potential to affect, national security, and that involves a specified biological, chemical, radiological, or nuclear agent or agents (“CBRN”), or a specified disease or condition that may be attributable to such CBRN. On February 4, 2020, the HHS Secretary determined that there is such a public health emergency that involves the virus now known as SARS-CoV-2, the virus that causes the COVID-19 infection. Once the determination of the threat or emergency has been made, the Secretary of HHS must then declare that an emergency exists justifying the issuance of EUAs for certain types of products (referred to as EUA declarations). On March 27, 2020, the Secretary of HHS declared – on the basis of his determination of a public health emergency that has the potential to affect national security or the health and security of U.S. citizens living abroad that involves SARS-CoV-2 – that circumstances exist justifying authorization of drugs and biologics during the COVID-19 pandemic, subject to the terms of any EUA that is issued.

Once an EUA declaration has been issued, the FDA can issue EUAs for products that fall within the scope of that declaration. To issue an EUA, the FDA Commissioner must conclude that (1) the CBRN that is referred to in the EUA declaration can cause serious or life-threatening diseases or conditions; (2) based on the totality of scientific evidence available, it is reasonable to believe that the product may be effective in diagnosing, treating, or preventing the disease or condition attributable to the CBRN and that the product’s known and potential benefits outweigh its known and potential risks; and (3) there is no adequate, approved, and available alternative to the product. Products subject to an EUA must still comply with the conditions of the EUA, including labeling and marketing requirements. Moreover, the authorization to market products under an EUA is limited to the period of time the EUA declaration is in effect, and the FDA can revoke an EUA in certain circumstances.

Rare Pediatric Disease Priority Review Voucher Program

In 2012, Congress authorized the FDA to award priority review vouchers to sponsors of certain rare pediatric disease product applications. This program is designed to encourage development of new drug and biological products for prevention and treatment of certain rare pediatric diseases. Specifically, under this program, a sponsor who receives an approval for a drug or biologic for a "rare pediatric disease" may qualify for a voucher that can be redeemed to receive a priority review of a subsequent marketing application for a different product. The sponsor of a rare pediatric disease drug product receiving a priority review voucher may transfer (including by sale) the voucher to another sponsor. The voucher may be further transferred any number of times before the voucher is used, as long as the sponsor making the transfer has not yet submitted the application. The FDA may also revoke any priority review voucher if the rare pediatric disease drug for which the voucher was awarded is not marketed in the U.S. within one year following the date of approval.

For purposes of this program, a "rare pediatric disease" is a (a) serious or life-threatening disease in which the serious or life-threatening manifestations primarily affect individuals aged from birth to 18 years, including age groups often called neonates, infants, children, and adolescents; and (b) rare diseases or conditions within the meaning of the Orphan Drug Act. On December 27, 2020, the Rare Pediatric Disease Priority Review Voucher Program was extended. Under the current statutory sunset provisions, after September 30, 2024, FDA may only award a voucher for an approved rare pediatric disease product application if the sponsor has rare pediatric disease designation for the drug, and that designation was granted by September 30, 2024. After September 30, 2026, FDA may not award any Rare Pediatric Disease Priority Review Voucher.

Post-Approval Requirements

Licensed biologics that are manufactured and distributed in the United States are subject to pervasive and continuing regulation by the FDA, including, among other things, requirements relating to recordkeeping, periodic reporting, product distribution, advertising and promotion and reporting of adverse experiences with the product. There is also a continuing, annual prescription drug program user fee.

Any biologics manufactured or distributed pursuant to FDA approvals remain subject to ongoing regulation by the FDA. Manufacturers and their subcontractors are required to register their establishments with the FDA and certain state agencies, and are subject to periodic unannounced inspections by the FDA and certain state agencies for compliance with ongoing regulatory requirements, including cGMP, which impose extensive procedural and documentation requirements. Failure to comply with statutory and regulatory requirements can subject a manufacturer to possible legal or regulatory action, such as warning letters, suspension of manufacturing, product seizures, injunctions, civil penalties or criminal prosecution.

Later discovery of previously unknown problems with a product, including adverse events of unanticipated severity or frequency, or with manufacturing processes, or failure to comply with regulatory requirements, may result in revisions to the approved labeling to add new safety information, requirements for post-market studies or clinical trials to assess new safety risks, imposition of distribution or other restrictions under a REMS. Other potential consequences include, among other things:

- restrictions on the marketing or manufacturing of the product, complete withdrawal of the product from the market or product recalls;
- fines, warning letters, untitled letters, or holds on post-approval clinical trials;
- refusal of the FDA to approve applications or supplements to approved applications, or suspension or revocation of product approvals;
- product seizure or detention, or refusal to permit the import or export of products;
- mandated modification of promotional materials and labeling and the issuance of corrective information;
- the issuance of safety alerts, Dear Healthcare Provider letters, press releases and other communications containing warnings or other safety information about the product; or
- injunctions or the imposition of civil or criminal penalties.

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 and social media. A company can make only those claims relating to safety and efficacy that are approved by the FDA. Physicians may prescribe legally available biologics for uses that are not described in the product's labeling and that differ from those tested by us and approved by the FDA. Such off-label uses are common across medical specialties. Physicians may believe that such off-label uses are the best treatment for many patients in varied circumstances.

The FDA does not regulate the behavior of physicians in their choice of treatments. The FDA does, however, impose stringent restrictions on manufacturers' communications regarding off-label use. Failure to comply with these requirements can result in adverse publicity, warning letters, corrective advertising and potential civil and criminal penalties.

Biosimilars and Regulatory Exclusivity

As part of the Patient Protection and Affordable Care Act enacted in 2010, as amended by the Health Care and Education Reconciliation Act of 2010, the Biologics Price Competition and Innovation Act ("BPCIA") established an abbreviated pathway for the approval of biosimilar and interchangeable biological products. The abbreviated regulatory pathway provides legal authority for the FDA to review and approve biosimilar biologics based on their similarity to an existing brand product, referred to as a reference product, including the possible designation of a biosimilar as interchangeable with a brand product.

Biosimilarity, which requires that there be no clinically meaningful differences between the biological product and the reference product in terms of safety, purity, and potency, can be shown through analytical studies, animal studies, and a clinical study or studies. Interchangeability requires that a product is biosimilar to the reference product and the product must demonstrate that it can be expected to produce the same clinical results as the reference product in any given patient and, for products that are administered multiple times to an individual, the biologic and the reference biologic may be alternated or switched after one has been previously administered without increasing safety risks or risks of diminished efficacy relative to exclusive use of the reference biologic.

Under the BPCIA, the approval of a biosimilar product may not be made effective by the FDA until 12 years from the date on which the reference product was first licensed by the FDA. In addition, the licensure of a biosimilar product may not be made effective by the FDA until 12 years from the date on which the reference product was first licensed. During this 12-year period of exclusivity, another company may still market a competing version of the reference product if the FDA approves a full BLA for the competing product containing that applicant's own preclinical data and data from adequate and well-controlled clinical trials to demonstrate the safety, purity and potency of its product. The BPCIA also created certain exclusivity periods for biosimilars approved as interchangeable products. At this juncture, it is unclear whether products deemed "interchangeable" by the FDA will, in fact, be readily substituted by pharmacies, which are governed by state pharmacy law. In addition, the period of exclusivity provided by the BPCIA only operates against third parties seeking approval via the abbreviated pathway, but would not prevent third parties from pursuing approval via the traditional BLA approval pathway.

In addition, a biological product can also obtain pediatric market exclusivity in the United States. Pediatric exclusivity, if granted, adds six months to existing exclusivity periods and patent terms. This six-month exclusivity, which runs from the end of other exclusivity protection or patent term, may be granted based on the voluntary completion of a pediatric study in accordance with an FDA-issued "Written Request" for such a study.

Other Healthcare Laws

Pharmaceutical companies are subject to additional healthcare regulation and enforcement by the federal government and by authorities in the states and foreign jurisdictions in which they conduct their business and may constrain the financial arrangements and relationships through which we and our partners research, sell, market and distribute any products for which we obtain marketing approval. Such laws include, without limitation, state and federal anti-kickback, fraud and abuse, false claims and transparency laws regarding drug pricing and payments and other transfer of value to physicians and other healthcare providers. If their operations are found to be in violation of any of such laws or any other governmental regulations that apply, they may be subject to penalties, including, without limitation, administrative, civil and criminal penalties, damages, fines, disgorgement, the curtailment or restructuring of operations, integrity oversight and reporting obligations, exclusion from participation in federal and state healthcare programs and individual imprisonment.

Coverage and Reimbursement

Sales of any product 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 for such product by third-party payors. Decisions regarding the extent of coverage and amount of reimbursement to be provided are made on a plan-by-plan basis. These third-party payors are increasingly reducing reimbursements for medical products, drugs and services. 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. 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. Decreases in third-party reimbursement for any product or a decision by a third-party payor not to cover a product could reduce physician usage and patient demand for the product and also have a material adverse effect on sales.

Healthcare Reform

In March 2010, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act, each as amended (collectively known as the "ACA"), was enacted, which substantially changed the way healthcare is financed by both governmental and private insurers, and significantly affected the pharmaceutical industry. The ACA contained a number of provisions, including those governing enrollment in federal healthcare programs, reimbursement adjustments and changes to fraud and abuse laws. For example, the ACA:

- increased the minimum level of Medicaid rebates payable by manufacturers of brand name drugs from 15.1% to 23.1% of the average manufacturer price;
- required collection of rebates for drugs paid by Medicaid managed care organizations;
- required manufacturers to participate in a coverage gap discount program, under which they must agree to offer 70 percent point-of-sale discounts off negotiated prices of applicable brand drugs to eligible beneficiaries during their coverage gap period, as a condition for the manufacturer's outpatient drugs to be covered under Medicare Part D; and
- imposed a non-deductible annual fee on pharmaceutical manufacturers or importers who sell "branded prescription drugs" to specified federal government programs.

Since its enactment, there have been judicial and Congressional challenges to certain aspects of the ACA.

On June 17, 2021, the U.S Supreme Court dismissed the most recent judicial challenge to the ACA brought by several states without specifically ruling on the constitutionality of the ACA. Thus, the ACA will remain in effect in its current form.

Other legislative changes have been proposed and adopted since the ACA was enacted. In March 2021, the American Rescue Plan Act of 2021 was signed into law, which eliminates the statutory cap on the Medicaid drug rebate, currently set at 100% of a drug's AMP, beginning January 1, 2024. Moreover, there has recently been heightened governmental scrutiny over the manner in which manufacturers set prices for their marketed products, which has resulted in several Congressional inquiries, proposed and enacted legislation and executive orders issued by the President designed to, among other things, bring more transparency to product pricing, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drug products. Most recently, the Inflation Reduction Act of 2022, or IRA, included a number of significant drug pricing reforms, which include the establishment of a drug price negotiation program within the U.S. Department of Health and Human Services, or HHS (beginning in 2026) that requires manufacturers to charge a negotiated "maximum fair price" for certain selected drugs or pay an excise tax for noncompliance, the establishment of rebate payment requirements on manufacturers under Medicare Parts B and D to penalize price increases that outpace inflation (first due in 2023), and a redesign of the Part D benefit, as part of which manufacturers are required to provide discounts on Part D drugs (beginning in 2025). The IRA permits the HHS Secretary to implement many of these provisions through guidance, as opposed to regulation, for the initial years. Additional drug pricing proposals could appear in future legislation. Individual states in the United States have also become increasingly active in implementing regulations designed to control pharmaceutical product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation from other countries and bulk purchasing.

Data Privacy and Security Laws

Numerous state, federal and foreign laws, including consumer protection laws and regulations, 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 data breach notification laws, health information privacy and security laws, and federal and state consumer protection laws and regulations (e.g., Section 5 of the Federal Trade Commission Act) 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. In addition, certain foreign laws govern the privacy and security of personal data, including health-related data. Failure to comply with these laws, were applicable, can result in the imposition of significant civil and /or criminal penalties and private litigation. Privacy and security laws, regulations, and other obligations are constantly evolving, may conflict with each other to make compliance efforts more challenging, and can result in investigations, proceedings, or actions that lead to significant penalties and restrictions on data processing.

Cybersecurity

In the normal course of business, we may collect and store personal information and other sensitive information, including proprietary and confidential business information, trade secrets, intellectual property, information regarding trial participants in connection with clinical trials, sensitive third-party information and employee information. To protect this information, our existing cybersecurity policies require continuous monitoring and detection programs, network security precautions, and in depth security assessment of technology vendors. We maintain various protections designed to safeguard against cyberattacks, including firewalls and virus detection software. We have established and regularly test our disaster recovery plan and we protect against business interruption by backing up our major systems. In addition, we periodically scan our environment for any vulnerabilities, perform penetration testing and engage third parties to assess effectiveness of our data security practices. A third party security consultant conducts regular network security reviews, scans and audits. In addition, we maintain insurance that includes cybersecurity coverage.

The program incorporates industry-standard frameworks, policies and practices designed to protect the privacy and security of our sensitive information.

Despite the implementation of our cybersecurity program, our security measures cannot guarantee that a significant cyberattack will not occur. A successful attack on our information technology systems could have significant consequences to the business. While we devote resources to our security measures to protect our systems and information, these measures cannot provide absolute security. See “Risk Factors – General Risk Factors” for additional information about the risks to our business associated with a breach or compromise to our information technology systems.

HUMAN CAPITAL RESOURCES

As of December 31, 2022, we had 248 full-time employees and part-time employees worldwide. Of these employees, 139 were engaged in research and development, 39 were engaged in operations and quality control and 70 were engaged in selling, general and administrative activities. None of our employees is represented by a labor union. Supported by our annual employee survey, we believe our relationship with our employees to be generally good. Our scientists, bioinformatics experts and other professionals work collaboratively as interdisciplinary teams to unlock and advance technological innovation.

Compensation, benefits and development

Our goal is to attract, motivate and retain talent with a focus on encouraging performance, promoting accountability and adhering to our company values. We offer competitive compensation and benefit programs including a company-matched 401(k) Plan, stock options for eligible employees, health savings and flexible spending accounts, paid time off, education and training programs, and employee assistance programs. We believe it is important to help build community and enabling our employees actively participate in community service projects and in company-sponsored philanthropic activities.

Diversity, inclusion and belonging

We are committed to our continued efforts to increase diversity and foster an inclusive work environment that supports the global workforce and the communities we serve. We recruit the best people for the job regardless of gender, ethnicity or other protected traits and it is our policy to fully comply with all laws applicable to discrimination in the workplace. Our diversity, equity and inclusion principles are also reflected in our employee training and policies. We continue to enhance our diversity, equity and inclusion policies which are guided by our executive leadership team.

Health and safety

We are committed to maintain a safe and healthy workplace for our employees. Our policies and practices are intended to protect our employees and surrounding communities in which we operate.

In 2020, in response to the COVID-19 pandemic, we implemented safety protocols and new procedures to protect our employees. These protocols include complying with social distancing and other health and safety standards as required by state and local government agencies, taking into consideration guidelines of the Centers for Disease Control and Prevention and other public health authorities. In addition, we modified the way we conduct many aspects of our business including the practice of social distancing, wearing face coverings mandated by state and local regulations, and maintaining a quarantine for employees determined to be in close contact with a COVID-19 case. For example, we implemented day-time shift hours in our R&D and manufacturing at our Redwood City pilot plant to minimize the number of employees in close proximity to each other and we have significantly expanded the use of virtual interaction whenever possible in our business. For a detailed discussion of the impact of the COVID-19 pandemic on our human capital resources, see “Risk Factors" Item 1A of this Form 10-K.

We previously launched the Employee-Requested Work from Home Policy in late 2020. This policy establishes the process and criteria to enable Redwood City employees to request permission to work from home on a regular basis.

CORPORATE & AVAILABLE INFORMATION

We were incorporated in Delaware in January 2002 as a wholly-owned subsidiary of Maxygen, Inc. We commenced independent operations in March 2002, after licensing core enabling technology from Maxygen, Inc. Our principal corporate offices are located at 200 Penobscot Drive, Redwood City, California 94063 and our telephone number is (650) 421-8100. Our internet address is www.codexis.com. The information on, or that can be accessed through, our website is not incorporated by reference into this Annual Report on Form 10-K or any other filings we make with the U.S. Securities and Exchange Commission (the "SEC").

We make available on or through our website certain reports and amendments to those reports that we file with, or furnish to, the SEC in accordance with the Exchange Act. These include our Annual Reports on Form 10-K, our Quarterly Reports on Form 10-Q and our Current Reports on Form 8-K, and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act. We make this information available on or through our website free of charge as soon as reasonably practicable after we electronically file the information with, or furnish it to, the SEC. Copies of this information may be obtained at the SEC website at www.sec.gov. The contents of these websites are not incorporated into this filing. Further, the references to website URLs are intended to be inactive textual references only.

ITEM 1A. RISK FACTORS

You should carefully consider the risks described below together with the other information set forth in this Annual Report on Form 10-K, which could materially affect our business, financial condition or future results. The risks described below are not the only risks facing our company. Risks and uncertainties not currently known to us or that we currently deem to be immaterial also may materially adversely affect our business, financial condition and/or operating results.

RISK FACTORS SUMMARY

The following is a summary of the principal factors that cause an investment in the company to be speculative or risky:

- We have a history of net losses and we may not achieve or maintain profitability.
- We are dependent on our collaborators, and our failure to successfully manage these relationships could prevent us from developing and commercializing many of our products.
- Our biotherapeutic programs are early stage, highly regulated and expensive.
- If either Nestlé Health Science or Takeda terminate their development programs under their respective license agreements with us, any potential revenue from those license agreements will be significantly reduced or non-existent.
- We may need additional capital in the future in order to expand our business.
- We are dependent on a limited number of customers.
- Our product supply agreements with customers have finite duration and may not be extended or renewed.
- With respect to customers purchasing our products for the manufacture of API, the termination or expiration of such patent protection may materially and adversely affect our revenues, financial condition or results of operations.
- We are dependent on a limited number of contract manufacturers for large scale production of substantially all of our enzymes, including CDX-616.
- If we are unable to develop and commercialize new products for the target markets, our business and prospects will be harmed.
- Competitors and potential competitors who have greater resources and experience than we do may develop products and technologies that make ours obsolete.
- The ongoing COVID-19 pandemic has adversely affected and may continue in the future to, directly or indirectly, adversely affect our business, results of operations and financial condition.
- Revenues in in future years from our sales of CDX-616 to Pfizer are subject to a number of factors which are outside of our control and may not materialize.
- We have investments in non-marketable securities, which may subject us to significant impairment charges.
- Ethical, legal and social concerns about genetically engineered products and processes could limit or prevent the use of our products, processes, and technologies and limit our revenues.
- We use hazardous materials in our business and we must comply with environmental laws and regulations.
- Our ability to use our net operating loss carryforwards to offset future taxable income may be subject to certain limitations.
- As a public reporting company, we are subject to rules and regulations established from time to time by the SEC and Nasdaq regarding our internal controls over financial reporting. We may not complete needed improvements to our internal controls over financial reporting in a timely manner, or these internal controls may not be determined to be effective, which may adversely affect investor confidence in our company and, as a result, the value of our common stock and your investment.
- If we engage in any acquisitions, we will incur a variety of costs and may potentially face numerous risks that could adversely affect our business and operations.
- We or our customers may not be able to obtain regulatory approval for the use of our products in food and food ingredients, if required.
- Our ongoing efforts to deploy our technology in the life science tools market may fail.
- The regulatory approval processes of the FDA and comparable foreign authorities are lengthy, time consuming and inherently unpredictable, and we may be unable to obtain regulatory approval for our product candidates.
- Clinical trials are difficult to design and implement, expensive, time-consuming and involve an uncertain outcome.
- Results of preclinical studies and early clinical trials of product candidates may not be predictive of results of later studies or trials.
- We may not be able to maintain orphan drug designations for certain of our product candidates, and may be unable to maintain the benefits associated with orphan drug designation, including the potential for market exclusivity.

- We have obtained rare pediatric disease designation for CDX-6512 and CDX-6210, however, there is no guarantee that such designation will result in approval of CDX-6512 or CDX-6210, and even if we obtain approval of CDX-6512 or CDX-6210 for the indication for which we have been awarded rare pediatric disease designation, there is no guarantee that such approval will result in an aware of a rare pediatric disease priority review voucher.
- Disruptions at the FDA and other government agencies caused by funding shortages or global health concerns could hinder their ability to hire, retain, or deploy key leadership and other personnel, or otherwise prevent new or modified products from being developed, approved, or commercialized in a timely manner, or at all, which could negatively impact our business.
- Even if we obtain regulatory approval for any products that we develop alone or with collaborators, such products will remain subject to ongoing regulatory requirements.
- Our business operations and future relationships with investigators, healthcare professionals, consultants, third-party payors, patient organizations and customers will be subject to applicable healthcare regulatory laws, which could expose us to penalties.
- The successful commercialization of product candidates developed by us or our partners will depend in part on the extent to which governmental authorities and health insurers establish adequate coverage, reimbursement levels and pricing policies.
- Recently enacted legislation, future legislation and healthcare reform measures may increase the difficulty and cost for our partners to obtain marketing approval for and commercialize product candidates developed by us.
- Compliance with European Union chemical regulations could be costly and adversely affect our business and results of operations.
- We rely on third parties to conduct our clinical trials and perform some of our research and preclinical studies, which if not satisfactorily carried out or fail to meet expected deadlines, may have an adverse effect on our business and prospects.
- We contract with third parties for the manufacturing and supply of product candidates, which supply may become limited or interrupted or may not be of satisfactory quality and quantity.
- Our efforts to prosecute, maintain, protect and/or defend our intellectual property rights may not be successful.
- Our ability to compete may decline if we do not adequately prosecute, maintain, protect and/or defend our proprietary technology, products or services or our intellectual property rights.
- Third parties may claim that we are infringing, violating or misappropriating their intellectual property rights, which may subject us to costly and time-consuming litigation and prevent us from developing or commercializing our technology, products or services.
- We may be involved in lawsuits to protect or enforce our intellectual property rights, which could be expensive, time-consuming and unsuccessful.
- We may not be able to enforce our intellectual property rights throughout the world.
- If our biocatalysts are stolen, misappropriated or reverse engineered, others could use these biocatalysts to produce competing products.
- Confidentiality and non-use agreements with employees, consultants, advisors, and other third parties may not adequately prevent disclosures and non-use of trade secrets and other proprietary information.
- We are subject to anti-takeover provisions in our certificate of incorporation and bylaws and under Delaware law that could delay or prevent an acquisition of our company.
- Our quarterly or annual operating results may fluctuate in the future.
- We do not intend to pay cash dividends for the foreseeable future.
- If securities or industry analysts do not publish research or reports about our business, or publish negative reports about our business, our stock price and trading volume could decline.
- We face risks associated with our international business.
- Market and economic conditions may negatively impact our business, financial condition, and share price.
- Business interruptions resulting from disasters or other disturbances could delay us in the process of developing our products and could disrupt our sales.
- We are dependent on information technology systems, infrastructure and data, and any failure of these systems could harm our business.
- Actual or perceived failures to comply with applicable data protection, privacy and security laws, regulations, standards and other requirements could adversely affect our business, results of operations and financial condition.
- Evolving expectations around environmental, social and governance matters may expose us to reputational and other risks.

Risks Relating to Our Business and Strategy

We have a history of net losses and we may not achieve or maintain profitability.

We have incurred net losses since our inception, including losses of $33.6 million in 2022, $21.3 million in 2021 and $24.0 million in 2020. As of December 31, 2022 and 2021, we had an accumulated deficit of $421.3 million and $387.7 million, respectively. If we are unable to expand our business, through new or expanded collaborations, development of new products or services, or increased sales of existing products and services, our net losses may increase and we may never achieve profitability. In addition, some of our collaboration agreements, including our collaboration with Nestlé Health Science and Takeda, and our performance enzyme agreements, including the agreements with GSK, Merck and Novartis, provide for milestone payments, usage payments, and/or future royalty payments, which we will only receive if we and our collaborators develop and commercialize products. We also may fund development of additional proprietary performance enzymes and/or biotherapeutic products. There can be no assurance that any of these products will become commercially viable or that we will ever achieve profitability on a quarterly or annual basis. If we fail to achieve profitability, or if the time required to achieve profitability is longer than we anticipate, we may not be able to continue our business. Even if we do achieve profitability, we may not be able to sustain or increase profitability on a quarterly or annual basis.

We are dependent on our collaborators, and our failure to successfully manage these relationships could prevent us from developing and commercializing many of our products and achieving or sustaining profitability, and could lead to disagreements with our current or former collaborators.

Our ability to maintain and manage collaborations in our markets is fundamental to the success of our business. We currently have license agreements, research and development agreements, supply agreements and/or distribution agreements with various collaborators. For example, we have ongoing collaborations and agreements with GSK, Merck, Novartis, Nestlé Health Science and Takeda that are important to our business and financial results. We may have limited or no control over the amount or timing of resources that any collaborator is able or willing to devote to our partnered products or collaborative efforts. Any of our collaborators may fail to perform its obligations. These collaborators may breach or terminate their agreements with us or otherwise fail to conduct their collaborative activities successfully and in a timely manner. Further, our collaborators may not develop products arising out of our collaborative arrangements or devote sufficient resources to the development, manufacture, marketing or sale of these products. Moreover, disagreements with a collaborator could develop, and any conflict with a collaborator could lead to litigation and could reduce our ability to enter into future collaboration agreements and negatively impact our relationships with one or more existing collaborators. If any of these events occur, especially if they occur in our collaborations with GSK, Merck, Novartis, Nestlé Health Science or Takeda, or if we fail to maintain our agreements with our collaborators, we may not be able to commercialize our existing and potential products or grow our business or generate sufficient revenues to support our operations, we may not receive contemplated milestone payments and royalties under the collaboration, and we may be involved in litigation. Our collaboration opportunities could be harmed and our financial condition and results of operations could be negatively affected if:

- we do not achieve our research and development objectives under our collaboration agreements in a timely manner or at all;
- we develop products and processes or enter into additional collaborations that conflict with the business objectives of our other collaborators;
- we, our collaborators and/or our contract manufacturers do not receive the required regulatory and other approvals necessary for the commercialization of the applicable product;
- we disagree with our collaborators as to rights to intellectual property that are developed during the collaboration, or their research programs or commercialization activities;
- we are unable to manage multiple simultaneous collaborations;
- our collaborators or licensees are unable or unwilling to implement or use the technology or products that we provide or license to them;
- our collaborators become competitors of ours or enter into agreements with our competitors;
- our collaborators become unable or less willing to expend their resources on research and development or commercialization efforts due to general market conditions, their financial condition or other circumstances beyond our control; or
- our collaborators experience business difficulties, which could eliminate or impair their ability to effectively perform under our agreements.

Even after collaboration relationships expire or terminate, some elements of the collaboration may survive. For instance, certain rights, licenses and obligations of each party with respect to intellectual property and program materials may survive the expiration or termination of the collaboration. Disagreements or conflicts between and among the parties could develop even though the collaboration has ended. These disagreements or conflicts could result in expensive arbitration or litigation, which may not be resolved in our favor.

Finally, our business could be negatively affected if any of our collaborators or suppliers undergoes a change of control or were to otherwise assign the rights or obligations under any of our agreements.

Our biotherapeutic programs are early stage, highly regulated and expensive. Our ability to obtain additional development partners or additional funding for the programs, to advance our product candidates to clinical trials and to ultimately receive regulatory approvals is highly uncertain.

We are developing and have developed novel biotherapeutic candidates, including CDX-6114, the novel oral enzyme product candidate for the treatment of PKU that we licensed to Nestlé Health Science. We are also developing protein sequences for use in gene therapy products for Fabry Disease, Pompe Disease, an undisclosed blood factor deficiency and a certain undisclosed rare genetic disorder for Takeda. The successful development of biotherapeutic candidates involves many risks and uncertainties, requires long timelines and may lead to uncertain results. In addition, drug development is highly regulated and requires areas of expertise and capital resources we do not currently possess. In order to market a biologic product in the United States, we or our collaborators must undergo the following process required by the FDA:

- completion of extensive preclinical laboratory tests and preclinical animal studies, all performed in accordance with GLP requirements;
- submission to the FDA of an IND, which must become effective before human clinical studies may begin in the United States;
- approval by an independent IRB representing each clinical site before the clinical study may be initiated at the site;
- performance of adequate and well-controlled human clinical studies (generally divided into three phases) in accordance with GCP requirements to establish the safety, purity and potency (or efficacy) of the product candidate for each proposed indication;
- preparation of and submission to the FDA of a BLA after completion of all clinical studies;
- potential review of the product candidate by an FDA advisory committee;
- satisfactory completion of an FDA pre-approval inspection of the manufacturing facilities where the product candidate is produced to assess compliance with cGMP requirements; and
- FDA review and approval of a BLA prior to any commercial marketing or sale of the product in the United States.

If we fail to comply with applicable FDA or other regulatory requirements at any time during the drug development process, clinical testing, the approval process or after approval, we may become subject to administrative or judicial penalties, including the FDA's refusal to approve a pending application, withdrawal of an approval, warning letters, product recalls and additional enforcement actions.

Our efforts to advance our biotherapeutic candidates that we develop are subject to numerous risks, including the following:

- The regulatory approval processes of the FDA and comparable foreign authorities are lengthy, time consuming and the results are inherently unpredictable. If we are ultimately unable to obtain regulatory approval for biotherapeutic product candidates, our business will be harmed. To obtain regulatory approval to market any product candidate, preclinical studies and costly and lengthy clinical trials are required, and the results of the studies and trials are highly uncertain. A failure of one or more preclinical or clinical trials can occur at any stage, and many companies that have believed their drug candidates performed satisfactorily in preclinical and clinical testing have nonetheless failed to obtain marketing approval of their product candidates.
- We may find it difficult to enroll patients in our clinical trials for product candidates. Any enrollment difficulties could delay clinical trials and any potential product approval.

- We may experience difficulty or delay in obtaining the FDA's acceptance of an IND for product candidates we may seek to enter into clinical development, which would delay initiation of Phase 1 clinical testing. Delays in the commencement or completion of clinical testing could significantly affect our product development costs or the product development costs of our present and any future collaborators. We do not know whether planned clinical trials will begin on time or be completed on schedule, if at all. The commencement and completion of clinical trials can be delayed for a number of reasons. For example, a clinical trial may be suspended or terminated by us, by the IRB of the institution in which such trial is being conducted, or by the FDA due to a number of factors, including unforeseen safety issues, changes in governmental regulations or lack of adequate funding to continue the clinical trial.
- We have limited experience in drug development or regulatory matters related to drug development. As a result, we rely or will rely on third parties to conduct our preclinical and clinical studies, assist us with drug manufacturing and formulation and perform other tasks for us. If these third parties do not successfully carry out their responsibilities or comply with regulatory requirements, we may receive lower quality products or services, suffer reputational harm and not be able to obtain regulatory approval for product candidates.
- Our efforts to use CodeEvolver® protein engineering technology platform to generate new lead biotherapeutic candidates, whether under our collaborations with Nestlé Health Science, Takeda or otherwise, may not be successful in creating candidates of value.
- We will be exposed to potential product liability risks through the testing of experimental therapeutics in humans, which may expose us to substantial uninsured liabilities.
- Third parties may develop intellectual property that could limit our ability to develop, market and commercialize product candidates.
- Changes in methods of treatment of disease, such as gene therapy, could cause us to stop development of our product candidates or reduce or eliminate potential demand for CDX-6114, if approved, or any other product candidates that we may develop in the future.

If either Nestlé Health Science or Takeda terminate their development programs under their respective license agreements with us, any potential revenue from those license agreements will be significantly reduced or non-existent, and our results of operations and financial condition will be materially and adversely affected.

We have invested significant time and financial resources in the development of CDX-6114 and other product candidates for the treatment of hyperphenylalaninemia now included in the Nestlé License Agreement as well as in the development of candidates for the treatment of Fabry disease and Pompe disease which are now included in the Takeda Agreement.

Under the Nestlé License Agreement, we are eligible to receive payments from Nestlé Health Science that include (i) development and approval milestones of up to $85.0 million, (ii) sales-based milestones of up to $250.0 million in the aggregate, which aggregate amount is achievable if net sales exceed $1.0 billion in a single year, and (iii) tiered royalties, at percentages ranging from the mid-single digits to low double-digits, of net sales of product. Under the Takeda Agreement, we are eligible to earn potential payments that include (i) reimbursement of research and development fees and preclinical development milestone payments for the three initial programs of $10.5 million, in aggregate, and $3.4 million for the fourth program, (ii) clinical development and commercialization-based milestone, per target gene, of up to $104.0 million, and (iii) tiered royalty payments based on net sales of applicable products at percentages ranging from the mid-single digits to low single-digits. While we have received milestone payments under the Nestlé License Agreement to date there is no guarantee that we will receive further milestone payments under the Nestlé Agreement or Takeda Agreement in the future.

Under the Nestle Agreement and the Takeda Agreement, either Nestlé Health Science and Takeda, as applicable, may each terminate the entire agreement or specified programs thereunder at will under certain circumstances as described in more detail under "Item 1. Business--Our Market Opportunities--Pharmaceutical Market--Our Solutions for the Pharmaceutical Market--Biotherapeutic Product Discovery and Development" in this Annual Report on Form 10-K.

If Nestlé Health Science terminates its rights and obligations with respect to the Nestlé License Agreement and/or Takeda terminates its rights and obligations with respect to the Takeda Agreement, then depending on the timing of such event:

- the development of our product candidates subject to the respective agreements may be terminated or significantly delayed;
- our cash expenditures could increase significantly if it is necessary for us to hire additional employees and allocate scarce resources to the development and commercialization of product candidates;

- we would bear all of the risks and costs related to the further development and commercialization of product candidates that were previously the subject of the respective agreements, including the reimbursement of third parties; and
- in order to fund further development and commercialization of new product candidates or programs, we may need to seek out and establish alternative collaboration arrangements with third-party partners; this may not be possible, or we may not be able to do so on terms which are acceptable to us, in which case it may be necessary for us to limit the size or scope of one or more of our programs or increase our expenditures and seek additional funding by other means.

We may need additional capital in the future in order to expand our business.

Our future capital requirements may be substantial, particularly as we continue to develop our business. Although we believe that, based on our current level of operations, our existing cash, cash equivalents and equity securities will provide adequate funds for ongoing operations, planned capital expenditures and working capital requirements for at least the next 12 months, we may need additional capital if our current plans and assumptions change. Our need for additional capital will depend on many factors, including the financial success of our performance enzyme business, our spending to develop and commercialize new and existing products and the amount of collaboration funding we may receive to help cover the cost of such expenditures, the effect of any acquisitions of other businesses, technologies or facilities that we may make or develop in the future, our spending on new market opportunities, including opportunities in the biotherapeutics markets, and the filing, prosecution, enforcement and defense of patent claims. If our capital resources are insufficient to meet our capital requirements, and we are unable to enter into or maintain collaborations with partners that are able or willing to fund our development efforts or commercialize any products that we develop or enable, we will have to raise additional funds to continue the development of our technology and products and complete the commercialization of products, if any, resulting from our technologies.

In addition, we may choose to raise additional capital due to market conditions or strategic considerations, such as funding investments in our biotherapeutics business, even if we believe we have sufficient funds for our current or future operating plans. We may seek to obtain such additional capital through equity offerings, debt financings, credit facilities and/or strategic collaborations. If future financings involve the issuance of equity securities, our existing stockholders would suffer dilution. If we raise debt financing or enter into credit facilities, we may be subject to restrictive covenants that limit our ability to conduct our business. Strategic collaborations may also place restrictions on our business. We may not be able to raise sufficient additional funds on terms that are favorable to us, if at all. If we fail to raise sufficient funds and fail to generate sufficient revenues to achieve planned gross margins and to control operating costs, our ability to fund our operations, take advantage of strategic opportunities, develop products or technologies, or otherwise respond to competitive pressures could be significantly limited. If this happens, we may be forced to delay or terminate research or development programs or the commercialization of products resulting from our technologies, curtail or cease operations or obtain funds through collaborative and licensing arrangements that may require us to relinquish commercial rights, or grant licenses on terms that are not favorable to us. If adequate funds are not available, we will not be able to successfully execute our business plan or continue our business.

We are dependent on a limited number of customers.

Our current revenues are derived from a limited number of key customers. For the years ended December 31, 2022 and 2021, customers that each individually contributed 10% or more of our total revenue accounted for 56% and 44% of our total revenues in 2022 and 2021, respectively. We expect a limited number of customers to continue to account for a significant portion of our revenues for the foreseeable future. This customer concentration increases the risk of quarterly fluctuations in our revenues and operating results. The loss or reduction of business from one or a combination of our significant customers could, materially adversely affect our revenues, financial condition and results of operations.

Our product supply agreements with customers have finite duration, may not be extended or renewed and generally do not require the customer to purchase any particular quantity or quantities of our products.

Our product supply agreements with customers generally have a finite duration, may not be extended or renewed and generally do not require the customer to purchase any particular quantity or quantities of our products. While our products are not considered commodities and may not be easily substituted for by our customers, particularly when our products are used in the manufacture of active pharmaceutical ingredients, our customers may nevertheless terminate or fail to renew their product supply agreements with us or significantly curtail their purchases thereunder under certain circumstances. Any such termination or reduction could materially adversely affect our revenues, financial condition and results of operations. For the year ended December 31, 2022, we derived a majority of our product revenue from these product supply agreements.

With respect to customers purchasing our products for the manufacture of active pharmaceutical ingredients ("API") for which they have exclusivity due to patent protection, the termination or expiration of such patent protection and any resulting generic competition may materially and adversely affect our revenues, financial condition or results of operations.

With respect to customers purchasing our products for the manufacture of API, or lead to the manufacture of API, for which exclusivity due to patent protection has or is about to expire, we can expect that the quantity of our products sold to such customers for such products may decline as generic competition for the API increases. While we anticipate that we may, in some cases, also be able to sell products to these generic competitors for the manufacture of these APIs, or lead to the manufacture of these APIs, the overall effect on our revenues, financial condition and results of operations could be materially adverse.

We are dependent on a limited number of contract manufacturers for large scale production of substantially all of our enzymes, including CDX-616. We are working to qualify new contract manufacturers to produce certain of our enzymes, including CDX-616, however those efforts may not be successful and therefore we may experience limitations on our ability to supply our enzymes to customers.

Manufacturing of our enzymes is conducted primarily in four locations: our in-house facility in Redwood City, California, and at three third-party contract manufacturing organizations, Lactosan GmbH & Co. KG ("Lactosan"), in Kapfenberg, Austria, ACS Dobfar S.p.A. ("ACSD") (formerly known as DPhar S.p.A.), in Anagni, Italy, and Alphazyme LLC in Florida, United States. Generally, we perform smaller scale manufacturing in-house and outsource the larger scale manufacturing to these contract manufacturers. We have limited internal capacity to manufacture enzymes. As a result, we are dependent upon the performance and capacity of third-party manufacturers for the larger scale manufacturing of the enzymes used in our pharmaceutical and life sciences businesses.

Accordingly, we face risks of difficulties with, and interruptions in, performance by third party manufacturers, the occurrence of which could adversely impact the availability, launch and/or sales of our enzymes in the future. Enzyme manufacturing capacity limitations at our third-party manufacturers and manufacturing delays could negatively affect our business, reputation, results of operations and financial condition. The failure of any contract manufacturer to supply us our required volumes of enzyme on a timely basis, or to manufacture our enzymes in compliance with our specifications or applicable quality requirements or in volumes sufficient to meet demand, would adversely affect our ability to sell pharmaceutical and fine and complex chemicals products, could harm our relationships with our collaborators or customers and could negatively affect our revenues and operating results. We may be forced to secure alternative sources of supply, which may be unavailable on commercially acceptable terms, and could cause delays in our ability to deliver products to our customers, increase our costs and decrease our profit margins.

We currently have supply agreements in place with Lactosan, ACSD and Alphazyme. In the absence of a supply agreement, a contract manufacturer will be under no obligation to manufacture our enzymes and could elect to discontinue their manufacture at any time. If we require additional manufacturing capacity and are unable to obtain it in sufficient quantity, we may not be able to increase our product sales, or we may be required to make substantial capital investments to build that capacity or to contract with other manufacturers on terms that may be less favorable than the terms we currently have with our suppliers. If we choose to build our own additional manufacturing facility, it could take two years or longer before our facility is able to produce commercial volumes of our enzymes. Any resources we expend on acquiring or building internal manufacturing capabilities could be at the expense of other potentially more profitable opportunities. In addition, if we contract with other manufacturers, we may experience delays of several months in qualifying them, which could harm our relationships with our collaborators or customers and could negatively affect our revenues or operating results.

If we are unable to develop and commercialize new products for the pharmaceutical, biotherapeutics, diagnostics and life science tools markets, our business and prospects will be harmed.

We plan to launch new products for the pharmaceutical, biotherapeutics, diagnostics and other life science tools markets. These efforts are subject to numerous risks, including the following:

- customers in these markets may be reluctant to adopt new manufacturing processes that use our enzymes;
- we may be unable to successfully develop the enzymes or manufacturing processes for our products in a timely and cost-effective manner, if at all;
- we may face difficulties in transferring the developed technologies to our customers and the contract manufacturers that we may use for commercial scale production of intermediates and enzymes in these markets;

- the contract manufacturers that we may use may be unable to scale their manufacturing operations to meet the demand for these products and we may be unable to secure additional manufacturing capacity;
- customers may not be willing to purchase these products for these markets from us on favorable terms, if at all;
- we may face product liability litigation, unexpected safety or efficacy concerns and product recalls or withdrawals;
- our customers' products may experience adverse events or face competition from new products, which would reduce demand for our products;
- we may face pressure from existing or new competitive products; and
- we may face pricing pressures from existing or new competitors, some of which may benefit from government subsidies or other incentives.

Competitors and potential competitors who have greater resources and experience than we do may develop products and technologies that make ours obsolete or may use their greater resources to gain market share at our expense.

The biocatalysis industry and each of our target markets are characterized by rapid technological change. Our future success will depend on our ability to maintain a competitive position with respect to technological advances. In addition, as we enter new markets, we will face new competition and will need to adapt to competitive factors that may be different from those we face today.

We are aware that other companies, including Royal DSM, N.V. ("DSM"), BASF, Bayer and Novozymes have alternative methods for obtaining and generating genetic diversity or use mutagenesis techniques to produce genetic diversity. Academic institutions such as the California Institute of Technology, the Max Planck Institute and the Austrian Centre of Industrial Biotechnology are also working in this field. Technological development by others may result in our technology, products and services, as well as products developed by our customers using our biocatalysts, becoming obsolete.

Our primary competitors in the performance enzymes for pharmaceutical products are companies marketing either conventional, non-enzymatic processes or biocatalytic enzymes to manufacturers of pharmaceutical intermediates and APIs, and also existing in-house technologies (both biocatalysts and conventional catalysts) within our client and potential client companies. The principal methods of competition and competitive differentiation in this market are price, product quality and performance, including manufacturing yield, safety and environmental benefits, and speed of delivery of product. Pharmaceutical manufacturers that use biocatalytic processes can face increased competition from manufacturers that use more conventional processes and/or manufacturers that are based in regions (such as India and China) with lower regulatory, safety and environmental costs.

The market for the manufacture and supply of APIs and intermediates is large with many established companies. These companies include many of our large innovator and generic pharmaceutical customers, such as Merck, GSK, Novartis, Pfizer, Bristol-Myers, Kyorin, Urovant and Teva which have significant internal research and development efforts directed at developing processes to manufacture APIs and intermediates. The processes used by these companies include classical conventional organic chemistry reactions, chemo catalytic reactions, biocatalytic reactions or combinations thereof. Our biocatalytic based manufacturing processes must compete with these internally developed routes. Additionally, we also face competition from companies developing and marketing conventional catalysts such as Solvias Inc., BASF and Takasago International Corporation.

The market for supplying enzymes for use in pharmaceutical manufacturing is quite fragmented. There is competition from large industrial enzyme companies, such as Novozymes and DuPont, as well as subsidiaries of larger contract research/contract manufacturing organizations, such as DSM, Cambrex Corporation, Lonza, WuXi STA and Almac Group Ltd. Some fermentation pathway design companies, like Ginkgo Bioworks (who recently acquired Zymergen), whose traditional focus has been to design microorganisms that express small molecule chemicals, could extend into designing organisms that express enzymes. There is also competition in the enzyme customization and optimization area from several smaller companies, such as BRAIN AG, Arzeda, c-LEcta GmbH and Evocatal GmbH.

We entered the fine chemicals market in 2013, by applying our protein engineering technology in the food market. We face similar forms of competition in this market as in the pharmaceutical markets with the exception that the risk of losing opportunities to larger competitors in fine chemicals is greater given the larger scale of opportunities available in the fine chemicals market compared to the pharmaceutical market. Our significant competitors in the fine chemicals markets include companies that have been in these marketplaces for many years, such as DuPont Industrial Biosciences ("DuPont Genencor"), DSM, Novozymes and A.B. Enzymes. These companies have greater resources in these markets than we do and have long-term supply arrangements already in place with customers. Our ability to compete in these markets may be limited by our relatively late entrance. We also face competition in both the fine chemicals and pharmaceutical markets from emerging companies offering whole cell metabolic pathway approaches to these markets.

There are numerous companies that participate in the biotherapeutics market generally and the PKU market specifically. Many of these companies are large, successful and well-capitalized. BioMarin Pharmaceutical Inc. ("BioMarin") and Daiichi Sankyo Company market Kuvan® in the United States, Europe and Japan for the treatment of a certain type of PKU. In addition, BioMarin gained US FDA approval in 2018 and began commercial sales of Palynziq™ as an injectable enzyme substitution therapy for the potential treatment of PKU. Several companies, i.e., Synlogic, Homology Medicines and Rubius have reported clinical efforts to develop biotherapeutic candidates for PKU. Beyond targeting PKU, Takeda (who acquired Shire Plc in 2019), Genzyme / Sanofi S.A., BioMarin and other companies market or are actively developing new enzyme therapeutics. There are numerous companies that are developing other forms of therapeutics, such as small molecules, gene therapies, as well as therapies based on gene editing, which could compete with biotherapeutics.

Our ability to compete successfully in any of these markets will depend on our ability to develop proprietary products that reach the market in a timely manner and are technologically superior to and/or are less expensive than other products on the market. Many of our competitors have substantially greater production, financial, research and development, personnel and marketing resources than we do. They also started developing products earlier than we did, which may allow them to establish blocking intellectual property positions or bring products to market before we can. In addition, certain of our competitors may also benefit from local government subsidies and other incentives that are not available to us. As a result, our competitors may be able to develop competing and/or superior technologies and processes, and compete more aggressively and sustain that competition over a longer period of time than we could. Our technologies and products may be rendered obsolete or uneconomical by technological advances or entirely different approaches developed by one or more of our competitors. We cannot be certain that any products we develop in the future will compare favorably to products offered by our competitors or that our existing or future products will compare favorably to any new products that are developed by our competitors. As more companies develop new intellectual property in our markets, the possibility of a competitor acquiring patent or other rights that may limit our products or potential products increases, which could lead to litigation.

Our limited resources relative to many of our competitors may cause us to fail to anticipate or respond adequately to new developments and other competitive pressures. This failure could reduce our competitiveness and market share, adversely affect our results of operations and financial position, and prevent us from obtaining or maintaining profitability.

The ongoing COVID-19 pandemic has adversely affected and may continue in the future to, directly or indirectly, adversely affect our business, results of operations and financial condition.

The COVID-19 pandemic has had, and continues to have, a significant impact globally, prompting governments and businesses to take unprecedented measures in response. In the United States, the COVID-19 pandemic has and may continue in the future to, directly or indirectly, adversely affect our business, results of operations and financial condition, including as a result of compliance with governmental orders governing the operation of businesses during the pandemic, the temporary closure of our Redwood City, California facilities from mid-March 2020 through the end of April 2020 and disruption of our research and development operations.

In the future, our business could be materially adversely affected, directly or indirectly, by the widespread outbreak of contagious disease, including the ongoing COVID-19 pandemic. National, state and local governments in affected regions have implemented and may continue to implement safety precautions, including quarantines, border closures, increased border controls, travel restrictions, governmental orders and shutdowns, business closures, cancellations of public gatherings and other measures. Organizations and individuals are taking additional steps to avoid or reduce infection, including limiting travel and staying home from work. These measures are disrupting normal business operations both in and outside of affected areas and have had significant negative impacts on businesses and financial markets worldwide.

The potential impact and duration of COVID-19 or another pandemic or public health crisis has had and could continue to have, significant repercussions across regional, national and global economies and financial markets, and could trigger a period of regional, national and global economic slowdown or regional, national or global recessions. The outbreak of COVID-19 in many countries continues to adversely impact regional, national and global economic activity and has contributed to significant volatility and negative pressure in financial markets. As a result, we may experience difficulty accessing debt and equity capital on attractive terms, or at all, due to the severe disruption and instability in the global financial markets. In addition, our customers may terminate or amend their agreements for the purchase of our technology, products and services due to bankruptcy, lack of liquidity, lack of funding, operational failures or other reasons.

Revenues in in future years from our sales of CDX-616 to Pfizer are subject to a number of factors which are outside of our control and may not materialize.

Starting the first and second quarters of 2021, we began to receive purchase orders from Pfizer, Inc. ("Pfizer") for large quantities of our proprietary enzyme product, CDX-616, for use by Pfizer in the manufacture of a critical intermediate for its proprietary active pharmaceutical ingredient, nirmatrelvir. Pfizer markets, sells and distributes nirmatrelvir, in combination with the active pharmaceutical ingredient ritonavir, as its PAXLOVID™ (nirmatrelvir tablets; ritonavir tablets) product, which received emergency use authorization ("EUA") by the U.S. Food and Drug Administration ("FDA") in late 2021 for the treatment of mild-to-moderate COVID-19 in adults and pediatric patients (12 years of age and older weighing at least 40 kg) with positive results of direct severe acute respiratory syndrome coronavirus 2 ("SARS-CoV-2") viral testing, and who are at high risk for progression to severe COVID-19, including hospitalization or death.

The FDA has the authority to issue an EUA under certain circumstances, such as during a public health emergency, pursuant to a declaration by the Secretary of the Department of Health and Human Services ("HHS"), that an emergency exists justifying the issuance of EUAs for certain types of products (referred to as EUA declarations). On March 27, 2020, the Secretary of HHS declared that circumstances exist justifying authorization of drugs and biologics during the COVID-19 pandemic, subject to the terms of any EUA that is issued for a specific product. Once an EUA declaration has been issued, the FDA can issue EUAs for products that fall within the scope of that declaration. To issue an EUA, the FDA Commissioner must conclude that (1) the chemical, biological, radioactive or nuclear agent ("CBRN") that is referred to in the EUA declaration can cause serious or life-threatening diseases or conditions; (2) based on the totality of scientific evidence available, it is reasonable to believe that the product may be effective in diagnosing, treating, or preventing the disease or condition attributable to the CBRN and that the product's known and potential benefits outweigh its known and potential risks; and (3) there is no adequate, approved, and available alternative to the product. the authorization to market products under an EUA is limited to the period of time the EUA declaration is in effect, and the FDA can revoke an EUA in certain circumstances. The FDA's policies regarding an EUA can change unexpectedly. We cannot predict how long Pfizer's EUA will remain in place. The FDA's policies regarding products used to diagnose, treat or mitigate COVID-19 remain in flux as the FDA responds to new and evolving public health information and clinical evidence. Therefore, it is possible that Pfizer's EUA may be revoked, which could adversely affect our financial condition and results of operations.

Revenues in 2023 and in future years from our sales of CDX-616 to Pfizer and other potential customers (including sublicensees of Pfizer technology from The Medicines Patent Pool (the "MPP")) are subject to a number of factors which are outside of our control, including, without limitation, the following, all of which could reduce or eliminate our sales of CDX-616, and therefore materially and adversely affect our business, results of operations and financial condition:

- Pfizer has no future binding commitment to purchase any particular quantity or quantities of CDX-616 from us, and we are dependent upon Pfizer continuing to place orders with us (whether on a spot basis or under a long term agreement, when and if executed) for their requirements, if any, for CDX-616;
- to our knowledge, sublicensees of Pfizer technology from the MPP have no obligation to purchase CDX-616 from us under their sublicenses with the MPP;
- the EUA granted by the FDA for the use of PAXLOVID™ for the treatment of COVID-19 infections in humans could be withdrawn at any time;
- future vaccine development and usage and the development and usage of other new therapies for the treatment or elimination of COVID-19 may eliminate or reduce demand for PAXLOVID™;
- new variants of COVID-19 may emerge which PAXLOVID™ is not effective in treating;
- Pfizer may not ultimately receive full marketing authorization for PAXLOVID™ from the FDA and other international regulatory authorities;
- Pfizer could reformulate or make changes in the manufacturing process for nirmatrelvir which would eliminate or reduce demand for the use of CDX-616 in its manufacture;

- sublicensees of Pfizer technology for the manufacture, sale and distribution of PAXLOVID™ from the MPP may not utilize CDX-616 in the manufacture of nirmatrelvir;
- national and regional governmental authorities (including those of the United States government) may mandate that raw materials and intermediates used in the manufacture of PAXLOVID™ to be marketed, sold and distributed within the borders of that country be domestically produced, which could eliminate or reduce demand for the use of CDX-616 in such country; and
- we may be unable (because of lack of available manufacturing capacity at our contract manufacturers, supply chain disruptions or an inability to obtain applicable regulatory approvals) to manufacture the quantities of CDX-616 that Pfizer may desire to purchase from us.

We have investments in non-marketable securities, which may subject us to significant impairment charges.

We have investments in illiquid non-marketable equity securities acquired in private transactions. At December 31, 2022, 8.2% of our consolidated assets consisted of investment securities, which are illiquid investments. Investments in illiquid, or non-marketable, securities are inherently risky and difficult to value. We account for our non-marketable equity securities under the measurement alternative. Under the measurement alternative, the carrying value of our non-marketable equity investments is adjusted to fair value for observable transactions for identical or similar investments of the same issuer or impairment. We evaluate our investment in non-marketable securities when circumstances indicate that we may not be able to recover the carrying value. We may impair these securities and establish an allowance for a credit loss when we determine that there has been an "other-than-temporary" decline in estimated fair value of the equity security compared to its carrying value. The impairment analysis requires significant judgment to identify events or circumstances that would likely have a material adverse effect on the fair value of the investment. Because over 5% of our total assets consisted of non-marketable investment securities, any future impairment charges from the write down in value of these securities could have a material adverse effect on our financial condition or results of operations.

Ethical, legal and social concerns about genetically engineered products and processes could limit or prevent the use of our technology, products and processes and limit our revenues.

Some of our technology, products and services are genetically engineered or involve the use of genetically engineered products or genetic engineering technologies. If we and/or our collaborators are not able to overcome the ethical, legal, and social concerns relating to genetic engineering, our technology, products and services may not be accepted. Any of the risks discussed below could result in increased expenses, delays, or other impediments to our programs or the public acceptance and commercialization of products and processes dependent on our technologies or inventions. Our ability to develop and commercialize one or more of our technologies, products, or processes could be limited by the following factors:

- public attitudes about the safety and environmental hazards of, and ethical concerns over, genetic research and genetically engineered products and processes, which could influence public acceptance of our technologies, products and processes;
- public attitudes regarding, and potential changes to laws governing ownership of genetic material, which could harm our intellectual property rights with respect to our genetic material and discourage collaborators from supporting, developing, or commercializing our technology, products and services; and
- governmental reaction to negative publicity concerning genetically modified organisms, which could result in greater government regulation of genetic research and derivative products.

The subject of genetically modified organisms has received negative publicity, which has aroused public debate. This adverse publicity could lead to greater regulation and trade restrictions on imports of genetically altered products. The biocatalysts that we develop have significantly enhanced characteristics compared to those found in naturally occurring enzymes or microbes. While we produce our biocatalysts only for use in a controlled industrial environment, the release of such biocatalysts into uncontrolled environments could have unintended consequences. Any adverse effect resulting from such a release could have a material adverse effect on our business and financial condition, and we may have exposure to liability for any resulting harm.

We use hazardous materials in our business and we must comply with environmental laws and regulations. Any claims relating to improper handling, storage or disposal of these materials or noncompliance of applicable laws and regulations could be time consuming and costly and could adversely affect our business and results of operations.

Our research and development and commercial processes involve the use of hazardous materials, including chemical, radioactive and biological materials. Our operations also produce hazardous waste. We cannot eliminate entirely the risk of accidental contamination or discharge and any resultant injury from these materials. Federal, state, local and foreign laws and regulations govern the use, manufacture, storage, handling and disposal of, and human exposure to, these materials. We may be sued for any injury or contamination that results from our use or the use by third parties of these materials, and our liability may exceed our total assets. Although we believe that our activities comply in all material respects with environmental laws, there can be no assurance that violations of environmental, health and safety laws will not occur in the future as a result of human error, accident, equipment failure or other causes. Compliance with applicable environmental laws and regulations may be expensive, and the failure to comply with past, present or future laws could result in the imposition of fines, third party property damage, product liability and personal injury claims, investigation and remediation costs, the suspension of production or a cessation of operations, and our liability may exceed our total assets. Liability under environmental laws can be joint and several and without regard to comparative fault. Environmental laws could become more stringent over time imposing greater compliance costs and increasing risks and penalties associated with violations, which could impair our research, development or production efforts and harm our business. In addition, we may have to indemnify some of our customers or suppliers for losses related to our failure to comply with environmental laws, which could expose us to significant liabilities.

Our ability to use our net operating loss carryforwards to offset future taxable income may be subject to certain limitations.

In general, under Section 382 of the Internal Revenue Code of 1986, as amended (the "Code"), a corporation that undergoes an "ownership change" is subject to limitations on its ability to utilize its pre-change net operating loss carryforwards ("NOLs"), to offset future taxable income. If the Internal Revenue Service challenges our analysis that our existing NOLs are not subject to limitations arising from previous ownership changes, our ability to utilize NOLs could be limited by Section 382 of the Code. Future changes in our stock ownership, some of which are outside of our control, could result in an ownership change under Section 382 of the Code. Furthermore, our ability to utilize NOLs of companies that we may acquire in the future may be subject to limitations. For these reasons, we may not be able to utilize a material portion of the NOLs reflected in our financial statements, even if we attain profitability.

As a public reporting company, we are subject to rules and regulations established from time to time by the SEC and Nasdaq regarding our internal controls over financial reporting. We may not complete needed improvements to our internal controls over financial reporting in a timely manner, or these internal controls may not be determined to be effective, which may adversely affect investor confidence in our company and, as a result, the value of our common stock and your investment.

We are subject to the rules and regulations established from time to time by the Securities and Exchange Commission, and Nasdaq. These rules regulations require, among other things, that we establish and periodically evaluate procedures with respect to our internal controls over financial reporting. As part of these evaluations, material weaknesses in our internal controls over financial reporting may be identified. A material weakness is a deficiency, or a combination of deficiencies, in internal controls over financial reporting such that there is a reasonable possibility that a material misstatement of a company's annual or interim consolidated financial statements will not be prevented or detected on a timely basis. While we were able to remediate previously identified material weaknesses in our internal controls over financial reporting, there can be no guarantee we will not identify similar or other material weaknesses in the future and if such material weaknesses are identified, there can be no guarantee we would be able to remediate such material weaknesses. Any material weaknesses in our internal controls may adversely affect our ability to record, process, summarize and accurately report timely financial information and, as a result, our consolidated financial statements may contain material misstatements or omissions.

Reporting obligations as a public company place a considerable strain on our financial and management systems, processes and controls, as well as on our personnel. In addition, as a public company we are required to document and test our internal controls over financial reporting pursuant to Section 404 of the Sarbanes-Oxley Act so that our management can certify as to the effectiveness of our internal controls over financial reporting. Likewise, our independent registered public accounting firm is required to provide an attestation report on the effectiveness of our internal controls over financial reporting in our Annual Reports on Form 10-K. If our management is unable to certify the effectiveness of our internal controls or if our independent registered public accounting firm cannot deliver a report attesting to the effectiveness of our internal controls over financial reporting, or if we identify or fail to remediate material weaknesses in our internal controls, we could be subject to regulatory scrutiny and a loss of public confidence, which could seriously harm our reputation and the market price of our common stock. In addition, if we do not maintain adequate financial and management personnel, processes and controls, we may not be able to manage our business effectively or accurately report our financial performance on a timely basis, which could cause a decline in our common stock price and may seriously harm our business.

If we engage in any acquisitions, we will incur a variety of costs and may potentially face numerous risks that could adversely affect our business and operations.

We have made acquisitions in the past, and if appropriate opportunities become available, we expect to acquire additional businesses, assets, technologies, or products to enhance our business in the future. For example, in October 2010, we acquired substantially all of the patents and other intellectual property rights associated with Maxygen's directed evolution technology.

In connection with any future acquisitions, we could:

- issue additional equity securities, which would dilute our current stockholders;
- incur substantial debt to fund the acquisitions;
- use our cash to fund the acquisitions; or
- assume significant liabilities including litigation risk.

Acquisitions involve numerous risks, including problems integrating the purchased operations, technologies or products, unanticipated costs and other liabilities, diversion of management's attention from our core businesses, adverse effects on existing business relationships with current and/or prospective collaborators, customers and/or suppliers, risks associated with entering markets in which we have no or limited prior experience and potential loss of key employees. We do not have extensive experience in managing the integration process and we may not be able to successfully integrate any businesses, assets, products, technologies or personnel that we might acquire in the future without a significant expenditure of operating, financial and management resources, if at all. The integration process could divert management's time from focusing on operating our business, result in a decline in employee morale and cause retention issues to arise from changes in compensation, reporting relationships, future prospects or the direction of the business. Acquisitions may also require us to record goodwill and non-amortizable intangible assets that will be subject to impairment testing on a regular basis and potential periodic impairment charges, incur amortization expenses related to certain intangible assets, and incur large and immediate write offs and restructuring and other related expenses, all of which could harm our operating results and financial condition. In addition, we may acquire companies that have insufficient internal financial controls, which could impair our ability to integrate the acquired company and adversely impact our financial reporting. If we fail in our integration efforts with respect to any of our acquisitions and are unable to efficiently operate as a combined organization, our business and financial condition may be adversely affected.

Risks Related to Government Regulation and Clinical Product Development

We or our customers may not be able to obtain regulatory approval for the use of our products in food and food ingredients, if required, and, even if approvals are obtained, complying on an ongoing basis with the numerous regulatory requirements applicable to these products will be time-consuming and costly.

The products that we develop for our food and food ingredient customers are, and any other products that we may develop for the food and food ingredients market will likely be, subject to regulation by various government agencies, including the FDA, state and local agencies and similar agencies outside the United States, as well as religious compliance certifying organizations. Food ingredients are regulated by the FDA either as food additives or as substances generally recognized as safe ("GRAS"). A substance can be listed or affirmed as GRAS by the FDA or self-affirmed by its manufacturer upon determination that independent qualified experts would generally agree that the substance is GRAS for a particular use. While we generally self-affirm GRAS status for the ingredients used in the products that we develop for the food market, our customer(s) may be required to submit a GRAS notification to FDA to establish that ingredients in a final commercial product may be considered GRAS. There can be no assurance that our customer(s) will not receive any objections from the FDA with respect to any GRAS notification our customer(s) may submit. If the FDA were to disagree with our customer's determination that their commercial product and/or its ingredients are GRAS or otherwise compliant, the FDA could ask such customer to voluntarily withdraw the final commercial product from the market or could initiate legal action to halt its sale. Such actions by the FDA could have an adverse effect on our business, financial condition, and results of our operations. Food ingredients that are not GRAS are regulated as food additives and require FDA approval prior to commercialization or must be the subject of an existing food additive regulation. The food additive petition process for ingredients that are not already authorized by regulation is generally expensive and time consuming, with approval, if secured, potentially taking years.

Our ongoing efforts to deploy our technology in the life science tools markets may fail.

We have recently begun to use our CodeEvolver® protein engineering technology platform to develop new products for customers using NGS and PCR/qPCR for *in vitro* molecular diagnostic applications. while we have entered into some license agreements for products in this market, we do not know if we can successfully compete in this new market. This new market is well established and consists of numerous large, well-funded entrenched market participants who have long and established track records and customer relationships. In December 2019, we licensed our first proprietary enzyme for this market, EvoT4™ DNA ligase, which is designed to improve library preparation for NGS users, to Roche. This enzyme, and any products that we may develop in the future for this market, may not succeed in displacing current products. If we succeed in commercializing new products for this market, we may not generate significant revenues and cash flows from these activities. The failure to successfully deploy products on timely basis in this space may limit our growth and have a material adverse effect on our financial condition, operating results and business prospects.

The regulatory approval processes of the FDA and comparable foreign authorities are lengthy, time consuming and inherently unpredictable, and if we are ultimately unable to obtain regulatory approval for our product candidates, our business will be substantially harmed.

We and any collaborators are not permitted to commercialize, market, promote or sell any product candidate in the United States without obtaining marketing approval from the FDA. Foreign regulatory authorities impose similar requirements. The time required to obtain approval by the FDA and comparable foreign authorities is unpredictable, but typically takes many years following the commencement of clinical trials and depends upon numerous factors, including substantial discretion of the regulatory authorities. In addition, approval policies, regulations or the type and amount of clinical data necessary to gain approval may change during the course of a product candidate's clinical development and may vary among jurisdictions. We and any collaborators must complete additional preclinical or nonclinical studies and clinical trials to demonstrate the safety, purity and potency (or efficacy) of our product candidates in humans to the satisfaction of the regulatory authorities before we will be able to obtain these approvals. Our product candidates could fail to receive regulatory approval for many reasons, including the following:

- the FDA or comparable foreign regulatory authorities may disagree with the design or implementation of our or our collaborators' clinical trials;
- we or our collaborators may be unable to demonstrate to the satisfaction of the FDA or comparable foreign regulatory authorities that a product candidate is safe and effective for its proposed indication;
- the results of clinical trials may not meet the level of statistical significance required by the FDA or comparable foreign regulatory authorities for approval;
- we or our collaborators may be unable to demonstrate that a product candidate's clinical and other benefits outweigh its safety risks;

- the FDA or comparable foreign regulatory authorities may disagree with our or our collaborators' interpretation of data from preclinical studies or clinical trials;
- the data collected from clinical trials of product candidates may not be sufficient to support the submission of a BLA to obtain regulatory approval in the United States or elsewhere;
- the FDA or comparable foreign regulatory authorities may fail to approve the manufacturing processes or facilities of third-party manufacturers with which we or our collaborators contract for clinical and commercial supplies;
- the FDA or comparable foreign regulatory authorities may fail to approve the companion diagnostics we contemplate developing with collaborators; and
- the approval policies or regulations of the FDA or comparable foreign regulatory authorities may significantly change in a manner rendering our or our collaborators' clinical data insufficient for approval.

This lengthy approval process as well as the unpredictability of future clinical trial results may result in our failing to obtain regulatory approval to market our product candidates, which would significantly harm our business, results of operations and prospects. 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 impose significant limitations in the form of narrow indications, warnings, or a REMS. Regulatory authorities may not approve the price we or our collaborators intend to charge for products we may develop, 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.

Clinical trials are difficult to design and implement, expensive, time-consuming and involve an uncertain outcome, and the inability to successfully conduct clinical trials and obtain regulatory approval for our product candidates would substantially harm our business.

Clinical testing is expensive and usually takes many years to complete, and its outcome is inherently uncertain. Failure can occur at any time during the clinical trial process, and product candidates in later stages of clinical trials may fail to show the desired safety and efficacy traits despite having progressed through preclinical studies and initial clinical trials. We do not know whether planned clinical trials will begin on time, need to be redesigned, recruit and enroll patients on time or be completed on schedule, or at all. Clinical trials can be delayed, suspended or terminated for a variety of reasons, including in connection with:

- the inability to generate sufficient preclinical, toxicology or other *in vivo* or *in vitro* data to support the initiation of clinical trials;
- applicable regulatory authorities disagreeing as to the design or implementation of the clinical trials;
- obtaining regulatory authorization to commence a trial;
- reaching an agreement on acceptable terms with prospective contract research organizations ("CROs"), and clinical trial sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and trial sites;
- obtaining IRB approval at each site;
- developing and validating the companion diagnostic to be used in a clinical trial, if applicable;
- insufficient or inadequate supply or quality of product candidates or other materials necessary for use in clinical trials, or delays in sufficiently developing, characterizing or controlling a manufacturing process suitable for clinical trials;
- recruiting and retaining enough suitable patients to participate in a trial;
- having enough patients complete a trial or return for post-treatment follow-up;
- adding a sufficient number of clinical trial sites;
- inspections of clinical trial sites or operations by applicable regulatory authorities, or the imposition of a clinical hold;
- clinical sites deviating from trial protocol or dropping out of a trial;
- the inability to demonstrate the efficacy and benefits of a product candidate;
- discovering that product candidates have unforeseen safety issues, undesirable side effects or other unexpected characteristics;

- addressing patient safety concerns that arise during the course of a trial; receiving untimely or unfavorable feedback from applicable regulatory authorities regarding the trial or requests from regulatory authorities to modify the design of a trial;
- non-compliance with applicable regulatory requirements by us or third parties or changes in such regulations or administrative actions;
- suspensions or terminations by IRBs of the institutions at which such trials are being conducted, by the Data Safety Monitoring Board for such trial or by the FDA or other regulatory authorities due to a number of factors, including those described above;
- third parties being unable or unwilling to satisfy their contractual obligations to us; or
- changes in our financial priorities, greater than anticipated costs of completing a trial or our inability to continue funding the trial.

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. Additionally, we or our collaborators may experience unforeseen events during or resulting from clinical trials that could delay or prevent receipt of marketing approval for or commercialization of product candidates. For example, clinical trials of product candidates may produce negative, inconsistent or inconclusive results, and we may decide, or regulators may require us, to conduct additional clinical trials or abandon development programs. Regulators may also revise the requirements for approving the product candidates, or such requirements may not be as we anticipate. If we or our collaborators are required to conduct additional clinical trials or other testing of product candidates beyond those that we or our collaborators currently contemplate, if we or our collaborators are unable to successfully complete clinical trials or other testing of such product candidates, if the results of these trials or tests are not positive or are only modestly positive or if there are safety concerns, we may:

- incur unplanned costs;
- be delayed in obtaining or fail to obtain marketing approval for product candidates;
- obtain marketing approval in some countries and not in others;
- obtain marketing approval for indications or patient populations that are not as broad as intended or desired;
- obtain marketing approval with labeling that includes significant use or distribution restrictions or safety warnings, including boxed warnings;
- be subject to additional post-marketing testing requirements;
- be subject to changes in the way the product is administered;
- have regulatory authorities withdraw or suspend their approval of the product or impose restrictions on its distribution;
- be sued; or
- experience damage to our reputation.

If we or our collaborators experience delays in the commencement or completion of our clinical trials, or if we or our collaborators terminate a clinical trial prior to completion, we may experience increased costs, have difficulty raising capital and/or be required to slow down the development and approval process timelines. Furthermore, the product candidates that are the subject of such trials may never receive regulatory approval, and their commercial prospects and our ability to generate product revenues from them could be impaired or not realized at all.

Results of preclinical studies and early clinical trials of product candidates may not be predictive of results of later studies or trials. Our product candidates may not have favorable results in later clinical trials, if any, or receive regulatory approval.

Preclinical and clinical drug development is expensive and can take many years to complete, and its outcome is inherently uncertain. Failure can occur at any time during the drug development process. Despite promising preclinical or clinical results, any product candidate can unexpectedly fail at any stage of preclinical or clinical development. The historical failure rate for product candidates in our industry is high. The results from preclinical studies or early clinical trials of a product candidate may not be predictive of the results from later preclinical studies or clinical trials, and interim results of a clinical trial are not necessarily indicative of final results. Product candidates in later stages of clinical trials may fail to show the desired safety and efficacy characteristics despite having progressed through preclinical studies and initial clinical trials.

Many companies in the biopharmaceutical and biotechnology industries have suffered significant setbacks at later stages of development after achieving positive results in early stages of development, and we may face similar setbacks. These setbacks have been caused by, among other things, preclinical findings made while clinical trials were underway or safety or efficacy observations made in clinical trials, including previously unreported adverse events. Moreover, non-clinical and clinical data are often susceptible to varying interpretations and analyses, and many companies that believed their product candidates performed satisfactorily in preclinical studies and clinical trials nonetheless failed to obtain regulatory approval. Even if any product candidates progress to clinical trials, these product candidates may fail to show the safety and efficacy in clinical development required to obtain regulatory approval, despite the observation of positive results in animal studies. Our or our collaborators' failure to replicate positive results from early research programs and preclinical or greenhouse studies may prevent us from further developing and commercializing those or other product candidates, which would limit our potential to generate revenues from them and harm our business and prospects.

For the foregoing reasons, we cannot be certain that any ongoing or future preclinical studies or clinical trials will be successful. Any safety or efficacy concerns observed in any one of our preclinical studies or clinical trials in a targeted area could limit the prospects for regulatory approval of product candidates in that and other areas, which could have a material adverse effect on our business and prospects.

We may not be able to maintain orphan drug designations for certain of our product candidates, and may be unable to maintain the benefits associated with orphan drug designation, including the potential for market exclusivity.

Regulatory authorities in some jurisdictions, including the U.S. and Europe, may designate drugs for relatively small patient populations as orphan drugs. Under the Orphan Drug Act of 1983, the FDA may designate a product candidate as an orphan product if it is intended to treat a rare disease or condition, which is generally defined as a patient population of fewer than 200,000 individuals in the U.S., or a patient population of greater than 200,000 individuals in the U.S., but for which there is no reasonable expectation that the cost of developing the drug will be recovered from sales in the U.S. The FDA has granted orphan drug designation to CDX-6512 for the treatment of HCU and to CDX-6210 for the treatment of Maple Syrup Urine Disease (MSUD).

In the U.S., orphan designation entitles a party to financial incentives such as opportunities for grant funding for clinical trial costs, tax advantages and user-fee waivers. In addition, if a product candidate that has orphan designation subsequently receives the first FDA approval for the disease for which it has such designation, the product is entitled to orphan drug exclusivity, which means that the FDA may not approve any other applications, including a BLA, to market the same drug for the same disease or condition for seven years, except in limited circumstances, such as a showing of clinical superiority to the product with orphan exclusivity or where the manufacturer is unable to assure sufficient product quantity.

Even if we obtain orphan drug exclusivity for a product, that exclusivity may not effectively protect the product from competition because different drugs can be approved for the same disease condition. Even after an orphan drug is approved, the FDA can subsequently approve the same drug for the same disease condition if such regulatory authority concludes that the later drug is clinically superior if it is shown to be safer, more effective or makes a major contribution to patient care. Orphan drug designation neither shortens the development time or regulatory review time of a drug nor gives the drug any advantage in the regulatory review or approval process.

We have obtained rare pediatric disease designation for CDX-6512 and CDX-6120, however, there is no guarantee that such designation will result in approval of CDX-6512 or CDX-6210, and even if we obtain approval of CDX-6512 or CDX-6210 for the indications for which we have been awarded rare pediatric disease designation, there is no guarantee that such approval will result in an aware of a rare pediatric disease priority review voucher.

In 2012, Congress authorized the FDA to award priority review vouchers to sponsors of certain rare pediatric disease product applications. This program is designed to encourage development of new drug and biological products for the prevention and treatment of certain rare pediatric diseases. Specifically, under this program, a sponsor who receives an approval for a drug or biologic for a "rare pediatric disease" that meets certain criteria may qualify for a voucher that can be redeemed to receive a priority review of a subsequent marketing application for a different product, even if that subsequent marketing application would not otherwise qualify for priority review on its own. The sponsor of a rare pediatric disease product receiving a priority review voucher may transfer (including by sale) the voucher to another sponsor. The voucher may be further transferred any number of times before the voucher is used, as long as the sponsor making the transfer has not yet submitted the application. The FDA may also revoke any priority review voucher if the rare pediatric disease drug for which the voucher was awarded is not marketed in the U.S. within one year following the date of approval.

We have obtained rare pediatric disease designation for CDX-6512 for the treatment of HCU and for CDX-6210 for the treatment of MSUD. Even though we have obtained rare pediatric disease designations, there is no guarantee that we will be able to obtain a priority review voucher, even if CDX-6512 and/or CDX-6210 are approved by the FDA. Moreover, Congress included a sunset provision in the statute authorizing the rare pediatric disease priority review voucher program. On December 27, 2020, the Rare Pediatric Disease Priority Review Voucher Program was extended, and under the current statutory sunset provisions, after September 30, 2024, FDA may only award a voucher for an approved rare pediatric disease product application if the sponsor has rare pediatric disease designation for the drug, and that designation was granted by September 30, 2024. After September 30, 2026, FDA may not award any rare pediatric disease priority review vouchers (unless Congress amends the law to extend the program further).

Disruptions at the FDA and other government agencies caused by funding shortages or global health concerns could hinder their ability to hire, retain, or deploy key leadership and other personnel, or otherwise prevent new or modified products from being developed, approved, or commercialized in a timely manner, or at all, which could negatively impact our business.

The ability of the FDA and other government agencies to review and approve new products can be affected by a variety of factors, including government budget and funding levels, statutory, regulatory and policy changes, a government agency's ability to hire and retain key personnel and accept the payment of user fees, and other events that may otherwise affect the government agency's ability to perform routine functions. Average review times at the FDA and other government agencies have fluctuated in recent years as a result. In addition, government funding of other government agencies that fund research and development activities is subject to the political process, which is inherently fluid and unpredictable. Disruptions at the FDA and other agencies may also slow the time necessary for new drugs and biologics or modifications to approved drugs or biologics to be reviewed and/or approved by necessary government agencies, which would adversely affect our business. For example, over the last several years, the United States government has shut down several times and certain regulatory agencies, such as the FDA, have had to furlough critical FDA employees and stop critical activities.

Separately, in response to the COVID-19 pandemic, the FDA postponed most inspections of domestic and foreign manufacturing facilities at various points. Even though the FDA has since resumed standard inspection operations of domestic facilities where feasible, the FDA has continued to monitor and implement changes to its inspectional activities to ensure the safety of its employees and those of the firms it regulates as it adapts to the evolving COVID-19 pandemic, and any resurgence of the virus or emergence of new variants may lead to further inspectional delays. Regulatory authorities outside the United States may adopt similar restrictions or other policy measures in response to the COVID-19 pandemic. If a prolonged government shutdown occurs, or if global health concerns continue to hinder or prevent the FDA or other regulatory authorities from conducting their regular inspections, reviews, or other regulatory activities, it could significantly impact the ability of the FDA or other regulatory authorities to timely review and process our regulatory submissions, which could have a material adverse effect on our business.

Even if we obtain regulatory approval for any products that we develop alone or with collaborators, such products will remain subject to ongoing regulatory requirements, which may result in significant additional expense.

Even if products we develop alone or with collaborators receive regulatory approval, they will be subject to ongoing regulatory requirements for manufacturing, labeling, packaging, distribution, storage, advertising, promotion, sampling, record-keeping and submission of safety and other post-market information, among other things. Any regulatory approvals received for such products may also be subject to limitations on the approved indicated uses for which they may be marketed or to the conditions of approval, or contain requirements for potentially costly post-marketing testing and surveillance studies. For example, the holder of an approved BLA in the United States is obligated to monitor and report adverse events and any failure of a product to meet the specifications in the BLA. In the United States, the holder of an approved BLA must also submit new or supplemental applications and obtain FDA approval for certain changes to the approved product, product labeling or manufacturing process. Similar provisions apply in the European Union (the "EU"). Advertising and promotional materials must comply with FDA rules and are subject to FDA review, in addition to other potentially applicable federal and state laws. Similarly, in the EU any promotion of medicinal products is highly regulated and, depending on the specific jurisdiction involved, may require prior vetting by the competent national regulatory authority. In addition, product manufacturers and their facilities are subject to payment of user fees and continual review and periodic inspections by the FDA and other regulatory authorities for compliance with cGMP requirements and adherence to commitments made in the BLA or foreign marketing application.

If we, our collaborators or 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 that product, a regulatory agency may impose restrictions relative to that product, the manufacturing facility or us or our collaborators, including requiring recall or withdrawal of the product from the market or suspension of manufacturing.

Moreover, if any of our product candidates are approved, our product labeling, advertising, promotion and distribution will be subject to regulatory requirements and continuing regulatory review. The FDA strictly regulates the promotional claims that may be made about drug products. In particular, a product may not be promoted for uses that are not approved by the FDA as reflected in the product's approved labeling. If we or our collaborators fail to comply with applicable regulatory requirements following approval of any potential products we may develop, authorities may:

- issue an untitled enforcement letter or a warning letter asserting a violation of the law;
- seek an injunction, impose civil and criminal penalties, and impose monetary fines, restitution or disgorgement of profits or revenues;
- suspend or withdraw regulatory approval;
- suspend or terminate any ongoing clinical trials or implement requirements to conduct post-marketing studies or clinical trials;
- refuse to approve a pending BLA or comparable foreign marketing application (or any supplements thereto) submitted by us or our collaborators;
- restrict the labeling, marketing, distribution, use or manufacturing of products;
- seize or detain products or otherwise require the withdrawal or recall of products from the market;
- refuse to approve pending applications or supplements to approved applications that we or our collaborators submit;
- refuse to permit the import or export of products; or
- refuse to allow us or our collaborators to enter into government contracts.

Any government investigation of alleged violations of law could require us to expend significant time and resources in response and could generate negative publicity. The occurrence of any event or penalty described above may inhibit our or our collaborators' ability to commercialize products and our ability to generate revenues.

In addition, the FDA's policies, and policies of foreign regulatory agencies, may change, and additional regulations may be enacted that could prevent, limit or delay regulatory approval of product candidates. We cannot predict the likelihood, nature or extent of government regulation that may arise from future legislation or administrative or executive action, either in the United States or abroad. 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 be subject to enforcement action and we may not achieve or sustain profitability.

Our business operations and future relationships with investigators, healthcare professionals, consultants, third-party payors, patient organizations and customers will be subject to applicable healthcare regulatory laws, which could expose us to penalties.

Our business operations and future arrangements with investigators, healthcare professionals, consultants, third-party payors, patient organizations and customers, may expose us to broadly applicable fraud and abuse and other healthcare laws and regulations. These laws may constrain the business or financial arrangements and relationships through which we will conduct our operations, including how we research, market, sell and distribute our product candidates, if approved. Such laws include:

- the U.S. federal Anti-Kickback Statute, which prohibits, among other things, persons or entities from knowingly and willfully soliciting, offering, receiving or providing any remuneration (including any kickback, bribe, or certain rebate), directly or indirectly, overtly or covertly, in cash or in kind, to induce or reward, or in return for, either the referral of an individual for, or the purchase, lease, order or recommendation of, any good, facility, item or service, for which payment may be made, in whole or in part, under U.S. federal and state healthcare programs such as Medicare and Medicaid. A person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;

- the U.S. federal false claims laws, including the civil False Claims Act, which, among other things, impose criminal and civil penalties, including through civil whistleblower or qui tam actions, against individuals or entities for knowingly presenting, or causing to be presented, to the U.S. federal government, claims for payment or approval that are false or fraudulent, knowingly making, using or causing to be made or used, a false record or statement material to a false or fraudulent claim, or from knowingly making a false statement to avoid, decrease or conceal an obligation to pay money to the U.S. federal government. In addition, the government may assert that a claim including items and services resulting from a violation of the U.S. federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the False Claims Act;
- the U.S. federal Health Insurance Portability and Accountability Act of 1996 ("HIPAA"), which imposes criminal and civil liability for, among other things, knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program, or knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statement, in connection with the delivery of, or payment for, healthcare benefits, items or services; similar to the U.S. federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;
- the U.S. federal Physician Payments Sunshine Act, which requires certain manufacturers of drugs, devices, biologics and medical supplies that are reimbursable under Medicare, Medicaid, or the Children's Health Insurance Program to report annually to the government information related to certain payments and other transfers of value to physicians (defined to include doctors, dentists, optometrists, podiatrists and chiropractors), certain non-physician practitioners such as physician assistants and nurse practitioners, and teaching hospitals, as well as ownership and investment interests held by the physicians described above and their immediate family members; and
- analogous U.S. state laws and regulations, including: state anti-kickback and false claims laws, which may apply to our future business practices, including but not limited to, research, distribution, sales and marketing arrangements and claims involving healthcare items or services reimbursed by any third-party payor, including private insurers; state laws that require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the U.S. federal government, or otherwise restrict payments that may be made to healthcare providers and other potential referral sources; and state laws and regulations that require drug manufacturers to file reports relating to pricing and marketing information, which requires tracking gifts and other remuneration and items of value provided to healthcare professionals and entities.

Ensuring that our internal operations and future business arrangements with third parties comply with applicable healthcare laws and regulations will involve substantial costs. It is possible that governmental authorities will conclude that our business practices do not comply with current or future statutes, regulations, agency guidance 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 the laws described above or any other governmental laws and regulations that may apply to us, we may be subject to significant penalties, including civil, criminal and administrative penalties, damages, fines, exclusion from government-funded healthcare programs, such as Medicare and Medicaid or similar programs in other countries or jurisdictions, disgorgement, individual imprisonment, contractual damages, reputational harm, diminished profits and the curtailment or restructuring of our operations.

The successful commercialization of product candidates developed by us or our partners will depend in part on the extent to which governmental authorities and health insurers establish adequate coverage, reimbursement levels and pricing policies. Failure to obtain or maintain coverage and adequate reimbursement for such product candidates, if approved, could limit our or our partners' ability to market those products and decrease our ability to generate revenue.

The availability and adequacy of coverage and reimbursement by governmental healthcare programs such as Medicare and Medicaid, private health insurers and other third-party payors are essential for most patients to be able to afford prescription medications such as our product candidates, assuming FDA approval. Our ability to achieve acceptable levels of coverage and reimbursement for products by governmental authorities, private health insurers and other organizations will have an effect on our ability to successfully commercialize our product candidates. Assuming we obtain coverage for our product candidates by a third-party payor, the resulting reimbursement payment rates may not be adequate or may require co-payments that patients find unacceptably high. We cannot be sure that coverage and reimbursement in the United States, the EU or elsewhere will be available for our product candidates or any product that we may develop, and any reimbursement that may become available may be decreased or eliminated in the future.

Third-party payors increasingly are challenging prices charged for pharmaceutical products and services, and many third-party payors may refuse to provide coverage and reimbursement for particular drugs or biologics when an equivalent generic drug, biosimilar or a less expensive therapy is available. It is possible that a third-party payor may consider our product candidates as substitutable and only offer to reimburse patients for the less expensive product. Even if we show improved efficacy or improved convenience of administration with our product candidates, pricing of existing third-party therapeutics may limit the amount we will be able to charge for our product candidates. These payors may deny or revoke the reimbursement status of a given product or establish prices for new or existing marketed products at levels that are too low to enable us to realize an appropriate return on our investment in our product candidates. 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. If reimbursement is not available or is available only at limited levels, we may not be able to successfully commercialize our product candidates, and may not be able to obtain a satisfactory financial return on our product candidates.

No uniform policy for coverage and reimbursement for products exists among third-party payors in the United States. Therefore, coverage and reimbursement for products can differ significantly from payor to payor. 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. Furthermore, rules and regulations regarding reimbursement change frequently, in some cases on short notice, and we believe that changes in these rules and regulations are likely.

Outside the United States, international operations are generally subject to extensive governmental price controls and other market regulations, and we believe the increasing emphasis on cost-containment initiatives in Europe and other countries have and will continue to put pressure on the pricing and usage of our product candidates. In many countries, the prices of medical products are subject to varying price control mechanisms as part of national health systems. Other countries allow companies to fix their own prices for medical products, but monitor and control company profits. Additional foreign price controls or other changes in pricing regulation could restrict the amount that we are able to charge for our product candidates. Accordingly, in markets outside the United States, the reimbursement for our product candidates may be reduced compared with the United States and may be insufficient to generate commercially-reasonable revenue and profits.

Moreover, increasing efforts by governmental and third-party payors in the United States and abroad to cap or reduce healthcare costs may cause such organizations to limit both coverage and the level of reimbursement for newly approved products and, as a result, they may not cover or provide adequate payment for our product candidates. We expect to experience pricing pressures in connection with the sale of our product candidates due to the trend toward managed health care, the increasing influence of health maintenance organizations and additional legislative changes. The downward pressure on healthcare costs in general, particularly prescription drugs and biologics and surgical procedures and other treatments, has become intense. As a result, increasingly high barriers are being erected to the entry of new products.

Recently enacted legislation, future legislation and healthcare reform measures may increase the difficulty and cost for our partners to obtain marketing approval for and commercialize product candidates developed by us.

In the United States and some foreign jurisdictions, there have been, and we expect there will continue to be, a number of legislative and regulatory changes to the healthcare system, including cost-containment measures that may reduce or limit coverage and reimbursement for newly approved drugs and affect our ability to profitably sell any product candidates for which we develop and our partners obtain marketing approval. In particular, there have been and continue to be a number of initiatives at the U.S. federal and state levels that seek to reduce healthcare costs and improve the quality of healthcare.

For example, in March 2010, the Affordable Care Act (the "ACA") was enacted in the United States. The ACA established an annual, nondeductible fee on any entity that manufactures or imports specified branded prescription drugs and biologic agents; extended manufacturers' Medicaid rebate liability to covered drugs dispensed to individuals who are enrolled in Medicaid managed care organizations; expanded eligibility criteria for Medicaid programs; expanded the entities eligible for discounts under the 340B drug pricing program; increased the statutory minimum rebates a manufacturer must pay under the Medicaid Drug Rebate Program; established a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in and conduct comparative clinical effectiveness research, along with funding for such research; and establishes a Center for Medicare & Medicaid Innovation at the Centers for Medicare & Medicaid Services to test innovative payment and service delivery models to lower Medicare and Medicaid spending.

Since its enactment, there have been executive, judicial and Congressional challenges to certain aspects of the ACA, and on June 17, 2021, the U.S. Supreme Court dismissed the most recent judicial challenge to the ACA brought by several states without specifically ruling on the constitutionality of the ACA. Prior to the Supreme Court's decision, President Biden had issued an executive order to initiate a special enrollment period from February 15, 2021 through August 15, 2021 for purposes of obtaining health insurance coverage through the ACA marketplace. The executive order also instructed certain governmental agencies to review and reconsider their existing policies and rules that limit access to healthcare, including among others, reexamining Medicaid demonstration projects and waiver programs that include work requirements, and policies that create unnecessary barriers to obtaining access to health insurance coverage through Medicaid or the ACA. It is unclear how the healthcare reform measures will impact our business.

In addition, other legislative changes have been proposed and adopted since the ACA was enacted. In March 2021, the American Rescue Plan Act of 2021 was signed into law, which eliminates the statutory cap on the Medicaid drug rebate, currently set at 100% of a drug's average manufacturer price, beginning January 1, 2024. Further, there has been heightened governmental scrutiny in the United States of pharmaceutical pricing practices in light of the rising cost of prescription drugs. Such scrutiny has resulted in several recent congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to product pricing, review the relationship between pricing and manufacturer patient assistance programs, and reform government program reimbursement methodologies for products. Most recently, the Inflation Reduction Act of 2022 (the "IRA"), included a number of significant drug pricing reforms, which include the establishment of a drug price negotiation program within the U.S. Department of Health and Human Services ("HHS") (beginning in 2026) that requires manufacturers to charge a negotiated "maximum fair price" for certain selected drugs or pay an excise tax for noncompliance, the establishment of rebate payment requirements on manufacturers under Medicare Parts B and D to penalize price increases that outpace inflation (first due in 2023), and a redesign of the Part D benefit, as part of which manufacturers are required to provide discounts on Part D drugs (beginning in 2025). The IRA permits the HHS Secretary to implement many of these provisions through guidance, as opposed to regulation, for the initial years. Additional drug pricing proposals could appear in future legislation. Further, it is possible that additional governmental action is taken in response to the COVID-19 pandemic.

At the state level, legislatures have increasingly passed legislation and implemented regulations designed to control pharmaceutical and biological product pricing, including price or reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation from other countries and bulk purchasing. Legally mandated price controls on payment amounts by third-party payors or other restrictions could harm our business, results of operations, financial condition and prospects. 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 any product candidate we develop, if approved, or put pressure on our product pricing, which could negatively affect our business, results of operations, financial condition and prospects.

We expect that these new laws and other healthcare reform measures that may be adopted in the future may result in additional reductions in Medicare and other healthcare funding, more rigorous coverage criteria, new payment methodologies and 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 any product candidates we develop, if approved.

Compliance with European Union chemical regulations could be costly and adversely affect our business and results of operations.

Some of our products are subject to the EU regulatory regime known as The Registration, Evaluation and Authorization of Chemicals ("REACH"). REACH mandates that certain chemicals manufactured in, or imported into, the EU be registered and evaluated for their potential effects on human health and the environment. Under REACH, we and our contract manufacturers located in the EU are required to register certain of our products based on the quantity of such product imported into or manufactured in the EU and on the product's intended end-use. The registration, evaluation and authorization process under REACH can be costly and time consuming. Problems or delays in the registration, evaluation or authorization process under REACH could delay or prevent the manufacture of some of our products in, or the importation of some of our products into, the EU, which could adversely affect our business and results of operations. In addition, if we or our contract manufacturers fail to comply with REACH, we may be subject to penalties or other enforcement actions, which could have a material adverse effect on our business and results of operations.

Risks Related to our Dependence on Third Parties

We rely on third parties to conduct our clinical trials and perform some of our research and preclinical studies. If these third parties do not satisfactorily carry out their contractual duties or fail to meet expected deadlines, our development programs may be delayed or subject to increased costs, each of which may have an adverse effect on our business and prospects.

We do not have the ability to conduct all aspects of our preclinical testing or clinical trials ourselves. As a result, we are and expect to remain dependent on third parties to conduct clinical trials of our product candidates. Specifically, we expect CROs, clinical investigators, and consultants to play a significant role in the conduct of these trials and the subsequent collection and analysis of data. However, we will not be able to control all aspects of their activities. Nevertheless, we are responsible for ensuring that each of our trials is conducted in accordance with the applicable protocol and legal, regulatory and scientific standards, and our reliance on the CROs and other third parties does not relieve us of our regulatory responsibilities. We and our CROs are required to comply with GCP requirements, which are regulations and guidelines enforced by the FDA and comparable foreign regulatory authorities for all of our product candidates in clinical development. Regulatory authorities enforce these GCP requirements through periodic inspections of trial sponsors, clinical trial investigators and clinical trial sites. If we or any of our CROs or clinical trial sites fail to comply with applicable GCP requirements, the 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. In addition, our clinical trials must be conducted with product produced under cGMP regulations. Our failure to comply with these regulations may require us to stop and/or repeat clinical trials, which would delay the marketing approval process.

There is no guarantee that any such CROs, clinical trial investigators or other third parties on which we rely will devote adequate time and resources to our development activities or perform as contractually required. If any of these third parties fail to meet expected deadlines, adhere to our clinical protocols or meet regulatory requirements, otherwise performs in a substandard manner, or terminates its engagement with us, the timelines for our development programs may be extended or delayed or our development activities may be suspended or terminated. If any of our clinical trial sites terminates for any reason, we may experience the loss of follow-up information on subjects enrolled in such clinical trials unless we are able to transfer those subjects to another qualified clinical trial site, which may be difficult or impossible. In addition, clinical trial investigators for our clinical trials 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 or comparable foreign regulatory authorities concludes that the financial relationship may have affected the interpretation of the trial, the integrity of the data generated at the applicable clinical trial site may be questioned and the utility of the clinical trial itself may be jeopardized, which could result in the delay or rejection of any marketing application we submit by the FDA or any comparable foreign regulatory authority. Any such delay or rejection could prevent us from commercializing our product candidates.

We contract with third parties for the manufacturing and supply of product candidates for use in preclinical testing and clinical trials and related services, which supply may become limited or interrupted or may not be of satisfactory quality and quantity.

We do not have any manufacturing facilities. We produce in our laboratory relatively small quantities of products for evaluation in our research programs. We rely, and expect to continue to rely, on third parties for the manufacture of our product candidates for preclinical and clinical testing, as well as for commercial manufacture if any of our product candidates are approved. We currently have limited manufacturing arrangements and expect that each of our product candidates will only be covered by single source suppliers for the foreseeable future. This reliance increases the risk that we will not have sufficient quantities of our product candidates or products, if approved, or such quantities at an acceptable cost or quality, which could delay, prevent or impair our development or commercialization efforts.

Furthermore, all entities involved in the preparation of therapeutics for clinical trials or commercial sale, including our existing contract manufacturers for our product candidates, are subject to extensive regulation. Components of a finished therapeutic product approved for commercial sale or used in clinical trials must be manufactured in accordance with cGMP requirements. These regulations govern manufacturing processes and procedures, including record keeping, and the implementation and operation of quality systems to control and assure the quality of investigational products and products approved for sale. Poor control of production processes can lead to the introduction of contaminants, or to inadvertent changes in the properties or stability of our product candidates that may not be detectable in final product testing. We or our contract manufacturers must supply all necessary documentation in support of a BLA on a timely basis and must adhere to the FDA's cGMP regulations enforced by the FDA through its facilities inspection program. Comparable foreign regulatory authorities may require compliance with similar requirements. The facilities and quality systems of our third-party contractor manufacturers must pass a pre-approval inspection for compliance with the applicable regulations as a condition of marketing approval of our product candidates. We do not control the manufacturing activities of, and are completely dependent on, our contract manufacturers for compliance with cGMP regulations.

In the event that any of our manufacturers fails to comply with such requirements or to perform its obligations to us in relation to quality, timing or otherwise, or if our supply of components or other materials becomes limited or interrupted for other reasons, we may be forced to manufacture the materials ourselves, for which we currently do not have the capabilities or resources, or enter into an agreement with another third party, which we may not be able to do on commercially reasonable terms, if at all. In particular, any replacement of our manufacturers could require significant effort and expertise because there may be a limited number of qualified replacements. In some cases, the technical skills or technology required to manufacture our product candidates may be unique or proprietary to the original manufacturer and we may have difficulty transferring such skills or technology to another third party and a feasible alternative may not exist. In addition, certain of our product candidates and our own proprietary methods have never been produced or implemented outside of our company, and we may therefore experience delays to our development programs if and when we attempt to establish new third party manufacturing arrangements for these product candidates or methods. These factors would increase our reliance on such manufacturer or require us to obtain a license from such manufacturer in order to have another third party manufacture our product candidates. If we are required to change manufacturers for any reason, we will be required to verify that the new manufacturer maintains facilities and procedures that comply with quality standards and with all applicable regulations and guidelines. The delays associated with the verification of a new manufacturer could negatively affect our ability to develop product candidates in a timely manner or within budget.

Our or a third party's failure to execute on our manufacturing requirements, do so on commercially reasonable terms and comply with cGMP could adversely affect our business in a number of ways, including:

- an inability to initiate or continue clinical trials of our product candidates under development;
- delay in submitting regulatory applications, or receiving marketing approvals, for our product candidates;
- loss of the cooperation of future collaborators;
- subjecting third-party manufacturing facilities or our manufacturing facilities to additional inspections by regulatory authorities;
- requirements to cease development or to recall batches of our product candidates; and
- in the event of approval to market and commercialize our product candidates, an inability to meet commercial demands for our product or any other future product candidates.

Risks Related to Intellectual Property and Information Technology

Our efforts to prosecute, maintain, protect and/or defend our intellectual property rights may not be successful.

We will continue to file and prosecute patent applications and maintain trade secrets in an ongoing effort to protect our intellectual property rights. It is possible that our current patents, or patents which we may later acquire, may be successfully challenged or invalidated, in whole or in part. It is also possible that we may not obtain issued patents from our pending patent applications. We sometimes permit certain patents or patent applications to lapse or go abandoned under appropriate circumstances. Due to uncertainties inherent in prosecuting patent applications, sometimes patent applications are rejected, and we subsequently abandon them. It is also possible that we may develop proprietary technology, products or services in the future that are not patentable or that the patents of others will limit or altogether preclude our ability to conduct business. In addition, any patent issued to us or to our licensor may provide us with little or no competitive advantage, in which case we may abandon such patent or license it to another entity, or terminate the license agreement.

Our means of protecting our proprietary rights may not be adequate and our competitors may independently develop technologies, products or services that are identical or similar to ours or that compete with ours. Patent, trademark, copyright and trade secret laws afford only limited protection for our technology, products and services . The laws of many countries do not protect our proprietary rights to as great an extent as do the laws of the United States. Despite our efforts to protect our proprietary rights, unauthorized parties have in the past attempted, and may in the future attempt, to operate under the aspects of our intellectual property rights, or proprietary technology, products or services or products, or to obtain and use information that we regard as proprietary. Third parties may also design around our proprietary rights, which may render our protected technology, services and products less valuable, if the design around is favorably received in the marketplace. In addition, if any of our technology, products and services is covered by third-party patents or other intellectual property rights, we could be subject to various legal actions. We cannot assure that our technology products and/or services do not infringe, violate or misappropriate any patents or other intellectual property rights owned or controlled by others or that they will not in the future.

Litigation may be necessary to enforce our intellectual property rights, to protect our trade secrets, to determine the validity and scope of the proprietary rights of others, or to defend against claims of infringement, invalidity, misappropriation, or other claims.

Any such litigation could result in substantial costs and diversion of our resources. Moreover, any settlement of or adverse judgment resulting from litigation relating to intellectual property rights could require us to obtain a license to continue to make, use, import, sell or offer for sale the technology, products or services that is the subject of the claim, or otherwise restrict or prohibit our use of the technology, products or services.

Our ability to compete may decline if we do not adequately prosecute, maintain, protect and/or defend our proprietary technology, products or services or our intellectual property rights.

Our success depends in part on our ability to obtain patents and maintain adequate protection of our intellectual property rights directed to our technology, products and services in the United States and other countries. We have adopted a strategy of seeking patent protection in the United States and in foreign countries with respect to certain of the technology used in or relating to our products, services, and processes. As such, as of December 31, 2022, we owned or controlled approximately 2,090 issued patents and pending patent applications in the United States and in various foreign jurisdictions. Our patents and patent applications, if issued, as of December 31, 2022, have terms that expire between 2023 and approximately 2043. We also have license rights to a number of issued patents and pending patent applications in the United States and in various foreign jurisdictions. Our owned and licensed patents and patent applications include those directed to our enabling technology and to the methods and products that support our business in the biotherapeutics, pharma manufacturing, life sciences, food and other markets. We intend to continue to apply for patents relating to our technology, methods, services and products as we deem appropriate.

Issuance of claims in patent applications and enforceability of such claims once issued involve complex legal and factual questions and, therefore, we cannot predict with any certainty whether any of our issued patents will survive invalidity claims asserted by third parties. Issued patents and patents issuing from pending applications may be challenged, invalidated, circumvented, rendered unenforceable or substantially narrowed in scope. In addition, the inventorship and ownership of the patents and patent applications may be challenged by others. Moreover, the United States Leahy-Smith America Invents Act (“AIA”), enacted in September 2011, brought significant changes to the United States patent system, which include a change to a “first to file” system from a “first to invent” system and changes to the procedures for challenging issued patents and disputing patent applications during the examination process, among other things. While interference proceedings are possible for patent claims filed prior to March 16, 2013, many of our filings will be subject to the post- and pre-grant proceedings set forth in the AIA, including citation of prior art and written statements by third parties, third party pre-issuance submissions, ex parte reexamination, inter partes review, post-grant review, and derivation proceedings. We may need to utilize the processes provided by the AIA for supplemental examination or patent reissuance. These proceedings could result in substantial cost to us even if the outcome is favorable. Even if successful, any proceeding may result in loss of certain claims. Any litigation or proceedings could divert our management's time and efforts. Even unsuccessful claims brought by third parties could result in significant legal fees and other expenses, diversion of management time, and disruption in our business. Uncertainties resulting from initiation and continuation of any patent or related litigation could harm our ability to compete.

Additional uncertainty may result from legal precedent handed down by the United States Federal Circuit Court and Supreme Court as they determine legal issues concerning the scope and construction of patent claims and inconsistent interpretation of patent laws by the lower courts. Accordingly, we cannot ensure that any of our pending patent applications will result in issued patents, or even if issued, predict the breadth of the claims upheld in our and other companies' patents. Given that the degree of future protection for our proprietary rights is uncertain, we cannot ensure that: (i) we were the first to invent the inventions covered by each of our pending applications, (ii) we were the first to file patent applications for these inventions, or (iii) the proprietary technology, products or services we develop will be patentable. In addition, unauthorized parties may attempt to copy or otherwise obtain and use our technology, products and services. Monitoring unauthorized use of our intellectual property rights is difficult, and we cannot be certain that the steps we have taken will prevent unauthorized use of our technology, products or services, particularly in certain foreign countries where the local laws may not protect our proprietary rights as fully as in the United States. Moreover, third parties could practice our inventions in territories where we do not have patent protection. Such third parties may then try to import products made using our inventions into the United States or other countries. If competitors are able to use our proprietary technology, products or services, our ability to compete effectively could be harmed. In addition, others may independently develop and obtain patents for technologies, products or services that are similar to or superior to our technologies, products or services. If that happens, we may need to license these technologies, products or services, and we may not be able to obtain licenses on reasonable terms, if at all, which could cause harm to our business.

Similarly, foreign courts have made, and will likely continue to make, changes in how the patent laws in their respective jurisdictions are interpreted. Changes in patent laws and regulations in other countries or jurisdictions, changes in the governmental bodies that enforce them, or changes in how the relevant governmental authority enforces patent laws or regulations may weaken our ability to obtain new patents or to enforce patents that we own or may obtain in the future. Further, 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. For example, in some foreign jurisdictions, governments have the right to compel patent owners to grant others licenses to their intellectual property under certain circumstances. In addition, any protection afforded by foreign patents may be more limited than that provided under U.S. patent and intellectual property laws. We may encounter significant problems in enforcing and defending our intellectual property both in the United States and abroad. For example, if the issuance in a given country of a patent covering an invention is not followed by the issuance in other countries of patents covering the same invention, or if any judicial interpretation of the validity, enforceability or scope of the claims or the written description or enablement in a patent issued in one country is not similar to the interpretation given to the corresponding patent issued in other countries, our ability to protect our intellectual property rights in those countries may be limited. Changes in either patent laws or in interpretations of patent laws in the United States and other countries may materially diminish the value of our intellectual property rights or narrow the scope of our patent protection. We cannot predict future changes in the interpretation of patent laws or changes to patent laws that might be enacted into law by U.S. and foreign legislative bodies. Those changes may materially affect our patents or patent applications and our ability to obtain additional patent protection in the future. Any of the foregoing could have a material adverse effect on our competitive position, business, financial condition, results of operations and prospects.

Third parties may claim that we are infringing, violating or misappropriating their intellectual property rights, which may subject us to costly and time consuming litigation and prevent us from developing or commercializing our technology, products or services.

Our commercial success also depends in part on our ability to operate without infringing, violating or misappropriating patents and other intellectual property rights of third parties, and without breaching any licenses or other agreements that we have entered into with regard to our technologies, products or services. We cannot ensure that patents have not been issued, or will not be issued, to third parties that could block our ability to obtain patents or to operate as we would like. There may be patents in some countries that, if valid, may block our ability to make, use, sell, or offer for sale our technology, products or services in those countries, or import our products into those countries, if we are unsuccessful in circumventing or acquiring rights to these patents. There also may be claims in patent applications filed in some countries that, if granted and valid, may also block our ability to commercialize technology, products, services or processes in these countries if we are unable to circumvent or obtain rights to them.

The industries in which we operate and the biotechnology industry, in particular, are characterized by frequent and extensive litigation regarding patents and other intellectual property rights. Many biotechnology companies have employed intellectual property litigation as a way to gain a competitive advantage. Any involvement in litigation or other intellectual property proceedings inside and outside of the United States to defend against claims that we infringe, misappropriate or violate the intellectual property of the rights of others may divert our management’s time from focusing on business operations and could cause us to spend significant amounts of money. Any potential intellectual property litigation also could force us to do one or more of the following:

- stop making, using, selling or importing our technologies, products and services that use the subject intellectual property;
- pay monetary damages to the third party asserting claims against us;
- grant or transfer rights to third parties relating to our patents or other intellectual property rights;
- obtain from the third party asserting its intellectual property rights a license to make, sell, offer for sale, import or use the relevant technology, product or service, which license may not be available on reasonable terms, or at all; or
- redesign those technologies, products, services or processes that use any allegedly infringing, misappropriating or violating intellectual property rights, or relocate the operations relating to the allegedly infringing misappropriating or violating intellectual property rights to another jurisdiction, which may result in significant cost or delay to us, could be technically infeasible or could prevent us from making, selling, offering for sale, using or importing some of our technologies, products or services in the United States or other jurisdictions.

We are aware of some patents and patent applications relating to aspects of our technologies, products or services filed by, and issued to, third parties. We cannot assure that if such third party patents rights are asserted against us that we would ultimately prevail.

We may be involved in lawsuits to protect or enforce our intellectual property rights, which could be expensive, time-consuming and unsuccessful.

Competitors may infringe, violate or misappropriate our intellectual property rights or those of our licensors. To prevent infringement, violation, misappropriation or other unauthorized use, we have in the past filed, and may in the future be required to file, enforcement claims, which can be expensive and time-consuming. In addition, in an enforcement proceeding, a court may decide that the intellectual property right that we own or control is not valid, is unenforceable and/or is not infringed, violated or misappropriated. In addition, in legal proceedings against a third party to enforce a patent directed at one of our technologies, products or services, the defendant could counterclaim that our patent is invalid and/or unenforceable in whole or in part. In patent enforcement litigation in the United States, defendant counterclaims alleging invalidity and/or unenforceability are commonplace. Grounds for a patent validity challenge include an alleged failure to meet any of several statutory requirements, including lack of novelty, obviousness or non-enablement. Grounds for an unenforceability assertion could include an allegation that someone connected with prosecution of the patent withheld relevant information from the United States Patent and Trademark Office ("USPTO") or made a misleading statement during prosecution. Third parties may also raise similar claims before the USPTO, even outside the context of enforcement litigation. The outcome following legal assertions of invalidity and unenforceability is unpredictable, and prior art could render our patents or those of our licensors invalid. If a defendant were to prevail on a legal assertion of invalidity and/or unenforceability, we would lose at least part, and perhaps all, of the patent protection on the respective technology, products or services. Such a loss of patent protection could have a material adverse impact on our business.

Even if resolved in our favor, litigation or other legal proceedings relating to our intellectual property rights may cause us to incur significant expenses, and could distract our technical and management personnel from their normal responsibilities. In addition, there could be public announcements of the results of hearings, motions or other interim proceedings or developments 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 expenses and reduce the resources available for operations and research and development activities. We may not have sufficient financial or other resources to conduct such litigation or proceedings adequately. Some of our competitors may be able to sustain the costs of such litigation or proceedings more effectively than we can because of their greater financial resources. Uncertainties resulting from the initiation and continuation of patent litigation or other proceedings could compromise our ability to compete in the marketplace. Furthermore, because of the substantial amount of discovery required in connection with U.S. 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 not be able to enforce our intellectual property rights throughout the world.

The laws of some foreign countries where we do business do not protect intellectual property rights to the same extent as the laws of the United States. Many companies have encountered significant problems in protecting and enforcing intellectual property rights in certain foreign jurisdictions. The legal systems of certain countries, particularly certain developing countries, do not favor the enforcement of patents and other intellectual property rights, particularly those relating to biotechnology technologies. Accordingly, our efforts to protect and enforce our intellectual property rights in such countries may be inadequate. This could make it difficult for us to stop the infringement, violation or misappropriation of our patents or other intellectual property rights. Additionally, proceedings to enforce our patent rights in foreign jurisdictions could result in substantial costs and divert our efforts and attention from other aspects of our business.

If our biocatalysts, or the genes that code for our biocatalysts, are stolen, misappropriated or reverse engineered, others could use these biocatalysts or genes to produce competing products.

Third parties, including our contract manufacturers, customers and those involved in shipping our biocatalysts, often have custody or control of our biocatalysts. If our biocatalysts, or the genes that code for our biocatalysts, were stolen, misappropriated or reverse engineered, they could be used by other parties who may be able to reproduce these biocatalysts for their own commercial gain. If this were to occur, it may be difficult for us to challenge this type of use, especially in countries with limited intellectual property rights protection or in countries in which we do not have patents covering the misappropriated biocatalysts.

Confidentiality and non-use agreements with employees, consultants, advisors and other third parties may not adequately prevent disclosures and non-use of trade secrets and other proprietary information.

In addition to patent protection, we also rely on other intellectual property rights, including protection of copyright, trade secrets, know-how and/or other proprietary information that is not patentable or that we elect not to patent. However, trade secrets can be difficult to protect, and some courts are less willing or unwilling to protect trade secrets. To maintain the confidentiality of our trade secrets and proprietary information, we rely in part on trade secret law and contractual agreements to protect our confidential and proprietary information and processes. We generally enter into confidentiality and invention assignment agreements with our employees, consultants and third parties working on our behalf upon their commencement of a relationship with us. However, trade secrets and confidential information are difficult to protect and we cannot guarantee that we have entered into such agreements with each party that may have or have had access to our trade secrets or proprietary technology and processes and we may not enter into such agreements with all employees, consultants and third parties who have been involved in the development of our intellectual property rights. Nevertheless, without our permission or awareness, our confidential and proprietary information may be disclosed to third parties, used by the respective individuals for purposes other than for the Company's business, or obtained through illegal means, such that third parties could reverse engineer our biocatalysts, product candidates, and processes, to attempt to develop the same technology or develop substantially equivalent technology.

Costly and time-consuming litigation could be necessary to enforce and determine the scope of our confidential and proprietary rights, and failure to protect our trade secrets could adversely affect our competitive business position. If any of our trade secrets were lawfully obtained, we may be unable to prevent them, or those to whom they communicate it, from using that technology or information to compete with us or disclosing it publicly. Therefore, these events could have a material adverse effect ob our business, financial condition and results of operations. In particular, a failure to protect our proprietary rights may allow competitors to copy our technology, which could adversely affect our pricing and market share.

In addition to contractual measures, we try to protect the confidential nature of our proprietary information by maintaining physical security of our premises and electronic security of our information technology systems. Such security measures may not, for example, in the case of misappropriation of a trade secret by an employee, consultant or other third party with authorized access or with unauthorized access but an intent to steal, provide adequate protection for our proprietary information. Our security measures may not prevent such employee, consultant or other third party from misappropriating our trade secrets and using them or providing them to a competitor, and recourse we take against such misconduct may not provide an adequate remedy to protect our interests fully. While we use commonly accepted security measures, trade secret violations are often a matter of state law in the United States, and the criteria for protection of trade secrets can vary among different jurisdictions. If the steps we have taken to maintain our trade secrets are deemed inadequate, we may have insufficient recourse against third parties for misappropriating the trade secret.

Risks Related to Owning our Common Stock

We are subject to anti-takeover provisions in our certificate of incorporation and bylaws and under Delaware law that could delay or prevent an acquisition of our company, even if the acquisition would be beneficial to our stockholders.

Provisions in our amended and restated certificate of incorporation and our bylaws may delay or prevent an acquisition of us. Among other things, our amended and restated certificate of incorporation and bylaws provide for a board of directors which is divided into three classes, with staggered three-year terms and provide that all stockholder action must be effected at a duly called meeting of the stockholders and not by a consent in writing, and further provide that only our board of directors, the chairman of the board of directors, our chief executive officer or president may call a special meeting of the stockholders. In addition, our amended and restated certificate of incorporation allows our board of directors, without further action by our stockholders, to issue up to 5,000,000 shares of preferred stock in one or more series and to fix the rights, preferences, privileges and restrictions thereof. These provisions may also frustrate or prevent any attempts by our stockholders to replace or remove our current management by making it more difficult for stockholders to replace members of our board of directors, who are responsible for appointing the members of our management team. Furthermore, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law which prohibits, with some exceptions, stockholders owning in excess of 15% of our outstanding voting stock from merging or combining with us. Finally, our charter documents establish advanced notice requirements for nominations for election to our board of directors and for proposing matters that can be acted upon at stockholder meetings. Although we believe these provisions together provide for an opportunity to receive higher bids by requiring potential acquirers to negotiate with our board of directors, they would apply even if an offer to acquire our company may be considered beneficial by some stockholders.

Our quarterly or annual operating results may fluctuate in the future. As a result, we may fail to meet or exceed the expectations of research analysts or investors, which could cause our stock price to decline.

Our financial condition and operating results have varied significantly in the past and may continue to fluctuate from quarter to quarter and year to year in the future due to a variety of factors, many of which are beyond our control. Factors relating to our business that may contribute to these fluctuations include the following factors, as well as other factors described elsewhere in this report:

- our ability to achieve or maintain profitability;
- our relationships with, and dependence on, collaborators in our principal markets;
- our dependence on a limited number of customers,;
- our product supply agreements with customers have finite duration, may not be extended or renewed and generally do not require the customer to purchase any particular quantity or quantities of our products;
- with respect to customers purchasing our products for the manufacture of active pharmaceutical ingredients for which they have exclusivity due to patent protection, the termination or expiration of such patent protection and any resulting generic competition may materially and adversely affect our revenues, financial condition or results of operations;
- our dependence on a limited number of products in our performance enzymes business;
- our reliance on a limited number of contract manufacturers for large scale production of substantially all of our enzyme products;
- our ability to develop and successfully commercialize new products for the markets we serve;
- our ability to obtain additional development partners for our novel biotherapeutic programs;
- potential of Nestlé Health Science or Takeda terminating any development program under their license agreements with us;
- potential of GSK, Merck, Novartis or any other performance enzyme customer terminating their agreements with us;
- the success of our customers' products in the market and the ability of such customers to obtain regulatory approvals for products and processes;
- our or our customers' ability to obtain regulatory approval for the sale and manufacturing of food products using our enzymes;
- our ability to deploy our technology platform in life science tools markets;
- our ability to successfully achieve domestic and foreign regulatory approval for product candidates;

- our ability to successfully design and execute clinical testing at a reasonable cost and on an acceptable time-frame;
- our dependence on product candidates which could unexpectedly fail at any stage of preclinical or clinical development;
- our dependence on product candidates which may lack the ability to work as intended or cause undesirable side effects;
- our dependency on third parties to conduct clinical trials, research, and preclinical studies;
- our ability to successfully prosecute and protect our intellectual property;
- our ability to compete if we do not adequately protect our proprietary technologies or if we lose some of our intellectual property rights;
- our ability to avoid infringing the intellectual property rights of third parties;
- our involvement in lawsuits to protect or enforce our patents or other intellectual property rights;
- our ability to enforce our intellectual property rights throughout the world;
- our dependence on, and the need to attract and retain, key management and other personnel;
- our ability to prevent the theft or misappropriation of our biocatalysts, the genes that code for our biocatalysts, know-how or technologies;
- our ability to protect our trade secrets and other proprietary information from disclosure by employees and others;
- our ability to obtain substantial additional capital that may be necessary to expand our business;
- our ability to comply with the terms of our credit facility;
- our ability to timely pay debt service obligations;
- our customers' ability to pay amounts owed to us in a timely manner;
- our ability to avoid charges to earnings as a result of any impairment of goodwill, intangible assets or other long-lived assets;
- changes in financial accounting standards or practices may cause adverse, unexpected financial reporting fluctuations and affect our reported results of operations;
- our ability to maintain effective internal control over financial reporting;
- our dependency on information technology systems, infrastructure and data;
- our ability to control and to improve product gross margins;
- our ability to protect against risks associated with the international aspects of our business;
- the cost of compliance with EU chemical regulations;
- potential advantages that our competitors and potential competitors may have in securing funding or developing products;
- our ability to accurately report our financial results in a timely manner;
- results of regulatory tax examinations;
- market and economic conditions may negatively impact our business, financial condition, and share price;
- business interruptions due to natural disasters, disease outbreaks or other events beyond our control;
- public concerns about the ethical, legal and social ramifications of genetically engineered products and processes;
- our ability to integrate our current business with any businesses that we may acquire in the future;
- our ability to properly handle and dispose of hazardous materials in our business;
- potential product liability claims;
- changes to tax law and related regulations could materially affect our tax obligations and effective tax rate; and
- our ability to use our NOLs to offset future taxable income.

Due to the various factors mentioned above, and others, the results of any prior quarterly or annual periods should not be relied upon as indications of our future operating performance.

We do not intend to pay cash dividends for the foreseeable future.

We currently intend to retain our future earnings, if any, to finance the further development and expansion of our business and do not intend to pay cash dividends in the foreseeable future. Any future determination to pay dividends will be at the discretion of our board of directors and will depend on our financial condition, results of operations, capital requirements, restrictions contained in future agreements and financing instruments, business prospects and such other factors as our board of directors deems relevant.

General Risk Factors

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

The trading market for our common stock will be influenced by the research and reports that securities or industry analysts publish about us or our business. We do not have any control over these analysts. If one or more of the analysts who cover us downgrade our stock or change their opinion of our stock in a negative manner, our stock price would likely decline. If one or more of these analysts cease coverage of our company or fail to regularly publish reports on us, we could lose visibility in the financial markets, which could cause our stock price or trading volume to decline.

We face risks associated with our international business.

While we have a limited number of employees located outside of the United States, we are and will continue to be dependent upon contract manufacturers located outside of the United States. In addition, we have customers and partners located outside of the United States. Conducting business internationally exposes us to a variety of risks, including:

- changes in or interpretations of foreign regulations that may adversely affect our ability to sell our products, repatriate profits to the United States or operate our foreign-located facilities;
- the imposition of tariffs;
- the imposition of limitations on, or increase of, withholding and other taxes on remittances and other payments by foreign subsidiaries or joint ventures;
- the imposition of limitations on genetically-engineered products or processes and the production or sale of those products or processes in foreign countries;
- currency exchange rate fluctuations;
- uncertainties relating to foreign laws, regulations and legal proceedings including tax, import/export, anti-corruption and exchange control laws;
- the availability of government subsidies or other incentives that benefit competitors in their local markets that are not available to us;
- increased demands on our limited resources created by our operations may constrain the capabilities of our administrative and operational resources and restrict our ability to attract, train, manage and retain qualified management, technicians, scientists and other personnel;
- economic or political instability in foreign countries;
- difficulties associated with staffing and managing foreign operations; and
- the need to comply with a variety of United States and foreign laws applicable to the conduct of international business, including import and export control laws and anti-corruption laws.

Market and economic conditions may negatively impact our business, financial condition, and share price.

Concerns about inflation, energy costs, geopolitical issues, the United States mortgage market and a declining real estate market, unstable global credit markets and financial conditions, and volatile oil prices have led to periods of significant economic instability, diminished liquidity and credit availability, declines in consumer confidence and discretionary spending, diminished expectations for the global economy and expectations of slower global economic growth going forward, increased unemployment rates, and increased credit defaults in recent years. Our general business strategy may be adversely affected by any such economic downturns, volatile business environments and continued unstable or unpredictable economic and market conditions. In addition, if the market and economic conditions described above continue to deteriorate or do not improve, it may make any necessary debt or equity financing more difficult to complete, more costly, and more dilutive. Failure to secure any necessary financing in a timely manner and on favorable terms could have a material adverse effect on our growth strategy, financial performance, and stock price. Additionally, rising rates of inflation have increased the costs associated with conducting our business, including by causing substantial increases in the costs of materials, including raw materials and consumables, equipment, services, and labor. Moreover, given the unpredictable nature of the current economic climate, including future changes in rates of inflation, it may be increasingly difficult for us to predict and control our future expenses, which may harm our ability to conduct our business.

Business interruptions resulting from disasters or other disturbances could delay us in the process of developing our products and could disrupt our sales. Our business continuity and disaster recovery plans may not adequately protect us from a serious disaster or other disturbance.

Our headquarters and other facilities are located in the San Francisco Bay Area, which in the past has experienced both severe earthquakes and wildfires. Earthquakes, wildfires or other natural disasters could severely disrupt our operations, and have a material adverse effect on our business, results of operations, financial condition and prospects. We are also vulnerable to other types of disasters and other events that could disrupt our operations, such as riot, civil disturbances, war, terrorist acts, infections in our laboratory or production facilities or those of our customers or contract manufacturers and other events beyond our control. If a natural disaster or other event occurred that prevented us from using all or a significant portion of our headquarters, that damaged critical infrastructure, such as our enterprise financial systems or manufacturing resource planning and enterprise quality systems, or that otherwise disrupted operations, it may be difficult or, in certain cases, impossible, for us to continue our business for a substantial period of time. The disaster recovery and business continuity plans we have in place currently are limited and are unlikely to prove adequate in the event of a serious disaster or similar event. We may incur substantial expenses as a result of the limited nature of our disaster recovery and business continuity plans. We do not carry insurance for earthquakes and we may not carry sufficient business interruption insurance to compensate us for losses that may occur. Any losses or damages we incur could have a material adverse effect on our cash flows and success as an overall business.

We are dependent on information technology systems, infrastructure and data, and any failure of these systems could harm our business. Security breaches, loss of data and other disruptions could compromise sensitive information related to our business or prevent us from accessing critical information and expose us to liability, which could adversely affect our business, results of operations and financial condition.

Information technology helps us operate efficiently, interface with customers, maintain financial accuracy and efficiency and accurately produce our financial statements. If we do not allocate and effectively manage the resources necessary to build and sustain the proper technology infrastructure, we could be subject to transaction errors, processing inefficiencies, the loss of customers, business disruptions or the loss of or damage to intellectual property through security breach. If our information technology systems do not effectively collect, store, process and report relevant data for the operation of our business, whether due to equipment malfunction or constraints, software deficiencies, or human error, our ability to effectively plan, forecast and execute our business plan and comply with applicable laws and regulations will be impaired, perhaps materially. Our information technology systems and those of our external vendors, strategic partners and other contractors or consultants are vulnerable to attack and damage or interruption from computer viruses and malware (e.g. ransomware), malicious code, natural disasters, terrorism, war, telecommunication and electrical failures, hacking, cyberattacks, phishing attacks and other social engineering schemes, employee theft or misuse, human error, fraud, denial or degradation of service attacks, sophisticated nation-state and nation-state-supported actors or unauthorized access or use by persons inside our organization, or persons with access to systems inside our organization. Any such impairment could materially and adversely affect our financial condition, results of operations, cash flows and the timeliness with which we report our internal and external operating results.

Our business may require us to use and store personal information of our customers, employees, and business partners. This may include names, addresses, phone numbers, email addresses, contact preferences, tax identification numbers and payment account information. We require usernames and passwords in order to access our information technology systems. We also use encryption and authentication technologies to secure the transmission and storage of data. However, these security measures may be compromised as a result of security breaches by unauthorized persons, employee error, malfeasance, faulty password management or other irregularity, and result in persons obtaining unauthorized access to our data or accounts. Third parties may attempt to fraudulently induce employees or customers into disclosing usernames, passwords or other sensitive information, which may in turn be used to access our information technology systems. For example, our employees have received "phishing" emails and phone calls attempting to induce them to divulge passwords and other sensitive information.

In addition, unauthorized persons may attempt to hack into our products or systems to obtain personal data relating to employees and other individuals, our confidential or proprietary information or confidential information we hold on behalf of third parties. We also rely on external vendors to supply and/or support certain aspects of our information technology systems. The systems of these external vendors may contain defects in design or manufacture or other problems that could unexpectedly compromise information security of our own systems, and we are dependent on these third parties to deploy appropriate security programs to protect their systems. If we or our third-party vendors were to experience a significant cybersecurity breach of our or their information systems or data, the costs associated with the investigation, remediation and potential notification of the breach to counter-parties and data subjects could be material. Our remediation efforts may not be successful. Further, if such an event were to occur and cause interruptions in our operations, it could result in a material disruption of our development programs and our business operations, whether due to a loss, corruption or unauthorized disclosure of our trade secrets, personal information or other proprietary or sensitive information or other similar disruptions. Attacks upon information technology systems are also increasing in their frequency, levels of persistence, sophistication and intensity, and are being conducted by sophisticated and organized groups and individuals with a wide range of motives and expertise. As a result of the COVID-19 pandemic, we may also face increased cybersecurity risks due to our reliance on internet technology and the number of our employees who are working remotely, which may create additional opportunities for cybercriminals to exploit vulnerabilities. We have programs in place to detect, contain and respond to data security incidents, and we make ongoing improvements to our information-sharing products in order to minimize vulnerabilities, in accordance with industry and regulatory standards. However, because the techniques used to obtain unauthorized access to or sabotage systems change frequently and may be difficult to detect, we may not be able to anticipate and prevent these intrusions or mitigate them when and if they occur. Even if identified, we may be unable to adequately investigate or remediate incidents or breaches due to attackers increasingly using tools and techniques that are designed to circumvent controls, to avoid detection and to remove or obfuscate forensic evidence.

We and certain of our external vendors are from time to time subject to cyberattacks and security incidents. While we do not believe that we have experienced any significant system failure, accident, or security breach to date, if such an event were to occur, it could result in the unauthorized access to or unauthorized use, disclosure, release or other processing of personal information, it may be necessary to notify individuals, governmental authorities, supervisory bodies, the media and other parties pursuant to privacy and security laws. Any security compromise affecting us, our service providers, vendors, strategic partners, other contractors, consultants or our industry, whether real or perceived, could harm our reputation, erode confidence in the effectiveness of our security measures and lead to regulatory scrutiny. To the extent that any disruption or security breach were to result in a loss of, or damage to, our data or systems, or inappropriate disclosure of confidential or proprietary or personal information, we could incur liability, including litigation exposure, penalties and fines, we could become the subject of regulatory action or investigation, our competitive position could be harmed and the further development of our products could be delayed. If such an event were to occur and cause interruptions in our operations, it could result in a material disruption of our business. Furthermore, federal, state and international laws and regulations can expose us to enforcement actions and investigations by regulatory authorities, and potentially result in regulatory penalties, fines and significant legal liability, if our information technology security efforts fail. We may also be exposed to a risk of loss or litigation and potential liability, which could materially and adversely affect our business, results of operations and financial condition.

Actual or perceived failures to comply with applicable data protection, privacy and security laws, regulations, standards and other requirements could adversely affect our business, results of operations and financial condition.

The global data protection landscape is rapidly evolving, and we are or may become subject to state, federal and foreign laws, regulations, decisions and directives governing the privacy, security, collection, storage, transmission, use, processing, retention and disclosure of personal information. Any failure or perceived failure by us to comply with applicable laws or regulations, our internal policies and procedures or our contracts governing our processing of personal information could result in negative publicity, government investigations and enforcement actions, claims by third parties and damage to our reputation, any of which could have a material adverse effect on our operations, financial performance and business.

In the United States, HIPAA imposes, among other things, certain standards relating to the privacy, security, transmission and breach reporting of individually identifiable health information. Certain states have also adopted comparable privacy and security laws and regulations, which govern the privacy, processing and protection of health-related and other personal information. Such laws and regulations will be subject to interpretation by various courts and other governmental authorities, thus creating potentially complex compliance issues for us and our future customers and strategic partners. For example, the California Consumer Privacy Act ("CCPA") went into effect on January 1, 2020 , and introduces new compliance burdens on organizations doing business in California that collect personal information about California residents. It creates individual privacy rights for California consumers and increases the privacy and security obligations of entities handling certain personal information. The CCPA also provides for civil penalties for violations, as well as a private right of action for data breaches that is expected to increase data breach litigation. Further, the California Consumer Privacy Act ("CCPA") recently passed in California. The CPRA will impose additional data protection obligations on covered businesses, including additional consumer rights processes, limitations on data uses, new audit requirements for higher risk data and opt outs for certain uses of sensitive data. It will also create a new California data protection agency authorized to issue substantive regulations and could result in increased privacy and information security enforcement. The majority of the provisions went into effect on January 1, 2023, and additional compliance investment and potential business process changes may be required. Similar laws have passed in Virginia, Colorado, Connecticut and Utah and have been proposed in other states and at the federal level, reflecting a trend toward more stringent privacy legislation in the United States. These developments increase our compliance burden and our risk, including risks of regulatory fines, litigation and associated reputational harm. Any liability from failure to comply with the requirements of these laws could adversely affect our financial condition.

Furthermore, the Federal Trade Commission ("FTC") and many state Attorneys General continue to enforce federal and state consumer protection laws against companies for online collection, use, dissemination and security practices that appear to be unfair or deceptive. For example, according to the FTC, failing to take appropriate steps to keep consumers' personal information secure can constitute unfair acts or practices in or affecting commerce in violation of Section 5(a) of the Federal Trade Commission Act. The FTC expects a company's data security measures to be reasonable and appropriate in light of the sensitivity and volume of consumer information it holds, the size and complexity of its business, and the cost of available tools to improve security and reduce vulnerabilities.

In Europe, the General Data Protection Regulation ("GDPR") went into effect in May 2018 and imposes strict requirements for processing the personal data of individuals within the European Economic Area ("EEA"). The GDPR imposes stringent requirements for controllers and processors of personal data and increases our obligations, for example, by imposing higher standards when obtaining consent from individuals to process their personal data, requiring more robust disclosures to individuals, strengthening individual data rights, shortening timelines for data breach notifications, limiting retention periods and secondary use of information, increasing requirements pertaining to health data as well as pseudonymized (i.e., key-coded) data and imposing additional obligations when we contract with third-party processors in connection with the processing of personal data. The GDPR provides that EEA member states may make their own additional laws and regulations limiting the processing of genetic, biometric or health data, which could limit our ability to use and share personal data or could cause our costs to increase and harm our business and financial condition. Failure to comply with the requirements of the GDPR can result in fines of up to the greater of €20 million and 4% of the total worldwide annual turnover of the preceding financial year and other administrative penalties. If we are required to comply with the new data protection rules imposed by GDPR, such compliance may be onerous and adversely affect our business, financial condition, and results of operations. Among other requirements, the GDPR regulates transfers of personal data subject to the GDPR to third countries that have not been found to provide adequate protection to such personal data, including the United States, and the efficacy and longevity of current transfer mechanisms between the EU and the United States remains uncertain. For example, in July 2020, the Court of Justice of the EU ("CJEU") limited how organizations could lawfully transfer personal data from the EU/EEA to the United States by invalidating the Privacy Shield for purposes of international transfers and imposing further restrictions on the use of standard contractual clauses ("SCCs"). In March 2022, the United States and EU announced a new regulatory regime intended to replace the invalidated regulations; however, this new EU-US Data Privacy Framework has not been implemented beyond an executive order signed by President Biden on October 7, 2022 on Enhancing Safeguards for United States Signals Intelligence Activities. The European Commission issued revised SCCs on June 4, 2021 to account for the decision of the CJEU and recommendations made by the European Data Protection Board. The revised SCCs must be used for relevant new data transfers from September 27, 2021; existing standard contractual clauses arrangements must be migrated to the revised clauses by December 27, 2022. The new SCCs apply only to the transfer of personal data outside of the EEA and not the United Kingdom; the United Kingdom's Information Commissioner's Office launched a public consultation on its draft revised data transfers mechanisms in August 2021. There is some uncertainty around whether the revised clauses can be used for all types of data transfers, particularly whether they can be relied on for data transfers to non-EEA entities subject to the GDPR. As supervisory authorities issue further guidance on personal data export mechanisms, including circumstances where the SCCs cannot be used, 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.

Further, from January 1, 2021, companies have had to comply with the GDPR and also the United Kingdom GDPR ("UK GDPR"), which, together with the amended UK Data Protection Act 2018, retains the GDPR in UK national law. The UK GDPR mirrors the fines under the GDPR, i.e., fines up to the greater of €20 million (or up to £17.5 million for UK) or 4% of global turnover. The relationship between the United Kingdom and the EU in relation to certain aspects of data protection law remains unclear, and it is unclear how United Kingdom data protection laws and regulations will develop in the medium to longer term. The European Commission has adopted an adequacy decision in favor of the United Kingdom, enabling data transfers from EU member states to the United Kingdom without additional safeguards. However, the UK adequacy decision will automatically expire in June 2025 unless the European Commission re-assesses and renews or extends that decision. In September 2021, the United Kingdom government launched a consultation on its proposals for wide-ranging reform of United Kingdom data protection laws following Brexit and the response to this consultation was published in June 2022. There is a risk that any material changes which are made to the United Kingdom data protection regime could result in the European Commission reviewing the United Kingdom adequacy decision, and the UK United Kingdom losing its adequacy decision if the European Commission deems the United Kingdom to no longer provide adequate protection for personal data.

Although we work to comply with applicable laws, regulations and standards, our contractual obligations and other legal obligations, these requirements are evolving and may be modified, interpreted and applied in an inconsistent manner from one jurisdiction to another, and may conflict with one another or other legal obligations with which we must comply. Various federal, state and foreign legislative or regulatory bodies may enact new or additional laws and regulations concerning privacy, data-retention and data-protection issues, including laws or regulations mandating disclosure to domestic or international law enforcement bodies, which could adversely impact our business or our reputation with customers. For example, some countries have adopted laws mandating that certain personal information regarding customers in their country be maintained solely in their country. Having to maintain local data centers and redesign product, service and business operations to limit processing of personal information to within individual countries could increase our operating costs significantly. Any failure, or perceived failure, by us to comply with federal, state or international privacy, data-retention or data-protection-related laws, regulations, orders or industry self-regulatory principles could result in proceedings or actions against us by governmental entities or others, a loss of customer confidence, damage to our brand and reputation and a loss of customers, any of which could have an adverse effect on our business.

Evolving expectations around corporate responsibility practices, specifically related to environmental, social and governance ("ESG") matters, may expose us to reputational and other risks.

Investors, stockholders, customers, suppliers and other third parties are increasingly focusing on ESG and corporate social responsibility endeavors and reporting. Companies that do not adapt to or comply with the evolving investor or stakeholder expectations and standards, or which are perceived to have not responded appropriately, may suffer from reputational damage and result in the business, financial condition and/or stock price of a company being materially and adversely affected. Further, this increased focus on ESG issues may result in new regulations and/or third-party requirements that could adversely impact our business, or certain shareholders reducing or eliminating their holdings of our stock. Additionally, an allegation or perception that we have not taken sufficient action in these areas could negatively harm our reputation.

ITEM 1B. UNRESOLVED STAFF COMMENTS

Not applicable.

ITEM 2. PROPERTIES

FACILITIES

Our headquarters are located in Redwood City, California, where we lease approximately 77,300 square feet of office and laboratory space.

Our lease ("RWC Lease") with Metropolitan Life Insurance Company ("MetLife") includes approximately 28,200 square feet of space located at 200 and 220 Penobscot Drive, Redwood City, California (the "200/220 Penobscot Space"), approximately 37,900 square feet of space located at 400 Penobscot Drive, Redwood City, California (the "400 Penobscot Space") (the 200/220 Penobscot Space and the 400 Penobscot Space are collectively referred to as the "Penobscot Space"), and approximately 11,200 square feet of space located at 501 Chesapeake Drive, Redwood City, California (the "Chesapeake Space").

We entered into the initial lease with MetLife for our facilities in Redwood City in 2004 and the RWC lease has been amended multiple times since then to adjust the leased space and terms of the RWC Lease. In February 2019, we entered into an Eighth Amendment to the RWC Lease (the "Eighth Amendment") with MetLife with respect to the Penobscot Space and the 501 Chesapeake Space to extend the term of the RWC Lease for additional periods. Pursuant to the Eighth Amendment, the term of the lease of the Penobscot Space has been extended through May 2027. The lease term for the 501 Chesapeake Space has been extended to May 2029. We have one (1) option to extend the term of the lease for the Penobscot Space for five (5) years, and one (1) separate option to extend the term of the lease for the 501 Chesapeake Space for five (5) years.

In January 2021, we entered into a lease agreement with ARE-San Francisco No. 63, LLC ("ARE") to lease a portion of a facility comprising approximately 36,593 rentable square feet at 825 Industrial Road, San Carlos, California to serve as additional office and research and development laboratory space (the "San Carlos Space"). In December 2021, we commenced occupancy of the San Carlos Space. The lease term for the San Carlos Space is through the end of November 2031. We have one (1) option to extend the term of the lease for the San Carlos Space for five (5) years.

In May 2021, we entered into a short-term office lease with The Inside Source, Inc., to sublease approximately 3,313 square feet of office space in a building located at 985 Industrial Blvd. San Carlos, California. This lease expired in April 2022.

We believe that the facilities that we currently lease in Redwood City and San Carlos, California are adequate for our needs for the immediate future and that, should it be needed, additional space can be leased to accommodate any future growth.

ITEM 3. LEGAL PROCEEDINGS

We are currently not a party to any material pending litigation or other material legal proceedings.

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

Our common stock is quoted on the Nasdaq Global Select Market ("Nasdaq"), under the symbol "CDXS."

As of February 22, 2023, there were approximately 125 stockholders of record. A substantially greater number of stockholders may be "street name" or beneficial holders, whose shares are held of record by banks, brokers and other financial institutions.

Dividend Policy

We have never declared or paid cash dividends on our common stock, and we currently do not plan to declare dividends on shares of our common stock in the foreseeable future. We expect to retain our future earnings, if any, for use in the operation and expansion of our business. In addition, unless waived, the terms of our Credit Facility prohibit us from paying any cash dividends or making other distributions. The payment of cash dividends in the future, if any, will be at the discretion of our board of directors and will depend upon such factors as earnings levels, capital requirements, our overall financial condition and any other factors deemed relevant by our board of directors.

Securities Authorized for Issuance under Equity Compensation Plans

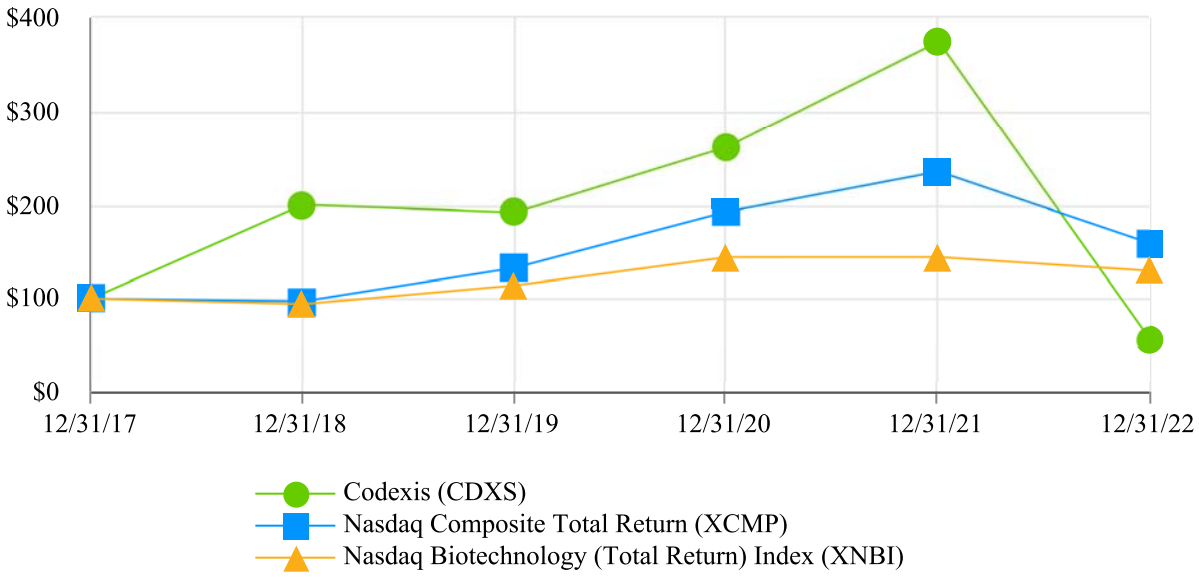
The information required by this item concerning securities authorized for issuance under equity compensation plans is incorporated by reference from the information that will be set forth in the Definitive Proxy Statement to be filed with the Securities and Exchange Commission in connection with the Annual Meeting of Stockholders to be held in 2023 (the "2023 Proxy Statement") under the heading "Executive Compensation—Equity Compensation Plan Information."

Stock Price Performance Graph

The following tabular information and graph compare our total common stock return with the total return for (i) the Nasdaq Composite Index and (ii) the Nasdaq Biotechnology Index for the period December 31, 2017 through December 31, 2022. The figures represented below assume an investment of $100 in our common stock at the closing price on December 31, 2017 and in the Nasdaq Composite Index and the Nasdaq Biotechnology Index on December 31, 2017 and the reinvestment of dividends into shares of common stock. The comparisons in the table and graph are required by the SEC and are not intended to forecast or be indicative of possible future performance of our common stock. The tabular information and graph shall not be deemed "soliciting material" or to be "filed" for purposes of Section 18 of the Exchange Act or otherwise subject to the liabilities under that Section, and shall not be deemed to be incorporated by reference into any of our filings under the Securities Act or the Exchange Act.

		December 31,					
$100 investment in stock or index	**Ticker**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Codexis, Inc.	CDXS	$ 100.00	$ 200.00	$ 191.50	$ 261.44	$ 374.49	$ 55.81
Nasdaq Composite Total Return	XCMP	$ 100.00	$ 97.16	$ 132.81	$ 192.48	$ 235.16	$ 158.65
Nasdaq Biotechnology (Total Return) Index	XNBI	$ 100.00	$ 91.14	$ 114.02	$ 144.14	$ 144.17	$ 129.58

Comparison of Cumulative Total Return
Among Codexis, Nasdaq Composite Index and Nasdaq Biotechnology Index



Unregistered Sales of Equity Securities and Use of Proceeds

Unregistered Sales of Equity Securities

During the year ended December 31, 2022, we did not issue or sell any unregistered securities not previously disclosed in a Quarterly Report on Form 10-Q or in a Current Report on Form 8-K.

Issuer Purchases of Equity Securities

None.

ITEM 6. [RESERVED]

ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

The following management's discussion and analysis of our financial condition and results of operations should be read in conjunction with our audited Consolidated Financial Statements and the related notes thereto included elsewhere in this Annual Report on Form 10-K. This Annual Report on Form 10-K contains forward-looking statements within the meaning of Section 21E of the Securities Exchange Act of 1934, as amended (the "Exchange Act"). These statements include, but are not limited to, expectations regarding our strategy, business plans, financial performance and developments relating to our industry. These statements are often identified by the use of words such as "may," "will," "expect," "believe," "anticipate," "intend," "could," "should," "estimate," or "continue," and similar expressions or variations. Such forward-looking statements are subject to risks, uncertainties and other factors that could cause actual results and the timing of certain events to differ materially from future results expressed or implied by such forward-looking statements. Factors that could cause or contribute to such differences include, but are not limited to, those discussed in Part I, Item IA:"Risk Factors," of this Annual Report on Form 10-K and elsewhere in this report. The forward-looking statements in this Annual Report on Form 10-K represent our views as of the date of this Annual Report on Form 10-K. We anticipate that subsequent events and developments will cause our views to change. However, while we may elect to update these forward-looking statements at some point in the future, we have no current intention of doing so except to the extent required by applicable law. You should, therefore, not rely on these forward-looking statements as representing our views as of any date subsequent to the date of this Annual Report on Form 10-K.

Business Overview

We are a leading enzyme engineering company leveraging our proprietary CodeEvolver® technology platform to discover, develop and enhance novel, high performance enzymes and other classes of proteins. Enzymes are naturally occurring biological molecules critical to almost all biochemical reactions that sustain life. They can be precisely engineered and optimized for specific functions, and to have particular characteristics, such as an ability to survive environments in which natural enzymes cannot, or to perform (bio)chemical transformations different than those for which they naturally evolved. The capacity to enhance the properties and performance of enzymes has led to pivotal improvements across three healthcare industry pillars: pharmaceutical manufacturing, life sciences, and biotherapeutics. The enzymes we produce solve for real-world challenges associated with small molecule pharmaceuticals manufacturing, nucleic acid synthesis and genomic sequencing, and – as biotherapeutic candidates – they have the potential to treat challenging diseases. Our unique enzymes drive improvements such as higher yields, reduced energy usage and waste generation, improved efficiency in manufacturing, greater sensitivity in genomic and diagnostic applications, and potentially more efficacious therapeutics.

Recent Developments

Announcement of interim results from Phase 1 trial of CDX-7108 for Exocrine Pancreatic Insufficiency ("EPI")

On February 23, 2023, we and our partner, Nestlé Health Science announced interim results from a Phase 1 clinical trial of CDX-7108 for the treatment of EPI. Data from the proof-of-concept arm indicated improved lipid absorption when patients are administered CDX-7108 versus placebo. Importantly, no safety issues were noted in the 48 subjects that participated in the single ascending dose and multiple ascending dose portion of the study. We believe the interim data support further development of CDX-7018 in partnership with Nestlé Health Science, with potential for the initiation of a Phase 2 study in early 2024.

Presentation of pre-clinical data from the Fabry disease transgene program

On February 22, 2023, we announced that Takeda Pharmaceutical Company Limited (Takeda) presented pre-clinical data from the Fabry disease transgene program, part of its Strategic Collaboration and License Agreement with Codexis, at the 19th Annual WORLD*Symposium*™. The gene therapy candidate is being developed to encode the codon optimized, CodeEvolver® engineered -GAL enzyme, which is designed to have improved serum and lysosomal stability and a predicted reduced immunogenicity.

Strengthened management team and Board of Directors with new appointments

On January 23,2023, we announced the appointment of Sri Ryali as Chief Financial Officer and on December 20, 2022, we announced the appointment of H. Stewart Parker to our Board of Directors.

Recent Investing and Financing Activities

In March 2022, we entered into a Stock Purchase Agreement with seqWell Inc. ("seqWell"), a privately held biotechnology company, pursuant to which we purchased 1,000,000 shares of seqWell's Series C preferred stock for $5.0 million.

In May 2021, we filed a Registration Statement on Form S-3 with the SEC, that automatically became effective upon its filing, under which we may sell common stock, preferred stock, debt securities, warrants, purchase contracts, and units from time to time in one or more offerings. On the date of this filing, we also filed a post-effective amendment to that Registration Statement on Form S-3. Pursuant to that post-effective amendment, we registered an aggregate $200.0 million of securities. In May 2021, we entered into an Equity Distribution Agreement ("EDA") with Piper Sandler & Co ("PSC"), under which PSC, as our exclusive agent, at our discretion and at such times that we may determine from time to time, may sell over a three-year period from the execution of the EDA up to a maximum of $50.0 million of shares of our common stock. Under the terms of the EDA, PSC may sell the shares at market prices by any method that is deemed to be an "at the market offering" as defined in Rule 415 under the Securities Act of 1933, as amended. During the year ended December 31, 2022, no shares of our common stock were issued pursuant to the EDA.

In December 2020, we completed an underwritten public offering of 4,928,572 shares of our common stock at a public offering price of $17.50 per share. The net proceeds to us were approximately $80.8 million after deducting offering costs, underwriting discounts and commissions and other offering expenses of $5.5 million.

In June 2020, we entered into a Stock Purchase Agreement with MAI pursuant to which we purchased 1,587,050 shares of MAI's Series A preferred stock for $1.0 million. In connection with the transaction, John Nicols, our former President and Chief Executive Officer, also joined MAI’s board of directors. Concurrently with our initial equity investment, we entered into the MAI Agreement pursuant to which performed services utilizing our CodeEvolver® protein engineering platform technology to improve DNA polymerase enzymes in exchange for compensation in the form of additional shares of MAI's Series A preferred stock. In April 2021, we purchased an additional 1,000,000 shares of MAI's Series A preferred stock for $0.6 million. In September 2021, we purchased 9,198,423 shares of MAI's Series B preferred stock for $7.0 million. As of December 31, 2022, we have 18,292,369 shares of MAI's Series A and B preferred stock that we have earned or purchased since executing the Stock Purchase Agreement with MAI.

In November 2020, we invested $1.0 million in Arzeda Corp., a privately-held computational protein design company that focuses on computational approaches to designing novel enzyme functionality, and received a convertible subordinated note issued by Arzeda Corp. In July 2021, we converted the non-marketable debt security with a carrying value of $1.3 million into 207,070 shares of Series B-2 preferred stock of Arzeda Corp.

Recent Accounting Pronouncements

For information on recent accounting pronouncements, see Note 2, "Summary of Significant Accounting Policies" in the Notes to the Consolidated Financial Statements set forth in Item 8 of this Annual Report on Form 10-K.

Business Update Regarding COVID-19

In March 2020, the World Health Organization declared COVID-19 a global pandemic and recommended containment and mitigation measures worldwide. The spread of COVID-19 has affected segments of the global economy and may affect our operations, including the potential interruption of our supply chain. We are monitoring this situation closely, and although operations have not been materially affected by the COVID-19 outbreak to date, the ultimate duration and severity of the outbreak and its impact on the economic environment and our business is uncertain.

As a result of the COVID-19 pandemic, we have received purchase orders from Pfizer Inc. ("Pfizer") for large quantities of our proprietary enzyme product, CDX-616, for use by Pfizer in the manufacture of a critical intermediate for its proprietary API, nirmatrelvir, used by Pfizer in combination with the API ritonavir, as its PAXLOVID™ (nirmatrelvir tablets; ritonavir tablets) product for the treatment of COVID-19 infections in humans. We are a party to an Enzyme Supply Agreement with Pfizer Ireland Pharmaceuticals, a subsidiary of Pfizer, Inc. (the "Pfizer Supply Agreement"), covering the manufacture, sale and purchase of CDX-616 for use by Pfizer in the manufacture of nirmatrelvir. Under the terms of the Pfizer Supply Agreement, Pfizer paid us a fee of $25.9 million in August 2022 which is creditable against future orders of CDX-616 used to manufacture its PAXLOVID™. The sale of CDX-616 to Pfizer had a substantial impact on our revenue for the year ended December 31, 2022. Revenues in 2023 and in future years from our sales of CDX-616 to Pfizer and other potential customers (including sublicensees of Pfizer technology from The Medicine Patent Pool) are subject to a number of factors which are outside of our control and could reduce or eliminate our sales of CDX-616, and therefore materially and adversely affect our business, results of operations and financial conditions.

For additional information on the various risks posed by the COVID-19 pandemic, please read Item 1A. Risk Factors included in this Annual Report on Form 10-K.

RESULTS OF OPERATIONS

The following table shows the amounts from our consolidated statements of operations for the periods presented (in thousands, except percentages):

	Year Ended December 31,			% of Total Revenues		
	2022	2021	2020	2022	2021	2020
Revenues:						
Product revenue	$ 116,676	$ 70,657	$ 30,220	84 %	67 %	44 %
Research and development revenue	21,914	34,097	38,836	16 %	33 %	56 %
Total revenues	138,590	104,754	69,056	100 %	100 %	100 %
Costs and operating expenses:						
Cost of product revenue	38,033	22,209	13,742	27 %	21 %	20 %
Research and development	80,099	55,919	44,185	58 %	53 %	64 %
Selling, general and administrative	52,172	49,323	35,049	38 %	47 %	51 %
Restructuring charges	3,167	—	—	2 %	— %	— %
Total costs and operating expenses	173,471	127,451	92,976	125 %	121 %	135 %
Loss from operations	(34,881)	(22,697)	(23,920)	(25)%	(21)%	(35)%
Interest income	1,441	459	405	1 %	— %	1 %
Other income (expense), net	124	1,148	(156)	— %	1 %	— %
Loss before income taxes	(33,316)	(21,090)	(23,671)	(24)%	(20)%	(34)%
Provision for income taxes	276	189	339	— %	— %	— %
Net loss	$ (33,592)	$ (21,279)	$ (24,010)	(24)%	(20)%	(34)%

Revenues

Our revenues consist of product revenue and research and development revenue as follows:

- Product revenue consist of sales of biocatalysts, pharmaceutical intermediates, and Codex® biocatalyst panels and kits.
- Research and development revenue include license, technology access and exclusivity fees, research services fees, milestone payments, royalties, optimization and screening fees.

Revenues are as follows (in thousands, except percentages):

	Year Ended December 31,			Change			
				2022		2021	
	2022	2021	2020	$	%	$	%
Product revenue	$ 116,676	$ 70,657	$ 30,220	$ 46,019	65 %	$ 40,437	134 %
Research and development revenue	21,914	34,097	38,836	(12,183)	(36)%	(4,739)	(12)%
Total revenues	$ 138,590	$ 104,754	$ 69,056	$ 33,836	32 %	$ 35,698	52 %

Revenues typically fluctuate on a quarterly basis due to the variability in our customers' manufacturing schedules and the timing of our customers' clinical trials. In addition, we have limited internal capacity to manufacture enzymes. As a result, we are dependent upon the performance and capacity of third party manufacturers for the commercial scale manufacturing of the enzymes used in our pharmaceutical and fine chemicals business.

We accept purchase orders for deliveries covering periods from one day up to 14 months from the date on which the order is placed. However, some of our purchase orders can be revised or cancelled by the customer without penalty. Considering these industry practices and our experience, we do not believe the total of customer purchase orders outstanding (backlog) provides meaningful information that can be relied on to predict actual sales for future periods.

2022 compared to 2021

Total revenues increased by $33.8 million in 2022 to $138.6 million, as compared to 2021. The increase was driven by growth in product revenue of $46.0 million, or 65%, but partially offset by a decrease in research and development revenue of $12.2 million, or 36%.

Product revenue, which consist primarily of sales of biocatalysts, pharmaceutical intermediates, and Codex® biocatalyst panels and kits, was $116.7 million in 2022, an increase of 65% compared with $70.7 million in 2021. The increase in product revenue was primarily due to $40.9 million higher revenue from Pfizer sales related to the purchase of CDX-616.

Research and development revenue decreased by $12.2 million in 2022 to $21.9 million, or 36% compared with $34.1 million in 2021, primarily due to lower license fees from Takeda, decreased revenue from milestone payments received from GSK in 2021 and lower research and development fees from other existing collaboration agreements being recognized in 2022 as compared to the prior year. A portion of our research and development revenue in 2022 and 2021 was paid to us by MAI in the form of additional shares of MAI Series A and Series B preferred stock. We received an aggregate of 1,587,049 and 3,491,505 shares of MAI's Series A and B preferred stock for the years ended December 31, 2022 and 2021, respectively.

2021 compared to 2020

Total revenues increased by $35.7 million in 2021 to $104.8 million, as compared to 2020. The increase was driven by growth in product revenue of $40.4 million, or 134%, but partially offset by a decrease in research and development revenue of $4.7 million, or 12%.

Product revenues were $70.7 million in 2021, an increase of 134% compared with $30.2 million in 2020. The increase in product revenue was primarily due to $34.5 million in revenue from Pfizer and an increase in demand for enzymes used in the manufacture of branded pharmaceutical products.

Research and development revenue decreased by $4.7 million in 2021 to $34.1 million, or 12% compared with $38.8 million in 2020, primarily due to lower license and research and development fees from Takeda and lower revenues from Novartis recognized in 2021 compared to the prior year, which was partially offset by higher license fees from other existing collaboration agreements. A portion of our research and development revenue in 2020 was paid to us by MAI in the form of additional shares of MAI Series A preferred stock. We received an aggregate of 714,171 shares of MAI's Series A preferred stock for the year ended December 31, 2020.

Costs and Operating Expenses (in thousands, except percentages):

	Year Ended December 31,			Change 2022		Change 2021	
	2022	2021	2020	$	%	$	%
Cost of product revenue	$ 38,033	$ 22,209	$ 13,742	$ 15,824	71 %	$ 8,467	62 %
Research and development	80,099	55,919	44,185	24,180	43 %	11,734	26 %
Selling, general and administrative	52,172	49,323	35,049	2,849	6 %	14,274	41 %
Restructuring charges	3,167	—	—	$ 3,167	100 %	$ —	— %
Total costs and operating expenses	$ 173,471	$ 127,451	$ 92,976	$ 46,020	36 %	$ 34,475	37 %

Costs of Product Revenue and Product Gross Margin

Our product revenues are derived entirely from our Performance Enzymes segment. Revenues from the Novel Biotherapeutics segment are only from collaborative research and development activities.

The following table shows the amounts of our product revenue, cost of product revenue, product gross profit and product gross margin from our consolidated statements of operations (in thousands, except percentages):

	Year Ended December 31,		Change		Year Ended December 31,		Change	
	2022	2021	$	%	2021	2020	$	%
Product revenue	$ 116,676	$ 70,657	$ 46,019	65 %	$ 70,657	$ 30,220	$ 40,437	134 %
Cost of product revenue [1]	38,033	22,209	15,824	71 %	22,209	13,742	8,467	62 %
Product gross profit	$ 78,643	$ 48,448	$ 30,195	62 %	$ 48,448	$ 16,478	$ 31,970	194 %
Product gross margin (%) [2]	67 %	69 %			69 %	55 %		

[1] Cost of product revenue comprises both internal and third-party fixed and variable costs, including materials and supplies, labor, facilities and other overhead costs associated with our product revenue.

[2] Product gross margin is used as a performance measure to provide additional information regarding our results of operations on a consolidated basis.

2022 compared to 2021

Cost of product revenue increased by $15.8 million in 2022 to $38.0 million, as compared to 2021. The increase was primarily due to a higher volume of product sales and variations in product mix. Product gross margins decreased to 67% in 2022 as compared to 69% in 2021, primarily due to variations in product mix, variation in prices per volume sold and higher shipping costs. Some of these cost increases are a result of the impact of inflation and supply chain pressures seen in 2022.

2021 compared to 2020

Cost of product revenue increased by $8.5 million in 2021 to $22.2 million, as compared to 2020. The increase was primarily due to a higher volume of product sales and variations in product mix. The product gross margin increased to 69% in 2021 as compared to 55% in 2020, primarily due to the sale of higher margin branded products.

Research and Development Expenses

Research and development expenses consist of costs incurred for internal projects as well as collaborative research and development activities. These costs primarily consist of (i) employee-related costs, which include salaries and other personnel-related expenses (including stock-based compensation), (ii) various allocable expenses, which include occupancy-related costs, supplies, depreciation of facilities and laboratory equipment, and (iii) external costs. Research and development expenses are expensed when incurred.

2022 compared to 2021

Research and development expenses were $80.1 million in 2022 compared to $55.9 million in 2021, an increase of $24.2 million, or 43%. The increase was primarily due to an increase of $7.4 million in costs associated with higher headcount, $4.8 million in higher facilities and repair and maintenance expenses, $5.3 million increase in outside services and Chemistry, Manufacturing and Controls (“CMC”) and regulatory expenses, $2.6 million in higher lab supplies, $2.1 million in higher depreciation expenses, $1.1 million in higher stock-based compensation expenses and $0.7 million in higher allocable expenses. Some of these cost increases are a result of the impact of inflation seen in 2022.

2021 compared to 2020

Research and development expenses were $55.9 million in 2021 compared to $44.2 million in 2020, an increase of $11.7 million, or 26%. The increase was primarily due to $7.6 million in costs associated with higher headcount, $0.8 million in higher stock-based compensation expenses, $2.6 million in higher lab supplies, $2.2 million in higher allocable expenses, $1.1 million increase in outside services, and $1.0 million in higher depreciation expenses, which was partially offset by a $3.7 million decrease in costs associated with outside services related to CMC and regulatory expenses.

Selling, General and Administrative Expenses

Selling, general and administrative expenses consist of employee-related costs, which include salaries and other personnel-related expenses (including stock-based compensation), hiring and training costs, consulting and outside services expenses (including audit and legal counsel related costs), marketing costs, building lease costs, and depreciation and amortization expenses.

2022 compared to 2021

Selling, general and administrative expenses were $52.2 million in 2022 compared to $49.3 million in 2021, an increase of $2.8 million, or 6%. The increase was primarily due to an increase of $6.0 million in costs associated with higher headcount, $1.8 million in higher stock-based compensation costs, $0.8 million in higher outside and temporary services, which was partially offset by a decrease of $3.5 million in allocable expenses due to higher expenses allocated to research and development activities in 2022 and $3.3 million in lower legal fees. Some of these cost increases are a result of the impact of inflation seen in 2022.

2021 compared to 2020

Selling, general and administrative expenses were $49.3 million in 2021 compared to $35.0 million in 2020, an increase of $14.3 million, or 41%. The increase was primarily due to an increase of $6.6 million in costs associated with higher headcount to support our growth, $3.1 million in higher stock-based compensation costs, $5.1 million increase in legal fees, $1.1 million in higher outside and temporary services, $1.0 million in higher facilities cost, and $0.4 million increase in allowance for credit losses, which was partially offset by a decrease of $3.0 million in allocable expenses due to higher expenses allocated to research and development activities in 2021.

Restructuring Charges

Restructuring charges in 2022 consist of one-time employee severance and other termination benefits due to a workforce reduction plan that occurred in the fourth quarter of 2022.

Interest Income and Other Income (Expense), net (in thousands, except percentages):

	Year Ended December 31,			Change			
				2022		2021	
	2022	2021	2020	$	%	$	%
Interest income	$ 1,441	$ 459	$ 405	$ 982	214 %	$ 54	13 %
Other income (expense), net	124	1,148	(156)	(1,024)	89 %	1,304	836 %
Total other income (expense), net	$ 1,565	$ 1,607	$ 249	$ (42)	(3)%	$ 1,358	545 %

Interest Income

Interest income increased by $1.0 million in 2022 compared to 2021, primarily due to higher average interest rates on cash balances and was partially offset by earned interest income on a non-marketable debt security in the prior year. Interest income increased by $0.1 million in 2021 compared to 2020, primarily due to earned interest income on a non-marketable debt security, which was partially offset by a reduction in interest income from lower average interest rates on lower average cash balances

Other Income (Expense), net

Other income (expense), net, decreased by $1.0 million in 2022 compared to 2021, primarily due to a higher gain from remeasurement on the carrying value of our investment in MAI in the prior year compared to this year. Other income (expense), net increased by $1.3 million in 2021 compared to 2020, primarily due to a $1.0 million gain from remeasurement on the carrying value of our investment in MAI.

Provision for Income Taxes (in thousands, except percentages):

	Year Ended December 31,			Change			
				2022		2021	
	2022	2021	2020	$	%	$	%
Provision for income taxes	$ 276	$ 189	$ 339	$ 87	46 %	(150)	(44)%

The provision for income taxes for 2022 was primarily due to the income tax withholding imposed by foreign taxing authorities on income earned in certain countries outside of the Unites Stated and remitted to the United States and the accrual of interest and penalties on historic uncertain tax positions, as well as current year state income taxes.

Starting in 2022, changes to Internal Revenue Code Section 174 made by the Tax Cuts and Jobs Act of 2017 no longer permit an immediate deduction for research and development expenditures in the tax year that such costs are incurred. As a result, the Company capitalized such costs in its 2022 income tax provision resulting in an increase in deferred tax assets and state income taxes. However, as we have recorded a full valuation allowance on our deferred tax assets, this did not have an impact on our net deferred tax assets.

The provision for income taxes in 2021 was primarily due to the income tax withholding imposed by foreign taxing authorities on income earned in certain countries outside of the Unites Stated and remitted to the United States and the accrual of interest and penalties on historic uncertain tax positions. The provision for income taxes in 2020 was primarily due to foreign withholding taxes on certain sales to non-U.S. customers.

Net Loss

Net loss for 2022 was $33.6 million, or a net loss per basic and diluted share of $0.51. This compared to a net loss of $21.3 million, or $0.33 per basic and diluted share for 2021. The increase in net loss was primarily related to lower research and development revenues and higher operating expenses.

Net loss for 2021 was $21.3 million, or a net loss per basic and diluted share of $0.33. This compared to a net loss of $24.0 million, or $0.40 per basic and diluted share for 2020. The decrease in net loss was primarily related to an increase in product revenue with higher margins, which was partially offset by higher operating expenses and lower research and development revenues.

Results of Operations by Segment (in thousands, except percentages)

Revenues by segment

	Year Ended December 31, 2022			Year Ended December 31, 2021			Change			
	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes		Novel Biotherapeutics	
							$	%	$	%
Revenues:										
Product revenue	$ 116,676	$ —	$116,676	$ 70,657	$ —	$ 70,657	$46,019	65 %	$ —	— %
Research and development revenue	9,936	11,978	21,914	19,858	14,239	34,097	(9,922)	(50)%	(2,261)	(16)%
Total revenues	$ 126,612	$ 11,978	$138,590	$ 90,515	$ 14,239	$104,754	$36,097	40 %	$(2,261)	(16)%

	Year Ended December 31, 2021			Year Ended December 31, 2020			Change			
	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes		Novel Biotherapeutics	
							$	%	$	%
Revenues:										
Product revenue	$ 70,657	$ —	$ 70,657	$ 30,220	$ —	$ 30,220	$40,437	134 %	$ —	— %
Research and development revenue	19,858	14,239	34,097	17,886	20,950	38,836	1,972	11 %	(6,711)	(32)%
Total revenues	$ 90,515	$ 14,239	$104,754	$ 48,106	$ 20,950	$ 69,056	$42,409	88 %	$(6,711)	(32)%

2022 compared to 2021

Revenues from the Performance Enzymes segment increased by $36.1 million, or 40%, to $126.6 million in 2022, compared to $90.5 million in 2021. The increase in product revenue of $46.0 million, or 65%, to $116.7 million in 2022, compared to $70.7 million in 2021 was primarily due to $40.9 million higher revenue from Pfizer sales related to the purchase of CDX-616. The decrease in research and development revenue of $9.9 million, or 50%, to $9.9 million in 2022, compared to $19.9 million in 2021 was primarily due to lower revenues from Novartis under the Novartis CodeEvolver® Agreement as we completed the technology transfer to Novartis during the third quarter of 2021, decreased revenue from milestone payments received from GSK, and lower research and development fees from other existing collaboration agreements compared to 2021.

Revenues from the Novel Biotherapeutics segment decreased by $2.3 million, or 16%, to $12.0 million in 2022, compared to $14.2 million in 2021. The decrease in revenue was primarily due to lower research and development fees from Takeda and lower research and development revenue from Nestlé Health Science recognized this year compared to the prior year.

2021 compared to 2020

Revenues from the Performance Enzymes segment increased by $42.4 million, or 88%, to $90.5 million in 2021, compared to $48.1 million in 2020. The increase in product revenue of $40.4 million, or 134%, to $70.7 million in 2021, compared to $30.2 million in 2020 was primarily due to $34.5 million in revenue from Pfizer and higher customer demand for enzymes used in the manufacture of branded pharmaceutical products. The increase in research and development revenue of $2.0 million, or 11%, to $19.9 million in 2021, compared to $17.9 million in 2020 was primarily due to higher licenses fees from existing collaboration arrangements, which was partially offset by lower revenues from Novartis.

Revenues from the Novel Biotherapeutics segment decreased by $6.7 million, or 32%, to $14.2 million in 2021, compared to $21.0 million in 2020. The decrease in revenue was primarily due to lower license and research and development fees from Takeda and a decrease in research and development revenue from Nestlé Health Science in 2021 compared to 2020.

Costs and operating expenses by segment

	Year Ended December 31, 2022			Year Ended December 31, 2021			Change			
	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes		Novel Biotherapeutics	
							$	%	$	%
Cost of product revenue	$ 38,033	$ —	$ 38,033	$ 22,209	$ —	$ 22,209	$ 15,824	71%	$ —	—%
Research and development[1]	25,786	49,770	75,556	23,140	30,219	53,359	2,646	11%	19,551	65%
Selling, general and administrative[1]	14,724	2,421	17,145	12,105	2,755	14,860	2,619	22%	(334)	(12)%
Restructuring Charges	$ 1,708	$ 966	2,674	$ —	$ —	—	$ 1,708	100%	$ 966	100%
Total segment costs and operating expenses	$ 80,251	$ 53,157	133,408	$ 57,454	$ 32,974	90,428	$ 22,797	40%	$ 20,183	61%
Corporate costs[2]			34,645			33,808				
Unallocated depreciation and amortization			5,418			3,215				
Total costs and operating expenses			$ 173,471			$ 127,451				

[1] Research and development expenses and selling, general and administrative expenses exclude depreciation and amortization of finance leases.
[2] Corporate costs include unallocated selling, general and administrative expense and restructuring charges.

	Year Ended December 31, 2021			Year Ended December 31, 2020			Change			
	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes		Novel Biotherapeutics	
							$	%	$	%
Cost of product revenue	$ 22,209	$ —	$ 22,209	$ 13,742	$ —	$ 13,742	$ 8,467	62%	$ —	—%
Research and development[1]	23,140	30,219	53,359	20,923	21,705	42,628	2,217	11%	8,514	39%
Selling, general and administrative[1]	12,105	2,755	14,860	9,597	2,355	11,952	2,508	26%	400	17%
Total segment costs and operating expenses	$ 57,454	$ 32,974	90,428	$ 44,262	$ 24,060	68,322	$13,192	30%	$ 8,914	37%
Corporate costs[2]			33,808			22,555				
Unallocated depreciation and amortization			3,215			2,099				
Total costs and operating expenses			$127,451			$ 92,976				

[1] Research and development expenses and selling, general and administrative expenses exclude depreciation and amortization of finance leases.
[2] Corporate costs include unallocated selling, general and administrative expenses.

For a discussion of product cost of revenue, see *"Results of Operations"*.

2022 compared to 2021

Research and development expense in the Performance Enzymes segment increased by $2.6 million, or 11%, to $25.8 million in 2022, compared to $23.1 million in 2021. The increase was primarily due to an increase in costs associated with outside services and higher headcount but partially offset by lower allocable expenses.

Selling, general and administrative expense in the Performance Enzymes segment increased by $2.6 million, or 22%, to $14.7 million in 2022, compared to $12.1 million in 2021. The increase was primarily due to an increase in costs associated with higher headcount and higher outside services expenses.

Research and development expense in the Novel Biotherapeutics segment increased by $19.6 million, or 65%, to $49.8 million in 2022, compared to $30.2 million in 2021. The increase was primarily due to higher costs associated with higher headcount, higher facilities cost and lab supplies, increase in outside services related to CMC and regulatory expenses and higher allocable expenses.

Selling, general and administrative expense in the Novel Biotherapeutics segment decreased by $0.3 million, or 12%, to $2.4 million in 2022, compared to $2.8 million in 2021. The decrease was primarily due to lower outside services expenses.

2021 compared to 2020

Research and development expense in the Performance Enzymes segment increased by $2.2 million, or 11%, to $23.1 million in 2021, compared to $20.9 million in 2020. The increase was primarily due to an increase in costs associated with higher headcount, higher outside services expenses, and higher lab supplies, which was partially offset by lower allocable expenses.

Selling, general and administrative expense in the Performance Enzymes segment increased by $2.5 million, or 26%, to $12.1 million in 2021, compared to $9.6 million in 2020. The increase was primarily due to an increase in costs associated with higher headcount and allocable expenses, which was partially offset by lower outside services expenses.

Research and development expense in the Novel Biotherapeutics segment increased by $8.5 million, or 39%, to $30.2 million in 2021, compared to $21.7 million in 2020. The increase was primarily due to higher costs associated with higher headcount and allocable expenses but partially offset by reduction in costs associated with outside services relating to CMC and regulatory expenses.

Selling, general and administrative expense in the Novel Biotherapeutics segment increased by $0.4 million, or 17%, to $2.8 million in 2021, compared to $2.4 million in 2020. The increase was primarily due to increase in costs associated with higher headcount and higher allocable expenses, which was partially offset by lower outside services expenses.

Income (loss) from operations by segment

	Year Ended December 31, 2022			Year Ended December 31, 2021			Change			
	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes		Novel Biotherapeutics	
							$	%	$	%
Income (loss) from operations	$ 46,361	$ (41,179)	$ 5,182	$ 33,061	$ (18,735)	$ 14,326	$ 13,300	40%	$(22,444)	(120)%

	Year Ended December 31, 2021			Year Ended December 31, 2020			Change			
	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes		Novel Biotherapeutics	
							$	%	$	%
Income (loss) from operations	$ 33,061	$ (18,735)	$ 14,326	$ 3,844	$ (3,110)	$ 734	$ 29,217	760%	$(15,625)	(502)%

2022 compared to 2021

Income from operations in the Performance Enzymes segment increased by $13.3 million, or 40%, to $46.4 million, in 2022, compared to $33.1 million in 2021. The increase in income from operations was primarily due to higher product revenue from Pfizer sales partially offset by lower research and development revenue and higher costs and operating expenses.

Loss from operations in the Novel Biotherapeutics segment increased by $22.4 million, or 120%, to $41.2 million in 2022 compared to a loss from operations of $18.7 million in 2021, primarily due to lower research and development revenue from Takeda and Nestlé Health Science and higher research and development expenses associated with higher headcount, higher facilities cost and lab supplies and higher allocable expenses.

2021 compared to 2020

Income from operations in the Performance Enzymes segment increased by $29.2 million, or 760%, to $33.1 million, in 2021, compared to $3.8 million in 2020. The increase in income from operations was primarily due to higher product revenue and research and development revenue, which was partially offset by higher costs and operating expenses.

Loss from operations in the Novel Biotherapeutics segment increased by $15.6 million, or 502%, to $18.7 million in 2021 compared to a loss from operations of $3.1 million in 2020. The increase in loss from operations was primarily due to lower research and development revenue from Takeda and decrease in research and development revenue from Nestlé Health Science, and higher research and development expenses associated with higher headcount and allocable expenses.

LIQUIDITY AND CAPITAL RESOURCES

Liquidity is the measurement of our ability to meet working capital needs and to fund capital expenditures. We have historically funded our operations primarily through cash generated from operations, stock option exercises and public and private offerings of our common stock. We also have the ability to borrow up to $5.0 million under our Credit Facility (defined below). We actively manage our cash usage and investment of liquid cash to ensure the maintenance of sufficient funds to meet our working capital needs. Our cash and cash equivalents are held in U.S banks. Our primary uses of capital are, and we expect will continue to be for the near future, compensation and related expenses, research and development expenses including costs related to the potential clinical development of our product candidates, manufacturing costs, laboratory and related supplies, legal and other regulatory expenses, and general overhead costs. We expect our cash requirements to increase in the near term as we continue to invest in high potential research and development activities with long-term commercial potential, if approved, and see less cash revenue from sales of CDX-616 to Pfizer for PAXLOVID™.

The following summarizes our cash and cash equivalents balance and working capital as of December 31, 2022, 2021 and 2020 (in thousands):

	December 31,		
	2022	2021	2020
Cash and cash equivalents	$ 113,984	$ 116,797	$ 149,117
Working capital	$ 113,828	$ 128,517	$ 159,442

Sources of Capital

In addition to our existing cash and cash equivalents and revenue generated through our existing operations, we are eligible to earn milestone and other contingent payments for the achievement of defined collaboration objectives and certain royalty payments under our collaboration agreements with Merck, Novartis and Nestlé Health Science of up to $439.0 million in aggregate. In addition, under the GSK CodeEvolver® Agreement, we have the potential to receive additional contingent payments that range from $5.8 million to $38.5 million per project. Our ability to earn these milestone and contingent payments and the timing of achieving these milestones is primarily dependent upon the outcome of our collaborators' research and development activities and is uncertain at this time.

In addition, pursuant to the terms of the Pfizer Supply Agreement, we received a fee of $25.9 million in August 2022. The fee is creditable against future orders of CDX-616 used to manufacture PAXLOVID™ with shipment dates prior to December 31, 2023 and for fees associated with any new development and licensing agreements with Pfizer entered into prior to March 31, 2023 that are invoiced prior to December 31, 2023. Up to 50% of any portion of the fee which has not been credited pursuant to credits granted under the preceding sentence is creditable against future orders of CDX-616 used to manufacture PAXLOVID™ with shipment dates prior to December 31, 2024. In the fourth quarter of 2022, we and Pfizer agreed to adjust the terms of certain existing non-cancelable purchase orders of CDX-616 issued under the Pfizer Supply Agreement pursuant to which Pfizer will pay us $36.8 million in lieu of the delivery of certain quantities of CDX-616 under those purchase orders, upon which we collected $19.8 million in December 2022 and the remaining amount is expected to be received in the first quarter of 2023.

We are actively collaborating with new and existing customers. We believe that we can utilize our current products and services, and develop new products and services, to increase our revenues and gross margins in future periods.

We have historically experienced negative cash flows from operations as we continue to invest in key technology development projects and improvements to our CodeEvolver® protein engineering technology platform, and expand our business development and collaboration with new customers. Our cash flows from operations will continue to be affected principally by product sales and product gross margins, sales from licensing our technology to major pharmaceutical companies, and collaborative research and development services provided to customers, as well as our headcount costs, primarily in research and development. Our primary source of cash flows from operating activities is cash receipts from our customers for purchases of products, collaborative research and development services, and licensing our technology to major pharmaceutical companies. Our largest uses of cash from operating activities are for employee-related expenditures, rent payments, inventory purchases to support our product sales and non-payroll research and development costs.

Equity Distribution Agreement

In May 2021, we entered into an Equity Distribution Agreement ("EDA") with Piper Sandler & Co ("PSC"), under which PSC, as our exclusive agent, at our discretion and at such times that we may determine from time to time, may sell over a three-year period from the execution of the EDA up to a maximum of $50.0 million of shares of our common stock. During the year ended December 31, 2022, no shares of our common stock were issued pursuant to the EDA, and as of December 31, 2022, $50.0 million worth of shares remained available for sale under the EDA. Sales of our common stock under this arrangement could be subject to business, economic or competitive uncertainties and contingencies, many of which may be beyond our control, and which could cause actual results from the sale of our common stock to differ materially from expectations.

Credit Facility

In June 2017, we entered into the Credit Facility with Western Alliance Bank consisting of term loans up to $10.0 million, and advances under a revolving credit facility up to $5.0 million with accounts receivable borrowing base of 80% of eligible accounts receivable. Our right to take draws on the term debt expired on December 31, 2021. On October 1, 2024, loans drawn, if any, under the Revolving Line of Credit terminate.

The Credit Facility requires us to maintain compliance with certain financial covenants including attainment of certain lender-approved projections or maintenance of certain minimum cash levels. Restrictive covenants in the Credit Facility restrict the payment of dividends or other distributions. As of December 31, 2022, no amounts were borrowed under the Credit Facility and we were in compliance with the covenants for the Credit Facility. For additional information about our contractual obligations, see Note 13, “Commitments and Contingencies” in the Notes to the Consolidated Financial Statements included in Item 8 of this Annual Report on Form 10-K.

We believe that our existing cash and cash equivalents, combined with our future expectations for product revenues, research and development revenue, and expense management will provide adequate funds for ongoing operations, planned capital expenditures and working capital requirements for at least the next twelve months. We have based this estimate on assumptions that may prove to be wrong, and we could utilize our capital resources sooner than we expect.

However, we may need additional capital if our current plans and assumptions change. In addition, we may choose to seek other sources of capital even if we believe we have generated sufficient cash flows to support our operating needs. Our need for additional capital will depend on many factors, including the financial success of our business, the spending required to develop and commercialize new and existing products, the effect of any acquisitions of other businesses, technologies or facilities that we may make or develop in the future, our spending on new market opportunities, and the potential costs for the filing, prosecution, enforcement and defense of patent claims, if necessary. If our capital resources are insufficient to meet our longer term capital requirements, and we are unable to enter into or maintain collaborations with partners that are able or willing to fund our development efforts or commercialize any products that we develop or enable, we will have to raise additional funds to continue the development of our technology and products and complete the commercialization of products, if any, resulting from our technologies. If future financings involve the issuance of equity securities, our existing stockholders would suffer dilution. If we raise debt financing or enter into credit facilities, we may be subject to restrictive covenants that limit our ability to conduct our business. We may not be able to raise sufficient additional funds on terms that are favorable to us, if at all. If we fail to raise sufficient funds and fail to generate sufficient revenues to achieve planned gross margins and to control operating costs, our ability to fund our operations, take advantage of strategic opportunities, develop products or technologies, or otherwise respond to competitive pressures could be significantly limited. If this happens, we may be forced to delay or terminate research or development programs or the commercialization of products resulting from our technologies, curtail or cease operations or obtain funds through collaborative and licensing arrangements that may require us to relinquish commercial rights, or grant licenses on terms that are not favorable to us. If adequate funds are not available, we will not be able to successfully execute our business plan or continue our business.

Cash Flows

The following is a summary of cash flows for the years ended December 31, 2022, 2021 and 2020 (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Net cash provided by (used in) operating activities	$ 11,284	$ (14,267)	$ (16,464)
Net cash used in investing activities	(13,578)	(21,422)	(5,748)
Net cash provided by (used in) financing activities	(575)	3,767	80,808
Net increase (decrease) in cash, cash equivalents and restricted cash	$ (2,869)	$ (31,922)	$ 58,596

Cash Flows from Operating Activities

The $25.6 million increase in net cash provided by operating activities in 2022 as compared to 2021 was primarily due to the receipt of a $25.9 million fee from Pfizer in August 2022 creditable against future orders and increases in cash received from revenue, which was partially offset by increased payments associated with higher operating costs.

The $2.2 million decrease in net cash used by operating activities in 2021 as compared to 2020 was primarily due to increases in cash received from revenue, which was partially offset by increased payments associated with higher operating costs.

Cash Flows from Investing Activities

The $7.8 million decrease in net cash used in investing activities in 2022 as compared to 2021, was primarily due to higher cash utilized for additional investments in equity securities and purchases of property and equipment in 2021.

The $15.7 million increase in net cash used in investing activities in 2021 as compared to 2020, was primarily due to higher cash utilized for the additional investments in MAI's Series A and B preferred stock for $7.6 million and higher purchases of property and equipment during 2021.

Cash Flows from Financing Activities

The $4.3 million decrease in net cash provided by financing activities in 2022 as compared to 2021 was primarily due to higher cash paid on taxes related to net share settlement of equity awards and lower proceeds from exercises of stock options.

The $77.0 million decrease in net cash provided by financing activities in 2021 as compared to 2020 was primarily due to the receipt of $80.8 million in net proceeds from our offering of common stock in 2020.

OFF-BALANCE SHEET ARRANGEMENTS

As of December 31, 2022, we had no off-balance sheet arrangements as defined in Item 303 of Regulation S-K as promulgated by the SEC.

CRITICAL ACCOUNTING POLICIES AND ESTIMATES

Management’s discussion and analysis of our financial condition and results of operations are based upon our consolidated financial statements. The consolidated financial statements have been prepared in conformity with generally accepted accounting principles in the United States and include our accounts and the accounts of our wholly owned subsidiaries. The preparation of our consolidated financial statements requires our management to make estimates, assumptions, and judgments that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements, and the reported amounts of revenues and expenses during the applicable periods. Management bases its estimates, assumptions and judgments on historical experience and on various other factors that are believed to be reasonable under the circumstances. Different assumptions and judgments would change the estimates used in the preparation of our consolidated financial statements, which, in turn, could change the results from those reported. Our management evaluates its estimates, assumptions and judgments on an ongoing basis.

The critical accounting policies requiring estimates, assumptions, and judgments that we believe have the most significant impact on our consolidated financial statements are described below.

Revenue Recognition

Our revenues are derived primarily from product revenue and collaborative research and development agreements. The majority of our contracts with customers typically contain multiple products and services.

The majority of our collaborative contracts contain multiple revenue streams such as upfront and/or annual license fees, research and development services, contingent milestone payments upon achievement of contractual criteria, and royalty fees based on the licensees' product revenue or usage, among others. We determine the stand-alone selling price ("SSP") and allocate consideration to distinct performance obligations.

We measure revenue based on the consideration specified in the contract with each customer, net of any sales incentives and taxes collected on behalf of government authorities. We recognize revenue in a manner that best depicts the transfer of promised goods or services to the customer, when control of the product or service is transferred to a customer. We make significant judgments when determining the appropriate timing of revenue recognition.

Product Revenue

Certain of our agreements provide options to customers which they can exercise at a future date, such as the option to purchase our product during the contract duration at discounted prices and an option to extend their contract, among others. In accounting for customer options, we determine whether an option is a material right and this requires us to exercise significant judgment. If a contract provides the customer an option to acquire additional goods or services at a discount that exceeds the range of discounts that we typically give for that product or service, or if the option provides the customer certain additional goods or services for free, the option may be considered a material right. If the contract gives the customer the option to acquire additional goods or services at their normal SSPs, we would likely determine that the option is not a material right and, therefore, account for it as a separate performance obligation when the customer exercises the option. We primarily account for options which provide material rights using the alternative approach available under ASC 606, as we concluded we meet the criteria for using the alternative approach. Therefore, the transaction price is calculated as the expected consideration to be received for all the goods and services we expect to provide. We update the transaction price for expected consideration, subject to constraint, each reporting period if our estimate of future goods to be ordered by customers change. Estimating expected consideration to be received under the alternative approach involves significant judgment.

Research and Development Revenue

The majority of our research and development agreements are based on a contractual rate per dedicated project team working on the project. The underlying product that we develop for customers does not create an asset with an alternative use to us and the customer receives benefits as we perform the work towards completion. Thus, our performance obligations are generally satisfied over time as the service is performed. We utilize an appropriate method of measuring progress towards the completion of our performance obligations to determine the timing of revenue recognition. For each performance obligation that is satisfied over time, we recognize revenue using a single measure of progress either based on hours incurred or based on stage of progress under the project.

Our contracts frequently provide customers with rights to use or access our products or technology, along with other promises or performance obligations. If we determine that the customer cannot benefit from the license without our services, the license will be accounted for as combined with the other performance obligations. If we determine that a license is distinct, we would recognize an allocable portion of the transaction price when the license is transferred to the customer, and the customer can use and benefit from it. We estimate the SSP for license rights by using historical information if licenses have been previously sold to customers and for new licenses, we consider multiple methods, a discounted cash flow method which includes the following key assumptions: the development timelines, revenue forecasts, commercialization expenses, discount rate, and the probability of technical and regulatory success.

At the inception of each arrangement that includes variable consideration such as development milestone payments, we evaluate whether the milestones are considered probable of being reached and estimate the amount to be included in the transaction price using the most likely amount method. If it is probable that a significant revenue reversal would not occur, the associated milestone value is included in the transaction price. Milestone payments that are not within our control or the licensee, such as regulatory approvals, are not considered probable of being achieved until those approvals are received.

Our CodeEvolver® platform technology transfer collaboration agreements typically include license fees, upfront fees, and variable consideration in the form of milestone payments, and sales or usage-based royalties. We have recognized revenues from our platform technology transfer agreements over time.

We also have an agreement under which we have granted a functional license to some elements of our biocatalyst technology. We will recognize revenues for the functional license at a point in time when the control of the license transfers to the customer.

For license agreements that include sales or usage-based royalty payments to us for which the license is the predominant item to which the royalty relates, we do not recognize revenue until the underlying sales of the product or usage has occurred. At the end of each reporting period, we estimate the royalty amount. We recognize revenue at the later of (i) when the related sale of the product occurs, or (ii) when the performance obligation to which some or all of the royalty has been allocated has been satisfied, or partially satisfied.

Investment in Non-Marketable Securities

Investment in Non-Marketable Equity Securities

We measure investments in non-marketable equity securities without a readily determinable fair value using a measurement alternative that measures these securities at the cost method minus impairment, if any, plus or minus changes resulting from observable price changes on a non-recurring basis. Gains and losses on these securities are recognized in other income (expense), net.

We evaluate equity securities for impairment when circumstances indicate that we may not be able to recover the carrying value. We may impair these securities and establish an allowance for a credit loss when we determine that there has been an "other-than-temporary" decline in estimated fair value of the debt or equity security compared to its carrying value. We calculate the estimated fair value of these securities using information from the investee, which may include:

- Audited and unaudited financial statements;
- Projected technological developments of the company;
- Projected ability of the company to service its debt obligations;
- If a deemed liquidation event were to occur;
- Current fundraising transactions;
- Current ability of the company to raise additional financing if needed;
- Changes in the economic environment which may have a material impact on the operating results of the company;
- Contractual rights, obligations or restrictions associated with the investment; and
- Other factors deemed relevant by our management to assess valuation.

The valuation may be reduced if the company's potential has deteriorated significantly. If the factors that led to a reduction in valuation are overcome, the valuation may be readjusted.

Recent Accounting Pronouncements

See Note 2, “Basis of Presentation and Summary of Significant Accounting Policies” in the Notes to the Consolidated Financial Statements set forth in Item 8 of this Annual Report on Form 10-K for a full description of recent accounting standards, including the respective dates of adoption and effects on our consolidated financial position, results of operations and cash flows.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Interest Rate Sensitivity

Our unrestricted cash and cash equivalents total $114.0 million at December 31, 2022. We primarily invest these amounts in money market funds which are held for working capital purposes. We do not enter into investments for trading or speculative purposes. As of December 31, 2022, the effect of a hypothetical 10% decrease in market interest rates would have an $316 thousand impact on a potential loss in future interest income and cash flows.

In June 2017, we entered into a Credit Facility with Western Alliance Bank consisting of term loans up to $10.0 million, and advances under a revolving line of credit up to $5.0 million. Our right to take draws on the long term debt expired on December 31, 2021. On October 1, 2024, loans drawn, if any, under the Revolving Line of Credit terminate. Advances made under the Revolving Line of Credit bear interest at a variable annual rate equal to the greater of (i) 4.25% or (ii) the sum of (A) the prime rate plus (B) 1.00%. Increases in these variable interest rates will increase our future interest expense and decrease our results of operations and cash flows. Our exposure to interest rates risk relates to our 2017 Credit Facility with variable interest rates, where an increase in interest rates may result in higher borrowing costs. Since we have no outstanding borrowings under our 2017 Credit Facility as of December 31, 2022, the effect of a hypothetical 10% change in interest rates would have an impact of nil on our interest expense.

Foreign Currency Risk

Our results of operations and cash flows are subject to fluctuations due to changes in foreign currency exchange rates. In periods when the USD declines in value as compared to the foreign currencies in which we incur expenses, our foreign-currency based expenses increase when translated into United States dollars. Although substantially all of our sales are denominated in United States dollars, future fluctuations in the value of the USD may affect the price competitiveness of our products outside the United States. Our most significant foreign currency exposure is due to non-functional currency denominated monetary assets, primarily currencies denominated in other than their functional currency. These non-functional currency denominated monetary assets are subject to re-measurement which may create fluctuations in other expense, net, a component in our consolidated statement of operations and in the fair value of the assets in the consolidated balance sheets. As of December 31, 2022, the effect of a hypothetical 10% unfavorable change in exchange rates on currencies denominated in other than their functional currency would result in a potential loss in future earnings in our consolidated statement of operations and a reduction in the fair value of the assets of approximately $42 thousand. We did not engage in hedging transactions in 2022, 2021 and 2020.

Investment in Non-Marketable Equity Securities

We own investments in non-marketable equity securities without readily determinable fair values. We may value these equity securities based on significant recent arms-length equity transactions with sophisticated non-strategic unrelated investors, providing the terms of these security transactions are substantially similar to the security transactions terms between the investors and us. The impact of the difference in transaction terms on the market value of the portfolio company may be difficult or impossible to quantify.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

Codexis, Inc.

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

Report of Independent Registered Public Accounting Firm

Shareholders and Board of Directors
Codexis, Inc.
Redwood City, California

Opinion on the Consolidated Financial Statements

We have audited the accompanying consolidated balance sheets of Codexis, Inc. (the "Company") as of December 31, 2022 and 2021, the related consolidated statements of operations, stockholders' equity, and cash flows for each of the three years in the period ended December 31, 2022, and the related notes (collectively referred to as the "consolidated financial statements"). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2022 and 2021, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2022, in conformity with accounting principles generally accepted in the United States of America.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) ("PCAOB"), the Company's internal control over financial reporting as of December 31, 2022, based on criteria established in Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO") and our report dated February 27, 2023 expressed an unqualified opinion thereon.

Basis for Opinion

These consolidated financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's consolidated 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 consolidated financial statements are free of material misstatement, whether due to error or fraud.

Our audits included performing procedures to assess the risks of material misstatement of the consolidated 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 consolidated 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 consolidated financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matter

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that: (1) relates to accounts or disclosures that are material to the consolidated financial statements and (2) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing separate opinions on the critical audit matter or on the accounts or disclosures to which it relates.

Revenue Recognition

As described in Notes 2 and 3 to the consolidated financial statements, the Company recognizes revenue in a manner that best depicts the transfer of promised goods or services to the customer when control of the product or service is transferred to a customer. The Company's contracts with customers include enzyme supply, licensing, and collaborative research and development agreements. Contracts with customers may contain multiple performance obligations, options, up-front or annual license fees, fees for full time employee research and development services, contingent milestone payments upon achievement of contractual criteria, and royalty fees based on the licensees' product revenue or usage. The Company makes significant judgments in determining revenue recognition for certain customer contracts.

We identified management's significant judgments and estimates related to revenue recognition for contracts with customers as a critical audit matter. Auditing the evaluation of distinct performance obligations, allocation of transaction price to distinct performance obligations, determination and estimation of material rights, determination of the pattern of transfer of control for each distinct performance obligation and estimation of variable consideration required significant audit effort and subjective judgments in evaluating management's estimates.

The primary procedures we performed to address this critical audit matter included:

- Testing the design and operating effectiveness of internal controls relating to the identification of distinct performance obligations and material rights, the determination of the timing of revenue recognition, allocation of transaction price to distinct performance obligations, and the estimation of variable consideration.
- Examining a sample of revenue contracts and other source documents to test management's identification of significant terms for completeness, including the identification of distinct performance obligations, material rights and variable consideration including sending confirmations to a sample of customers to confirm our understanding of the parties' rights and obligations.
- Evaluating the reasonableness and accuracy of management's judgments and estimates used in accounting for identified material rights.
- Assessing the reasonableness of management's judgments and estimates to calculate variable consideration, and the timing of recognizing the related revenue subject to any constraints.
- Evaluating the appropriateness of management's allocation of the transaction price to the distinct performance obligation and determination of whether identified performance obligations meet the criteria for over-time revenue recognition.

/s/ BDO USA, LLP

We have served as the Company's auditor since 2013.

San Jose, California
February 27, 2023

Report of Independent Registered Public Accounting Firm

Shareholders and Board of Directors
Codexis, Inc.
Redwood City, California

Opinion on Internal Control over Financial Reporting

We have audited Codexis, Inc.'s (the "Company's") internal control over financial reporting as of December 31, 2022, based on criteria established in *Internal Control – Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission (the "COSO criteria"). In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2022, based on the COSO criteria.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) ("PCAOB"), the consolidated balance sheets of the Company as of December 31, 2022 and 2021, the related consolidated statements of operations, stockholders' equity, and cash flows for each of the three years in the period ended December 31, 2022, and the related notes and our report dated February 27, 2023 expressed an unqualified opinion thereon.

Basis for Opinion

The Company's management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying "Item 9A, Controls and Procedures". Our responsibility is to express an opinion on the Company's internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit of internal control over financial reporting in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audit also included performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed 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. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

/s/ BDO USA, LLP

San Jose, California
February 27, 2023

Codexis, Inc.
Consolidated Balance Sheets
(In Thousands, Except Per Share Amounts)

	December 31,	
	2022	**2021**
Assets		
Current assets:		
Cash and cash equivalents	$ 113,984	$ 116,797
Restricted cash, current	521	579
Financial assets:		
Accounts receivable	31,904	24,953
Contract assets	2,116	4,557
Unbilled receivables	7,016	8,558
Total financial assets	41,036	38,068
Less: allowances	(163)	(416)
Total financial assets, net	40,873	37,652
Inventories	2,029	1,160
Prepaid expenses and other current assets	5,487	5,700
Total current assets	162,894	161,888
Restricted cash	1,521	1,519
Investment in non-marketable equity securities ($13,921 and $12,713 with a related party)	20,510	14,002
Right-of-use assets - Operating leases, net	39,263	44,095
Right-of-use assets - Finance leases, net	—	17
Property and equipment, net	22,614	21,345
Goodwill	3,241	3,241
Other non-current assets	350	276
Total assets	$ 250,393	$ 246,383
Liabilities and Stockholders' Equity		
Current liabilities:		
Accounts payable	$ 3,246	$ 2,995
Accrued compensation	11,453	11,119
Other accrued liabilities	15,279	12,578
Current portion of lease obligations - Operating leases	5,360	4,093
Deferred revenue ($0 and $245 to a related party)	13,728	2,586
Total current liabilities	49,066	33,371
Deferred revenue, net of current portion	16,881	3,749
Long-term lease obligations - Operating leases	38,278	43,561
Other long-term liabilities	1,371	1,311
Total liabilities	105,596	81,992
Commitments and contingencies (Note 13)		
Stockholders' equity:		
Preferred stock, $0.0001 par value per share; 5,000 shares authorized, none issued and outstanding	—	—
Common stock, $0.0001 par value per share; 100,000 shares authorized; 65,811 and 65,109 shares issued and outstanding at December 31, 2022 and December 31, 2021, respectively	6	6
Additional paid-in capital	566,081	552,083
Accumulated deficit	(421,290)	(387,698)
Total stockholders' equity	144,797	164,391
Total liabilities and stockholders' equity	$ 250,393	$ 246,383

See accompanying notes to consolidated financial statements

Codexis, Inc.
Consolidated Statements of Operations
(In Thousands, Except Per Share Amounts)

	Year Ended December 31,		
	2022	**2021**	**2020**
Revenues:			
Product revenue ($514, $0 and $0 from a related party)	$ 116,676	$ 70,657	$ 30,220
Research and development revenue ($1,245, $1,955 and $900 from a related party)	21,914	34,097	38,836
Total revenues	138,590	104,754	69,056
Costs and operating expenses:			
Cost of product revenue	38,033	22,209	13,742
Research and development	80,099	55,919	44,185
Selling, general and administrative	52,172	49,323	35,049
Restructuring charges	3,167	—	—
Total costs and operating expenses	173,471	127,451	92,976
Loss from operations	(34,881)	(22,697)	(23,920)
Interest income	1,441	459	405
Other income (expense), net ($208, $983 and $0 from a related party)	124	1,148	(156)
Loss before income taxes	(33,316)	(21,090)	(23,671)
Provision for income taxes	276	189	339
Net loss	$ (33,592)	$ (21,279)	$ (24,010)
Net loss per share, basic and diluted	$ (0.51)	$ (0.33)	$ (0.40)
Weighted average common stock shares used in computing net loss per share, basic and diluted	65,344	64,568	59,360

See accompanying notes to consolidated financial statements

Codexis, Inc.
Consolidated Statements of Stockholders' Equity
(In Thousands)

	Common Stock		Additional Paid-in Capital	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount			
December 31, 2019	58,877	$ 6	$ 447,920	$ (342,409)	$ 105,517
Exercise of stock options	210	—	1,323	—	1,323
Release of stock awards	370	—	—	—	—
Employee stock-based compensation	—	—	7,622	—	7,622
Non-employee stock-based compensation	—	—	106	—	106
Taxes paid related to net share settlement of equity awards	(103)	—	(1,257)	—	(1,257)
Issuance of common stock, net of issuance costs of $5,448	4,929	—	80,802	—	80,802
Net loss	—	—	—	(24,010)	(24,010)
December 31, 2020	64,283	6	536,516	(366,419)	170,103
Exercise of stock options	699	—	5,180	—	5,180
Release of stock awards	181	—	—	—	—
Employee stock-based compensation	—	—	11,346	—	11,346
Non-employee stock-based compensation	—	—	247	—	247
Taxes paid related to net share settlement of equity awards	(54)	—	(1,206)	—	(1,206)
Net loss	—	—	—	(21,279)	(21,279)
December 31, 2021	65,109	6	552,083	(387,698)	164,391
Exercise of stock options	410	—	955	—	955
Release of stock awards	373	—	—	—	—
Employee stock-based compensation	—	—	14,398	—	14,398
Non-employee stock-based compensation	—	—	133	—	133
Taxes paid related to net share settlement of equity awards	(81)	—	(1,488)	—	(1,488)
Net loss	—	—	—	(33,592)	(33,592)
December 31, 2022	65,811	$ 6	$ 566,081	$ (421,290)	$ 144,797

See accompanying notes to consolidated financial statements

Codexis, Inc.
Consolidated Statements of Cash Flows
(In Thousands)

	Year Ended December 31,		
	2022	**2021**	**2020**
Operating activities:			
Net loss	$ (33,592)	$ (21,279)	$ (24,010)
Adjustments to reconcile net loss to net cash provided by (used in) operating activities:			
Depreciation	5,402	3,113	1,950
Amortization expense - right-of-use assets - operating and finance leases	4,849	2,834	2,604
Stock-based compensation	14,531	11,593	7,728
Provision for credit losses	4	342	40
Equity securities earned from research and development activities from a related party	(1,245)	(1,955)	(900)
Unrealized gain on non-marketable securities (($208) and ($983) from a related party)	(208)	(1,272)	—
Other non-cash items	(29)	(19)	15
Changes in operating assets and liabilities:			
Financial assets ($0, $0 and ($450) from a related party)	(3,225)	(9,156)	(8,723)
Inventories	(869)	(196)	(593)
Prepaid expenses and other assets	181	(2,268)	(1,012)
Accounts payable	207	268	101
Accrued compensation and other accrued liabilities	5,983	6,575	6,175
Other long-term liabilities	(5,223)	(4,147)	(2,586)
Deferred revenue ($0, $245, $0 to a related party)	24,518	1,300	2,747
Net cash provided by (used in) operating activities	11,284	(14,267)	(16,464)
Investing activities:			
Purchase of property and equipment	(8,307)	(13,828)	(3,748)
Proceeds from sale of property and equipment	29	36	—
Investment in non-marketable securities ($0, ($7,630) and ($1,000) in a related party)	(5,300)	(7,630)	(2,000)
Net cash used in investing activities	(13,578)	(21,422)	(5,748)
Financing activities:			
Proceeds from exercises of stock options	955	5,180	1,323
Proceeds from issuance of common stock in connection with public offering	—	—	86,250
Costs incurred in connection with equity financing	(42)	(207)	(5,448)
Payments of lease obligations - Finance leases	—	—	(60)
Taxes paid related to net share settlement of equity awards	(1,488)	(1,206)	(1,257)
Net cash provided by (used in) financing activities	(575)	3,767	80,808
Net increase (decrease) in cash, cash equivalents and restricted cash	(2,869)	(31,922)	58,596
Cash, cash equivalents and restricted cash at the beginning of the year	118,895	150,817	92,221
Cash, cash equivalents and restricted cash at the end of the year	$ 116,026	$ 118,895	$ 150,817
Supplemental disclosure of cash flow information:			
Interest paid	$ 34	$ 14	$ 52
Income taxes	$ 100	$ 102	$ 312
Supplemental non-cash investing and financing activities:			
Capital expenditures incurred but not yet paid	$ 897	$ 2,533	$ 1,750

The following table provides a reconciliation of cash, cash equivalents and restricted cash reported within the consolidated balance sheets to the total of the same such amounts shown above (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Cash and cash equivalents	$ 113,984	$ 116,797	$ 149,117
Restricted cash, current and non-current	2,042	2,098	1,700
Total cash, cash equivalents and restricted cash at the end of the period	$ 116,026	$ 118,895	$ 150,817

See accompanying notes to consolidated financial statements

Codexis, Inc.

Notes to Consolidated Financial Statements

Note 1. Description of Business

In these notes to the Consolidated Financial Statements, the "Company," "we," "us," and "our" refers to Codexis, Inc. and its subsidiaries on a consolidated basis.

We discover, develop and sell enzymes and other proteins that deliver value to our clients in a growing set of industries to commercialize an increasing number of novel enzymes, both as proprietary Codexis products and in partnership with our customers.

We report our financial results based on two reportable segments: Performance Enzymes and Novel Biotherapeutics. The segment information aligns with how the chief operating decision maker (CODM), who is our Chief Executive Officer (CEO), reviews and manages the business.

Business Update Regarding COVID-19

In March 2020, the World Health Organization declared COVID-19 a global pandemic and recommended containment and mitigation measures worldwide. The spread of COVID-19 has affected segments of the global economy and may affect our operations, including the potential interruption of our supply chain. We are monitoring this situation closely, and although operations have not been materially affected by the COVID-19 outbreak to date, the ultimate duration and severity of the outbreak and its impact on the economic environment and our business is uncertain.

As a result of the COVID-19 pandemic, we have received purchase orders from Pfizer Inc. (“Pfizer”) for large quantities of our proprietary enzyme product, CDX-616, for use by Pfizer in the manufacture of a critical intermediate for its proprietary API, nirmatrelvir, used by Pfizer in combination with the API ritonavir, as its PAXLOVID™ (nirmatrelvir tablets; ritonavir tablets) product for the treatment of COVID-19 infections in humans. In July 2022, we entered into an Enzyme Supply Agreement with Pfizer Ireland Pharmaceuticals, a subsidiary of Pfizer, Inc. (the “Pfizer Supply Agreement”), covering the manufacture, sale and purchase of CDX-616 for use by Pfizer in the manufacture of nirmatrelvir. Under the terms of the Pfizer Supply Agreement, Pfizer paid us a fee of $25.9 million in August 2022 which is creditable against future orders of CDX-616 used to manufacture PAXLOVID™. Revenues in 2023 and in future years from our sales of CDX-616 to Pfizer and other potential customers (including sublicensees of Pfizer technology from The Medicine Patent Pool) are subject to a number of factors which are outside of our control and could reduce or eliminate our sales of CDX-616.

The near-and-long term impact of COVID-19 to our financial condition, liquidity, or results of operations remains uncertain. Although some of the government orders that were enacted to control the spread of COVID-19 have been scaled back and the vaccine rollout has expanded, surges in the spread of COVID-19 due to the emergence of new more contagious or virulent variants or the ineffectiveness of the vaccines against such strains, may result in the reimplementation of certain government orders, which could adversely impact our business. The extent to which the COVID-19 pandemic may materially impact our financial condition, liquidity, or results of operations in the future is uncertain.

Note 2. Basis of Presentation and Summary of Significant Accounting Policies

Basis of Presentation and Principles of Consolidation

The accompanying consolidated financial statements have been prepared in accordance with generally accepted accounting principles in the United States of America ("GAAP") and the applicable rules and regulations of the Securities and Exchange Commission ("SEC") and include the accounts of Codexis, Inc. and its wholly-owned subsidiaries.

The consolidated financial statements include the accounts of Codexis, Inc. and its wholly owned subsidiaries. All intercompany balances and transactions have been eliminated in consolidation.

Use of Estimates

The preparation of our consolidated financial statements in conformity with GAAP requires us to make estimates, judgments and assumptions that may affect the reported amounts of assets, liabilities, equity, revenues and expenses and related disclosure of contingent assets and liabilities. We regularly assess these estimates which primarily affect revenue recognition, inventories, valuation of equity investments, goodwill arising out of business acquisitions, accrued liabilities, stock awards, and the valuation allowances associated with deferred tax assets. Actual results could differ from those estimates and such differences may be material to the consolidated financial statements. The full extent to which the COVID-19 pandemic will directly or indirectly impact our business, results of operations and financial condition, including sales, expenses, reserves and allowances, manufacturing, research and development costs and employee-related amounts, will depend on future developments that are highly uncertain, and may not be accurately predicted, including as a result of new information that may emerge concerning COVID-19 and the actions taken to contain or treat COVID-19, as well as the economic impact on local, regional, national and international customers, markets and economies.

Segment Reporting

We report two business segments, Performance Enzymes and Novel Biotherapeutics, which are based on our operating segments. Operating segments are defined as components of an enterprise about which separate financial information is available that is evaluated regularly by the CODM, in deciding how to allocate resources, and in assessing performance. Our business segments are primarily based on our organizational structure and our operating results as used by our CODM in assessing performance and allocating resources for the Company. We do not allocate or evaluate assets by segment.

The Novel Biotherapeutics segment focuses on new opportunities in the pharmaceutical industry to discover or improve novel biotherapeutic drug candidates that will target human diseases that are in need of improved therapeutic interventions. Similarly, we believe that we can deploy our platform technology to improve specific characteristics of a customer's pre-existing biotherapeutic drug candidate, such as its activity, stability, or immunogenicity. The Performance Enzymes segment consists of biocatalyst products and services with focus on pharmaceutical, molecular diagnostics, and other industrial markets.

Foreign Currency Translation

The USD is the functional currency for our operations outside the United States. Accordingly, non-monetary assets and liabilities originally acquired or assumed in other currencies are recorded in USD at the exchange rates in effect at the date they were acquired or assumed. Monetary assets and liabilities denominated in other currencies are translated into United States dollars at the exchange rates in effect at the balance sheet date. Translation adjustments are recorded in other expense in the consolidated statements of operations. Gains and losses realized from non-USD transactions, including intercompany balances not considered as permanent investments, are included in other expense in the accompanying consolidated statements of operations.

Revenue Recognition

Our revenues are derived primarily from product revenue and collaborative research and development agreements. The majority of our contracts with customers typically contain multiple products and services. We account for individual products and services separately if they are distinct-that is, if a product or service is separately identifiable from other items in the contract and if a customer can benefit from it on its own or with other resources that are readily available to the customer.

In determining the appropriate amount of revenue to be recognized as we fulfill our obligations under our product revenue and collaborative research and development agreements, we perform the following steps: (i) identification of the promised goods or services in the contract; (ii) determination of whether the promised goods or services are performance obligations, including whether they are distinct in the context of the contract; (iii) measurement of the transaction price, including the constraint on variable consideration; (iv) allocation of the transaction price to the performance obligations based on estimated selling prices; and (v) recognition of revenue when (or as) we satisfy each performance obligation.

The majority of our collaborative contracts contain multiple revenue streams such as upfront and/or annual license fees, fees for research and development services, contingent milestone payments upon achievement of contractual criteria, and royalty fees based on the licensees' product revenue or usage, among others. We determine the stand-alone selling price ("SSP") and allocate consideration to distinct performance obligations. Typically, we base our SSPs on our historical sales. If an SSP is not directly observable, then we estimate the SSP taking into consideration market conditions, forecasted sales, entity-specific factors and available information about the customer. We estimate the SSP for license rights by using historical information if licenses have been previously sold to customers and for new licenses, we consider multiple methods, including a discounted cash flow method which includes the following key assumptions: the development timelines, revenue forecasts, commercialization expenses, discount rate, and the probability of technical and regulatory success.

We account for a contract with a customer when there is approval and commitment from both parties, the rights of the parties are identified, payment terms are identified, the contract has commercial substance and collectability of consideration is probable. Non-cancellable purchase orders received from customers to deliver a specific quantity of product, when combined with our order confirmation, in exchange for future consideration, create enforceable rights and obligations on both parties and constitute a contract with a customer.

We measure revenue based on the consideration specified in the contract with each customer, net of any sales incentives and taxes collected on behalf of government authorities. We recognize revenue in a manner that best depicts the transfer of promised goods or services to the customer, when control of the product or service is transferred to a customer. We make significant judgments when determining the appropriate timing of revenue recognition.

The following is a description of principal activities from which we generate revenue:

Product Revenue

Product revenue consist of sales of biocatalysts, pharmaceutical intermediates and Codex® biocatalyst panels and kits. A majority of our product revenue is made pursuant to purchase orders or supply agreements and is recognized either at a point in time when the control of the product has been transferred to the customer typically upon shipment or over time as the product is manufactured because we have a right to payment from the customer under a binding, non-cancellable purchase order, and there is no alternate use of the product for us as it is specifically made for the customer's use.

Certain of our agreements provide options to customers which they can exercise at a future date, such as the option to purchase our product during the contract duration at discounted prices and an option to extend their contract, among others. In accounting for customer options, we determine whether an option is a material right and this requires us to exercise significant judgment. If a contract provides the customer an option to acquire additional goods or services at a discount that exceeds the range of discounts that we typically give for that product or service for the same class of customer, or if the option provides the customer certain additional goods or services for free, the option may be considered a material right. If the contract gives the customer the option to acquire additional goods or services at their normal SSPs, we would likely determine that the option is not a material right and, therefore, account for it as a separate performance obligation when the customer exercises the option. We primarily account for options which provide material rights using the alternative approach available pursuant to the applicable accounting guidance, as we concluded we meet the criteria for using the alternative approach. Therefore, the transaction price is calculated as the expected consideration to be received for all the goods and services we expect to provide under the contract. We update the transaction price for expected consideration, subject to constraint, each reporting period if our estimates of future goods to be ordered by customers change.

Research and Development Revenue

We perform research and development activities as specified in each respective customer agreement. We identify each performance obligation in our research and development agreements at contract inception. We allocate the consideration to each distinct performance obligation based on the SSP of each performance obligation. Performance obligations included in our research and services agreements typically include research and development services for a specified term, periodic reports and small samples of enzyme produced.

The majority of our research and development agreements are based on a contractual rate per dedicated project team working on the project. The underlying product that we develop for customers does not create an asset with an alternative use to us and the customer receives benefits as we perform the work towards completion. Thus, our performance obligations are generally satisfied over time as the service is performed. We utilize an appropriate method of measuring progress towards the completion of our performance obligations to determine the timing of revenue recognition. For each performance obligation that is satisfied over time, we recognize revenue using a single measure of progress either based on hours incurred or based on stage of progress under the project.

Our contracts frequently provide customers with rights to use or access our products or technology, along with other promises or performance obligations. We must first determine whether the license is distinct from other promises, such as our promise to manufacture a product. If we determine that the customer cannot benefit from the license without our manufacturing capability, the license will be accounted for as combined with the other performance obligations. If we determine that a license is distinct and has significant standalone functionality, we recognize revenues from a functional license at a point in time when the license is transferred to the customer, and the customer can use and benefit from it. We estimate the SSP for license rights by using historical information if licenses have been previously sold to customers and for new licenses, we consider multiple methods, including a discounted cash flow method which includes the following key assumptions: the development timelines, revenue forecasts, commercialization expenses, discount rate, and the probability of technical and regulatory success. For licenses that have been previously sold to other customers, we use historical information to determine SSP.

At the inception of each arrangement that includes variable consideration such as development milestone payments, we evaluate whether the milestones are considered probable of being reached and estimate the amount to be included in the transaction price using the most likely amount method. If it is probable that a significant revenue reversal would not occur, the associated milestone value is included in the transaction price. Milestone payments that are not within our control or the licensee, such as regulatory approvals, are not considered probable of being achieved until those approvals are received. The transaction price is then allocated to each performance obligation on a relative stand-alone selling price basis, for which we recognize revenue as or when the performance obligations under the contract are satisfied. At the end of each subsequent reporting period, we re-evaluate the probability of achievement of such development milestones and any related constraint, and if necessary, adjust our estimate of the overall transaction price. Any such adjustments are recorded on a cumulative catch-up basis, which would affect license, collaboration and other revenues and earnings in the period of adjustment.

Our CodeEvolver® platform technology transfer collaboration agreements typically include license fees, upfront fees, and variable consideration in the form of milestone payments, and sales or usage-based royalties. We have recognized revenues from our platform technology transfer agreements over time as our customer uses our technology.

For license agreements that include sales or usage-based royalty payments to us, we do not recognize revenue until the underlying sales of the product or usage has occurred. At the end of each reporting period, we estimate the royalty amount. We recognize revenue at the later of (i) when the related sale of the product occurs, or (ii) when the performance obligation to which some or all of the royalty has been allocated has been satisfied, or partially satisfied.

Practical Expedients, Elections, and Exemptions

We apply certain practical expedients available which permit us not to adjust the amount of consideration for the effects of a significant financing component if, at contract inception, the expected period between the transfer of promised goods or services and customer payment is one year or less.

We perform monthly services under our research and development agreements, and we use a practical expedient permitting us to recognize revenue at the same time that we have the right to invoice our customer for monthly services completed to date.

We have elected to treat shipping and handling activities as fulfillment costs.

We have elected to record revenue net of sales and other similar taxes.

Contract Assets

Contract assets include amounts related to our contractual right to consideration for completed performance obligations not yet invoiced. Contract assets are reclassified to receivables when the rights become unconditional.

Contract Liabilities

Contract liabilities are recorded as deferred revenues and include payments received in advance of performance under the contract. Contract liabilities are realized when the development services are provided to the customer or control of the products has been transferred to the customer. A portion of our contract liabilities relate to supply arrangements that contain material rights that are recognized using the alternative method, under which the aggregate amount invoiced to the customer for shipped products, including contractual fees, is higher than the amount of revenue recognized based on the transaction price allocated to the shipped products.

Contract Costs

We recognize a non-current asset for the incremental costs of obtaining a contract with a customer if the entity expects to recover such costs and if those costs would not have been incurred if the contract had not been obtained, such as commissions paid to sales personnel. We do not typically incur significant incremental costs because the compensation of our salespeople is not based on contracts closed but on a mixture of company goals, individual goals, and sales goals. If a commission paid is directly related to obtaining a specific contract, our policy is to capitalize and amortize such costs on a systematic basis, consistent with the pattern of transfer of the good or service to which the asset relates, and over a period beyond 12 months. Contract costs are reported in other non-current assets and were not significant in any of the periods presented.

Cost of Product Revenue

Cost of product revenue comprises both internal and third party fixed and variable costs including materials and supplies, labor, facilities, and other overhead costs associated with our product sales. Shipping costs are included in our cost of product revenue. Shipping costs were $3.0 million, $1.8 million, and $0.1 million for the years ended December 31, 2022, 2021, and 2020, respectively.

Fulfillment costs, such as shipping and handling, are recognized at a point in time and are included in cost of product revenue.

Cost of Research and Development Services

Cost of research and development services related to services under research and development agreements approximate the research funding over the term of the respective agreements and is included in research and development expense. Costs of services provided under license and platform technology transfer agreements are included in research and development expenses and are expensed in the periods in which such costs are incurred.

Research and Development Expenses

Research and development expenses consist of costs incurred for internal projects and partner-funded collaborative research and development activities, as well as license and platform technology transfer agreements, as mentioned above. These costs include our direct and research-related overhead expenses, which include salaries and other personnel-related expenses (including stock-based compensation), occupancy-related costs, supplies, and depreciation of facilities and laboratory equipment, as well as external costs, and are expensed as incurred. Costs to acquire technologies that are utilized in research and development and that have no alternative future use are expensed when incurred.

Advertising

Advertising costs are expensed as incurred and included in selling, general and administrative expenses in the consolidated statements of operations. Advertising costs were $0.3 million for each of the years ended December 31, 2022, 2021 and 2020.

Stock-Based Compensation

We use the Black-Scholes-Merton option pricing model to estimate the fair value of options granted under our equity incentive plans. The Black-Scholes-Merton option pricing model requires the use of assumptions, including the expected term of the award and the expected stock price volatility. The expected term is based on historical exercise behavior for similar awards, giving consideration to the contractual terms, vesting schedules and expectations of future employee behavior. We use historical volatility to estimate expected stock price volatility. The risk-free rate assumption is based on United States Treasury instruments whose terms are consistent with the expected term of the stock options. The expected dividend assumption is based on our history and expectation of dividend payouts.

Restricted Stock Units ("RSUs"), Restricted Stock Awards ("RSAs") and performance-contingent restricted stock units ("PSUs") are measured based on the fair market values of the underlying stock on the dates of grant. Performance based options ("PBOs") are measured using the Black-Scholes-Merton option pricing model. The vesting of PBOs and PSUs awarded is conditioned upon the attainment of one or more performance objectives over a specified period and upon continued employment through the applicable vesting date. At the end of the performance period, shares of stock subject to the PBOs and PSUs vest based upon both the level of achievement of performance objectives within the performance period and continued employment through the applicable vesting date.

Stock-based compensation expense is calculated based on awards ultimately expected to vest and is reduced for estimated forfeitures at the time of grant and revised, if necessary, in subsequent periods if actual forfeitures differ from those estimates. The estimated annual forfeiture rates for stock options, RSUs, PSUs, PBOs, and RSAs are based on historical forfeiture experience.

The estimated fair value of stock options, RSUs and RSAs are expensed on a straight-line basis over the vesting term of the grant and the estimated fair value of PSUs and PBOs are expensed using an accelerated method over the term of the award once management has determined that it is probable that the performance objective will be achieved. Compensation expense is recorded over the requisite service period based on management's best estimate as to whether it is probable that the shares awarded are expected to vest. Management assesses the probability of the performance milestones being met on a continuous basis.

Cash and Cash Equivalents

We consider all highly liquid investments with maturity dates of three months or less at the date of purchase to be cash equivalents. Cash and cash equivalents consist of cash on deposit with banks and money market funds. The majority of cash and cash equivalents is maintained with major financial institutions in the United States. Deposits with these financial institutions may exceed the amount of insurance provided on such deposits.

Restricted Cash

In 2016, we began the process of liquidating our Indian subsidiary. The local legal requirements for liquidation required us to maintain our subsidiary's cash balance in an account managed by a legal trustee to satisfy our financial obligations. This balance is recorded as current restricted cash on the consolidated balance sheets of $0.5 million and $0.6 million as of December 31, 2022 and 2021, respectively.

Pursuant to the terms of the lease agreements for our Redwood City and San Carlos facilities, we obtained letters of credit collateralized by cash deposit balances of $1.5 million as of December 31, 2022 and 2021. These cash deposits balances are recorded as non-current restricted cash on the consolidated balance sheets. For additional information, see Note 13, "Commitments and Contingencies".

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. In determining fair value, we utilize valuation techniques that maximize the use of observable inputs and minimize the use of unobservable inputs to the extent possible and we consider counterparty credit risk in our assessment of fair value. Carrying amounts of financial instruments, including cash equivalents, accounts receivable, accounts payable, and accrued liabilities, approximate their fair values as of the balance sheet dates because of their short maturities.

The fair value hierarchy distinguishes between (1) market participant assumptions developed based on market data obtained from independent sources (observable inputs) and (2) an entity’s own assumptions about market participant assumptions developed based on the best information available in the circumstances (unobservable inputs). The fair value hierarchy consists of three broad levels, giving the highest priority to unadjusted quoted prices in active markets for identical assets or liabilities (Level 1) and the lowest priority to unobservable inputs (Level 3). The three levels of the fair value hierarchy are described below:

- Level 1: Inputs that are unadjusted, quoted prices in active markets for identical assets or liabilities at the measurement date.
- Level 2: Inputs that are either directly or indirectly observable for the asset or liability through correlation with market data at the measurement date and for the duration of the instrument’s anticipated life.
- Level 3: Unobservable inputs that are supported by little or no market activity and that are significant to the fair value of the assets or liabilities and which reflect management’s best estimate of what market participants would use in pricing the asset or liability at the measurement date.

Concentrations of Credit Risk

Financial instruments that potentially subject us to significant concentrations of credit risk consist primarily of cash and cash equivalents, accounts receivable and unbilled receivables, contract assets, non-marketable securities, and restricted cash. Cash that is not required for immediate operating needs is invested principally in money market funds. Cash and cash equivalents are invested through banks and other financial institutions in the United States, India, and the Netherlands. Such deposits in those countries may be in excess of insured limits. The Company has not experienced material losses on its deposits of cash and cash equivalents.

We perform ongoing credit evaluations of our customer's financial condition whenever deemed necessary. We maintain an allowance for doubtful accounts based on the expected collectability of all financial assets, which takes into consideration an analysis of historical bad debts, specific customer creditworthiness and current economic trends. As of December 31, 2022, we had two customers that accounted for 63% of our accounts receivable balance. As of December 31, 2021, one customer accounted for 62% of our accounts receivable balance. We believe the accounts receivable balances from our largest customers do not represent a significant credit risk, based on cash flow forecasts, balance sheet analysis, and past collection experience.

Financial Assets and Allowances

We currently sell enzymes primarily to pharmaceutical and fine chemicals companies throughout the world by the extension of trade credit terms based on an assessment of each customer's financial condition. Trade credit terms are generally offered without collateral and may include an insignificant discount for prompt payment for specific customers. To manage our credit exposure, we perform ongoing evaluations of our customers' financial conditions. In addition, accounts receivable include amounts owed to us under our collaborative research and development agreements.

We recognize accounts receivable at invoiced amounts and we maintain a valuation allowance for credit losses using an impairment model (known as the "current expected credit loss model" or "CECL") based on estimates and forecasts of future conditions requiring recognition of a lifetime of expected credit losses at inception on our financing receivables measured at amortized costs which consisted of accounts receivable, contract assets, and unbilled receivables. We have determined that our financing receivables share similar risk characteristics including: (i) customer origination in the pharmaceutical and fine chemicals industry, (ii) similar historical credit loss pattern of customers (iii) no meaningful trade receivable differences in terms, (iv) similar historical credit loss experience and (v) our belief that the composition of certain assets are comparable to our historical portfolio used to develop loss history. As a result, we measured the allowance for credit loss ("ACL") on a collective basis. Our ACL methodology considers how long the asset has been past due, the financial condition of the customers, which includes ongoing quarterly evaluations and assessments of changes in customer credit ratings, and other market data that we believe are relevant to the collectability of the assets. Nearly all financing receivables are due from customers that are highly rated by major rating agencies and have a long history of no credit loss. We derive our ACL by establishing an impairment rate attributable to assets not yet identified as impaired.

Unbilled Receivable

The timing of revenue recognition may differ from the timing of invoicing to our customers. When we satisfy (or partially satisfy) a performance obligation, prior to being able to invoice the customer, we recognize an unbilled receivable when the right to consideration is unconditional.

Inventories

Inventories are stated at the lower of cost or net realizable value. Cost is determined using a weighted-average approach, assuming full absorption of direct and indirect manufacturing costs, or based on cost of purchasing from our vendors. If inventory costs exceed expected net realizable value due to obsolescence or lack of demand, valuation adjustments are recorded for the difference between the cost and the expected net realizable value.

Concentrations of Supply Risk

We rely on a limited number of suppliers for our products. We believe that other vendors would be able to provide similar products; however, the qualification of such vendors may require substantial start-up time. In order to mitigate any adverse impacts from a disruption of supply, we attempt to maintain an adequate supply of critical single-sourced materials. For certain materials, our vendors maintain a supply for us. We outsource the large-scale manufacturing of our products to contract manufacturers with facilities in Austria and Italy.

Property and Equipment

Property, equipment and leasehold improvements are stated at cost less accumulated depreciation and amortization calculated using the straight-line method over their estimated useful lives as follows:

Asset classification	Estimated useful life
Laboratory equipment	5 years
Computer equipment and software	3 to 5 years
Office equipment and furniture	5 years
Leasehold improvements	Lesser of useful life or lease term

Property and equipment classified as construction in process includes equipment that has been received but not yet placed in service. Normal repairs and maintenance costs are expensed as incurred.

Impairment of Long-Lived Assets

We have not identified property and equipment by segment since these assets are shared or commingled. We evaluate the carrying values of long-lived assets, which include property and equipment and right-of-use assets, whenever events, changes in business circumstances or our planned use of long-lived assets indicate that their carrying amounts may not be fully recoverable or that their useful lives are no longer appropriate. If these facts and circumstances exist, we assess for recovery by comparing the carrying values of long-lived assets with their future net undiscounted cash flows. If the comparison indicates that impairment exists, long-lived assets are written down to their respective fair values based on discounted cash flows. Management judgment is required in the forecast of future operating results that are used in the preparation of undiscounted cash flows.

As of December 31, 2022 and 2021, there were no events or changes in circumstances which indicated that the carrying amount of our asset group might not be recoverable. No impairment charges for long-lived assets were recorded during the years ended December 31, 2022, 2021 and 2020.

Investment in Non-Marketable Securities

Investment in Non-Marketable Equity Securities

We measure investments in non-marketable equity securities without a readily determinable fair value using a measurement alternative that measures these securities at the cost method minus impairment, if any, plus or minus changes resulting from observable price changes on a non-recurring basis. Gains and losses on these securities are recognized in other income (expense), net.

Investment in Non-Marketable Debt Securities

We measure available-for-sale investments in non-marketable debt securities at fair value. Unrealized gains and losses on these securities are recognized in other comprehensive income until realized. Non-marketable debt securities are classified as available-for-sale securities.

We classify non-marketable debt securities as Level 3 in the fair value hierarchy because we estimate the fair value based on a qualitative analysis using the most recent observable transaction price and other significant unobservable inputs including volatility, rights, and obligations of the securities we hold. Significant changes to the unobservable inputs may result in a significantly higher or lower fair value estimate. We may value these securities based on significant recent arms-length transactions with sophisticated non-strategic unrelated new investors.

We evaluate both equity and debt securities for impairment when circumstances indicate that we may not be able to recover the carrying value. We may impair these securities and establish an allowance for a credit loss when we determine that there has been an "other-than-temporary" decline in the estimated fair value of the debt or equity security compared to its carrying value. We calculate the estimated fair value of these securities using information from the investee, which may include:

- Audited and unaudited financial statements;
- Projected technological developments of the company;
- Projected ability of the company to service its debt obligations;
- If a deemed liquidation event were to occur;
- Current fundraising transactions;
- Current ability of the company to raise additional financing if needed;
- Changes in the economic environment which may have a material impact on the operating results of the company;
- Contractual rights, obligations or restrictions associated with the investment; and
- Other factors deemed relevant by our management to assess valuation.
- The valuation may be reduced if the company's potential has deteriorated significantly. If the factors that led to a reduction in valuation are overcome, the valuation may be readjusted.

Goodwill

Goodwill represents the excess of the consideration transferred over the fair value of net assets of businesses acquired and is assigned to reporting units. We test goodwill for impairment considering amongst other things, whether there have been sustained declines in our share price. If we conclude it is more likely than not that the fair value of a reporting unit is less than its carrying amount, a quantitative fair value test is performed. We manage our business as two reporting units and we test goodwill for impairment at the reporting unit level. We allocated goodwill to the two reporting units using a relative fair value allocation methodology that primarily relied on our estimates of revenue and future earnings for each reporting unit. Using the relative fair value allocation methodology, we have determined that approximately $2.4 million, or 76%, of the goodwill is allocated to the Performance Enzymes segment and $0.8 million, or 24%, is assigned to the Novel Biotherapeutics segment.

We test goodwill for impairment annually on a reporting unit basis, on the last day of the fourth fiscal quarter, and between annual tests if events and circumstances indicate it is more likely than not that the fair value of a reporting unit is less than its carrying amount. The annual impairment test is completed using either: a qualitative "Step 0" assessment based on reviewing relevant events and circumstances; or a quantitative "Step 1" assessment, which determines the fair value of the reporting unit. To the extent the carrying amount of a reporting unit is less than its estimated fair value, an impairment charge is recorded. Using the relative fair value allocation methodology for assets and liabilities used in both of our reporting units, we compare the allocated carrying amount of each reporting unit's net assets and the assigned goodwill to its fair value. If the fair value of the reporting unit exceeds its carrying amount, goodwill of the reporting unit is considered not impaired. Any excess of the reporting unit's carrying amount of goodwill over its fair value is recognized as an impairment. During 2022, 2021 and 2020, we did not record impairment charges related to goodwill.

Lease Accounting

We determine if an arrangement is a lease at inception. Where an arrangement is a lease, we determine if it is an operating lease or a finance lease. At lease commencement, we record a lease liability and ROU asset. Lease liabilities represent the present value of our future lease payments over the expected lease term which includes options to extend or terminate the lease when it is reasonably certain those options will be exercised. The present value of our lease liability is determined using our incremental collateralized borrowing rate at lease inception. ROU assets represent our right to control the use of the leased asset during the lease and are recognized in an amount equal to the lease liability for leases with an initial term greater than 12 months. Over the lease term, we use the effective interest rate method to account for the lease liability as lease payments are made and the ROU asset is amortized to the consolidated statement of operations in a manner that results in straight-line expense recognition. We do not apply lease recognition requirements for short-term leases. Instead, we recognize payments related to these arrangements in the consolidated statement of operations as lease costs on a straight-line basis over the lease term.

Income Taxes

We use the liability method of accounting for income taxes, whereby deferred tax asset or liability account balances are calculated at the balance sheet date using current tax laws and rates in effect for the year in which the differences are expected to affect taxable income. Valuation allowances are provided when necessary to reduce deferred tax assets to the amount that will more likely than not be realized.

We make certain estimates and judgments in determining income tax expense for financial statement purposes. These estimates and judgments occur in the calculation of tax credits, benefits and deductions and in the calculation of certain tax assets and liabilities, which arise from differences in the timing of recognition of revenues and expenses for tax and financial statement purposes. Significant changes to these estimates may result in an increase or decrease to our tax provision in a subsequent period.

In assessing the realizability of deferred tax assets, we consider whether it is more likely than not that some portion or all of the deferred tax assets will be realized on a jurisdiction by jurisdiction basis. The ultimate realization of deferred tax assets is dependent upon the generation of taxable income in the future. We have recorded a valuation allowance against these deferred tax assets in jurisdictions where ultimate realization of deferred tax assets is more likely than not to occur. As of December 31, 2022, we maintain a full valuation allowance in all jurisdictions against the net deferred tax assets as we believe that it is more likely than not that the majority of deferred tax assets will not be realized.

We make estimates and judgments about our future taxable income that are based on assumptions that are consistent with our plans and estimates. Should the actual amounts differ from our estimates, the amount of our valuation allowance may be materially impacted. Any adjustment to the deferred tax asset valuation allowance would be recorded in the statements of operations for the periods in which the adjustment is determined to be required.

We account for uncertainty in income taxes as required by the provisions of ASU 2009-06, *Income Taxes (Topic 740) Implementation Guidance on Accounting for Uncertainty in Income Taxes and Disclosure Amendments for Nonpublic Entities*, which clarifies the accounting for uncertainty in income taxes recognized in an enterprise's financial statements. The first step is to evaluate the tax position for recognition by determining if the weight of available evidence indicates that it is more likely than not that the position will be sustained on audit, including resolution of related appeals or litigation processes, if any. The second step is to estimate and measure the tax benefit as the largest amount that is more than 50% likely of being realized upon ultimate settlement. It is inherently difficult and subjective to estimate such amounts, as this requires us to determine the probability of various possible outcomes. We consider many factors when evaluating and estimating our tax positions and tax benefits, which may require periodic adjustments and may not accurately anticipate actual outcomes.

The Tax Reform Act of 1986 and similar state provisions limit the use of net operating loss ("NOL") carryforwards in certain situations where equity transactions result in a change of ownership as defined by Internal Revenue Code Section 382. In the event we should experience such a change of ownership, utilization of our federal and state NOL carryforwards could be limited.

Accounting Pronouncements

Recently adopted accounting pronouncements

In May 2021, FASB issued ASU No. 2021-04, *Earnings Per Share (Topic 260), Debt—Modifications and Extinguishments (Subtopic 470-50), Compensation—Stock Compensation (Topic 718), and Derivatives and Hedging—Contracts in Entity's Own Equity (Subtopic 815-40), Issuer's Accounting for Certain Modifications or Exchanges of Freestanding Equity-Classified Written Call Options, a consensus of the Emerging Issues Task Force*. The standard establishes a principles-based framework in accounting for modifications of freestanding equity-classified written call options on the basis of the economic substance of the underlying transaction. The standard also requires incremental financial statement disclosures. The standard affects entities that present earnings per share in accordance with the guidance in Topic 260, Earnings Per Share. The standard was adopted beginning January 1, 2022 on a prospective basis. The adoption of ASU 2021-04 did not have an impact on our consolidated financial statements and related disclosures.

In August 2020, FASB issued ASU No. 2020-06 *Debt—Debt with Conversion and Other Options (Subtopic 470-20) and Derivatives and Hedging— Contracts in Entity's Own Equity (Subtopic 815-40) No. 2020-06 August 2020 Accounting for Convertible Instruments and Contracts in an Entity's Own Equity*, to reduce the complexity and to simplify the accounting for convertible debt instruments and convertible preferred stock, and the derivatives scope exception for contracts in an entity's own equity. In addition, the guidance on calculating diluted earnings per share has been simplified and made more internally consistent. The standard was adopted beginning January 1, 2022 on a modified retrospective basis. The adoption of ASU 2020-06 did not have an impact on our consolidated financial statements and related disclosures.

In March 2020, the FASB issued ASU No. 2020-04, Reference Rate Reform (Topic 848): *Facilitation of the Effects of Reference Rate Reform on Financial Reporting*. The standard provides optional expedients and exceptions for applying GAAP to contracts, hedging relationships, and other transactions in which the reference LIBOR or another reference rate are expected to be discontinued as a result of the Reference Rate Reform. The standard was adopted beginning January 1, 2022 on a prospective basis. The adoption of ASU 2020-04 had no significant impact on our consolidated financial statements and related disclosures. In December 2022, the FASB issued ASU 2022-06, *Reference Rate Reform (Topic 848): Deferral of the Sunset Date of Topic 848*, which extends the period of time preparers can utilize the reference rate reform guidance in Topic 848. The standard was adopted upon its issuance on a prospective basis. The adoption of ASU 2022-06 did not have an impact on our consolidated financial statements and related disclosures.

Recently issued accounting pronouncements not yet adopted

There have been no other recent accounting pronouncements or changes in accounting pronouncements during the year ended December 31, 2022 that are of significance or potential significance to us.

Note 3. Revenue Recognition

Disaggregation of Revenue

The following table provides information about disaggregated revenue from contracts with customers into the nature of the products and services, and geographic regions, and includes a reconciliation of the disaggregated revenue with reportable segments. The geographic regions that are tracked are the Americas (United States, Canada, and Latin America), EMEA (Europe, Middle East, and Africa), and APAC (Australia, New Zealand, Southeast Asia, and China).

Segment information is as follows (in thousands):

	Year Ended December 31, 2022		
	Performance Enzymes	Novel Biotherapeutics	Total
Major products and service:			
Product revenue	$ 116,676	$ —	$ 116,676
Research and development revenue	9,936	11,978	21,914
Total revenues	$ 126,612	$ 11,978	$ 138,590
Primary geographical markets:			
Americas	$ 12,089	$ 4,911	$ 17,000
EMEA	49,473	7,067	56,540
APAC	65,050	—	65,050
Total revenues	$ 126,612	$ 11,978	$ 138,590

	Year Ended December 31, 2021		
	Performance Enzymes	Novel Biotherapeutics	Total
Major products and service:			
Product revenue	$ 70,657	$ —	$ 70,657
Research and development revenue	19,858	14,239	34,097
Total revenues	$ 90,515	$ 14,239	$ 104,754
Primary geographical markets:			
Americas	$ 16,114	$ 7,367	$ 23,481
EMEA	13,315	6,872	20,187
APAC	61,086	—	61,086
Total revenues	$ 90,515	$ 14,239	$ 104,754

	Year Ended December 31, 2020		
	Performance Enzymes	Novel Biotherapeutics	Total
Major products and service:			
Product revenue	$ 30,220	$ —	$ 30,220
Research and development revenue	17,886	20,950	38,836
Total revenues	$ 48,106	$ 20,950	$ 69,056
Primary geographical markets:			
Americas	$ 11,111	$ 13,241	$ 24,352
EMEA	11,548	7,709	19,257
APAC	25,447	—	25,447
Total revenues	$ 48,106	$ 20,950	$ 69,056

Contract Balances

The following table presents balances of contract assets, unbilled receivables, contract costs, and contract liabilities (in thousands):

	December 31, 2022	December 31, 2021
Contract assets	$ 2,116	$ 4,557
Unbilled receivables	$ 7,016	$ 8,558
Contract costs	$ 19	$ 56
Contract liabilities: deferred revenue	$ 30,609	$ 6,335

We recognize accounts receivable when we have an unconditional right to recognize revenue and have issued an invoice to the customer. Our payment terms are generally between 30 and 90 days. We recognize unbilled receivables when we have an unconditional right to recognize revenue and have not issued an invoice to our customer. Unbilled receivables are transferred to accounts receivable on issuance of an invoice. Unbilled receivables are classified separately on the consolidated balance sheets as an asset. We maintain a valuation allowance on accounts receivables and unbilled receivables.

Contract assets represent our right to recognize revenue for custom products with no alternate use and under binding non-cancellable contracts and are largely related to our procurement of product. We recognize contract assets when we have a conditional right to recognize revenue. The transfer of control of certain products occurs in advance of the invoicing process, which generates contract assets. In addition, we recognize a contract asset related to milestones not eligible for royalty accounting when we assess it is probable of being achieved and there will be no significant reversal of cumulative revenues. Contract assets are classified separately on the consolidated balance sheets as an asset and transferred to accounts receivables when our rights to payment become unconditional.

Contract liabilities, or deferred revenue, represent our obligation to transfer a product or service to the customer, and for which we have received consideration from the customer. We recognize a contract liability when we receive advance customer payments under development agreements for research and development services, upfront license payments, and from upfront customer payments received under product supply agreements. Contract liabilities are classified as a liability on the consolidated balance sheets.

Contract costs relate to incremental costs of obtaining a contract with a customer. Contract costs are amortized along with the associated revenue over the term of the contract.

During the years ended December 31, 2022, 2021 and 2020, we had no asset impairment charges related to contract assets.

We recognized the following revenues (in thousands):

	Year Ended December 31,	
Revenue recognized in the period for:	**2022**	**2021**
Amounts included in contract liabilities at the beginning of the period:		
Performance obligations satisfied	$ 2,038	$ 1,858
Changes in the period:		
Changes in the estimated transaction price allocated to performance obligations satisfied in prior periods	279	7,645
Performance obligations satisfied from new activities in the period - contract revenue	136,273	95,251
Total revenues	$ 138,590	$ 104,754

Performance Obligations

The following table includes estimated revenue expected to be recognized in the future related to performance obligations that are unsatisfied or partially unsatisfied at the end of the reporting periods. The estimated revenue does not include contracts with original durations of one year or less, amounts of variable consideration attributable to royalties, or contract renewals that are unexercised as of December 31, 2022.

The balances in the table below are partially based on judgments involved in estimating future orders from customers subject to the exercise of material rights pursuant to respective contracts (in thousands):

	2023	2024	2025	2026 and Thereafter	Total
Product revenue	$ 12,136	$ 13,080	$ 140	$ 3,640	$ 28,996
Research and development revenue	1,592	21	—	—	1,613
Total revenues	$ 13,728	$ 13,101	$ 140	$ 3,640	$ 30,609

Note 4. Net Loss per Share

Basic net loss per share is computed by dividing the net loss by the weighted-average number of shares of common stock outstanding, less restricted stock awards ("RSAs") subject to forfeiture. Diluted net loss per share is computed by dividing net loss by the weighted-average number of shares of common stock shares outstanding, less RSAs subject to forfeiture, plus all additional common shares that would have been outstanding, assuming dilutive potential common stock shares had been issued for other dilutive securities. For all periods presented, diluted and basic net loss per share are identical since potential common stock shares are excluded from the calculation, as their effect was anti-dilutive.

Anti-Dilutive Securities

In periods of net loss, the weighted average number of shares outstanding, prior to the application of the treasury stock method, excludes potentially dilutive securities from the computation of diluted net loss per common share because including such shares would have an anti-dilutive effect.

The following shares were not considered in the computation of diluted net loss per share because their effect was anti-dilutive (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Shares issuable under the Equity Incentive Plan	7,442	5,215	5,348

Note 5. Collaborative Arrangements

GSK Platform Technology Transfer, Collaboration and License Agreement

In July 2014, we entered into a CodeEvolver® protein engineering platform technology transfer collaboration and license agreement (the "GSK CodeEvolver® Agreement") with GSK. Pursuant to the terms of the agreement, we granted GSK a non-exclusive license to use the CodeEvolver® protein engineering platform technology to develop novel enzymes for use in the manufacture of GSK's pharmaceutical and health care products. We completed the transfer of the CodeEvolver® protein engineering platform technology to GSK in April 2016 and all revenues relating to the technology transfer have been recognized as of April 2016. Depending upon GSK's successful application of the licensed technology, we have the potential to receive additional contingent payments that range from $5.75 million to $38.5 million per project.

In 2019, we received a $2.0 million milestone payment relating to the advancement of an enzyme developed by GSK using our CodeEvolver® protein engineering platform technology. In 2021, we received two additional milestone payments from GSK under the agreement. We recognized research and development revenue of nil, $4.3 million, and nil in the years ended December 31, 2022, 2021, and 2020, respectively.

Merck Platform Technology Transfer and License Agreement

In August 2015, we entered into a CodeEvolver® platform technology transfer collaboration and license agreement (the "Merck CodeEvolver® Agreement") with Merck, Sharp & Dohme ("Merck") which allows Merck to use the CodeEvolver® protein engineering technology platform in the field of human and animal healthcare. In 2016, we completed the final phase in the transfer of CodeEvolver® technology to Merck under the Merck CodeEvolver® Agreement.

We recognized research and development revenues of $40 thousand, $0.6 million, and $3.1 million in the years ended December 31, 2022, 2021 and 2020, respectively, for various research projects under our collaborative arrangement.

We have the potential to receive payments of up to a maximum of $15.0 million for each commercial active pharmaceutical ingredient ("API") that is manufactured by Merck using one or more novel enzymes developed by Merck using the CodeEvolver® protein engineering technology platform. The API payments, which are currently not recognized in revenue, are based on the quantity of API developed and manufactured by Merck and will be recognized as usage-based royalties.

In October 2018, we entered into an amendment to the Merck CodeEvolver® Agreement which amended certain licensing provisions and one exhibit. In January 2019, we amended the Merck CodeEvolver® Agreement to install certain CodeEvolver® protein engineering technology upgrades into Merck's platform license installation and maintain those upgrades for a multi-year term that expired in January 2022. The license installation was completed in 2019. We recognized nil, $0.1 million and $0.1 million in research and development revenues under the terms of the amendment in 2022, 2021 and 2020 respectively.

Merck Sitagliptin Catalyst Supply Agreement

In February 2012, we entered into a five-year Sitagliptin Catalyst Supply Agreement ("Sitagliptin Supply Agreement") with Merck whereby Merck may obtain commercial scale enzyme for use in the manufacture of Januvia®, its product based on the active ingredient Sitagliptin. In December 2015, Merck exercised its options under the terms of the Sitagliptin Catalyst Supply Agreement to extend the agreement for an additional five years through February 2022. In September 2021, the Sitagliptin Catalyst Supply Agreement was amended to extend the agreement through December 2026.

Effective as of January 2016, we and Merck amended the Sitagliptin Supply Agreement to prospectively provide for variable pricing based on the cumulative volume of sitagliptin enzyme purchased by Merck. We have previously determined that the variable pricing, which provides a discount based on the cumulative volume of sitagliptin enzyme purchased by Merck, provides Merck material rights and we recognized product revenues using the alternative method wherein we estimated the total expected consideration and allocated it proportionately with the expected sales. Pursuant to the latest amendment of the Sitagliptin Supply Agreement, we have determined that the latest price per volume of sitagliptin enzyme to be purchased by Merck no longer provides Merck material rights, and as such we are recognizing product revenue based on contractually stated prices effective as of February 2022.

We recognized $5.9 million, $9.8 million and $13.4 million in product revenue under this contract for the years ended December 31, 2022, 2021 and 2020, respectively. Revenues recognized by us under the Sitagliptin Supply Agreement comprised 4%, 9%, and 19% of our total revenues for the years ended December 31, 2022, 2021 and 2020, respectively.

During the year ended December 31, 2022, we recorded revenue of $1.6 million from sitagliptin enzyme sales that were recognized over time based on the progress of the manufacturing process. These products will be shipped in the first quarter of 2023.

Enzyme Supply Agreement

In November 2016, we entered into a supply agreement whereby our customer may purchase quantities of one of our proprietary enzymes for use in its commercial manufacture of a product. Pursuant to the supply agreement, we received an upfront payment in December 2016 which was recorded as deferred revenue. Such upfront payment will be recognized over the period of the supply agreement as the customer purchases our proprietary enzyme. We additionally have determined that the volume discounts under the supply agreement provide the customer material rights and we are recognizing revenues using the alternative method. As of December 31, 2022 and 2021, we had deferred revenue balances from the supply agreement of $3.3 million and $2.6 million.

Commercial Agreement

In April 2019, we entered into a multi-year commercial agreement with Tate & Lyle under which Tate & Lyle has received an exclusive license to use a suite of Codexis novel performance enzymes in the manufacture of Tate & Lyle's zero-calorie stevia sweetener, TASTEVA® M, and other stevia products. Under the agreement, we will supply Tate & Lyle with its requirements for these enzymes over a multiple year period and receive royalties on stevia products. In November 2020, we amended the commercial agreement based on Tate & Lyle's intent to use a specific Codexis novel performance enzyme in its production of TASTEVA® M Stevia Sweetener and became eligible to receive milestone payments of up to $1.1 million. In the fourth quarter of 2020, we became eligible to receive a milestone payment of $0.4 million which we subsequently received in February 2021.

Global Development, Option and License Agreement and Strategic Collaboration Agreement

In October 2017, we entered into the Nestlé License Agreement with Nestlé Health Science and, solely for the purpose of the integration and the dispute resolution clauses of the Nestlé License Agreement, Nestlé Health Science S.A., to advance CDX-6114, our enzyme biotherapeutic product candidate for the potential treatment of PKU.

In January 2019, we received notice from the U.S. Food and Drug Administration ("FDA") that it had completed its review of our IND for CDX-6114 and concluded that we may proceed with the proposed Phase 1b multiple ascending dose study in healthy volunteers in the United States. In February 2019, Nestlé Health Science exercised its option to obtain an exclusive, worldwide, royalty-bearing, sub-licensable license for the global development and commercialization of CDX-6114 for the management of PKU. Upon exercising its option, Nestlé Health Science made an option payment and assumed all responsibilities for future clinical development and commercialization of CDX-6114. We are also eligible to receive payments from Nestlé Health Science under the Nestlé License Agreement that include (i) development and approval milestones of up to $85.0 million, (ii) sales-based milestones of up to $250.0 million in the aggregate, which aggregate amount is achievable if net sales exceed $1.0 billion in a single year, and (iii) tiered royalties, at percentages ranging from the mid-single digits to low double-digits of net sales of product.

In October 2017, we entered into the Nestlé SCA pursuant to which we and Nestlé Health Science are collaborating to leverage the CodeEvolver® protein engineering technology platform to develop novel enzymes for Nestlé Health Science's established Consumer Care and Medical Nutrition business areas. The term of the Nestlé SCA has been extended through December 2023 with an automatic renewal through December 2024.

In January 2020, we entered into a development agreement with Nestlé Health Science pursuant to which we and Nestlé Health Science are collaborating to advance CDX-7108, targeting a gastrointestinal disorder discovered through our Nestlé SCA, into preclinical and early clinical studies. We, together with Nestlé Health Science, are continuing to advance CDX-7108 and initiated a Phase 1 clinical trial with the first subject being dosed in the fourth quarter of 2021. The term of the development agreement has been extended through December 2023 with an automatic renewal through December 2024.

Under the Nestlé SCA and the development agreement, we recognized $7.1 million, $6.9 million and $7.9 million in research and development revenue for the years ended December 31, 2022, 2021 and 2020, respectively.

Strategic Collaboration Agreement

In April 2018, we entered into the Porton Agreement with Porton to license key elements of our biocatalyst technology for use in Porton's global custom intermediate and API development and manufacturing business. Under the Porton Agreement, we are eligible to receive annual collaboration fees and research and development revenues. We received initial collaboration payments of $0.5 million and $0.5 million within 30 days of the effective date and on the first anniversary of the effective date of the Porton Agreement, respectively. We also received annual collaboration payments of $1.0 million each during the first through third anniversaries of the effective date of the Porton Agreement and are eligible to receive $1.0 million on the fourth anniversary of the effective date of the Porton Agreement. We completed the technical transfer in the fourth quarter of 2018 and recognized the related revenue in 2018. We recognized revenue related to the functional license provided to Porton at a point in time when control of the license was transferred to the customer. The initial term of the Porton Agreement will expire on April 22, 2023 and is not being renewed for an extended term. We recognized research and development revenue related to the Porton Agreement of $0.1 million, $1.1 million and $1.1 million in the years ended December 31, 2022, 2021 and 2020, respectively.

Platform Technology Transfer and License Agreement

In May 2019, we entered into a Platform Technology Transfer and License Agreement (the "Novartis CodeEvolver® Agreement") with Novartis. The Agreement allows Novartis to use our proprietary CodeEvolver® protein engineering platform technology in the field of human healthcare. In July 2021, we announced the completion of the technology transfer period during which we transferred our CodeEvolver® protein engineering platform technology to Novartis (the "Technology Transfer Period"). As a part of this technology transfer, we provided to Novartis our proprietary enzymes, proprietary protein engineering protocols and methods, and proprietary software algorithms. In addition, our teams and Novartis scientists participated in technology training sessions and collaborative research projects at our laboratories in Redwood City, California and at a designated Novartis laboratory in Basel, Switzerland. Novartis has now installed the CodeEvolver® protein engineering platform technology at its designated laboratory.

Pursuant to the agreement, we received an upfront payment of $5.0 million shortly after the effective date of the Novartis CodeEvolver® Agreement. We completed the second technology milestone transfer under the agreement in 2020 and received a milestone payment of $4.0 million. We have also received an aggregate of $5.0 million for the completion of the third technology milestone in 2021. In consideration for the continued disclosure and license of improvements to the technology and materials during a multi-year period that began on the conclusion of the Technology Transfer Period ("Improvements Term"), Novartis will pay Codexis annual payments over four years which amount to an additional $8.0 million in aggregate. We received the first annual payment of $2.0 million in the fourth quarter of 2022. The Company also has the potential to receive quantity-dependent, usage payments for each API that is manufactured by Novartis using one or more enzymes that have been developed or are in development using the CodeEvolver® protein engineering platform technology during the period that began on the conclusion of the Technology Transfer Period and ends on the expiration date of the last to expire licensed patent. Revenue for the combined initial license and technology transfer performance obligation was recognized using a single measure of progress that depicted our performance in transferring control of the services. Revenue allocated to improvements made during the Improvements Term are being recognized during the Improvement Term.

We recognized $1.0 million, $1.6 million and $6.2 million in research and development revenue in the year ended December 31, 2022, 2021 and 2020, respectively.

License Agreement

In December 2019, we entered a license agreement with Roche Sequencing Solutions, Inc. ("Roche") to provide Roche with our EvoT4 DNA™ ligase high-performance molecular diagnostic enzyme. The royalty bearing license grants Roche worldwide rights to include the EvoT4 DNA™ ligase in its nucleic acid sequencing products and workflows. Under the license agreement, we received an initial collaboration fee payment of $0.8 million within 45 days of the effective date of the agreement, and we received an additional $0.9 million milestone payment after the completion of technology transfer in October 2020. The agreement also contemplates milestone payments to Codexis upon the achievement of various development and commercialization events and royalty payments from commercial sales of the enzyme. We recognized research and development fees of nil, $0.9 million and $0.9 million for the years ended December 31, 2022, 2021 and 2020, respectively.

Strategic Collaboration and License Agreement

In March 2020, we entered into a Strategic Collaboration and License Agreement (the "Takeda Agreement") with Takeda under which we are collaborating to research and develop protein sequences for use in gene therapy products for certain diseases (each, a "Field") in accordance with each applicable program plan (each, a "Program Plan").

On execution of the Takeda Agreement in March 2020, we received an upfront nonrefundable cash payment of $8.5 million and we initiated activities under three Program Plans for Fabry Disease, Pompe Disease, and an undisclosed blood factor deficiency respectively (the "Initial Programs"). In May 2021, Takeda elected to exercise its option to initiate an additional program for a certain undisclosed rare genetic disorder; as a result, we received the option exercise fee during the third quarter of 2021. Pursuant to the Takeda Agreement, we are eligible to receive other payments that include (i) reimbursement of research and development fees and preclinical development milestones for the three initial programs of $10.5 million, in aggregate, and $3.4 million for the fourth program, (ii) clinical development and commercialization-based milestones, per target gene, of up to $104.0 million and (iii) tiered royalty payments based on net sales of applicable products at percentages ranging from the mid-single digits to low single-digits.

Revenue relating to the functional licenses provided to Takeda was recognized at a point in time when the control of the license transferred to the customer. We recognized research and development revenue related to the Takeda Agreement of $4.9 million, $7.4 million and $13.2 million in the years ended December 31, 2022, 2021, and 2020, respectively. As of December 31, 2022 and 2021, we had deferred revenue balances of $0.9 million and $2.2 million, respectively.

Master Collaboration and Research Agreement, Stock Purchase Agreement and Enzyme Supply Agreement

In June 2020, we entered into a Stock Purchase Agreement with MAI in which we purchased 1,587,050 shares of MAI's Series A preferred stock for $1.0 million. In connection with the June 2020, transaction, John Nicols, our former President and Chief Executive Officer, joined MAI's board of directors. For additional information, see Note 14, "Related Party Transactions".

Concurrently with our initial equity investment, we entered into the MAI Agreement, pursuant to which we performed services utilizing our CodeEvolver® protein engineering platform technology to improve DNA polymerase enzymes in exchange for compensation in the form of additional shares of MAI's Series A and B preferred stock which are valued based on the observed transaction price of similar securities of MAI issued to third parties. Under the MAI Agreement, we will have the right to use and sell the engineered enzymes to third parties for any purpose other than for the synthesis of native DNA. Under the MAI Agreement, we would make a $0.5 million payment to MAI upon our achievement of a milestone of $5.0 million in aggregate commercial sales to third parties of the engineered enzymes or any product incorporating or derived from the engineered enzymes for any purpose other than the synthesis of native DNA. As contemplated in the MAI Agreement, we executed the Commercial License and Enzyme Supply Agreement with MAI ("MAI Supply Agreement") in July 2022 following the completion of certain timelines specified in the SOW.

We completed the R&D service with MAI pursuant to the MAI Agreement during the first quarter of 2022. In December 2021, we received the primary milestone payment pursuant to the MAI Agreement of $1.0 million in the form of an additional 1,587,049 shares of Series B preferred stock. Upon execution of the MAI Supply Agreement in July 2022, we received the commercialization and enzyme supply agreement milestone payment pursuant to the MAI Agreement of $1.0 million in the form of an additional 1,587,049 shares of Series B preferred stock. We recognized $1.2 million, $2.0 million and $0.9 million in research and development revenue from transactions with MAI in the years ended December 31, 2022, 2021 and 2020, respectively. Payment for the services rendered was received in the form of additional MAI Series A and Series B preferred stock. We received an aggregate of 1,587,049, 3,491,505 and 714,171 shares of MAI's Series A and B preferred stock in the years ended December 31, 2022, 2021 and 2020, respectively.

In July 2022, we and MAI executed the MAI Supply Agreement that will enable MAI to utilize an evolved terminal deoxynucleotidyl transferase ("TdT") enzyme in MAI's Fully Enzymatic Synthesis™ ("FES™") technology. We recognized $0.5 million in product revenue for the year ended December 31, 2022.

Pfizer Enzyme Supply Agreement

During 2021 and 2022, we received purchase orders from Pfizer, Inc. ("Pfizer") for large quantities of our proprietary enzyme product, CDX-616, for use by Pfizer in the manufacture of a critical intermediate for its proprietary active pharmaceutical ingredient, nirmatrelvir, used by Pfizer in combination with the active pharmaceutical ingredient ritonavir, as its PAXLOVID™ (nirmatrelvir tablets; ritonavir tablets) product for the treatment of COVID-19 infections in humans.

We are a party to an Enzyme Supply Agreement with Pfizer Ireland Pharmaceuticals, a subsidiary of Pfizer (the "Pfizer Supply Agreement"), covering the manufacture, sale and purchase of CDX-616 for use by Pfizer in the manufacture of nirmatrelvir. Under the terms of the Pfizer Supply Agreement, Pfizer paid us a fee of $25.9 million in August 2022 which was recorded as deferred revenue. The fee is creditable against future orders of CDX-616 used to manufacture PAXLOVID™ with shipment dates prior to December 31, 2023 and for fees associated with any new development and licensing agreements with Pfizer entered into prior to March 31, 2023 that are invoiced prior to December 31, 2023. Up to 50% of any portion of the fee which has not been credited pursuant to credits granted under the preceding sentence is creditable against future orders of CDX-616 used to manufacture PAXLOVID™ with shipment dates prior to December 31, 2024.

In the fourth quarter of 2022, we and Pfizer agreed to adjust the terms of certain existing non-cancelable purchase orders of CDX-616 issued under the Pfizer Supply Agreement pursuant to which Pfizer will pay us $36.8 million in lieu of the delivery of certain quantities of CDX-616 under those purchase orders, thereby relieving both parties of further obligations under those purchase orders. We recognized $36.8 million in product revenue in 2022 for these existing orders that were invoiced in 2022, of which $19.8 million was collected in December 2022 and the remaining amount was included in accounts receivable as of December 31, 2022, as our right to payment became unconditional upon modification. We expect to receive the $16.9 million in accounts receivable in the first quarter of 2023.

We recognized product revenue of $75.4 million and $34.5 million in the years ended December 31, 2022 and 2021, respectively, from the sale of quantities of CDX-616 to Pfizer. Revenues recognized by us from sale of CDX-616 to Pfizer comprised 54% and 33% of our total revenues for the years ended December 31, 2022 and 2021, respectively.

As of December 31, 2022, we had $24.4 million in deferred revenue related to the $25.9 million fee received from Pfizer, net of $1.5 million of product revenue recognized from the fee during the year ended December 31, 2022. We had nil and $1.7 million in contract assets as of December 31, 2022 and 2021, respectively.

Note 6. Investments in Non-Marketable Securities

Non-Marketable Debt Securities

We classify non-marketable debt securities, which are accounted for as available-for-sale, within Level 3 in the fair value hierarchy because we estimate the fair value based on a qualitative analysis using the most recent observable transaction price and other significant unobservable inputs including volatility, rights, and obligations of the securities we hold.

We determine gains or losses on the sale or extinguishment of non-marketable debt securities using a specific identification method. Unrealized gains and losses from bifurcated embedded derivatives, which represent share-settled redemption features, are recorded as other expense, net, in the consolidated statements of operations. Unrealized gains and losses on non-marketable debt securities are recorded as a component of other comprehensive loss until realized. Realized gains or losses are recorded as a component of other income (expense), net.

In November 2020, we purchased convertible subordinated notes issued by Arzeda Corp. (“Arzeda”), an early-stage computational protein design company, for $1.0 million and the investment was classified as available-for-sale non-marketable interest-bearing debt securities. In July 2021, we converted the non-marketable debt security with a carrying value of $1.3 million into 207,070 shares of Series B-2 preferred stock of Arzeda. During the year ended December 31, 2021, we recognized $0.3 million in interest income from interest earned on our investment in this debt security.

There were no investments in non-marketable debt securities as of December 31, 2022 and 2021.

Non-Marketable Equity Securities

Our non-marketable equity securities are investments in privately held companies without readily determinable market value. These investments are accounted for under the measurement alternative and are measured at cost minus impairment, if any, plus or minus changes resulting from observable price changes for identical or similar securities of the same issuer. Non-marketable equity securities are measured at fair value on a non-recurring basis and classified within Level 2 in the fair value hierarchy because we estimate the fair value of these investments using the observable transaction price paid by third party investors for the same or similar security of the same issuers. We adjust the carrying value of non-marketable equity securities which have been remeasured during the period and recognize resulting gains or losses as a component of other income (expense), net in the consolidated statements of operations.

In March 2022, we entered into a Stock Purchase Agreement with seqWell Inc. (“seqWell”), a privately held biotechnology company, pursuant to which we purchased 1,000,000 shares of seqWell's Series C preferred stock for $5.0 million.

For the year ended December 31, 2022, we recognized a $0.2 million unrealized gain in other income, net, and included as adjustment to the carrying value of our investment in MAI, for the remeasurement of the additional 1,587,049 shares of Series B preferred stock received as a milestone payment during the third quarter of 2022 based on the latest observed transaction price of MAI's preferred stock. For the year ended December 31, 2021, we recognized a $1.0 million unrealized gain in other income, net, due to an adjustment to the carrying value of our investment in MAI based on an analysis of the observed transaction price from MAI's round of financing during the third and fourth quarters of 2021. See Note 14 “Related Party Transactions” for additional information on our investment in MAI. Other than as disclosed above, there were no remeasurement events for our investments in MAI and other non-marketable equity securities in 2022 and 2021. We recognized no realized gains or losses during the years ended December 31, 2022 and 2021.

The following table presents the carrying value of our non-marketable equity securities (in thousands):

	December 31, 2022	December 31, 2021
MAI	$ 13,921	$ 12,713
seqWell	5,000	—
Arzeda	1,289	1,289
Other investments in non-marketable equity securities	300	—
Total non-marketable equity securities	$ 20,510	$ 14,002

Note 7. Fair Value Measurements

The following tables present the financial instruments that were measured at fair value on a recurring basis within the fair value hierarchy (in thousands):

	December 31, 2022			
	Level 1	Level 2	Level 3	Total
Money market funds	$ 77,309	$ —	$ —	$ 77,309

	December 31, 2021			
	Level 1	Level 2	Level 3	Total
Money market funds	$ 86,095	$ —	$ —	$ 86,095

During the years ended December 31, 2022 and 2021, we did not recognize any significant credit losses nor other-than-temporary impairment losses on non-marketable securities.

Note 8. Balance Sheet Details

Cash Equivalents

Cash equivalents consisted of the following (in thousands):

	December 31, 2022		December 31, 2021	
	Adjusted Cost	Estimated Fair Value	Adjusted Cost	Estimated Fair Value
Money market funds [1]	$ 77,309	$ 77,309	$ 86,095	$ 86,095

[1] Money market funds are classified in cash and cash equivalents on our consolidated balance sheets. Average contractual maturities (in days) is not applicable.

As of December 31, 2022, the total cash and cash equivalents balance of $114.0 million consisted of money market funds of $77.3 million and cash of $36.7 million held with major financial institutions. As of December 31, 2021, the total cash and cash equivalents balance of $116.8 million consisted of money market funds of $86.1 million and cash of $30.7 million held with major financial institutions.

Inventories

Inventories consisted of the following (in thousands):

	December 31,	
	2022	2021
Raw materials	$ 108	$ 49
Work in process	91	65
Finished goods	1,830	1,046
Total inventories	$ 2,029	$ 1,160

Inventories are recorded net of reserves of $1.2 million and $1.4 million as of December 31, 2022 and December 31, 2021 respectively.

Property and Equipment, net

Property and equipment, net consisted of the following (in thousands):

	December 31,	
	2022	2021
Laboratory equipment [1]	$ 39,679	$ 33,101
Leasehold improvements	16,633	16,117
Computer equipment and software	3,039	3,481
Office equipment and furniture	1,345	1,297
Construction in progress [2]	1,739	3,231
Property and equipment	62,435	57,227
Less: accumulated depreciation and amortization	(39,821)	(35,882)
Property and equipment, net	$ 22,614	$ 21,345

[1] Fully depreciated property and equipment with a cost of $1.5 million and $0.6 million were retired during the years ended December 31, 2022 and 2021, respectively.
[2] Construction in progress includes equipment received but not yet placed into service pending installation.

Depreciation expense included in both research and development expenses and selling, general and administrative expenses in the consolidated statements of operations was as follows (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Depreciation expense	$ 5,402	$ 3,113	$ 1,950

Goodwill

Goodwill had a carrying value of $3.2 million as of December 31, 2022 and 2021.

Other Accrued Liabilities

Other accrued liabilities consisted of the following (in thousands):

	December 31,	
	2022	2021
Accrued purchases	$ 10,852	$ 6,755
Accrued professional and outside service fees	3,495	5,147
Other	932	676
Total other accrued liabilities	$ 15,279	$ 12,578

Note 9. Stock-based Compensation

Equity Incentive Plans

In 2019, our board of directors (the "Board") and stockholders approved the 2019 Incentive Award Plan (the "2019 Plan"). The 2019 Plan superseded and replaced in its entirety our 2010 Equity Incentive Plan (the “2010 Plan") which was effective in March 2010, and no further awards will be granted under the 2010 Plan; however, the terms and conditions of the 2010 Plan will continue to govern any outstanding awards thereunder.

The 2019 Plan provides for the grant of stock options, including incentive stock options and non-qualified stock options, stock appreciation rights, restricted stock awards ("RSAs"), restricted stock units ("RSUs"), performance-contingent restricted stock units ("PSUs"), performance-based options ("PBOs"), other stock or cash-based awards and dividend equivalents to eligible employees and consultants of the Company or any parent or subsidiary, as well as members of the Board.

The number of shares of our common stock available for issuance under the 2019 Plan is equal to the sum of (i) 7,897,144 shares and (ii) any shares subject to awards granted under the 2010 Plan that were outstanding as of April 22, 2019 and thereafter terminate, expire, lapse or are forfeited; provided that no more than 14,000,000 shares may be issued upon the exercise of incentive stock options ("ISOs"). In June 2019, 8.1 million shares authorized for issuance under the 2019 Plan were registered under the Securities Act of 1933, as amended (the "Securities Act").

The 2010 Plan provided for the grant of incentive stock options, non-statutory stock options, RSUs, RSAs, PSUs, PBOs, stock appreciation rights, and stock purchase rights to our employees, non-employee directors and consultants.

As of December 31, 2022, total shares remaining available for issuance under the 2019 Plan were 2.8 million shares.

Stock Options

The option exercise price for incentive stock options must be at least 100% of the fair value of our common stock on the date of grant and the option exercise price for non-statutory stock options is at least 85% of the fair value of our common stock on the date of grant, as determined by the Board. If, at the time of a grant, the optionee directly or by attribution owns stock possessing more than 10% of the total combined voting power of all of our outstanding capital stock, the exercise price for these options must be at least 110% of the fair value of the underlying common stock. Stock options granted to employees generally have a maximum term of ten years and vest over four years from the date of grant, of which 25% vest at the end of one year, and 75% vest monthly over the remaining three years. We may grant options with different vesting terms from time to time. Unless an employee's termination of service is due to disability or death, upon termination of service, any unexercised vested options will be forfeited at the end of three months or the expiration of the option, whichever is earlier.

Restricted Stock Units ("RSUs")

We also grant employees RSUs, which generally vest over either a three year period with 33% of the shares subject to the RSUs vesting on each yearly anniversary of the vesting commencement date or over a four-year period with 25% of the shares subject to the RSU vesting on each yearly anniversary of the vesting commencement date, in each case contingent upon such employee’s continued service on such vesting date. RSUs are generally subject to forfeiture if employment terminates prior to the release of vesting restrictions. We may grant RSUs with different vesting terms from time to time.

Performance-contingent Restricted Stock Units ("PSUs") and Performance Based Options ("PBOs")

The compensation committee of the Board, solely in respect of non-executive employees, delegated to our Chief Executive Officer the authority to approve grants of PSUs. The compensation committee of the Board also approves grants of PBOs and PSUs to our executives. The PSUs and PBOs vest based upon both the successful achievement of certain corporate operating milestones in specified timelines and continued employment through the applicable vesting date. When the performance goals are deemed to be probable of achievement for these types of awards, recognition of stock-based compensation expense commences. Once the number of shares eligible to vest is determined, those shares vest in two equal installments with 50% vesting upon achievement and the remaining 50% vesting on the first anniversary of achievement, in each case, subject to the recipient’s continued service through the applicable vesting date. If the performance goals are achieved at the threshold level, the number of shares eligible to vest in respect of the PSUs and PBOs would be equal to half the number of PSUs granted and one-quarter the number of shares underlying the PBOs granted. If the performance goals are achieved at the target level, the number of shares eligible to vest in respect of the PSUs and PBOs would be equal to the number of PSUs granted and half of the shares underlying the PBOs granted. If the performance goals are achieved at the superior level, the number of shares eligible to vest in respect of the PSUs would be equal to two times the number of PSUs granted and equal to the number of PBOs granted. The number of shares issuable upon achievement of the performance goals at the levels between the threshold and target levels for the PSUs and PBOs or between the target level and superior levels for the PSUs would be determined using linear interpolation. Achievement below the threshold level would result in no shares being eligible to vest in respect of the PSUs and PBOs.

In 2022, we awarded PSUs ("2022 PSUs") and PBOs ("2022 PBOs"), each of which commence vesting based upon the achievement of various weighted performance goals, including finance and corporate strategy, performance enzymes and biotherapeutics deliverables, research plans, and organizational development. As of December 31, 2022, we estimated that the 2022 PSUs and 2022 PBOs performance goals would be achieved at 85.0% and 42.5% of the target level, respectively, and recognized stock-based compensation expenses accordingly.

In 2021, we awarded PSUs ("2021 PSUs") and PBOs ("2021 PBOs"), each of which commence vesting based upon the achievement of various weighted performance goals, including total revenues, product revenue, performance enzymes pipeline advancements, biotherapeutics pipeline advancements, organization and infrastructure upgrades, and significant events that can be publicly announced. In the first quarter of 2022, we determined that the 2021 PSUs and 2021 PBOs performance goals had been achieved at 146% and 73% of the target level, respectively, and recognized stock-based compensation expenses accordingly. Accordingly, 50% of the shares underlying the 2021 PSUs and PBOs vested in the first quarter of 2022 and 50% of the shares underlying the 2021 PSUs and PBOs will vest in the first quarter of 2023, in each case, subject to the recipient’s continued service on each vesting date.

In 2020, we awarded PSUs ("2020 PSUs") and PBOs ("2020 PBOs"), each of which commenced vesting based upon the achievement of various weighted performance goals, including total revenues, performance enzyme segment gross margin, major new biotherapeutics publicity events, strategic performance enzyme and biotherapeutics deliverables, and strategic plan development. In the first quarter of 2021, we determined that the 2020 PSUs and 2020 PBOs performance goals had been achieved at 88% and 44% of the target level, respectively, and recognized stock-based compensation expenses accordingly. Accordingly, 50% of the shares underlying the 2020 PSUs and PBOs vested in the first quarter of 2021 and 50% of the shares underlying the 2020 PSUs and PBOs vested in the first quarter of 2022, in each case, subject to the recipient's continued service on each vesting date.

Stock-Based Compensation Expense

Stock-based compensation expense is included in the consolidated statements of operations as follows (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Costs of product revenue	$ 452	$ 224	$ 104
Research and development	$ 3,907	$ 2,663	$ 1,843
Selling, general and administrative	10,172	8,706	5,781
Total	$ 14,531	$ 11,593	$ 7,728

The following table presents total stock-based compensation expense by security type included in the consolidated statements of operations (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Stock options	$ 4,167	$ 2,764	$ 2,381
RSUs and RSAs	4,807	2,768	2,231
PSUs	3,268	2,333	1,160
PBOs	2,289	3,728	1,956
Total	$ 14,531	$ 11,593	$ 7,728

In connection with the retirement of John Nicols, our former President and Chief Executive Officer, in August 2022, and the Transition and Separation Agreement between Mr. Nicols and the Company, certain supplementary modifications were made to Mr. Nicols' vested and unvested stock option and PBOs awards including voluntary forfeiture of certain unvested stock option and PBOs awards and the extension of the post-termination exercise period of certain vested stock option and PBOs awards. During the year ended December 31, 2022, we recorded a one-time, non-cash incremental compensation expense of $1.0 million, net of the required reversal of previously recognized stock-based compensation expenses attributed to unvested shares, in selling, general and administrative expenses related to these stock option award modifications.

Grant Award Activities:

Stock Option Awards

We estimated the fair value of stock options using the Black-Scholes-Merton option-pricing model based on the date of grant. The following summarizes the weighted-average assumptions used to estimate the fair value of employee stock options granted:

	Year Ended December 31,		
	2022	2021	2020
Expected life (years)	5.7	5.6	5.3
Volatility	62.1 %	52.5 %	50.4 %
Risk-free interest rate	3.1 %	0.8 %	1.0 %
Expected dividend yield	0.0 %	0.0 %	0.0 %

No stock options were granted to non-employees for services during year ended December 31, 2022. The following summarizes the weighted-average assumptions used to estimate the fair value of 9,000 and 76,000 shares of stock options granted to non-employees for services valued at $0.1 million and $0.4 million during the years ended December 31, 2021 and 2020 respectively:

	Year Ended December 31,	
	2021	2020
Expected life (years)	5.6	5.4
Volatility	54.1 %	51.6 %
Risk-free interest rate	0.9 %	0.4 %
Expected dividend yield	0.0 %	0.0 %

The weighted average grant date fair value per share of non-employee stock options granted respectively in 2021 and 2020 was $11.29 and $5.04.

The following tables summarizes stock option activities:

	Number of Shares	Weighted Average Exercise Price Per Share
	(In Thousands)	
Outstanding at December 31, 2019	3,147	$ 6.31
Granted	496	$ 13.30
Exercised	(210)	$ 6.30
Forfeited/Expired	(48)	$ 16.71
Outstanding at December 31, 2020	3,385	$ 7.19
Granted	286	$ 26.85
Exercised	(664)	$ 6.96
Forfeited/Expired	(72)	$ 17.99
Outstanding at December 31, 2021	2,935	$ 8.90
Granted	2,000	$ 8.90
Exercised	(410)	$ 2.33
Forfeited/Expired	(275)	$ 19.01
Outstanding at December 31, 2022	4,250	$ 8.88

	Number of Shares	Weighted Average Exercise Price Per Share	Weighted Average Remaining Contractual Term	Aggregate Intrinsic Value
	(In Thousands)		(In Years)	(In Thousands)
Outstanding at December 31, 2022	4,250	$ 8.88	6.2	$ 1,556
Exercisable at December 31, 2022	2,162	$ 8.26	3.1	$ 1,556
Vested and expected to vest at December 31, 2022	3,898	$ 8.91	5.9	$ 1,556

The weighted average grant date fair value per share of employee stock options granted in 2022, 2021 and 2020 were $4.99, $12.80 and $6.03, respectively. The total intrinsic value of options exercised in 2022, 2021 and 2020 were $3.1 million, $14.9 million and $1.8 million, respectively.

As of December 31, 2022, there was $8.1 million of unrecognized stock-based compensation, net of expected forfeitures, related to unvested stock options, which we expect to recognize over a weighted average period of 3.4 years.

Restricted Stock Awards ("RSAs")

The following table summarizes RSA activities:

	Number of Shares	Weighted Average Grant Date Fair Value Per Share
	(In Thousands)	
Non-vested balance at December 31, 2019	35	$ 17.18
Granted	96	$ 11.44
Vested	(35)	$ 17.18
Non-vested balance at December 31, 2020	96	$ 11.44
Granted	46	$ 21.91
Vested	(62)	$ 11.31
Non-vested balance at December 31, 2021	80	$ 17.53
Granted	159	$ 7.53
Vested	(58)	$ 18.42
Non-vested balance at December 31, 2022	181	$ 8.45

The total fair value, as of the vesting date, of RSAs vested in fiscal years 2022, 2021 and 2020 were $0.5 million, $1.3 million and $0.4 million respectively.

As of December 31, 2022, there was $0.8 million of unrecognized stock-based compensation cost related to non-vested RSAs, which we expect to recognize over a weighted average period of 1.4 years.

Restricted Stock Units ("RSUs")

The following table summarizes RSU activities:

	Number of Shares	Weighted Average Grant Date Fair Value Per Share
	(In Thousands)	
Non-vested balance at December 31, 2019	201	$ 10.76
Granted	156	$ 14.22
Vested	(168)	$ 10.05
Forfeited/Expired	(13)	$ 15.16
Non-vested balance at December 31, 2020	176	$ 14.17
Granted	163	$ 26.59
Vested	(70)	$ 13.57
Forfeited/Expired	(37)	$ 21.89
Non-vested balance at December 31, 2021	232	$ 21.83
Granted	518	$ 17.46
Vested	(106)	$ 21.21
Forfeited/Expired	(126)	$ 19.55
Non-vested balance at December 31, 2022	518	$ 18.15

The total fair value, as of the vesting date, of RSUs vested in fiscal years 2022, 2021 and 2020 were $1.8 million, $1.8 million and $2.1 million respectively.

As of December 31, 2022, there was $5.2 million of unrecognized stock-based compensation cost related to non-vested RSUs, which we expect to recognize over a weighted average period of 1.9 years.

Performance-Contingent Restricted Stock Units ("PSUs")

The following table summarizes PSU activities:

	Number of Shares	Weighted Average Grant Date Fair Value Per Share
	(In Thousands)	
Non-vested balance at December 31, 2019	120	$ 13.88
Granted	124	$ 13.59
Vested	(107)	$ 11.28
Forfeited/Expired	(6)	$ 21.80
Non-vested balance at December 31, 2020	131	$ 15.34
Granted	82	$ 26.16
Vested	(66)	$ 16.14
Forfeited/Expired	(19)	$ 19.38
Non-vested balance at December 31, 2021	128	$ 21.24
Granted	686	$ 9.55
Vested	(107)	$ 20.52
Forfeited/Expired	(40)	$ 19.93
Non-vested balance at December 31, 2022	667	$ 9.41

The total fair value, as of the vesting date, of PSUs vested in the years ended December 31, 2022, 2021, and 2020 were $2.1 million, $1.3 million, and $1.3 million, respectively.

As of December 31, 2022, there was $2.2 million of unrecognized stock-based compensation cost related to non-vested PSUs, which we expect to recognize over a weighted average period of 0.7 years.

Performance Based Options ("PBOs")

We estimated the fair value of PBOs using the Black-Scholes-Merton option-pricing model based on the date of grant. The following summarize the weighted-average assumptions used to estimate the fair value of PBOs granted:

	Year Ended December 31,		
	2022	2021	2020
Expected life (years)	5.6	5.5	5.3
Volatility	54.9 %	51.9 %	49.9 %
Risk-free interest rate	1.8 %	0.7 %	1.3 %
Expected dividend yield	0.0 %	0.0 %	0.0 %

The following tables summarizes PBOs activities:

	Number of Shares	Weighted Average Grant Date Fair Value Per Share
	(In Thousands)	
Outstanding at December 31, 2019	1,260	$ 4.75
Granted	689	$ 6.37
Forfeited/Expired	(389)	$ 6.42
Outstanding at December 31, 2020	1,560	$ 5.05
Granted	433	$ 12.23
Exercised	(35)	$ 9.02
Forfeited/Expired	(118)	$ 12.23
Outstanding at December 31, 2021	1,840	$ 4.11
Granted	733	$ 9.89
Forfeited/Expired	(747)	$ 8.29
Outstanding at December 31, 2022	1,826	$ 4.70

	Number of Shares	Weighted Average Exercise Price Per Share	Weighted Average Remaining Contractual Term	Aggregate Intrinsic Value
	(In Thousands)		(In Years)	(In Thousands)
Exercisable at December 31, 2022	1,674	$ 11.09	5.4	$ 40
Vested and expected to vest at December 31, 2022	1,808	$ 11.85	5.7	$ 40

The total fair value of exercised PBOs for 2022, 2021 and 2020, was nil, $0.3 million and nil, respectively.

As of December 31, 2022, there was $0.4 million of unrecognized stock-based compensation cost related to non-vested PBOs, which we expect to recognize over a weighted average period of 1.0 years.

Note 10. Capital Stock

Equity Distribution Agreement

We filed a shelf Registration Statement on Form S-3 with the SEC, under which we may sell common stock, preferred stock, debt securities, warrants, purchase contracts, and units from time to time in one or more offerings. The registration statement became effective on May 7, 2021. In May 2021, we entered into an Equity Distribution Agreement ("EDA") with Piper Sandler & Co ("PSC"), under which PSC, as our exclusive agent, at our discretion and at such times that we may determine from time to time, may sell over a three-year period from the execution of the EDA up to a maximum of $50.0 million of shares of our common stock. Under the terms of the EDA, PSC may sell the shares at market prices by any method that is deemed to be an "at the market offering" as defined in Rule 415 under the Securities Act of 1933, as amended.

We are not required to sell any shares at any time during the term of the EDA. The EDA will terminate upon the earlier of: (i) the issuance and sale of all shares through PSC on the terms and conditions of the EDA, or (ii) the termination of the EDA in accordance with its terms. Either party may terminate the EDA at any time upon written notification to the other party in accordance with the EDA, and upon such notification, the offering will terminate. Under no circumstances shall any shares be sold pursuant to the EDA after the date which is three years after the registration statement is first declared effective by the SEC. We agreed to pay PSC a commission of 3% of the gross sales price of any shares sold pursuant to the EDA. With the exception of certain expenses, we will pay PSC up to 8% of the gross sales price of the shares sold pursuant to the EDA for a combined amount of commission and reimbursement of PSC's expenses and fees.

During the year ended December 31, 2022, no shares of our common stock were issued pursuant to the EDA. As of December 31, 2022, $50.0 million worth of shares remained available for sale under the EDA.

Public Offerings

In December 2020, we completed an underwritten public offering in which we issued and sold 4.9 million shares of our common stock, par value $0.0001 per share, at a public offering price of $17.50 per share. We received gross proceeds of $86.3 million, net of underwriting discounts and commissions of $5.2 million and direct offering expenses of $0.3 million for net proceeds of $80.8 million.

Note 11. 401(k) Plan

In January 2005, we implemented a 401(k) Plan covering certain employees. Currently, all of our United States based employees over the age of 18 are eligible to participate in the 401(k) Plan. Under the 401(k) Plan, eligible employees may elect to reduce their current compensation up to a certain annual limit and contribute these amounts to the 401(k) Plan. We may make matching or other contributions to the 401(k) Plan on behalf of eligible employees. We recorded employer matching contributions expense of $1.6 million, $1.1 million, and $0.8 million in the years ended December 31, 2022, 2021, and 2020, respectively.

Note 12. Income Taxes

Our loss before provision for income taxes were as follows (in thousands):

	Year Ended December 31,		
	2022	2021	2020
United States	$ (33,269)	$ (21,037)	$ (23,452)
Foreign	(47)	(53)	(219)
Loss before provision for income taxes	$ (33,316)	$ (21,090)	$ (23,671)

The tax provision for the year ended December 31, 2022 consists primarily of current year state and foreign income taxes. The tax provision for the years ended December 31, 2021 and 2020 consists primarily of taxes attributable to foreign operations. The components of the provision for income taxes are as follows (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Current provision:			
State	$ 141	$ —	$ 5
Foreign	142	198	342
Total current provision	$ 283	$ 198	$ 347
Deferred benefit:			
Foreign	(7)	(9)	(8)
Total deferred benefit	$ (7)	$ (9)	$ (8)
Provision for income taxes	$ 276	$ 189	$ 339

Reconciliation of the provision for income taxes calculated at the statutory rate to our provision for income taxes is as follows (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Tax benefit at federal statutory rate	$ (6,996)	$ (4,429)	$ (4,971)
State taxes	(494)	(2,235)	(708)
Research and development credits	(1,793)	(1,132)	(811)
Foreign operations taxed at different rates	78	80	245
Stock-based compensation	239	(2,698)	140
Other nondeductible items	(238)	711	61
Executive compensation	80	257	24
Change in valuation allowance	9,400	9,635	6,359
Provision for income taxes	$ 276	$ 189	$ 339

Deferred income taxes reflect the net tax effects of (a) temporary differences between the carrying amounts of assets and liabilities for financial reporting purposes and the amounts used for income tax purposes, and (b) operating losses and tax credit carryforwards.

Significant components of our deferred tax assets and liabilities are as follows (in thousands):

	December 31,	
	2022	2021
Deferred tax assets:		
Net operating losses	$ 69,915	$ 78,525
Credits	14,806	11,895
Deferred revenues	1,123	1,490
Stock-based compensation	4,967	3,946
Reserves and accruals	2,487	2,928
Depreciation	—	514
Intangible assets	866	1,356
Capital losses	413	26
R&D Capitalization	16,502	—
Unrealized gain/loss	1	418
Lease liability	9,586	11,206
Other assets	124	122
Total deferred tax assets:	120,790	112,426
Valuation allowance	(111,183)	(101,762)
Deferred tax liabilities:		
Right-of-use assets	(8,624)	(10,373)
Property and Equipment	(736)	—
Other	(263)	(314)
Total deferred tax liabilities:	(9,623)	(10,687)
Net deferred tax liabilities	$ (16)	$ (23)

ASC 740 requires that the tax benefit of NOLs, temporary differences and credit carryforwards be recorded as an asset to the extent that management assesses that realization is "more likely than not." Realization of the future tax benefits is dependent on our ability to generate sufficient taxable income within the carryforward period. Because of our history of operating losses, management believes that recognition of the deferred tax assets arising from the above-mentioned future tax benefits is currently not more likely than not to be realized and, accordingly, has provided a valuation allowance against our deferred tax assets. Accordingly, the net deferred tax assets in all our jurisdictions have been fully reserved by a valuation allowance. The net valuation allowance increased by $9.4 million during the year ended December 31, 2022, increased by $9.6 million during the year ended December 31, 2021, and increased by $6.4 million during the year ended December 31, 2020. At such time as it is determined that it is more likely than not that the deferred tax assets are realizable, the valuation allowance will be reduced.

The following table sets forth our federal, state and foreign NOL carryforwards and federal research and development tax credits as of December 31, 2022 (in thousands):

	December 31, 2022	
	Amount	Expiration Years
Net operating losses, federal	$ 183,022	2026-2037
Net operating losses, federal	$ 109,069	Do not expire
Net operating losses, state	$ 138,775	2028-2041
Tax credits, federal	$ 16,228	2023-2041
Tax credits, state	$ 17,168	Do not expire

Current U.S. federal and California tax laws include substantial restrictions on the utilization of NOLs and tax credit carryforwards in the event of an ownership change of a corporation. Accordingly, the Company's ability to utilize NOLs and tax credit carryforwards may be limited as a result of such ownership changes. We performed an analysis in 2022 and determined that there was not a limitation that would result in the expiration of carryforwards before they are utilized.

Income tax expense or benefit from continuing operations is generally determined without regard to other categories of earnings, such as discontinued operations and other comprehensive income. An exception is provided in ASC 740 when there is aggregate income from categories other than continuing operations and a loss from continuing operations in the current year. In this case, the tax benefit allocated to continuing operations is the amount by which the loss from continuing operations reduces the tax expenses recorded with respect to the other categories of earnings, even when a valuation allowance has been established against the deferred tax assets. In instances where a valuation allowance is established against current year losses, income from other sources is considered when determining whether sufficient future taxable income exists to realize the deferred tax assets.

In 2014, we determined that the undistributed earnings of our India subsidiary will be repatriated to the United States, and accordingly, we have provided a deferred tax liability totaling $16 thousand and $23 thousand as of December 31, 2022 and 2021 respectively, for local taxes that would be incurred upon repatriation.

We apply the provisions of ASC 740 to account for uncertain income taxes. A reconciliation of the beginning and ending amount of unrecognized tax benefits is as follows (in thousands):

	December 31,		
	2022	2021	2020
Balance at beginning of year	$ 15,261	$ 12,683	$ 11,330
Additions based on tax positions related to current year	3,553	2,206	1,357
Additions to tax position of prior years	—	372	—
Reductions to tax position of prior years	(243)	—	(4)
Balance at end of year	$ 18,571	$ 15,261	$ 12,683

We recognize interest and penalties as a component of our income tax expense. Total interest and penalties recognized in the consolidated statements of operations were $42 thousand, $61 thousand and $39 thousand in 2022, 2021 and 2020, respectively. Total penalties and interest recognized in the balance sheet was $0.5 million, $0.5 million and $0.4 million as of December 31, 2022, 2021 and 2020, respectively. The total unrecognized tax benefits that, if recognized currently, would impact our company’s effective tax rate were $0.3 million as of December 31, 2022, 2021 and 2020. We do not expect any material changes to our uncertain tax positions within the next 12 months. We are not subject to examination by United States federal or state tax authorities for years prior to 2002 and foreign tax authorities for years prior to 2014.

Note 13. Commitments and Contingencies

Operating Leases

Our headquarters are located in Redwood City, California, where we occupy approximately 77,300 square feet of office and laboratory space in multiple buildings within the same business park of Metropolitan Life Insurance Company ("MetLife"). Our lease agreement with MetLife ("RWC Lease") includes approximately 28,200 square feet of space located at 200 and 220 Penobscot Drive, Redwood City, California (the "200/220 Penobscot Space") and approximately 37,900 square feet of space located at 400 Penobscot Drive, Redwood City, California (the "400 Penobscot Space") (the 200/220 Penobscot Space and the 400 Penobscot Space are collectively referred to as the "Penobscot Space"), and approximately 11,200 square feet of space located at 501 Chesapeake Drive, Redwood City, California (the "501 Chesapeake Space").

We entered into the initial lease with MetLife for our facilities in Redwood City in 2004 and the RWC Lease has been amended multiple times since then to adjust the leased space and terms of the Lease. In February 2019, we entered into an Eighth Amendment to the Lease (the "Eighth Amendment") with MetLife with respect to the Penobscot Space and the 501 Chesapeake Space to extend the term of the Lease for additional periods. Pursuant to the Eighth Amendment, the term of the lease of the Penobscot Space has been extended through May 2027. The lease term for the 501 Chesapeake Space has been extended to May 2029. We have one (1) option to extend the term of the lease for the Penobscot Space for five (5) years, and one (1) separate option to extend the term of the lease for the 501 Chesapeake Space for five (5) years.

Pursuant to the terms of the RWC Lease, we exercised our right to deliver a letter of credit in lieu of a security deposit. The letter of credit is collateralized by deposit balances held by the bank in the amount of $1.1 million as of December 31, 2022 and 2021, and are recorded as non-current restricted cash on the consolidated balance sheets.

We entered into a short-term office lease in San Carlos, California during the second quarter of 2021 and this lease expired in April 2022.

In January 2021, we entered into a lease agreement with ARE-San Francisco No. 63, LLC ("ARE") to lease a portion of a facility consisted of approximately 36,593 rentable square feet in San Carlos, California to serve as additional office and research and development laboratory space (the "San Carlos Space"). The lease has a 10-year term from the lease commencement date of November 30, 2021 with one option to extend the term for an additional period of 5 years. We have provided ARE with a $0.5 million security deposit in the form of a letter of credit and is recorded as non-current restricted cash on the consolidated balance sheets.

We are required to restore certain areas of the Redwood City and San Carlos facilities that we are renting to their original form. We are expensing the asset retirement obligation over the terms of the respective leases. We review the estimated obligation each reporting period and make adjustments if our estimates change. We recorded asset retirement obligations of $0.5 million and $0.4 million as of December 31, 2022 and 2021, respectively, which are included in other liabilities on the consolidated balance sheets. Accretion expense related to our asset retirement obligations was nominal in 2022 and 2021.

Lease and other information

Lease costs, amounts included in measurement of lease obligations and other information related to non-cancellable operating leases and finance leases were as follows (in thousands):

	Year Ended December 31,		
	2022	**2021**	**2020**
Amortization of right-of-use assets	$ 18	$ 106	$ 152
Interest on lease obligations	—	—	1
Finance lease costs	18	106	153
Operating lease cost	7,321	4,396	3,879
Short-term lease costs [(1)]	40	70	47
Sublease income	—	—	(55)
Total lease cost [(2)]	$ 7,379	$ 4,572	$ 4,024

[(1)] Short-term lease costs on leases with terms of over one month and less than one year.
[(2)] The Company had no variable lease costs.

Amounts included in measurement of lease obligations (in thousands):

	Year Ended December 31,		
	2022	**2021**	**2020**
Cash paid:			
Operating cash flows from operating leases	$ 6,506	$ 4,197	$ 2,816
Operating cash flow from finance leases	$ —	$ —	$ 1
Financing cash flows from finance leases	$ —	$ —	$ 60
Non-cash activity:			
Operating Lease - Right-of-use assets obtained in exchange for lease liabilities	$ —	$ 25,445	$ —
Finance Lease - Right-of-use assets obtained in exchange for lease liabilities	$ —	$ —	$ —

	Operating Lease
Other information:	
Weighted-average remaining lease term (in years)	7.1 years
Weighted-average discount rate	5.4 %

As of December 31, 2022, our maturity analysis of annual undiscounted cash flows of the non-cancellable operating leases are as follows (in thousands):

Years ending December 31,	Operating Leases
2023	$ 7,568
2024	7,783
2025	8,004
2026	8,232
2027	5,835
Thereafter	14,871
Total minimum lease payments	52,293
Less: imputed interest	8,655
Lease obligations	$ 43,638

Reconciliation of operating lease liabilities as shown within the audited consolidated balance sheets:	
Current portion of lease obligations - Operating leases	$ 5,360
Long-term lease obligations - Operating leases	38,278
Total operating lease liabilities	$ 43,638

Other Commitments

We enter into supply and service arrangements in the normal course of business. Supply arrangements are primarily for fixed-price manufacture and supply. Service agreements are primarily for the development of manufacturing processes and certain studies. Commitments under service agreements are subject to cancellation at our discretion which may require payment of certain cancellation fees. The timing of completion of service arrangements is subject to variability in estimates of the time required to complete the work.

The following table provides quantitative data regarding our other commitments. Future minimum payments reflect amounts that we expect to pay including potential obligations under services agreements subject to risk of cancellation by us (in thousands):

	Payments Due by Period		
	Total	2023	2024 and Thereafter
Development and manufacturing services agreements	$ 3,093	$ 2,938	$ 155
Facility maintenance agreement	2,249	2,249	—
Total other commitments	$ 5,342	$ 5,187	$ 155

Credit Facility

In June 30, 2017, we entered into a credit facility (the "Credit Facility") with Western Alliance Bank consisting of term loans ("Term Debt") up to $10.0 million, and advances ("Advances") under a revolving line of credit ("Revolving Line of Credit") up to $5.0 million with an accounts receivable borrowing base of 80% of eligible accounts receivable. The right to take draws on the Term Debt expired on December 31, 2021. On October 1, 2024, loans drawn, if any, under the Revolving Line of Credit terminate. Advances made under the Revolving Line of Credit bear interest at a variable annual rate equal to the equal to the greater of (i) 4.25% or (ii) the sum of (A) the prime rate plus (B) 1.00%. As of December 31, 2022 and 2021, we have not drawn from the Credit Facility.

Our obligations under the Credit Facility are secured by a lien on substantially all of our personal property other than our intellectual property. The Credit Facility includes a number of customary covenants and restrictive financial covenants including meeting minimum product revenue levels and maintaining certain minimum cash levels with the lender. The Credit Facility's financial covenants restrict the ability of the Company to transfer collateral, incur additional indebtedness, engage in mergers or acquisitions, pay dividends or make other distributions, make investments, create liens, sell assets, or sell certain assets held at foreign subsidiaries. A failure to comply with these covenants could permit the lender to exercise remedies against us and the collateral securing the Credit Facility, including foreclosure of our properties securing the Credit Facilities and our cash. As of December 31, 2022 and 2021, we were in compliance with the covenants for the Credit Facility.

Legal Proceedings

We may be involved in legal actions in the ordinary course of business, including inquiries and proceedings concerning business practices and intellectual property infringement, employee relations and other claims. We will recognize a loss contingency in the condensed consolidated financial statements when it is probable a liability has been incurred and the amount of the loss can be reasonably estimated. We will disclose any loss contingencies that do not meet both conditions if there is a reasonable possibility that a material loss may have been incurred. Gain contingencies are not recorded until they are realized.

In April 2022, we reached a settlement resolving a non-material dispute involving the Company's trademark. The terms of the settlement are not material to our business or the results of operations. We are currently not a party to any material pending litigation of other material proceedings.

Indemnifications

We are required to recognize a liability for the fair value of any obligations we assume upon the issuance of a guarantee. We have certain agreements with licensors, licensees and collaborators that contain indemnification provisions. In such provisions, we typically agree to indemnify the licensor, licensee and collaborator against certain types of third party claims. The maximum amount of the indemnifications is not limited. We accrue for known indemnification issues when a loss is probable and can be reasonably estimated. There were no accruals for expenses related to indemnification issues for any periods presented.

Note 14. Related Party Transactions

Molecular Assemblies, Inc.

In June 2020, we entered into a Stock Purchase Agreement with MAI pursuant to which we purchased 1,587,050 shares of MAI's Series A preferred stock for $1.0 million. In connection with the transaction, Mr. Nicols, our former President and Chief Executive Officer, also joined MAI’s board of directors. Concurrently with our initial equity investment, we entered into the MAI Agreement, pursuant to which we performed services utilizing our CodeEvolver® protein engineering platform technology to improve DNA polymerase enzymes in exchange for compensation in the form of additional shares of MAI's Series A and B preferred stock which are valued based on the observed transaction price of similar securities of MAI issued to third parties. We completed the R&D service with MAI pursuant to the MAI Agreement during the first quarter of 2022. In December 2021, we received the primary milestone payment pursuant to the MAI Agreement of $1.0 million in the form of an additional 1,587,049 shares of Series B preferred stock. Upon execution of the Commercial License and Enzyme Supply Agreement with MAI (“MAI Supply Agreement”) in July 2022, we received the commercialization and enzyme supply agreement milestone payment pursuant to the MAI Agreement of $1.0 million in the form of an additional 1,587,049 shares of Series B preferred stock. In addition to our initial equity investment and the shares we have received under the MAI Agreement, in April 2021, we purchased an additional 1,000,000 shares of MAI's Series A preferred stock for $0.6 million and in September 2021, we purchased 9,198,423 shares of MAI's Series B preferred stock for $7.0 million.

We recognized $1.2 million, $2.0 million and $0.9 million in research and development revenue from transactions with MAI in the years ended December 31, 2022, 2021 and 2020, respectively. Payment for the R&D services rendered under the MAI Agreement was received in the form of additional shares of MAI's Series A and Series B preferred stock. We received an aggregate of 1,587,049, 3,491,505 and 714,171 shares of MAI's Series A and B preferred stock for the years ended December 31, 2022, 2021 and 2020, respectively. As of December 31, 2022, we hold an aggregate 18,292,369 shares of MAI's Series A and B preferred stock that we have earned or purchased since executing the Stock Purchase Agreement with MAI.

In April 2022, we received a purchase order from MAI for the delivery of certain enzyme products to MAI in 2022. In July 2022, we and MAI executed the MAI Supply Agreement that will enable MAI to utilize an evolved terminal deoxynucleotidyl transferase (TdT) enzyme in MAI’s Fully Enzymatic Synthesis™ (or FES™) technology. We recognized $0.5 million in product revenue for the year ended December 31, 2022.

The carrying value of our investment in MAI's Series A and B preferred stock was $13.9 million and $12.7 million at December 31, 2022 and 2021, respectively. We had nil and $0.2 million in deferred revenue as of December 31, 2022 and 2021, respectively.

Note 15. Segment, Geographical and Other Revenue Information

Segment Information

We manage our business as two business segments: Performance Enzymes and Novel Biotherapeutics. Our chief operating decision maker ("CODM") is our Chief Executive Officer. Our business segments are primarily based on our organizational structure and our operating results as used by our CODM in assessing performance and allocating resources for the Company.

We report corporate-related expenses such as legal, accounting, information technology, and other costs that are not otherwise included in our reportable business segments as "corporate costs." All items not included in income (loss) from operations are excluded from the business segments.

All of our long lived assets are located in the United States. We manage our assets on a total company basis, not by business segment, as the majority of our operating assets are shared or commingled. Our CODM does not review asset information by business segment in assessing performance or allocating resources, and accordingly, we do not report asset information by business segment.

Factors considered in determining the two reportable segments of the Company include the nature of business activities, the management structure directly accountable to our CODM for operating and administrative activities, availability of discrete financial information and information presented to the Board of Directors. Our CODM regularly reviews our segments and the approach provided by management for performance evaluation and resource allocation.

Operating expenses that directly support the segment activity are allocated based on segment headcount, revenue contribution or activity of the business units within the segments, based on the corporate activity type provided to the segment. The expense allocation excludes certain corporate costs that are separately managed from the segments. This provides the CODM with more meaningful segment profitability reporting to support operating decisions and allocate resources.

The following table provides financial information by our reportable business segments along with a reconciliation to consolidated loss before income taxes (in thousands):

	Year Ended December 31, 2022			Year Ended December 31, 2021		
	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes	Novel Biotherapeutics	Total
Revenues:						
Product revenue	$ 116,676	$ —	$ 116,676	$ 70,657	$ —	$ 70,657
Research and development revenue	9,936	11,978	21,914	19,858	14,239	34,097
Total revenues	126,612	11,978	138,590	90,515	14,239	104,754
Costs and operating expenses:						
Cost of product revenue	38,033	—	38,033	22,209	—	22,209
Research and development [1]	25,786	49,770	75,556	23,140	30,219	53,359
Selling, general and administrative[1]	14,724	2,421	17,145	12,105	2,755	14,860
Restructuring charges	1,708	966	2,674	—	—	—
Total segment costs and operating expenses	80,251	53,157	133,408	57,454	32,974	90,428
Income (loss) from operations	$ 46,361	$ (41,179)	5,182	$ 33,061	$ (18,735)	14,326
Corporate costs [2]			(33,080)			(32,201)
Depreciation and amortization			(5,418)			(3,215)
Loss before income taxes			$ (33,316)			$ (21,090)

[1] Research and development expenses and selling, general and administrative expenses exclude depreciation and amortization of finance leases.
[2] Corporate costs include unallocated selling, general and administrative expense and restructuring charges, interest income, and other income (expense), net.

	Year Ended December 31, 2021			Year Ended December 31, 2020		
	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes	Novel Biotherapeutics	Total
Revenues:						
Product revenue	$ 70,657	$ —	$ 70,657	$ 30,220	$ —	$ 30,220
Research and development revenue	19,858	14,239	34,097	17,886	20,950	38,836
Total revenues	90,515	14,239	104,754	48,106	20,950	69,056
Costs and operating expenses:						
Cost of product revenue	22,209	—	22,209	13,742	—	13,742
Research and development [1]	23,140	30,219	53,359	20,923	21,705	42,628
Selling, general and administrative [1]	12,105	2,755	14,860	9,597	2,355	11,952
Total segment costs and operating expenses	57,454	32,974	90,428	44,262	24,060	68,322
Income (loss) from operations	$ 33,061	$ (18,735)	14,326	$ 3,844	$ (3,110)	734
Corporate costs [2]			(32,201)			(22,306)
Depreciation and amortization			(3,215)			(2,099)
Loss before income taxes			$ (21,090)			$ (23,671)

[1] Research and development expenses and selling, general and administrative expenses exclude depreciation and amortization of finance leases.
[2] Corporate costs include unallocated selling, general and administrative expense, interest income, and other income (expense), net.

The following table provides stock-based compensation expense included in income (loss) from operations (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Performance Enzymes	$ 6,035	$ 5,047	$ 3,296
Novel Biotherapeutics	903	1,100	768
Corporate cost	7,593	5,446	3,664
Total	$ 14,531	$ 11,593	$ 7,728

Significant Customers

Customers that each accounted for 10% or more of our total revenues were as follows:

	Percentage of Total Revenues For the Year Ended December 31,		
	2022	2021	2020
Customer A	56 %	33 %	*
Customer B	*	11 %	26 %
Customer C	*	*	19 %
Customer D	*	*	11 %

** Percentage was less than 10%*

Customers that each accounted for 10% or more of accounts receivable balances as of the periods presented are as follows:

	As of December 31,	
	2022	2021
Customer A	53 %	62 %
Customer D	10 %	*

** Percentage was less than 10%*

Geographical Information

Geographic revenues are identified by the location of the customer and consist of the following (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Revenues			
Americas	$ 17,000	$ 23,481	$ 24,352
EMEA	56,540	20,187	19,257
APAC	65,050	61,086	25,447
Total revenues	$ 138,590	$ 104,754	$ 69,056

Identifiable long-lived assets by location was as follows (in thousands):

	December 31,	
	2022	2021
United States	$ 61,877	$ 65,457

Identifiable goodwill by reporting unit was as follows (in thousands):

	December 31, 2022			December 31, 2021		
	Performance Enzymes	Novel Biotherapeutics	Total	Performance Enzymes	Novel Biotherapeutics	Total
Goodwill	$ 2,463	$ 778	$ 3,241	$ 2,463	$ 778	$ 3,241

Note 16. Allowance for Credit Losses

The following table summarizes the financial assets allowance for credit losses (in thousands):

	December 31,		
	2022	2021	2020
Balance at beginning of period	$ 416	$ 74	$ 34
Provision for credit losses	54	342	40
Write-offs	(257)	—	—
Recoveries collected	(50)	—	—
Balance at end of period	$ 163	$ 416	$ 74

The following tables summarize accounts receivable by aging category (in thousands):

	December 31, 2022					
	Current	31-60 Days	61-90 Days	91 Days and Over	Total over 31 Days	Total Balance
Accounts receivable	$ 28,896	$ 1,747	$ 469	$ 792	$ 3,008	$ 31,904

	December 31, 2021					
	Current	31-60 Days	61-90 Days	91 Days and Over	Total over 31 Days	Total Balance
Accounts receivable	$ 22,697	$ 536	$ 569	$ 1,151	$ 2,256	$ 24,953

Note 17. Restructuring Charges

In November 2022, we announced a plan for a workforce reduction of approximately 18% of our total employee to realign and optimize our workforce requirements in alignment with our refined corporate strategy.

During the year ended December 31, 2022, we recorded a restructuring charge of $3.2 million related to severance, bonus and other termination benefits in connection with the workforce reduction. As of December 31, 2022, we have accrued $1.2 million as a current liability within accrued compensation on our consolidated balance sheets and is expected to be paid in the first quarter of 2023. We do not expect to record any significant future charges related to the restructuring plan.

Note 18. Subsequent Events

On January 23, 2023, we announced the appointment of Sriram Ryali as our new Chief Financial Officer, effective immediately. In connection with Mr. Ryali's appointment as Chief Financial Officer, Ross Taylor ceased to serve as our Chief Financial Officer and principal financial and accounting officer, effective as of January 23, 2023. Mr. Taylor will provide transition and advisory services on an as-needed basis until March 6, 2023.

ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURES

None.

ITEM 9A. CONTROLS AND PROCEDURES

Evaluation of Disclosure Controls and Procedures

Our management, under the supervision of our Chief Executive Officer and Chief Financial Officer and with the participation of our disclosure committee, evaluated the effectiveness of the design and operation of our disclosure controls and procedures as of December 31, 2022. The term "disclosure controls and procedures," as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act, means controls and other procedures of a company that are designed to ensure that information required to be disclosed by us in the reports that we file or submit under the Exchange Act is 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 that we file or submit under the Exchange Act is accumulated and communicated to our management, including our Chief Executive Officer and Chief Financial Officer, as appropriate, to allow timely decisions regarding required disclosure. Based on this evaluation, our Chief Executive Officer and Chief Financial Officer concluded that our disclosure controls and procedures were effective as of December 31, 2022 at the reasonable assurance level.

Remediation of Previously Reported Material Weakness

A material weakness in internal control over financial reporting was identified in the first quarter of 2022 related to management's controls over the revenue recognition process in the three months ended March 31, 2022. Specifically, our controls addressing the completeness and accuracy of reports used to calculate product revenue from arrangements subject to over time revenue recognition did not operate at the proper level of precision to identify material errors. The control deficiency resulted in a material misstatement of revenue related accounts in the three months ended March 31, 2022, which management corrected before the financial statements for the three months ended March 31, 2022 were issued

We implemented a detailed plan for the remediation of the material weakness identified in the first quarter of 2022, including an enhancement of management's review controls over revenue and the level of detail and precision applied when reviewing the completeness and accuracy of reports used to determine product revenue for arrangements subject to over time revenue recognition. We believe that our remediation efforts to enhance the controls surrounding product revenue for arrangements subject to over time revenue recognition are significant improvements to our processes and controls which address the material weakness. The remediation process was complete as of December 31, 2022, when our enhanced controls were operational for a sufficient period of time and tested, which enabled management to conclude that the enhanced controls related to revenue recognition are operating effectively.

Management's Report on Internal Control over Financial Reporting

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

Under the supervision and with the participation of our management, including our Chief Executive Officer and Chief Financial Officer, we conducted an evaluation of the effectiveness of our internal control over financial reporting as of December 31, 2022 based on the guidelines established in *Internal Control-Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO"). Based on the results of our evaluation, our management concluded that our internal control over financial reporting was effective as of December 31, 2022. We reviewed the results of management's assessment with our Audit Committee.

Our internal control over financial reporting as of December 31, 2022 has been audited by BDO USA, LLP, an independent registered public accounting firm, as stated in their report which is included in Item 8 of this Annual Report.

Inherent Limitations on Effectiveness of Controls

In designing and evaluating the disclosure controls and procedures, management recognizes that any controls and procedures, even if determined effective and no matter how well designed and operated, can provide only reasonable assurance of achieving the desired control objectives to prevent or detect misstatements. In addition, the design of disclosure controls and procedures must reflect the fact that there are resource constraints and that management is required to apply judgment in evaluating the benefits of possible controls and procedures relative to their costs. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Changes in Internal Control over Financial Reporting

Other than as described above, there were no changes in our internal control over financial reporting (as defined in Rule 13a-15(f) of the Exchange Act) identified in connection with the evaluation required by paragraph (d) of Rule 13a-15 or 15d-15 of the Exchange Act, which occurred during the fourth fiscal quarter of the year ended December 31, 2022, which has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

ITEM 9B. OTHER INFORMATION

Not applicable.

ITEM 9C. DISCLOSURE REGARDING FOREIGN JURISDICTIONS THAT PREVENT INSPECTIONS

Not applicable.

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

We have adopted a code of conduct applicable to our principal executive, financial and accounting officers and all persons performing similar functions. A copy of our code of ethics is available on our principal corporate website at www.codexis.com in the Investors section under "Corporate Governance."

The information required by this item concerning our directors, executive officers, compliance with Section 16 of the Exchange Act, our code of ethics and our Nominating and Corporate Governance Committee, and our Audit Committee is incorporated by reference from the information that will be set forth in the sections under the headings "Election of Directors," "Other Matters —Section 16(a) Beneficial Ownership Reporting Compliance" and "Corporate Governance Matters" in the 2023 Proxy Statement.

ITEM 11. EXECUTIVE COMPENSATION

The information required by this item concerning executive compensation and our Compensation Committee is incorporated by reference from the information that will be set forth in the 2023 Proxy Statement under the headings "Executive Compensation," and "Corporate Governance Matters."

ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

The information required by this item concerning securities authorized for issuance under equity compensation plans and security ownership of certain beneficial owners and management is incorporated by reference from the information that will be set forth in the 2023 Proxy Statement under the headings "Executive Compensation—Equity Compensation Plan Information" and "Information Concerning Voting and Solicitation—Security Ownership of Certain Beneficial Owners and Management."

ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS,

AND DIRECTOR INDEPENDENCE

The information required by this item concerning transactions with related persons and director independence is incorporated by reference from the information that will be set forth in the 2023 Proxy Statement under the headings "Certain Relationships and Related Transactions" and "Corporate Governance Matters."

ITEM 14. PRINCIPAL ACCOUNTING FEES AND SERVICES

The information required by this item is incorporated by reference from the information that will be set forth in the 2023 Proxy Statement under the heading "Ratification of Independent Registered Public Accounting Firm—Principal Accounting Fees and Services."

PART IV

ITEM 15. EXHIBITS AND FINANCIAL STATEMENT SCHEDULES

1. Financial Statements: See "Index to Consolidated Financial Statements" in Part II, Item 8 of this Annual Report on Form 10-K

2. Exhibits: The exhibits listed in the accompanying index to exhibits are filed or incorporated by reference as part of this Annual Report on Form 10-K.

EXHIBIT INDEX

Exhibit No.	Description
3.1	Amended and Restated Certificate of Incorporation of Codexis, Inc. filed with the Secretary of the State of the State of Delaware on April 27, 2010 and effective as of April 27, 2010 (incorporated by reference to Exhibit 3.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2010, filed on May 28, 2010).
3.2	Certificate of Designations of Series A Junior Participating Preferred Stock of Codexis, Inc., filed with the Secretary of State of the State of Delaware on September 4, 2012 (incorporated by reference to Exhibit 3.1 to the Company's Current Report on Form 8-K, filed on September 4, 2012).
3.3	Amended and Restated Bylaws of Codexis, Inc. effective as of April 27, 2010 (incorporated by reference to Exhibit 3.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2010, filed on May 28, 2010).
4.1	Reference is made to Exhibits 3.1 through 3.3.
4.2	Form of the Company's Common Stock Certificate (incorporated by reference to Exhibit 4.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2012, filed on August 9, 2012).
4.3	Description of Codexis' Securities Registered Pursuant to Section 12 of the Securities Exchange Act of 1934 (incorporated by reference to Exhibit 4.3 to the Company's Annual Report on Form 10-K for the year ended December 31, 2022, filed on February 28, 2022).
10.1A*	Lease Agreement by and between the Company and Metropolitan Life Insurance Company dated as of February 1, 2004.
10.1B*	Amendment to Lease Agreement by and between the Company and Metropolitan Life Insurance Company dated as of June 1, 2004.
10.1C*	Amendment to Lease Agreement by and between the Company and Metropolitan Life Insurance Company dated as of March 9, 2007.
10.1D*	Amendment to Lease Agreement by and between the Company and Metropolitan Life Insurance Company dated as of March 31, 2008.
10.1E	Fourth Amendment to Lease Agreement by and between the Company and Metropolitan Life Insurance Company dated as of September 17, 2010 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2010, filed on November 4, 2010).
10.1F	Fifth Amendment to Lease Agreement by and between the Company and Metropolitan Life Insurance Company dated as of March 16, 2011 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2011, filed on May 6, 2011).
10.1G	Sixth Amendment to Lease by and between the Company and Metropolitan Life Insurance Company dated as of September 27, 2012 (incorporated by reference to Exhibit 10.6 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2012, filed on November 7, 2012).
10.1H	Seventh Amendment to Lease by and between the Company and Metropolitan Life Insurance Company dated as of October 11, 2016 (incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2016, filed on November 8, 2016).
10.1I***	Eighth Amendment to Lease, dated as of February 8, 2019, by and between the Company and Metropolitan Life Insurance Company (incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2019, filed on May 8, 2019).
10.2+*	Codexis, Inc. 2010 Equity Incentive Award Plan and Form of Stock Option Agreement.

Exhibit No.	Description
10.3A+	Codexis, Inc. 2019 Incentive Award Plan (incorporated by reference to Exhibit 99.1 to the Company's Registration Statement on Form S-8 (File No. 333-232262) filed with the SEC on June 21, 2019).
10.3B+	Form of Restricted Stock Unit Award Grant Notice and Restricted Stock Unit Award Agreement under 2019 Incentive Award Plan (incorporated by reference to Exhibit 99.2 to the Company's Registration Statement on Form S-8 (File No. 333-232262) filed with the SEC on June 21, 2019).
10.3C+	Form of Stock Option Grant Notice and Stock Option Agreement under 2019 Incentive Award Plan (incorporated by reference to Exhibit 99.3 to the Company's Registration Statement on Form S-8 (File No. 333-232262) filed with the SEC on June 21, 2019).
10.3D+	Form of Stock Option Grant Notice and Stock Option Agreement under 2019 Incentive Award Plan (incorporated by reference to Exhibit 99.4 to the Company's Registration Statement on Form S-8 (File No. 333-232262) filed with the SEC on June 21, 2019).
10.3E+	Form of Performance Stock Unit Award Grant Notice and Performance Stock Unit Award Agreement under 2019 Incentive Award Plan (incorporated by reference to Exhibit 99.5 to the Company's Registration Statement on Form S-8 (File No. 333-232262) filed with the SEC on June 21, 2019).
10.3F+	Form of Restricted Stock Award Grant Notice and Restricted Stock Award Agreement under 2019 Incentive Award Plan (incorporated by reference to Exhibit 99.6 to the Company's Registration Statement on Form S-8 (File No. 333-232262) filed with the SEC on June 21, 2019).
10.3G+	Codexis, Inc. 2022 Employment Inducement Award Plan (incorporated by reference to Exhibit 99.1 to the Company's Registration Statement on Form S-8 (File No. 333-269163) filed with the SEC on January 9, 2023).
10.3H+	Form of Stock Option Grant Notice and Stock Option Agreement under the 2022 Employment Inducement Award Plan (incorporated by reference to Exhibit 99.2 to the Company's Registration Statement on Form S-8 (File No. 333-269163) filed with the SEC on January 9, 2023).
10.3I+	Form of Restricted Stock Unit Award Grant Notice and Restricted Stock Unit Award Agreement under the 2022 Employment Inducement Award Plan (incorporated by reference to Exhibit 99.3 to the Company's Registration Statement on Form S-8 (File No. 333-269163) filed with the SEC on January 9, 2023).
10.4	Form of Indemnification Agreement between the Company and each of its directors, officers and certain employees.
10.5+	Form of Amended and Restated Change in Control Severance Agreement between the Company and certain of its officers (incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2019, filed on November 6, 2019).
10.6	Asset Purchase Agreement, dated October 28, 2010, by and among the Company, Codexis Mayflower Holdings, LLC and Maxygen, Inc. (incorporated by reference to Exhibit 2.1 to the Company's Current Report on Form 8-K, filed on October 28, 2010).
10.7A†	Manufacture and Supply Agreement, dated May 16, 2011, by and between the Company and Lactosan GmbH & Co. KG (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2011, filed on August 3, 2011).
10.7B	Amendment No. 1 to the Manufacture and Supply Agreement by and between the Company and Lactosan GmbH & Co. KG dated as of March 9, 2012 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2012, filed on May 10, 2012).
10.8A+	Employment Agreement by and between the Company and Ross Taylor effective as of August 4, 2019 (incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2019, filed on November 6, 2019).
10.8B+	Transition and Separation Agreement by and between the Company and Ross Taylor, dated as of February 3, 2023.

Exhibit No.	Description
10.9A+	Employment Agreement by and between the Company and John Nicols effective as of May 28, 2012 (incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2012, filed on August 9, 2012).
10.9B+	John Nicols Stock Option Grant Notice and Stock Option Agreement dated June 13, 2012 between John J. Nicols and the Company (incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2012, filed on August 9, 2012).
10.9C+	Amendment to Employment Agreement between the Company and John Nicols, dated April 21, 2016 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2016, filed on August 9, 2016).
10.9D+	Amendment to Employment Agreement between the Company and John Nicols, dated November 16, 2017 (incorporated by reference to Exhibit 10.8E to the Company's Annual Report on Form 10-K for the year ended December 31, 2017, filed on March 15, 2018).
10.9E+	Amendment to Employment Agreement between the Company and John Nicols, effective as of June 28, 2019 (incorporated by reference to Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2019, filed on November 6, 2019).
10.9F+	Transition and Separation Agreement by and between the Company and John Nicols, dated as of July 18, 2022 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2022, filed on November 4, 2022).
10.10A†	Sitagliptin Catalyst Supply Agreement by and between Merck Sharp and Dohme Corp. and the Company dated as of February 1, 2012 (incorporated by reference to Exhibit 10.25 to the Company's Annual Report on Form 10-K for the year ended December 31, 2012, filed on April 2, 2013).
10.10B†	Amendment to Sitagliptin Catalyst Supply Agreement between Merck Sharp and Dohme Corp. and the Company dated as of October 1, 2013 (incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2013, filed on November 12, 2013).
10.10C	Amendment No. 2 to Sitagliptin Catalyst Supply Agreement between Merck Sharp and Dohme Corp. and the Company dated as of February 25, 2015 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2015, filed on May 7, 2015).
10.10D	Amendment No. 3 to Sitagliptin Catalysts Supply Agreement between Merck Sharp and Dohme Corp. and the Company dated as of December 17, 2015 (incorporated by reference to Exhibit 10.11D to the Company's Annual Report on Form 10-K for the year ended December 31, 2015, filed on March 8, 2016).
10.10E	Amendment No. 4 to Sitagliptin Catalysts Supply Agreement, effective as of January 1, 2016, by and between the Company and Merck Sharp and Dohme Corp. (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2016, filed on November 8, 2016).
10.10F	Amendment No. 5 to Sitagliptin Catalysts Supply Agreement, effective as of July 1, 2021, by and between the Company and Merck Sharp and Dohme Corp. (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2021, filed on November 5, 2021).
10.11A†	Global Development, Option and License Agreement by and among the Company, Societé des Produits Nestlé S.A., formerly known as Nestec Ltd. ("Nestlé Health Science"), effective as of October 12, 2017 (incorporated by reference to Exhibit 10.10 to the Company's Annual Report on Form 10-K for the year ended December 31, 2017, filed on March 15, 2018).
10.11B†	Amendment No. 1 to Global Development, Option and License Agreement by and among the Company, Nestec Ltd. and Nestlé Amendment No. 1 to Global Development, Option and License Agreement by and among the Company, Nestec Ltd. and Nestlé Health Science S.A., effective as of July 26, 2018 (incorporated by reference to Exhibit 10.12B to the Company's Annual Report on Form 10-K for the year ended December 31, 2018, filed on March 3, 2019).

Exhibit No.	Description
10.11C†	Letter Agreement to Global Development, Option and License Agreement by and among the Company, Nestec Ltd. and Nestlé Health Science S.A., effective as of December 12, 2018. (incorporated by reference to Exhibit 10.12C to the Company's Annual Report on Form 10-K for the year ended December 31, 2018, filed on March 3, 2019).
10.12A†	Platform Technology Transfer, Collaboration and License Agreement by and between the Company and GlaxoSmithKline Intellectual Property Limited, effective as of July 10, 2014 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 31, 2014, filed on November 6, 2014).
10.12B†	Letter Agreement, effective as of February 21, 2020, by and between Codexis, Inc. and GlaxoSmithKline Intellectual Property Development Limited (incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2020, filed on May 8, 2020).
10.13A***	Platform Technology Transfer and License Agreement by and between the Company and Merck Sharp & Dohme Corp., dated as of August 3, 2015 (incorporated by reference to Exhibit 10.13A to the Company's Annual Report on Form 10-K for the year ended December 31, 2021, filed on February 28, 2022).
10.13B†	Amendment No. 1 to Platform Technology Transfer and License Agreement by and between the Company and Merck Sharp & Dohme Corp., dated as of October 10, 2018 (incorporated by reference to Exhibit 10.14A to the Company's Annual Report on Form 10-K for the year ended December 31, 2018, filed on March 3, 2019).
10.13C***	Amendment No. 2 to Platform Technology Transfer and License Agreement by and between Merck and the Company dated as of January 1, 2019 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2019, filed on May 8, 2019).
10.14***	Platform Technology Transfer and License Agreement, dated May 2, 2019, by and between the Company and Novartis Pharma AG (incorporated by reference to Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2019, filed on August 6, 2019).
10.15***	Strategic Collaboration and License Agreement by and between Shire Human Genetic Therapies, Inc., a wholly-owned subsidiary of Takeda Pharmaceutical Company Limited and the Company, dated March 23, 2020 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2020, filed on May 8, 2020).
10.16A†	Loan and Security Agreement effective as of June 30, 2017 by and between the Company and Western Alliance Bank (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2017, filed on August 9, 2017).
10.16B†	First Amendment to Loan and Security Agreement effective as of September 28, 2017 by and between the Company and Western Alliance Bank (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2017, filed on November 9, 2017).
10.16C†	Second Amendment to Loan and Security Agreement effective as of November 7, 2017 by and between the Company and Western Alliance Bank (incorporated by reference to Exhibit 10.15B to the Company's Annual Report on Form 10-K for the year ended December 31, 2017, filed on March 15, 2018).
10.16D†	Third Amendment to Loan and Security Agreement by and between the Company and Western Alliance Bank dated as of June 29, 2018 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2018, filed on August 9, 2018).
10.16E†	Fourth Amendment to Loan and Security Agreement effective as of September 28, 2018 by and between the Company and Western Alliance Bank (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2018, filed on November 9, 2018).
10.16F	Fifth Amendment to Loan and Security Agreement effective as of January 23, 2019 by and between the Company and Western Alliance Bank (incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2019, filed on May 8, 2019).

Exhibit No.	Description
10.16G	Sixth Amendment to Loan and Security Agreement by and between the Company and Western Alliance Bank dated as of July 11, 2019 (incorporated by reference to Exhibit 10.1A to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2019, filed on November 6, 2019).
10.16H	Seventh Amendment to Loan and Security Agreement by and between the Company and Western Alliance Bank dated as of September 30, 2019 (incorporated by reference to Exhibit 10.1B to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2019, filed on November 6, 2019).
10.16I	Eighth Amendment to Loan and Security Agreement by and between the Company and Western Alliance Bank dated as of September 30, 2020 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2020, filed on November 6, 2020.)
10.16J	Ninth Amendment to Loan and Security Agreement by and between the Company and Western Alliance Bank dated as of September 30, 2021 (incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2021, filed on November 5, 2021).
10.17	Lease Agreement by and between the Company and ARE-SAN FRANCISCO NO. 63, LLC dated as of January 29, 2021 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended March 31, 2021, filed on May 7, 2021).
10.18***	Platform Technology Transfer, Collaboration and License Agreement by and between the Company and GlaxoSmithKline Intellectual Property Limited, effective as of July 10, 2014 (incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2022, filed on August 5, 2022).
10.19A***	Enzyme Supply Agreement by and between the Company and Pfizer Ireland Pharmaceuticals, dated as of July 14, 2022.
10.19B	Amendment No. 1 to the Enzyme Supply Agreement by and between the Company and Pfizer Ireland Pharmaceuticals, effective as of December 19, 2022.
10.19C	Amendment No. 2 to the Enzyme Supply Agreement by and between the Company and Pfizer Ireland Pharmaceuticals, effective as of February 1, 2023.
10.20+	Employment Agreement by and between the Company and Stephen Dilly dated as of August 9, 2022 (incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2022, filed on November 4, 2022).
10.21A+	Offer Letter by and between the Company and Kevin Norrett dated as of September 12, 2022 (incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2022, filed on November 4, 2022).
10.21B+	Change in Control Severance Agreement by and between the Company and Kevin Norrett dated September 12, 2022 (incorporated by reference to Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q for the quarter ended September 30, 2022, filed on November 4, 2022).
10.22A+	Offer Letter by and between the Company and Margaret Fitzgerald dated as of October 5, 2022.
10.22B+	Change in Control Severance Agreement by and between the Company and Margaret Fitzgerald dated October 10, 2022.
10.23A+	Offer Letter by and between the Company and Sriram Ryali dated as of December 30, 2023.
10.23B+	Change in Control Severance Agreement by and between the Company and Sriram Ryali dated January 27, 2023
23.1	Consent of BDO USA, LLP, independent registered public accounting firm.
24.1	Power of Attorney (see signature page to this Annual Report on Form 10-K).

Exhibit No.	Description
31.1	Certification of Principal Executive Officer Required Under Rule 13a-14(a) and 15d-14(a) of the Securities Exchange Act of 1934, as amended.
31.2	Certification of Principal Financial Officer Required Under Rule 13a-14(a) and 15d-14(a) of the Securities Exchange Act of 1934, as amended.
32.1**	Certification of Principal Executive Officer and Principal Financial Officer Required Under Rule 13a-14(b) of the Securities Exchange Act of 1934, as amended, and 18 U.S.C. §1350.
101	The following materials from Registrant's Annual Report on Form 10-K for the fiscal year ended December 31, 2022 formatted in Inline Extensible Business Reporting Language (iXBRL) includes: (i) Consolidated Balance Sheets at December 31, 2022 and December 31, 2021, (ii) Consolidated Statements of Operations for the years ended December 31, 2022, December 31, 2021 and December 31, 2020, (iii) Consolidated Statements of Cash Flows for the years ended December 31, 2022, December 31, 2021 and December 31, 2020, (vi) Consolidated Statements of Stockholders' Equity for the years ended December 31, 2022, December 31, 2021 and December 31, 2020 and (vii) Notes to Consolidated Financial Statements.
101.SCH	Inline XBRL Taxonomy Extension Schema Document
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document
104	The cover page from the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2022, formatted in Inline XBRL and contained in Exhibit 101.

+ Indicates a management contract or compensatory plan or arrangement.

† Confidential treatment has been granted for certain information contained in this exhibit. Such information has been omitted and filed separately with the Securities and Exchange Commission.

* Filed as exhibits to the registrant's Registration Statement on Form S-1 (File No. 333-164044), effective April 21, 2010, and incorporated herein by reference.

** Pursuant to Item 601(b)(32) of Regulation S-K this exhibit is furnished rather than filed with this report.

*** Portions of the exhibit, marked by brackets, have been omitted because the omitted information is (i) not material and (ii) would be competitively harmful if publicly disclosed.

ITEM 16. FORM 10-K SUMMARY

Not applicable.

SIGNATURES

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

CODEXIS, INC.

Date: February 27, 2023

By: /s/ Stephen Dilly

President and Chief Executive Officer
(Principal Executive Officer)

POWER OF ATTORNEY

Each person whose individual signature appears below hereby authorizes and appoints Stephen Dilly, Sriram Ryali and Margaret Fitzgerald, and each of them, with full power of substitution and resubstitution and full power to act without the other, as his or her true and lawful attorney-in-fact and agent to act in his or her name, place and stead and to execute in the name and on behalf of each person, individually and in each capacity stated below, and to file 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, ratifying and confirming all that said attorneys-in-fact and agents or any of them or their or his substitute or substitutes may lawfully do or cause to be done by virtue thereof.

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

SIGNATURE	TITLE		DATE
/s/ Stephen Dilly Stephen Dilly	President, Chief Executive Officer and Director (Principal Executive Officer)	Date:	February 27, 2023
/s/ Sriram Ryali Sriram Ryali	Chief Financial Officer (Principal Financial and Accounting Officer)	Date:	February 27, 2023
/s/ Byron L. Dorgan Byron L. Dorgan	Chairman of the Board of Directors	Date:	February 27, 2023
/s/ Jennifer Aaker Jennifer Aaker	Director	Date:	February 27, 2023
/s/ Esther Martinborough Esther Martinborough	Director	Date:	February 27, 2023
/s/ Alison Moore Alison Moore	Director	Date:	February 27, 2023
/s/ John J. Nicols John J. Nicols	Director	Date:	February 27, 2023
/s/ H. Stewart Parker H. Stewart Parker	Director	Date:	February 27, 2023
/s/ Rahul Singhvi Rahul Singhvi	Director	Date:	February 27, 2023
/s/ David V. Smith David V. Smith	Director	Date:	February 27, 2023
/s/ Dennis P. Wolf Dennis P. Wolf	Director	Date:	February 27, 2023
/s/ Patrick Y. Yang Patrick Y. Yang	Director	Date:	February 27, 2023

April 27, 2023

Dear Stockholder:

You are invited to attend the annual meeting of stockholders (the "Annual Meeting") of Codexis, Inc. ("Codexis," "we," "us" or "our") to be held on Tuesday, June 13, 2023, at 9:00 a.m., California time. The Annual Meeting will be held in a virtual format via live audio webcast. You will be able to attend and participate in the Annual Meeting online by visiting *www.virtualshareholdermeeting.com/CDXS2023*, where you will be able to listen to the meeting live, submit questions and vote.

At the Annual Meeting, you will be asked to:

(i) elect three Class I directors to hold office until the 2026 annual meeting of stockholders;

(ii) ratify the selection of BDO USA, LLP as our independent registered public accounting firm for the year ending December 31, 2023;

(iii) vote, on a non-binding, advisory basis, on the compensation of our named executive officers;

(iv) vote, on a non-binding, advisory basis, to determine the frequency of future advisory votes on compensation for our named executive officers;

(v) approve an amendment to our certificate of incorporation to increase the number of authorized shares of our common stock, par value $0.0001 per share (the "common stock"), from 100,000,000 to 200,000,000 shares;

(vi) approve the Codexis, Inc. 2023 Employee Stock Purchase Plan;

(vii) approve an amendment to the Codexis, Inc. 2019 Incentive Award Plan; and

(viii) transact such other business as may properly come before the Annual Meeting.

The accompanying Notice of Annual Meeting and proxy statement describe these matters. We urge you to read this information carefully.

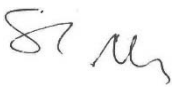
Your board of directors unanimously believes that each of the proposals set forth above and described in the accompanying Notice of Annual Meeting and proxy statement are in the best interests of Codexis and its stockholders, and, accordingly, recommends a vote "**FOR**" the election of all of its nominees for director, "**FOR**" the ratification of the selection of BDO USA, LLP as our independent registered public accounting firm, "**FOR**" the approval of the compensation of our named executive officers on a non-binding, advisory basis, in favor of the option of "**ONE YEAR**" for the non-binding, advisory vote on the frequency of the advisory vote on compensation for our named executive officers, "**FOR**" the approval of an amendment to our certificate of incorporation to increase the number of authorized shares of our common stock, "**FOR**" the approval of the Codexis, Inc. 2023 Employee Stock Purchase Plan and "**FOR**" the approval of an amendment to the Codexis, Inc. 2019 Incentive Award Plan.

In addition to the business to be transacted as described above, management will speak on developments in the past year and respond to comments and questions of general interest to stockholders.

It is important that your shares be represented and voted whether or not you plan to attend the Annual Meeting online. Whether or not you expect to attend the Annual Meeting online, please vote as soon as possible. You may vote on the Internet or by telephone. If, however, you requested to receive paper proxy materials, then you may also vote by mailing a complete, signed and dated proxy card or voting instruction card in the envelope provided. If your shares are held in "street name," which means your shares are held of record by a broker, bank or other

nominee, you should review the instructions provided to you by that broker, bank or other nominee to determine how you will be able to submit your voting instructions. Voting by written proxy, over the Internet or by telephone will ensure your shares are represented at the Annual Meeting.

Sincerely,



Stephen Dilly, M.B.B.S., Ph.D.
President and Chief Executive Officer

CODEXIS, INC.
200 Penobscot Drive
Redwood City, CA 94063

NOTICE OF ANNUAL MEETING OF STOCKHOLDERS
TO BE HELD ON TUESDAY, JUNE 13, 2023

To the Stockholders of Codexis, Inc. ("Codexis," "we," "us" and "our"):

We will hold an annual meeting of our stockholders (the "Annual Meeting") on Tuesday, June 13, 2023, at 9:00 a.m., California time, for the following purposes:

(i) To elect Stephen Dilly, M.B.B.S., Ph.D., Alison Moore, Ph.D. and Rahul Singhvi, Sc.D. to our board of directors for a three-year term expiring at the 2026 annual meeting of stockholders or until their respective successors are duly elected and qualified or their earlier resignation or removal;

(ii) To ratify the selection of BDO USA, LLP as our independent registered public accounting firm for the year ending December 31, 2023;

(iii) To hold a non-binding, advisory vote on the compensation of our named executive officers;

(iv) To hold a non-binding, advisory vote to determine the frequency of future advisory votes on compensation for our named executive officers;

(v) To approve an amendment to our certificate of incorporation to increase the number of authorized shares of our common stock, par value $0.0001 per share (the "common stock"), from 100,000,000 to 200,000,000 shares;

(vi) To approve the Codexis, Inc. 2023 Employee Stock Purchase Plan;

(vii) To approve an amendment to the Codexis, Inc. 2019 Incentive Award Plan; and

(viii) To transact such other business as may properly come before the Annual Meeting or any adjournments or postponements of the Annual Meeting.

The Annual Meeting will be held in a virtual format via live audio webcast. You will be able to attend and participate in the Annual Meeting online by visiting *www.virtualshareholdermeeting.com/CDXS2023*, where you will be able to listen to the meeting live, submit questions and vote.

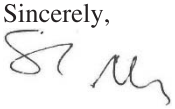
These items of business are described in the attached proxy statement. Only stockholders of record of shares of our common stock at the close of business on April 20, 2023, the record date for the Annual Meeting, are entitled to notice of and to vote at the Annual Meeting and any adjournments or postponements of the Annual Meeting.

We have elected to provide our proxy materials to our stockholders over the Internet as permitted by the rules of the U.S. Securities and Exchange Commission. As a result, we are mailing most of our stockholders a paper copy of the Notice of Internet Availability of Proxy Materials (the "Notice"), but not a paper copy of our proxy statement and our 2022 annual report to stockholders. This process allows us to provide our proxy materials to our stockholders in a timelier and more readily accessible manner, while reducing the environmental impact and lowering the costs of printing and distributing our proxy materials. The Notice contains instructions on how to access those documents over the Internet. The Notice also contains instructions on how to request a paper copy of our proxy materials, including this proxy statement, our 2022 annual report to stockholders, including the consolidated financial statements and financial statement schedules from our Annual Report on Form 10-K, but excluding exhibits to the Annual Report on Form 10-K, and a form of proxy card or voting instruction card. All stockholders who have previously requested a paper copy of our proxy materials will continue to receive a paper copy of our proxy materials by mail.

A list of stockholders eligible to vote at the Annual Meeting will be available for inspection during the virtual Annual Meeting at *www.virtualshareholdermeeting.com/CDXS2023*, and at the principal executive offices of Codexis during regular business hours for a period of not less than ten days prior to the Annual Meeting.

Your vote is very important. It is important that your shares be represented and voted whether or not you plan to attend the Annual Meeting online. You may vote on the Internet or by telephone. If, however, you requested to receive paper proxy materials, then you may also vote by mailing a complete, signed and dated proxy card or voting instruction card in the envelope provided. If your shares are held in "street name," which means your shares are held of record by a broker, bank or other nominee, you should review the instructions provided to you by that broker, bank or other nominee to determine how you will be able to submit your voting instructions. Submitting a proxy over the Internet, by telephone or by mailing a proxy card will ensure that your shares are represented at the Annual Meeting.

Sincerely,



Stephen Dilly, M.B.B.S., Ph.D.
President and Chief Executive Officer

Redwood City, California
April 27, 2023

CODEXIS, INC.
200 Penobscot Drive
Redwood City, CA 94063

PROXY STATEMENT
FOR THE ANNUAL MEETING OF STOCKHOLDERS
TO BE HELD ON JUNE 13, 2023

IMPORTANT NOTICE REGARDING THE AVAILABILITY OF PROXY MATERIALS FOR THE ANNUAL MEETING OF STOCKHOLDERS TO BE HELD ON JUNE 13, 2023

The Board of Directors of Codexis, Inc. (referred to herein as the "Company," "Codexis," "we," "us" or "our") is soliciting your proxy to vote at our 2023 Annual Meeting of Stockholders to be held on Tuesday, June 13, 2023, at 9:00 a.m., California time, or at any continuation, postponement or adjournment thereof (the "Annual Meeting"). The Annual Meeting will be held in a virtual format via live audio webcast for the purposes discussed in this proxy statement (the "Proxy Statement") and in the accompanying Notice of Annual Meeting, as well as any other business properly brought before the Annual Meeting. Stockholders can attend the meeting via the Internet at *www.virtualshareholdermeeting.com/CDXS2023* by using the 16-digit control number which appears on the Notice of Internet Availability of Proxy Materials, the proxy card and the instructions that accompanied your proxy materials. This Proxy Statement is dated as of April 27, 2023.

All costs of solicitation of proxies will be borne by us. In addition to solicitations by mail, our directors, officers and regular employees, without additional remuneration, may solicit proxies by telephone, e-mail and personal interviews. We have also retained Innisfree M&A Incorporated to assist in the solicitation for an anticipated fee up to $35,000, plus expenses related to calling stockholders. Brokers, custodians and fiduciaries will be requested to forward proxy soliciting material to the owners of stock held in their names, and we will reimburse them for their reasonable out-of-pocket expenses incurred in connection with the distribution of proxy materials.

We have elected to provide access to our proxy materials on the Internet. Accordingly, we are sending a Notice of Internet Availability of Proxy Materials (the "Notice") to our stockholders of record as of April 20, 2023 (the "Record Date"), while brokers and other nominees who hold shares on behalf of beneficial owners will be sending their own similar notice. All stockholders will have the ability to access the proxy materials on the website referred to in the Notice, or to request a printed set of the proxy materials. Instructions on how to request a printed copy by mail or e-mail may be found in the Notice and on the website referred to in the Notice, including an option to request paper copies on an ongoing basis. On or about April 27, 2023, we are making this Proxy Statement available on the Internet. We are mailing the Notice to all stockholders entitled to vote at the Annual Meeting on or about April 27, 2023. We intend to mail or e-mail this Proxy Statement, together with a proxy card, to those stockholders entitled to vote at the Annual Meeting who have properly requested copies of such materials by mail or e-mail, within three business days of such request.

The Company's 2022 annual report to stockholders, which contains consolidated financial statements and financial statement schedules from our Annual Report on Form 10-K for 2022 (the "Annual Report"), accompanies this Proxy Statement if you have requested and received a copy of the proxy materials in the mail. Stockholders that receive the Notice can access this Proxy Statement and the Annual Report at the website referred to in the Notice. The Annual Report and this Proxy Statement are also available on our investor relations website at *www.codexis.com/investors*, at the website of the Securities and Exchange Commission (the "SEC") at *www.sec.gov* and at *www.proxyvote.com*. You also may obtain a copy of our Annual Report, including the consolidated financial statements and financial statement schedules, but excluding exhibits to the Annual Report on Form 10-K, without charge, by writing to our Investor Relations department at the above address. Exhibits to the Annual Report on Form 10-K are available upon payment of a reasonable fee, which is limited to our expenses in furnishing the requested exhibit.

INFORMATION CONCERNING VOTING AND SOLICITATION

Who Can Vote

You are entitled to vote if you are a stockholder of record of our common stock, par value $0.0001 per share (the "common stock"), as of the close of business on April 20, 2023. You are entitled to one vote for each share of common stock held on all matters to be voted upon at the Annual Meeting. Your shares may be voted at the Annual Meeting only if you are present at the Annual Meeting or represented by a valid proxy.

Voting of Shares

If, at the close of business on April 20, 2023, your shares of common stock were registered directly in your name with Equiniti Trust Company, our transfer agent, then you are a stockholder of record. As a stockholder of record, you may vote online at the Annual Meeting or vote by proxy by completing, dating and signing the proxy card that was included with this Proxy Statement and promptly returning it in the preaddressed, postage paid envelope provided to you, or by submitting a proxy over the Internet or by telephone by following the instructions on the proxy card. If your shares of common stock are held in street name through a broker, bank or other nominee, you are considered the beneficial owner of those shares and you have the right to instruct your broker, bank or other nominee, who is considered the stockholder of record for the purposes of voting at the Annual Meeting, on how to vote the shares in your account. Your broker, bank or nominee will send you a voting instruction form for you to use to direct how your shares should be voted.

The Internet and telephone voting will close at 11:59 p.m., New York time, on June 12, 2023. If you vote through the Internet, you should be aware that you may incur costs to access the Internet, such as usage charges from telephone companies or Internet service providers and that these costs must be borne by you. If you vote by the Internet or telephone, then you do not need to return a written proxy card by mail.

YOUR VOTE IS VERY IMPORTANT. You should submit your proxy even if you plan to attend the virtual Annual Meeting online. If you properly give your proxy and submit it to us in time to vote, one of the individuals named as your proxy will vote your shares as you have directed.

All shares entitled to vote and represented by properly submitted proxies (including those submitted electronically, telephonically and in writing by 11:59 p.m., New York time, on June 12, 2023) that are received before the polls are closed at the Annual Meeting, and that are not revoked or superseded, will be voted at the Annual Meeting in accordance with the instructions indicated on those proxies. If no direction is indicated on a proxy, your shares will be voted "**FOR**" the election of all of Stephen Dilly, M.B.B.S., Ph.D., Alison Moore, Ph.D. and Rahul Singhvi, Sc.D. and as our Class I directors, "**FOR**" the ratification of the selection of BDO USA, LLP ("BDO") as our independent registered public accounting firm, "**FOR**" the approval of the compensation of our named executive officers in a non-binding, advisory vote, in favor of the option of "**ONE YEAR**" for the non-binding, advisory vote on the frequency of the advisory vote on compensation for our named executive officers, "**FOR**" the approval of an amendment to our certificate of incorporation to increase the number of authorized shares of our common stock, "**FOR**" the approval of the Codexis, Inc. 2023 Employee Stock Purchase Plan and "**FOR**" the approval of an amendment to the Codexis, Inc. 2019 Incentive Award Plan. The proxy gives each of Stephen Dilly, M.B.B.S., Ph.D., and Sriram Ryali discretionary authority to vote your shares in accordance with his best judgment with respect to all additional matters that might come before the Annual Meeting.

Revocation of Proxy

If you are a stockholder of record, you may revoke your proxy at any time before your proxy is voted at the Annual Meeting by taking any of the following actions:

- delivering to our Secretary a signed written notice of revocation, bearing a date later than the date of the original proxy, stating that the original proxy is revoked;

- signing and delivering a new paper proxy, relating to the same shares and bearing a later date than the original proxy;
- submitting another proxy by telephone or over the Internet (your latest telephone or Internet voting instructions will be followed); or
- attending the virtual Annual Meeting and voting online by following the instructions at *www.virtualshareholdermeeting.com/CDXS2023*, although attendance at the Annual Meeting will not, by itself, revoke a proxy.

Written notices of revocation and other communications with respect to the revocation of Codexis proxies should be addressed to:

Codexis, Inc.
200 Penobscot Drive
Redwood City, CA 94063
Attention: Secretary

If your shares are held in "street name," you may change your vote by submitting new voting instructions to your broker, bank or other nominee. You must contact your broker, bank or other nominee to find out how to do so. See below regarding how to vote online if your shares are held in street name.

Voting Online

If you are a stockholder of record, you may vote online at the Annual Meeting by attending the Annual Meeting online and following the instructions posted at *www.virtualshareholdermeeting.com/CDXS2023*. If you are a beneficial owner, you are also invited to attend the Annual Meeting online. Since a beneficial owner is not the stockholder of record, however, you may not vote these shares online at the Annual Meeting unless you obtain a "legal proxy" from the organization that holds your shares, giving you the right to vote the shares at the Annual Meeting.

Quorum and Votes Required

At the close of business on April 20, 2023, 66,767,717 shares of our common stock were outstanding and entitled to vote. All votes will be tabulated by the inspector of elections appointed for the Annual Meeting, who will separately tabulate affirmative and negative votes, withheld votes and abstentions.

Quorum. A majority in voting power of the common stock issued and outstanding and entitled to vote, present in person or represented by proxy at the Annual Meeting, will constitute a quorum at the Annual Meeting. Shares of common stock held by persons attending the Annual Meeting online but not voting, shares represented by proxies that reflect abstentions as to a particular proposal and broker "non-votes" will be counted as present for purposes of determining a quorum.

Broker Non-Votes. Brokers or other nominees who hold shares of common stock in "street name" for a beneficial owner of those shares typically have the authority to vote in their discretion on "routine" proposals when they have not received instructions from beneficial owners. However, brokers are not allowed to exercise their voting discretion with respect to the election of directors or for any matter that the SEC determines to be a "significant matter" without specific instructions from the beneficial owner. These non-voted shares are referred to as "broker non-votes." If your broker holds your common stock in "street name," your broker is not entitled to vote your shares on "non-routine" proposals (i.e., of the proposals to be considered at the Annual Meeting, the election of directors, the non-binding, advisory vote on executive compensation, the non-binding, advisory vote on the frequency of the advisory vote on compensation for our named executive officers, the approval of the Codexis, Inc. 2023 Employee Stock Purchase Plan and the amendment to the Codexis, Inc. 2019 Incentive Award Plan)

without your instructions and will only vote your shares on such proposals if you provide instructions on how to vote by filling out the voter instruction form sent to you by your broker with this Proxy Statement. Broker "non-votes" are considered in determining whether a quorum exists at the Annual Meeting but they are not included in the tabulation of voting results for "non-routine" proposals for purposes of determining whether such proposals have been approved. Therefore, broker non-votes will have no effect on the outcome of Proposals 1, 3, 4, 6 and 7, and will have the same effect as a vote "AGAINST" Proposal 5. Because brokers have discretionary authority to vote on Proposals 2, broker "non-votes" are not expected on Proposal 2.

Election of Class I Directors. Our amended and restated bylaws ("bylaws") provide that a plurality of votes cast in favor of the election of a director shall be sufficient to elect such director to the board of directors. Under this plurality voting standard, the nominees for available directorships who receive the highest number of affirmative votes cast are elected. Withheld votes will not have any effect on the election of directors. Brokers are not empowered to vote on the election of directors without instructions from the beneficial owner of the shares, and thus broker non-votes likely will occur. Since broker non-votes are not considered votes cast for a candidate, they will not have any effect on the election of directors.

Ratification of Independent Registered Public Accounting Firm. The affirmative vote of a majority of the shares present in person by attendance online or represented by proxy at the Annual Meeting and entitled to vote on the proposal is required for the ratification of the selection of BDO as our independent registered public accounting firm. Abstentions will have the same effect as voting against this proposal. Brokers generally have discretionary authority to vote on the ratification of our independent registered public accounting firm; thus broker non-votes are generally not expected to result from the vote on this proposal.

Non-Binding, Advisory Vote on Named Executive Officer Compensation. The affirmative vote of a majority of the shares present in person by attendance online or represented by proxy at the Annual Meeting and entitled to vote on the proposal will be deemed to be approval of the resolution on the compensation of our named executive officers as disclosed in this Proxy Statement. However, because this proposal is intended to be advisory, we will exclude abstentions and broker non-votes from the determination of approval. Although the outcome of this advisory vote on the compensation of the named executive officers is non-binding, the compensation committee of the board of directors and the board of directors will review and consider the outcome of this vote when making future compensation decisions for our named executive officers.

Frequency of Future Non-Binding, Advisory Votes on Named Executive Officer Compensation. The option of every one year, two years or three years that receives the affirmative vote of a majority of the shares present in person by attendance online or represented by proxy at the Annual Meeting and entitled to vote on the proposal will be the frequency recommended by stockholders, unless none of the frequency options receives a majority vote, in which case the option that receives the highest number of votes will be considered to be the frequency recommended by stockholders. Abstentions on each frequency option will have the same effect as a vote against such option. Brokers are not empowered to vote on this proposal without instruction from the beneficial owner of the shares, therefore broker non-votes will not be treated as entitled to vote on this proposal and will not be counted for any purpose in determining which frequency option has been recommended by stockholders. Although the outcome of this vote is non-binding, the compensation committee of the board of directors and the board of directors will review and consider the outcome of this vote when making future decisions about the frequency of the advisory vote on the compensation of our named executive officers.

Amendment to our Certificate of Incorporation to Increase the Number of Authorized Shares of our Common Stock. The affirmative vote of a majority of our issued and outstanding shares of common stock entitled to vote is required to approve this proposal. Abstentions will have the same effect as voting against this proposal. Brokers generally have discretionary authority to vote on the amendment of our amended and restated certificate of incorporation; thus broker non-votes are generally not expected to result from the vote on this proposal.

Adoption of the Codexis, Inc. 2023 Employee Stock Purchase Plan. The affirmative vote of a majority of the shares represented in person or by proxy at the Annual Meeting and entitled to vote on the proposal is required to

approve this proposal. Brokers are not empowered to vote on this proposal without instruction from the beneficial owner of the shares, therefore broker non-votes will not be treated as entitled to vote on this proposal. Abstentions will have the same effect as voting against this proposal.

Amendment to the Codexis, Inc. 2019 Incentive Award Plan. The affirmative vote of a majority of the shares represented in person or by proxy at the Annual Meeting and entitled to vote on the proposal is required to approve this proposal. Brokers are not empowered to vote on this proposal without instruction from the beneficial owner of the shares, therefore broker non-votes will not be treated as entitled to vote on this proposal. Abstentions will have the same effect as voting against this proposal.

How do I attend the Virtual Annual Meeting?

The Annual Meeting will be held entirely online. Stockholders as of April 20, 2023 will be able to attend and participate in the Annual Meeting online by accessing *www.virtualshareholdermeeting.com/CDXS2023*. To join the Annual Meeting, you will need to have your 16-digit control number which is included on the Notice and your proxy card.

Even if you plan to attend the Annual Meeting online, we recommend that you also vote by proxy as described herein so that your vote will be counted if you decide not to attend the Annual Meeting.

Access to the Audio Webcast of the Annual Meeting. The live audio webcast of the Annual Meeting will begin promptly at 9:00 a.m., California time. Online access to the audio webcast will open approximately 10 minutes prior to the start of the Annual Meeting to allow time for you to log in and test the computer audio system. We encourage you to access the meeting prior to the start time.

Log in Instructions. To attend the online Annual Meeting, log in at *www.virtualshareholdermeeting.com/CDXS2023*. Stockholders will need their unique 16-digit control number which appears on the Notice and the instructions that accompanied the proxy materials. In the event that you do not have a control number, please contact your broker, bank or other nominee as soon as possible, so that you can be provided with a control number and gain access to the meeting.

Submitting Questions at the virtual Annual Meeting. Stockholders may submit questions in writing during the Annual Meeting on *www.virtualshareholdermeeting.com/CDXS2023*. Stockholders will need their unique control number which appears on their Notice, the proxy card and the instructions that accompanied the proxy materials.

As part of the Annual Meeting, we will hold a live question and answer session, during which we intend to answer questions submitted during the meeting in accordance with the Annual Meeting's Rules of Conduct and that are pertinent to the Company and the meeting matters, as time permits. Questions and answers will be grouped by topic and substantially similar questions will be grouped and answered once. In order to promote fairness, efficient use of the Company's resources and in order to ensure all stockholders are responded to, we will respond to up to two questions from a single stockholder.

The Annual Meeting's Rules of Conduct will be posted on *www.codexis.com/investors* approximately two weeks prior to the day of the Annual Meeting.

Technical Assistance. Beginning 10 minutes prior to the start of and during the virtual Annual Meeting, we will have support team ready to assist stockholders with any technical difficulties they may have regarding accessing or hearing the virtual meeting.

If you encounter any difficulties accessing the virtual meeting during the check-in or meeting time, please call the technical support number that will be posted on the Virtual Shareholder Meeting log in page.

Solicitation of Proxies

Our board of directors is soliciting proxies for the Annual Meeting from our stockholders. We will bear the entire cost of soliciting proxies from our stockholders. In addition to the solicitation of proxies by mail, we will request that brokers, banks and other nominees that hold shares of our common stock, which are beneficially owned by our stockholders, send Notices of Annual Meeting, proxies and proxy materials to those beneficial owners and secure those beneficial owners' voting instructions. We will reimburse those record holders for their reasonable out-of-pocket expenses incurred in connection with the distribution of proxy materials.

In addition, we have retained Innisfree M&A Incorporated to assist in the solicitation for an anticipated fee up to $35,000, plus expenses related to calling stockholders.

Security Ownership of Certain Beneficial Owners and Management

The following table sets forth information regarding the beneficial ownership of shares of our common stock as of April 20, 2023 for:

- each person known to us to be the beneficial owner of more than 5% of our outstanding shares of common stock;
- each of our named executive officers;
- each of our directors and director nominees; and
- all directors and current executive officers as a group.

Unless otherwise noted below, the address of each beneficial owner listed on the table is c/o Codexis, Inc., 200 Penobscot Drive, Redwood City, CA 94063. We have determined beneficial ownership in accordance with the rules promulgated by the SEC. Except as indicated by the footnotes below, we believe, based on the information furnished to us, that the persons and entities named in the tables below have sole voting and investment power with respect to all shares of common stock that they beneficially own, subject to applicable community property laws.

In computing the number of shares of common stock beneficially owned by a person and the percentage ownership of that person, we deemed outstanding shares of common stock subject to options held by that person that are currently exercisable or exercisable within 60 days of April 20, 2023. We did not deem these shares outstanding, however, for the purpose of computing the percentage ownership of any other person.

Percentage of beneficial ownership is based on 66,767,717 shares of common stock outstanding as of April 20, 2023.

Name and Address of Beneficial Owner	Number of Shares Beneficially Owned	Percentage of Shares Beneficially Owned
5% Stockholders:		
Baillie Gifford & Co [1]	6,210,551	9.3%
BlackRock, Inc. [2]	6,154,933	9.2%
Nantahala Capital Management, LLC [3]	4,487,782	6.7%
ARK Investment Management LLC [4]	3,941,985	5.9%
The Vanguard Group [5]	3,642,208	5.5%
Named Executive Officers, Directors and Director Nominees:		
Stephen Dilly, M.B.B.S., Ph.D.	123,397	*%
John J. Nicols [6]	3,361,721	5.0%
Ross Taylor [7]	136,071	*%
Kevin Norrett, M.B.A.	24,874	*%
Margaret Nell Fitzgerald	22,950	*%
Jennifer Aaker, Ph.D.	31,609	*%
Byron L. Dorgan	178,859	*%
Esther Martinborough, Ph.D.	23,331	*%
Alison Moore, Ph.D.	33,974	*%
H. Stewart Parker	37,878	*%
Rahul Singhvi, Sc.D.	31,347	*%
David V. Smith [8]	88,570	*%
Dennis P. Wolf	42,198	*%
Patrick Y. Yang, Ph.D.	53,785	*%
All executive officers and directors as a group (14 persons) [9]	4,190,564	6.3%

* Represents beneficial ownership of less than 1% of the outstanding shares of our common stock.

(1) Based solely on a Schedule 13G/A (the "Baillie Gifford 13G/A") filed by Baillie Gifford & Co. on January 18, 2023, with respect to shares of Codexis common stock beneficially owned by Baillie Gifford as of December 30, 2022. Based solely on the Baillie Gifford 13G/A, Baillie Gifford & Co. has sole voting power with respect to 4,966,529 shares of Codexis common stock and sole dispositive power with respect to 6,210,551 shares of Codexis common stock, and therefore Baillie Gifford & Co. may be deemed to have beneficial ownership with respect to 6,210,551 shares of Codexis common stock. Based solely on the Baillie Gifford 13G/A, shares of Codexis common stock reported on Baillie Gifford 13G/A as being beneficially owned by Baillie Gifford & Co. are held by Baillie Gifford & Co. and/or one or more of its investment adviser subsidiaries, which may include Baillie Gifford Overseas Limited, on behalf of investment advisory clients, which may include investment companies registered under the Investment Company Act, employee benefit plans, pension funds or other institutional clients. The principal business address of Baillie Gifford & Co is Calton Square, 1 Greenside Row, Edinburgh, EH1 3AN, United Kingdom.

(2) Based solely on a Schedule 13G/A (the "BlackRock 13G/A") filed by BlackRock, Inc. ("BlackRock") on January 24, 2023, with respect to shares of Codexis common stock beneficially owned by BlackRock as of December 31, 2022. Based solely on the BlackRock 13G/A, BlackRock has sole voting power with respect to 5,933,223 shares of Codexis common stock and sole dispositive power with respect to 6,154,933 shares of Codexis common stock, and therefore BlackRock may be deemed to have beneficial ownership with respect to 6,154,933 shares of Codexis common stock. The principal business address of BlackRock is 55 East 52nd Street, New York, NY 10055.

(3) Based solely on a Schedule 13G/A (the "Nantahala 13G/A") filed by Nantahala Capital Management, LLC ("Nantahala"), Wilmot B. Harkey and Dan Mack (collectively, the "Nantahala Reporting Persons") on February 14, 2023 with respect to shares of Codexis common stock beneficially owned by the Nantahala Reporting Persons as of December 31, 2022. Wilmot B. Harkey and Dan Mack are the managing members of Nantahala. Based solely on the Nantahala 13G/A, each of the Nantahala Reporting Persons has shared voting and dispositive power with respect to shares of Codexis common stock, Nantahala may be deemed to be the beneficial owner of shares of Codexis common stock held by funds and separately managed accounts under its control, and as the managing members of Nantahala, each of Messrs. Harkey and Mack may be deemed to be a beneficial owner of those shares. The address of the Nantahala Reporting Persons is 130 Main St, 2nd Floor, Suite 200, New Canaan, CT 06840.

(4) Based solely on a Schedule 13G/A (the "ARK 13G/A") filed by ARK Investment Management LLC on February 10, 2023, with respect to shares of Codexis common stock beneficially owned by ARK as of December 31, 2022. Based solely on the ARK 13G/A, ARK has sole voting and dispositive power with respect to shares of Codexis common stock. The principal business address of ARK is 200 Central Avenue, St. Petersburg FL 33701.

(5) Based solely on a Schedule 13G/A (the "Vanguard 13G/A") filed by The Vanguard Group ("Vanguard") on February 9, 2023 with respect to shares of Codexis common stock beneficially owned by Vanguard as of December 30, 2022. Based solely on the Vanguard 13G/A, Vanguard has shared voting power with respect to 101,361 shares of Codexis common stock, sole dispositive power with respect to 3,492,097 shares of Codexis common stock and shared dispositive power with respect to 150,111 shares of Codexis common stock, and therefore, Vanguard may be deemed to have beneficial ownership with respect to 3,642,208 shares of Codexis common stock. The principal business address of Vanguard is 100 Vanguard Blvd., Malvern, PA 19355.

(6) Consists of 313,545 shares owned directly by Mr. Nicols, (ii) 470,420 shares owned by a trust for the benefit of Mr. Nicols and his immediate family members, of which Mr. Nicols serves as trustee, and (iii) 2,577,756 shares issuable pursuant to stock options exercisable within 60 days of April 20, 2023.

(7) Consists of (i) 37,466 shares owned directly by Mr. Taylor and (ii) 98,605 shares issuable pursuant to stock options exercisable within 60 days of April 20, 2023.

(8) Consists of (i) 11,273 shares owned directly by Mr. Smith and (ii) 77,297 shares owned directly by a family trust of which Mr. Smith is trustee.

(9) Consists of (i) 966,486 shares owned directly, (ii) 547,717 shares owned by family trusts, and (iii) 2,676,361 shares issuable pursuant to stock options exercisable within 60 days of April 20, 2023.

Forward-Looking Statements

This proxy statement contains "forward-looking statements" (as defined in the Private Securities Litigation Reform Act of 1995). These statements are based on our current expectations and involve risks and uncertainties, which may cause results to differ materially from those set forth in the statements. The forward-looking statements may include statements regarding actions to be taken by us. We undertake no obligation to publicly update any forward-looking statement, whether as a result of new information, future events or otherwise. Forward-looking statements should be evaluated together with the many uncertainties that affect our business, particularly those mentioned in the risk factors in Item 1A of our Annual Report on Form 10-K for the year ended December 31, 2022, our quarterly reports on Form 10-Q and our current reports on Form 8-K.

PROPOSAL 1

ELECTION OF DIRECTORS

Board Structure

Our bylaws provide for a fixed number of directors as set by the board of directors. There are currently 11 directors on our board of directors. Mr. Nicols will retire from the board of directors effective the date of the Annual Meeting and Dr. Yang previously informed us of his decision not to stand for reelection. As a result of the foregoing, the board of directors has approved reducing the authorized number of directors to nine, effective as of the Annual Meeting.

The directors are divided into three classes, each of whom serves for a term of three years: Class I directors (who hold office until the close of the Annual Meeting), Class II directors (who hold office until the close of the 2024 annual meeting of stockholders) and Class III directors (who hold office until the close of the 2025 annual meeting of stockholders). At each annual meeting of stockholders, the term of one of the classes of directors expires. The class of directors with a term expiring at the Annual Meeting are the Class I directors, currently consisting of four directors, Stephen Dilly, M.B.B.S., Ph.D., Alison Moore, Ph.D., Rahul Singhvi, Sc.D. and Patrick Y. Yang, Ph.D.

Director Nominees

Based upon the recommendation of our nominating and corporate governance committee, our board of directors has nominated each of Drs. Dilly, Moore and Singhvi for election as a Class I director to our board; Dr. Yang previously informed us of his decision not to stand for reelection and consequently was not nominated by the board of directors. If elected, each director nominee would serve a three-year term expiring at the close of our 2026 annual meeting of stockholders, or until his or her successor is duly elected and qualified. Drs. Dilly, Moore and Singhvi currently serve on our board of directors and have agreed to be named in this proxy statement and to serve as a director if elected. Biographical information on each of the director nominees is furnished below under "Director Nominee Biographical Information."

Set forth below is information regarding the director nominees as of April 20, 2023:

Name	Age	Director Since	Class/Term Expires
Stephen Dilly, M.B.B.S., Ph.D.	63	2020	Class I/2023
Alison Moore, Ph.D. [1][2]	56	2020	Class I/2023
Rahul Singhvi, Sc.D. [1][2]	58	2022	Class I/2023

(1) Member of the Compensation Committee.
(2) Member of the Science & Technology Committee.

Director Nominee Biographical Information

The following biographical information is furnished as of April 20, 2023 with regard to the director nominees.

Stephen G. Dilly, M.B.B.S., Ph.D. has served as our President and Chief Executive Officer since August 2022 and as a director of Codexis since June 2020. Dr. Dilly brings to our board of directors and Codexis extensive management experience in the life science industry and experience in drug development. From May 2020 until its acquisition by GlaxoSmithKline plc in July 2022, Dr. Dilly served as Chief Executive Officer of Sierra Oncology, a public, late-stage clinical biopharmaceutical company, and as a member of Sierra's board of directors. Dr. Dilly previously served as Chief Executive Officer of Aimmune Therapeutics, a public biopharmaceutical company that was acquired by Nestlé Health Science, from April 2014 to June 2018 and as a member of Aimmune's board of directors from April 2013 to June 2018. Dr. Dilly was Chief Executive Officer

of PhotoThera, Inc., a medical device company, from January 2012 to December 2012. From 2006 to 2011, Dr. Dilly served as President and Chief Executive Officer and a member of the board of directors of APT Pharmaceuticals, Inc., a drug development company. From 2007 to 2009, he was a member of the board of directors of Avigen, Inc., a biopharmaceutical company, which merged with MediciNova, Inc. in December 2009. From 2003 to 2006, he served as Chief Medical Officer and Senior Vice President of Development of Chiron BioPharma, a biotechnology company which was later acquired by Novartis International AG. From 1998 to 2003, Dr. Dilly held various management positions at Genentech, Inc., a biotechnology company acquired by Roche Holding, including Vice President of Development Sciences from 2002 to 2003 and Vice President of Medical Affairs from 1998 to 2001. From 1988 to 1998, Dr. Dilly held various management positions in drug development with SmithKline Beecham, PLC, a healthcare company in the U.K. Dr. Dilly currently serves on the board of directors of Cognoa, Inc., a digital healthcare company. From 2010 until September 2020, Dr. Dilly served on the board of directors of Sangamo Therapeutics, Inc., a public genomic therapies company. Dr. Dilly holds an M.B.B.S. from the University of London in the U.K. and a Ph.D. in cardiac physiology from the University of London.

Alison Moore, Ph.D. has served as a director of Codexis since June 2020. Dr. Moore brings to our board of directors significant experience as an executive of biotechnology and pharmaceutical companies. Dr. Moore has recently announced her resignation from her position as Chief Technical Officer of Allogene Therapeutics, Inc., a public biotechnology company, which she has held since June 2018. Prior to joining Allogene, she most recently served as Senior Vice President, Process Development at Amgen Inc., a public biotechnology company, from January 2013 until June 2018. Dr. Moore has previously held senior roles at Amgen in Operations Technology from January 2013 until August 2014, Process and Product engineering from January 2011 until January 2013, and Corporate Manufacturing from August 2008 until December 2010. Prior to these positions, she was Vice President, Site Operations at Amgen's Fremont, California, manufacturing facility, from March 2006 until August of 2008. Before re-joining Amgen, from 2005 to 2006, Dr. Moore was a Director in Chemistry, Manufacturing and Controls, and Regulatory Affairs at Genentech, Inc. Prior to Genentech, she held roles of increasing responsibility in Process Development at Amgen from 1996 through the end of 2004. Dr. Moore currently services as a member of the technical advisory board of National Resilience, Inc., a private biomanufacturing company, and as an executive board member for the Alliance for Regenerative Medicine, an international advocacy organization dedicated to realizing the promise of regenerative medicines and advanced therapies. Dr. Moore was a Postdoctoral Research Fellow at Genentech from 1993 to 1996, and prior to that, she was a Postdoctoral Research Fellow at the Medical University of Lübeck, Germany. Dr. Moore holds both a bachelor's degree in Pharmacology with Honors and a Ph.D. in Cell Biology from Manchester University, England.

Rahul Singhvi, Sc.D. has served as a director of Codexis since September 2022. Dr. Singhvi brings to our board of directors extensive experience and expertise in research and development, operations and commercialization of pharmaceuticals. Dr. Singhvi has served as the Chief Executive Officer and a member of the board of directors of National Resilience, Inc., a private biomanufacturing company, since July 2020. From October 2019 to July 2020, Dr. Singhvi was an Operating Partner at Flagship Pioneering, a life sciences innovation firm, where he was responsible for founding and operating companies launched from Flagship's innovation foundry, Flagship Venture Labs. Before joining Flagship, from September 2013 until October 2019, Dr. Singhvi was the Chief Operating Officer of the Global Vaccine Business Unit at Takeda Vaccines, a biotechnology company, where he oversaw the worldwide supply and expansion efforts of all commercialized vaccines and development candidates within the business unit. Prior to Takeda, from August 2005 to April 2011, he was the President and Chief Executive Officer of Novavax, Inc., a public vaccine-development company. Dr. Singhvi previously served on the board of directors of ImmunoCellular Therapeutics, Ltd., a public immunotherapy company, from June 2010 to November 2018. Dr. Singhvi serves on the board of directors of Garuda Therapeutics, a private stem cell-based cellular therapies company. Dr. Singhvi holds a B. Tech in Chemical Engineering from the Indian Institute of Technology at Kanpur, an M.S. and Sc.D. in Chemical Engineering from the Massachusetts Institute of Technology and an M.B.A. from The Wharton School of the University of Pennsylvania.

Board Recommendation

THE BOARD UNANIMOUSLY RECOMMENDS A VOTE "FOR" ALL OF THE DIRECTOR NOMINEES.

Directors Not Standing for Election

Set forth below is information, as of April 20, 2023, for the members of the board who are not standing for election at the Annual Meeting:

Name	Age	Director Since	Class/Term Expires
Jennifer Aaker, Ph.D. [1]	56	2020	Class II/2024
Esther Martinborough, Ph.D. [2][3]	57	2021	Class II/2024
John J. Nicols	59	2012	Class II/2023*
H. Stewart Parker [3][4]	67	2022	Class II/2024
Byron L. Dorgan [1]	80	2011	Class III/2025
David V. Smith [3][4]	63	2016	Class III/2025
Dennis P. Wolf [3][5]	70	2007	Class III/2025
Patrick Y. Yang, Ph.D.	75	2006	Class I/2023**

(1) Member of the Nominating and Corporate Governance Committee.
(2) Member of the Science & Technology Committee.
(3) Member of the Strategic Committee.
(4) Member of the Audit Committee.
(5) Member of the Compensation Committee
* Pursuant to the Transition and Separation Agreement entered into between Codexis, Inc. and Mr. Nicols on July 18, 2022, Mr. Nicols will retire from the board of directors on the date of the Annual Meeting.
** Dr. Yang previously informed us of his decision not to stand for reelection to the board of directors at the Annual Meeting.

The following biographical information is furnished as of April 20, 2023 with regard to our directors who are not standing for election at the Annual Meeting.

Jennifer Aaker, PhD. has served as a director of Codexis since August 2020. Dr. Aaker brings to our board of directors a unique academic expertise and perspective on delivering long-term, sustainable value. Dr. Aaker is currently the General Atlantic Professor at the Stanford Graduate School of Business, and a leading scholar and best-selling author. Dr. Aaker joined the faculty of Stanford University in 2005 where she teaches ground-breaking courses. She is the recipient of the Distinguished Scientific Achievement Award, Stanford Distinguished Teaching Award, Jaedicke Silver Apple Award, and the MBA Professor of the Year Award recognizing her as "one of the most creative thinkers and innovators." Dr. Aaker currently serves on the board of directors and the audit committee of the Stephen and Ayesha Curry Eat. Learn. Play. Foundation, a director for Decarbonization + Acquisition Corp (DCRB, DCRN, DCRC), and is an advisor to Fortune 100 companies including Goldman Sachs. Dr. Aaker is an advisor to Fortune 100 companies including Goldman Sachs. Previously, Dr. Aaker has served on the board of directors of Corporate Visions, Inc., and as an advisor to X Development, LLC, a part of Alphabet. Dr. Aaker is widely published in leading scientific journals and featured in The Wall Street Journal, The Economist, The New York Times, Science, and The Atlantic. Dr. Aaker has co-authored multiple books. Previously, Dr. Aaker was a professor at the UCLA Anderson School of Management, where she conducted research that resulted in her seminal paper, *Dimensions of Brand Personality*, a model that empirically illuminates how to build strong global brands. Dr. Aaker holds a Ph.D. in business from the Stanford Graduate School of Business and a BA in psychology from the University of California, Berkeley.

Esther Martinborough, Ph.D. has served as a director of Codexis since February 2021. Dr. Martinborough brings to our board of directors significant experience as an executive of biotechnology and pharmaceutical companies

as well as expertise in drug development. Dr. Martinborough has served as the Chief Scientific Officer at Escient Pharmaceuticals since April 2023, after having previously served as its Senior Vice President of Research since August 2018. Previously, between 2008 and 2018, Dr. Martinborough held roles of increasing responsibility at Receptos, Inc., a biotechnology company acquired by Celgene Corporation in 2015. Most recently, from 2015 to 2018, Dr. Martinborough was Executive Director of Research at Receptos, where she headed the chemistry, biology and pharmacokinetics efforts focused on the selection of strategic new drug discovery programs in neurology and metabolic diseases. From 2008 to 2015, she served as Senior Director, Head of Chemistry at Receptos. Before Receptos, Dr. Martinborough held positions at Vertex Pharmaceuticals, a publicpharmaceutical company, developing novel approaches to treating pain and at Ligand Pharmaceuticals, a public biopharmaceutical company, focused on hormonal dysfunctions. Dr. Martinborough holds a Ph.D. from the Swiss Institute of Technology, Zurich, and performed post-doctoral studies at the University of Illinois, at Urbana-Champaign.

H. Stewart Parker has served as a director of Codexis since December 2022. Ms. Parker brings to our board of directors extensive experience in management of biotechnology companies and public company corporate governance. Ms. Parker has served as a Principal at Parker BioConsulting, a biotechnology consulting firm, since January 2009. From March 2011 to June 2014, Ms. Parker served in various roles at the Infectious Disease Research Institute, a not-for-profit global health research institute, including as its Chief Executive Officer, strategic advisor and a member of its board of directors. Prior to that, Ms. Parker served in various roles of leadership at biopharmaceutical companies since 1992, including as Chief Executive Officer of Targeted Genetics Corporation, a public biopharmaceutical company, which she founded. Since 2014, Ms. Parker has served on the board of directors of IMPEL Pharmaceuticals Inc., a public pharmaceutical company and Sangamo Therapeutics, Inc., a public genomic therapies company. Ms. Parker has also served on the board of directors of Stride Bio, Inc., a private biotechnology company concentrating on gene therapy, since January 2018, and Inventprise, Inc., a private biotechnology company, since February 2018. Previously, Ms. Parker served on the board of directors of Achieve Life Sciences, Inc., a public pharmaceutical company, from August 2017 to May 2021, and Armata Pharmaceuticals, Inc. (formerly C3J Therapeutics, Inc.), a public biotechnology company, from May 2019 to December 2020. Ms. Parker also serves on the advisory boards of the University of Washington Foster School of Business and College of Arts & Sciences. Ms. Parker holds a B.A. in Slavic Language & Literature and an M.B.A. in Finance and International Business from the University of Washington.

Byron L. Dorgan has served as a director of Codexis since February 2011 and as chairman of our board of directors since June 2021. Mr. Dorgan brings to our board of directors experience in economic issues, policy making, health care and government affairs. Mr. Dorgan represented the State of North Dakota in the United States Senate from 1992 to January 2011, when he retired. Prior to serving in the United States Senate, Mr. Dorgan served in the United States House of Representatives from 1981 to 1992. During his time in the United States Senate, Mr. Dorgan served in the United States Senate Leadership, first as Assistant Democratic Floor Leader and then as Chairman of the Democratic Policy Committee. He also served as the Chairman of the Committee on Indian Affairs and was the senior Senator on the Appropriations, Energy and Commerce Committees. Prior to being elected to the United States House of Representatives, Mr. Dorgan served as North Dakota State Tax Commissioner from 1969 until 1980. Mr. Dorgan is a New York Times bestselling author of five books, including *Take this Job and Ship It: How Corporate Greed and Brain-Dead Politics Are Selling Out America*; *Reckless! How Debt, Deregulation and Dark Money Nearly Bankrupted America*; *Blowout*; *Gridlock*; and *The Girl in the Photograph*. Mr. Dorgan serves on the board of advisors to OpenGov, a private software firm that focuses on products for state and local governments. Mr. Dorgan is a Senior Fellow at the Bipartisan Policy Center, a non-profit Washington, D.C. thinktank. Mr. Dorgan is chairman emeritus of a non-profit board, The Center for Native American Youth (CNAY), working with Native American youth living on Indian Reservations in the United States. Mr. Dorgan also serves as a member of the Board of Governors of Argonne National Laboratory and has served as an Adjunct Visiting Professor at Georgetown University. Additionally, Mr. Dorgan serves on the board of directors of the Energy Futures Initiative. Mr. Dorgan holds a B.S. from the University of North Dakota and an M.B.A. from the University of Denver.

David V. Smith has served as a director of Codexis since March 2016. Mr. Smith brings to our board of directors extensive experience in financial management, corporate finance and corporate governance. Mr. Smith served as Executive Vice President and Chief Financial Officer at Five Prime Therapeutics, Inc., a public company focused on discovering and developing novel immuno-oncology protein therapeutics, from November 2018 until its acquisition by Amgen, Inc. in April 2021. Previously, Mr. Smith served as Chief Operating Officer of IntegenX, a private company focused on rapid DNA identification technology, until its acquisition by Thermo Fisher Scientific in March 2018. Prior to IntegenX, he was Executive Vice President and Chief Financial Officer of Thoratec Corporation, a public company focused on the development of advanced therapy options for the treatment of heart disease, from December 2006 until July 2011. Prior to joining Thoratec in 2006, Mr. Smith served as Vice President and Chief Financial Officer of Chiron Corporation, which he joined in 1999, and where he held a number of positions of increasing responsibility, including Vice President, Principal Accounting Officer and Controller, and Vice President of Finance. Mr. Smith served as the Vice President of Finance and Chief Financial Officer at Anergen Incorporated from 1997 to 1999. From 1988 to 1997, Mr. Smith served in various financial management positions with Genentech, Inc., both in the United States and Europe. He previously held finance positions at Syntex Corporation and IBM Corporation. Mr. Smith previously served as chair of the Audit Committee and a Director of OncoGenex Pharmaceuticals, Inc., a public biopharmaceutical company. He also served on the board of directors of Perlegen Sciences, Inc., a private biotechnology company, and of Acepodia, Inc, a private biotechnology company. Mr. Smith currently serves on the board of directors of IO Biotech, a public clinical-stage biopharmaceutical company developing novel, immune-modulating cancer therapies, and Neurelis Inc., private commercial-stage neuroscience company focused on the development and commercialization of therapeutics for the treatment of epilepsy and orphan neurologic disorders. Additionally, Mr. Smith currently serves as an advisor to Monterey Bio Acquisition Corporation, a public special purpose acquisition company. Mr. Smith holds a B.A. in Economics and History from Willamette University and an M.B.A. specializing in finance from Golden Gate University.

Dennis P. Wolf has served as a director of Codexis since December 2007. Mr. Wolf brings to our board of directors extensive experience in financial management, corporate finance and public company corporate governance. Mr. Wolf served as Chief Financial Officer of DataStax, Inc., a private software company, from November 2013 to February 2017. Previously, Mr. Wolf served as Executive Vice President and Chief Financial Officer of Fusion-io Multisystems, a private computer hardware and software company, from November 2009 to October 2013. Prior to Fusion-io, Mr. Wolf served as Executive Vice President and Chief Financial Officer of MySQL AB, a private software company. Mr. Wolf has served as Chief Financial Officer of several public and private companies including Centigram Communications, Credence Systems, DataStax, Omnicell and Redback Networks. Earlier in his career he held executive positions at both Apple Computer and Sun Microsystems. Mr. Wolf has been a director and chair of the audit committee for other public companies including Quantum Corporation, Avanex Corporation, Bigband Networks, Komag, Inc., Registry Magic, Inc., Vitria Technology, Inc., Alphaeon Corporation and Exponential Interactive, Inc. He is a member of the board of the non-profit Siegel Rare Neuro Immune Association (SRNA) whose charter is to provide research and support for those suffering from neurological diseases. Mr. Wolf holds a B.A. from the University of Colorado (where he was a member of Phi Beta Kappa) and an M.B.A. from the University of Denver.

Executive Officers

The executive officers of Codexis are set forth below with their ages as of April 20, 2023:

Name	Age	Position
Stephen Dilly, M.B.B.S, Ph.D. . . .	63	President and Chief Executive Officer
Kevin Norrett, M.B.A.	50	Chief Operating Officer
Sriram Ryali, M.B.A.	42	Chief Financial Officer
Margaret Nell Fitzgerald	52	Chief Legal and Compliance Officer, General Counsel and Secretary

Executive Officer Biographical Information

The following biographical information is furnished with regard to our executive officers (except for Dr. Dilly, whose biographical information appears above under "Director Nominees") as of April 20, 2023:

Kevin Norrett M.B.A. has served as our Chief Operating Officer since October 2022. Mr. Norrett served as the Chief Business Officer of Sierra Oncology, a public clinical stage oncology company acquired by GlaxoSmithKline plc, a public pharmaceutical industry company, from August 2020 to September 2022. He served as Chief Commercial Officer at Angion Biomedica Corp., a public clinical stage biopharmaceutical company, from July 2019 to August 2020. Prior to Angion, Mr. Norrett held roles of increasing responsibility at Aimmune Therapeutics, Inc., a public biopharmaceutical company that was acquired by Nestlé Health Science, between January 2017 and July 2019, most recently serving as Vice President, Marketing, Market Access & Commercial Operations from May 2019 until July 2019. Prior to that, Mr. Norrett was Vice President of Market Access & Commercial Development at ZS Pharma, Inc., a biopharmaceutical company, from October 2014 until January 2017. Mr. Norrett holds a B.S. in Biological Sciences from the University of California, Davis, an M.S. in Biochemistry and Molecular Biology from the University of California, Los Angeles and an M.B.A. from the University of California, Berkeley, Haas School of Business.

Sriram Ryali, M.B.A. has served as our Chief Financial Officer since January 2023. Mr. Ryali served as the Chief Financial Officer of Eiger BioPharmaceuticals, Inc., a public commercial-stage biopharmaceutical company, from December 2018 to January 2023. During this time, Mr. Ryali was responsible for Finance, Investor Relations and other General and Administrative functions as the company initiated multiple late-stage clinical trials and launched its first commercial product in the U.S. and Europe. He served as Vice President, Finance from December 2017 to December 2018, and Senior Director, Finance from 2015 to 2017, at Aimmune Therapeutics, Inc., a public biopharmaceutical company that was acquired by Nestlé Health Science. Prior to that, Mr. Ryali was Senior Director, Financial Planning & Analysis at Jazz Pharmaceuticals, plc., a private pharmaceutical company, in 2015, and held a series of different finance-related positions of increasing responsibility at Onyx Pharmaceuticals, Inc. and Amgen, Inc. from 2004 to 2015. Mr. Ryali holds a B.A. from the University of California, Los Angeles with a double-major in Economics and Microbiology, Immunology, and Molecular Genetics, and an M.B.A. from the UCLA Anderson School of Management.

Margaret Nell Fitzgerald has served as the Chief Legal and Compliance Officer, General Counsel and Secretary of Codexis since October 2022. Ms. Fitzgerald served as General Counsel, Corporate Secretary and Chief Compliance Officer at Allakos, Inc., a public biotechnology company, from January 2022 to October 2022. Prior to Allakos, Ms. Fitzgerald was Associate General Counsel and Privacy Officer at Aimmune Therapeutics, Inc., a public biopharmaceutical company that was acquired by Nestlé Health Science, from 2017 to December 2018. Previously, Ms. Fitzgerald served as Vice President of Corporate Law at ZS Pharma, Inc., a biopharmaceutical company, from 2015 to 2017, where she chaired negotiations, resulting in the $2.7 billion sale of ZS Pharma to AstraZeneca plc, a public pharmaceutical industry company. Prior to ZS Pharma, Ms. Fitzgerald held roles of increasing responsibility at Genentech, Inc. from 2003 to 2012, ultimately serving as Associate General Counsel and Director of Transactional Law. Ms. Fitzgerald also served as an Associate Attorney at Pillsbury Winthrop Shaw Pittman LLP. Ms. Fitzgerald holds a B.A. and an M.A. in History from Stanford University and a J.D. from the University of California, Berkeley.

CORPORATE GOVERNANCE MATTERS

Composition of the Board of Directors

Our bylaws and amended and restated certificate of incorporation ("Certificate of Incorporation") provide that the authorized number of directors may be changed only by resolution of the board of directors. Any additional directorships resulting from an increase in the number of directors will be distributed among the three classes so that, as nearly as possible, each class will consist of one-third of the directors. The division of our board of directors into three classes with staggered three-year terms may delay or prevent a change of our management or a change of control at our Company. Of the members of our board of directors and nominees to serve as members of our board of directors, Drs. Aaker, Martinborough, Moore and Singhvi, Messrs. Dorgan, Smith and Wolf and Ms. Parker are independent directors as defined under the listing standards of The Nasdaq Stock Market LLC ("Nasdaq"). There are no family relationships among any of our directors or executive officers.

Board Leadership Structure

The role of chairman of our board of directors is separate from the Chief Executive Officer position in order to ensure independent leadership of our board of directors. Our board of directors has determined that its structure is appropriate to fulfill its duties effectively and efficiently, so that our Chief Executive Officer can focus on leading our Company, while the chairman can focus on leading the board of directors in overseeing management.

Board Meetings

Our board of directors held 10 meetings during 2022. During 2022, all of our directors attended at least 75% of the combined total of (i) all board of directors meetings held during the period for which each such director was a member of the board of directors and (ii) all meetings of committees of the board of directors of which the director was a member. Each board member is free to suggest the inclusion of items on the agenda for each board meeting. The independent members of our board of directors regularly meets in executive session without management or other employees present. The board of directors encourages its members to attend its annual meetings of stockholders. Mr. Nicols was the only member of our board of directors to attend our 2022 annual meeting of stockholders.

Board Committees

Our board of directors has the following standing committees: an audit committee, a compensation committee, a nominating and corporate governance committee, a science and technology committee and a strategic committee. The composition and responsibilities of the audit committee, the compensation committee, the nominating and corporate governance committee, the science and technology committee and the strategic committee are described below. Members serve on these committees until their resignation or until otherwise determined by our board of directors.

Audit Committee

Our audit committee oversees our corporate accounting and financial reporting process. Among other matters, the audit committee selects the independent registered public accounting firm; evaluates the independent registered public accounting firm's qualifications, independence and performance; determines the engagement of the independent registered public accounting firm; reviews and approves the scope of the annual audit and the audit fees; discusses with management and the independent registered public accounting firm the results of the annual audit and the review of our quarterly consolidated financial statements; approves the retention of the independent registered public accounting firm to perform any proposed permissible non-audit services; monitors the rotation of partners of the independent registered public accounting firm on our engagement team as required by law; reviews our consolidated financial statements and our management's discussion and analysis of financial

condition and results of operations to be included in our annual and quarterly reports to be filed with the SEC; reviews our critical accounting policies and estimates; and annually reviews the audit committee charter and the committee's performance. Additionally, our audit committee reviews the relevant facts and circumstances of any related party transactions and reviews the conflicts of interest and corporate opportunity provisions of our Code of Business Conduct and Ethics. In 2022, the members of our audit committee were Stephen Dilly (beginning February 2022 until August 2022), Byron L. Dorgan (until February 2022 and again from August 2022 until December 2022), H. Stewart Parker (beginning December 2022), David V. Smith and Dennis P. Wolf. The current members of our audit committee are Messrs. Smith and Wolf and Ms. Parker. Mr. Smith serves as the chair of our audit committee. All members of our audit committee meet the requirements for financial literacy under the applicable rules and regulations of the SEC and Nasdaq. Our board of directors has determined that each of Messrs. Smith and Wolf is an audit committee financial expert as defined under the applicable rules of the SEC and has the requisite financial sophistication as defined under applicable Nasdaq rules. Each of the members of our audit committee qualifies as an independent director under the applicable rules and regulations of the SEC and Nasdaq listing standards relating to audit committee independence. Our audit committee has been established in accordance with Section 3(a)(58)(A) of the Exchange Act and operates under a written charter that satisfies the applicable standards of the SEC and Nasdaq. The audit committee charter can be found in the corporate governance section of our website at *www.codexis.com*. The audit committee met five times during 2022.

Compensation Committee

Our compensation committee reviews and recommends policies relating to compensation and benefits of our officers and employees. Our compensation committee reviews and approves corporate goals and objectives relevant to the compensation of our Chief Executive Officer and other executive officers, evaluates the performance of these officers in light of those goals and objectives, and sets the compensation of these officers based on such evaluations. Our compensation committee also reviews and approves the grants of stock options and other equity awards under our stock plans. Our compensation committee reviews and evaluates, at least annually, the performance of the compensation committee and its members, including compliance of the compensation committee with its charter. The compensation committee's charter permits it to delegate any or all of its responsibilities to a subcommittee of compensation committee members, but only to the extent consistent with our Certificate of Incorporation, bylaws, Nasdaq rules and other applicable law. In 2022, the members of our compensation committee were Bryon L. Dorgan (until December 2022), Alison Moore, Rahul Singhvi (beginning October 2022) and Dennis P. Wolf. The current members of our compensation committee are Drs. Moore and Singhvi and Mr. Wolf. Dr. Moore serves as the chair of our compensation committee. Each of the members of our compensation committee is an independent director under the Nasdaq listing standards and an "outside" director under the applicable rules and regulations under the Internal Revenue Code of 1986, as amended, (the "Code") relating to compensation committee independence. Our compensation committee operates under a written charter, which can be found in the corporate governance section of our website at *www.codexis.com*. The compensation committee met six times during 2022.

Nominating and Corporate Governance Committee

Our nominating and corporate governance committee is responsible for making recommendations to our board of directors regarding candidates for directorships and the size and composition of our board of directors. In addition, the nominating and corporate governance committee is responsible for overseeing our corporate governance policies and reporting and making recommendations to our board of directors concerning governance matters. In 2022, the members of our nominating and corporate governance committee were Jennifer Aaker, Byron Dorgan (beginning December 2022), Stephen Dilly (until August 2022) and Patrick Y. Yang. The current members of our nominating and corporate governance committee are Drs. Aaker and Yang (until the Annual Meeting) and Mr. Dorgan. Dr. Yang serves as the chair of our nominating and corporate governance committee and Mr. Dorgan will serve as chair following the Annual Meeting. Each of the members of our nominating and corporate governance committee is an independent director under Nasdaq listing standards relating to nominating

and corporate governance committee independence. The nominating and corporate governance committee operates under a written charter, which can be found in the corporate governance section of our website at *www.codexis.com.* The nominating and corporate governance committee met four times during 2022.

Science and Technology Committee

Our science and technology committee assists our board of directors and management in understanding emerging or evolving scientific or technological issues of importance to the Company, the status and progress of our research and development programs and our intellectual property position. In addition, the science and technology committee advises management on our technology development programs in order to enable us to achieve our long-term strategic technology development objectives. In 2022, the members of our science and technology committee were Stephen Dilly (until December 2022), Esther Martinborough, Alison Moore, Rahul Singhvi (beginning October 2022) and Patrick Y. Yang (until October 2022). The current members of our science and technology committee are Drs. Martinborough, Moore and Singhvi. Dr. Martinborough serves as the chair of our science and technology committee. The science and technology committee operates under a written charter, which can be found in the corporate governance section of our website at *www.codexis.com.* The science and technology committee met four times during 2022.

Strategic Committee

Our strategic committee assists our board of directors by making recommendations to our board of directors on the Company's strategic direction and objectives and serve as a liaison between the board of directors and management. In 2022, the members of our strategic committee were Esther Martinborough, H. Stewart Parker (beginning December 2022), David V. Smith and Patrick Y. Yang (until December 2022). The current members of our strategic committee are Dr. Martinborough, Ms. Parker and Mr. Smith. Mr. Smith serves as the chair of our strategic committee. The strategic committee operates under a written charter, which can be found in the corporate governance section of our website at *www.codexis.com.* The strategic committee met two times during 2022.

Risk Oversight

Our board of directors generally oversees corporate risk in its review and deliberations relating to our activities, including financial and strategic risk relevant to our operations. In addition, our board of directors regularly reviews information regarding our credit, liquidity and operations, as well as the risks associated with each. The audit committee oversees management of financial risks. Our compensation committee is responsible for overseeing the management of risks relating to our executive and other compensation plans and arrangements and employee retention. The nominating and corporate governance committee manages risks associated with the independence of our board of directors and potential conflicts of interest. While each committee is responsible for evaluating certain risks and overseeing the management of such risks, the entire board of directors is regularly informed through committee reports about such risks. Our board of directors believes that administration of its risk oversight function has not affected the board of directors' leadership structure.

Risk Assessment and Compensation Practices

Our management assesses and discusses with our compensation committee our compensation policies and practices for our employees as they relate to our risk management and, based upon this assessment, we believe that any risks arising from such policies and practices are not reasonably likely to have a material adverse effect on us in the future.

Our employees' base salaries are fixed in amount and thus we do not believe that they encourage excessive risk-taking. While performance-based cash bonuses focus on achievement of annual goals, which may encourage the taking annual risks at the expense of long-term results, we believe that our compensation policies help mitigate

this risk and that our performance-based cash bonuses are limited, representing a small portion of the total compensation opportunities available to most employees. We also believe that our performance-based cash bonuses appropriately balance risk and the desire to focus our employees on specific short-term goals important to our success, and do not encourage unnecessary or excessive risk-taking.

A portion of the compensation provided to our eligible employees is in the form of long-term equity-based incentives that we believe are important to help further align our employees' interests with those of our stockholders. We do not believe that these equity-based incentives encourage unnecessary or excessive risk taking because their ultimate value is tied to our stock price.

Director Nominations and Board Diversity

Our nominating and corporate governance committee is responsible for reviewing with our board of directors, on an annual basis, the appropriate characteristics, skills and experience required for the board of directors as a whole and its individual members. In evaluating the suitability of individual candidates (both new candidates and current members), the nominating and corporate governance committee, in recommending candidates for election, and the board of directors, in approving (and, in the case of vacancies, appointing) such candidates, takes into account many factors, including: personal and professional integrity, ethics and values; experience in corporate management, such as serving as an officer or former officer of a publicly held company and a general understanding of marketing, finance and other elements relevant to the success of a publicly-traded company in today's business environment; experience in Codexis' industry and relevant social policy concerns; experience as a board member of another publicly held company; academic expertise in an area of Codexis' operations; practical and mature business judgment, including the ability to make independent analytical inquiries; and diversity of business or career experience relevant to the success of Codexis, such as public policy and government relations. The board of directors evaluates each individual in the context of the board of directors as a whole, with the objective of assembling a group that can best maximize the success of the business and represent stockholder interests through the exercise of sound judgment using its diversity of experience in these various areas.

The nominating and corporate governance committee may decide to retain an executive search firm to identify director candidates, and if so, will identify the search firm and approve the search firm's fees and other retention terms and will specify for the search firm the criteria to use in identifying potential candidates, consistent with the director qualification criteria described above. The nominating and corporate governance committee will also consider director candidates recommended by stockholders. For a stockholder to make any nomination for election to the board of directors at an annual meeting, the stockholder must provide notice to Codexis, which notice must be delivered to, or mailed and received at, Codexis' principal executive offices not less than 90 days and not more than 120 days prior to the one-year anniversary of the preceding year's annual meeting; provided, that if the date of the annual meeting is more than 30 days before or more than 60 days after such anniversary date, the stockholder's notice must be delivered, or mailed and received, not later than 90 days prior to the date of the annual meeting or, if later, the 10th day following the date on which public disclosure of the date of such annual meeting is made. Further updates and supplements to such notice may be required at the times and in the forms required under our bylaws. As set forth in our bylaws, in addition to the specific information required by Rule 14a-19(b) under the Exchange Act, submissions must include the name and address of the proposed nominee and the nominating person, information regarding the proposed nominee that is required to be disclosed in a proxy statement or other filings in a contested election pursuant to Section 14(a) under the Exchange Act, information regarding the proposed nominee's and the nominating person's indirect and direct interests in shares of our common stock, information regarding the relationships between the proposed nominee and the nominating person (and such nominating person's affiliates and those with whom the nominating person is acting in concert), and a completed and signed questionnaire, representation and agreement of the proposed nominee. Our bylaws also specify further requirements as to the form and content of a stockholder's notice. We recommend that any stockholder wishing to make a nomination for director review a copy of our bylaws, which are available, without charge, upon request to our Secretary, at 200 Penobscot Drive, Redwood City, California 94063. Candidates

recommended by our stockholders are evaluated in the same manner as candidates identified by a member of the nominating and corporate governance committee.

Director Demographic Matrix

The demographic information presented below is based on voluntary self-identification by each nominee or director. Additional biographical information on each nominee is set out under "Director Nominees" and "Directors Not Standing for Election."

	Jennifer Aaker	Stephen Dilly	Byron Dorgan	Esther Martinborough	Alison Moore	Rahul Singhvi	Stewart Parker	David Smith	Dennis Wolf
Gender	Female	Male	Male	Female	Female	Male	Female	Male	Male
LGBTQ+	*	No	No	No	No	No	No	No	No
Race/ Ethnicity	*	White	White	Black	White	Asian	White	White	White

* Preferred not to answer.

Compensation Committee Interlocks and Insider Participation

During 2022, Drs. Moore and Singhvi and Messrs. Dorgan and Wolf served as members of our compensation committee. None of the members of our compensation committee in 2022 nor any of the current members of the compensation committee, has at any time during the prior three years been an officer or employee of Codexis. None of our executive officers currently serves, or in the prior three years has served, as a member of the board of directors or compensation committee of any entity that has one or more executive officers serving on our board of directors or compensation committee.

Communication with the Board

Interested persons, including stockholders, may communicate with our board of directors by sending a letter to our Secretary at our principal executive offices at 200 Penobscot Drive, Redwood City, California 94063. Our Secretary will submit all correspondence to the chairman of the board of directors and to any specific director to whom the correspondence is directed.

Code of Business Conduct and Ethics

Our board of directors has adopted a code of business conduct and ethics that applies to all of our employees, officers and directors, including those officers responsible for financial reporting. Our code of business conduct and ethics can be found in the corporate governance section of our website at *www.codexis.com*. Please direct all requests to our Secretary at our principal executive offices at Codexis, Inc., 200 Penobscot Drive, Redwood City, California 94063. We intend to disclose future amendments to certain provisions of our code of business conduct and ethics, or waivers of such provisions, applicable to our directors and officers, on our website identified above.

Derivatives Trading, Hedging and Pledging Policies

Our Insider Trading Compliance Program provides that no employee, officer, director, consultant or contractor, or any family member or member of the same household of any such person, should directly or indirectly participate in transactions involving trading activities which by their aggressive or speculative nature may give rise to an appearance of impropriety, including short sales and the purchase or writing of put or call options. In addition, our Insider Trading Compliance Program specifically prohibits short sales, put and call options and other hedging transactions under 10b5-1 trading plans and provides that no employee, officer or director may pledge Company securities as collateral to secure loans. This prohibition means, among other things, that these individuals may not hold Company securities in a "margin" account, which would allow the individual to borrow against their holdings to buy securities.

Director Compensation

Our non-employee director compensation policy provides for the following annual cash compensation to our non-employee directors: an annual cash retainer of $50,000 for their service as members of the board of directors, other than the chairman of the board of directors, who receives an annual cash retainer of $110,000; an additional annual cash retainer of $20,000 per year to members of our compensation committee, other than the chairperson of our compensation committee, who receives an additional annual cash retainer of $30,000 per year; an additional annual cash retainer of $10,000 per year to members of our nominating and corporate governance committee, other than the chairperson of our nominating and corporate governance committee, who receives an additional annual cash retainer of $15,000 per year; an additional annual cash retainer of $20,000 per year to members of our audit committee, other than the chairperson of our audit committee, who receives an additional annual cash retainer of $30,000 per year; an additional annual cash retainer of $10,000 per year to members of the science and technology committee, other than the chairperson of our science and technology committee, who receives an additional cash retainer of $15,000; and an additional annual cash retainer of $10,000 per year to members of our strategic committee, other than the chairperson of our strategic committee, who receives an additional cash retainer of $15,000 per year. These cash retainers are paid quarterly in arrears.

In addition to the annual cash retainers, our non-employee director compensation policy provides that, upon election to our board of directors, each non-employee director is automatically granted an initial restricted stock award covering a number of shares of our common stock equal to $200,000 divided by the per share closing trading price of our common stock on the date of grant. Such initial restricted stock awards vest as to one-third of the total number of shares subject to the award on the first anniversary of the date the director commences service on our board of directors, with the remainder of the award vesting and becoming exercisable at a rate of one-third of the total number of shares subject to the award each year thereafter, subject to the director's continued service to the Company on each applicable vesting date. In addition, the policy provides that, on the date of each annual meeting of stockholders, each non-employee director is granted a restricted stock award covering a number of shares of our common stock equal to $100,000 divided by the per share closing trading price of our common stock on the date of grant. Such annual restricted stock awards vest as to all of the shares subject to the award on the earlier of the first anniversary of the date of grant or the next annual stockholder meeting, subject to the director's continued service to the Company on such vesting date.

The following table sets forth information regarding compensation earned by our non-employee directors who served during the year ended December 31, 2022. The compensation Dr. Dilly received as a non-employee director prior to being appointed our President and Chief Executive Officer and the compensation Mr. Nicols received during 2022 is reported below in "Executive Compensation – Compensation Tables – 2022 Summary Compensation Table."

2022 Director Compensation Table

Name	Fees Earned or Paid in Cash ($)	Stock Awards ($) [1]	Total ($)
Jennifer Aaker, Ph.D.	77,019	99,992	177,011
Byron L. Dorgan	121,668	99,992	221,659
Esther Martinborough, Ph.D.	70,217	99,992	170,209
Alison Moore, Ph.D.	90,000	99,992	189,992
H. Stewart Parker [2]	3,478	199,994	203,472
Rahul Singhvi, Sc.D. [3]	17,962	199,994	217,956
David V. Smith	95,000	99,992	194,992
Dennis P. Wolf	90,000	99,992	189,992
Patrick Y. Yang, Ph.D.	75,621	99,992	175,612

(1) The amounts reported in this column reflect the grant date fair value of stock awards granted during the year ended December 31, 2022 calculated in accordance with FASB ASC Topic 718. The valuation assumptions used in determining such amounts are described in Note 9 to our consolidated financial statements included in our Annual Report on Form 10-K for the year ended December 31, 2022. The following table sets forth the number of shares of restricted stock held by each non-employee director as of December 31, 2022. None of our non-employee directors held any stock options as of December 31, 2022.

Name	Shares of Restricted Stock (#)
Jennifer Aaker, Ph.D.	16,453
Byron L. Dorgan	11,273
Esther Martinborough, Ph.D.	16,114
Alison Moore, Ph.D.	17,241
H. Stewart Parker (2)	37,878
Rahul Singhvi, Sc.D. (3)	31,347
David V. Smith	11,273
Dennis P. Wolf	11,273
Patrick Y. Yang, Ph.D.	11,273

(2) Ms. Parker was appointed to our board of directors effective December 16, 2022.

(3) Dr. Singhvi was appointed to our board of directors effective September 28, 2022.

PROPOSAL 2

RATIFICATION OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

The audit committee of our board of directors has selected BDO as our independent registered public accounting firm for the year ending December 31, 2023, and has further directed that management submit the selection of our independent registered public accounting firm for ratification by the stockholders at the Annual Meeting. BDO has audited our financial statements since the year ended December 31, 2013. A representative of BDO is expected to be present at the Annual Meeting and will have an opportunity to make a statement if he or she so desires and will be available to respond to appropriate questions.

Stockholder ratification of the selection of BDO as our independent registered public accounting firm is not required by our bylaws or otherwise. However, the board of directors is submitting the selection of BDO to the stockholders for ratification as a matter of good corporate practice. If the stockholders fail to ratify the selection, the audit committee will reconsider whether or not to retain BDO. Even if the selection is ratified, the audit committee in its discretion may direct the appointment of a different independent registered public accounting firm at any time during the year if the audit committee determines that such a change would be in our and our stockholders' best interests.

Principal Accounting Fees and Services

BDO provided audit, audit-related, tax and other services to us during the years ended December 31, 2022 and 2021 as follows:

Type of Fees	Fiscal 2022	Fiscal 2021
Audit Fees	$1,300,210	$1,210,975
Audit-Related Fees	—	—
Tax Fees	—	—
All Other Fees	—	—
Total	$1,300,210	$1,210,975

Audit Fees

This category includes fees associated with professional services rendered for the audit of our annual financial statements and the effectiveness of our internal control over financial reporting, issuance of consents in connection with registration statements, providing comfort letters in connection with Codexis' funding transactions and for the review of our interim financial statements included in our Quarterly Reports on Form 10-Q.

Audit-Related Fees

There were no fees for services rendered by BDO that fall into the classification of audit-related fees for the years ended December 31, 2022 and 2021.

Tax Fees

There were no fees for services rendered by BDO that fall into the classification of tax fees for the years ended December 31, 2022 and 2021.

All Other Fees

There were no fees for services rendered by BDO that fall into the classification of All Other Fees for the years ended December 31, 2022 and 2021.

Pre-Approval Policies and Procedures

Before an independent registered public accounting firm is engaged by Codexis or its subsidiaries to render audit or non-audit services, our audit committee must review the terms of the proposed engagement and pre-approve the engagement. Our audit committee may delegate authority to a member of the audit committee to provide such pre-approvals for audit or non-audit services, provided that such person will be required to report all such pre-approvals to the full audit committee at its next scheduled meeting. All fees paid to BDO for audit and non-audit services provided during years 2022 and 2021 were pre-approved by the audit committee in accordance with the policy described above.

Board Recommendation

THE BOARD OF DIRECTORS RECOMMENDS A VOTE "FOR" THE RATIFICATION OF BDO USA, LLP AS OUR INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM FOR THE YEAR ENDING DECEMBER 31, 2023.

PROPOSAL 3

NON-BINDING, ADVISORY VOTE ON EXECUTIVE COMPENSATION

The Dodd-Frank Wall Street Reform and Consumer Protection Act (the "Dodd-Frank Reform Act") added Section 14A to the Securities Exchange Act of 1934, as amended, which requires that we provide our stockholders with the opportunity to vote to approve, on a non-binding, advisory basis, the compensation of our named executive officers as disclosed in this proxy statement in accordance with the compensation disclosure rules of the SEC. Accordingly, our board of directors has approved the submission of the following resolution to our stockholders for approval at the Annual Meeting:

> "RESOLVED, that the compensation paid to Codexis, Inc.'s named executive officers, as disclosed pursuant to Item 402 of Regulation S-K, including the Compensation Discussion and Analysis, compensation tables and narrative discussion, is hereby APPROVED."

As described in greater detail under the heading "Compensation Discussion and Analysis," we seek to closely align the interests of our named executive officers with the interests of our stockholders. Our executive compensation program is designed to attract talented individuals to lead, manage and operate all aspects of our business and reward and retain those individuals who continue to meet our high expectations over time. Our executive compensation program combines short-term and long-term components, cash and equity, and fixed and contingent payments in the amounts and proportions that we believe are most appropriate to incentivize, retain and reward our named executive officers for achieving our objectives. Our executive compensation program also is intended to make us competitive in our industry, where there is considerable competition for talented executives. For more information on our executive compensation program, please refer to the "Compensation Discussion and Analysis" section of this proxy statement.

This vote is advisory, which means that the vote on executive compensation is not binding on Codexis, our board of directors or the compensation committee of our board of directors. Although the outcome of this advisory vote on the compensation of our named executive officers is non-binding, our compensation committee and our board of directors will review and consider the outcome of this vote when making future compensation decisions for our named executive officers. The vote on this resolution is not intended to address any specific element of compensation, but rather relates to the overall compensation of our named executive officers, as described in this proxy statement in accordance with the compensation disclosure rules of the SEC. Unless our board of directors changes its policy with respect to the frequency of the advisory vote on executive compensation, including in response to the outcome of the vote on Proposal 4, the next such vote will be held at our next annual meeting of stockholders.

Board Recommendation

THE BOARD OF DIRECTORS RECOMMENDS A VOTE "FOR" THE APPROVAL OF THE NON-BINDING, ADVISORY RESOLUTION ON THE COMPENSATION OF OUR NAMED EXECUTIVE OFFICERS.

PROPOSAL 4

NON-BINDING, ADVISORY VOTE ON THE FREQUENCY OF FUTURE ADVISORY VOTES BY STOCKHOLDERS ON THE COMPENSATION OF OUR NAMED EXECUTIVE OFFICERS

In accordance with the Dodd-Frank Reform Act, we are seeking a non-binding, advisory vote as to the frequency with which stockholders would have an opportunity to provide an advisory vote to approve the compensation of our named executive officers. Stockholders have the option of voting for future advisory votes on the compensation of our named executive officers to be held at a frequency of every one, two or three years, or abstaining.

While we will continue to monitor developments in this area, our board of directors believes it is appropriate and desirable to seek an advisory "Say-on-Pay" vote from stockholders every year. We believe that this frequency is appropriate because it will enable our stockholders to vote, on an advisory basis, on the most recent executive compensation information that is presented in each of our proxy statements, leading to a more meaningful and coherent communication between the Company and our stockholders on the compensation of our named executive officers.

Our board of directors' current plan is further based on the premise that this recommendation could be modified if it becomes apparent that an annual frequency vote is not meaningful, is burdensome or is more frequent than indicated by best corporate governance practices.

Based on the factors discussed, our board of directors recommends that future non-binding, advisory votes to approve the compensation of our named executive officers occur every year until the next advisory vote on the frequency of advisory votes to approve the compensation of our named executive officers. Stockholders are not being asked to approve or disapprove our board of director's recommendation, but rather to indicate their choice among the following frequency options: one year, two years or three years, or to abstain from voting.

This vote is advisory, and therefore not binding on us, the compensation committee or the board of directors. However, we value the opinions of our stockholders and will take into account the outcome of the vote when considering the frequency of submitting to stockholders a resolution to afford stockholders the opportunity to vote on executive compensation. If none of the frequency alternatives—one year, two years or three years—receives the affirmative vote of a majority of the shares present in person by attendance online or represented by proxy at the Annual Meeting and entitled to vote on the proposal, we will consider the highest number of votes cast by stockholders to be the frequency that has been selected by stockholders.

Board Recommendation

THE BOARD OF DIRECTORS RECOMMENDS THAT STOCKHOLDERS VOTE FOR FUTURE ADVISORY VOTES ON THE COMPENSATION OF OUR NAMED EXECUTIVE OFFICERS TO BE HELD AT A FREQUENCY OF "EVERY ONE YEAR."

PROPOSAL 5

APPROVAL OF AN AMENDMENT TO OUR CERTIFICATE OF INCORPORATION TO INCREASE THE NUMBER OF AUTHORIZED SHARES OF OUR COMMON STOCK

Overview of Amendment

Our Certificate of Incorporation currently authorizes the issuance of 100,000,000 shares of common stock. In April 2023, our board of directors adopted a resolution to amend the Certificate of Incorporation, subject to stockholder approval, to increase the number of authorized shares of our common stock to 200,000,000 shares (the "Share Increase Amendment"). The additional 100,000,000 shares of common stock authorized for issuance pursuant to the proposed Share Increase Amendment would be part of the existing class of common stock and, if and when issued, would have the same rights and privileges as the shares of common stock presently issued and outstanding. The holders of common stock are not entitled to preemptive rights or cumulative voting.

The Share Increase Amendment will not affect the number of authorized shares of preferred stock of the Company, par value $0.0001 per share (the "Preferred Stock"), which is 5,000,000 shares. There are currently no issued and outstanding shares of Preferred Stock.

Reasons for the Increase in Authorized Shares

As of the Record Date, 66,767,717 shares of our common stock were issued and outstanding out of the 100,000,000 shares that we are currently authorized to issue. In addition, as of the Record Date, an aggregate of approximately shares of common stock are issuable, including: (i) 5,777,166 shares of common stock issuable upon the exercise of outstanding stock options having a weighted-average exercise price of approximately $7.94 per share; (ii) 1,252,142 shares of common stock issuable upon vesting of outstanding restricted stock units; (iii) up to 307,346 shares of common stock issuable upon the vesting of outstanding performance stock units; (iv) up to 1,813,947 shares of common stock issuable pursuant to outstanding performance-based options having a weighted-average exercise price of approximately $11.89 per share; (v) 803,328 shares of common stock reserved for issuance pursuant to future awards under the 2019 Plan; and (v) 1,325,729 shares of common stock reserved for issuance pursuant to future awards under the Codexis, Inc. 2022 Employment Inducement Plan. In addition to the foregoing, if (a) Proposal 6 is approved, an additional 2,000,000 shares will be issuable pursuant to the Codexis, Inc. 2023 Employee Stock Purchase Plan and if (b) Proposal 7 is approved, an additional 8,000,000 shares will be issuable pursuant to the 2019 Plan.

Our board of directors believes it is in the best interests of the Company and our stockholders to increase our authorized shares of common stock so that we have shares of common stock available to provide additional flexibility to promptly and appropriately use our common stock for business and financial purposes in the future, as well as to have sufficient shares available to provide appropriate equity incentives for our employees and other eligible service providers. The additional shares of common stock, if approved, may be used for various purposes without further stockholder approval. These purposes may include: raising capital; providing equity incentives to employees, officers, directors, consultants and/or advisers; establishing collaborative or partnering arrangements with other companies; expanding our business through the acquisition of other businesses, products or technologies; and other purposes.

For example, we may decide to raise additional capital to fund our operations, research and development expenses and commercially launch new novel biotherapeutics, if approved, or to make other strategic transactions. In light of our capital needs, we regularly consider fund raising opportunities and may decide, from time to time, to raise capital based on various factors, including market conditions and our plans of operation.

In this regard, if the board of directors determines that raising additional capital through issuing the additional shares of our common stock is desirable, we want to be able to act quickly if market conditions are favorable.

Given the lack of sufficient available unissued and unreserved authorized shares of our common stock, if this proposal is not approved, we will not be able to raise future capital without first obtaining stockholder approval for an increase in the number of authorized shares of common stock. The cost, prior notice requirements and delay involved in obtaining stockholder approval at the time that corporate action may be necessary or desirable could completely eliminate our ability to opportunistically capitalize on favorable market windows, which could delay or preclude our ability to advance our development and potential commercialization efforts.

In addition, our success depends in part on our continued ability to attract, retain and motivate highly qualified management and clinical personnel, and if this Share Increase Amendment is not approved by our stockholders, the lack of unissued and unreserved authorized shares of common stock to provide future equity incentive opportunities that our board of directors and compensation committee deem appropriate could adversely impact our ability to achieve these goals.

In summary, if our stockholders do not approve this proposal, we may not be able to access the capital markets; continue to conduct the research and development and clinical and regulatory activities necessary to advance our biotherapeutic candidates and performance enzymes; complete future corporate collaborations and partnerships; attract, retain and motivate employees, officers, directors, consultants and/or advisers; and pursue other business opportunities integral to our growth and success, all of which could severely harm our business and our prospects.

Effects of Increase

The Share Increase Amendment will not have any immediate effect on the rights of existing stockholders. However, our board of directors will have the authority to issue authorized common stock without requiring future stockholder approval of such issuances, except as may be required by applicable law or Nasdaq rules. Future issuances of common stock or securities convertible into or exchangeable for common stock could have a dilutive effect on our earnings per share, book value per share and the voting power and interest of our current stockholders.

Our board of directors has not proposed the Share Increase Amendment with the intention of discouraging tender offers or takeover attempts of the Company. However, the availability of additional authorized shares for issuance could, under certain circumstances, discourage or make more difficult efforts to obtain control of our Company. This proposal is not being presented with the intent that it be used to prevent or discourage any acquisition attempt, but nothing would prevent our board of directors from taking any appropriate actions not inconsistent with its fiduciary duties. We do not have a poison pill plan and have not made any non-shareholder approved repricings of our equity awards.

The Proposed Amendment

If our stockholders approve this proposal, then the first sentence of Article IV, Section A of our Certificate of Incorporation will be deleted and replaced in its entirety to read as follows:

> "This Corporation is authorized to issue two classes of stock to be designated, respectively, "Common Stock" and "Preferred Stock." The total number of shares that the Corporation is authorized to issue is two hundred five million (205,000,000) shares, two hundred million (200,000,000) shares of which shall be Common Stock and five million (5,000,000) shares of which shall be Preferred Stock. The Common Stock shall have a par value of one-hundredth of one cent ($0.0001) per share and the Preferred Stock shall have a par value of one-hundredth of one cent ($0.0001) per share."

Vote Required

The affirmative vote of a majority of our issued and outstanding shares of common stock entitled to vote is required to approve this proposal. If the Share Increase Amendment is approved by stockholders, all other

sections of the Certificate of Incorporation would be maintained in their current form. The Share Increase Amendment would become effective upon the filing of a certificate of amendment to our Certificate of Incorporation with the Secretary of State of the State of Delaware, which the Company would do promptly after the Annual Meeting. The form of the certificate of amendment is attached hereto as Appendix A. In the event that the Share Increase Amendment is not approved by our stockholders at the Annual Meeting, the current Certificate of Incorporation would remain in effect in its entirety. Our board of directors reserves the right, notwithstanding stockholder approval of the Share Increase Amendment and without further action by our stockholders, not to proceed with the Share Increase Amendment at any time before it becomes effective. Abstentions will have the same effect as voting against this proposal.

Dissenters' Rights of Appraisal

Under Delaware law, stockholders are not entitled to appraisal rights with respect to the Share Increase Amendment, and we will not independently provide our stockholders with any such right.

Board Recommendation

THE BOARD OF DIRECTORS RECOMMENDS THAT STOCKHOLDERS VOTE "FOR" THE APPROVAL OF THE AMENDMENT OF THE COMPANY'S AMENDED AND RESTATED CERTIFICATE OF INCORPORATION TO INCREASE THE NUMBER OF AUTHORIZED SHARES OF COMMON STOCK OF THE COMPANY FROM 100,000,000 to 200,000,000.

PROPOSAL 6

APPROVAL OF THE CODEXIS, INC. 2023 EMPLOYEE STOCK PURCHASE PLAN

Overview

Our stockholders are being asked to approve the Codexis, Inc. 2023 Employee Stock Purchase Plan (the "ESPP") and the material terms thereunder. The board of directors approved the ESPP, subject to stockholder approval at the Annual Meeting. The ESPP will become effective upon approval by our stockholders.

The ESPP is described in more detail below. A copy of the ESPP is included in Appendix B to this proxy statement.

The ESPP

The ESPP is designed to allow eligible employees of the Company to purchase shares of the our common stock with their accumulated payroll deductions. The ESPP is divided into two components: the "Section 423 Component" and the "Non-Section 423 Component." The Section 423 Component is intended to qualify under Section 423 of the Code. The Non-Section 423 Component is not intended to qualify under Section 423 of the Code and will be used to grant stock options to certain non-U.S. employees, eligible consultants and certain U.S. employees who are employed by certain of our subsidiaries that do not participate in the Section 423 Component. The material terms of the ESPP are summarized below. The purpose of the ESPP is to assist such employees (and certain eligible consultants who may participate in the Non-section 423 Component only) in acquiring a stock ownership interest in the Company, to help such service providers provide for their future security and to encourage such service providers to remain in the service of Codexis. The board of directors believes that equity awards are necessary to remain competitive in its industry and are essential to recruiting and retaining the highly qualified employees who help us meet our goals.

Summary of the ESPP

This section summarizes certain principal features of the ESPP. The summary is qualified in its entirety by reference to the complete text of the ESPP, which is attached hereto as Appendix B.

Administration

Subject to the terms and conditions of the ESPP, the compensation committee will administer the ESPP. The compensation committee can delegate administrative tasks under the ESPP to the services of an agent and/or employees to assist in the administration of the ESPP. The administrator will have the discretionary authority to administer and interpret the ESPP. Interpretations and constructions of the administrator of any provision of the ESPP or of any rights thereunder will be conclusive and binding on all persons. We will bear all expenses and liabilities incurred by the ESPP administration.

Shares Available for Awards

The maximum number of shares of our common stock which will be authorized for sale under the ESPP is 2,000,000 shares of our common stock. The shares reserved for issuance under the ESPP may be authorized but unissued shares or reacquired shares.

Eligibility

Employees eligible to participate in the ESPP for a given offering period generally include employees who are employed by us or one of our designated subsidiaries on the first day of the offering period, or the enrollment

date. Our employees (and, if applicable, any employees of our subsidiaries) who customarily work less than five months in a calendar year or are customarily scheduled to work less than 20 hours per week will not be eligible to participate in the ESPP. Finally, an employee who owns (or is deemed to own through attribution) 5% or more of the combined voting power or value of all our classes of stock or of one of our subsidiaries will not be allowed to participate in the ESPP.

A consultant may be designated by the compensation committee to participate in the Non-Section 423 Component if the consultant is engaged by us or one of our designated subsidiaries, including, without limitation, through a professional employer organization, on a given enrollment date for an offering period. In no event shall a consultant be eligible to participate in the Section 423 Component.

As of April 20, 2023, we had approximately 239 full-time employees who could have been eligible to participate in the Section 423 Component and 36 consultants who, if designated by the compensation committee, could have been eligible to participate in the Non-Section 423 Component.

Participation

Employees will enroll under the ESPP by completing a payroll deduction form permitting the deduction from their compensation of at least 1% of their compensation but not more than 15% of their compensation. Such payroll deductions may be expressed as either a whole number percentage or a fixed dollar amount, and the accumulated deductions will be applied to the purchase of shares on each purchase date. Eligible consultants may become a participant in the Non-Section 423 Component by completing a fee deduction authorization.

Offering

Under the ESPP, participants are offered the option to purchase shares of our common stock at a discount during a series of successive offering periods, the duration and timing of which will be determined by the ESPP administrator. However, in no event may an offering period be longer than 27 months in length. The offering periods are each comprised of one or more equal length or shorter purchase periods. Initially, each offering period will be 24 months and comprised of four six-month purchase periods. If the fair market value of a share of common stock on any exercise date (other than the final scheduled exercise date of an offering period) is lower than the fair market value of a share of common stock on the grant date of an offering period, then the offering period will automatically terminate, and each participant will automatically be enrolled in the next offering period.

The option purchase price will be the lower of 85% of the closing trading price per share of our common stock on the first trading date of an offering period in which a participant is enrolled or 85% of the closing trading price per share on the purchase date. Our closing trading price of our common stock as of April 20, 2023 was $4.10.

Under the Section 423 Component, participants may not purchase shares of our common stock at a rate which exceeds $25,000 of fair market value of our stock (determined at the time the option to purchase shares under the ESPP is granted) for each calendar year in which the option is outstanding (as determined in accordance with Section 423 of the Code).

Unless a participant has previously canceled his or her participation in the ESPP before the purchase date, the participant will be deemed to have exercised his or her option in full as of each purchase date. Upon exercise, the participant will purchase the number of whole shares that his or her accumulated payroll deductions will buy at the option purchase price, subject to the participation limitations listed above.

A participant may cancel his or her payroll deduction authorization at any time prior to the end of the offering period. Upon cancellation, the participant will have the option to either (i) receive a refund of the participant's account balance in cash without interest or (ii) exercise the participant's option for the current offering period for

the maximum number of shares of common stock on the applicable purchase date, with the remaining account balance refunded in cash without interest. Following at least one payroll deduction, a participant may also decrease (but not increase) his or her payroll deduction authorization once during any offering period. If a participant wants to increase or decrease the rate of payroll withholding, he or she may do so effective for the next offering period by submitting a new form before the offering period for which such change is to be effective.

A participant may not assign, transfer, pledge or otherwise dispose of (other than by will or the laws of descent and distribution) payroll deductions credited to a participant's account or any rights to exercise an option or to receive shares of our common stock under the ESPP, and during a participant's lifetime, options in the ESPP shall be exercisable only by such participant. Any such attempt at assignment, transfer, pledge or other disposition will not be given effect.

Adjustments

In the event of any increase or decrease in the number of issued shares of our common stock resulting from a stock split, reverse stock split, stock dividend, combination or reclassification of our common stock, or any other increase or decrease in the number of shares of our common stock effected without receipt of consideration by us, we will proportionately adjust the aggregate number of shares of our common stock offered under the ESPP, the number and price of shares which any participant has elected to purchase under the ESPP and the maximum number of shares which a participant may elect to purchase in any single offering period. If there is a proposal to dissolve or liquidate us, then the ESPP will terminate immediately prior to the consummation of such proposed dissolution or liquidation, and any offering period then in progress will be shortened by setting a new purchase date to take place before the date of our dissolution or liquidation. We will notify each participant of such change in writing at least ten business days prior to the new exercise date. If we undergo a merger with or into another corporation or sell all or substantially all of our assets, each outstanding option will be assumed or an equivalent option substituted by the successor corporation or the parent or subsidiary of the successor corporation. If the successor corporation refuses to assume the outstanding options or substitute equivalent options, then any offering period then in progress will be shortened by setting a new purchase date to take place before the date of our proposed sale or merger. We will notify each participant of such change in writing at least ten business days prior to the new exercise date.

Amendment and Termination

Our board of directors may amend, suspend or terminate the ESPP at any time. However, our board of directors may not amend the ESPP without obtaining shareholder approval within 12 months before or after such amendment to the extent required by applicable laws.

Material United States Federal Income Tax Consequences

The following is a general summary under current law of the principal United States federal income tax consequences related to the purchase of shares under the ESPP. This summary deals with the general federal income tax principles that apply and is provided only for general information. Certain taxes, such as state, local and foreign income taxes and federal employment taxes, are not discussed. As such, tax consequences for employees participating in the Non-Section 423 Component of the ESPP are not discussed. This summary is not intended as tax advice to participants, who should consult their own tax advisors.

The Section 423 Component of the ESPP, and the right of participants to make purchases thereunder, is intended to qualify under the provisions of Section 423 of the Code. Under the applicable Code provisions, no income will be taxable to a participant until the sale or other disposition of the shares purchased under the ESPP. This means that an eligible employee will not recognize taxable income on the date the employee is granted an option under the ESPP. In addition, the employee will not recognize taxable income upon the purchase of shares. Upon such

sale or disposition, the participant generally will be subject to tax in an amount that depends upon the length of time such shares are held by the participant prior to disposing of them. If the shares are sold or disposed of more than two years from the date of grant and more than one year from the date of purchase, or if the participant dies while holding the shares, the participant (or his or her estate) will recognize ordinary income measured as the lesser of (i) the excess of the fair market value of the shares at the time of such sale or disposition (or death) over the purchase price or (ii) an amount equal to the applicable discount from the fair market value of the shares as of the date of grant. Any additional gain will be treated as long-term capital gain. If the shares are held for the holding periods described above but are sold for a price that is less than the purchase price, there is no ordinary income and the participating employee has a long-term capital loss for the difference between the sale price and the purchase price.

If the shares are sold or otherwise disposed of before the expiration of the holding periods described above, the participant will recognize ordinary income generally measured as the excess of the fair market value of the shares on the date the shares are purchased over the purchase price and Codexis will be entitled to a tax deduction for compensation expense in the amount of ordinary income recognized by the employee. Any additional gain or loss on such sale or disposition will be long-term or short-term capital gain or loss, depending on how long the shares were held following the date they were purchased by the participant prior to disposing of them. If the shares are sold or otherwise disposed of before the expiration of the holding periods described above but are sold for a price that is less than the purchase price, the participant will recognize ordinary income equal to the excess of the fair market value of the shares on the date of purchase over the purchase price (and Codexis will be entitled to a corresponding deduction), but the participant generally will be able to report a capital loss equal to the difference between the sales price of the shares and the fair market value of the shares on the date of purchase.

New Plan Benefits

Because the number of shares that may be purchased under the ESPP will depend on each employee's voluntary election to participate and on the fair market value of our common stock at various future dates, the actual number of shares that may be purchased by any individual cannot be determined in advance. No shares of our common stock have been issued under the ESPP as it is not yet effective.

Vote Required

To be approved, this proposal must receive a "For" vote from the holders of a majority of the shares represented in person or by proxy at the Annual Meeting and entitled to vote on the proposal. Abstentions and broker non-votes will have no effect on the proposal.

Board Recommendation

THE BOARD OF DIRECTORS RECOMMENDS THAT STOCKHOLDERS VOTE "FOR" THE APPROVAL OF THE CODEXIS, INC. 2023 EMPLOYEE STOCK PURCHASE PLAN.

PROPOSAL 7

APPROVAL OF AN AMENDMENT TO OUR 2019 INCENTIVE AWARD PLAN

Overview

We are asking our stockholders to approve an amendment to the 2019 Plan (the "2019 Plan") to increase the number of shares authorized and available for issuance under the 2019 Plan by 8,000,000 shares, resulting in an increase to the total shares authorized and available for issuance under the 2019 Plan from 7,897,144 shares to 15,897,144 (the "2019 Plan Amendment"). Our Board, upon recommendation of the compensation committee, approved the increase by 8,000,000 shares of the shares authorized for issuance in April 2023, subject to stockholder approval. The 2019 Plan was originally adopted by our Board in April 2019 and approved by stockholders in June 2019. Within this Proposal 7, we refer to the 2019 Plan, as amended by the 2019 Plan Amendment, as the "Amended Plan." Upon the effectiveness of the 2019 Plan, we intend to terminate the 2022 Employment Inducement Plan and will discontinue making grants under our 2022 Employment Inducement Plan; however, existing awards will remain outstanding pursuant to their terms.

The Amended Plan includes provisions that implement compensation and governance best practices to ensure our equity compensation aligns employee interests with that of our stockholders and incentivizes the creation of long-term stockholder value. Accordingly, our Board and compensation committee believe that the share increase to the Amended Plan is reasonable and appropriate at this time. Based on our projected usage of shares authorized for issuance under the Amended Plan and our reasonable expectation of future equity usage, we believe that the number of shares being requested for authorization under the Amended Plan is equivalent to what we anticipate as two years of usage based on expected key hires and aggregate equity need in a highly competitive talent market; share usage is ultimately dependent on factors such as stock price movement, participation levels and corporate activities that could impact our grant practices.

Employees and consultants of the Company, its subsidiaries and affiliates, as well as members of our Board, are eligible to receive awards under the 2019 Plan. The Amended Plan provides for the grant of incentive stock options ("ISOs"), nonqualified stock options ("NQSOs"), stock appreciation rights ("SARs"), restricted stock, restricted stock units ("RSUs"), other stock or cash-based awards and dividend equivalents to eligible individuals.

As of April 20, 2023, we had an aggregate of 66,767,717 shares of common stock outstanding and a total of approximately 803,328 shares of common stock reserved for issuance and available for future grants under the 2019 Plan. As of April 20, 2023, there were approximately 5,777,176 shares of common stock subject to options outstanding under the 2019 Plan and our other equity incentive plans, with an approximate weighted average exercise price of the outstanding options of $7.94 per share and an approximate weighted average remaining contractual term for the outstanding options of 7.27 years. As of April 20, 2023, there were also approximately 3,373,435 restricted stock units and performance stock units outstanding under the 2019 Plan and our other equity incentive plans. We expect that the additional 8,000,000 share increase to the shares available under the Amended Plan should accommodate grants for approximately two years.

Approval of the 2019 Plan Amendment will constitute approval pursuant to the stockholder approval requirements of Section 422 of the Code, relating to ISOs. If our stockholders do not approve the 2019 Plan Amendment, the additional shares proposed by the 2019 Plan Amendment will not become available for issuance; instead, the 2019 Plan will continue in full force and effect, without giving effect to the 2019 Plan Amendment, and we may continue to grant equity-based awards under the Plan to the extent that shares remain available for grant under the 2019 Plan.

A summary of the principal provisions of the Amended Plan, including a number of important compensation and governance best practices we implemented to ensure the Amended Plan furthers our compensation plan objectives and supports long-term stockholder interests, is set forth below. The summary is qualified by reference to the full text of the 2019 Plan, which is attached as Appendix A to the Company's 2019 Proxy Statement filed

with the SEC on April 26, 2019, and the 2019 Plan Amendment, which is attached as Appendix C to this Proxy Statement.

We are asking our stockholders to approve the 2019 Plan Amendment because the availability of an adequate reserve of shares under the 2019 Plan is an integral part of our compensation program, as well as our continued growth and success. The 2019 Plan was structured to provide the Company with the necessary flexibility to design long-term incentive programs for our employees that align with our compensation philosophy, and more effectively support the strategic priorities of our organization. The equity-based awards issued under the 2019 Plan increase our ability to attract, motivate and retain high quality talent, as providing equity-based awards is critical to achieving success as we compete for talent in our industry in which equity compensation is market practice and is expected by many existing personnel and prospective candidates. Further, we believe that grants of equity-based incentive awards are necessary to enable us to design and implement executive compensation programs that retain our key employees, and compensate those employees based on the performance of the Company and other individual performance factors, thereby aligning the goals and objectives of our employees with the interests of our stockholders. If the 2019 Plan Amendment is not approved, we believe the foregoing goals will be adversely affected.

Key Features of the Amended Plan

The Amended Plan reflects a broad range of compensation and governance best practices, as highlighted below. Unless otherwise stated, these are new features introduced with the adoption of the Amended Plan and are intended to align our equity compensation practices with current best practices.

- ***Automatic acceleration of awards only if not assumed or substituted.*** The Amended Plan provides that awards will automatically accelerate upon a change in control only if not assumed or substituted.
- ***Prohibition of liberal stock recycling on all awards.*** The Amended Plan prohibits any shares withheld for taxes on all awards from being added back to the share reserve, in addition to prohibiting other practices considered to be liberal stock recycling with respect to stock options and SARs.
- ***Minimum vesting requirements.*** Subject to limited exceptions, awards granted under the Amended Plan may not vest until the first anniversary of the date of grant.
- ***Payment of dividends only if underlying awards vest.*** Under the Amended Plan, dividends and dividend equivalents may only be paid to the extent the underlying award vests.
- ***No repricing of awards without stockholder approval.*** Under the Amended Plan, awards may not be repriced, replaced or regranted through cancellation or modification without stockholder approval if the effect would be to reduce the exercise price for the shares under the award.
- ***No evergreen feature/stockholder approval required for stock reserve increases.*** The Amended Plan does not provide for an annual increase in the share reserve, and the Amended Plan may not be amended to increase the share reserve without stockholder approval.
- ***Limitation on awards granted to directors.*** The grant date fair value of awards granted under the Amended Plan to any non-employee director during any calendar year may not exceed $750,000, subject to exceptions made by the plan administrator in extraordinary circumstances.

Background of Share Request

In its determination to approve the 2019 Plan Amendment, the board of directors was primarily motivated by a desire to ensure the Company has an available pool of shares from which to grant long-term equity-based incentive awards, which the board of directors believes is a primary incentive and retention mechanism for our employees, consultants and directors. The Board and compensation committee reviewed an analysis prepared by Compensia, Inc. (“Compensia”) our compensation committee’s independent compensation consultant, which included an analysis of our historical share usage, certain burn rate metrics, the potential dilution associated with the 2019 Plan and the costs of the 2019 Plan.

This review included consideration of the following:

- While we had expected our initial 2019 Plan to last two to three years, the board has been a careful steward of stockholder capital and the share reserve has lasted over four years; however, given the limited amount of shares left in the 2019 Plan today, the board deemed the requested shares necessary and reasonable to drive our new corporate strategy. The new equity will continue to be used in a responsible manner as we have done in the past.
- In determining the reasonableness of the 2019 Plan share reserve, our compensation committee considered our historic burn rate. The following historical grant information results in an average annual burn rate for the last three fiscal years of 2.91 % of the total of then-outstanding shares, or Basic Weighted Average Common Shares Outstanding, as shown in the following table, counting both options and full-value awards on a one-for-one basis. Our Compensation Committee considered our historic burn rate levels and the impact of utilizing regular annual equity compensation grants in determining how long the amended share authorization could potentially last.
- Our three-year average burn rate was approximately 2.91%, as shown in the following table.

	2020	2021	2022	Three-Year Average
Options granted	496,530	286,350	1,999,884	927,588
Restricted Stock Units granted	252,110	208,531	677,340	379,327
Performance Restricted Stock Units vested [1]	567,855	380,773	416,439	455,022
Total Shares [1]	1,316,495	875,654	3,093,663	1,761,937
Performance shares granted [2]	418,500	267,500	973,593	553,198
Weighted Average Shares Outstanding—Basic	59,360,488	64,568,357	65,343,574	63,090,806

(1) Reflects the aggregate amount of options and restricted stock units granted, and PSUs vested in the applicable year.

(2) Reflects PSU awards granted in the applicable year based on the achievement of "target" performance goals.

- An additional metric that we use to measure the cumulative dilutive impact of our equity-based awards program is fully diluted overhang, which is the sum of (1) the number of shares subject to equity awards outstanding, but not exercised or settled and (2) the number of shares available to be granted under our equity compensation plans, divided by the sum of (1) the total common shares outstanding, (2) the number of shares subject to equity awards outstanding but not exercised or settled, and (3) the number of shares available to be granted under our equity compensation plans. Our approximate overhang as of the April 20, 2023 was 14%. In addition, over 90% of our total outstanding options as of April 20, 2023 are underwater meaning that the exercise price per share is greater than the closing trading price of a share of our common stock on April 20, 2023. If the 2019 Plan Amendment had been approved as of such date, our approximate potential overhang, as of April 20, 2023, would increase to 22% and then would decline over time.
- We expect the share authorization under the Amended Plan to provide us with enough shares for awards for approximately two years, assuming we continue to grant awards consistent with our current practices and historical usage, as reflected in our historical burn rate, and further dependent on the price of our shares and hiring activity during the next few years and forfeitures of outstanding awards under the Codexis, Inc. 2010 Equity Incentive Award Plan (the "2010 Plan") and the 2022 Employment Inducement Plan. However, future circumstances may require us to change our current equity grant practices. We cannot predict our future equity grant practices, the future price of our shares or future hiring activity with any degree of certainty at this time, and the share reserve under the 2019 Plan could last for a shorter or longer time.
- If we exhaust the share reserve under the 2019 Plan without approval of the 2019 Plan Amendment, we would lose an important element of our compensation program that is essential to attract, motivate and retain highly qualified talent, and that aligns the interests of our employees with our stockholders.

- Compensia's analysis, which is based on generally accepted evaluation methodologies, concluded that the share increase under the 2019 Plan Amendment provides for a pool within the market range with practices that are aligned with shareholders.

In light of the factors described above, the board of directors believes that the size of the share reserve proposed by the 2019 Plan Amendment is reasonable and appropriate at this time.

Summary of the Amended Plan

A summary of the principal provisions of the Amended Plan is set forth below. The summary is qualified by reference to the full text of the 2019 Plan, which is attached as Appendix A to the Company's 2019 Proxy Statement, filed with the SEC on April 26, 2019, and the 2019 Plan Amendment, attached to this Proxy Statement as Appendix C.

Administration

The Amended Plan may be administered by the Board, Compensation Committee or other committee designated by the Board. To the extent required to comply with Rule 16b-3 of the U.S. Securities Exchange Act of 1934, as amended (the "Exchange Act"), it is intended that each member of the committee will be a "non-employee director" within the meaning of Rule 16b-3. The committee or our Board may delegate its powers under the 2019 Plan to one or more members of the Board or one or more directors, officers or managers of the Company or any subsidiary, provided that no officer may be delegated the authority to grant awards to or amend awards held by senior executives of the Company who are subject to Section 16 of the Exchange Act or any officer or director to whom authority to grant or amend awards has been delegated. The Board, committee or delegate thereof, as applicable, are referred to herein as the "plan administrator."

The plan administrator has the authority to administer the Amended Plan, including the power to determine eligibility, the types and sizes of awards, the price and vesting schedule of awards, the methods for settling awards, the method of payment for any exercise or purchase price, any rules and regulations the plan administrator deems necessary to administer the Amended Plan, and the acceleration or waiver of any vesting restriction.

Eligibility

Persons eligible to participate in the Amended Plan include all members of the Board, currently comprised of eight non-employee directors, approximately 146 employees (including four executive officers) and currently zero consultants of the Company and its subsidiaries, in each case, as determined by the plan administrator.

Limitation on Awards and Shares Available

If our stockholders approve the 2019 Plan Amendment, the number of shares of common stock authorized for issuance under the Amended Plan is equal to the sum of (i) 15,897,144 shares and (ii) any shares subject to awards granted under the 2010 Plan and 2022 Employment Inducement Plan that were outstanding as of April 20, 2019 and thereafter expire, are cancelled or otherwise terminate; provided, that no more than 22,000,000 shares may be issued pursuant to the exercise of ISOs. The shares issued pursuant to an award under the 2019 Plan may be authorized but unissued shares, shares purchased by the Company on the open market or treasury shares.

If any shares subject to an award under the Amended Plan or any award under the 2010 Plan are forfeited, expire or are settled for cash, any shares deemed subject to such award may, to the extent of such forfeiture, expiration or cash settlement, be used again for new grants under the Amended Plan. However, the following shares may not be used again for grant under the Amended Plan: (1) shares tendered or withheld to satisfy the exercise price

of an option; (2) shares tendered or withheld to satisfy the tax withholding obligations with respect to an award; (3) shares subject to a SAR (or other stock-settled award) that are not issued in connection with the stock settlement of the SAR or other award on its exercise; and (4) shares purchased on the open market with the cash proceeds from the exercise of stock options. Awards granted under the Amended Plan in connection with the assumption or substitution of outstanding equity awards previously granted by a company or other entity in the context of a corporate acquisition or merger will not reduce the shares authorized for grant under the Amended Plan.

As of April 20, 2023, the closing price of a share of our common stock was $4.10.

The grant date fair value of awards granted under the Amended Plan to any non-employee director during any calendar year may not exceed $750,000. The plan administrator may make exceptions to this limit for individual non-employee directors in extraordinary circumstances, provided that the director receiving such additional compensation may not participate in the decision to award such compensation or in other contemporaneous compensation decisions involving non-employee directors.

In addition, awards granted under the Amended Plan must vest no earlier than one year measured from the date of grant and no award agreement shall reduce or eliminate such minimum vesting requirement, provided that an award may provide that such minimum vesting restrictions may lapse or be waived upon a participant's termination of service or death or disability. In addition, up to an aggregate of 5% of the number of shares available for issuance under the Amended Plan as of its effective date may be granted without regard to the foregoing minimum vesting requirement. For the purposes of awards to non-employee directors, a vesting period shall be deemed to be one year if it runs from the date of one annual meeting of the Company's stockholders to the next annual meeting of the Company's stockholders.

Awards

The Amended Plan provides for the grant of ISOs, NQSOs, SARs, restricted stock, RSUs, other stock or cash-based awards and dividend equivalents. All awards under the Amended Plan will be set forth in award agreements, which will detail all terms and conditions of the awards, including any applicable vesting and payment terms and post-termination exercise limitations. Vesting conditions determined by the plan administrator may include continued service, attainment of performance goals and/or other conditions. No fractional shares shall be issued or delivered pursuant to the Amended Plan or any award thereunder.

Options. Stock options provide for the purchase of shares of common stock in the future at an exercise price set on the grant date. ISOs, by contrast to NQSOs, may provide tax deferral beyond exercise and favorable capital gains tax treatment to their holders if certain holding period and other requirements of the Code are satisfied. The exercise price of an option may not be less than 100% of the fair market value of the underlying stock on the date of grant (or 110% in the case of ISOs granted to certain significant stockholders), except with respect to certain substitute stock options granted in connection with a corporate transaction. The term of an option may not be longer than ten years (or five years in the case of ISOs granted to certain significant stockholders). Unless otherwise provided by the plan administrator or otherwise directed by the participant, each vested and in-the-money option will be automatically exercised on the last business day prior to the expiration of its original term.

Stock Appreciation Rights. SARs entitle their holder, upon exercise, to receive an amount equal to the appreciation of the shares subject to the award between the grant date and the exercise date. The exercise price of a SAR may not be less than 100% of the fair market value of the underlying stock on the date of grant (except with respect to certain substitute SARs granted in connection with a corporate transaction) and the term of a SAR may not be longer than ten years. SARs under the 2019 Plan will be settled in cash or shares, or in a combination of both, as determined by the plan administrator. Unless otherwise provided by the plan administrator or otherwise directed by the participant, each vested and in-the-money SAR will be automatically exercised on the last business day prior to the expiration of its original term.

Restricted Stock. A restricted stock award is an award of nontransferable shares of common stock that remains forfeitable unless and until specified vesting conditions are met. In general, restricted stock may not be sold or otherwise transferred until restrictions are removed or expire. Holders of restricted stock will have voting rights and will have the right to receive dividends; however, dividends may not be paid until the applicable shares of restricted stock vest.

Restricted Stock Units. RSUs are contractual promises to deliver shares of common stock (or the fair market value of such shares in cash) in the future, which may also remain forfeitable unless and until specified vesting conditions are met. RSUs generally may not be sold or transferred until vesting conditions are removed or expire. The shares underlying RSUs will not be issued until the RSUs have vested, and recipients of RSUs generally will have no voting or dividend rights prior to the time the RSUs are settled in shares. Delivery of the shares underlying RSUs may be deferred under the terms of the award or at the election of the participant, if the plan administrator permits such a deferral. On the settlement date or dates, we will issue to the participant unrestricted, fully transferable shares of common stock (or the fair market value of one such shares in cash) in respect of the vested RSUs.

Dividend Equivalents. Dividend equivalents represent the right to receive the equivalent value of dividends paid on shares of common stock and may be granted alone or in tandem with awards other than stock options or SARs. Dividend equivalents may accrue on awards, but shall not be payable unless and until the applicable award vests.

Other Stock or Cash Based Awards. Other stock or cash based awards are awards of cash, fully vested shares of common stock and other awards valued wholly or partially by referring to, or otherwise based on, our common stock. Other stock or cash based awards may be granted to participants and may also be available as a payment form in the settlement of other awards, as standalone payments and as payment in lieu of base salary, bonus, fees or other cash compensation otherwise payable to any individual who is eligible to receive awards. The plan administrator will determine the terms and conditions of other stock or cash based awards, which may include vesting conditions based on continued service, performance and/or other conditions.

Amendment and Termination

Our Board may amend or terminate the Amended Plan at any time; however, except in connection with certain changes in our capital structure, stockholder approval will be required for any amendment that increases the aggregate number of shares available under the Amended Plan, "reprices" any stock option or SAR, or cancels any stock option or SAR in exchange for cash or another award when the option or SAR price per share exceeds the fair market value of the underlying share. In addition, no amendment, suspension or termination of the 2019 Plan may, without the consent of the affected participant, materially and adversely affect the participant's rights. No ISO may be granted pursuant to the Amended Plan after the tenth anniversary of the date the 2019 Plan was adopted by our Board.

Corporate Transactions

The plan administrator has broad discretion to take action under the Amended Plan, as well as make adjustments to the terms and conditions of existing and future awards, to prevent the dilution or enlargement of intended benefits and facilitate necessary or desirable changes in the event of certain transactions and events affecting our common stock, such as stock dividends, stock splits, mergers, acquisitions, consolidations and other corporate transactions. In addition, in the event of certain non-reciprocal transactions with our stockholders known as "equity restructurings," the plan administrator will make equitable adjustments to the Amended Plan and outstanding awards.

If a Change in Control (as defined in the Amended Plan) of the Company occurs and the successor refuses to assume or substitute for an award, the award shall accelerate and become fully vested and exercisable upon the Change in Control and all restrictions on the award shall lapse.

U.S. Federal Income Tax Consequences

This discussion regarding federal tax consequences is intended for the general information of our stockholders, not Amended Plan awardees. Alternative minimum tax and state and local income taxes are not discussed and may vary depending on individual circumstances and from locality to locality.

Code Section 162(m)

Under Code Section 162(m), income tax deductions of publicly-traded companies may be limited to the extent total compensation (including, without limitation, base salary, annual bonus, RSU settlement and nonqualified benefits) for certain executive officers exceeds $1 million (less the amount of any "excess parachute payments" as defined in Code Section 280G) in any one year. Under the tax rules in effect before 2018, the Code Section 162(m) deduction limit did not apply to qualified "performance-based" compensation that was established by an independent compensation committee and conformed to certain restrictive conditions stated under the Code and related regulations. However, the U.S. Tax Cuts and Jobs Act of 2017 eliminated this performance-based compensation exception effective January 1, 2018, subject to a special rule that "grandfathers" certain awards and arrangements that were in effect on or before November 2, 2017. As a result, compensation awarded under the Amended Plan in excess of $1 million to our current and former NEOs generally is not deductible.

Code Section 409A

Certain awards under the Amended Plan may be considered "nonqualified deferred compensation" subject to Code Section 409A, which imposes additional requirements on the payment of deferred compensation. These requirements generally provide that, if at any time during a taxable year a nonqualified deferred compensation plan fails to meet the requirements of Code Section 409A or is not operated in accordance with those requirements, all amounts deferred under the nonqualified deferred compensation plan for the then-current taxable year and all preceding taxable years, by or for any awardee with respect to whom the failure relates, are includible in the gross income of the awardee for the taxable year to the extent not subject to a substantial risk of forfeiture and not previously included in gross income. If a deferred amount is required to be included in income under Code Section 409A, the amount will be subject to income tax at regular income tax rates plus a 20 percent penalty, as well as potential penalties and interest.

Federal Tax Treatment of Award Types

With respect to NQSOs, the Company is generally entitled to deduct and the optionee recognizes taxable income in an amount equal to the difference between the option exercise price and the fair market value of the shares at the time of exercise.

A participant receiving ISOs will not recognize taxable income upon grant. Additionally, if applicable holding period requirements are met, the participant will not recognize taxable income at the time of exercise. However, the excess of the fair market value of the common stock received over the option price is an item of tax preference income potentially subject to the alternative minimum tax. If shares acquired upon exercise of an ISO are held for a minimum of two years from the date of grant and one year from the date of exercise, the gain or loss (in an amount equal to the difference between the fair market value on the date of sale and the exercise price) upon disposition of such shares will be treated as a long-term capital gain or loss, and the Company will not be entitled to any deduction. If the holding period requirements are not met, the ISO will be treated as one which does not meet the requirements of the Code for ISOs and the tax consequences described for NQSOs will apply.

The current federal income tax consequences of other awards authorized under the 2019 Plan generally follow certain basic patterns: SARs are taxed and deductible in substantially the same manner as NQSOs;

nontransferable restricted stock subject to a substantial risk of forfeiture and RSUs will result in income recognition equal to the excess of the fair market value over the price paid, if any, only at the time the restrictions applicable to such awards lapse (unless, with respect to an award of restricted stock, the recipient elects to accelerate recognition as of the date of grant); stock-based performance awards, dividend equivalents and other types of awards are generally subject to tax at the time of payment. Compensation otherwise effectively deferred is taxed when paid. In each of the foregoing cases, the Company will generally have a corresponding deduction at the time the participant recognizes income, subject to Section 162(m) with respect to our current and former NEOs. An award of a retainer, committee fee or meeting-based fee generally realizes ordinary income and we are entitled to a deduction in an amount equal to the amount of such retainer or fees upon payment thereof.

New Plan Benefits

As of April 20, 2023, 4,528,905 shares subject to stock options and performance-based stock options, 1,398,162 RSUs, 750,957 PSUs and 311,985 shares of restricted stock have been granted under the 2019 Plan. Other than with respect to annual grants of restricted stock award to our non-employee directors that will be made immediately following the date of the Annual Meeting, all future awards under the Amended Plan are subject to the discretion of the plan administrator, and therefore it is not possible to determine the benefits that will be received in the future by other participants in the Amended Plan (the *Grants of Plan-Based Awards in 2022* table in this Proxy Statement describes all equity awards granted to our named executive officers during our fiscal year ended December 31, 2022 under the 2019 Plan). Therefore, the table below provides information only for our non-employee directors.

Name and Position	Dollar Value ($)	Number of Units
Named Executive Officers:		
Stephen Dilly, M.B.B.S, Ph.D., *President and Chief Executive Officer*		
Kevin Norrett, *Chief Operating Officer*		
Ross Taylor, *Senior Vice President and Chief Financial Officer*		
Margaret Nell Fitzgerald, *Chief Legal and Compliance Officer, General Counsel and Secretary*		
John J. Nicols, *former President and Chief Executive Officer*		
All Current Executive Officers as a Group		
All Current Directors Who Are Not Executive Officers as a Group [1]	$ 800,000	
All Employees, including All Current officers Who Are Not Executive Officers, as a Group		

(1) Our non-employee director compensation policy provides that on the date of each annual meeting of stockholders, each non-employee director is granted a restricted stock award covering a number of shares of our common stock equal to $100,000 divided by the per share closing trading price of our common stock on the date of grant, which vests as to all of the shares subject to the award on the earlier of the first anniversary of the date of grant or the next annual stockholder meeting, subject to the director's continued service through the vesting date.

Awards Granted Under the 2019 Plan

The following table shows the number of shares of our common stock underlying options and performance-based stock options, RSUs, PSUs and shares of restricted stock granted under the 2019 Plan through April 20, 2023 by certain individuals and certain groups of individuals.

Certain awards set forth in this table for the named executive officers were granted in fiscal year 2022 and therefore also are included in the Summary Compensation Table and in the Grants of Plan-Based Awards Table set forth in this Proxy Statement and are not additional awards. Certain awards set forth in this table for the

non-employee directors were granted in fiscal year 2022 and therefore also are included in the Director Compensation Table set forth in this Proxy Statement and are not additional awards.

Name and Position	Shares of Common Stock Underlying Stock Options (#)	Restricted Stock Units (#)	Performance Stock Units (#) [1]	Shares of Restricted Stock
Named Executive Officers:				
Stephen Dilly, M.B.B.S, Ph.D., *President and Chief Executive Officer*	1,037,500	112,500	340,000	33,974
Kevin Norrett, *Chief Operating Officer*	480,905	22,500	98,184	
Ross Taylor, *Senior Vice President and Chief Financial Officer*	130,891	22,000	34,000	
Margaret Nell Fitzgerald, *Chief Legal and Compliance Officer, General Counsel and Secretary*	407,775	8,000	77,273	
John J. Nicols, *former President and Chief Executive Officer*	523,062			
All Current Executive Officers as a Group	2,580,133	165,000	563,093	33,974
All Current Non-Executive Directors as a Group				278,011
Current Director Nominees:				
Stephen Dilly, M.B.B.S., Ph.D.	1,037,500	112,500	340,000	33,974
Alison Moore, Ph.D.				33,974
Rahul Singhvi, Sc.D.				31,347
Each Associate of any of such Directors, Executive Officers or Nominees				
Each Other Person who Received or is to Receive 5% of such Options, Warrants or Rights				
All Employees, including all Officers who are not Executive Officers, as a Group	1,948,772	1,233,162	201,500	

[1] Represents performance stock unit awards reported assuming payout at "target" award levels.

Vote Required

To be approved, this proposal must receive a "For" vote from the holders of a majority of the shares represented in person or by proxy at the Annual Meeting and entitled to vote on the proposal. Abstentions and broker non-votes will have no effect on the proposal.

Board Recommendation

THE BOARD OF DIRECTORS RECOMMENDS THAT STOCKHOLDERS VOTE "FOR" THE APPROVAL OF THE AMENDMENT TO THE CODEXIS, INC. 2019 INCENTIVE AWARD PLAN.

EXECUTIVE COMPENSATION

Compensation Discussion and Analysis

Executive Summary

The following overview highlights and summarizes information regarding executive compensation and does not purport to contain all of the information that is necessary to gain an understanding of our executive compensation policies and decisions. Please carefully read the Compensation Discussion and Analysis section and the compensation tables and related disclosures that follow for a more complete understanding of our executive compensation program.

Codexis, Inc. is a leading enzyme engineering company leveraging our proprietary CodeEvolver® technology platform to discover, develop and enhance novel, high performance enzymes and other classes of proteins. Our business requires a talented, motivated and capable leadership team. To that end, our executive compensation program plays a vital role in our ability to attract, retain and motivate top talent for continued business success.

2022 Executive Compensation Program Summary. Our executive compensation program is designed to attract and retain talented individuals to lead, manage and operate all aspects of our business and reward and retain those individuals who continue to meet our high expectations over time. Our executive compensation program combines short- and long-term components, cash and equity and fixed and contingent payments in the amounts and proportions that we believe are most appropriate to incentivize, retain and reward our named executive officers for achieving our objectives. Our executive compensation program is also intended to make us competitive in our industry, where there is considerable competition for talented executives.

For 2022, our named executive officers and their positions during 2022 were as follows:

- Stephen Dilly, M.B.B.S, Ph.D., our President and Chief Executive Officer;
- Kevin Norrett, M.B.A., our Chief Operating Officer;
- Ross Taylor, our Senior Vice President and Chief Financial Officer;
- Margaret Nell Fitzgerald, our Chief Legal and Compliance Officer, General Counsel and Secretary; and
- John J. Nicols, our former President and Chief Executive Officer.

2022 was a transformational year for our company. After serving as our President and Chief Executive Officer for 10 years, Mr. Nicols retired and Dr. Dilly was appointed our President and Chief Executive Officer in August 2022. Shortly thereafter, in October 2022, Mr. Norrett and Ms. Fitzgerald commenced employment with us as our Chief Operating Officer and Chief Legal and Compliance Officer, respectively. In January 2023, Mr. Ryali succeeded Mr. Taylor as our Chief Financial Officer.

2022 Performance Highlights

In 2022, we refined our corporate strategy to focus our resources on programs where we believe we are best positioned to win and create long term success. Specifically, we are leveraging our CodeEvolver® enzyme engineering technology platform to (i) create and advise novel biotherapeutic drug candidates, (ii) grow our pharmaceutical manufacturing business and (iii) develop high-performance enzymes for life science applications and nucleic acid synthesis. The early returns on this new corporate strategy is evidenced by the continued momentum in our novel biotherapeutics business while our CodeEvolver® enzyme engineering platform continues to enable us to discover and commercialize novel, high performance enzymes for use in diverse applications, thereby providing us ongoing revenue opportunities to support our operations.

In addition, we had strong financial and operational performance in 2022.

- We delivered our 9th consecutive year of year-over-year revenue growth in 2022.
- Total revenues increased by 65% from $105 million in 2021 to $139 million in 2022 with product revenue growing from $71 million in 2021 to $117 million in 2022.
- Our cash position remained strong with $114 million on hand as of December 31, 2022, which based on our current operating plans and strategies, we believe this cash will provide us at least two years of runway as December 31, 2022.
- Product gross margin remained strong at 67%.

We also achieved the following major wins and milestones:

- We successfully onboarded critical new leaders, both in our executive ranks and on our board of directors, that have spearheaded the implementation of our refined corporate strategy.
- As of December 31, 2022, we were selling biocatalysts to pharmaceutical manufacturers for 18 therapeutic drugs that are currently approved for commercial sales.
- In March 2022, we announced the initiation of a strategic partnership with seqWell Inc. ("seqWell"), a developer of transformative library preparation products for demanding genomics plan application, which included an investment to accelerate the commercialization of seqWell's genomics workflow solutions.
- In April 2022, we and Molecular Assemblies, Inc. ("MAI") announced that, using our CodeEvolver® platform technology, we had developed a novel, engineered terminal deoxynucleotidyl transferase ("TdT") enzyme that enables MAI's Fully Enzymatic Synthesis™ ("FES™") technology that produces highly pure, sequence-specific DNA on demand.

Commitment to Pay-for-Performance. We have structured our executive compensation programs to provide our named executive officers appropriate incentives to drive positive and sustainable long-term results. We believe that our executive compensation program is appropriately sensitive to Company financial performance and long-term stockholder returns, as a significant portion of our named executive officers' compensation is in the form of performance-based cash and equity-based long-term incentive awards.

The key components of our compensation program for our named executive officers and actions taken in 2022 with respect to those components are as follows:

- *Limited Base Salary Increases for Continuing Named Executive Officers; Competitive Base Salaries for New Named Executive Officers*. Base salaries represent a fixed component of our executive compensation program that are intended to keep us competitive with the market while remaining cost effective and providing security to our named executive officers as a predictable stream of income. In 2022, our existing named executive officers received limited base salary increases of 3% over their 2021 base salary levels. We established the base salaries of named executive officers that joined us during the year pursuant to arm's length negotiations after considering market data, base salaries with prior employers and in light of each named executive officer's skillset and experience.
- *Annual Cash Incentive Bonuses Adjusted to Reflect Changed Priorities and Capped at 85% of Target*. Our named executive officers participate in the Executive Incentive Compensation Plan. In late 2022, in connection with the refinement of our corporate strategy, we modified the goals under our Executive Incentive Plan to incentivize results in key areas our compensation committee determined were critical to our evolved corporate strategy. At the time our compensation committee modified our corporate performance goals in light of this new strategy, it determined that the original goals were likely to be achieved at 85% of target and capped achievement of the modified corporate performance goals at 85% of target.

- *Equity Awards as a Key Component of Compensation*. Our compensation committee provides a significant portion of our named executive officers' target total direct compensation opportunity in the form of equity awards which we believe helps align the interests of our named executive officers with our stockholders and provide our named executive officers incentive to drive long-term growth in our stock price.
- *Performance-Based Equity Awards*. Further demonstrating our board of directors' commitment to our pay-for-performance philosophy, in 2022, we continued to grant performance-based equity awards to our named executive officers as part of the executives' long-term incentive program, the value of which may only be realized if the applicable performance metrics are achieved or exceeded. Similar to our annual cash incentive bonuses, our compensation committee modified or, in the case of new named executive officers, established performance goals to align with our change in corporate strategy with performance capped at 85% of target.

Commitment to Strong Governance Standards. We are committed to having strong governance standards with respect to our executive compensation policies and practices. The Company has a number of executive compensation practices that we believe reflect the interests of our stockholders and governance best practices, including:

- We use a mix of fixed and variable compensation, with an emphasis on variable, at-risk performance-based compensation.
- We have no "gross up" agreements or entitlements of excise taxes on severance or other payments in connection with a change in control.
- We do not offer any other "gross up" agreements or entitlements on perquisites and benefits, except for relocations that are under our control and are at our direction.
- We provide for multi-year vesting periods for equity award grants to reinforce a culture in which the Company's executives remain focused on the Company's long-term success.
- We offer minimal perquisites to our named executive officers.
- We do not maintain any pension benefits or nonqualified deferred compensation plans.
- Our compensation committee engages its own independent compensation consultant, Compensia, Inc. ("Compensia"), which performs an annual comprehensive market analysis of our executive compensation programs and pay levels.
- Based on our annual risk assessment, our compensation programs do not present any risk that is reasonably likely to have a material adverse effect on the Company.

Stockholder Advisory Vote on Executive Compensation

At our 2017 annual meeting of stockholders, our stockholders voted in a non-binding advisory vote in favor of having a non-binding advisory stockholder vote on the compensation of our named executive officers once every three years. At this Annual Meeting, we are again seeking a non-binding advisory vote of our stockholders on the frequency of our non-binding advisory stockholder votes on the compensation of our named executive officers but are recommending that stockholders approve a frequency of one year so that we may receive more frequent input from our stockholders on our executive compensation programs. See Proposal 3.

Our compensation committee reviewed the result of the 2020 stockholders' advisory vote on the compensation of our named executive officers and, in light of the approval by a substantial majority of our stockholders of the compensation programs described in our 2020 proxy statement (representing approximately 93% of the shares represented in person or by proxy at the meeting and entitled to vote), did not implement any significant changes to our executive compensation program as a result of the stockholders' advisory vote. At this Annual Meeting, we are again seeking a non-binding advisory stockholder vote on executive compensation. See Proposal 4.

While we will review the result of the non-binding advisory vote on the frequency of "say-on-pay" votes at this Annual Meeting we expect to hold the next non-binding advisory vote on executive compensation at our 2024 annual meeting of stockholders.

Objectives and Philosophy of Our Executive Compensation Program

Our compensation program for our named executive officers is designed to achieve the following objectives:

- attract, engage and retain executives of superior ability, experience and managerial talent enabling us to be an employer of choice in our highly competitive and dynamic industry;
- motivate and reward executives whose knowledge, skills and performance ensure our continued success;
- encourage and inspire our executives to achieve key corporate performance objectives by linking base salary increases and incentive award opportunities to the achievement of individual and company-wide short- and long-term goals; and
- align the interests of our executives and stockholders by providing a significant portion of total compensation opportunities for our executive officers in the form of direct ownership in our Company through stock options and other equity incentive awards, which will motivate executives to increase stockholder value.

Components of Our Executive Compensation Program and Determination of Compensation

The components of our executive compensation program consist primarily of base salaries, annual cash incentive bonuses, equity awards and broad-based benefits programs. We combine short-term compensation components (such as base salaries and annual cash incentive bonuses) and long-term compensation components (such as equity incentive awards) to provide an overall compensation structure that is designed to both attract and retain key executives as well as provide incentive for the achievement of short- and long-term corporate objectives.

Our compensation committee is responsible for evaluating and administering our compensation programs and practices for our named executive officers. Our compensation committee uses its judgment and experience and the recommendations of our Chief Executive Officer with respect to the compensation for our named executive officers (other than himself) to determine the appropriate mix of short- and long-term compensation components for each named executive officer. Short- and long-term compensation components are balanced to encourage each named executive officer to use his time and talents to accomplish both our short- and long-term corporate objectives. Our Chief Executive Officer generally attends our compensation committee meetings to provide input on factors that may influence our compensation committee members' consideration of compensation programs and individual compensation, including individual performance (other than with respect to their own performance), financial, legal and compensation parity considerations. In addition, our Chief Financial Officer and other members of management occasionally attend such compensation committee meetings when their expertise may be required based on the issues being discussed. No named executive officer is present at the meetings at the time that his own compensation is being reviewed by the compensation committee. Our compensation committee analyzes each of the primary elements of our compensation program to ensure that our executive officers' overall compensation is competitive with executive officers in similar positions at comparable companies in our labor market and to ensure internal compensation equality among incentive awards for our employees, including our named executive officers.

Our compensation committee determines compensation for our executive officers, including our named executive officers, in large part based upon our financial resources, as well as competitive market data. Our compensation committee has engaged Compensia to provide competitive market data and to provide advisory support to the compensation committee with regards to the compensation of our named executive officers. Compensia works directly with our compensation committee and did not provide any non-compensation related

services to us during 2022. After review and consultation with Compensia, the compensation committee determined that Compensia is independent and that there is no conflict of interest resulting from retaining Compensia currently or during 2022. In reaching these conclusions, our compensation committee considered the factors set forth in the SEC rules and Nasdaq listing standards.

In November 2021, based on the recommendation of Compensia, our compensation committee adopted a peer group of companies to serve as a reference when reviewing the compensation levels for our named executive officers for 2022. The companies that formed our 2022 compensation peer group were selected from biotechnology and chemical companies having business models and financial characteristics similar to us. Following best practices, we specifically selected companies that generally fell within the range of 0.5–2.0x of our Company in terms of revenue and within the range of 0.33–3.0x of market capitalization. The 2022 compensation peer group consisted of the following companies:

- Amyris
- Atrion
- Avid Bioservices
- Berkeley Lights
- BioCyst Pharmaceuticals
- Cytokinetics
- Deciphera Pharmaceuticals
- Editas Medicine
- ImmunoGen
- Inovio Pharmaceuticals
- MacroGenics
- Meridian Bioscience
- NanoSting Technologies
- Precigen
- Quanterix
- REGENXBIO
- Sangamo Therapeutics
- Seres Therapeutics

This 2022 peer group was determined following review of the peer group referenced for reviewing the 2021 compensation of our named executive officers, and appropriate changes were made based on the updated selection criteria.

As compared to our 2022 peer group, in November 2021, when the peer group was adopted, the Company was at the 34th percentile for the last four quarters' revenue and at the 55th percentile for 30 day average market capitalization. In addition to data from our 2022 peer group, our compensation committee considered market analysis from Compensia using data from the Radford Global Life Sciences Compensation Survey. Our compensation committee was not made aware of the constituent companies in the survey. For our 2022 assessment of executive compensation, Compensia's analysis was based on 2022 survey and proxy cash compensation data pulled forward to February 2022 using a 5% update factor.

In determining the 2022 compensation for our named executive officers, we believe that the practices of the companies in the compensation peer group provided our compensation committee with relevant compensation information, not only because of the similarity of their business models and financial characteristics, but because several of these companies have similar organizational structures and tend to compete with us for executive talent.

Our overall compensation philosophy is to generally target the median of the market for base salaries and above the median for total cash and equity incentives, with annual cash and equity incentives tied to Company and individual achievement such that actual total compensation levels will be generally aligned with performance. The compensation committee works within the general framework of this market-competitive philosophy to determine each component of our named executive officers' compensation packages based on numerous factors, including:

- the demand for the particular skill sets we need within the marketplace;
- performance goals and other expectations for the position and the individual;
- the individual's background and relevant expertise, including training and prior relevant work experience;

- the individual's role with us and the compensation paid to similar persons at the companies that participate in the surveys that we review; and
- comparison to other executives within our Company having similar levels of expertise and experience.

During 2022, our compensation committee reviewed all aspects of our executive compensation program, including base salaries, annual cash incentive bonuses and equity incentive targets for each of our named executive officers.

Based on our 2022 peer group and the Radford Global Life Sciences Compensation Survey, using survey and proxy cash compensation data updated to February 2022 using a 5% update factor, the total direct compensation for each of our named executive officers was at or above the 35th percentile of market, which reflects the competitiveness of the markets in which we compete for executive talent as well as other factors, including Company and individual performance and criticality to the organization. The market analysis also found that our equity grant is more heavily focused on performance than our peers on average.

Each of the primary elements of our executive compensation program is discussed in more detail below. While we have identified particular compensation objectives that each element of executive compensation serves, our compensation programs are designed to be flexible and complementary and to collectively serve all of the executive compensation objectives described above. Accordingly, whether or not specifically mentioned below, we believe that, as a part of our overall executive compensation policy, each individual element of our executive compensation program, to a greater or lesser extent, serves each of our objectives as set forth above.

Annual Cash Compensation

Base Salary

The base salaries of our named executive officers are established when they are hired and reviewed annually and adjusted when necessary to reflect individual roles and performance and the competitive market. Our compensation committee also reviews each named executive officer's annual base salary in comparison with other executives who are at the same level at our Company and seeks parity among executives within our Company who have similar levels of responsibility and authority. Our compensation committee believes that a competitive base salary is a necessary element of any compensation program designed to attract and retain talented and experienced executives. We also believe that competitive base salaries can motivate and reward executives for their overall performance.

Annual Cash Incentive Bonuses

Our compensation philosophy with respect to annual cash incentive bonuses is consistent with our overall compensation program philosophy. The annual cash incentive bonus is directed at tying individual compensation to both corporate and individual performance while maintaining market-competitive compensation. Performance, as measured against individual performance and corporate goals, directly determines the level of bonus payment.

Our annual cash bonus program (the "Executive Incentive Compensation Plan") is comprised of three elements that factor into the cash incentive bonus paid to our named executive officers: the annual cash incentive bonus targets, the company performance factor and the individual performance factor, each of which is set by our compensation committee.

In February 2022, our compensation committee determined to maintain the target bonus percentages of Mr. Nicols and Mr. Taylor at 75% and 50% of annual base salary, respectively. In connection with the commencement of employment of each of Dr. Dilly, Mr. Norrett and Ms. Fitzgerald, our compensation committee established target bonus percentages of 75%, 50% and 40% of annual base salary, respectively, in each case, subject to proration based on when the named executive officer commenced employment.

The target bonus percentage for our named executive officers, other than our Chief Executive Officer, is established or adjusted based on our Chief Executive Officer's evaluation of the corporate goals over which he or she has control or influence given his or her position with the Company and the market practices of the companies in our compensation peer group. Our compensation committee considers similar factors in setting the target bonus percentage for our Chief Executive Officer.

In March 2022, our board of directors approved the following pre-established performance goals as set forth below, along with their weights, for determining the Company performance factor under our Executive Incentive Compensation Plan:

Goal	Weight
Corporate Revenue	15%
Research and Development Revenues	5%
Product Revenue (excluding Paxlovid)	10%
Operating Expenses (excluding Costs of Goods Sold)	10%
Strategic Performance Enzymes Deliverables	17.5%
Strategic Biotherapeutics Deliverables	17.5%
Organization/Infrastructure Upgrades	20%
Safety	5%

Threshold, target and superior levels of achievement were set for each of our performance goals, corresponding to achievement at 50%, 100% and 150% of target, respectively. The threshold, target and superior levels for our 2022 corporate revenue goal were $145.0 million, $161.1 million and $177.2 million, respectively; the threshold, target and superior levels for our 2022 research and development revenues revenue goal were $36.8 million, $40.9 million and $45.0 million, respectively; the threshold, target and superior levels for our 2022 product revenues revenue goal were $34.1 million, $37.9 million and $41.7 million, respectively; and the threshold, target and superior levels for our 2022 operating expenses (excluding costs of goods sold) goal were $165.8 million, $105.7 million and $135.6 million, respectively, in each case, with achievement between the threshold and target levels or the target and superior levels determined by linear interpolation.

In setting these performance goals and their relative weights, our compensation committee considered the Company's strategic vision and key areas necessary to our growth and financial success. The specific performance goals that comprise the corporate performance factor are intended to be difficult to achieve and require above what our compensation committee has determined to be average performance to meet the minimum acceptable standard. However, because each of our performance goals other than our 2022 corporate revenue and product revenue goals is related to our business strategy and is highly confidential, we do not publicly disclose them, as we believe their disclosure would provide our competitors, customers and other third-parties with significant insights regarding are confidential business strategies that could cause us substantial harm.

Following the entry into a new supply agreement for CDX-616, which is used to manufacture Paxlovid, with Pfizer and Dr. Dilly's commencement of employment in August 2022 and a change in corporate strategy, in November 2022, our compensation committee modified the performance goals under our Executive Incentive Compensation Plan to reflect key areas of immediate focus necessary to successfully execute our new corporate strategy. After determining that the original performance goals established for the performance-based equity awards was likely to be achieved at 85%, our compensation committee capped achievement of the modified corporate performance goals at 85%. The modified corporate performance goals and their weightings were as follows:

Goal	Weight
Corporate Revenue, Product Revenue and Year End Cash Balance	20%
Other Finance and Corporate Strategy	15%
Performance Enzymes	20%
BioTherapeutics	20%
Organizational Development	25%

Our compensation committee did not establish threshold or superior level of achievements for the modified corporate performance goals, but instead limited them to target achievement while including a modifier of up to 25% based on stretch achievement within biotherapeutics (15%), research (5%) and performance enzymes and organizational development (together 5%). The specific target level for corporate revenue, product revenue and year end cash balance were $135.0 million, $112.0 million and $90.0 million, respectively. Our compensation committee intended for the modified corporate performance goals, as a whole, to continue to be difficult to achieve while aligning with our new corporate strategy. However, because each of our performance goals other than our 2022 corporate revenue, product revenue goals is related to our business strategy and is highly confidential, we do not publicly disclose them, as we believe their disclosure would provide our competitors, customers and other third-parties with significant insights regarding are confidential business strategies that could cause us substantial harm.

The individual performance factor of the bonus for our named executive officers, other than our Chief Executive Officer, was determined by our compensation committee based upon the recommendations of our Chief Executive Officer, and the individual performance factor of the bonus for our Chief Executive Officer was based on our compensation committee's own assessment, in each case, with respect to the contribution of the named executive officer to the achievement of our corporate goals. These individual performance factors are determined based on our Chief Executive Officer's and our compensation committee's holistic evaluation of each executive's performance during the year, taking into account the executive's position within the company and the corporate goals over which that executive has control or influence. High performance on the individual performance factor is intended to be difficult to achieve and requires above what our compensation committee has determined to be average performance to meet the minimum acceptable standard.

Failure to achieve the target result for any modified corporate performance goal results in a zero for that particular goal, but will not alone result in zero total bonus. The bonus amount is determined as follows:

Bonus Amount = (Base Salary) x (Target Percentage) x (Company Performance Factor Achievement Level) x (Individual Performance Factor Achievement Level)

The maximum corporate performance factor achievement level for the modified corporate performance goals was 85%.

Our compensation committee did not evaluate performance under our original corporate performance goals. In early 2023, our compensation committee evaluated achievement of our modified corporate performance goals as follows:

Goal	Weight	Weighted Actual Achievement
Corporate Revenue, Product Revenue and Year End Cash Balance	20%	100%
Other Finance and Corporate Strategy	15%	100%
Performance Enzymes	20%	100%
BioTherapeutics	20%	100%
Organizational Development	25%	100%
Stretch Goals Related to BioTherapeutics, Performance Enzymes, Research and Organizational Development	25%	24.5%
Total	125%	124.5%

Despite us achieving each of our modified corporate performance goals and substantially all of the stretch goals, our compensation committee applied the cap it set when establishing the modified corporate goals and determined corporate performance goal achievement of 85%.

In February 2023, our compensation committee also evaluated the individual performance of our named executive officers for 2022 (which in the case of our named executive officers other than our Chief Executive Officer, was based on input from the Chief Executive Officer) and determined, based on their significant individual and team contributions to the achievement of our corporate goals, that our named executive officers had each achieved the individual performance factor at 100%.

The following table sets forth the 2022 bonus targets and actual bonuses paid to our named executive officers:

Name of Executive Officer	Bonus Target (Base Salary x Target %) ($)	2022 Individual Performance Factor (%)	2022 Company Performance Factor (%)	Bonus Payment ($)
Stephen Dilly	$223,651	N/A	85%	$190,103
Kevin Norrett	$ 56,250	100%	85%	$ 47,813
Ross Taylor	$218,500	100%	85%	$185,725
Margaret Nell Fitzgerald	$ 30,236	100%	85%	$ 25,700
John J. Nicols	$332,408	N/A	85%	$282,547

We believe that our annual cash incentive bonus plans help to attract and motivate our executives, encourage and inspire our executives to achieve key corporate performance objectives and to align the compensation payable to our executives with our corporate objectives, thereby maximizing stockholder value. By reevaluating the corporate goals and individual performance factors under our bonus program for executives each year, we believe we provide sufficient and attainable incentives for our executives that align with both our financial and non-financial goals.

Sign-On Bonuses

In connection with the commencement of employment of Dr. Dilly and Ms. Fitzgerald, we agreed to pay the named executive officer a sign on bonus of $200,000 and $200,000 respectively, with Dr. Dilly's sign on bonus paid in a single installment in 2022 and Ms. Fitzgerald's sign on bonus paid in two equal installments in 2022 and 2023. These sign on bonuses are subject to repayment if the named executive officer voluntarily resigns without good reason or we terminate the named executive officer's employment for cause, in each case, within

one year following the named executive officer's commencement of employment with us, with 100% of the amount paid subject to repayment in the event of such a resignation or termination within 6 months following the commencement of employment and 50% of the amount paid subject to repayment in the event of such a resignation or termination between 6 months and one year following commencement of employment with us. These sign on bonuses were negotiated in connection with each named executive officer's commencement of employment and were intended to act as an additional inducement for each named executive officer to commence employment with us.

Equity Incentive Compensation

We believe that our long-term performance is best facilitated through a culture of executive equity ownership that encourages long-term investment by our named executive officers in our equity, thereby better aligning the named executive officers' interests with the interests of our stockholders. During 2022, our compensation committee granted our named executive officers service-based and performance-based stock options, restricted stock units and performance stock units. In addition, in June 2022, while Dr. Dilly was serving as a non-employee member of our board of directors, he was automatically granted an award of restricted stock.

As part of our annual refresh cycle, in February 2022, our board of directors granted Mr. Nicols a time-based option to purchase 40,000 shares of our common stock and a performance-based option to purchase 430,000 shares of our common stock. Also in February 2022, our compensation committee granted Mr. Taylor a time-based option to purchase 13,000 shares of our common stock, a performance-based option to purchase 40,000 shares of our common stock, 9,000 restricted stock units and 10,000 performance stock units.

In connection with Dr. Dilly's commencement of employment, our board of directors granted Dr. Dilly a time-based option to purchase 700,000 shares of our common stock and 340,000 performance stock units. In connection with Mr. Norrett's and Ms. Fitzgerald's commencement of employment, our compensation committee granted Mr. Norrett and Ms. Fitzgerald a time-based option to purchase 413,405 and 382,775 shares of our common stock, respectively, and 98,184 and 90,909 performance stock units, respectively.

While no single factor determined the size of these awards, our compensation committee generally considered the following factors in making such awards: internal equity within our management team, individual performance, tenure with our Company, equity awards newly appointed named executive officers held at their prior companies, the criticality of each named executive officer's role at our Company, and the periodic equity incentive award practices observed by the companies in our 2022 compensation peer group.

Time-based options granted in 2022 vest as to 25% of the underlying shares on the first anniversary of the vesting commencement date and in substantially equal monthly installments over the subsequent three years, subject to continued service. Restricted stock units vest in three substantially equal installments, subject to continued service. The vesting commencement date for time-based options and restricted stock units is generally the date of grant for refresh equity grants and the date of hire or promotion for new hire and promotion grants. Performance-based options and performance stock units vest based on the achievement of corporate performance goals as described below, with 50% of the underlying shares vesting upon achievement and the remaining 50% vesting approximately one year thereafter, subject to continued service. In keeping with our market-competitive philosophy, our board of directors and compensation committee established the foregoing vesting schedules because it determined such vesting represents market practice in our industry based on the experience of the members of our compensation committee.

In February 2022, when grants of performance-based options and performance stock units to our named executive officers were initially approved for 2022, our board of directors and our compensation committee established the following performance goals:

Goal	Weight
Corporate Revenue	15%
Research and Development Revenues	5%
Product Revenue (excluding Paxlovid)	15%
Operating Expenses (excluding Costs of Goods Sold)	10%
Strategic Performance Enzymes Deliverables	15%
Strategic Biotherapeutics Deliverables	15%
Organization/Infrastructure Upgrades	15%
Corporate Developments	5%
Significant Announcable Events	5%

The threshold, target and superior performance levels of our 2022 corporate revenue and product revenue goals were the same as the levels under our Executive Incentive Compensation Plan, as described above.

As under our Executive Incentive Compensation Plan, the financial and non-financial goals for our performance-based options are intended to be difficult to achieve and require above what our compensation committee has determined to be average performance to meet the minimum acceptable standard. However, because each of our performance goals other than our 2022 corporate revenue and product revenue goals for our performance-based awards are related to our business strategy and are highly confidential, we do not publicly disclose them, as we believe their disclosure would provide our competitors, customers and other third-parties with significant insights regarding our confidential business strategies that could cause us substantial harm.

The number of shares eligible to vest in respect of the performance-based options and performance stock units was determined by multiplying the target number of shares subject to the award by a multiplier, which is calculated as the sum overall performance goals of (i) the weight of each performance goal multiplied by (ii) the applicable achievement percentage. The performance-based option achievement percentage for each performance goal is 0% if achieved at less than threshold, 25% if achieved at threshold, 50% if achieved at target level, and 100% if achieved at or above the superior level. The performance stock unit achievement percentage for each performance goal is 0% if achieved at less than threshold, 50% if achieved at threshold, 100% if achieved at target level, and 200% if achieved at or above the superior level. For the corporate revenue and product revenue goals, achievement between the foregoing levels was determined using linear interpolation.

As under our Executive Incentive Compensation Plan, in November 2022, our compensation committee modified the performance goals applicable to our performance-based equity awards to reflect key areas of immediate focus necessary to successfully execute our new corporate strategy. After determining that the original performance goals established for the performance-based equity awards was likely to be achieved at 85%, our compensation committee capped achievement of the modified corporate performance goals at 85%. The modified corporate performance goals and their weightings were the same as under our Executive Incentive Compensation Plan as follows:

Goal	Weight
Corporate Revenue, Product Revenue and Year End Cash Balance	20%
Other Finance and Corporate Strategy	15%
Performance Enzymes	20%
BioTherapeutics	20%
Organizational Development	25%

Consistent with our Executive Incentive Compensation Plan, our compensation committee did not establish threshold or superior level of achievements for the modified corporate performance goals, but instead limited them to target achievement while including a modifier of up to 25% based on stretch achievement within biotherapeutics (15%), research (5%) and performance enzymes and organizational development (together 5%). The specific target level for corporate revenue, product revenue and year end cash balance were $135.0 million, $112.0 million and $90.0 million, respectively. Our compensation committee intended for the modified corporate performance goals, as a whole, to continue to be difficult to achieve while aligning with our new corporate strategy. However, because each of our performance goals other than our 2022 corporate revenue, product revenue goals is related to our business strategy and is highly confidential, we do not publicly disclose them, as we believe their disclosure would provide our competitors, customers and other third-parties with significant insights regarding are confidential business strategies that could cause us substantial harm.

Our compensation committee assessed performance for our performance-based equity awards the same as under our Executive Incentive Compensation Plan. Despite us achieving each of our modified corporate performance goals and substantially all of the stretch goals, our compensation committee applied the cap it set when establishing the modified corporate goals and determined corporate performance goal achievement of 85%. As a result, 85% of the performance stock units held by our named executive officers and 42.5% of the shares underlying the performance-based options held by our named executive officers became eligible to vest, with 50% vesting immediately and the remaining 50% scheduled to vest on March 5, 2023, subject to continued service to us.

Termination-Based Compensation

Our compensation committee provides our named executive officers with termination of employment protection when it determines that such protection is necessary to attract or retain an executive.

We believe that concerns about potential job loss or the possibility or occurrence of a change in control of the Company can create uncertainty for our executive officers that may unduly affect their performance. For example, the possibility of a change in control of the Company may create uncertainty for our named executive officers regarding their continued employment because such transactions frequently result in changes in senior management. Consequently, we have entered into an employment agreement with Dr. Dilly and Mr. Nicols and a change of control severance agreement with Messrs. Norrett and Taylor and Ms. Fitzgerald, which provide severance payments and benefits in the event of certain qualifying terminations, both within and outside of a change in control context. We believe that such arrangements are necessary to attract and retain talent in the markets in which we compete for talent.

The severance payments and benefits that are payable under the Company's severance and change in control arrangements are further described below in the section entitled "—Change in Control and Severance Arrangements."

Other Compensation

All of our named executive officers are eligible to participate in certain benefit plans and arrangements offered to employees generally, including health, dental, life and disability insurance, 401(k) plan. We currently provide company contributions to the 401(k) plans for all employees, including our named executive officers. Consistent with our market-competitive compensation philosophy, we intend to continue to maintain these benefit plans and arrangements for our employees, including our named executive officers.

Each of our named executive officers is also paid a cell phone allowance of $80 per month.

In connection with Dr. Dilly's commencement of employment with us, we agreed to provide Dr. Dilly an annual travel allowance of $40,000, which is intended to offset expenses Dr. Dilly incurs in travelling to our offices in Redwood City, California. Our board of directors approved the travel allowance in order to induce Dr. Dilly to commence employment with us.

Our compensation committee in its discretion may revise, amend or add to any executive's benefits and perquisites if it deems it advisable. We currently do not believe it is necessary for the attraction or retention of management talent to provide our named executive officers with a substantial amount of compensation in the form of perquisites or other personal benefits.

Tax and Accounting Considerations

Section 162(m) of the Code generally disallows a tax deduction for compensation in excess of $1.0 million paid to all former and current named executive officers. Our board of directors and our compensation committee may, in its judgment, authorize compensation payments that exceed the deductibility limits under Section 162(m) when it believes that such payments are appropriate to attract, retain and reward executive talent.

Section 409A of the Code imposes additional taxes on certain non-qualified deferred compensation arrangements that do not comply with its requirements. These requirements regulate an individual's election to defer compensation and the individual's selection of the timing and form of distribution of the deferred compensation. Section 409A generally also provides that distributions of deferred compensation only can be made on or following the occurrence of certain events (e.g., the individual's separation from service, a predetermined date or fixed schedule, a change-in-control, or the individual's death or disability). For certain executives, Section 409A requires that such individual's distribution of certain non-qualified deferred compensation amounts commence no earlier than six months after such officer's separation from service. We have and will continue to endeavor to structure our compensation arrangements to be exempt from or comply with Section 409A so as to avoid the adverse tax consequences associated therewith. We have not provided any executives or other employees with any gross-up in connection with Section 409A.

We account for stock-based compensation in accordance with FASB ASC Topic 718, which requires us to recognize compensation expense for share-based payments (including stock options and other forms of equity compensation). Our compensation committee takes into account the expense taken under FASB ASC Topic 718 when determining equity grants.

Derivatives Trading, Hedging and Pledging Policies

Our Insider Trading Compliance Program provides that no employee, officer, director, consultant or contractor, or any family member or member of the same household of any such person, should directly or indirectly participate in transactions involving trading activities which by their aggressive or speculative nature may give rise to an appearance of impropriety, including short sales and the purchase or writing of put or call options. In addition, our Insider Trading Compliance Program specifically prohibits short sales, put and call options and other hedging transactions under 10b5-1 trading plans. In addition, our Insider Trading Compliance Policy provides that no employee, officer or director may pledge Company securities as collateral to secure loans. This prohibition means, among other things, that these individuals may not hold Company securities in a "margin" account, which would allow the individual to borrow against their holdings to buy securities.

2022 Summary Compensation Table

The following table summarizes the compensation that we paid to our named executive officers related to the year ended December 31, 2022.

Name and Principal Position	Year	Salary ($)	Bonus ($)[1]	Stock Awards ($)[2]	Option Awards ($)[2]	Non-Equity Incentive Plan Compensation ($)[3]	All Other Compensation ($)[4]	Total ($)
Stephen Dilly, M.B.B.S, Ph.D.[5]								
President and Chief Executive Officer	2022	279,449	200,000	2,388,192	2,751,350	190,103	84,057	5,893,152
Kevin Norrett[6]								
Chief Operating Officer	2022	112,500		595,977	1,519,305	47,813	240	2,275,835
Ross Taylor	2022	426,430		368,410	326,268	185,725	13,640	1,320,473
Senior Vice President,	2021	408,270	—	340,080	256,802	246,000	13,040	1,264,192
Chief Financial Officer	2020	406,923	66,950	—	228,565	118,450	12,640	833,528
Margaret Nell Fitzgerald[7]								
Chief Legal and Compliance Officer, General Counsel and Secretary	2022	74,167	200,000	465,950	1,414,354	25,700	160	2,180,331
John J. Nicols[8]	2022	603,208			2,521,160	282,547	13,040	3,419,955
Former President and Chief Executive Officer	2021	696,562	—	—	2,109,577	619,000	13,040	3,438,179
	2020	686,667	168,188	—	1,795,800	297,562	12,640	2,960,857

(1) The amounts reported in the bonus column for 2022 represent sign-on bonuses awarded in connection with the commencement of employment. Dr. Dilly's sign-on bonus was paid shortly after he commenced employment with us. Ms. Fitzgerald's sign-on bonus was paid in two equal installments, the first in late 2022 and the second at the same time as the annual bonus payout in 2023.

(2) The amounts reported in the "Stock Awards" and "Option Awards" columns represent the grant date fair value of restricted stock, restricted stock units, performance stock units and stock options calculated in accordance with FASB ASC Topic 718. The valuation assumptions used in determining such amounts are described in Note 9 to our consolidated financial statements included in our Annual Report on Form 10-K for the year ended December 31, 2022. Amounts reported for performance stock units and performance-based stock options are based on the probable outcome of the applicable performance goals for 2022 as of the grant date, which was determined to equal 100% of target or, in the case of Ms. Fitzgerald whose performance stock units were granted at the same time the performance goals were modified to cap performance at 85% of target, calculated in accordance with FASB ASC Topic 718. The value of each of the performance-based award granted to the named executive officers, assuming that the highest level of performance conditions were achieved, is set forth in the table below:

Name	Grant Date Fair Value Assuming Maximum Achievement
Stephen Dilly (performance stock units)	$4,576,400
Kevin Norrett (performance stock units)	$1,191,954
Ross Taylor (performance stock units)	$ 387,800
Ross Taylor (performance-based options)	$ 395,476
John J. Nicols (performance-based options)	$4,251,367

While the performance goals for performance stock units and performance-based stock options for named executive officers other than Ms. Fitzgerald were modified in November 2022, we determined that the modification did not constitute a "modification" for the purposes of FASB ASC Topic 718 and did not record any incremental fair value. The modifications are described above under "—Components of Our Executive Compensation Program—Equity Incentive Compensation."

(3) The amounts reported in this column for 2022 reflect bonus payments made pursuant to the Executive Incentive Compensation Plan earned based on corporate and individual achievement. Please see the section "—Components of Our Executive Compensation Program—Annual Cash Compensation" above for more information.
(4) Amounts reflect the following for each named executive officer: Dr. Dilly: a travel allowance of $16,767, non-employee director fees of $55,457 and 401(k) matching contribution of $11,833; Mr. Norrett: a cell phone stipend of $240; Mr. Taylor: a cell phone stipend of $1,440 and 401(k) matching contribution of $12,200; Ms. Fitzgerald: a cell phone stipend of $160; and Mr. Nicols: a cell phone stipend of $840 and 401(k) matching contribution of $12,200.
(5) Dr. Dilly was appointed our President and Chief Executive Officer effective as of August 9, 2022.
(6) Mr. Norrett was appointed our Chief Operating Officer effective as of October 3, 2022.
(7) Ms. Fitzgerald was appointed our Chief Legal and Compliance Officer, General Counsel and Secretary effective as of October 31, 2022.
(8) Mr. Nicols retired as our President and Chief Executive Officer effective as of August 8, 2022.

Grants of Plan-Based Awards in 2022 Table

The following table shows information regarding grants of non-equity incentive and equity incentive awards during the year ended December 31, 2022 to each of our named executive officers:

Name	Grant Date	Estimated Future Payouts Under Non-Equity Incentive Plan Awards [1]			Estimated Future Payouts Under Equity Incentive Plan Awards [2]			All Other Stock Awards: Number of Shares of Stock or Units (#) [3]	All Other Option Awards: Number of Securities Underlying Options (#) [4]	Exercise or Base Price of Option Awards ($/Sh)	Grant Date Fair Value of Stock and Option Awards ($) [5]
		Threshold ($)	Target ($)	Maximum ($)	Threshold (#)	Target (#)	Maximum (#)				
Stephen Dilly, M.B.B.S, Ph.D.	8/1/2022								700,000	6.73	2,751,350
	8/1/2022				8,500	340,000	680,000				2,288,200
	6/14/2022							11,273			99,992
		5,591	223,651	335,476							
Ross Taylor	2/7/2022								13,000	19.39	128,530
	2/7/2022				500	20,000	40,000			19.39	197,738
	2/7/2022							9,000			174,510
	2/7/2022				250	10,000	20,000				193,900
		5,463	218,500	327,750							
Kevin Norrett	10/3/2022								413,405	6.07	1,519,305
	10/3/2022				2,454	98,184	196,368				595,977
		1,406	56,250	84,375							
Margaret Nell Fitzgerald	11/8/2022								382,775	6.03	1,414,354
	11/8/2022				13,636	77,272	77,272				465,950
		756	30,236	45,353							
John J. Nicols	2/7/2022								40,000	19.39	395,476
	2/7/2022				5,375	215,000	430,000				2,125,684
		13,725	549,000	823,500							

(1) The amounts reported in the "Estimated Future Payouts Under Non-Equity Incentive Plan Awards" column relate to amounts payable under our 2022 Executive Incentive Compensation Plan. The threshold column assumes the achievement of the least weighted performance goal at threshold, the target column assumes the achievement of both the company performance factor and the individual performance factor at the target level, and the maximum column assumes the maximum achievement for the company performance factor, in each case, pursuant to the original corporate performance goals established under the 2022 Executive Incentive Compensation Plan. The maximum achievement was reduced to 85% of the amount reported in the target column when our board and compensation committee modified the corporate performance goals in November 2022. The actual amounts paid to our named executive officers are set forth in the bonus and non-equity incentive plan compensation columns of the 2022 Summary Compensation Table.

(2) Amounts reported reflect performance stock units and shares underlying performance-based stock options granted in 2022 described above under "—Components of Our Executive Compensation Program—Equity Incentive Compensation," which are earned and become eligible to vest based on the Company's achievement of established performance goals. The threshold column assumes the achievement of the least weighted performance goal at threshold, the target column assumes the achievement of both the company performance factor and the individual performance factor at the target level, and the maximum column assumes the maximum achievement for the company performance factor, in each case, pursuant to the original corporate performance goals established by our board of directors and compensation committee. In November 2022, when the corporate performance goals were modified, the maximum achievement was reduced to 85% of the original amount reported in the target column. No incremental fair value was recognized in connection with the modification of corporate performance goals. See above under "—Components of Our Executive Compensation Program—Equity Incentive Compensation" for additional information on the modifications. Earned performance-based awards vest as to 50% of the earned shares on March 5, 2023 and the remaining 50% vests on March 5, 2024, in each case, subject to the named executive officer's continued service to our Company.

(3) The RSUs vest in three substantially equal installments on each of the first three anniversaries of the grant date, subject to the named executive officer's continued service to our Company.

(4) The options vest as to 1/4th of the shares subject to the option on the first anniversary of the date of grant and the remainder of the shares vest at a rate of 1/48th of the total shares subject to the option each month thereafter, subject to the named executive officer's continued service to our Company.

(5) The amounts reported in the "Grant Date Fair Value of Stock and Option Awards" column represents the grant date fair value of restricted stock, restricted stock units, performance stock units and options calculated in accordance with FASB ASC Topic 718. The valuation assumptions used in determining such amounts are described in Note 9 to our consolidated financial statements included in our Annual Report on Form 10-K for the year ended December 31, 2022. For performance-based awards, the amount shown is based on the probable outcome of the applicable performance goals for 2022 as of the grant date, which was determined to equal 100% of target, determined in accordance with FASB ASC Topic 718.

Outstanding Equity Awards at 2022 Year-End Table

The following table shows grants of stock options, performance stock units, and performance-based options outstanding on December 31, 2022, the last day of our year, for each of our named executive officers.

		Option Awards					Stock Awards			
Name	Vesting Commencement Date [1]	Number of Securities Underlying Unexercised Options Exercisable (#)	Number of Securities Underlying Unexercised Options Unexercisable (#)	Equity Incentive Plan Awards: Number of Securities Underlying Unexercised, Unearned Options (#) [2]	Option Exercise Price ($)	Option Expiration Date	Number of Shares or Units of Stock That Have Not Vested (#)	Market Value of Shares or Units of Stock That Have Not Vested ($) [1]	Equity Incentive Plan Awards: Number of Unearned Shares, Units, or Other Rights That Have Not Vested (#) [2]	Equity Incentive Plan Awards: Market or Payout Value of Unearned Shares, Units, or Other Rights That Have Not Vested ($) [3]
Stephen Dilly, M.B.B.S, Ph.D.	6/16/2020 [4]	—	—		—		5,968	27,811		
	6/14/2022 [5]	—	—		—		11,273	52,532		
	8/1/2022	—	700,000		6.73	8/1/2032				
	3/5/2022	—	—		—				289,000	1,346,740
Kevin Norrett	10/3/2022	—	413,405		6.07	11/8/2032				
	3/5/2022	—	—						83,456	388,907
Ross Taylor	8/20/2019	35,237	7,048		13.01	8/20/2029				
	2/11/2020	10,625	4,375		14.43	2/11/2030				
	2/11/2020	17,600	—		14.43	2/11/2030				
	2/11/2020	—	—		—		2,666	12,424		
	2/16/2021	4,583	5,417		26.16	2/16/2031				
	3/5/2021 [6]	8,003	8,003		26.16	2/16/2031				
	2/16/2021	—	—		—		5,820	27,121		
	3/5/2021 [6]	—	—		—		3,333	15,532		
	2/7/2022	—	13,000		19.39	2/7/2032				
	3/5/2022	—		17,000	19.39	2/7/2032				
	2/7/2022	—	—		—				8,500	39,610
	3/5/2022	—	—		—		9,000	41,940		
Margaret Nell Fitzgerald	11/8/2022	—	382,775		6.03	11/8/2032				
	3/5/2022	—	—						77,273	360,091
John J. Nicols	2/24/2014	357,140	—		1.97	2/24/2024				
	2/11/2015	306,000	—		3.39	2/11/2025				
	2/19/2016	211,000	—		4.10	2/19/2026				
	2/3/2017	220,000	—		4.60	2/3/2027				
	2/3/2017	671,000	—		4.60	2/3/2027				
	2/20/2018	130,000	—		8.95	2/20/2028				
	2/20/2018	383,500	—		8.95	2/20/2028				
	2/20/2019	34,166	—		21.80	2/20/2029				
	2/20/2019	138,600	—		21.80	2/20/2029				
	2/11/2020	30,208	—		14.43	2/11/2030				
	2/11/2020	198,000	—		14.43	2/11/2030				
	2/16/2021	12,395	—		26.16	2/16/2031				
	2/16/2021	100,031	—		26.16	2/16/2031				

(1) Except as otherwise noted, each stock option vests as to 25% of the total number of shares subject to the option on the first anniversary of the vesting commencement date and as to 1/48th of the total number of shares subject to the option on each monthly anniversary thereafter, in each case, subject to continued service to us, and each restricted stock unit award vests in three substantially equal installments on each anniversary of the vesting commencement date, subject to continued service to us. All awards reported for Mr. Nicols were vested as of December 31, 2022.

(2) Performance-based options and performance stock units are earned based on the achievement of performance goals, and earned award vest 50% on March 5, 2023 and 50% on March 5, 2024, subject to continued service to us. Number of shares underlying performance-based options and performance stock units reflect maximum achievement of 85% of the original number granted, based on the cap established by our board of directors and compensation committee in November 2022 when our corporate performance goals were modified. See above under "—Components of Our Executive Compensation Program—Equity Incentive Compensation."

(3) The market value of restricted stock units and performance stock units is calculated using $4.66, the closing trading price of our common stock on December 30, 2022.

(4) Represents restricted stock granted to Dr. Dilly in connection with his appointment as a member of our board of directors that will vest in full on the third anniversary of the vesting commencement date.

(5) Represents restricted stock granted to Dr. Dilly in connection with his service as a member of our board of directors that will vest in full on June 13, 2023.

(6) Represents the earned portion of performance-based awards that vest in full on March 5, 2023, subject to continued employment.

Option Exercises and Stock Vested in 2022

The following table sets forth information regarding stock option exercises completed by our named executive officers during 2021 and stock awards in which our named executive officers vested during 2022.

	Option Awards		Stock Awards	
Name	Number of Shares Acquired on Exercise (#)	Value Realized on Exercise ($)[1]	Number of Shares Vested (#)	Value Realized on Vesting ($)[2]
Stephen Dilly, M.B.B.S, Ph.D.			10,764	160,561
Ross Taylor			17,194	423,710
John J. Nicols	374,300	2,963,337		

(1) The value realized equals the excess of the per-share closing trading price of our common stock at exercise over the option exercise price, multiplied by the number of shares for which the option was exercised.

(2) The dollar amounts shown above for stock awards are determined by multiplying the number of shares that vested by the per-share closing trading price of our common stock on the vesting date.

Pension Benefits

We do not maintain any defined benefit pension plans.

Nonqualified Deferred Compensation

We do not maintain any nonqualified deferred compensation plans.

Employment, Change in Control and Severance Arrangements

We are party to an employment agreement with Dr. Dilly and a change of control severance agreement with each of Mr. Norrett, Mr. Taylor and Ms. Fitzgerald, each of which provide for payments and benefits upon certain terminations of employment. In August 2022, we entered into a transition and separation agreement with Mr. Nicols. In March 2023, we entered into a separation agreement with Mr. Taylor.

We entered into an employment agreement with Dr. Dilly in August 2022 in connection with his commencement of employment with us that provides the terms and conditions of his employment with us as President and Chief Executive Officer. The employment agreement provides for Dr. Dilly to be paid an annual base salary of $710,000 and an annual bonus targeted at 75% of his annual base salary, in each case, subject to increase from time to time as may be determined by our board of directors or compensation committee. Dr. Dilly's employment agreement also provides for Dr. Dilly to be paid a sign on bonus of $200,000 that is subject to repayment in the event we terminate his employment for cause or he resigns his employment for other than good reason (as each term is defined in his employment agreement), with 100% subject to repayment if such termination or resignation occurs within 6 months of his commencement of employment with us and 50% subject to repayment if such

termination or resignation occurs between 6 months and one year after he commences employment with us. In addition, the employment agreement provides for Dr. Dilly to be paid an annual travel allowance of $40,000, pro-rated for any partial year of service.

Under Dr. Dilly's employment agreement, in the event that his employment is terminated without cause, he resigns for good reason or his employment is terminated due to death or disability (as defined in his employment agreement), he will be eligible to receive: an amount equal to 12 months of his base salary and 100% of his annual target bonus, payable in a cash lump sum, 12 months' vesting acceleration for all outstanding equity awards (with any performance-based award deemed achieved at target), and continued healthcare coverage for up to 12 months. In addition, in the event Dr. Dilly's employment is terminated without cause, he resigns for good reason, or his employment is terminated due to death or disability, in each case, within three months prior to or 12 months following a change in control of our Company, Dr. Dilly is entitled to receive a lump sum severance payment in an amount equal to 150% of his annual base salary and 150% of his annual target bonus, up to 18 months of continued health coverage and full acceleration of vesting for each of his outstanding equity awards. The employment agreement also provides that in the event Dr. Dilly's employment with the Company is terminated by the Company without Cause in connection with the sale or exclusive license of a substantial portion of the assets of the Company, as reasonably determined by our board of directors, then each outstanding equity award held by Dr. Dilly as of the date immediately preceding his termination of employment will fully vest. All of the foregoing payments and benefits are subject to Dr. Dilly's execution and subsequent non-revocation of a release of claims in favor of the Company.

We have entered into change of control severance agreements with each of Mr. Norrett, Mr. Taylor and Ms. Fitzgerald. Each change of control severance agreement provides that, in the event the named executive officer experiences an involuntary termination without cause or a voluntary resignation for good reason (as such terms are defined in the agreement), the named executive officer will be entitled to an amount equal to twelve, or, in the case of Mr. Taylor, six months of his base salary and continued healthcare coverage for up to twelve, or, in the case of Mr. Taylor, six, months. In the event the named executive officer experiences an involuntary termination without cause or a voluntary termination for good reason during the period commencing 90 days prior to and ending 12 months following a change of control of the Company, or the change in control period, the named executive officer will be entitled to a lump sum payment equal to 18, or, in the case of Mr. Taylor, 12, months of base salary, continued healthcare coverage for up to 18, or, in the case of Mr. Taylor, 12 months, and full accelerated vesting of the named executive officer's outstanding equity awards. In the event that the named executive's employment is terminated without cause or resigns for good reason and the event giving rise to such termination occurs at the direction of a person or entity that has entered into an agreement with the Company that contemplates a transaction which would constitute a change of control if consummated, then such termination will be deemed to have occurred within the change in control period, and the named executive officer will be entitled to the payments and benefits described in the preceding sentence. The change of control severance agreement also provides that in the event a named executive's employment is terminated as a result of death or disability, the named executive officer will be entitled to vesting of the named executive officer's equity awards with respect to that number of shares that would otherwise vest on the next vesting date for such equity award, pro-rated to the date of termination and continued healthcare coverage for up to 12 months. All of the foregoing payments and benefits are subject to the named executive officer's execution and subsequent non-revocation of a release of claims in favor of the Company.

Under each named executive officer's change of control severance agreement, in the event of a change of control, performance under any outstanding performance-based equity awards (including any performance-based options and performance stock units) would be determined as follows: (i) if the change of control is consummated prior to the date the compensation committee determines the achievement of the applicable performance goals, performance would be deemed achieved at 100% of target level; and (ii) if the change of control is consummated on or after the date the compensation committee determines the achievement of the applicable performance goals, performance will be deemed achieved at the level determined by our compensation committee based on actual performance.

In August 2022, we entered into a transition and separation agreement with Mr. Nicols, pursuant to which Mr. Nicols serves as a strategic advisor to us through the earliest of August 7, 2024, the date we terminate Mr. Nicols' employment for cause or the date Mr. Nicols voluntarily resigns his employment with us. Under the transition and separation agreement, Mr. Nicols will be paid an annual base salary of $480,000 through August 6, 2023 and an annual base salary of $240,000 between August 7, 2023 and August 7, 2024. The agreement also provides for Mr. Nicols to cease serving as a member of our board of directors at this Annual Meeting, and for the reimbursement of legal fees incurred by Mr. Nicols negotiating the agreement, capped at $35,000. The transition and separation agreement included a full general release of claims against us.

The following table sets forth quantitative estimates of the payments and benefits pursuant to Dr. Dilly's employment agreement, Mr. Norrett's, Mr. Taylor's and Ms. Fitzgerald's change of control severance agreement and Mr. Nicols transition and separation agreement, as applicable, that would have accrued to each such named executive officer if the named executive officer's employment had been terminated on December 31, 2022 by us without cause or, except in the case of Mr. Nicols, by the named executive officer for good reason, due to the named executive officer's death or disability and, solely in the case of Dr. Dilly, a termination without cause in connection with the sale or license of a substantial portion of our assets, in each case, either outside of or in connection with a change of control of the Company or an asset sale or license that occurred on December 31, 2022.

Name	Salary Lump Sum ($)	Target Bonus ($)	Value of Accelerated Equity Awards ($)[1]	Value of Continued Healthcare Coverage ($)	Total ($)
Stephen Dilly					
Without cause, for good reason or due to death or disability	710,000	532,500	294,040	23,789	1,560,329
Without cause, for good reason or due to death or disability in connection with a change in control	1,065,000	798,750	1,399,272	35,683	3,298,750
Without cause in connection with a sale or license of a substantial portion of our assets	710,000	532,500	1,399,272	23,789	2,665,561
Kevin Norrett					
Without cause or for good reason	450,000			23,789	473,789
Without cause or for good reason in connection with a change in control	675,000		388,907	35,683	1,099,590
Due to death or disability			48,073	23,789	71,862
Ross Taylor					
Without cause or for good reason	218,500			11,894	230,394
Without cause or for good reason in connection with a change in control	437,000		136,627	23,789	597,415
Due to death or disability			73,515	23,789	97,304
Margaret Nell Fitzgerald					
Without cause or for good reason	445,000			7,274	452,274
Without cause or for good reason in connection with a change in control	667,500		360,091	10,911	1,038,502
Due to death or disability			26,507	7,274	33,781
John J. Nicols					
Without cause	528,387				528,387

(1) The value of the accelerated vesting of option awards is calculated based on the aggregate amount, if any, by which $4.66, the closing trading price of our common stock on December 30, 2022, the last trading day

in 2022, exceeded the exercise price of the outstanding and unvested stock options as of December 31, 2022. The value of the accelerated restricted stock unit and performance stock unit awards is calculated based on the number of shares of our common stock or units subject to the outstanding unvested award (calculated at target in respect of performance-based awards), multiplied by $4.66, the closing trading price of our common stock on December 30, 2022, the last trading day in 2022.

Pay Ratio of CEO to Median Employee

As required by Section 953(b) of the Dodd-Frank Wall Street Reform and Consumer Protection Act, and Item 402(u) of Regulation S-K, we are providing information about the relationship of the annual total compensation of our employees and the annual total compensation of Dr. Dilly, who served as our CEO as of December 31, 2022. For 2022, our last completed year, the total compensation in 2022 of our CEO was approximately 39 times the median total compensation in 2022 of all of our other employees (the "Pay Ratio"). The median of the annual total compensation of all employees of our Company (other than our CEO) was $162,077. For the purposes of the Pay Ratio calculation, we annualized our CEO's 2022 salary since becoming CEO, then added all other forms of compensation as outlined in the "Summary Compensation Table" above, for a total of $6,306,935.

The Company chose December 31, 2022 as the date for establishing the employee population used in identifying the median employee and used the 12 month period from January 1, 2022 through December 31, 2022, as the measurement period. We identified the median employee using the consistently applied compensation measure of base salary earned during the measurement period for each employee (U.S. and non-U.S.). Permanent employees who joined in 2022 and permanent employees who were on leave during 2022 were assumed to have worked for the entire measurement period. We captured all employees as of December 31, 2022, consisting of approximately 248 individuals globally, with approximately 98% of these individuals located in the U.S. and approximately 2% located outside of the U.S. Earnings of our employees outside the U.S. were converted to U.S. dollars using an average currency exchange rate over the measurement period. No cost-of-living adjustments were made. The annual total compensation of the median employee and the annual total compensation of our CEO were calculated in accordance with the requirements of Item 402(c)(2)(x) of Regulation S-K.

Pay-Versus-Performance Disclosure

As required by Item 402(v) of Regulation S-K, we are providing the following information about the relationship between the compensation actually paid to our named executive officers and certain aspects of our financial performance. For further information concerning our pay for performance philosophy and how executive compensation aligns with our performance, please refer to "*Executive Compensation – Compensation Discussion and Analysis*."

Pay-Versus-Performance Table

	Pay Versus Performance									
							Value of Initial Fixed $100 Investment Based On:			
Year (a)	Summary Compensation Table Total for PEO (Current) (b)	Compensation Actually Paid for PEO (Current) (c)	Summary Compensation Table Total for PEO (Former) (b)	Compensation Actually Paid for PEO (Former) (c)	Average Summary Compensation Table Total for Non-PEO NEOs (d)	Average Compensation Actually Paid for Non-PEO NEOs (e)	Total Shareholder Return (f)	Peer Group Total Return (g)	Net Income (h)	Company-Selected Measure: Revenue (i)
2022	$5,876,384	$3,461,766	$3,419,955	($3,857,296)	$1,919,623	$ 846,088	$ 29	$114	($33,592,000)	$138,590,000
2021	N/A	N/A	$3,438,179	$ 6,518,158	$1,264,192	$2,093,766	$196	$126	($21,279,000)	$104,754,000
2020	N/A	N/A	$2,960,857	$ 3,592,089	$ 833,528	$1,569,978	$137	$126	($24,010,000)	$ 69,056,000

(1) During fiscal years 2020, 2021 and 2022, our PEOs and non-PEO NEOs were as follows:.

Year	PEO (Current CEO) (1)	PEO (Former CEO) (2)	Non-PEO NEOs
2022	Stephen Dilly	John Nicols	Ross Taylor, Kevin Norrett, Margaret Fitzgerald
2021		John Nicols	Ross Taylor
2020		John Nicols	Ross Taylor

(2) The dollar amounts reported in column (c) and (e) represent the amount of "compensation actually paid" to our PEOs and Non-PEO NEOs in each respective year. The dollar amounts do not reflect the actual amount of compensation earned or received during the applicable fiscal year. There are no material differences between the assumptions used to compute the valuation of the equity awards for calculating the compensation actually paid from the assumptions used to compute the valuation of such equity awards as of the grant date. In accordance with the requirements of Item 402(v) of Regulation S-K, the following adjustments were made to the total compensation of our PEOs and non-PEO NEOs for each year to determine the "compensation actually paid" to him or her:

	PEO (Current)				
			2020	2021	2022
	Summary Compensation Table - Total Compensation	(a)	N/A	N/A	$ 5,876,384
-	Grant Date Fair Value of Stock Awards and Option Awards Granted in Fiscal Year	(b)	N/A	N/A	$ 5,139,542
+	Fair Value at Fiscal Year End of Outstanding and Unvested Stock Awards and Option Awards Granted in Fiscal Year	(c)	N/A	N/A	$ 3,127,949
+	Change in Fair Value of Outstanding and Unvested Stock Awards and Option Awards Granted in Prior Fiscal Years	(d)	N/A	N/A	($158,808)
+	Fair Value at Vesting of Stock Awards and Option Awards Granted in Fiscal Year That Vested During Fiscal Year	(e)	N/A	N/A	$ —
+	Change in Fair Value as of Vesting Date of Stock Awards and Option Awards Granted in Prior Fiscal Years For Which Applicable Vesting Conditions Were Satisfied During Fiscal Year	(f)	N/A	N/A	($244,217)
-	Fair Value as of Prior Fiscal Year End of Stock Awards and Option Awards Granted in Prior Fiscal Years That Failed to Meet Applicable Vesting Conditions During Fiscal Year	(g)	N/A	N/A	$ —
=	Compensation Actually Paid				$ 3,461,766

PEO (Former)

		2020	2021	2022
Summary Compensation Table - Total Compensation	(a)	$ 2,960,857	$3,438,179	$ 3,419,955
- Grant Date Fair Value of Stock Awards and Option Awards Granted in Fiscal Year	(b)	$ 1,795,800	$2,109,577	$ 2,521,160
+ Fair Value at Fiscal Year End of Outstanding and Unvested Stock Awards and Option Awards Granted in Fiscal Year	(c)	$ 2,968,985	$3,900,233	$ —
+ Change in Fair Value of Outstanding and Unvested Stock Awards and Option Awards Granted in Prior Fiscal Years	(d)	$ 559,924	$1,262,770	$ —
+ Fair Value at Vesting of Stock Awards and Option Awards Granted in Fiscal Year That Vested During Fiscal Year	(e)	$ —	$ —	$ —
+ Change in Fair Value as of Vesting Date of Stock Awards and Option Awards Granted in Prior Fiscal Years For Which Applicable Vesting Conditions Were Satisfied During Fiscal Year	(f)	($1,101,877)	$ 26,552	($2,208,709)
- Fair Value as of Prior Fiscal Year End of Stock Awards and Option Awards Granted in Prior Fiscal Years That Failed to Meet Applicable Vesting Conditions During Fiscal Year	(g)	$ —	$ —	$ 2,547,383
= Compensation Actually Paid		$ 3,592,089	$6,518,158	($3,857,296)

NEO Average

		2020	2021	2022
Summary Compensation Table - Total Compensation	(a)	$ 833,528	$1,264,192	$ 1,919,623
- Grant Date Fair Value of Stock Awards and Option Awards Granted in Fiscal Year	(b)	$ 228,565	$ 596,882	$ 1,590,832
+ Fair Value at Fiscal Year End of Outstanding and Unvested Stock Awards and Option Awards Granted in Fiscal Year	(c)	$ 872,284	$ 951,834	$ 978,796
+ Change in Fair Value of Outstanding and Unvested Stock Awards and Option Awards Granted in Prior Fiscal Years	(d)	$ 118,975	$ 426,740	($250,128)
+ Fair Value at Vesting of Stock Awards and Option Awards Granted in Fiscal Year That Vested During Fiscal Year	(e)	$ —	$ —	$ —
+ Change in Fair Value as of Vesting Date of Stock Awards and Option Awards Granted in Prior Fiscal Years For Which Applicable Vesting Conditions Were Satisfied During Fiscal Year	(f)	($26,244)	$ 47,882	($211,371)
- Fair Value as of Prior Fiscal Year End of Stock Awards and Option Awards Granted in Prior Fiscal Years That Failed to Meet Applicable Vesting Conditions During Fiscal Year	(g)	$ —	$ —	$ —
= Compensation Actually Paid		$1,569,978	$2,093,766	$ 846,088

(3) Cumulative TSR is calculated by dividing the sum of the cumulative amount of dividends during the measurement period, assuming dividend reinvestment, and the difference between our share price at the end of the applicable measurement period and the beginning assuming $100 of investment as of December 31, 2019.

(4) The peer group used for this purpose is the NASDAQ Biotechnology Index.

Financial Performance Measures

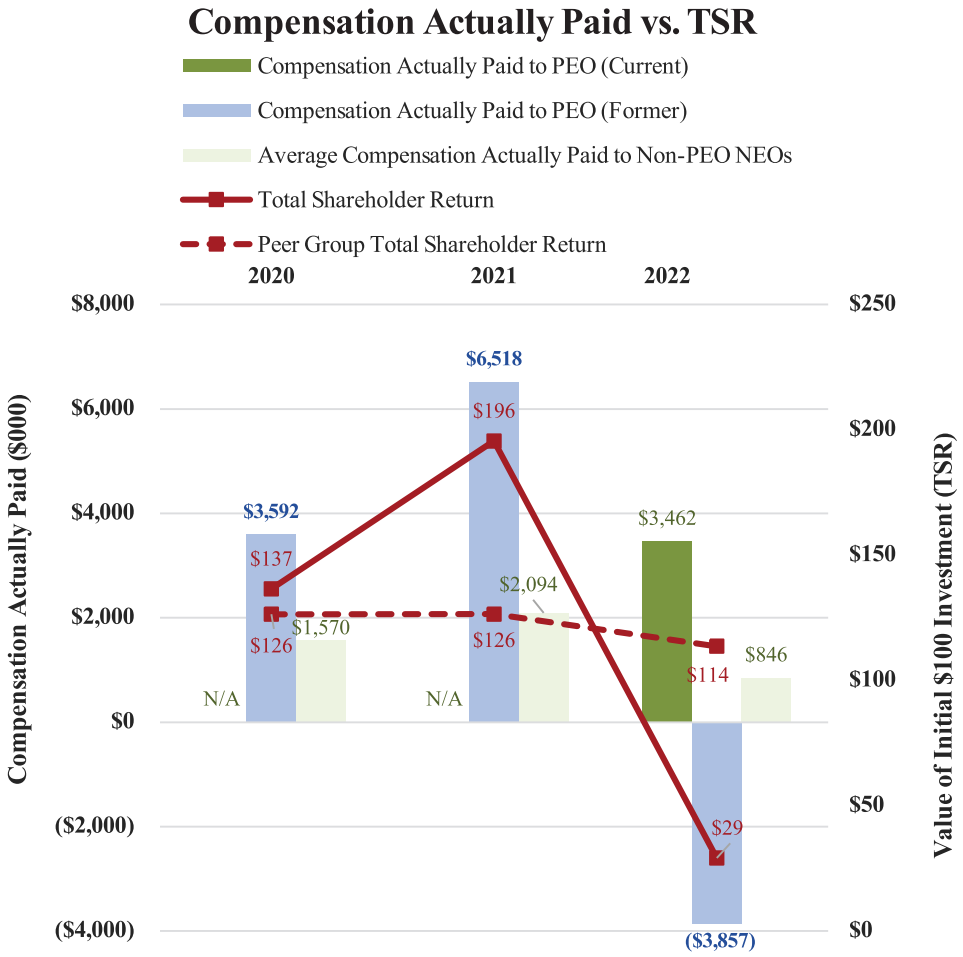
The following table sets forth the company's most important financial performance measures used to link NEO compensation actually paid during 2022 to company performance.

Company Performance Metrics
Total Revenue
Product Revenue
Product Gross Margin
Cash Reserves

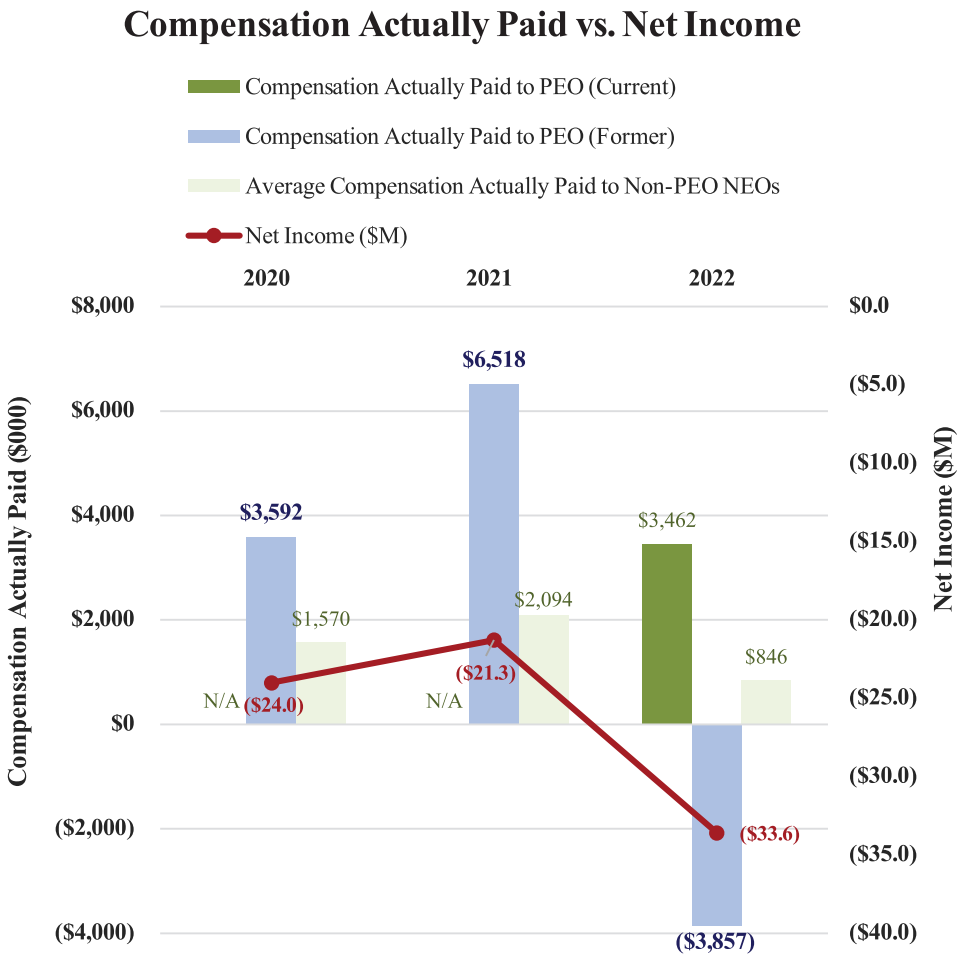
Additional information about each of these performance measures and the role of our performance in each of these measures in determining our executive compensation are discussed in greater detail in "*Executive Compensation – Compensation Discussion and Analysis*."

Analysis of Information Presented in Pay-Versus-Performance Table

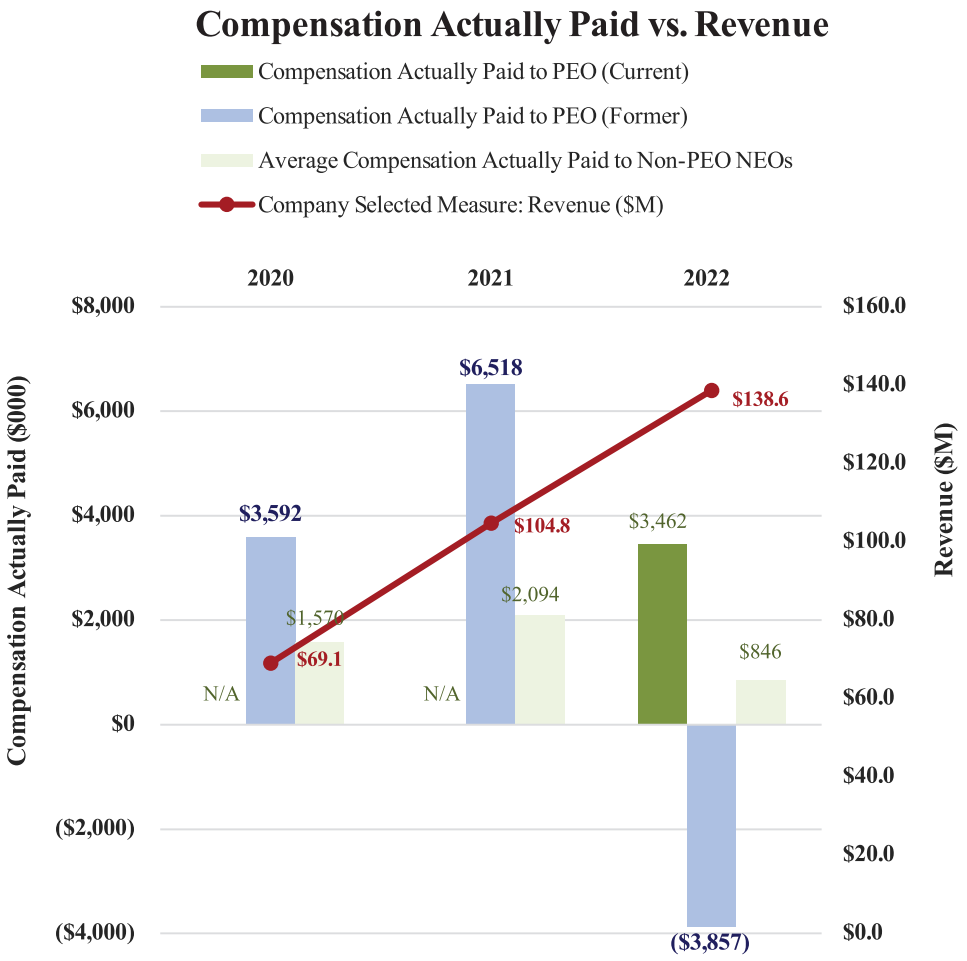
The following graph illustrates the relationship between compensation actually paid to our PEOs and our non-PEO NEOs and our TSR for the period presented in the Pay-Versus-Performance table.



The following graph illustrates the relationship between compensation actually paid to our PEOs and our non-PEO NEOs and our net income for the period presented in the Pay-Versus-Performance table.



The following graph illustrates the relationship between compensation actually paid to our PEOs and our non-PEO NEOs and our revenue for the period presented in the Pay-Versus-Performance table.



Equity Compensation Plan Information

The following table provides certain information as of December 31, 2022, with respect to all of our equity compensation plans in effect on that date.

	Number of securities to be issued upon exercise of outstanding options and rights (a)	Weighted-average exercise price of outstanding options rights (b)	Number of securities remaining available for future issuance under equity compensation plans (excluding securities reflected in column (a)) (c)
Equity compensation plans approved by security holders [1]	7,155,075	$9.63	2,930,328
Equity compensation plans not approved by security holders [2]	—	—	2,000,000
Total	7,155,075	$9.63	4,930,328

(1) Includes the 2010 Plan and the 2019 Plan. The number of shares of Codexis common stock that may be issued pursuant to outstanding awards under the 2010 Plan and 2019 Plan include, respectively: (A) outstanding awards of 666,343 performance stock units, 1,719,597 shares underlying performance-based stock options and 518,714 time-based restricted stock units and (B) 4,250,421 shares underlying time-based stock options. The weighted average exercise price shown is for stock options and excludes performance stock units and restricted stock units, which do not have an exercise price. No new awards may be made under the 2010 Plan.

(2) Includes the 2022 Employment Inducement Award Plan. The 2022 Employment Inducement Award Plan provides for the grant of non-qualified stock options, restricted stock units, restricted stock awards, performance awards, dividend equivalents, deferred stock awards, deferred stock units, stock payment and stock appreciation rights to a person not previously an employee or director of the Company, or following a bona fide period of non-employment, as an inducement material to the individual's entering into employment with the Company. No awards were outstanding under the 2022 Employment Inducement Award Plan as of December 31, 2022.

Compensation Committee Report

The material in this report is not "soliciting material," is not deemed "filed" with the SEC, and is not to be incorporated by reference into any filing of Codexis under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended.

The compensation committee has reviewed and discussed the Compensation Discussion and Analysis with management. Based on the review and discussions, the compensation committee recommended to the board of directors that the Compensation Discussion and Analysis be included in this proxy statement for the Annual Meeting and incorporated by reference in our Annual Report on Form 10-K for the year ended December 31, 2022.

Submitted by the Compensation Committee of the Board of Directors:

Alison Moore, Ph.D. (Chair)
Rahul Singhvi, Sc.D.
Dennis P. Wolf

AUDIT MATTERS

Audit Committee Report

The material in this report is not "soliciting material," is not deemed "filed" with the SEC, and is not to be incorporated by reference into any filing of Codexis under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended.

The following is the report of the audit committee with respect to Codexis' audited consolidated balance sheets as of December 31, 2022 and 2021, and the related consolidated statements of operations, stockholders' equity and cash flows for each of the three years in the period ended December 31, 2022 and the notes thereto.

Responsibilities. The audit committee operates under a written charter adopted by the board of directors. The role of the audit committee is to oversee our financial reporting process on behalf of the board of directors. Our management has the primary responsibility for our financial statements as well as our financial reporting process and principles, internal controls and disclosure controls. The independent registered public accounting firm, BDO, is responsible for performing an audit of our financial statements and expressing an opinion as to the conformity of such financial statements with U.S. generally accepted accounting principles. BDO is also responsible for expressing an opinion on our internal control over financial reporting based on its audit.

Review with Management. The audit committee has reviewed and discussed our audited financial statements (including the quality of our accounting principles) with management. Our management is responsible for the preparation, presentation and integrity of our financial statements. Management is also responsible for establishing and maintaining internal controls over financial reporting (as defined in Exchange Act Rule 13a-15(f)) and for evaluating the effectiveness of those internal controls and for evaluating any changes in those controls that will, or are reasonably likely to, affect internal controls over financial reporting. Management is also responsible for establishing and maintaining disclosure controls (as defined in Exchange Act Rule 13a-15(e)) and for evaluating the effectiveness of disclosure controls and procedures.

Review and Discussions with Independent Accountants. The audit committee has reviewed and discussed our audited financial statements (including the quality of Codexis' accounting principles) with BDO. The audit committee has discussed with BDO the matters required to be discussed by the applicable requirements of the Public Company Accounting Oversight Board ("PCAOB") and the SEC. Further, the audit committee reviewed BDO's Report of Independent Registered Public Accounting Firm included in our Annual Report on Form 10-K related to its audit of the consolidated financial statements.

The audit committee has also received and reviewed the written disclosures and the letter from BDO required by the applicable requirements of the PCAOB regarding BDO's communications with the Audit Committee concerning independence, and has discussed with BDO its independence from us.

Conclusion. Based on the review and discussions referred to above, the audit committee recommended to the board of directors that our audited financial statements be included in our Annual Report on Form 10-K for the year ended December 31, 2022.

Submitted by the Audit Committee of the Board of Directors:

David V. Smith (Chair)
H. Stewart Parker
Dennis P. Wolf

CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS

We describe below transactions, since January 1, 2022, to which we were a party or will be a party, in which:

- The amounts involved exceeded or are expected to exceed $120,000; and
- A director, executive officer, holder of more than 5% of our common stock or any member of their immediate family had or will have a direct or indirect material interest.

Molecular Assemblies, Inc.

In June 2020, we entered into a Stock Purchase Agreement with Molecular Assembles, Inc. ("MAI") pursuant to which we purchased 1,587,050 shares of MAI's Series A preferred stock for $1.0 million. In connection with the transaction, Mr. Nicols, our former President and Chief Executive Officer and a current member of our board of directors, also joined MAI's board of directors. Concurrently with our initial equity investment, we entered into a Master Collaboration and Research Agreement with MAI (the "MAI Agreement"), pursuant to which we performed services utilizing our CodeEvolver® protein engineering platform technology to improve DNA polymerase enzymes in exchange for compensation in the form of additional shares of MAI's Series A and B preferred stock which are valued based on the observed transaction price of similar securities of MAI issued to third parties. We completed the R&D service with MAI pursuant to the MAI Agreement during the first quarter of 2022. In December 2021, we received the primary milestone payment pursuant to the MAI Agreement of $1.0 million in the form of an additional 1,587,049 shares of Series B preferred stock. Upon execution of the Commercial License and Enzyme Supply Agreement with MAI ("MAI Supply Agreement") in July 2022, we received the commercialization and enzyme supply agreement milestone payment pursuant to the MAI Agreement of $1.0 million in the form of an additional 1,587,049 shares of Series B preferred stock. In addition to our initial equity investment and the shares we have received under the MAI Agreement, in April 2021, we purchased an additional 1,000,000 shares of MAI's Series A preferred stock for $0.6 million and in September 2021, we purchased 9,198,423 shares of MAI's Series B preferred stock for $7.0 million.

We recognized $1.2 million, $2.0 million and $0.9 million in research and development revenue from transactions with MAI in the years ended December 31, 2022, 2021 and 2020, respectively. Payment for the R&D services rendered under the MAI Agreement was received in the form of additional shares of MAI's Series A and Series B preferred stock. We received an aggregate of 1,587,049, 3,491,505 and 714,171 shares of MAI's Series A and B preferred stock for the years ended December 31, 2022, 2021 and 2020, respectively. As of December 31, 2022, we hold an aggregate 18,292,369 shares of MAI's Series A and B preferred stock that we have earned or purchased since executing the Stock Purchase Agreement with MAI.

In April 2022, we received a purchase order from MAI for the delivery of certain enzyme products to MAI in 2022. In July 2022, we and MAI executed the MAI Supply Agreement that will enable MAI to utilize an evolved terminal deoxynucleotidyl transferase enzyme in MAI's Fully Enzymatic Synthesis™ technology. We recognized $0.5 million in product revenue for the year ended December 31, 2022.

Director and Officer Indemnification Agreements

In addition to the indemnification required in our Certificate of Incorporation and amended and restated bylaws, we have entered into indemnification agreements with each of our directors and executive officers. These agreements provide for the indemnification of our directors, officers, and certain employees for all reasonable expenses and liabilities incurred in connection with any action or proceeding brought against them by reason of the fact that they are or were our agents. This description of the indemnification provisions of our indemnification agreements is qualified in its entirety by reference to these documents, each of which is attached as an exhibit to our most recent registration statement.

Policies and Procedures for Related Party Transactions

Our board of directors has adopted a written related party transaction policy. This policy covers, with certain exceptions set forth in Item 404 of Regulation S-K under the Exchange Act, any transaction, arrangement or relationship, or any series of similar transactions, arrangements or relationships in which we were or are to be a participant, the amount involved exceeds $120,000, and a related party had or will have a direct or indirect material interest**.** Under the policy, the audit committee is required to review the relevant facts and circumstances of any such transaction, arrangement or relationship, including whether the transaction is on comparable terms to arm's length dealings with third parties, the extent of the related party's interest in the transaction, and the conflicts of interest and corporate opportunity provisions of our code of business conduct and ethics. Such transactions, arrangements or relationships may only be consummated or continue if the audit committee approves or ratifies such transaction, arrangement or relationship. If advance approval by the audit committee is not feasible, then management may preliminarily enter into the transaction, arrangement or relationship upon prior approval by the chairman of the audit committee, subject to ratification of the transaction, arrangement or relationship at the audit committee's next regularly scheduled meeting.

Each transaction required to be reported under Item 404(a) of Regulation S-K since the beginning of last year was entered into in compliance with our related person transaction policy described above.

OTHER MATTERS

Section 16(a) Beneficial Ownership Reporting Compliance

Section 16(a) of the Securities Exchange Act of 1934 requires our directors and executive officers, and persons who own more than 10% of a registered class of our securities, to file with the SEC initial reports of ownership and reports of changes in ownership of common stock and other equity securities of our Company. Based solely on a review of copies of such forms received with respect to 2022 and the written representations received from certain reporting persons that no other reports were required, we believe that all directors, executive officers and persons who own more than 10% of our common stock complied with the reporting requirements of Section 16(a) during 2022.

Stockholder Proposals and Nominations

Proposals Pursuant to Rule 14a-8. Pursuant to Rule 14a-8 under the Exchange Act, stockholders may present proper proposals for inclusion in the proxy statement and for consideration at our next annual meeting of stockholders. To be eligible for inclusion in our proxy statement for the 2024 Annual Meeting of Stockholders, your proposal must be received by our Secretary at our principal executive offices at 200 Penobscot Drive, Redwood City, CA 94063 no later than December 29, 2023, and must otherwise comply with Rule 14a-8. While our board will consider stockholder proposals, we reserve the right to omit from the proxy statement stockholder proposals that we are not required to include under the Exchange Act, including Rule 14a-8.

Proposals and Nominations Pursuant to Our Bylaws. Under our bylaws, in order to nominate a director or bring any other business before the stockholders at the 2024 Annual Meeting of Stockholders, other than proposals pursuant to Rule 14a-8, you must notify us in writing and such notice must be received by us no earlier than February 14, 2024 and no later than March 15, 2024. You must comply with specific procedures set forth in our bylaws and the nomination or proposal notice must contain the specific information required by our bylaws and, for nominations, the specific information required by Rule 14a-19(b) under the Exchange Act. You may write to our Secretary at our principal executive offices at 200 Penobscot Drive, Redwood City, CA 94063, to deliver the notices discussed above and to request a copy of the relevant bylaw provisions regarding the requirements for making stockholder proposals and nominating director candidates pursuant to the bylaws. In addition to satisfying the requirements under our bylaws, to comply with the universal proxy rules under the 1934 Act, stockholders who intend to solicit proxies in support of director nominees other than the company's nominees must provide notice that sets forth the information required by Rule 14a-19 under the 1934 Act, no later than April 14, 2024. In connection with the 2024 Annual Meeting of Stockholders, we intend to file a proxy statement and a WHITE proxy card with the SEC in connection with our solicitation of proxies for that meeting.

Householding of Proxy Materials

Under the rules adopted by the SEC, we may deliver a single set of proxy materials to one address shared by two or more of our stockholders. This delivery method is referred to as "householding" and can result in significant cost savings. To take advantage of this opportunity, we have delivered only one set of proxy materials to multiple stockholders who share an address, unless we received contrary instructions from the impacted stockholders prior to the mailing date. We agree to deliver promptly, upon written or oral request, a separate copy of the proxy materials, as requested, to any stockholder at the shared address to which a single copy of these documents was delivered. If you prefer to receive separate copies of the proxy statement or annual report, contact Broadridge Financial Solutions, Inc. by calling 1-866-540-7095 or in writing at 51 Mercedes Way, Edgewood, New York 11717, Attention: Householding Department.

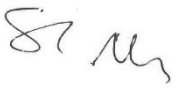
In addition, if you currently are a stockholder who shares an address with another stockholder and would like to receive only one copy of future notices and proxy materials for your household, you may notify your broker if your shares are held in a brokerage account or you may notify us if you hold registered shares. Registered stockholders may notify us by contacting Broadridge Financial Solutions, Inc. at the above telephone number or address.

Incorporation by Reference

Notwithstanding anything to the contrary set forth in any of our previous filings under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, which might incorporate future filings made by us under those statutes, neither the preceding Compensation Committee Report nor the Audit Committee Report will be incorporated by reference into any of those prior filings, nor will any such report be incorporated by reference into any future filings made by us under those statutes. In addition, information on our website, other than our proxy statement, notice and form of proxy, is not part of the proxy soliciting material and is not incorporated herein by reference.

We have filed our Annual Report on Form 10-K for the year ended December 31, 2022 with the SEC. It is available free of charge at the SEC's web site at www.sec.gov and our website at www.codexis.com. Upon written request by a Codexis stockholder, we will mail without charge a copy of our Annual Report on Form 10-K, including the consolidated financial statements and financial statement schedules, but excluding exhibits to the Annual Report on Form 10-K. Exhibits to the Annual Report on Form 10-K are available upon payment of a reasonable fee, which is limited to our expenses in furnishing the requested exhibit. All requests should be directed to 200 Penobscot Drive, Redwood City, CA 94063 Attention: Secretary.

BY ORDER OF THE BOARD OF DIRECTORS



Stephen Dilly, M.B.B.S., Ph.D.
President and Chief Executive Officer

April 27, 2023

Appendix A

CERTIFICATE OF AMENDMENT
TO
NINTH AMENDED AND RESTATED CERTIFICATE OF INCORPORATION OF CODEXIS, INC.

The undersigned duly authorized officer of Codexis, Inc., a Delaware corporation, hereby certifies the following:

ONE: The original name of this corporation is Codexis, Inc. and the date of filing the original Certificate of Incorporation of this corporation with the Secretary of State of the State of Delaware was January 31, 2002.

TWO: The Corporation's Ninth Amended and Restated Certificate of Incorporation (the "Restated Certificate of Incorporation") shall be amended by replacing Article IV Section A with the following:

ARTICLE IV

"A. This Corporation is authorized to issue two classes of stock to be designated, respectively, "Common Stock" and "Preferred Stock." The total number of shares that the Corporation is authorized to issue is two hundred and five million (205,000,000) shares, two hundred million (200,000,000) shares of which shall be Common Stock and five million (5,000,000) shares of which shall be Preferred Stock. The Common Stock shall have a par value of one-hundredth of one cent ($0.0001) per share and the Preferred Stock shall have a par value of one-hundredth of one cent ($0.0001) per share."

THREE: This Certificate of Amendment of the Restated Certificate of Incorporation has been duly adopted in accordance with the provisions of Sections 242 of the DGCL.

FOURTH: This Certificate of Amendment of the Restated Certificate of Incorporation shall become effective immediately upon filing of this Certificate of Amendment with the Secretary of State of the State of Delaware.

IN WITNESS WHEREOF, the Corporation has caused this Certificate of Amendment to be executed on its behalf on this day of , .

CODEXIS, INC.

By: _____
Sriram Ryali
Chief Financial Officer

Appendix B

CODEXIS, INC.
2023 EMPLOYEE STOCK PURCHASE PLAN

ARTICLE 1
PURPOSE

The Plan's purpose is to assist employees of the Company and its Designated Subsidiaries in acquiring a stock ownership interest in the Company, and to help such employees provide for their future security and to encourage them to remain in the employment of the Company and its Subsidiaries.

The Plan consists of two components: the Section 423 Component and the Non-Section 423 Component. The Section 423 Component is intended to qualify as an "employee stock purchase plan" under Section 423 of the Code and shall be administered, interpreted and construed in a manner consistent with the requirements of Section 423 of the Code. In addition, this Plan authorizes the grant of Options under the Non-Section 423 Component, which need not qualify as Options granted pursuant to an "employee stock purchase plan" under Section 423 of the Code; such Options granted under the Non-Section 423 Component shall be granted pursuant to separate Offerings containing such sub-plans, appendices, rules or procedures as may be adopted by the Administrator and designed to achieve tax, securities laws or other objectives for Eligible Employees, Eligible Consultants and the Designated Subsidiaries in locations outside of the United States. Except as otherwise provided herein, the Non-Section 423 Component will operate and be administered in the same manner as the Section 423 Component. Offerings intended to be made under the Non-Section 423 Component will be designated as such by the Administrator at or prior to the time of such Offering.

For purposes of this Plan, the Administrator may designate separate Offerings under the Plan, the terms of which need not be identical, in which Eligible Employees and Eligible Consultants will participate, even if the dates of the applicable Offering Period(s) in each such Offering is identical, provided that the terms of participation are the same within each separate Offering under the Section 423 Component as determined under Section 423 of the Code, *provided*, that no Eligible Consultants shall be permitted to participate in any Offering under the Section 423 Component. Solely by way of example and without limiting the foregoing, the Company could, but shall not be required to, provide for simultaneous Offerings under the Section 423 Component and the Non-Section 423 Component of the Plan.

ARTICLE 2
DEFINITIONS

As used in the Plan, the following words and phrases have the meanings specified below, unless the context clearly indicates otherwise:

2.1 "***Administrator***" means the Committee, or such individuals to which authority to administer the Plan has been delegated under Section 7.1 hereof.

2.2 "***Agent***" means the brokerage firm, bank or other financial institution, entity or person(s), if any, engaged, retained, appointed or authorized to act as the agent of the Company or an Employee with regard to the Plan.

2.3 "***Board***" means the Board of Directors of the Company.

2.4 "***Code***" means the U.S. Internal Revenue Code of 1986, as amended, and all regulations, guidance, compliance programs and other interpretative authority issued thereunder.

2.5 "***Committee***" means the Compensation Committee of the Board.

2.6 "***Common Stock***" means the common stock of the Company.

2.7 "***Company***" means Codexis, Inc., a Delaware corporation, or any successor.

2.8 "***Compensation***" of an Employee means the regular earnings or base salary paid to the Employee from the Company on each Payday as compensation for services to the Company or any Designated Subsidiary, before deduction for any salary deferral contributions made by the Employee to any tax-qualified or nonqualified deferred compensation plan, including overtime, shift differentials, vacation pay, salaried production schedule premiums, holiday pay, jury duty pay, funeral leave pay, paid time off, military pay, and prior week adjustments, but excluding bonuses, education or tuition reimbursements, imputed income arising under any group insurance or benefit program, travel expenses, business and moving reimbursements, including tax gross ups and taxable mileage allowance, income received in connection with any stock options, restricted stock, restricted stock units or other compensatory equity awards and all contributions made by the Company or any Designated Subsidiary for the Employee's benefit under any employee benefit plan now or hereafter established. Such Compensation shall be calculated before deduction of any income or employment tax withholdings, but shall be withheld from the Employee's net income.

2.9 "***Consultant***" means any person, including any adviser, engaged by the Company or its parent or Designated Subsidiary to render services to such entity if the consultant or adviser: (i) renders bona fide services to the Company; (ii) renders services not in connection with the offer or sale of securities in a capital-raising transaction and does not directly or indirectly promote or maintain a market for the Company's securities; and (iii) is a natural person.

2.10 "***Designated Subsidiary***" means each Subsidiary, including any Subsidiary in existence on the Effective Date and any Subsidiary formed or acquired following the Effective Date, that has been designated by the Board or Committee from time to time in its sole discretion as eligible to participate in the Plan, in accordance with Section 7.2 hereof, such designation to specify whether such participation is in the Section 423 Component or Non-Section 423 Component. A Designated Subsidiary may participate in either the Section 423 Component or Non-Section 423 Component, but not both, *provided* that a Subsidiary that, for U.S. tax purposes, is disregarded from the Company or any Subsidiary that participates in the Section 423 Component shall automatically constitute a Designated Subsidiary that participates in the Section 423 Component.

2.11 "***Effective Date***" means the later of the date the Board has adopts the Plan or the approval of the Plan by the Company's stockholders.

2.12 "***Eligible Consultant***" means a Consultant designated by the Committee to participate in the Non-Section 423 Component. In no event shall a Consultant be eligible to participate in the Section 423 Component.

2.13 "***Eligible Employee***" means an Employee:

(a) who is customarily scheduled to work at least 20 hours per week;

(b) whose customary employment is more than five months in a calendar year; and

(c) who, after the granting of the Option, would not be deemed for purposes of Section 423(b)(3) of the Code to possess 5% or more of the total combined voting power or value of all classes of stock of the Company or any Subsidiary.

For purposes of clause (c), the rules of Section 424(d) of the Code with regard to the attribution of stock ownership shall apply in determining the stock ownership of an individual, and stock which an Employee may purchase under outstanding options shall be treated as stock owned by the Employee.

Notwithstanding the foregoing, the Administrator may exclude from participation in the Section 423 Component as an Eligible Employee:

(x) any Employee that is a "highly compensated employee" of the Company or any Designated Subsidiary (within the meaning of Section 414(q) of the Code), or that is such a "highly compensated employee" (A) with compensation above a specified level, (B) who is an officer or (C) who is subject to the disclosure requirements of Section 16(a) of the Exchange Act; or

(y) any Employee who is a citizen or resident of a foreign jurisdiction (without regard to whether they are also a citizen of the United States or a resident alien (within the meaning of Section 7701(b)(1)(A) of the Code)) if either (A) the grant of the Option is prohibited under the laws of the jurisdiction governing such Employee, or (B) compliance with the laws of the foreign jurisdiction would cause the Section 423 Component, any Offering thereunder or an Option granted thereunder to violate the requirements of Section 423 of the Code; *provided* that any exclusion in clauses (x) or (y) shall be applied in an identical manner under each Offering to all Employees of the Company and all Designated Subsidiaries, in accordance with Treas. Reg. § 1.423-2(e). Notwithstanding the foregoing, with respect to the Non-Section 423 Component, the first sentence in this definition shall apply in determining who is an "Eligible Employee," except (a) the Administrator may limit eligibility further within the Company or a Designated Subsidiary so as to only designate some Employees of the Company or a Designated Subsidiary as Eligible Employees, and (b) to the extent the restrictions in the first sentence in this definition are not consistent with applicable local laws, the applicable local laws shall control.

2.14 "***Employee***" means any person who renders services to the Company or a Designated Subsidiary in the status of an employee within the meaning of Section 3401(c) of the Code. "Employee" shall not include any director of the Company or a Designated Subsidiary who does not render services to the Company or a Designated Subsidiary in the status of an employee within the meaning of Section 3401(c) of the Code. For purposes of the Plan, the employment relationship shall be treated as continuing intact while the individual is on military leave, sick leave or other leave of absence approved by the Company or a Designated Subsidiary and meeting the requirements of Treas. Reg. § 1.421-1(h)(2). Where the period of leave exceeds three months, or such other period specified in Treas. Reg. § 1.421-1(h)(2), and the individual's right to reemployment is not guaranteed either by statute or by contract, the employment relationship shall be deemed to have terminated on the first day immediately following such three-month period, or such other period specified in Treas. Reg. § 1.421-1(h)(2).

2.15 "***Enrollment Date***" means the first date of each Offering Period.

2.16 "***Exercise Date***" means the last day of each Purchase Period, except as provided in Section 5.2 hereof.

2.17 "***Exchange Act***" means the Securities Exchange Act of 1934, as amended.

2.18 "***Fair Market Value***" means, as of any date, the value of Common Stock determined as follows:

(a) If the Common Stock is (i) listed on any established securities exchange (such as the New York Stock Exchange or Nasdaq Stock Market), (ii) listed on any national market system or (iii) listed, quoted or traded on any automated quotation system, its Fair Market Value shall be the closing sales price for a share of Common Stock as quoted on such exchange or system for such date or, if there is no closing sales price for a share of Common Stock on the date in question, the closing sales price for a share of Common Stock on the last preceding date for which such quotation exists, as reported in *The Wall Street Journal* or such other source as the Administrator deems reliable;

(b) If the Common Stock is not listed on an established securities exchange, national market system or automated quotation system, but the Common Stock is regularly quoted by a recognized securities dealer, its Fair Market Value shall be the mean of the high bid and low asked prices for such date or, if there are no high bid and

low asked prices for a share of Common Stock on such date, the high bid and low asked prices for a share of Common Stock on the last preceding date for which such information exists, as reported in *The Wall Street Journal* or such other source as the Administrator deems reliable; or

(c) If the Common Stock is neither listed on an established securities exchange, national market system or automated quotation system nor regularly quoted by a recognized securities dealer, its Fair Market Value shall be established by the Administrator in good faith.

2.19 "***Grant Date***" means the first day of an Offering Period.

2.20 "***New Exercise Date***" has the meaning set forth in Section 5.2(b) hereof.

2.21 "***Non-Section 423 Component***" means those Offerings under the Plan, together with the sub-plans, appendices, rules or procedures, if any, adopted by the Administrator as a part of this Plan, in each case, pursuant to which Options may be granted to non-U.S. Eligible Employees and Eligible Consultants that need not satisfy the requirements for Options granted pursuant to an "employee stock purchase plan" that are set forth under Section 423 of the Code.

2.22 "***Offering***" means an offer under the Plan of an Option that may be exercised during an Offering Period as further described in Section 4 hereof. Unless otherwise specified by the Administrator, each Offering to the Eligible Employees of the Company or a Designated Subsidiary shall be deemed a separate Offering, even if the dates and other terms of the applicable Exercise Periods of each such Offering are identical and the provisions of the Plan will separately apply to each Offering. To the extent permitted by Treas. Reg. § 1.423-2(a)(1), the terms of each separate Offering under the Section 423 Component need not be identical, provided that the terms of the Section 423 Component and an Offering thereunder together satisfy Treas. Reg. § 1.423-2(a)(2) and (a)(3).

2.23 "***Offering Period***" means each consecutive, overlapping twenty-four (24) month period commencing on such date(s) as determined by the Board or Committee, in its sole discretion, and with respect to which Options shall be granted to Participants. The duration and timing of Offering Periods may be established or changed by the Board or Committee at any time, in its sole discretion. Notwithstanding the foregoing, in no event may an Offering Period exceed twenty-seven (27) months.

2.24 "***Option***" means the right to purchase shares of Common Stock pursuant to the Plan during each Offering Period.

2.25 "***Option Price***" means the purchase price of a share of Common Stock hereunder as provided in Section 4.2 hereof.

2.26 "***Parent***" means any entity that is a parent corporation of the Company within the meaning of Section 424 of the Code.

2.27 "***Participant***" means any Eligible Employee who elects to participate in the Plan and any Eligible Consultant who elects to participate in the Non-Section 423 Component of the Plan.

2.28 "***Payday***" means the regular and recurring established day for payment of Compensation to an Employee of the Company or any Designated Subsidiary.

2.29 "***Plan***" means this 2023 Employee Stock Purchase Plan, including both the Section 423 Component and Non-Section 423 Component and any other sub-plans or appendices hereto, as amended from time to time.

2.30 "***Plan Account***" means a bookkeeping account established and maintained by the Company in the name of each Participant.

2.31 "***Purchase Period***" means each consecutive six (6) month period commencing on such date(s) as determined by the Board or Committee, in its sole discretion, within each Offering Period. The first Purchase Period of each Offering Period shall commence on the Grant Date and end with the next Exercise Date. The duration and timing of Purchase Periods may be established or changed by the Board or Committee at any time, in its sole discretion. Notwithstanding the foregoing, in no event may a Purchase Period exceed the duration of the Offering Period under which it is established.

2.32 "***Section 409A***" means Section 409A of the Code.

2.33 "***Section 423 Component***" means those Offerings under the Plan that are intended to meet the requirements under Section 423(b) of the Code.

2.34 "***Subsidiary***" means any entity that is a subsidiary corporation of the Company within the meaning of Section 424 of the Code. In addition, with respect to the Non-Section 423 Component, Subsidiary shall include any corporate or noncorporate entity in which the Company has a direct or indirect equity interest or significant business relationship.

2.35 "***Treas. Reg.***" means U.S. Department of the Treasury regulations.

2.36 "***Withdrawal Election***" has the meaning set forth in Section 6.1(a) hereof.

ARTICLE 3
PARTICIPATION

3.1 Eligibility.

(a) Any Eligible Employee who is employed by the Company or a Designated Subsidiary on a given Enrollment Date for an Offering Period shall be eligible to participate in the Plan during such Offering Period, subject to the requirements of Articles 4 and 5 hereof, and, for the Section 423 Component, the limitations imposed by Section 423(b) of the Code. Any Eligible Consultant who is engaged by the Company or a Designated Subsidiary, including, without limitation, through a professional employer organization, on a given Enrollment Date for an Offering Period shall be eligible to participate in the Non-Section 423 Component of the Plan during such Offering Period, subject to the requirements of Article 4 and 5 hereof.

(b) No Eligible Employee shall be granted an Option under the Section 423 Component which permits the Participant's rights to purchase shares of Common Stock under the Plan, and to purchase stock under all other employee stock purchase plans of the Company, any Parent or any Subsidiary subject to Section 423 of the Code, to accrue at a rate which exceeds $25,000 of fair market value of such stock (determined at the time such Option is granted) for each calendar year in which such Option is outstanding at any time. The limitation under this Section 3.1(b) shall be applied in accordance with Section 423(b)(8) of the Code. No Eligible Consultant shall be granted an Option under the Section 423 Component.

3.2 Election to Participate; Payroll Deductions

(a) Except as provided in Sections 3.2(e) and 3.3 hereof, an Eligible Employee may become a Participant in the Plan only by means of payroll deduction. Each individual who is an Eligible Employee as of an Offering Period's Enrollment Date may elect to participate in such Offering Period and the Plan by delivering to the Company a payroll deduction authorization no later than the period of time prior to the applicable Enrollment Date that is determined by the Administrator, in its sole discretion. Except as provided in Sections 3.2(e) and 3.3 hereof, an Eligible Consultant may become a Participant in the Non-Section 423 Component of the Plan only by means of a deduction from fees payable by the Company or a Designated Subsidiary to such Eligible Consultant.

Each individual who is an Eligible Consultant as of an Offering Period's Enrollment Date may elect to participate in the Non-Section 423 Component of such Offering Period and the Plan by delivering to the Company a fee deduction authorization no later than the period of time prior to the applicable Enrollment Date that is determined by the Administrator, in its sole discretion.

(b) Subject to Section 3.1(b) hereof and except as may otherwise be determined by the Administrator, payroll deductions (i) shall equal at least 1% of the Participant's Compensation as of each Payday of the Offering Period following the Enrollment Date, but not more than 15% of the Participant's Compensation as of each Payday of the Offering Period following the Enrollment Date; and (ii) may be expressed either as (A) a whole number percentage, or (B) a fixed dollar amount. Amounts deducted from a Participant's Compensation with respect to an Offering Period pursuant to this Section 3.2 shall be deducted each Payday through payroll deduction and credited to the Participant's Plan Account; provided that for the first Offering Period under this Plan, payroll deductions shall not begin until such date determined by the Board or Committee, in its sole discretion.

(c) Following at least one payroll or fee deduction, a Participant may decrease (to as low as zero) the amount deducted from such Participant's Compensation only once during an Offering Period upon ten calendar days' prior written notice to the Company. A Participant may not increase the amount deducted from such Participant's Compensation during an Offering Period.

(d) Upon the completion of an Offering Period, each Participant in such Offering Period shall automatically participate in the immediately following Offering Period at the same payroll or fee deduction percentage or fixed amount as in effect at the termination of such Offering Period, unless such Participant delivers to the Company a different election with respect to the successive Offering Period in accordance with Section 3.2(a) hereof, or unless such Participant becomes ineligible for participation in the Plan.

(e) Notwithstanding any other provisions of the Plan to the contrary, in non-U.S. jurisdictions where participation in the Plan through payroll or fee deductions is prohibited, the Administrator may provide that an Eligible Employee may elect to participate through contributions to the Participant's account under the Plan in a form acceptable to the Administrator in lieu of or in addition to payroll or fee deductions; provided, however, that, for any Offering under the Section 423 Component, the Administrator must determine that any alternative method of contribution is applied on an equal and uniform basis to all Eligible Employees in the Offering.

3.3 Leave of Absence. During leaves of absence approved by the Company meeting the requirements of Treas. Reg. § 1.421-1(h)(2), a Participant may continue participation in the Plan by making cash payments to the Company on the Participant's normal payday equal to the Participant's authorized payroll deduction.

ARTICLE 4
PURCHASE OF SHARES

4.1 Grant of Option. The Company may make one or more Offerings under the Plan, which may be successive or overlapping with one another, until the earlier of: (i) the date on which the Shares available under the Plan have been sold or (ii) the date on which the Plan is suspended or terminates. The Administrator shall designate the terms and conditions of each Offering in writing, including without limitation, the Offering Period and the Purchase Periods. Each Participant shall be granted an Option with respect to an Offering Period on the applicable Grant Date. Subject to the limitations of Section 3.1(b) hereof, the number of shares of Common Stock subject to a Participant's Option shall be determined by dividing (a) such Participant's payroll deductions accumulated prior to an Exercise Date and retained in the Participant's Plan Account on such Exercise Date by (b) the applicable Option Price; *provided* that in no event shall a Participant be permitted to purchase during each Offering Period more than 100,000 shares of Common Stock (subject to any adjustment pursuant to Section 5.2 hereof). The Administrator may, for future Offering Periods, increase or decrease, in its absolute discretion, the

maximum number of shares of Common Stock that a Participant may purchase during such future Offering Periods. Each Option shall expire on the last Exercise Date for the applicable Offering Period immediately after the automatic exercise of the Option in accordance with Section 4.3 hereof, unless such Option terminates earlier in accordance with Article 6 hereof.

4.2 Option Price. The "***Option Price***" per share of Common Stock to be paid by a Participant upon exercise of the Participant's Option on an Exercise Date for an Offering Period shall equal 85% of the lesser of the Fair Market Value of a share of Common Stock on (a) the applicable Grant Date and (b) the applicable Exercise Date, or such other price designated by the Administrator; *provided* that in no event shall the Option Price per share of Common Stock be less than the par value per share of the Common Stock.

4.3 Purchase of Shares.

(a) On each Exercise Date for an Offering Period, each Participant shall automatically and without any action on such Participant's part be deemed to have exercised the Participant's Option to purchase at the applicable per share Option Price the largest number of whole shares of Common Stock which can be purchased with the amount in the Participant's Plan Account. Any balance less than the per share Option Price that is remaining in the Participant's Plan Account (after exercise of such Participant's Option) as of the Exercise Date shall be carried forward to the next Purchase Period or Offering Period, unless the Participant has elected to withdraw from the Plan pursuant to Section 6.1 hereof or, pursuant to Section 6.2 hereof, such Participant has ceased to be an Eligible Employee or Eligible Consultant. Any balance not carried forward to the next Purchase Period or Offering Period in accordance with the prior sentence promptly shall be refunded to the applicable Participant. In no event shall an amount greater than or equal to the per share Option Price as of an Exercise Date be carried forward to the next Purchase Period or Offering Period.

(b) As soon as practicable following each Exercise Date, the number of shares of Common Stock purchased by such Participant pursuant to Section 4.3(a) hereof shall be delivered (either in share certificate or book entry form), in the Company's sole discretion, to either (i) the Participant or (ii) an account established in the Participant's name at a stock brokerage or other financial services firm designated by the Company. If the Company is required to obtain from any commission or agency authority to issue any such shares of Common Stock, the Company shall seek to obtain such authority. Inability of the Company to obtain from any such commission or agency authority which counsel for the Company deems necessary for the lawful issuance of any such shares shall relieve the Company from liability to any Participant except to refund to the Participant such Participant's Plan Account balance, without interest thereon.

4.4 Automatic Termination of Offering Period. If the Fair Market Value of a share of Common Stock on any Exercise Date (except the final scheduled Exercise Date of any Offering Period) is lower than the Fair Market Value of a share of Common Stock on the Grant Date for an Offering Period, then such Offering Period shall terminate on such Exercise Date after the automatic exercise of the Option in accordance with Section 4.3 hereof, and each Participant shall automatically be enrolled in the Offering Period that commences immediately following such Exercise Date and such Participant's payroll deduction authorization shall remain in effect for such Offering Period.

4.5 Transferability of Rights. An Option granted under the Plan shall not be transferable, other than by will or the applicable laws of descent and distribution, and is exercisable during the Participant's lifetime only by the Participant. No option or interest or right to the Option shall be available to pay off any debts, contracts or engagements of the Participant or the Participant's successors in interest or shall be subject to disposition by pledge, encumbrance, assignment or any other means whether such disposition be voluntary or involuntary or by operation of law by judgment, levy, attachment, garnishment or any other legal or equitable proceedings (including bankruptcy), and any attempt at disposition of the Option shall have no effect.

ARTICLE 5
PROVISIONS RELATING TO COMMON STOCK

5.1 Common Stock Reserved. Subject to adjustment as provided in Section 5.2 hereof, the maximum number of shares of Common Stock that shall be made available for sale under the Plan shall be 2,000,000 shares. Shares made available for sale under the Plan may be authorized but unissued shares, treasury shares of Common Stock, or reacquired shares reserved for issuance under the Plan.

5.2 Adjustments Upon Changes in Capitalization, Dissolution, Liquidation, Merger or Asset Sale.

(a) Changes in Capitalization. Subject to any required action by the stockholders of the Company, the number of shares of Common Stock which have been authorized for issuance under the Plan but not yet placed under Option, as well as the price per share and the number of shares of Common Stock covered by each Option under the Plan which has not yet been exercised shall be proportionately adjusted for any increase or decrease in the number of issued shares of Common Stock resulting from a stock split, reverse stock split, stock dividend, combination or reclassification of the Common Stock, or any other increase or decrease in the number of shares of Common Stock effected without receipt of consideration by the Company; *provided*, *however*, that conversion of any convertible securities of the Company shall not be deemed to have been "effected without receipt of consideration." Such adjustment shall be made by the Administrator, whose determination in that respect shall be final, binding and conclusive. Except as expressly provided herein, no issuance by the Company of shares of stock of any class, or securities convertible into shares of stock of any class, shall affect, and no adjustment by reason thereof shall be made with respect to, the number or price of shares of Common Stock subject to an Option.

(b) Dissolution or Liquidation. In the event of the proposed dissolution or liquidation of the Company, the Offering Periods then in progress shall be shortened by setting a new Exercise Date (the "***New Exercise Date***"), and shall terminate immediately prior to the consummation of such proposed dissolution or liquidation, unless provided otherwise by the Administrator. The New Exercise Date shall be before the date of the Company's proposed dissolution or liquidation. The Administrator shall notify each Participant in writing, at least ten business days prior to the New Exercise Date, that the Exercise Date for the Participant's Option has been changed to the New Exercise Date and that the Participant's Option shall be exercised automatically on the New Exercise Date, unless prior to such date the Participant has withdrawn from the Offering Period as provided in Section 6.1 hereof or the Participant has ceased to be an Eligible Employee as provided in Section 6.2 hereof.

(c) Merger or Asset Sale. In the event of a proposed sale of all or substantially all of the assets of the Company, or the merger of the Company with or into another corporation, each outstanding Option shall be assumed or an equivalent Option substituted by the successor corporation or a Parent or Subsidiary of the successor corporation. If the successor corporation refuses to assume or substitute for the Option, any Offering Periods then in progress shall be shortened by setting a New Exercise Date and any Offering Periods then in progress shall end on the New Exercise Date. The New Exercise Date shall be before the date of the Company's proposed sale or merger. The Administrator shall notify each Participant in writing, at least ten business days prior to the New Exercise Date, that the Exercise Date for the Participant's Option has been changed to the New Exercise Date and that the Participant's Option shall be exercised automatically on the New Exercise Date, unless prior to such date the Participant has withdrawn from the Offering Period as provided in Section 6.1 hereof or the Participant has ceased to be an Eligible Employee as provided in Section 6.2 hereof.

5.3 Insufficient Shares. If the Administrator determines that, on a given Exercise Date, the number of shares of Common Stock with respect to which Options are to be exercised may exceed the number of shares of Common Stock remaining available for sale under the Plan on such Exercise Date, the Administrator shall make a pro rata allocation of the shares of Common Stock available for issuance on such Exercise Date in as uniform a manner as shall be practicable and as it shall determine in its sole discretion to be equitable among all Participants exercising Options to purchase Common Stock on such Exercise Date, and unless additional shares

are authorized for issuance under the Plan, no further Offering Periods shall take place and the Plan shall terminate pursuant to Section 7.5 hereof. If an Offering Period is so terminated, then the balance of the amount credited to the Participant's Plan Account which has not been applied to the purchase of shares of Common Stock shall be paid to such Participant in one lump sum in cash within 30 days after such Exercise Date, without any interest thereon.

5.4 Rights as Stockholders. With respect to shares of Common Stock subject to an Option, a Participant shall not be deemed to be a stockholder of the Company and shall not have any of the rights or privileges of a stockholder. A Participant shall have the rights and privileges of a stockholder of the Company when, but not until, shares of Common Stock have been deposited in the designated brokerage account following exercise of the Participant's Option.

ARTICLE 6
TERMINATION OF PARTICIPATION

6.1 Cessation of Contributions; Voluntary Withdrawal.

(a) A Participant may cease payroll deductions during an Offering Period and elect to withdraw from the Plan by delivering written notice of such election to the Company in such form and at such time prior to the Exercise Date for such Offering Period as may be established by the Administrator (a "***Withdrawal Election***"). A Participant electing to withdraw from the Plan may elect to either (i) withdraw all of the funds then credited to the Participant's Plan Account as of the date on which the Withdrawal Election is received by the Company, in which case amounts credited to such Plan Account shall be returned to the Participant in one lump-sum payment in cash within 30 days after such election is received by the Company, without any interest thereon, and the Participant shall cease to participate in the Plan and the Participant's Option for such Offering Period shall terminate; or (ii) exercise the Option for the maximum number of whole shares of Common Stock on the applicable Exercise Date with any remaining Plan Account balance returned to the Participant in one lump-sum payment in cash within 30 days after such Exercise Date, without any interest thereon, and after such exercise cease to participate in the Plan. Upon receipt of a Withdrawal Election, the Participant's payroll deduction authorization and the Participant's Option shall terminate.

(b) A Participant's withdrawal from the Plan shall not have any effect upon the Participant's eligibility to participate in any similar plan which may hereafter be adopted by the Company or in succeeding Offering Periods which commence after the termination of the Offering Period from which the Participant withdraws.

(c) A Participant who ceases contributions to the Plan during any Offering Period shall not be permitted to resume contributions to the Plan during that Offering Period.

6.2 Termination of Eligibility. Upon a Participant's ceasing to be an Eligible Employee or Eligible Consultant, for any reason, such Participant's Option for the applicable Offering Period shall automatically terminate, the Participant shall be deemed to have elected to withdraw from the Plan, and such Participant's Plan Account shall be paid to such Participant or, in the case of the Participant's death, to the person or persons entitled thereto pursuant to applicable law, within 30 days after such cessation of being an Eligible Employee or Eligible Consultant, without any interest thereon. If a Participant transfers employment from the Company or any Designated Subsidiary participating in the Section 423 Component to any Designated Subsidiary participating in the Non-Section 423 Component, such transfer shall not be treated as a termination of employment, but the Participant shall immediately cease to participate in the Section 423 Component; however, any contributions made for the Offering Period in which such transfer occurs shall be transferred to the Non-Section 423 Component, and such Participant shall immediately join the then-current Offering under the Non-Section 423 Component upon the same terms and conditions in effect for the Participant's participation in the Section 423 Component, except for such modifications otherwise applicable for Participants in such Offering. A Participant

who transfers employment from any Designated Subsidiary participating in the Non-Section 423 Component to the Company or any Designated Subsidiary participating in the Section 423 Component shall not be treated as terminating the Participant's employment and shall remain a Participant in the Non-Section 423 Component until the earlier of (i) the end of the current Offering Period under the Non-Section 423 Component, or (ii) the Enrollment Date of the first Offering Period in which the Participant is eligible to participate following such transfer. Notwithstanding the foregoing, the Administrator may establish different rules to govern transfers of employment between companies participating in the Section 423 Component and the Non-Section 423 Component, consistent with the applicable requirements of Section 423 of the Code.

ARTICLE 7
GENERAL PROVISIONS

7.1 Administration.

(a) The Plan shall be administered by the Committee, which shall be composed of members of the Board. The Committee may delegate administrative tasks under the Plan to the services of an Agent or Employees to assist in the administration of the Plan, including establishing and maintaining an individual securities account under the Plan for each Participant.

(b) It shall be the duty of the Administrator to conduct the general administration of the Plan in accordance with the provisions of the Plan. The Administrator shall have the power, subject to, and within the limitations of, the express provisions of the Plan:

(i) To establish and terminate Offerings;

(ii) To determine when and how Options shall be granted and the provisions and terms of each Offering (which need not be identical);

(iii) To select Designated Subsidiaries in accordance with Section 7.2 hereof; and

(iv) To construe and interpret the Plan, the terms of any Offering and the terms of the Options and to adopt such rules for the administration, interpretation, and application of the Plan as are consistent therewith and to interpret, amend or revoke any such rules. The Administrator, in the exercise of this power, may correct any defect, omission or inconsistency in the Plan, any Offering or any Option, in a manner and to the extent it shall deem necessary or expedient to administer the Plan, subject to Section 423 of the Code for the Section 423 Component.

(c) The Administrator may adopt rules or procedures relating to the operation and administration of the Plan to accommodate the specific requirements of local laws and procedures. Without limiting the generality of the foregoing, the Administrator is specifically authorized to adopt rules and procedures regarding handling of participation elections, payroll deductions, payment of interest, conversion of local currency, payroll tax, withholding procedures and handling of stock certificates which vary with local requirements. In its absolute discretion, the Board may at any time and from time to time exercise any and all rights and duties of the Administrator under the Plan.

(d) The Administrator may adopt sub-plans applicable to particular Designated Subsidiaries or locations, which sub-plans may be designed to be outside the scope of Section 423 of the Code. The rules of such sub-plans may take precedence over other provisions of this Plan, with the exception of Section 5.1 hereof, but unless otherwise superseded by the terms of such sub-plan, the provisions of this Plan shall govern the operation of such sub-plan.

(e) All expenses and liabilities incurred by the Administrator in connection with the administration of the Plan shall be borne by the Company. The Administrator may, with the approval of the Committee, employ attorneys, consultants, accountants, appraisers, brokers or other persons. The Administrator, the Company and its officers and directors shall be entitled to rely upon the advice, opinions or valuations of any such persons. All actions taken and all interpretations and determinations made by the Administrator in good faith shall be final and binding upon all Participants, the Company and all other interested persons. No member of the Board or Administrator shall be personally liable for any action, determination or interpretation made in good faith with respect to the Plan or the options, and all members of the Board or Administrator shall be fully protected by the Company in respect to any such action, determination, or interpretation.

7.2 Designation of Subsidiary Corporations. The Board or Administrator shall designate from time to time the Subsidiaries that shall constitute Designated Subsidiaries, and determine whether such Designated Subsidiaries shall participate in the Section 423 Component or Non-Section 423 Component. The Board or Administrator may designate a Subsidiary, or terminate the designation of a Subsidiary, without the approval of the stockholders of the Company.

7.3 Reports. Individual accounts shall be maintained for each Participant in the Plan. Statements of Plan Accounts shall be given to Participants at least annually, which statements shall set forth the amounts of payroll deductions, the Option Price, the number of shares purchased and the remaining cash balance, if any.

7.4 No Right to Employment. Nothing in the Plan shall be construed to give any person (including any Participant) the right to remain in the employ of the Company, a Parent or a Subsidiary or to affect the right of the Company, any Parent or any Subsidiary to terminate the employment of any person (including any Participant) at any time, with or without cause, which right is expressly reserved.

7.5 Amendment and Termination of the Plan.

(a) The Board may, in its sole discretion, amend, suspend or terminate the Plan at any time and from time to time. To the extent necessary to comply with Section 423 of the Code (or any successor rule or provision), with respect to the Section 423 Component, or any other applicable law, regulation or stock exchange rule, the Company shall obtain stockholder approval of any such amendment to the Plan in such a manner and to such a degree as required by Section 423 of the Code or such other law, regulation or rule.

(b) If the Administrator determines that the ongoing operation of the Plan may result in unfavorable financial accounting consequences, the Administrator may in its discretion modify or amend the Plan to reduce or eliminate such accounting consequence including, but not limited to:

(i) altering the Option Price for any Offering Period including an Offering Period underway at the time of the change in Option Price;

(ii) shortening any Offering Period so that the Offering Period ends on a new Exercise Date, including an Offering Period underway at the time of the Administrator action; and

(iii) allocating shares of Common Stock.

Such modifications or amendments shall not require stockholder approval or the consent of any Participant.

(c) Upon termination of the Plan, the balance in each Participant's Plan Account shall be refunded as soon as practicable after such termination, without any interest thereon.

7.6 Use of Funds; No Interest Paid. All funds received by the Company by reason of purchase of shares of Common Stock under the Plan shall be included in the general funds of the Company free of any trust or other restriction and may be used for any corporate purpose. No interest shall be paid to any Participant or credited under the Plan.

7.7 Term; Approval by Stockholders. No Option may be granted during any period of suspension of the Plan or after termination of the Plan. The Plan shall be submitted for the approval of the Company's stockholders within 12 months after the date of the Board's initial adoption of the Plan. Options may be granted prior to such stockholder approval; *provided*, *however*, that such Options shall not be exercisable prior to the time when the Plan is approved by the stockholders; *provided*, *further* that if such approval has not been obtained by the end of the 12-month period, all Options previously granted under the Plan shall thereupon terminate and be canceled and become null and void without being exercised.

7.8 Effect Upon Other Plans. The adoption of the Plan shall not affect any other compensation or incentive plans in effect for the Company, any Parent or any Subsidiary. Nothing in the Plan shall be construed to limit the right of the Company, any Parent or any Subsidiary (a) to establish any other forms of incentives or compensation for Employees of the Company or any Parent or any Subsidiary, or (b) to grant or assume Options otherwise than under the Plan in connection with any proper corporate purpose, including, but not by way of limitation, the grant or assumption of options in connection with the acquisition, by purchase, lease, merger, consolidation or otherwise, of the business, stock or assets of any corporation, firm or association.

7.9 Conformity to Securities Laws. Notwithstanding any other provision of the Plan, the Plan and the participation in the Plan by any individual who is then subject to Section 16 of the Exchange Act shall be subject to any additional limitations set forth in any applicable exemption rule under Section 16 of the Exchange Act (including any amendment to Rule 16b-3 of the Exchange Act) that are requirements for the application of such exemptive rule. To the extent permitted by applicable law, the Plan shall be deemed amended to the extent necessary to conform to such applicable exemptive rule.

7.10 Notice of Disposition of Shares. Each Participant shall give the Company prompt notice of any disposition or other transfer of any shares of Common Stock, acquired pursuant to the exercise of an Option granted under the Section 423 Component, if such disposition or transfer is made (a) within two years after the applicable Grant Date or (b) within one year after the transfer of such shares of Common Stock to such Participant upon exercise of such Option. The Company may direct that any certificates evidencing shares acquired pursuant to the Plan refer to such requirement.

7.11 Tax Withholding. The Company or any Parent or any Subsidiary shall be entitled to require payment in cash or deduction from other compensation payable to each Participant of any sums required by federal, state or local tax law to be withheld with respect to any purchase of shares of Common Stock under the Plan or any sale of such shares.

7.12 Governing Law. The Plan and all rights and obligations thereunder shall be construed and enforced in accordance with the laws of the State of Delaware, without regard to the conflict of law rules thereof or of any other jurisdiction.

7.13 Notices. All notices or other communications by a Participant to the Company under or in connection with the Plan shall be deemed to have been duly given when received in the form specified by the Company at the location, or by the person, designated by the Company for the receipt thereof.

7.14 Conditions To Issuance of Shares.

(a) Notwithstanding anything herein to the contrary, the Company shall not be required to issue or deliver any certificates or make any book entries evidencing shares of Common Stock pursuant to the exercise of an Option by a Participant, unless and until the Board or the Committee has determined, with advice of counsel, that the issuance of such shares of Common Stock is in compliance with all applicable laws, regulations of governmental authorities and, if applicable, the requirements of any securities exchange or automated quotation system on which the shares of Common Stock are listed or traded, and the shares of Common Stock are covered by an effective registration statement or applicable exemption from registration. In addition to the terms and

conditions provided herein, the Board or the Committee may require that a Participant make such reasonable covenants, agreements, and representations as the Board or the Committee, in its discretion, deems advisable in order to comply with any such laws, regulations, or requirements.

(b) All certificates for shares of Common Stock delivered pursuant to the Plan and all shares of Common Stock issued pursuant to book entry procedures are subject to any stop-transfer orders and other restrictions as the Committee deems necessary or advisable to comply with federal, state, or foreign securities or other laws, rules and regulations and the rules of any securities exchange or automated quotation system on which the shares of Common Stock are listed, quoted, or traded. The Committee may place legends on any certificate or book entry evidencing shares of Common Stock to reference restrictions applicable to the shares of Common Stock.

(c) The Committee shall have the right to require any Participant to comply with any timing or other restrictions with respect to the settlement, distribution or exercise of any Option, including a window-period limitation, as may be imposed in the sole discretion of the Committee.

(d) Notwithstanding any other provision of the Plan, unless otherwise determined by the Committee or required by any applicable law, rule or regulation, the Company may, in lieu of delivering to any Participant certificates evidencing shares of Common Stock issued in connection with any Option, record the issuance of shares of Common Stock in the books of the Company (or, as applicable, its transfer agent or stock plan administrator).

7.15 Equal Rights and Privileges. All Eligible Employees of the Company (or of any Designated Subsidiary) granted Options pursuant to an Offering under the Section 423 Component shall have equal rights and privileges under this Plan to the extent required under Section 423 of the Code so that the Section 423 Component qualifies as an "employee stock purchase plan" within the meaning of Section 423 of the Code. Any provision of the Section 423 Component that is inconsistent with Section 423 of the Code shall, without further act or amendment by the Company or the Board, be reformed to comply with the equal rights and privileges requirement of Section 423 of the Code. Eligible Employees and Eligible Consultants participating in the Non-Section 423 Component need not have the same rights and privileges as Eligible Employees and Eligible Consultants participating in the Section 423 Component.

7.16 Rules Particular to Specific Countries. Notwithstanding anything herein to the contrary, the terms and conditions of the Plan with respect to Participants who are tax residents of a particular non-U.S. country or who are foreign nationals or employed in non-U.S. jurisdictions may be subject to an addendum to the Plan in the form of an appendix or sub-plan (which appendix or sub-plan may be designed to govern Offerings under the Section 423 Component or the Non-Section 423 Component, as determined by the Administrator). To the extent that the terms and conditions set forth in an appendix or sub-plan conflict with any provisions of the Plan, the provisions of the appendix or sub-plan shall govern. The adoption of any such appendix or sub-plan shall be pursuant to Section 7.1 above. Without limiting the foregoing, the Administrator is specifically authorized to adopt rules and procedures, with respect to Participants who are foreign nationals or employed in non-U.S. jurisdictions, regarding the exclusion of particular Subsidiaries from participation in the Plan, eligibility to participate, the definition of Compensation, handling of payroll deductions or other contributions by Participants, payment of interest, conversion of local currency, data privacy security, payroll tax, withholding procedures, establishment of bank or trust accounts to hold payroll deductions or contributions.

7.17 Section 409A. The Section 423 Component of the Plan and the Options granted pursuant to Offerings thereunder are intended to be exempt from the application of Section 409A. Neither the Non-Section 423 Component nor any Option granted pursuant to an Offering thereunder is intended to constitute or provide for "nonqualified deferred compensation" within the meaning of Section 409A. Notwithstanding any provision of the Plan to the contrary, if the Administrator determines that any Option granted under the Plan may be or become subject to Section 409A or that any provision of the Plan may cause an Option granted under the Plan to

be or become subject to Section 409A, the Administrator may adopt such amendments to the Plan and/or adopt other policies and procedures (including amendments, policies and procedures with retroactive effect), or take any other actions as the Administrator determines are necessary or appropriate to avoid the imposition of taxes under Section 409A, either through compliance with the requirements of Section 409A or with an available exemption therefrom.

Appendix C

AMENDMENT TO THE CODEXIS, INC. 2019 INCENTIVE AWARD PLAN

THIS AMENDMENT TO THE CODEXIS, INC. 2019 INCENTIVE AWARD PLAN (this "Amendment") is made and adopted by Codexis, Inc. a Delaware corporation (the "Company"). Capitalized terms used but not otherwise defined herein shall have the meanings ascribed to them in the Plan (as defined below).

RECITALS

WHEREAS, the Company maintains the Codexis, Inc. 2019 Incentive Award Plan (as amended from time to time, the "Plan");

WHEREAS, pursuant to Section 12.1 of the Plan, the Plan may be wholly or partially amended or otherwise modified, suspended or terminated at any time or from time to time by the Board of Directors of the Company (the "Board"), subject to the terms of the Plan; and

WHEREAS, the Board has adopted this Amendment, subject to approval by the stockholders of the Company within twelve months following the date of such action.

NOW, THEREFORE, in consideration of the foregoing, the Company hereby amends the Plan as follows, subject to approval by the stockholders of the Company within twelve months following the date of Board adoption of this Amendment:

1. Section 3.1(a) of the Plan is hereby amended and restated in its entirety to read as follows:

   "Subject to adjustment as provided in Section 3.1(b) and Section 12.2, the aggregate number of Shares which may be issued or transferred pursuant to Awards under the Plan is (i) 15,897,144 plus (ii) that number of Shares that are subject to equity awards granted under the Prior Plan which are outstanding as of April 22, 2019 and thereafter terminate, expire, lapse or are forfeited for any reason and which following the termination, expiration, lapse or forfeiture of such awards do not again become available for issuance under the Prior Plan; provided, however, that no more than 22,000,000 Shares may be issued upon the exercise of Incentive Stock Options."

2. This Amendment shall be and is hereby incorporated in and forms a part of the Plan; provided that the Amendment shall be subject to approval by the stockholders of the Company within twelve (12) months of the date hereof.

3. Except as expressly provided herein, all other terms and provisions of the Plan shall remain unchanged and in full force and effect.

IN WITNESS WHEREOF, I hereby certify that this Amendment was duly adopted by the Board of Directors of Codexis, Inc. on _____, 2023 and was approved by the stockholders of Codexis, Inc. on _____, 2023.

Codexis, Inc.

By: _____
[_____]
[_____]

Date: _____