GINKGO BIOWORKS

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Dear Shareholders,

As we come up on Ginkgo's 15th anniversary this summer, we are reminded that important things take time to build.

Ginkgo was launched by a founding team committed to delivering on a mission to make biology easier to engineer. Importantly, over the past 15 years we were joined by a group of Bioworkers who want to own this mission and the company dedicated to delivering it. We believe that a workforce that has a personal interest in creating long term value through their own shareholdings will best deliver returns for you in the long run (employees and founders own about a quarter of Ginkgo's outstanding shares today).

2022 was a tough year for equity capital markets generally, and particularly for companies investing in longer-term opportunities. Ginkgo saw its stock price drop 80% while revenue increased 52%. But Ginkgo entered 2022 well-positioned for a downturn with over $1.5 billion of liquidity and we continue to be well positioned for the years ahead, with over $1.3 billion of liquidity entering 2023, providing crucial stability as our platform matures. We'll note that Ginkgo was founded in 2008 during the financial crisis; we built our first labs with equipment rescued from MIT dumpsters and bootstrapped for 5 years before taking venture capital funding. We know how to manage in a capital-constrained environment and will continue to maintain a conservative approach to our balance sheet in 2023.

Despite these challenges, our sights as always remain on the long term opportunities that we believe will be enabled by biological engineering. We can't think of anything more impactful to spend our lives working on. The great challenges of this century – climate change, food security, clean water, and better medicines – are all global problems in the physical world and we believe biology is the most powerful and scalable technology to address these needs.

To make biology easier to engineer, we're building a general-purpose biotechnology platform that provides services across all end markets. Platform service providers that capture value

from customers' applications are common in information technology – cloud computing providers, app stores, payment processors – but are atypical in biotechnology. We will use this letter to outline some of the key features of our model, address some common questions we hear from shareholders, and highlight our recent progress in support of our goals.

Customers only choose Ginkgo if they believe our services are superior to their in-house R&D capabilities

Today, biotechnology companies are focused on developing products across the consumer & industrial, food & agriculture, and biopharma markets. They do this work at their in-house labs filled with scientists running lab experiments by-hand over several years in the hope of ultimately developing a working product. Many attempted cell engineering projects fail in development due to scientific challenges and many are terminated because they are taking too long or because the budget is running higher than planned.

Customers will always want cell programs completed with a higher probability of scientific success, faster, and at a lower cost of development.

Ginkgo offers contract research services on our platform that replace our customers' in-house cell engineering activities. In exchange for our services, Ginkgo's customers generally pay us in two ways:

1. Fees during the development of their product
2. Downstream value share (milestones, royalties, or equity), which allows us to share in the ultimate commercial value of the product

We added 59 new customer programs in 2022, representing 90% growth over 2021, so it's clear that customers are choosing to outsource these activities that they currently conduct in-house and share the value of their products with Ginkgo. Why?

Simple – our services are perceived by our customers to be superior to what they can do in-house on the dimension of cost, speed, or probability of success – and ideally on all three.

> **"Ginkgo's expertise and resources have moved our drug discovery project along at a pace that just would not be possible either using internal resources or via a traditional CRO approach."**
>
> - Trent Munro, SVP Therapeutics, Microba

We believe this will allow the industry to follow in the footsteps of other similar transitions from in-house ("on-prem") to outsourced services – notably the shift from in-house IT teams

and servers to cloud computing providers that occurred over the past 15 years. The early stages of such a transition are often challenging for service providers as customers don't yet know if outsourced services are better than what they can do in-house – so each new customer we add on the platform is an important validation, particularly among customers who are highly technically sophisticated such as Novo Nordisk, Merck, and Bayer. Despite market turmoil, we are happy to see strong growth of new programs on Ginkgo's platform.

Ginkgo's platform improves with scale and we will keep investing to improve our platform scale in 2023

The fundamental advantage of our platform over traditional cell-engineering done by-hand at our customers' labs is that our platform **improves with scale** while in-house cell engineering in our customers' labs largely does not.

- **Our Foundry** is a highly automated lab powered by robotics and software. Similar to other factories, we see that as Foundry scale increases, the output efficiency – as measured by data generated per R&D dollar spent – increases as well.
- **Our Codebase** is a data asset which accumulates as we operate our Foundry in service of customer projects. The improvement in our codebase is ultimately measured in shortened timelines and/or reduced costs for customer programs due to lab work saved and increased probability of scientific success (particularly for programs that are similar to ones we've done before).

Quality (program execution) also improves with scale. In addition to the benefits of Foundry and Codebase scale, we are building specialized expertise in running hundreds of diverse R&D projects in parallel. This allows us to more rapidly iterate our program strategies by comparing learnings and best practices across similar programs. We believe this creates a powerful "flywheel," where new cell programs drive improvements in our platform which in turn drives customers to outsource even more new cell programs:

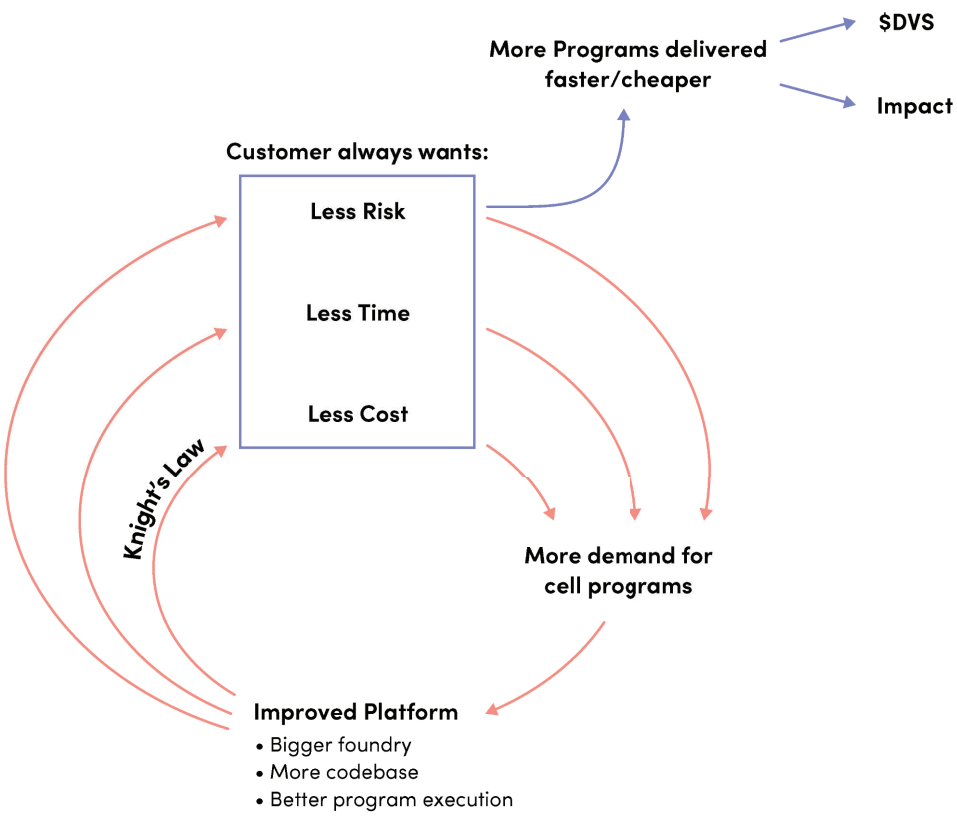

Image 1: *Ginkgo's flywheel is driven by a scale economic: as we add cell programs, we aim to make programs better, faster, and cheaper – qualities for which we expect our customers will have infinite demand.*

In 2022, we continued to invest in driving these scale improvements:

- We doubled the output of our Foundry while dropping the unit cost of strain tests by approximately 30% - these investments are essential if we want to provide better offerings year-over-year to our customers.

- We acquired several capabilities, including:
  - Zymergen: world-class biological automation and software capabilities along with a large proprietary metagenomic database
  - FGen: ultra high throughput screening technology that has the potential to drop the cost of screening cells for performance by orders of magnitude
  - Altar: adaptive laboratory evolution technology that allows us to benefit from the natural process of evolution to create valuable genetic diversity

- We ended the year with well over 2 billion *unique and proprietary* protein sequences in our metagenomics databases and in some cases we have an order of magnitude more examples of genetic systems (e.g. CRISPR-like editors) in our codebase than exist in the public databases.

Before we move on, a last note on the value of generating large amounts of data in biology. We are seeing a revolution driven by the quality of the new AI models developed by large

tech companies and smaller players such as OpenAI. The effectiveness of these models depends on the data available to train and fine tune them. In areas like human language and financial data there are large pools of low-cost public data, but in biotechnology there are only a handful of large high-quality public data sets available. Ginkgo today has a large proprietary data asset and our automated labs generate new data much more efficiently than by-hand labs. Customers are increasingly coming to Ginkgo to leverage AI in biotech due to these advantages of our platform.

“Science is currently undergoing a revolution, driven by scientists being able to ask bigger questions by the combination of expanded data sets and groundbreaking tools to decipher these. Large scale datasets coupled with AI is opening up a greater opportunity space within biology — we no longer have to limit ourselves to the questions that can be addressed by traditional research methods.”

- Brian VanDahl, Head of Global Research Technologies, Novo Nordisk

To sell to our customers, we must offer *market-specific services* on top of a *general platform*. Increasing these market-specific service offerings is a focus in 2023.

You likely now understand that as an outsourced services company, we can only enter a market if we have established enough credibility to displace a potential customer's internal R&D capabilities. Ginkgo now operates in all major biotech markets: Consumer & Industrial Biotech, Food & Agriculture, and Biopharma. In each of these markets, we have a strong value proposition for both large market-leaders as well as with emerging companies and believe a mix is healthy.

Image 2: *Sample of Ginkgo customers by industry and size (non-exhaustive due to customer confidentiality).*

Consumer & Industrial Biotech:

Generally speaking, industrial biotechnology projects use biology as a manufacturing tool: cells as factories. This is the first market we entered as programs were well defined and our customers typically didn't have strong in-house R&D capabilities.

Food & Agriculture:

Agriculture has two major areas of biotechnology R&D - biologicals (microbes producing natural products or applied directly to crops to improve yield or kill pests) and plant genetic traits. We've had a long 5+ year history working with Bayer Crop Science in biologicals and they recently outsourced their broader agricultural biologicals R&D portfolio to us, including a facility and team in West Sacramento, California. We also work with Corteva and Syngenta as well as with smaller companies.

Biopharma:

This is our newest market but also by far the fastest growing given the strong latent demand. Biopharma companies often organize themselves by the *disease* they are pursuing, but the R&D platforms underlying that work are organized by *modalities*. Modalities are *types of therapeutics* (see the table below for our experience across modalities). Cell engineering research in these modalities ranges from R&D work to discover a new therapeutic to work to improve manufacturing of new and existing therapeutics. We have partnerships with leaders such as Novo Nordisk, Merck, and Biogen and we also partner with earlier stage innovators such as Selecta.

Image 3: *Select Ginkgo biopharma partners by modality.*

While we hope the advantages of being a general-purpose platform are clear to our shareholders, this is a new proposition in the biotech ecosystem. The conventional wisdom is that specialization and prior expertise in an area is really the only thing that matters and so customers either specialize themselves or seek out specialized companies for R&D partnerships. As a horizontal platform, Ginkgo is often not top of mind when customers are thinking about who to work with in specific areas.

As such, one of our highest priorities for 2023 is doing a better job speaking to customers directly in their market, highlighting the successes we've had *in their space.* We took a small step towards this in 2022, when we defined our "Ginkgo Enzyme Services" product and we see value in replicating this model in other areas. In fact, at our recent Ferment conference, we announced several more specialized services in RNA therapeutics, AAV gene therapy, cell therapy, and microbial engineering. We will be speaking much more directly to customers in these markets going forward.

We also plan to continue acquiring and building codebase assets, particularly in biopharma, where having relevant data and experience is critical to establishing credibility with customers. Our recent acquisitions of Circularis' (circularRNA) and StrideBio's (AAV capsids) platform IP are models for our M&A strategy in 2023 and generated significant name recognition and inbound interest for Ginkgo from potential partners in those modalities.

New program additions are our most important leading indicator

While the cell engineering service fee component of Ginkgo's business helps to offset near-term spending (our fee revenue in 2022 was $106 million, up 23% from 2021) – we believe the true value of the business is in the downstream value share we take on our customers' products.

Investors are often trying to understand how best to measure the progress of Ginkgo's business. Of course, the ultimate "proof" would be a portfolio of recurring cash flow streams in the form of royalties on successfully completed projects, but that is the laggiest of all lagging indicators and we must find other ways to measure our progress in the interim. Before that, we'll have discrete milestone payments (in 2022 we added over $2 billion in such future potential milestones) and successfully completed programs, but there's one leading indicator metric that we are most focused on: **new programs.**

To get a new program, the following must occur:

1. A customer must ***think about*** Ginkgo when considering how to pursue an R&D challenge
2. A customer must ***evaluate*** Ginkgo and determine that Ginkgo's capabilities are better than their in-house capabilities or what they can get elsewhere in the market
3. A customer must agree to our ***financial and IP terms***, which look very different from a traditional contract research organization (CRO) in biotech

Each of these hurdles is significant, so it's a big deal when we bring on new programs, particularly with customers that have strong in-house capabilities (e.g. Biogen, Novo Nordisk, Merck, Bayer, Corteva, Syngenta, etc.). The flywheel is spinning around our ability to add these new programs and we're focused on delivering value for our customers - happy customers add new programs and generate downstream economics.

We care how our platform is used. Biosecurity is developing into a durable business that can help to ensure synthetic biology is deployed with care.

We generated $334 million in Biosecurity revenue in 2022, more than doubling the original guidance we provided in March 2022. While COVID monitoring in US schools contributed to this performance, biosecurity is a long-term imperative for Ginkgo and we believe this business has incredible long-term value.

In 2022, we expanded our airports monitoring program with the CDC where we collect airplane wastewater and sequence the DNA to look for new viruses. Our program with the CDC caught the first DNA sequences for Omicron sublineages BA.2 and BA.3 weeks before they were caught in hospital sequencing programs and was featured in the CDC's Morbidity and Mortality Weekly Report (MMWR).

We have also continued to establish international partnerships, including in Australia, Botswana, Qatar, Rwanda, Saudi Arabia, the United Kingdom, and Ukraine, as well as multilateral partnerships with Africa CDC and African Risk Capacity. Our hope is to have a collection of "biological radar stations" where we monitor environmental DNA sequences collected regularly for the spread of infectious disease in airports and other sites globally. Much like radar enabled hurricane warning systems, we believe these stations could be part of a global response network that detects new viruses of concern early and helps prevent future pandemics.

We have each invested 15 years of our lives building a company that we hope will change the world for the better. We will continue to invest in ensuring synthetic biology technology is deployed at scale, with purpose and with care.

Sincerely,

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 Number 001-40097

GINKGO BIOWORKS HOLDINGS, INC.

(Exact name of Registrant as specified in its Charter)

Delaware	**87-2652913**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
27 Drydock Avenue 8th Floor Boston, MA	**02210**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code: (877) 422-5362

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

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A common stock, par value $0.0001 per share	DNA	NYSE
Warrants to purchase one share of Class A common stock, each at an exercise price of $11.50 per share	DNA.WS	NYSE

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

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

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

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

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

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

Large accelerated filer	☒	Accelerated filer	☐
Non-accelerated filer	☐	Smaller reporting company	☐
		Emerging growth company	☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

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

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

As of June 30, 2022, the last business day of the registrant's most recently completed second fiscal quarter, the aggregate market value of the voting and non-voting common equity held by our non-affiliates was approximately $2,392 million based upon the closing price reported for such date on the New York Stock Exchange.

As of March 2, 2023, there were 1,570,064,412 shares of Class A common stock, 382,516,010 shares of Class B common stock, and 120,000,000 shares of non-voting Class C common stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

The information required by Part III of this report is incorporated by reference from the registrant's definitive proxy statement relating to its annual meeting of stockholders to be held in 2023, which definitive proxy statement will be filed with the Securities and Exchange Commission within 120 days after the end of the fiscal year to which this report relates.

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Cautionary Note Regarding Forward Looking Statements

This report includes forward-looking statements regarding, among other things, the plans, strategies and prospects, both business and financial, of Ginkgo Bioworks Holdings, Inc. ("Ginkgo"). These statements are based on the beliefs and assumptions of the management of Ginkgo. Although Ginkgo believes that its plans, intentions and expectations reflected in or suggested by these forward-looking statements are reasonable, Ginkgo cannot assure you that it will achieve or realize these plans, intentions or expectations. Forward-looking statements are inherently subject to risks, uncertainties and assumptions. Generally, statements that are not historical facts, including statements concerning possible or assumed future actions, business strategies, events or results of operations, are forward-looking statements. These statements may be preceded by, followed by or include the words “believes”, “estimates”, “expects”, “projects”, “forecasts”, “may”, “will”, “should”, “seeks”, “plans”, “scheduled”, “anticipates” or “intends” or similar expressions. Forward-looking statements contained in this annual report on Form 10-K (“Annual Report”) include, but are not limited to, statements about:

- Ginkgo’s ability to raise financing in the future and to comply with restrictive covenants related to long-term indebtedness;
- Ginkgo’s ability to retain or recruit, or adapt to changes required in, its founders, senior executives, key personnel or directors;
- factors relating to the business, operations and financial performance of Ginkgo, including:
    - the performance and output of Ginkgo’s cell engineering platform;
    - Ginkgo’s ability to effectively manage its growth;
    - Ginkgo’s exposure to the volatility and liquidity risks inherent in holding equity interests in certain of its customers;
    - rapidly changing technology and extensive competition in the synthetic biology industry that could make the products and processes Ginkgo is developing obsolete or non-competitive unless it continues to collaborate on the development of new and improved products and processes and pursue new market opportunities;
    - Ginkgo’s ability to convert potential customers from “on prem” R&D to outsourced services and Ginkgo’s reliance on its customers to develop, produce and manufacture products using the engineered cells and/or biomanufacturing processes that Ginkgo develops;
    - Ginkgo’s ability to comply with laws and regulations applicable to its business; and
    - market conditions and global and economic factors beyond Ginkgo’s control, including initiatives undertaken by the U.S. government in the biotechnology sector;
- intense competition and competitive pressures from other companies worldwide in the industries in which Ginkgo operates;
- litigation, including securities or shareholder litigation, and the ability to adequately protect Ginkgo’s intellectual property rights;
- the success of Ginkgo’s programs, including the growing efficiency and cost-advantage of Foundry cell engineering services, and their potential to contribute revenue, and the relative contribution of Ginkgo’s programs to its future revenue, including the potential for future revenue related to downstream value to be in the form of potential future milestone payments, royalties, and/or equity consideration;
- Ginkgo’s ability to successfully integrate and realize the benefits of merger and acquisition transactions including its ability to expand its platform capabilities; and
- other factors detailed under the section entitled “Risk Factors.”

These and other factors that could cause actual results to differ from those implied by the forward-looking statements in this Annual Report are more fully described under the heading "Risk Factors" and elsewhere in this report. The risks described under the heading "Risk Factors" are not exhaustive. Other sections of this Annual Report describe additional factors that could adversely affect the business, financial condition or results of Ginkgo. New risk factors emerge from time to time and it is not possible to predict all such risk factors, nor can Ginkgo assess the impact of all such risk factors on the business of Ginkgo, or the extent to which any factor or combination of factors may cause actual results to differ materially from those contained in any forward-looking statements. Forward-looking statements are not guarantees of performance. You should not put undue reliance on these statements, which speak only as of the date hereof. All forward-looking statements attributable to Ginkgo or persons acting on its behalf are expressly qualified in their entirety by the foregoing cautionary statements. Ginkgo undertakes no obligation to update or revise publicly any forward-looking statements, whether as a result of new information, future events or otherwise, except as required by law.

Risk Factors Summary

Investing in our securities involves risks. You should carefully consider the risks described in "Risk Factors" beginning on page 41 before making a decision to invest in our Class A common stock. If any of these risks actually occur, our business, financial condition and results of operations would likely be materially adversely affected. Some of the risks related to Ginkgo's business and industry are summarized below. References in the summary below to "we," "us," "our" and "the Company" generally refer to Ginkgo.

- We have a history of net losses. We expect to continue to incur losses for the foreseeable future, and we may never achieve or maintain profitability.

- We are not, and do not intend to become, regulated as an "investment company" under the Investment Company Act of 1940, as amended ("Investment Company Act"), and if we were deemed an "investment company" under the Investment Company Act, applicable restrictions could make it impractical for us to continue our business as contemplated and could have a material adverse effect on our business.

- Only our employees and directors are entitled to hold shares of Class B common stock (including shares of Class B common stock issued in the future), which have ten votes per share. This limits or precludes other stockholders' ability to influence the outcome of matters submitted to stockholders for approval, including the election of directors, the approval of certain employee compensation plans, the adoption of certain amendments to our organizational documents and the approval of any merger, consolidation, sale of all or substantially all of our assets, or other major corporate transactions requiring stockholder approval.

- Outstanding Class C common stock may have the effect of extending voting power in Class B common stock, and may discourage potential acquisitions of our business and could have an adverse effect on the trading price of Class A common stock.

- We may need substantial additional capital in the future in order to fund our business.

- We have experienced rapid growth and expect our growth to continue, and if we fail to effectively manage our growth, then our business, results of operations, and financial condition could be adversely affected.

- Our limited operating history makes it difficult to evaluate our current business and future prospects.

- We currently own and may in the future own equity interests in other operating companies, including certain of our customers and we may receive non-cash consideration which involves estimations of fair market value. The initial fair market value of the non-cash consideration may decrease after contract inception and the amount of cash proceeds eventually realized may be less than the revenue recognized. Consequently, we have exposure to the volatility and liquidity risks inherent in holding their equity and overall operational and financial performance of these businesses.

- We may pursue strategic acquisitions and investments that are dilutive to our stockholders and that could have an adverse impact on our business if they are unsuccessful.

- We must continue to secure and maintain sufficient and stable supplies of laboratory reagents, consumables, equipment, and laboratory services. We depend on a limited number of suppliers, some of which are single-source suppliers, and contract manufacturers for critical supplies, equipment, and services for research, development, and

manufacturing of our products and processes. Our reliance on these third parties exposes us to risks relating to costs, contractual terms, supply, and logistics, and the loss of any one or more of these suppliers or contract manufacturers or their failure to supply us with the necessary supplies, equipment, or services on a timely basis, could cause delays in our research, development, or production capacity and adversely affect our business.

- We use biological, hazardous, flammable and/or regulated materials that require considerable training, expertise and expense for handling, storage and disposal and may result in claims against us.

- Third parties may use our engineered cells, materials, and organisms and accompanying production processes in ways that could damage our reputation.

- If our customers discontinue their development, production and manufacturing efforts using our engineered cells and/or biomanufacturing processes, our future financial position may be adversely impacted.

- We may fail to realize the benefits and synergies expected from our acquisition of Zymergen, Inc. (the "Zymergen Acquisition"), which could adversely affect our stock price.

- Our revenue is concentrated in a limited number of customers, some of which are related parties, and our revenue, results of operations, cash flows and reputation in the marketplace may suffer upon the loss of a significant customer.

- In certain cases, our business partners may have discretion in determining when and whether to make announcements about the status of our collaborations, including about developments and timelines for advancing programs, and the price of our common stock may decline as a result of announcements of unexpected results or developments.
- Demand for our COVID-19 individual and pooled sample tests has significantly diminished, particularly in light of the White House's announcement that the public health emergency will end in May 2023, and this could materially adversely affect our business. Further, we may be subject to tort liability if the COVID-19 tests we utilize in our testing programs provide inaccurate results.

- Rapidly changing technology and emerging competition in the synthetic biology industry could make the platform, programs, and products we and our customers are developing obsolete or non-competitive unless we continue to develop our platform and pursue new market opportunities.

- Ethical, legal and social concerns about genetically modified organisms ("GMOs") and genetically modified plant or animal cells and genetically modified proteins and biomaterials (collectively, "Genetically Modified Materials") and their resulting products could limit or prevent the use of products or processes using our technologies, limit public acceptance of such products or processes and limit our revenues.

- If we are unable to obtain, maintain and defend patents protecting our intellectual property, our competitive position will be harmed. If we are unable to protect the confidentiality of our trade secrets, our business and competitive position will be harmed. We may become involved in lawsuits or other enforcement proceedings to protect or enforce our patents or other intellectual property, which could be expensive, time consuming and potentially unsuccessful.

- We rely on our customers, joint ventures, equity investees and other third parties to deliver timely and accurate information in order to accurately report our financial results in the time frame and manner required by law.
- We identified material weaknesses in our internal controls over financial reporting and may identify additional material weaknesses in the future. A failure to maintain an effective system of internal control over financial reporting may result in a failure to accurately report our financial results or prevent fraud, which could harm our business and the trading price of our common stock.
- Our ability to use our net operating loss carryforwards and certain other tax attributes may be limited.

- Failure to comply with federal, state, local and international laws and regulations could lead to substantial penalties and adversely affect our business, financial condition and results of operations. We may incur significant costs complying with such laws and regulations, and failure to comply could expose us to significant liabilities.

- We may become subject to the comprehensive laws and rules governing billing and payment, noncompliance with which could result in non-payment or recoupment of overpayments for our services or other sanctions.
- We and our laboratory partners are subject to a variety of laboratory testing standards, compliance with which is an expensive and time-consuming process, and any failure to comply could result in substantial penalties and disruptions to our business.

- We are engaged in certain research activities involving controlled substances, including cannabinoids and other chemical intermediates, the making, use, sale, importation, exportation, and distribution of which may be subject to significant regulation by the U.S. Drug Enforcement Administration ("DEA") and other regulatory agencies.

- Significant disruptions to our and our service providers' information technology systems or data security incidents could result in significant financial, legal, regulatory, business and reputational harm to us.

- Our business could be adversely affected by legal challenges to our telehealth partner's business model.

PART I

Item 1. Business.

Unless the context otherwise requires, all references in this section to the "Company," "Ginkgo," "we," "us," or "our" refer to the business of Ginkgo Bioworks Holdings, Inc. and our subsidiaries.

Mission

Our mission is to make biology easier to engineer. That has never changed. Every choice we've made with respect to our business model, our platform, our people and our culture is grounded in whether it will advance our mission. Biology inherently offers incredible capabilities that we can only imagine in human-made technologies—self-assembly, self-repair, self-replication—capabilities that can enable more renewable and innovative approaches for nearly every industry. To realize this potential, we are building a platform for cell programming by bringing together unparalleled scale, software, automation, data science and reusable biological knowledge, enabling responsible solutions for the next generation of foods, pharmaceuticals, materials and more.

Overview

Ginkgo is the leading platform for cell programming, providing flexible, end-to-end services that solve challenges for organizations across diverse markets, from food and agriculture to pharmaceuticals to industrial and specialty chemicals. Ginkgo's biosecurity and public health unit, Concentric by Ginkgo, is building global infrastructure for biosecurity to empower governments, communities, and public health leaders to prevent, detect and respond to a wide variety of biological threats.

Our founders are engineers from diverse fields who, more than 20 years ago, were inspired by an astonishing feature of biology: it runs on digital code. It's just A, T, C, and G rather than 0 and 1. But where computer bits are used to communicate information, genetic code is inherently physical and as it is read, physical structures are made. We program computers to manipulate bits, but we program cells to manipulate atoms. Cells are the building blocks of our food, our environment and even ourselves.

We use our platform to program cells on behalf of our customers. These "cell programs" are designed to enable biological production of products as diverse as novel therapeutics, key food ingredients, and chemicals currently derived from petroleum. Biology did not evolve by end market. All of these applications run on cells which have a common code—DNA—and a common programming platform can enable all of them. Because of this shared platform, we are able to drive scale and learning efficiencies while maintaining flexibility and diversity in our program areas. Ultimately, customers come to us because they believe we maximize the probability of successfully developing their products.

Customers may work with Ginkgo to discover new molecules or biological systems, to accelerate the development of a system, or to overhaul their manufacturing processes. They might, for example, be looking to produce a particular chemical via fermentation, at a lower cost, with enhanced supply chain reliability or sustainability. Or perhaps the customer needs a microbe that will live and grow on the roots of corn and convert nitrogen in the air into usable fertilizer for a plant, resulting in improved plant growth. Or a customer might need a viral capsid engineered to target certain tissue types and deliver a gene therapy where it's needed while not causing a problematic immune response. All of these programs and more run on a common platform at Ginkgo.

We care deeply how our platform is used and recognize biosecurity as a necessary complement to our cell programming work. Biology has the potential to transform health, agriculture, energy, materials, and beyond—but we also know that advances in biotechnology, alongside an increasingly interconnected biological world, contribute to enhanced biological risk. The first, critical step in addressing this risk is to build a robust early warning system to act as a radar for biological threats. This is the focus of our biosecurity and public health unit, Concentric by Ginkgo. Through this initiative, we are building a biosecurity "operating system" that manages the underlying capabilities, networks, and data infrastructure needed for a flexible combination of biomonitoring solutions.

The foundation of our cell programming platform includes two core assets that execute a wide variety of cell programs for customers according to their specifications: our Foundry and our Codebase.

- Our Foundry wraps proprietary software and automation around core cell engineering workflows—designing DNA, writing DNA, inserting that DNA into cells, testing cells to measure performance—and leverages data analytics and data science to inform each iteration of design. The software, automation and data analysis pipelines we leverage in

the Foundry drive a strong scale economic that we refer to as “Knight's Law.” We expect Foundry output, which we currently measure by daily strain tests, to increase year over year, while the cost per strain test decreases. We expect to be able to pass these savings along to our customers, allowing them to take more “shots on goal” with their programs.

- Our Codebase includes both our physical (engineered cells and genetic parts) and digital (genetic sequences and performance data) biological assets. Codebase accumulates as we execute more cell programs on the platform. Every program, whether successful or not, generates valuable Codebase and helps inform future experimental designs and provides reusable genetic parts, making our cell program designs more efficient. Historically, we have augmented our Codebase via acquisition of assets such as microbial strains, sample collections, and sequence data. In 2022, our Codebase grew to over two billion proprietary protein sequences as a result of recent acquisitions.

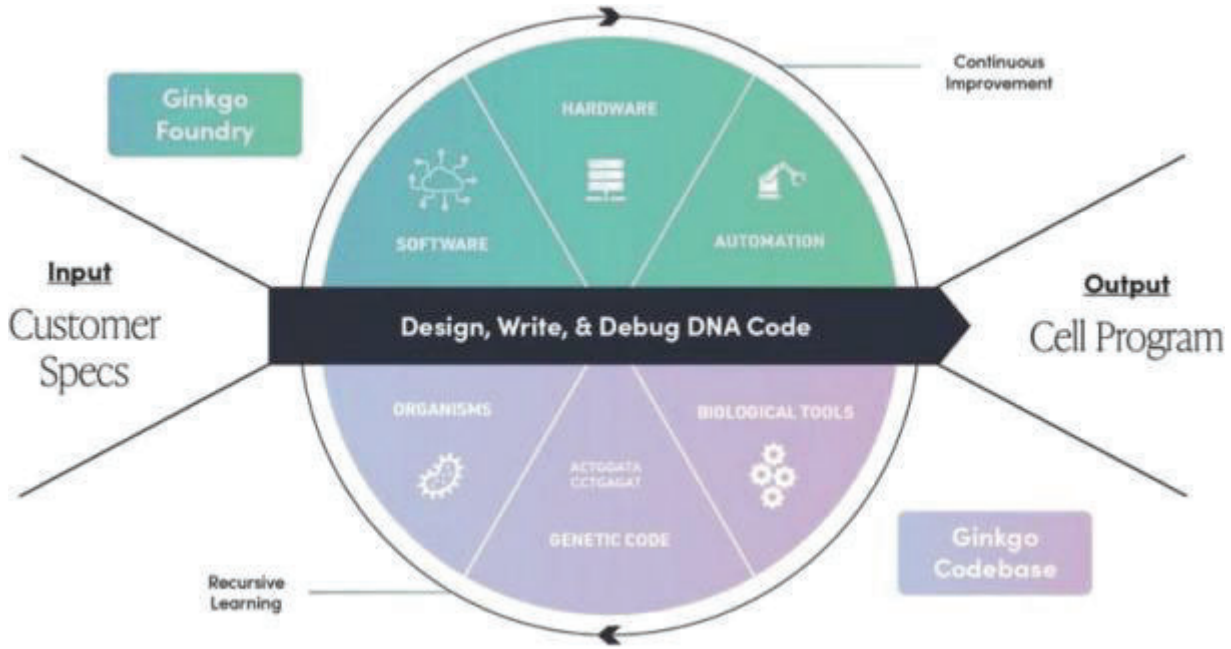


Figure 1: Our platform is used to design, write, and debug DNA code in engineered organisms to execute programs for our customers. Our Foundry leverages proprietary software, automation, and data analytics to reduce the cost of cell programming. Our Codebase consists of reusable biological assets that help accelerate the engineering process.

As the platform scales, we have observed a virtuous cycle between our Foundry, our Codebase, and the value we deliver to customers. Sketched below, we believe this virtuous cycle sustains Ginkgo’s growth and differentiated value proposition.

- Foundry: As we take on more work in the Foundry, we benefit from scale economics, which over time may lead to lower program costs. We expect that these lower costs, in turn, will drive additional demand for our cell programming capabilities.
- Codebase: Cell programs also generate Codebase, which can drive better experimental direction and improve the odds of technical success, further increasing our customer value proposition, which we believe will result in additional demand.

Put simply: we believe that as we scale, the platform improves. We believe that this in turn yields better program execution and customer outcomes, ultimately driving more demand, which drives further investments in scale and platform improvements, and so on. We believe this positive feedback loop has the potential to drive compounding value creation in the future, as every new program we add contributes to both near-term revenues and has the potential to add significant downstream economics and more positive impact.

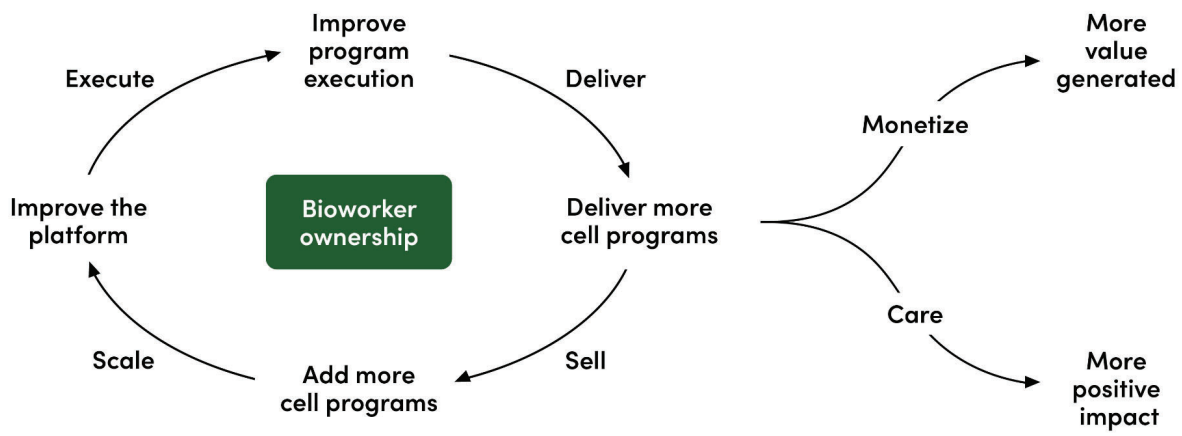


Figure 2: Ginkgo's virtuous cycle: as we scale, we see greater efficiency and higher odds of technical success, which helps drive further scaling as our value proposition improves.

Our cell programming business model mirrors the structure of our platform and we are compensated in two primary ways. First, we charge usage fees for services, in much the same way that cloud computing companies charge usage fees for utilization of computing capacity or contract research organizations ("CROs") charge for services. The total addressable market for biological R&D services, including labor and tools, is in the tens of billions of dollars—performed mainly by companies in-house—and Ginkgo has a significant penetration opportunity. Additionally, we negotiate a value share with our customers (typically in the form of royalties, milestones, and/or equity interests) in order to align our economics with the success of the programs enabled by our platform. As we add new programs, our portfolio of programs with this "downstream" value potential grows.

We believe that cell programming has the potential to be as ubiquitous in the physical world as computer programming has become in the digital world and that products in the future will be *grown* rather than *made*. To enable that vision, we are building a horizontal platform to make biology easier to engineer. Our business model is aligned with this strategy and with the success of our customers, setting us on what we believe is a path towards sustainable innovation for years to come.

An Introduction to Synthetic Biology

To fully tell the story of cell programming, we have to start four billion years ago. All living things evolved from a single cell, a tiny bubble containing the code that enabled it to assemble and reproduce itself. But, importantly, that process of reproduction wasn't perfect; each copy introduced new mutations in the code. These changes are responsible for one of the most powerful and defining features of biology: evolution. Over eons, that first cell and all its progeny copied themselves, and their DNA evolved to create new functions: to eat new kinds of foods and to produce new kinds of chemicals, structures, and behaviors. As reproduction became more, well, *interactive*, organisms developed tools to borrow DNA from each other, accelerating the pace of evolution. These functions, and thus the genetic code programming the functions, stuck around when they helped the organisms survive and create more descendants. This went on and on for four billion years, leaving us the wild codebase of DNA that enables the diversity of life forms we see on the planet today.

Synthetic biology's story begins mere decades ago, as biologists began to decode the molecular secrets of DNA. The billions-year-old tools of cells—enzymes that cut, copy, and paste sequences of DNA code—are now being leveraged by humans to read, write, and edit DNA in the lab. Polymerases that copy DNA are used to enable polymerase chain reaction ("PCR") tests

for COVID-19 and the CRISPR/Cas system from bacteria now enables editing of human genomes to potentially cure genetic diseases.

Today we are using these tools to learn from the full breadth of evolution and biodiversity to write *new* biological code. Simple soil bacteria produce everything from vital antibiotics to the smell of fresh rain. We can reuse elements of these DNA programs to make new products. Biochemistry is extraordinarily versatile; we've reused the same genetic code libraries across applications as diverse as fine fragrances, baking, and consumer electronics. We may be able to develop programs that can digest human-made "forever chemicals" that biology never encountered before.

As cell programmers, we operate with humility and respect for biology. Our tools are simply borrowed, and the history of biotechnology is a mere blink of an eye compared to the history of living things. Today, we write rudimentary code. We believe that someday our children will write poetry in DNA.

Programming life

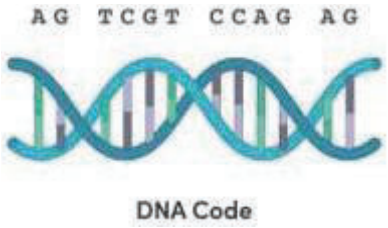


Figure 3: DNA strands are sequences composed of four chemical bases, or nucleotides, represented by the letters A, T, C and G.

Like computers, cells run on digital code. DNA strands are sequences composed of four chemical bases, or nucleotides, represented by the letters A, T, C and G. The letters along the strand encode the proteins that make up the cell and perform biochemical functions. The translation of DNA to RNA to protein is known as the "central dogma" of molecular biology.

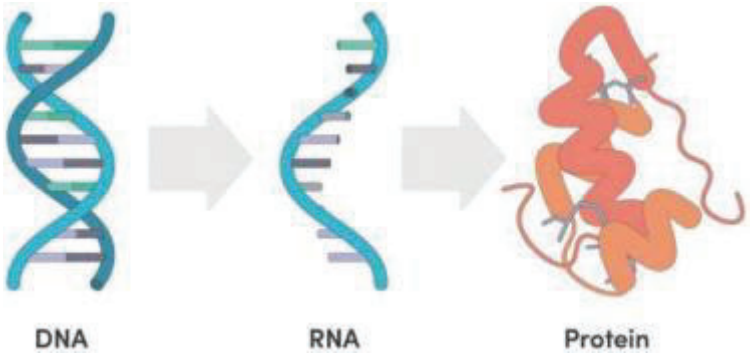


Figure 4: The translation of DNA to RNA to Protein is known as the "central dogma" of molecular biology.

DNA is transcribed to RNA, which is translated to proteins, which in turn perform myriad functions inside or outside of the cell, as structural supports, antibodies, and enzymes that catalyze reactions of all the chemistry performed by the cell. Synthetic biology, through the programming of DNA, enables the development of products made from all of these biological molecules, including DNA based gene therapies, mRNA vaccines, proteins and enzymes used as therapeutics, food ingredients or processing aids, or organic molecules that can be made by building pathways of enzymes inside a cell, antibiotics and other medicines, vitamins, fragrances, and even the building blocks of polymers that are today produced via petroleum. Programmed cells themselves are also products of synthetic biology, as probiotics for nutrition and wellness, microbiome therapeutics or cell therapies, agricultural biologicals, or industrial tools for remediation.

Once a cell is programmed to produce a new molecule, it can produce the molecule and also replicate itself, creating an exponentially growing number of product-producing cells. Many products of genetic engineering are manufactured in facilities that look like breweries, taking advantage of the centuries old process of industrial fermentation to grow cells at high density, and transforming simple sugars into valuable products that can be extracted and commercialized.

Cell programming services

Ginkgo's platform is a generalized, horizontal platform that provides end-to-end cell programming services to our customers, enabling them to develop the wide array of biological products listed above (and beyond). From the discovery of novel biological functions through the optimization of production strains, processes, and downstream purification of biological products, Ginkgo's platform is a full spectrum synthetic biology R&D services provider. We provide more details about our platform and our customers' applications in the sections that follow.

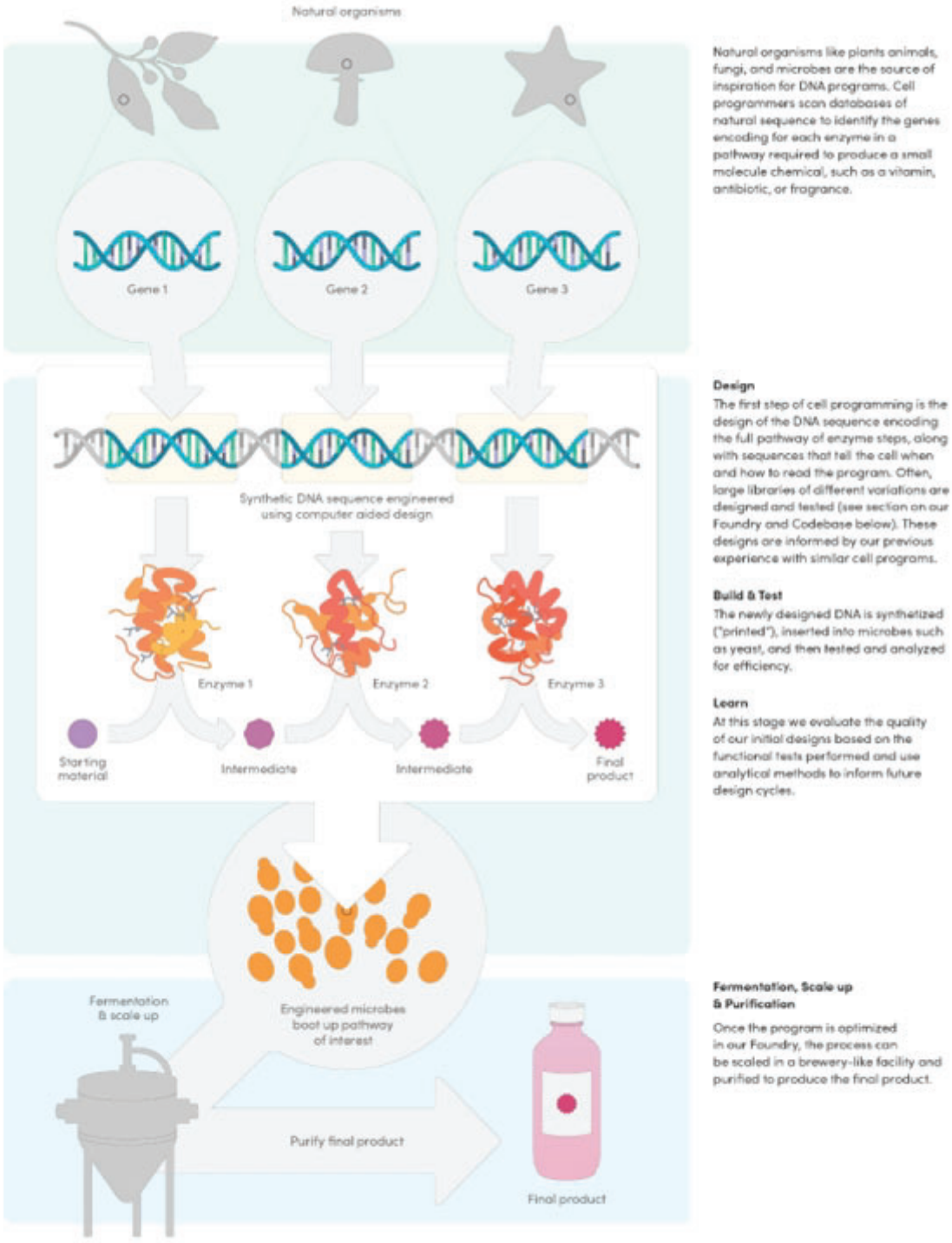


Figure 5: An overview of a simple cell program.

The Impact of Cell Programming & Biosecurity

The power of biology has never been more apparent. When synthetic biology was featured on the cover of *The Economist* in April of 2019, a much smaller segment of the world considered its implications. Today, the global lexicon has shifted. The

COVID-19 pandemic awakened billions of people to the need for biosecurity infrastructure and showed them the value biological products provide to their lives. The impact biology can have on society and industries is clearer than ever.

Further, in September 2022, Jake Sullivan—President Biden's national security adviser—announced that the U.S. government expects biotechnology to have "outsized importance over the coming decade" in the context of geopolitical competition, because of the ability to "read, write, and edit genetic code, which has rendered biology programmable." To this end, President Biden issued an Executive Order on Advancing Biotechnology and Biomanufacturing for a Sustainable, Safe and Secure American Bioeconomy and the U.S. government launched a new National Biotechnology and Biomanufacturing Initiative. Both are meant to unlock synthetic biology innovations for health, climate change, energy, food security, agriculture, supply chain resilience, and national and economic security. The Administration also released a National Biodefense Strategy and Implementation Plan, underscoring that advances in biotechnology must be accompanied by robust capabilities to counter biological threats, whether naturally-occurring, accidental, or deliberate.

We no longer question *if* biotechnology will transform a given industry, we simply question whether we are creative enough to imagine *how*, and whether we are ready to utilize biology *responsibly*.

ESG is in our DNA

Biology affects all of us, and we believe cell programming will change the world. Our customers are developing products with far reaching implications for health and the environment. This potential for extraordinary impact, which reaches to the core of who we are and everything about our natural world, requires extraordinary care in how the tools of cell programming are built and used. Technologies reflect the values of the organizations that build them, so our commitment to Environmental, Social and Governance ("ESG") priorities and care must underscore everything we do.

We also must recognize that biotechnologies have not always reflected the values necessary for sustainable and equitable impact and, as a result, remain controversial. Indeed, companies that produce GMOs for human consumption are restricted from certain ESG indices, placing genetic engineering as a major ESG risk alongside the production of weapons, tobacco products, and fossil fuels. We hope to chart a new course built on *care* so that the world can benefit from the power of biological engineering while avoiding potential risks.

In July 2022, we released our inaugural sustainability report, *Caring at Ginkgo*. Our inaugural report was guided by key ESG frameworks and standards (e.g., the Global Reporting Initiative ("GRI") and Stakeholder Capitalism Metrics) as well as a third-party led materiality assessment (as defined by GRI).

Environmental

We face an urgent environmental crisis that is forcing us to reconsider how we make everything, from our homes, to our food, to our clothing. For centuries, we've treated nature as an infinite resource and infinite trash can, extracting raw materials, shaping them through industrial processes that spew out greenhouse gases, and then throwing them away. But these resources are not infinite and there is no "away." The results have been disastrous—climate change, loss of biodiversity, and pollution have impacted every corner of our world and continue to threaten our way of life.

Cell programming and biological manufacturing are working to address some of the issues that are most contributing to climate change today, from fossil fuel dependency to agricultural emissions, and land use to plastic pollution. Ultimately, biology offers a fundamental shift in how things are made and disposed of: a world where things grow and decay, creating circular, regenerative processes.

There is significant concern that genetic engineering itself creates a form of genetic "pollution" in the environment, with genes from one context introduced into another. This is a concern we take seriously and consider deeply throughout the lifecycle of our programs to ensure that genes introduced will not cause damage—for example, by spreading antibiotic resistance or toxins. We *care* because the environmental release of certain genetically engineered microbes can also offer tremendous environmental benefit. For example:

- Crop-associated microbes programmed with the nitrogen fixing properties of common soil bacteria may be able to reduce the use of chemical fertilizers, which have been estimated to contribute 5% of global greenhouse gas emissions and account for 4% of natural gas consumption. This is a key priority for Bayer Crop Science ("Bayer"), which is working with us in this space.
- Microbes programmed to clean up wastewater or contaminated land is the work of Allonnia, LLC ("Allonnia"), a company we formed in partnership with Battelle.

And we are just getting started… we believe biology is our best tool to reverse the damage to our planet and chart us on a path towards sustainability in the future.

Social

Technology isn't neutral. Our values and biases are embedded in the technologies we make, in the applications we consider, and in the ways we address problems. Inclusion of those who have historically been left out of the development of new technologies is essential to building equitable and positive outcomes. Just as biological ecosystems thrive with more diversity, the inclusion of many different voices is essential to growing our company and to ensuring that the viewpoints of historically marginalized people are included in the development of our platform. We have many active efforts in recruiting and retaining diverse talent and will continue to invest in this work (see "*—Our People & Culture*").

Marginalized people who have been left out of the development of technologies are also the groups most likely to bear the greatest harm, whether from climate change, pollution, or health disparities. The COVID-19 pandemic has made this inequality starkly clear—in the United States, it has been communities of color that have been disproportionately impacted by the pandemic and have had the least access to testing, treatment, and vaccination.

These values and initiatives are not just a top-down corporate policy, they are an intrinsic part of our culture. Grassroots fundraising challenges to support local and international aid organizations are a regular feature of our internal messaging channels.

Governance

Our culture is built on care, transparency, diversity, employee ownership and engagement, and a deep, humble respect for biology. Transparency is essential to how we operate, to enable sharing of the insights and tools that enable our platform to grow, as well as to build trust and accountability with all of our stakeholders. We have advocated for more transparency in our industry, including supporting GMO labeling, and seek to educate policymakers and the general public about the benefits and risks of synthetic biology through our advocacy efforts.

The individuals who work at Ginkgo and build our platform care deeply about how that platform is used and the impact our company will have in the world. We believe a workforce with strong equity ownership will make the wise decisions needed to build long-term value for our company, and a company whose long-term impacts make them proud. That is why we have implemented a multi-class stock structure that permits all employees (current and future), not just founders, to hold high-vote (10 votes per share) common stock. We believe that our multi-class stock structure will help maintain the long-term mentality we have benefited from as a founder-led company.

For more information, see "*Risk Factors—Risks Related to Ginkgo's Business—Risks Related to Our Common Stock, Organizational Structure and Governance—Only our employees and directors are entitled to hold shares of Class B common stock (including shares of Class B common stock granted or otherwise issued to our employees and directors in the future), which shares have ten votes per share. This limits or precludes other stockholders' ability to influence the outcome of matters submitted to stockholders for approval, including the election of directors, the approval of certain employee compensation plans, the adoption of certain amendments to our organizational documents and the approval of any merger, consolidation, sale of all or substantially all of our assets, or other major corporate transaction requiring stockholder approval.*"

We have selected directors with decades of experience serving as leaders in the life sciences and technology industries. Ginkgo's board of directors and management team will leverage that experience and consider the interests of stockholders, customers, employees, suppliers, academic researchers, governments, communities, and other stakeholders to pursue long-term value for our company and drive the sustained health of our global community. For more information, see "*Risk Factors—Risks Related to Ginkgo's Business—Risks Related to Our Common Stock, Organizational Structure and Governance—Our focus on the long-term best interests of our company and our consideration of all of our stakeholders, including our stockholders, workforce, customers, suppliers, academic researchers, governments, communities and other stakeholders that we may identify from time to time, may conflict with short-term or medium-term financial interests and business performance, which may adversely impact the value of our common stock.*"

Cell programming is expected to transform all industries

Biology grows. Biology adapts and evolves. Biology heals itself and regenerates. Biology is also, remarkably, programmable, offering us the tools to work with biology to transform how we make *stuff*. With cell programming, we help our customers

across industries *grow* better products. What does "better" mean? Better products might be more sustainable, have more stable and resilient supply chains, be more accessible, have higher quality and more consistency, and come with lower economic and environmental costs of manufacturing. They can also be truly transformative, fundamentally changing the field of possibilities for what products can do. We have supported many companies that are leveraging our cell programming platform to address some of the world's most challenging environmental and social issues.

Pharma & Biotech

Biopharma has been a nexus of tremendous innovation in cell programming and synthetic biology. The COVID-19 pandemic brought emerging novel technologies, such as mRNA vaccines, to the mainstream. These vaccines contain genetic code that our bodies read to produce viral proteins and stimulate an immune response and antibody production. New nucleic acid vaccines can be programmed quickly, such as the booster vaccines being developed against emerging SARS-CoV-2 variants, offering the potential for rapid response to other future pathogens. They can also be programmed to target a number of other diseases. In the wake of the success of nucleic acid vaccines during the COVID-19 pandemic, new programs for HIV and cancer vaccines, among others, are accelerating.

Biologic medicines like insulin and other protein drugs and antibodies are also produced via cell programming, making a difference in the treatment of countless diseases. Over 40% of the therapies approved by the U.S. Food and Drug Administration ("FDA") in 2022 were biologics. In addition, new modalities enabled by cell programming, such as cell and gene therapies, microbiome therapies, and regenerative medicines, are beginning to come online. We believe human health and the ways we treat disease will be transformed by improvements in cell programming technology.

Ginkgo has been active in this field in recent years and we expect to significantly expand our support of therapeutic applications over coming years. From supporting companies like Biogen, Inc. ("Biogen") to develop gene therapies to creating biocatalysts for the production of active pharmaceutical ingredients ("APIs") with Merck & Co. ("Merck") to building novel expression hosts for biologic medicines with Novo Nordisk A/S ("Novo Nordisk"), we are using our platform to deliver transformational innovations across a range of disease areas.

Industrials & Environment

Since the industrial revolution, manufacturing techniques have been extractive, wasteful, and unsustainable. Not only must we innovate new manufacturing methods in order to keep up with growing demand, we must also work to remediate issues we have caused historically, by cleaning up our environment and addressing climate change.

Ginkgo is not only working with customers to create cell programs that enable cost-efficient, renewable, and sustainable production of chemicals and materials, such as our work with Genomatica, Inc. ("Genomatica"), but we have also participated in the formation of Allonnia, a company focused on environmental remediation. Plastic waste and many of the pollutants that plague industrial manufacturing and extraction sites are novel in the course of evolutionary history, so biology has not yet evolved to degrade them efficiently. Cell programming can enable the discovery and development of new enzymes capable of degrading recalcitrant pollutants and recycling waste while entirely reimagining manufacturing for the future.

Food & Agriculture

Food is inherently biological: it comes from life and sustains life. Cell programming can be leveraged to improve the availability of essential food and nutrition to a growing population, decrease the environmental impact and cost of food production, and provide consumers with increased choice.

We are working with some of the largest multinational agriculture companies, including Bayer and Corteva, to develop cell programs that would make crop production more efficient and sustainable, reducing synthetic nitrogen fertilizer and pesticide usage. In food, we have been active in flavors and sweeteners with leading global companies such as Robertet, Inc. ("Robertet") and Givaudan S.A. ("Givaudan"), and helped Motif FoodWorks, Inc. ("Motif") produce animal proteins without the need for industrial farming of animals, resulting in the launch of its first product, HEMAMI™, in 2021.

Consumer & Technology

Most physical goods have biological origins—from the petrochemicals in our fabrics to fine chemicals extracted from plants—but industry does not necessarily leverage biology, or leverage biology efficiently, to produce these items. Petrochemicals, for example, are used in everything from our fabrics to our cosmetics to our paints. These chemicals and

polymers are generally created in complex chemical and physical reactions from crude oil, but crude oil is just the result of millions of years of decomposition of previously living matter (they are *fossil* fuels after all). These biological building blocks can instead be programmed in a living organism to produce these items sustainably, without extracting natural resources. Even in areas where industry does leverage biology, such as extracting raw materials or fine chemicals from plants, we believe the current approaches are woefully inefficient or rife with social consequences.

We have supported Cronos in their effort to biosynthesize multiple cannabinoid molecules, with the goal of reducing cost, improving purity and predictability, and enabling production of rare molecules. In 2022, we partnered with Sumitomo Chemical Co., Ltd. (“Sumitomo”) to help produce ingredients for beauty and personal care through fermentation. We also helped launch a new company in 2021, Arcaea LLC ("Arcaea"), which is focusing on leveraging biology, from proteins to the microbiome, to build a suite of innovative and efficacious personal care products.

Market Opportunity

For several decades in the computing industry, software ran entirely in local environments: companies built and ran their own servers and customized their applications. The dominance of software-as-a-service (“SaaS”) and cloud computing over the past decade has demonstrated the value in having common architectures and enabling horizontal platforms. What users may have sacrificed in customizability, they more than gained in innovation, efficiency, and scalability. We believe Ginkgo is ushering in a similar transition in cell programming, a programming discipline with the power to shape living things and *grow* applications across the physical world.

The value of these applications will be significant

Given the breadth of application areas and the potential of biology (see “*—The Impact of Cell Programming*”), we believe that the end markets for bioengineered products will be enormous. But these applications reflect only what we can already imagine. As we develop a greater ability to program biology and direct it towards novel and more challenging applications, the spectrum of possibilities will undoubtedly grow. Computers were used for little more than counting for decades; we firmly believe the most valuable applications of cell programming are not yet apparent.

Large existing market for “on prem” cell programming research and development

Cell programming today is done in a highly inefficient, distributed manner reminiscent of the early days of computing. Essentially every organization looking to innovate in biology builds its own biology labs in the same way that individual tech companies used to set up their own servers instead of using cloud computing. Scientists spend hours moving liquids around rather than designing novel experiments just as computer programmers once spent most of their time physically writing and debugging code (by punching cards, for example) rather than designing new applications.

Because of the way cell programming is done today, intellectual property that could be useful for multiple applications is tied up by exclusivities that delay the progress of the field overall. Ginkgo’s platform breaks down these silos and democratizes access to the most advanced technologies in the field, enabling customers of all sizes to more efficiently drive innovation.

While R&D budgets may rise and fall based on the macroeconomic climate, the market is estimated to be in the tens of billions of dollars. This work is being done in a distributed manner, sacrificing benefits from scale and learning economies. The spend comprises both labor—scientists designing and executing experiments—and “tools”—things like DNA synthesis, reagents, and equipment. Ginkgo brings efficiencies to both elements of this existing market.

- Labor: When scientists leverage advanced automation, they can both reduce error rates and free time otherwise spent performing manual work (e.g., pipetting liquids from one plate to another). Freed from the burden of manual programming, scientists have more time to practice the art of cell programming: designing the direction of experimentation, mining data for new insights or exploring new techniques or application areas. This in turn increases the demand for programs as scientists retain a greater capacity for innovation and generate more ideas to test.
- Tools: Ginkgo’s scale provides a cost advantage in two primary ways. First, we reduce the amount of capital investment required by our customers—an early stage company building on our platform may never need to build a molecular biology lab. Second, our proprietary technologies and scale economics drive down the marginal cost of each experiment. Combined, these factors have the impact of transforming what is typically a large fixed cost investment for a cell programmer into a much lower variable cost. This is akin to an IT department not having to build and maintain a costly bank of servers and instead paying a marginal usage-based fee to their cloud computing vendor. Additionally, and perhaps even more impactful, our Codebase provides host cells, genetic parts and

associated data for our customers that are unavailable elsewhere and which may reduce the total amount of work required.

As the cost of computing power declined exponentially in computer programming, the demand for computing power increased exponentially as developers dreamed up more and more sophisticated applications. We expect the same to be true in cell programming: as our platform scales in capability and capacity, we hope that the range of applications accessible to cell programming will likewise expand in breadth and sophistication.

Given the current and potential future size of the market for this work, Ginkgo's ability to penetrate the market and convert customers from "on prem" R&D to outsourced services is a key driver. In the current macroeconomic climate, where potential customers' R&D budgets may be cut, Ginkgo may be somewhat insulated because our growth has much more to do with the willingness of customers to outsource R&D than the growth rate of the industry overall. In fact, we believe that challenging economic climates may actually encourage potential customers to re-evaluate the way they perform R&D, potentially favoring variable cost service providers like us over "on prem" facilities and employee populations that are harder to ramp up and down quickly.

Industry Overview

We believe that Ginkgo is changing the structure of the biotechnology industry. In much the same way that cloud computing centralized hosting services and ushered in a wave of SaaS companies, Ginkgo is scaling the capabilities needed to program cells. By making these tools more accessible, we hope to usher in a wave of innovation in both "hardware" (life science tools) and "software" (cell programs).

At Ginkgo, we have always admired the symbiotic and regenerative nature of biology, which sits in stark contrast to the often extractive nature of existing technologies. We are often asked who we think the "winners" and "losers" in the industry will be as Ginkgo scales, as if it is a given that our growth must come at the expense of others in the ecosystem. We reject that notion. As our platform scales, we seek to drive benefits for all existing players in this ecosystem:

- Innovators—whether in academic labs, startups, or global conglomerates—benefit from faster and more successful R&D efforts
- Scientists are freed to unleash their creativity (we understand the pain of spending years pipetting at the bench too!)
- Life science tools and manufacturing companies benefit from having a clear technical roadmap and known demand to justify investments
- Society benefits from responsible innovation, driving more sustainable, cost effective, and high-performance products

Program Layer: Ginkgo enables and accelerates product companies, which historically have had to vertically integrate

Ginkgo is not a product company; we are an enabling platform for product companies in a range of end markets. We do not seek to "pick winners" and focus instead on building our platform rather than investing in product-specific risk. Platforms require scale and a relentless focus on innovation while taking a product to market requires many specialized functions that vary depending on the product:

- A novel food ingredient requires food scientists to test and enhance taste and functionality
- A therapeutic requires clinicians to conduct animal and human studies to test safety and efficacy
- A novel material requires materials scientists to evaluate elasticity, durability, conductivity, or other required features
- An agricultural product requires field trials

Once the product is developed, major investments are also needed to manufacture, distribute, and market the product. These are the jobs of our customers, the product companies.

Historically, product companies have had to invest in their own R&D capabilities, building their own labs and hiring their own scientists. This investment is inefficient due to lack of scale and drains resources away from application testing and product development. Ginkgo's platform is not application-specific. The same engineering tools can be used for programs in completely different application areas: cells all run on the same genetic code. As product companies develop their products on Ginkgo's platform, they gain efficiencies and increase their probability of success. New companies that build on our

platform never need to make the fixed capital investments to start a lab from scratch; they are able to leapfrog and compete effectively against established companies.

Technology Layer: Ginkgo collaborates with life science tools companies to drive technology advancements

Because we're constantly thinking about how to enable the next several years of scaling of our platform, we have good insights into future bottlenecks and welcome the opportunity to collaborate to build and invest in technologies that will break through those barriers. We are the largest customer for many of our strategic suppliers and, as such, play an important role in advancing new technologies. As a result, we are often able to secure preferred access, often including custom development and leading economic terms, to next-generation technologies and pass those benefits along to customers.

We expect to continue to invest in and support the development of emerging technologies in this space. In certain areas where Ginkgo has unique needs, we may acquire technologies directly, as we did with Gen9, Inc.'s ("Gen9") DNA assembly platform, which was particularly valuable for more complex DNA synthesis needs. In many other areas, we will support new and existing technology companies by placing anchor orders and partnering to develop technology roadmaps that break new ground. In 2022, we made several acquisitions that brought technologies that can be broadly deployed across our programs, including Zymergen Inc. ("Zymergen"), FGen AG ("FGen"), and Altar SAS ("Altar"). We also acquired specialized assets that opened up new market opportunities for us such as Bayer's West Sacramento Agricultural Biologicals team and facility, and Circularis Biotechnologies, Inc. ("Circularis"), an emerging circular RNA company.

By acting as a *horizontal platform*, Ginkgo can focus on what we do best (cell programming), our customers can focus on what they do best (bringing products to market in their industry), and our suppliers can focus on what they do best (building great hardware and tools). Biology did not evolve by industry and so cell programming is able to benefit from the scale and efficiency of a horizontal platform. Vertical integration is no longer required, allowing each layer of the ecosystem to flourish as we collectively enable more rapid growth across the industry.

Enabling Customer Success

Ginkgo serves diverse customers across a variety of end markets. Some of these customers may have in-house biological R&D teams and others may have never thought biotechnology applied to their business. In either case, they come to us with a challenge—whether it is supply chain volatility, a race to develop an innovative new product, or an existential threat facing an industry on the wrong side of history—and we partner to enable a biological solution. We begin our relationship by working collaboratively to design the set of specifications for the end product(s) our customer desires. Our cell programmers then take that set of specifications and design an engineering plan to create a cell program that meets or exceeds that set of specifications. When we finish, our customers receive the final engineered organism (which either produces or *is* their product of interest) and a full "tech transfer" package for manufacturing and downstream processing (which they can implement themselves or pass to a contract manufacturer with our support). Our customers then take these organisms and/or purified products through the final stages of product development (e.g., formulations, clinical trials, field trials, etc.).

Our commercial team is organized to both establish new relationships with potential customers (traditional business development) as well as maintain and expand relationships with our existing customers (which we call "alliance management"; this team often works jointly with our business development team on sales efforts).

Our business development team has both expertise in relevant industries (Consumer & Technology, Industrial & Environment, Agriculture, Food & Nutrition, Pharma & Biotech, and Government & Defense) as well as expertise in our Foundry capabilities and synthetic biology. With this background we are able to identify industry or consumer challenges where biology can serve as a solution. Our categories of customers, independent of industry, include potential customers who have R&D teams with some synthetic biology capabilities where choosing Ginkgo can bring automation, scale, and codebase beyond their own; potential customers who are considering but have not yet built lab-scale capabilities where a partnership with Ginkgo allows them to spend their capital on commercialization efforts; and potential customers who are not yet working in synthetic biology whose industries or products stand to be disrupted by biological solutions. Our business development team, with support from our Codebase and Foundry team members, crafts solutions for each of these types of customers through a strategic discussion of customer needs and fit with Ginkgo capabilities.

To grow existing customers, our alliance management and business development teams work closely with customers to identify technical and business opportunities that serve as the basis for consideration of future programs. Through these discussions, our existing customers often bring upcoming strategic R&D needs to our attention.

Over 160 Cumulative Programs across diverse industries have run on our platform

While most biotechnology companies focus on building products within a fairly narrow scope, Ginkgo has uniquely pursued a partnered strategy across all end markets. This was not easy. For many years, our platform was less efficient than the status quo of an expert scientist working by-hand at a lab bench. In the early days, the only end markets willing to take a chance on our platform were those without in-house biotechnology capabilities. But as Ginkgo's platform improved over time and with scale, we were able to win contracts in increasingly sophisticated end markets with more in-house biotechnology expertise. Today, our platform is diversified across all major end markets with marquee customers and a range of focus areas within each.

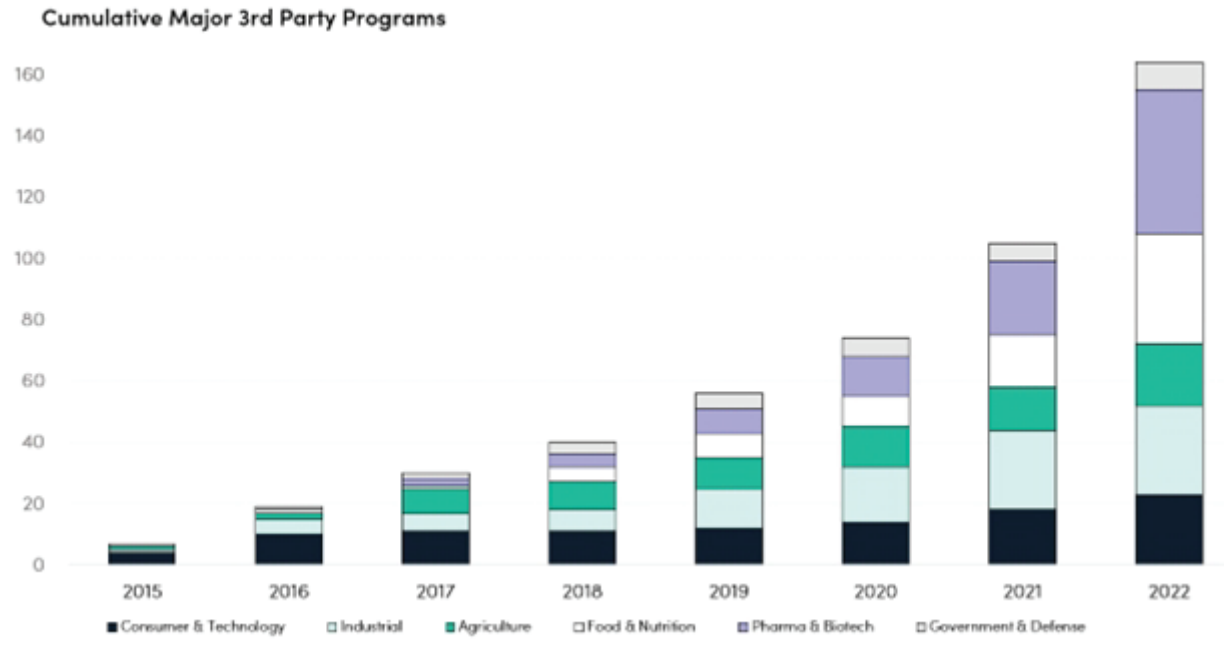


Figure 6: Cumulative Programs run by third-party customers on Ginkgo's platform (excluding proof of concept projects and other exploratory work). Today, Ginkgo has a diverse set of programs across all major end markets.

Our customers include large multinational organizations with multibillion dollar R&D budgets as well as startups who are depending on us for essentially all of their bioengineering needs. While these customers and their focus areas may look very different, they are all important and valuable to Ginkgo. All of these programs leverage a common infrastructure, and as we demonstrate the value of this platform, we have the ability to grow significantly with our customers.

Ability to grow with our customers and increasingly complement existing R&D budgets

Ginkgo has grown substantially through inside sales with our existing customers. Some of our customers forego building their own lab space in favor of outsourcing all of their cell engineering needs and so when they grow and expand their product pipeline, we expect their demand for our platform to increase. We believe the relative value of our platform compared to the next best option (building a lab, bioengineering team, and intellectual property from scratch) is immense, which helps us retain customers in this category.

Other customers may already have in-house cell programming capabilities. As Ginkgo demonstrates the value-add of our platform by successfully delivering on programs, we have the opportunity to grow our collaborations with them, complementing their core R&D capabilities. We don't view this as a "replacement" of customer scientists with Ginkgo's platform. Rather, we hope to *expand* our customers' capacity and need for innovation—giving them more "shots on goal" and enabling them to invest *more* heavily in R&D as the return on investment of each dollar spent increases.

We have demonstrated our ability to "land and expand" with several customers. With one customer, an initial proof of concept program has turned into a broader strategic relationship with 11 programs today. With another, we launched a relationship with two programs, quickly expanding it to five by the end of the following year. While this initially drove some customer concentration, that has naturally decreased as we've scaled and added new customers to the platform. During 2022,

two of our customers each contributed greater than 10% of revenue and collectively they accounted for 22% of total revenue, down from 28% in 2021. With the addition of new customers, we believe customer concentration will decline over time even as we expect to continue to grow our relationships with existing large customers. However, our ability to grow with our customers requires us to maintain satisfied customers, and program or other operational setbacks could impede our ability to meet customer expectations and grow our business.

Powerful proof points across categories

Our platform has now been validated by sophisticated customers across a range of industries. As we launch programs in new areas, those provide a toehold for future sales in that space. As an example, our *pro bono* project for Moderna, Inc. ("Moderna") at the start of the COVID-19 pandemic to enhance production of a key raw ingredient through process engineering provided a proof point and initiated us into this emerging segment, leading to a commercial relationship with another nucleic acid vaccine company, as well as a program to produce a key processing enzyme for mRNA vaccines. Biopharma discovery programs remain the hardest area to break into as our customers have strong in-house capabilities and many specialized competitors exist in this area. In the last 12-18 months, however, we have been able to demonstrate powerful data and capabilities that have enabled us to sign programs with leading biopharma companies such as Biogen, Merck, and Novo Nordisk.

Our Platform

Ginkgo's platform combines a strong technical foundation with an ecosystem of supporting resources to maximize our partners' odds of technical and commercial success. In the nucleus of our platform are our Foundry and Codebase, which our scientists leverage to complete customer programs. The Foundry is, in its simplest form, a very large, highly efficient biology lab, enabled by over a decade of investment in proprietary workflows, custom software, robotic automation, and data science and analytics. It is paired with our Codebase, a collection of biological "parts" and a database of biological data, which helps our scientists program cells. But great technology alone is not enough, and we are building a community and ecosystem around our technical platform that provides our partners with end-to-end support.

Our Foundry brings economies of scale to cell programming

Cell programming projects involve a conceptually similar process regardless of the specific product or market. Based on customer specifications, Ginkgo's program team develops designs of proteins, pathways and gene networks (see Figure 5) that might meet the specification, leveraging public and proprietary biological knowledge bases (see "*—Our Codebase—organizing the world's biological code*"). Those conceptual designs are refined and specified into particular DNA sequences using computer-aided design tools. Those DNA sequences are then chemically synthesized and inserted into a cell to execute the new DNA code. These prototype cells are then studied and the output or performance of each is measured and compared to the customer's desired specification. Learnings using data analytics and data science tools can inform a new round of prototypes, if needed. We refer to this engineering cycle from design to learning as a *campaign* and we perform campaigns both in parallel and serially until either the specification has been met or the customer decides to end the program.

The likelihood of technical success increases with each iterative campaign and with the number of prototypes that are explored per campaign. However, with traditional tools for genetic engineering, each campaign can be slow, expensive and error prone. Many projects across the industry run out of budget or time. Conventional R&D teams often look to stay within budget by running rapid campaigns using largely manual tools and small numbers of prototypes per campaign. However, the inability to broadly explore the potential design space (there are more possible sequences of a 200 amino acid protein encoded in 600 DNA letters than there are stars in the observable universe) and the reliance on manual tools is a difficult handicap to overcome. Since people can only work so hard and since campaigns can't be shortened beyond the duration of the physical steps, this approach has limited potential to improve in the future.

At Ginkgo, we invest in improving the tools and technology for programming cells in order to maximize program success within the constraints of customer timelines and budgets. We do so by scaling the number of prototypes that can be evaluated in each campaign in an effort to reduce the number of campaigns required to meet the customer's specification and ultimately shorten project timelines. A typical campaign for one enzyme step in a program might evaluate 1,000 to 2,000 prototypes to optimize function, of which the top 10 to 100 might be short-listed for further study. A relatively basic program might have three to five enzymes working in concert, and so in the process of optimizing the entire pathway, thousands or tens of thousands of enzymes and pathway combinations might be designed, built, and tested in the Foundry. The methods we use to increase scale also tend to reduce the average cost per prototype, which means that more prototypes can be evaluated for a given program budget.

Because diverse cell programs share similarities in process and code, many programs can be run simultaneously in a carefully designed centralized facility. This facility, where we use our investments in advanced cell programming technologies to manage diverse programs, is what we call our *Foundry*.

We make it possible to centralize many cell programming projects in our Foundry by deconstructing programs into a set of common steps and then standardizing those steps. For each step, we have built a specialized functional team that performs that step for all programs. Those teams define a set of standardized services that can be used in concert to execute an end-to-end cell programming process. Each team has access to scientific, software, and robotic engineering resources to replace manual ad hoc operations with standardized, automated, and optimized services. In addition to enabling scale, this approach ensures standard operating procedures, know-how, and human skill become encoded in software that can be more effectively debugged, monitored, controlled, and optimized.

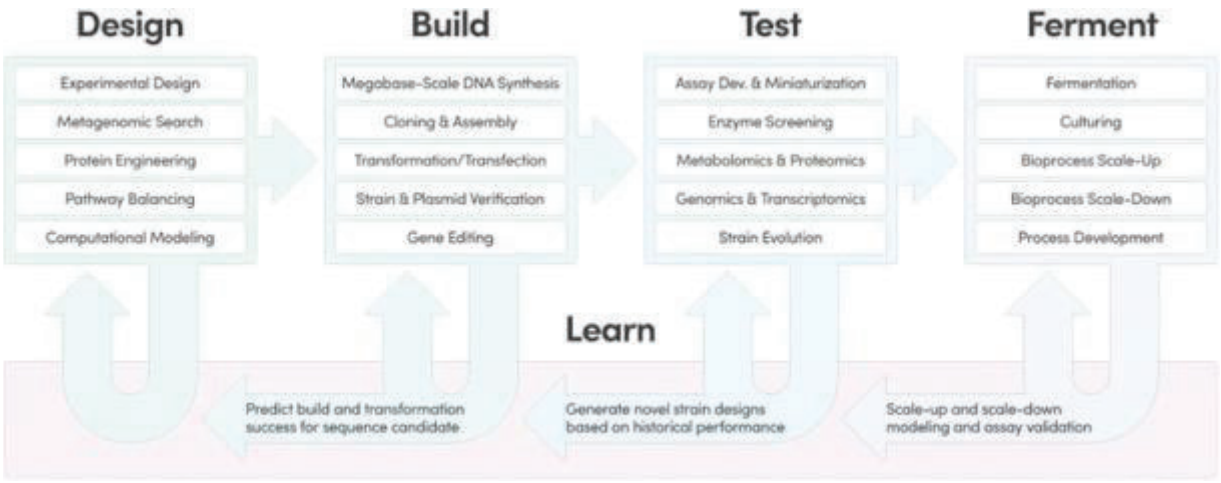


Figure 7: A non-exhaustive summary of the functions performed throughout the lifecycle of a program in the Foundry. At each stage, learnings are generated, driving improved designs and functional optimizations.

While the engineering strategies described above have historically been relatively uncommon in the life sciences, they are obviously not our invention. Rather, we are inspired by the lessons from other engineering disciplines and seek to apply those to biology. Automotive manufacturing, semiconductor fabrication, and data centers, among many other industries, demonstrate how automation, data, economies of scale, and continuous improvement can produce compounding gains in scale, costs, and quality. Critically, routine performance of these strategies across dozens of projects gives us the data and experience needed to drive continuous improvement.

As described above, a key strategy in our Foundry is to increase the scale of our operations so that we can run larger campaigns, a greater number of campaigns, and hence run more programs. This approach benefits from operational efficiencies and economies of scale across many dimensions:

- *Fixed Cost Amortization*: Our Foundry is an inherently physical facility and as we scale and improve utilization, we are able to amortize this fixed cost across more work.
- *Continuous Learning and Improvement*: The cumulative amount of work done as we scale leads to a better understanding about how to program cells. Much of this is then encoded in our Codebase, described below.
- *Purchasing Economies*: By partnering with Ginkgo, our technology partners and suppliers can generate more value from a single account than they could from multiple smaller accounts, and that extra value is shared with Ginkgo.
- *Technology Specialization*: Certain technologies that we leverage in the Foundry (such as acoustic liquid handling, automated bioreactors, and advanced mass spectrometry systems) are not easily leveraged or practical for smaller organizations. But for an engineering organization of our size, those investments can drive material improvements in cost efficiency.

These efficiencies and economies of scale can be observed empirically from a relationship we refer to as “Knight’s Law,” named after Tom Knight, one of our co-founders, and loosely inspired by Moore’s Law for semiconductors. As shown below, we have seen a significant increase in the output of the Foundry over time alongside a significant decline in the average cost per unit of output except during temporary lab shutdowns during the COVID-19 pandemic and reduced capacity due to social

distancing. In 2022, we continued to see significant year-over-year improvements in Foundry output and cost per unit as measured by strain tests, a metric related to the number of prototypes evaluated across all active programs. While strain tests offer one useful measure of Foundry output, we intend to evolve our metrics relating to Knight's Law to provide what we believe to be a more dispositive snapshot of the true output of our Foundry as it evolves. For example, campaigns using the FGen and Altar technologies we acquired in 2022 are useful to advance certain programs but they do not generate strain tests due to the stringent definition we use for strain tests. Thus, campaigns are a higher level and more generic unit of Foundry output than strain tests. We plan to monitor and assess whether a metric such as number of campaigns serves as a useful metric for Foundry output that may complement our current low-level metric (strain tests) and high-level metric (New Programs).

Knight's Law does not provide the full story on our development, but it is a useful tool that allows us to continue to build efficiencies of scale. We believe we can continue to drive significant capacity growth in the foreseeable future, though it is dependent on the development of new technologies, which inherently carries risk, and, like Moore's Law, we will likely hit a limit over time. This feature compares to a conventional facility, where scaling is driven predominantly by the addition of employees, an exponential increase in work would be infeasible and the cost per unit of work would decline little, if at all.

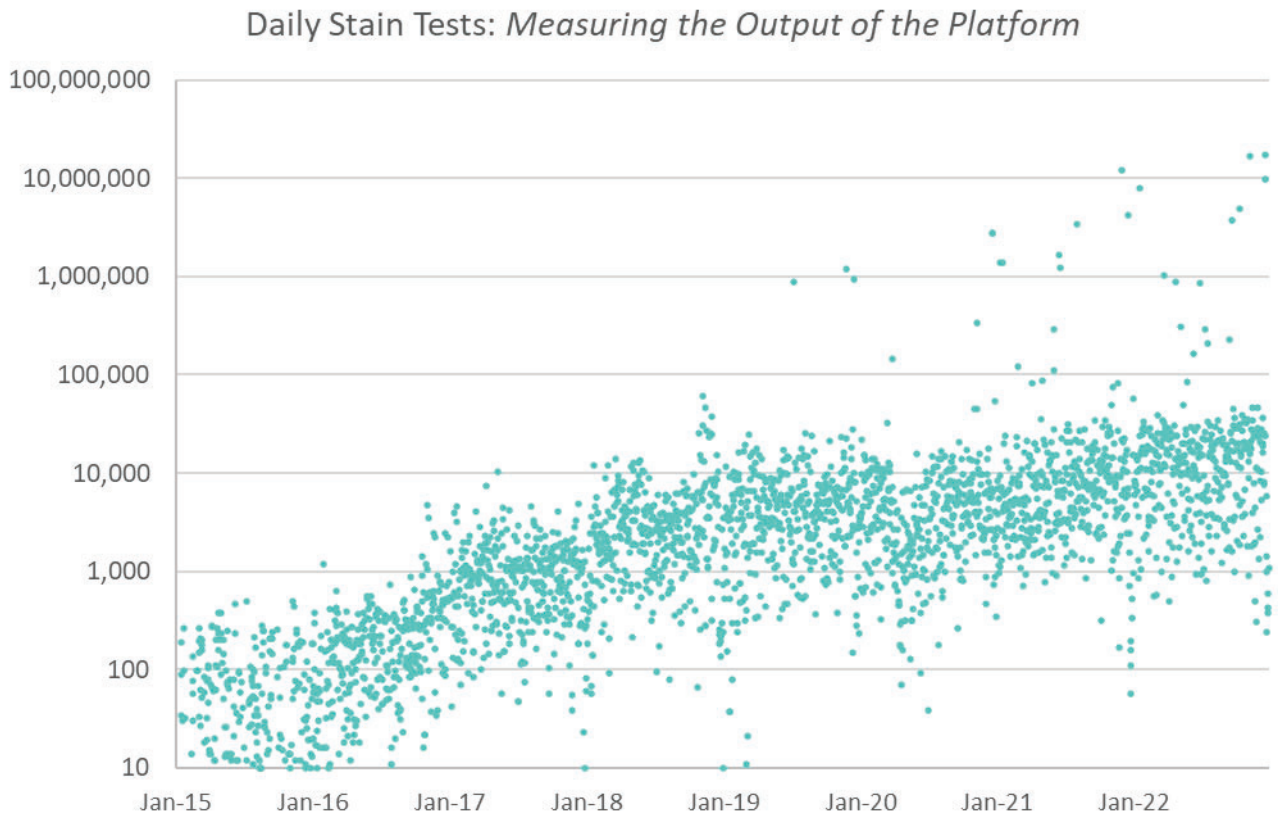


Figure 8: The output of the platform as measured by daily strain tests increased by well over 2X in 2022 following growth of over 3X per year during the preceding several years (with the exception of 2020). While we expect significant scaling to continue, there is no guarantee that we will be able to do so.

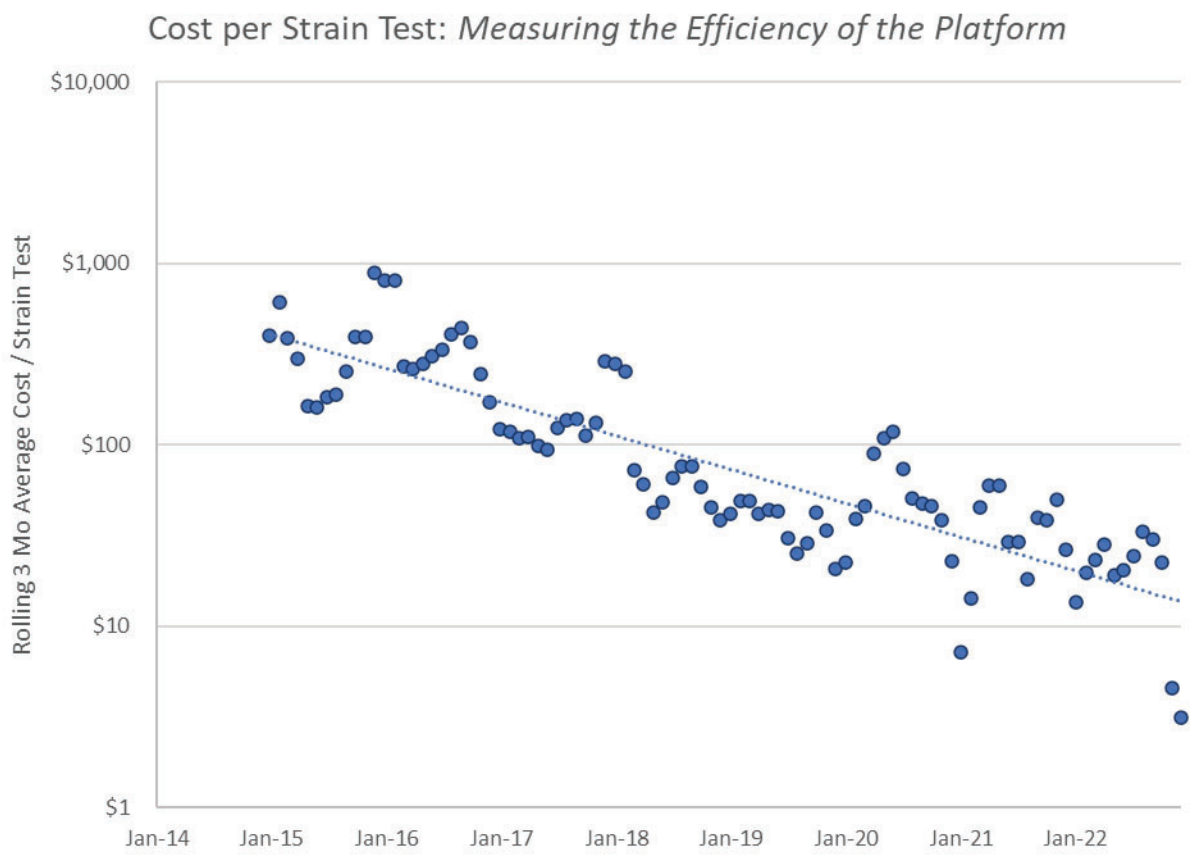


Figure 9: As the output of the platform has increased, our total R&D / operational costs per unit of output has decreased by approximately 30% in 2022 and approximately 50% per year during the preceding several years (with the exception of 2020).

We are frequently asked, and spend much time thinking about, whether it will be possible for compounding gains in output and productivity to continue for many years in the future. It is important to note that given significantly advanced tools, most steps in cell programming could be miniaturized to a point where single molecules of DNA and single cells are being manipulated and monitored. At that ultimate degree of miniaturization, the costs and timelines of cell programming could be reduced orders of magnitude from where they are today. Microfluidic and encapsulation technologies point to the reality of this future of cell programming at the single-cell level. Additionally, because many of the enabling tools of cell programming are *biological* in nature (e.g., polymerases and CRISPR), we are able to point the platform at *itself*, developing new biological tools to reduce the number of steps or the complexity of a certain operation. For example, we could develop better gene editing enzymes or novel ways to screen cells in a multiplexed format using biological sensors. It is easy to theorize about these types of developments, however they are hard to execute, we will undoubtedly run into roadblocks along the way and we will have to invest significantly in developing new technologies in order to enable the types of improvements we seek to achieve.

Recent advances in machine learning, molecular simulation, and other computational techniques also hold great promise to improve our ability to program cells. We believe our Foundry is well-positioned to build the kind of large, well-structured datasets that such computational approaches need to succeed. In time, we believe computational approaches will reduce the need for certain kinds of experiments (for example, we already use machine learning to make protein and enzyme design projects more efficient). If computational approaches can replace certain sets of experiments, we expect to use the recovered Foundry capacity to work on ever-more complex cell programming challenges. The reality is that the cells that we program today accomplish relatively simple functions, such as: “produce as much of molecule X as possible.” Programming cells for complex functions, such as live-cell therapeutics, responsive building materials, multicellular organisms, etc., will require sophisticated sub-systems for environmental sensing, intracellular information processing and feedback, and a multidimensional program that responds to such environmental stimuli. Only when we can deliver such sophisticated

programmed cells will we have truly unlocked the potential of biology, and we see the Foundry as being an integral part of the platform for doing so.

Our Codebase—organizing the world's biological code

Codebase is a familiar term to software developers but is a new concept in biology. Modern software firms develop their own (typically proprietary) codebase of source code and code libraries that can be leveraged by their software developers to more easily create new applications than they could starting from scratch. Additionally, vast repositories of debugged code are shared publicly so that programmers across application areas can leverage prior art in order to innovate faster. This allows software developers to focus their time and effort on developing new features rather than recreating existing logic. Ginkgo's Codebase consists of reusable genetic parts and strains that can be repurposed in new cell programs as well as vast datasets mapping genotype to phenotype. We are continually investing in better ways to characterize functional biological code to drive increased reusability. In addition to the raw performance data we generate through our Foundry experiments (approximately 70 million strain tests run in 2022), we have also incorporated many public databases for protein sequences and, together with proprietary databases, have amassed a data set of approximately 5.7 billion unique protein sequences that we leverage in our designs.

Engineering biology is complex—one of the reasons that Foundry scale is important is that it remains highly difficult to predict the performance of a biological "part" in a given context from a DNA sequence alone. The genomics revolution has outpaced biologists' ability to test the functionality of each DNA sequence as it was discovered, particularly because most of the community is still performing biological experiments by hand without the benefit of automation. Each program performed at Ginkgo involves testing thousands or millions of DNA sequences; with a small fraction of those ending up in our final engineered cells. For that reason, high-performance biological sequences—the handful of designs from thousands of candidate designs that meet our performance goals for an experiment—are hard-won assets and form a key component of Ginkgo's Codebase. Not to be discounted, the "losing" designs are still valuable, helping inform more effective campaigns in the future that avoid known failure modes.

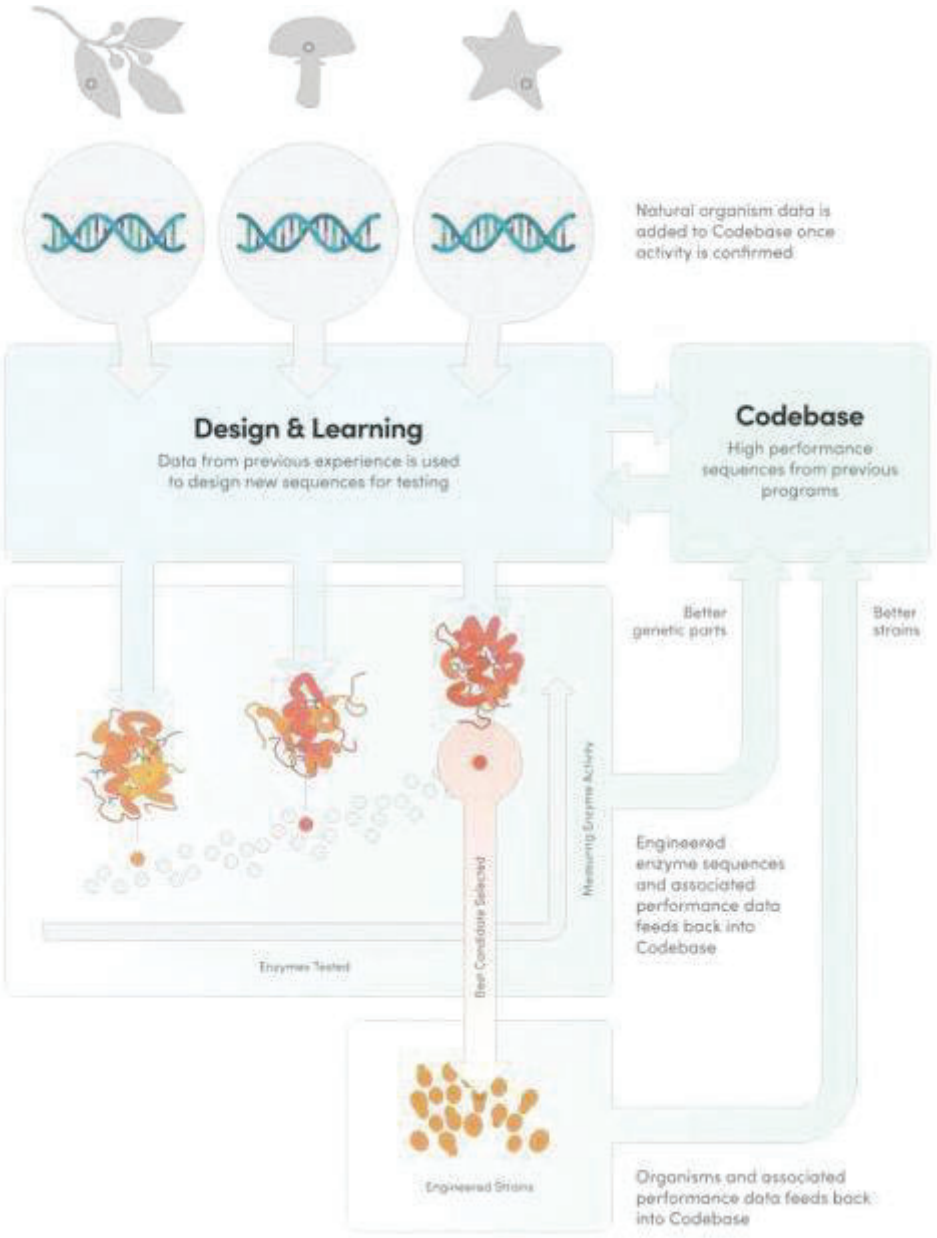


Figure 10: Our Codebase incorporates both biological assets from nature as well as engineered assets and data from our Foundry experiments. Because the Foundry enables us to test many thousands of prototype enzymes, pathways, and strains in individual engineering cycles, we are able to quickly expand the range of characterized biological assets in our Codebase.

In some ways Codebase is a "parts catalog" that we can draw from when developing a new organism. As Ginkgo performs more projects, we contribute new parts to our Codebase that can be reused in new contexts. For example, we developed novel synthetic promoters (DNA sequences that can turn on the expression of a gene of interest) that allowed us to increase production of proteins in yeast. Initially, we tested thousands of designs to arrive at a select number of promoters with high performance. Now those high-performing promoters can be reused in any program that involves producing a protein in yeast; they are a modular piece of genetic code. Over the past 20 years, our team has supported efforts to build these kinds of parts libraries—the International Genetically Engineered Machine ("iGEM") Parts Registry and AddGene are two notable examples of initiatives to make reusable parts available to researchers in the community. But despite these efforts, we continue to see intellectual property siloed within organizations across the biotechnology industry, leaving many without the additional intellectual property they need to develop their programs. Ginkgo's Codebase allows our customers to draw from a broader set of biological assets than any single company would develop for a given application. The scale and diversity of our programs have allowed us to develop a large Codebase that grows with the addition of each new program and can be opened to the broad swath of partners and cell programmers using our platform.

Cell programmers must consider not only the genes in the programs that they design, but also the ways that they interact with the cell that "runs" the program. Therefore, Codebase is more than just the individual modular parts we use to design biological programs. The organisms that have been optimized to run the programs, whether because they have been engineered for robust growth or because they are particularly adept at producing certain classes of products, are known as "chassis" strains. These strains can be reused across multiple programs, significantly reducing the amount of work needed to optimize a program and engineer a commercially viable organism. The breadth of Ginkgo's customer base allows us to use these chassis strains in many more contexts than traditional industrial biotech players.

For example:

- Our collaboration with Cronos involves the production of many different cannabinoids; these cannabinoids share common precursor molecules such that a single chassis strain can be modified to produce each product.
- In 2021, Ginkgo acquired Dutch DNA Biotech B.V. This team specializes in the development of filamentous fungi for protein production. Traditionally, filamentous fungi have been used for the production of industrial enzymes—typically enzymes that are native to fungi or close relatives. At Ginkgo, these fungal strains are being engineered to produce a broad range of proteins, including bacterial and mammalian proteins. These proteins are applicable to a wide range of end products, such as food and materials.
- In 2022, Ginkgo acquired Zymergen, a company with extensive codebase assets of their own, including engineered chassis strains and over one billion proprietary gene sequences used for gene discovery. These assets were originally developed for applications in novel materials, drug discovery, and agriculture, and are being broadly repurposed across Ginkgo's portfolio.
- In 2022, Ginkgo announced a new cell programming project with Sumitomo to produce a target molecule for the personal care and cosmetic industries. The target molecule is envisioned to augment or replace one that is otherwise currently gathered from animal sources. This program was selected in part due to the availability of a precursor molecule in Ginkgo's Codebase.
- In 2022, Ginkgo acquired Circularis, a company with a proprietary screening platform for genetic regulatory elements based on a circular RNA transcriptional reporter. The acquisition provided large sets of promoters and other regulatory elements whose performance has been assessed in multiple mammalian cell lines. The platform is being integrated into the Foundry to accelerate screening of regulatory elements and the circularization technology is being used to develop circular RNA for therapeutic purposes.
- We aim to re-deploy Codebase assets in new contexts. In 2021, we launched our "Cell Development Kit" ("CDK") product offering. Inspired by "Software Development Kits" ("SDKs") used in the software industry, CDKs offer a standardized entry point for Ginkgo to input new projects on the Ginkgo platform. The first CDKs to launch are focused on protein expression programs. CDKs provide cell programmers access to the toolkit needed to get started developing commercial proteins, including access to pre-engineered host cells optimized for such protein production, specialized equipment, automation capabilities, genetic engineering expertise, insights garnered from Ginkgo's Codebase and the applicable infrastructure to design, build and test a custom protein production microbe.
- Ginkgo's CDKs are designed to cut the cost of launching a cell program and speed up development timelines to build engineered microbes, for example, to determine whether a protein may be successfully and commercially produced. By simplifying the pathway for companies to get started on the Ginkgo platform with standard terms, a phased approach, low costs and clear deliverables, the CDK can help de-risk projects prior to full scale technical development. In effect, CDKs allow us to more efficiently deploy useful Codebase and the cell engineering know-how we have accumulated to add new projects to the platform.

Our Foundry and Codebase are inextricably linked. Our Foundry scale allows us to generate unparalleled Codebase assets. These Codebase assets help us improve our designs and provide reusable parts and chassis strains that improve the efficiency and probability of success of our cell programming efforts in the Foundry. As the capabilities of the platform improve, it drives further demand, which increases the *rate* of learning in our Codebase. The continuous learning and improvements inherent in this relationship is one of the key features of our platform.

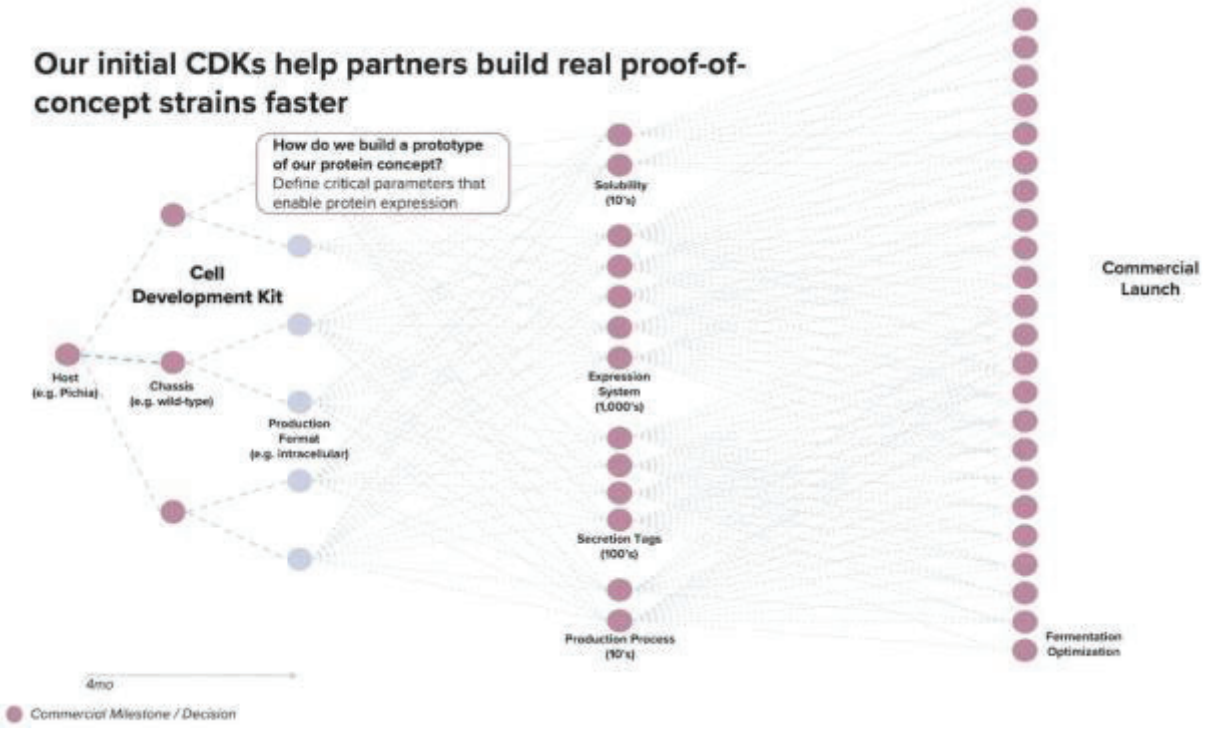


Figure 11: We believe our initial CDKs can help cell programmers build proof-of-concept strains faster.

An ecosystem to support cell programmers

Ginkgo has long recognized that it is critical to build a true ecosystem around our technical platform. We have been inspired by the leading horizontal platforms in information technology, such as Microsoft Windows and Amazon Web Services ("AWS"), which built real developer communities and provided a range of value-added services on top of their core technology. Like these pathbreakers, who set the stage for a generation of computer developers, we too are trying to ensure that the cell programmers who build applications on our platform have the tools they need to succeed beyond the lab.

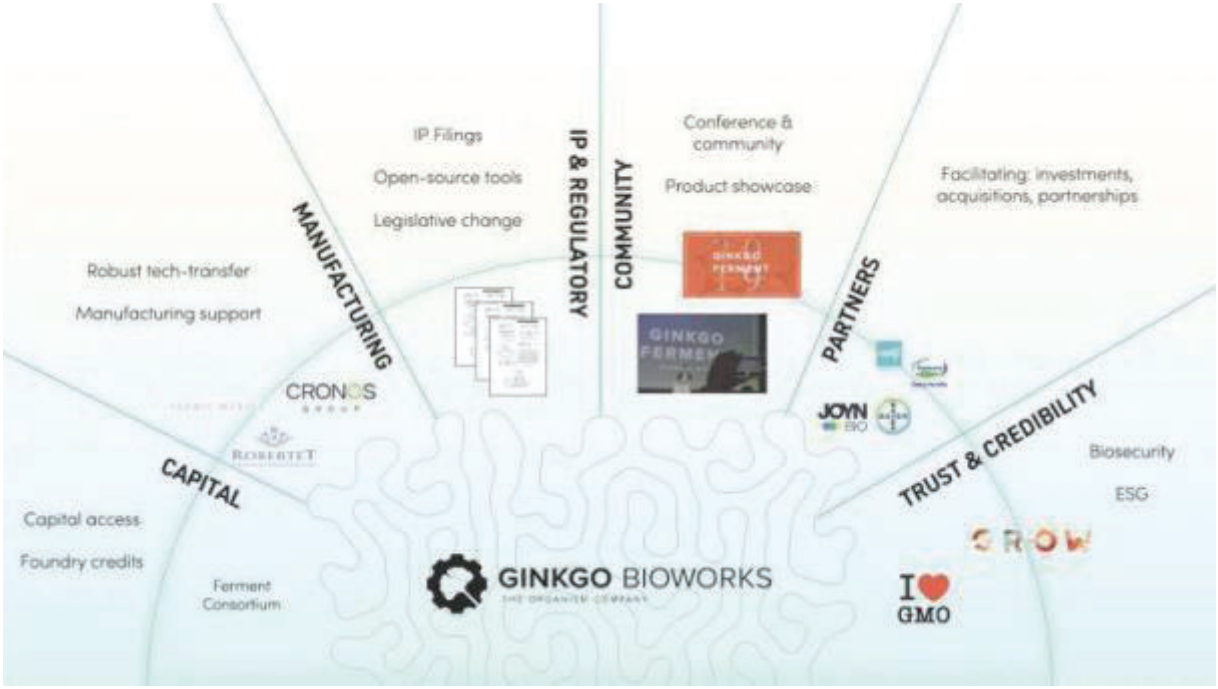


Figure 12: Ginkgo strives to create an ecosystem to ensure that cell programmers have the tools they need to succeed.

Access to capital

As in the early days of computer programming, it is still extremely expensive to program biology. For that reason, it can be easier for larger companies to make investments in innovation around this space. But Ginkgo's platform gives small companies and innovators access to the same horsepower as larger players and obviates the need to invest in fixed laboratory assets, providing an even greater strategic benefit. To help address this discrepancy, Ginkgo has assisted in launching new companies (such as Motif and Arcaea) by bringing together strategic and financial investors to secure funding for these early stage companies. While we maintain a conservative approach to cash management, we are able to leverage our capacity and partner with investors to enable companies at all stages to benefit from our platform. We believe that, as Ginkgo's customers demonstrate increasing success, there will be an explosion of capital for cell programming applications and a recognition of Ginkgo's platform as setting the industry standard and providing the backbone for these development efforts. In a challenging capital markets environment, such as the one we have experienced in 2022, access to capital becomes an even bigger challenge for emerging companies. While we remain thoughtful around ensuring a healthy mix of large and small customers, our value proposition to emerging companies has continued to expand significantly.

Manufacturing support

Our job is to ensure that our cell programs can be executed at scale and we support our customers to ensure successful commercial scale manufacturing. We have built relationships with a number of leading contract manufacturing organizations and have demonstrated that we can transfer our lab-developed protocols to commercial scale (e.g., 50,000+ L fermentation tanks) with predictable performance. We have an in-house deployment team dedicated to supporting our customers' scale-up and downstream processing needs. We have even helped certain customers, such as Cronos acquire and build out their own in-house manufacturing capabilities and certain programs, such as our work with Moderna, *focus* on manufacturing process optimization.

In 2022, we acquired Bayer's West Sacramento agricultural biologicals R&D facility, which included robust pilot manufacturing infrastructure for microbial strains, with room to grow. We plan to continue to invest in this capability, helping bridge the gap for our customers between R&D and commercial production.

Intellectual property protection and regulatory support

Ginkgo takes responsibility for the cell engineering intellectual property generated through customer collaborations. Our scientific team collaborates with our customers and with Ginkgo's intellectual property team to file patent applications and

monitor collaboration deliverables for freedom to operate. We are also active in the evolving regulatory landscape for biological engineering. While our customers are responsible for handling their own regulatory procedures on a product-by-product basis, our broader view can help build understanding of and support for novel product classes.

Building a community of cell programmers

We launched Ferment, our annual conference, in 2018. The conference highlights developments and thought leadership in the field and brings together scientists, entrepreneurs, investors, and suppliers, and we look forward to hosting our next Ferment in April 2023. Even prior to launching Ginkgo, our founders focused on building community within the emerging field of cell programming. Tom Knight, one of our founders, was among the professors who launched the iGEM Competition in 2004, which has now had over 70,000 participants from over 40 countries take part in the competition (including dozens of Ginkgo employees and all five founders!).

Facilitating partnerships within our community

Because Ginkgo serves both large market incumbents and smaller startups, our community also serves to facilitate introductions between innovators and those looking to invest in innovation. We believe that investors and large strategic companies have come to recognize Ginkgo's platform as a key enabler of innovation and are keen to get to know the companies that are building with us. Those relationships can be the source of funding and go-to-market support for the earlier stage companies building on the platform, increasing the odds that they develop successful products.

We invest in building trust and credibility for the entire industry

The most powerful technologies require the most care. Biology is too powerful for us to not care about how our platform is used. We have and will continue to invest heavily to build and maintain trust in bioengineering as a technology platform across all layers of the industry. At the platform layer, we have focused on building robust biosecurity measures. At the application layer, we are proud to enable a diverse set of programs that drive towards environmental sustainability. We are committed to ESG practices and broad stakeholder engagement at a corporate level. We are also engaged in deep conversations around the implications and ethics of biotechnologies through many public forums, helping shape our platform to promote sustainability in our global community.

Biosecurity: An imperative for our platform and demonstrated source of value

With a mission to make biology easier to engineer, we have always recognized the need to invest in biosecurity as a key component of our platform. We're building the future bioeconomy with our customers and partners, and we envision the future of biosecurity as a global immune system equipped with the capabilities to prevent, detect, and respond to biological threats. The first, critical step in realizing this future is to build a robust early warning system for biological threats—this is the primary focus of Ginkgo's biosecurity and public health unit, Concentric by Ginkgo.

The COVID-19 pandemic created a renewed sense of urgency for the need to counter biological risk, deepening our resolve and leading us to accelerate our early warning capabilities. Beginning in 2020, Concentric built a large-scale, end-to-end testing network that has empowered communities and public health leaders at the local, state, and federal levels to make informed decisions as the pandemic has continued to evolve. As part of this work, we launched large-scale efforts in K-12 schools in many U.S. states and partnered with Eurofins' Clinical Enterprise to support the federal Operation Expanded Testing program in providing free, low-burden testing solutions in underserved and high-risk communities, such as schools and early childhood education centers, long-term care communities, and corrections facilities.

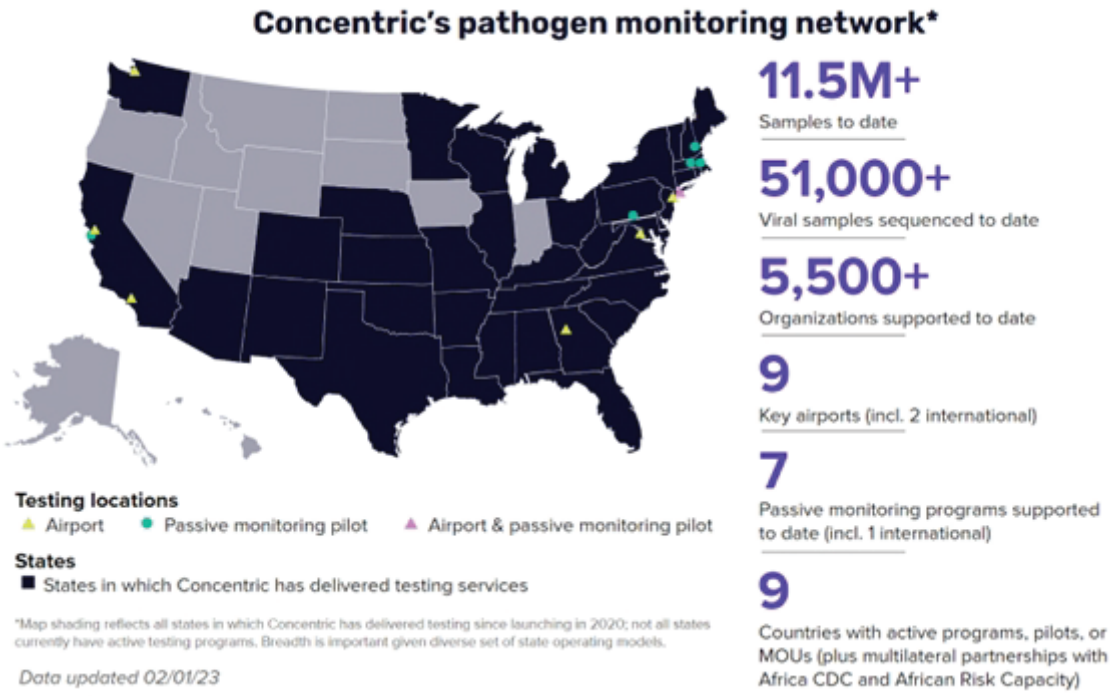


Figure 13: Concentric's pathogen monitoring network has conducted testing in communities across most of the U.S.

This network is now forming the foundation for a global, real-time biological threat monitoring network. As we grow this network, we are maturing our platform capabilities in several key ways:

- Expanding to multiple pathogen targets and laying the groundwork for threat-agnostic approaches;
- Diversifying our sampling modalities from nasal swab and saliva samples to more passive approaches that take environmental samples from wastewater and air;
- Maturing our bioinformatics offering and adding enhanced analytic modules, such as Engineered Nucleotide Detection and Ranking ("ENDAR"), a computational platform to detect engineered biology that was developed in collaboration with the Intelligence Advanced Research Projects Activity ("IARPA"); and
- Adding state-of-the-art epidemiological data infrastructure through an asset purchase from Baktus, Inc., that enables us to track, model, and forecast epidemics and associated risks and impacts.

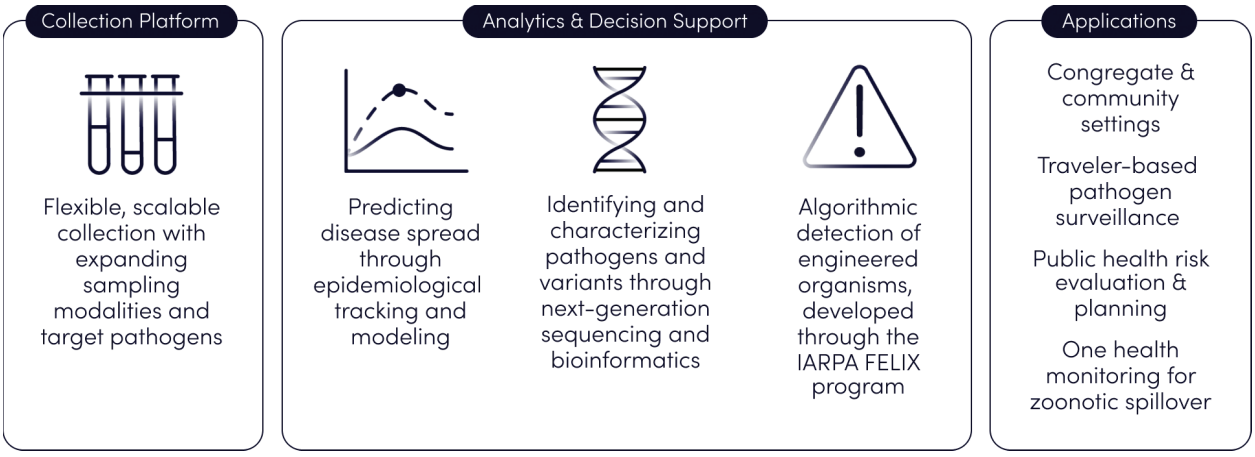


Figure 14: Concentric's growing platform for real-time biological threat monitoring will work like an "operating system" for biosecurity, managing the underlying capabilities, networks, and data infrastructure needed for a flexible combination of biomonitoring solutions.

We have reached several key milestones in the expansion of our global biosecurity network in the past year, including:

- Growing the Traveler-Based Genomic Surveillance program, an initiative to identify emerging viral variants by sampling arriving international travelers at major airports, in partnership with the U.S. Centers for Disease Control and Prevention ("CDC") and XpresCheck. The program continued to deliver early insights into emerging SARS-CoV-2 variants like BQ.1.1, A.2.75.2, XBB, and CH.1.1, announced expansion to three additional airport locations to address winter surges in late 2022 (to a total of seven airports), and began sampling for influenza A and B alongside SARS-CoV-2.
- Partnering with communities to run a series of passive monitoring pilots to optimize methodology and insights delivery. These pilots explore opportunities to mitigate risk in vulnerable community settings, incorporate passive monitoring data into layered strategies alongside testing, and leverage rural schools as a public health sentinel in areas lacking centralized municipal wastewater systems.
- Laying the groundwork for international expansion through a series of biosecurity-focused Memoranda of Understanding with partners in Qatar, Rwanda, the Kingdom of Saudi Arabia, and the Republic of Botswana (building on prior agreements with the Africa Centres for Disease Control and Prevention and mRNA Victoria). We are in the process of developing aircraft wastewater monitoring programs in Rwanda and Qatar.

In addition to these biological threat detection efforts, we are also engaged in prevention and response efforts. Ginkgo is a longtime member of the International Gene Synthesis Consortium, and as mentioned above, we recently completed a project with IARPA to develop a biodetection tool that can serve as a deterrent for bad actors seeking to engineer biology for malicious purposes. We have also continued and renewed our efforts to support the development of medical countermeasures like vaccines and therapeutics. Early in the pandemic, we launched partnerships with Moderna and Aldevron to support mRNA vaccine manufacturing. In the past year, we've built partnerships with key biopharma industry leaders like Novo Nordisk and Merck and invested in enhancing our capabilities to help deliver innovative therapeutics.

Our Business Model

The key input into our unit economics is a *cell program*. For each of these cell programs, we generate economic value in two primary ways. First, we charge usage fees for Foundry services, in much the same way that cloud computing companies charge usage fees for utilization of computing capacity or CROs charge for services. Additionally, we negotiate a value share with our customers (typically in the form of royalties, milestones, and/or equity interests) in order to align our economics with the success of the programs enabled by our platform. As we add new programs, our portfolio of programs with this "downstream" value potential grows. Because we typically do not incur material downstream costs (e.g., manufacturing or product development, which our customers manage), these value share payments flow through with approximately 100% contribution margin. This flexible business model allows for more predictable near-term revenue without sacrificing our ability to create long-term value with asymmetric upside.

Foundry (or Cell Engineering) Revenue

Illustrative Program Economics

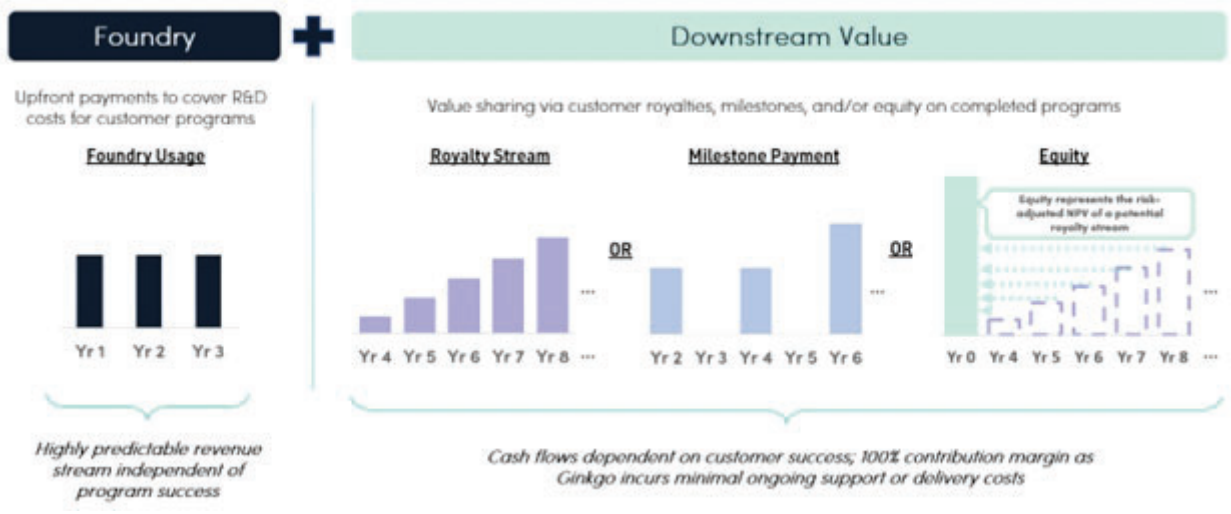


Figure 15: Ginkgo generates economics from programs in two primary ways. First, customers pay upfront fees to cover initial R&D costs for a program. Second, Ginkgo shares in the downstream value (typically in the form of a royalty stream, milestone, and/or equity share) generated by programs.

Foundry (or Cell Engineering) Usage Fees

The first stage of a cell program consists of R&D work being performed on Ginkgo's platform, leveraging our Foundry and Codebase. R&D is inherently risky and our customers recognize that this is a cost they will incur regardless of success and whether they are working on the program in-house or with a partner. Ginkgo provides a much more efficient platform to conduct this R&D work, encouraging companies to build on or adopt our platform.

We estimate that the unit costs of our Foundry cell engineering services are several times less expensive on average than the status quo (a customer doing equivalent R&D in-house, by-hand) and we expect that cost advantage to grow over time. We typically earn usage fees tied to the units of work that we perform on behalf of our customers' programs and as our platform matures, we would expect our growing cost advantage to enable us to fully cover our direct costs, eventually enabling us to earn a modest margin. Foundry usage fees provide a strong foundation of predictable revenue that is independent of any commercialization efforts by our partners.

As we continue to scale the Foundry and build Codebase, we expect to drive further efficiencies and decrease our average unit costs. This presents us with a strategic choice going forward. We could retain these efficiencies and increase our margins or we could pass these efficiencies on to our customers, increasing the number of shots on goal and, therefore, the likelihood of program success given a fixed budget. We believe the right choice for long-term value creation is to pass the savings to our customers, reducing the barriers to adoption and driving increased demand for our platform. Our Foundry usage fees are thus impacted by a number of drivers:

- Number of active programs: We hope to dramatically increase the number of programs working on our platform over time, and if we are successful, we believe this will drive increasing usage fees.
- Units of work per program per year: If our Foundry becomes more efficient and we generate more scale, we expect to be able to do more work per program in a fixed period of time, improving chances of program success.
- Average price per unit of work: If we bring on innovative technologies or step change improvements in existing Foundry services, we plan to pass capability and cost improvements on to our customers. If these new technologies or services are adopted across programs, we believe the average price per unit of work will fall over time.
- Number of years per program: If our platform improves, we expect program duration to decrease over time. Some programs may still be charting new territories and take several years, but programs that are able to leverage substantial pre-existing Codebase (e.g., our Nth program in bulk protein production) should have shorter duration and, in general, greater Foundry capabilities should shorten program durations.

The expected impact of these drivers is represented below:

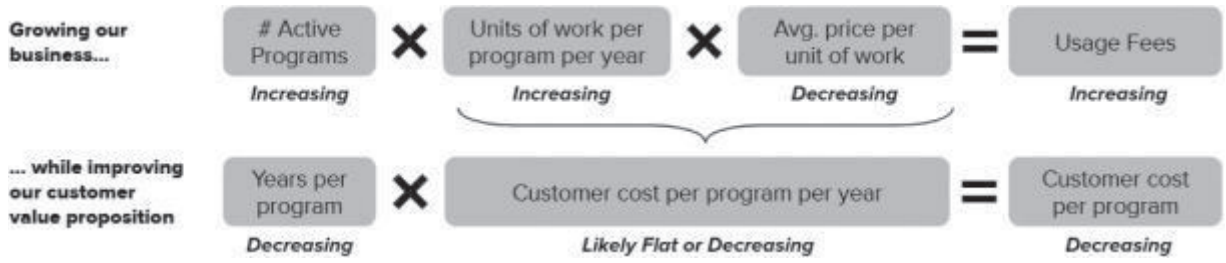


Figure 16: Illustrative drivers of Ginkgo's long-term financial model and customer value proposition.

The multi-year nature of an average cell programming project means that our usage fees are recurring in nature. Additionally, given the lead times inherent in developing technical plans as part of a sales process, we have good visibility into new Foundry usage fee bookings. This provides a strong foundation for the business and allows us to be patient while we wait for downstream economics.

Downstream Value Share

As the key enabling technology for our customers' products, we are able to earn a share of the value of the products that are created using our platform, an important component of the financial potential of most cell programs. We are quite flexible and have structured a variety of value sharing mechanisms, including royalties, equity, and lump-sum milestone payments. Because the economics to us should be roughly equivalent, we are generally agnostic on which form of downstream value capture we receive and the decision is typically based on customer size and preference.

Because Ginkgo typically will have completed the program (and received associated usage fees) prior to realizing downstream value, cash flows from the downstream value capture component generally fall straight to the bottom line as we incur minimal to no ongoing support or delivery costs once the strain is commercialized. This dynamic creates opportunities for outsized returns as our clients successfully commercialize products built on our platform. As we add more programs to the platform over time, we expect downstream value share to contribute income, and therefore we believe our overall margins and cash flow profile will grow significantly. The realization of potential revenue related to downstream value in the form of potential future milestone payments and royalties and/or equity consideration is dependent upon a number of factors, including our ability to successfully develop engineered cells, bioprocesses, data packages, or other deliverables, and the product development and commercialization success of our customers.

Biosecurity Revenue

In the second quarter of 2020, in response to the COVID-19 pandemic, we launched our commercial offering of COVID-19 testing products and services for businesses, academic institutions, and other organizations in which we generate product and service revenue. We generate product revenue through the sale of lateral flow assay ("LFA") diagnostic test kits, PCR sample collection kits and pooled test kits, all of which we sell to our customers on a standalone basis. We generate service revenue primarily through the sale of our end-to-end COVID-19 testing services which consist of multiple promised goods and services including sample collection kits, physician authorizations, onsite test administration, outsourced laboratory PCR analysis, and access to results reported through a web-based portal.

Beginning in the first quarter of 2021, we launched our pooled testing initiative which focuses on providing end-to-end COVID-19 testing and reporting services to public health authorities. We are currently offering pooled testing and reporting services for K-12 schools across the United States, at airports through our partnership with XpresCheck and the CDC, as well as through other congregate settings such as our partnership with Eurofins. Our COVID-19 testing business is subject to seasonality, and the demand for COVID-19 testing in schools is diminished, particularly in light of the White House's announcement that the public health emergency will end in May 2023. Over time, Concentric by Ginkgo has added new offerings such as wastewater monitoring and bioinformatic support and has expanded internationally. These expanded offerings were not a material portion of our revenue in 2022, but we expect their relative value to increase in future years.

Our Sustainable Advantage

We have defined a unique business model over the past 15 years. The biotechnology industry has been product-centric for decades, with early horizontal platforms in life sciences frequently vertically integrating upon the development of the first

successful product on their platform. As Ginkgo has embarked on this journey, we have studied and learned from innovators and established platform companies in other industries as we built our platform and business. We now benefit from significant historical investments, a virtuous cycle that grows with scale, and a strong business model that is aligned with our customers' outcomes. These establish a strong sustainable advantage that we believe will help establish Ginkgo as a true industry standard.

Decade-plus head start in creating an industry standard platform

Hardware, software and biological tools need to be tightly integrated to replicate our platform. We have spent over 15 years building the software, automation and data science to best support a high throughput, generalized platform and expect to continue investing in this area. Our software, automation and data infrastructure cannot be easily replicated without bringing together a number of rare, specialized skill sets. In addition, without the scale and demand to stress test a high throughput platform, we expect any newly developed platform would be suboptimal. We estimate that it took us over eight years of investment and iteration to reach cost parity with "by hand" cell programming. We believe competitors will find it difficult to justify the investment in the software, automation and data science needed for high throughput operations before they acquire matching high demand.

Scale economics provide a structural cost advantage

As the only scaled horizontal platform in this space, we have the broadest number of programs that can be run on our platform, providing the highest potential for scale economics. Other companies choose to target specific markets and vertically integrate into products with high expected value. This has a tendency to overfit the capabilities of their R&D team to their targets. As discussed above, our continued scaling and investment in flexible tools that can apply to a broad range of end markets helps us drive efficiencies in the Foundry and Codebase across our diverse programs. Furthermore, as we scale, we are able to leverage advanced technologies that are only practical at scale and also may obtain preferred pricing with a number of suppliers. Competitors may be unable to source equivalent technology or negotiate similar pricing without first achieving scale, a feat that is difficult to do with a narrowly focused R&D platform.

Strong network and learning effects

In addition to a raw scale economic, we also accumulate knowledge and reusable Codebase from each program that runs on the platform. Every program benefits from the programs that came before and generates benefits for other current and future programs. These learnings and reusable assets are cumulative, extremely hard to replicate, and increasingly valuable to our customers. Because our learnings are generated by the work we execute in our Foundry, the scaling in our Foundry drives a scaling in our rate of learning. Thus, there is a recursive element to our platform: as the platform gets better, it also improves faster—we are excited to make this advantage of our platform available to our ecosystem of cell programmers.

Ginkgo's value creation is aligned closely with customer success

Our platform drives value for customers along two dimensions: reducing the cost of laboratory work via automation and increasing the probability of technical success due to cumulative data and learnings. Our financial model is aligned with those factors. As we gain efficiency, we drive further demand for cell programming, which drives our Foundry revenue up. As both demand and probability of success increase, our risk-adjusted value share also increases. Our model only requires we share in a small fraction of the downstream value created by our programs, providing our customers the opportunity to generate and retain significant value. Ultimately, this encourages broader adoption of our platform across industries.

Furthermore, we seek to maintain close relationships with our customers, supporting their work, and earning their loyalty and satisfaction. The breadth and highly integrated nature of our platform makes it inefficient for a customer to simultaneously work with Ginkgo and any theoretical competitor. As there is not yet a standard interface for cell programming, it requires an upfront investment to learn how to choose and design programs to make the best use of our platform. Thus, customer retention is high and there are substantial switching costs.

We are uniquely positioned to attract the top cell programmers

Just as the top software programmers want to work with the latest technologies, we believe the top cell programmers will be attracted to our industry leading platform and access to its unique capabilities. Our ability to hire and retain the best cell programmers as internal users and developers of our platform pushes us to continually improve and also builds a base of Ginkgo-trained experts. If these Ginkgo trained cell programmers move on to roles and opportunities in product-specific

companies, we expect they will become ambassadors for the Ginkgo approach in their next role, expanding our reach into potential customers.

History of investing in credibility and trust

Let's face it, GMOs have an image problem. This image problem has led to activities by the first generation of genetic engineering companies that backfired: lobbying against transparency in labeling laws, trying to "rebrand" GMOs with different terminology, and other efforts that have failed to build trust and engagement with stakeholders. We have taken a different approach. Rather than avoid the term, we've championed transparent labeling, sought to engage and build trust through open dialog, and enthusiastically embraced the potential for GMOs to do great things. We don't seek to make GMOs acceptable through branding; we aim to make GMOs that people love.

Figure 17: Ginkgo seeks to make GMOs that people love.

Doing so requires care and attention to both the technical and social aspects of our platform and its impacts. This means investing in biosecurity and, as noted above, embedding it into our platform and how we operate. This also means engaging with the social complexities of science and technology with a diverse group of people. We strive for a company culture based on a foundation of Diversity, Equity and Inclusion (see also the sections titled "*—The Impact of Cell Programming—ESG is in our DNA*" and "*—Our People & Culture*"), and aim to engage different perspectives through our creative residency and through our magazine, Grow. Through both our internal and external efforts, we seek to engage with the realities of what has made genetic engineering an ESG risk historically, and work towards equitable and positive impact.

Our Growth Strategy

We are seeking to usher in a new paradigm for cell programming. It took us over eight years of basic research and investment in software, automation, data science and scale to reach parity with the status quo of individual scientists conducting experiments by hand at a lab bench. It took us several more years to demonstrate business model maturity: delivering a platform with enough value-add to customers that we could cover the cost of cell engineering R&D programs while building Codebase and sharing in the downstream value of our programs. We believe that we are now at an inflection point where we have the opportunity to become the industry standard. We see several drivers of this evolution and growth.

Scale our platform and continue to drive efficiencies and improvements

As discussed above, our platform improves with scale and to date we have observed a positive feedback loop between our Foundry and Codebase. As we scale capacity and demand on the Foundry, we expect our average unit costs to fall, creating a better value proposition for our customers as their program budgets stretch further and drive more demand. Similarly, Foundry output also grows our Codebase, which supports better program execution, creating a better value proposition for our customers as well.

We occupy over 325,000 square feet at our headquarters and maintain state-of-the-art machinery and laboratory equipment. We have built more than 50 custom integrated work cells, consisting of robotic automation systems, mass spectrometry, fermenters, sequencers, and more. We have the capabilities to engineer dozens of species of organisms from bacteria to fungi to mammalian cells. We have worked on enabling products as varied as polymers, bacterial therapeutics, bulk protein production, novel antibiotics, fine chemicals, and more.

We have been able to work on a diversity of programs while consistently driving efficiencies in the Foundry with scale. We expect to accelerate growth in capacity by integrating new technologies across our existing footprint, building new Foundry space, and investing in software, automation and data to increase utilization.

Leverage our proof points to grow within all industries

We have now established proof points of success in a diverse set of end markets, in several cases far exceeding our customers' specifications. When engaging with existing customers or potential new customers in similar or adjacent industry verticals, we can point to these case studies of success to demonstrate the value of our platform. This reduces the barriers to adoption, helps us grow our customer base, and increases the number of new programs under contract. Importantly, the reusable Codebase we generate from these new programs enables us to stay ahead of vertically focused competitors.

Grow with existing customers

Once we establish a relationship with a customer, there is significant room to expand the scope of our program engagements. We are able to grow with our customers and/or expand into other existing pockets of R&D spending. We have seen customers expand from one early program to five or ten programs a few years later and each new logo we add has the potential to become a true platform partner.

When we work with companies from their inception (or at least from the inception of their biotech investments), we enable them to avoid significant fixed cost investments and benefit from our economies of scale. Our relationship with these customers is extremely strong, as we are the core technology powering their R&D efforts. As a result, when these customers scale, their usage of our platform typically scales commensurately. For companies with existing, established biological capabilities, as we demonstrate the value of our flexible platform, we are able to grow our relationships to complement their core capabilities and increase the probability of success.

Reduce barriers to adoption by integrating with external R&D teams

It can be easy to fall into the trap of assuming that new disruptive technologies must subsume existing ways of working. When hosted servers and SaaS started rising in prominence, corporate IT teams had to wrestle with changing integrations and demands. Some information technology departments were resistant to moving "off-prem" because they felt they were effectively outsourcing their jobs. In response, the leaders in this field, such as Dell, would sometimes hire their customers' information technology departments and find them jobs within Dell simply to get past this internal resistance. The reality was that these technologies were ushering in a much more substantial era for information technology, which dramatically increased the demand for this type of talent. This centralization of the model (from every company having large information technology departments building customized code to a broader array of specialized software vendors) didn't come at the *expense* of information technology and digital technologies, but enabled its flourishing across *all* industries. We see something similar happening in biotechnology today. Internal R&D teams are typically both very excited to learn about the power of our platform but are also understandably nervous about what "outsourcing" work to Ginkgo might mean for the future of their teams. We have the opportunity to help them see the benefit in a true partnership with Ginkgo.

The vast majority of programs being run on the platform today are being run and managed by Ginkgo program teams—in-house scientists and engineers who are managing the R&D project to meet a customer's specifications. Over time, we would like to build in enough standardized interfaces that a distributed network of scientists could access the platform directly through a well-defined integration and self-service layer. This transition will allow our program teams to devote more of their efforts to developing Codebase assets, enabling more rapid scaling, and reducing the barriers to adoption by our customers. There are significant technical hurdles for us to overcome in developing this technology, but it is on our near-term roadmap and we are constantly thinking about how to "productize" individual workflows on the platform. As an example, we are developing CDKs that standardize common cell engineering workflows and assets, capturing best practices that we've identified.

Build an ecosystem

As described above in "*—Our Platform*," we believe we are building the industry standard developer platform for cell programming. In much the same way that early computing platforms and operating systems built real communities around their platforms in the 80s and 90s, we intend to build a community of developers building on the Ginkgo platform. As we invest to expand this ecosystem of services for cell programmers building on the Ginkgo platform, our value proposition to cell programmers increases and we become more ubiquitous.

Our People & Culture

A company is made of people. We have sought to bring together a diverse and multidisciplinary group of people who share our mission to make biology easier to engineer. Today, our extensive cross-functional team is collaborating to build our ecosystem, from organism designers to automation engineers, software developers to people operations, business development to facilities management, finance to molecular biology.

A culture built on care

We've strived to grow a culture based on *care.* As engineers, it is easy to fall into the trap of thinking of ourselves simply as tool builders. Tools can be used in many different ways, both good and bad, and engineers often discuss their tools as value neutral. But tools reflect the social beliefs and biases of the people who make them: today this is becoming increasingly apparent, with more and more evidence of algorithmic bias being built into AI systems, facial recognition, and much more.

As designers of the largest horizontal platform for cell programming, we are keenly aware of the need to care about how our platform is used. More significant than the impacts we have seen from digital platforms on our social world, biology *is* our health, our bodies, our food, and our environment. As we build the tools for programming biology, we must also care how those tools are used, and ensure that the risks and benefits are transparently and equitably shared.

A diverse, world-class team

As of December 31, 2022 we had 1,292 employees. Building a horizontal platform for cell engineering and a biosecurity and public health unit requires collaboration between diverse skills and functions. It also requires deep technical expertise. Our employees are dedicated to the following functions:

- Platform functions including organism engineering, design, DNA synthesis and assembly, genome engineering, protein engineering and characterization, transformation and transfection, next generation sequencing, assay development, ultra high throughput screening, analytical chemistry, synthetic chemistry, directed evolution, and fermentation.
- Platform infrastructure functions including automation, software, development operations ("DevOps"), product management, data engineering, data analysis, and data science.
- Deployment functions including upstream and downstream process engineering, project engineering, quality assurance and quality control.
- Commercial functions including marketing, business development, alliance management, and corporate development.
- Operational functions including bioinformatics, lab network management, delivery logistics and customer support.
- Shared enabling functions including legal, people, operations, finance, information technology, information security, facilities, environmental health and safety, procurement, shipping and receiving, inventory management, laboratory operations, media preparation, and transformations.

In addition to our employees, our success would not be possible without the collaboration and support of the broad network of partners, contractors, contingent workers and temporary staff who make up the Ginkgo team.

Technologies reflect the values of the people who build them. Diversity, Equity, and Inclusion are valuable and necessary in their own right, but we believe that it is essential to build a diverse team where people from different backgrounds are included and empowered to speak up and shape the growth of this technology. We are committed to growing a diverse team and continuing to empower an inclusive culture with strong employee ownership and engagement.

The full breadth of Ginkgo's diversity and inclusion cannot be captured in demographic statistics, just as demographic categories cannot capture the full spectrum of diversity of human experience; however, we collect and report these numbers

for transparency and as a lagging indicator of our efforts. As of December 31, 2022, 44% of our U.S. employees self-identify as an underrepresented gender (not cis male) and 15% self-identify as coming from an underrepresented racial or ethnic group in science and engineering (Black or African American, Hispanic or Latino, American Indian or Alaska Native, and Native Hawaiian and other Pacific Islander). We are not yet satisfied with these numbers and all teams have objectives around increasing diversity and building a culture of inclusion to ensure that diverse perspectives thrive.

Laying the groundwork for strong employee engagement in the future

As a founder-led company we have been able to infuse the organization with long-term strategic thinking from the start. The long-term engagement and mentality of our employees can be seen in our turnover: voluntary attrition is well below the industry average.

The individuals who work at Ginkgo and build our platform care deeply about how that platform is used and the impact our company will have in the world. We hope to maintain the long-term mentality we have benefited from as a founder-led public company. We believe a workforce with strong equity ownership will make the wise decisions needed to build long-term value for our company and build a company whose long-term impacts make them proud. That is why we have implemented a multi-class stock structure that permits all employees (current and future), not just founders, to hold high-vote (10 votes per share) common stock. We believe that our multi-class stock structure will help maintain this long-term mentality and encourage long-term equity ownership by our employees, thereby resulting in increasing employee ownership over time. For more information, see "*Risk Factors—Risks Related to Ginkgo's Business—Risks Related to Our Organizational Structure and Governance—Only our employees and directors are entitled to hold shares of Class B common stock (including shares of Class B common stock granted or otherwise issued to our employees and directors in the future), which shares have ten votes per share. This limits or precludes other stockholders' ability to influence the outcome of matters submitted to stockholders for approval, including the election of directors, the approval of certain employee compensation plans, the adoption of certain amendments to our organizational documents and the approval of any merger, consolidation, sale of all or substantially all of our assets, or other major corporate transaction requiring stockholder approval.*"

Competition

To our knowledge, there are currently no other companies that serve all industries covered by our horizontal cell programming platform. The solutions and applications offered by potential competitors vary in size, breadth, and scope, and given our broad set of application areas, we could face competition in many different forms. We face competition from customers' internal R&D departments and other research solution providers that largely conduct genetic engineering by-hand. We also compete against companies that seek to utilize synthetic biology technologies to develop specific products or target certain end markets. Additionally, competing platforms may emerge from various sources, including from joint ventures and partnerships between well-capitalized technology and life sciences companies. We identify the following three groups as our principal set of competitors:

The Status Quo: "on prem" cell programming efforts

The main source of competition we encounter is from potential customers choosing to build or maintain in-house cell engineering teams and capabilities. This status quo includes building out laboratory space and then hiring a team of highly trained scientists to conduct research, largely "by-hand" and with limited scale efficiencies. Some internal R&D operations maintain a full suite of capabilities and can design, build and test relatively complex pathways while others may have certain internal capabilities and need to outsource other elements to CROs. We believe this is far less efficient for the customer and likely to yield worse outcomes as customers get fewer shots on goal for a given program budget.

That said, it can still be very difficult for companies to choose to trust Ginkgo with their R&D efforts versus building more traditional "on prem" labs. Smaller companies may feel like they're "betting the farm" on Ginkgo, while larger companies may be sensitive to displacing existing R&D teams. As such, a key focus area for us is reducing the barriers to adoption for the platform by de-risking the upfront investment for earlier-stage companies and by helping larger companies integrate their scientists closely into our workflows and empower their scientists to manage requests directly so we feel more like a resource and partner than a fully outsourced provider. Investing in these areas is a key focus area for us going forward.

Examples of traditional "synthetic biology" companies that have been vertically integrated from their founding with a focus on building products using synthetic biology include Amyris, Inc. ("Amyris"), Genomatica, Novozymes, DuPont, and DSM. Additionally, the vast majority of therapeutics companies that are leveraging genetic engineering have in-house capabilities, including Biogen, Novo Nordisk, Vertex, Regeneron, Bayer, and many others. These companies may be viewed as

competitors to Ginkgo because they are creating products, using cell programming, that may compete with the products Ginkgo is enabling for our customers. However, as a horizontal platform, we view these companies not as competitors but as potential customers and focus not on "beating" them but rather on demonstrating our value proposition.

Verticalized cell engineering platforms

Within certain end markets, Ginkgo may compete against vertically-focused biotechnology companies providing cell engineering R&D capabilities to customers within a narrow set of end markets. While we believe the siloed nature of these companies limits their long-term potential, in the near-term, we may have a harder time penetrating those end markets given the incumbent vertical specialists in that space. The vast majority of these companies exist within therapeutic end markets given the history of cell engineering in that field. In theory, the expertise and learnings they develop from work in one field could be leveraged into neighboring end markets if these companies decided to adopt (and invest in) a more horizontal strategy. Examples of these vertically-focused platforms include AbCellera (antibody discovery), Codexis (enzymes), Senti Bio (cell therapy for oncology applications) and WuXi biologics (therapeutics).

Other possible entrants

We may also face competition from new entrants in the market, including well-capitalized technology companies with possible strategic interests in synthetic biology and its capabilities. Such companies may emerge as competitors given their access to capital, capacity to create multi-disciplinary teams across biology, chemistry, computer science and engineering, and flexibility to enter strategic ventures with life sciences companies.

Intellectual Property

Overview: Foundry and Codebase

As discussed above, Ginkgo's two core platform assets include:

- Ginkgo's Foundry, which enables high-throughput cell programming; and
- Ginkgo's Codebase, which includes reusable biological assets that can be used to accelerate cell programs.

Ginkgo protects each of these core assets—the Foundry and the Codebase—through a combination of patents and trade secret protections.

Patents

Our general policy has been to seek patent protection for those inventions likely to be incorporated into our offerings. Many of our collaboration agreements also provide a limited exclusive patent license to our collaboration partners relating to new technology developed in the collaboration. We typically retain the right to outlicense patents developed in connection with collaborations to third parties outside the scope of the exclusive license granted to our collaboration partner.

Our worldwide patent portfolio includes patents acquired in transactions over time, including, most significantly, our acquisitions of Gen9 in 2017; Novogy in 2020; and Bayer Biologics and Zymergen in October 2022. Because these acquisitions more than doubled the size of our patent portfolio, and because the strategic priorities of the companies we acquired often differed from Ginkgo's priorities, we may decide that it is in our interest to abandon, sell, or otherwise dispose of certain patents or patent applications from these acquisitions or that we determine are no longer relevant to our business.

Patents generally have a term of twenty years from the date they are filed. As our patent portfolio has been built over time, the remaining terms of the individual patents across our patent portfolio vary. No single patent or patent family is essential to Ginkgo as a whole or to any of Ginkgo's subsidiaries. In addition to developing our patent portfolio, we license patents from third parties.

We intend to pursue additional patent protection to the extent that we believe that it would be beneficial and cost-effective. We cannot provide any assurance that any of our current or future patent applications will result in the issuance of patents. We also cannot assure the scope of any of our future issued patents or warrant that any of our patents will prevent others from commercializing infringing products or technology.

Trade secrets

Ginkgo's technology-related intellectual property that is not patent-protected is maintained as trade secrets. We employ a variety of safeguards to protect our information and trade secrets, including contractual arrangements with our employees, consultants, contractors and other advisors that impose obligations of confidentiality, assignment of inventions, and security; digital security measures; and physical security precautions.

We require confidentiality and material transfer agreements from third parties that receive our confidential data or materials, and we also incorporate confidentiality and material transfer precautions into our collaboration agreements. For example, in the course of a cell program, we might transfer samples of intermediate strains to the customer for testing and scale-up work and then transfer a final commercial strain upon completion of our work. To protect both intermediate and final strains, we use strain transfer agreements that document the contractual restrictions and controls we have put into place, typically including, in the case of intermediate strains, covenants requiring the customer to return or destroy all strain samples after testing.

Trademarks and domain names

Although our business is directed at sophisticated corporate customers rather than end consumers, we have trademark rights and registrations in our name, logo, and other brand indicia in the United States and other jurisdictions around the world. We also have registered domain names for websites that we use in our business, such as www.ginkgobioworks.com.

Intellectual property transaction structure

We earn revenue from collaboration agreements with customers under which we perform cell programming activities. Through our cell programs, we develop cells that produce or are products for our customers, which they market in their verticals.

With respect to intellectual property, we have relatively standard transaction structures that apply to cell programs for a customer. In this situation, our collaboration agreements typically provide that Ginkgo will own all collaboration-related intellectual property ("Foreground IP") concerning cell programming. To protect our collaboration partners' investment in the collaboration and to provide them with a competitive advantage from working with Ginkgo, Ginkgo provides a limited exclusive license to patents within the Foreground IP that cover the product, usually within a specified field. However, our terms may vary.

We typically do not provide exclusive licenses to unpatented Foreground IP (i.e., trade secrets and other know-how) that results from a collaboration. In our typical deal structure, we also do not provide exclusive licenses to our "background" intellectual property—i.e., the intellectual property, whether patented or unpatented, that we developed before entering into a collaboration or develop independently from our work in the collaboration. We believe that our transaction structures allow us to maximize the reuse of Codebase across programs and ensure that technology we develop does not lie fallow.

In-License Agreements

In addition to our proprietary methods and technologies, we also non-exclusively in-license certain intellectual property assets from third parties.

Amyris Partnership Agreement

On October 20, 2017, we entered into a partnership agreement (the "Partnership Agreement") with Amyris, which, as amended from time to time, terminated all prior agreements between Ginkgo and Amyris. In the Partnership Agreement, Amyris, among other things, granted us a non-exclusive license effective as of June 28, 2016 (the date of an earlier agreement between the parties) under all of Amyris's rights in and to certain specified microbial strains, and under all patents and applications associated with such microbial strains, to make, have made, use, sell, offer to sell and import any products other than farnesene and/or farnesene derivatives that are chemically produced from farnesene. The license is subject to any previous exclusive licenses provided to third parties and is royalty-free, fully paid-up, sublicensable, non-exclusive and perpetual (i.e., it survives termination or expiration of the Partnership Agreement except in the case of our insolvency).

Strateos Collaboration Agreement

On October 2, 2017, we entered into a collaboration agreement with Strateos, Inc. f/k/a Transcriptic, Inc. ("Strateos"), which was amended and restated on April 20, 2021 (the "Strateos Collaboration Agreement"). Under the Strateos Collaboration Agreement, Strateos granted us a non-exclusive, perpetual, irrevocable, fully paid-up, royalty-free license under certain intellectual property rights to use its software platform in a range of activities relating to our business, including, among other things, developing and commercializing cell lines, developing data packages, providing foundry and analytical services and performing diagnostic testing. The Strateos Collaboration Agreement expired in 2022 and we retain a license to use Strateos' software.

Suppliers

Ginkgo's suppliers for cell programming operations comprise primarily manufacturers and distributors of life science tools, consumables and equipment as well as certain specific providers of contract research, development and manufacturing services. We will sometimes enter into long-term, strategic partnerships with innovative suppliers. Because of the significant scale of our Foundry's operations, we believe we are often an early adopter and the largest customer at scale of certain new life science tools and technologies. Our supply agreements with Twist Bioscience Corporation ("Twist"), as further described below, are examples of such strategic supplier relationships. We will also occasionally acquire technology or Codebase assets for strategic reasons and because we can integrate the technology effectively into our platform — Zymergen, Altar, and Circularis are recent examples.

Our suppliers for Concentric by Ginkgo include multiple manufacturers and distributors of LFA test kits and COVID-19 sample collection kits. We have developed a national network of third party labs for provision of COVID-19 molecular testing services. We also utilize third parties for certain other services, including physician authorizations and on-site test administration, in the provision of our end-to-end COVID-19 testing offering.

Our software, automation, data, information technology, DevOps and information security functions utilize various third party software and information technology service providers, including AWS, for data storage and processing. We also routinely engage a variety of third parties for professional services, contract employment services and consulting services.

Twist

In April 2022, we entered into a non-cancelable supply agreement (the "2022 Agreement") with Twist, which requires us to purchase synthetic DNA at specified volumes on an annual basis over a four-year term. To the extent we fail to meet our annual minimum purchase obligations, we are required to pay a fee per unit of shortfall. The products we may purchase that contribute toward achieving our annual minimum purchase obligation can vary based on our discretion, subject to advance notice provided to Twist.

Our annual minimum purchase obligation may be adjusted for the following reasons: (i) the unavailability of certain products for purchase in a given quarter; (ii) the unavailability of certain features; (iii) delays in shipments; and (iv) lack of performance. We receive volume discounts on purchases based on specified volume thresholds over the term of the 2022 Agreement.

The 2022 Agreement can only be terminated (i) upon mutual agreement of both parties, (ii) by us upon a specified change of control, (iii) upon a material breach of the contract by either party, or (iv) by Twist in the event that we fail to place orders for more than a certain percentage of our required annual minimums under the 2022 Agreement. The purchase minimums in the 2022 Agreement create an enforceable obligation only in conjunction with each purchase order.

Government Contracts

We have entered into agreements with governmental entities and contractors in the past to serve as a U.S. government contractor or subcontractor and may do so again in the future. See "*Risk Factors—Risks Related to Governmental Regulation and Litigation—We have pursued in the past and may pursue additional U.S. Government contracting and subcontracting opportunities in the future and as a U.S. Government prime contractor and subcontractor, we are subject to a number of procurement rules and regulations.*"

Government Regulations

Our business, or the business of our customers, may be regulated by the FDA and other federal authorities in the United States, including the U.S. Federal Trade Commission ("FTC"), U.S. Department of Agriculture ("USDA"), DEA and U.S. Environmental Protection Agency ("EPA"), as well as comparable authorities in foreign jurisdictions and various state and local authorities in the United States. Failure to comply with applicable regulations may result in enforcement actions, civil or criminal sanctions, and adverse publicity.

FDA regulation

We provide cell engineering and product discovery services to customers engaged in the manufacture of foods, cosmetics and pharmaceutical products. The FDA regulates the research, development, testing, quality control, import, export, safety, effectiveness, storage, recordkeeping, premarket review, approval or licensure, processing, formulation, manufacturing, packaging, labeling, advertising, promotion, marketing, distribution, sale, post-market monitoring and reporting of our customers' pharmaceuticals, cosmetics and food products, and the FTC also regulates the advertising and promotion of these products.

We also act as a systems integrator and authorized distributor of certain COVID-19 diagnostic test and collection kits manufactured by independent third parties, and we work with laboratory partners that provide clinical laboratory testing services as part of the COVID-19 testing services we offer, and these tests and test kits may be subject to regulation by the FDA. In particular, the tests and test kits used in our COVID-19 testing services may be subject to regulation by the FDA as medical devices, and may be required to comply with the requirement that such products have obtained clearance, approval, or other marketing authorizations, such as an Emergency Use Authorization ("EUA"), before they can be commercialized, as well as post-market requirements such as adverse event reporting and restrictions on labeling, marketing, and distribution.

The U.S. Department of Health and Human Services ("HHS") and FDA issued several policy statements in November 2021 governing the regulation of COVID-19 Laboratory Developed Tests ("LDTs") that resume FDA premarket review of COVID-19 LDTs that HHS halted in August 2020. Pursuant to these new policy statements, FDA expects laboratories to seek FDA marketing authorization and otherwise comply with FDA device regulations when marketing COVID-19 LDTs. An LDT is an in vitro diagnostic test that is intended for clinical use and is designed, manufactured, and used within a single laboratory. LDTs are classified as medical devices, but the FDA has historically exercised enforcement discretion and has generally not enforced FDA requirements, including premarket review, with respect to laboratories that offer LDTs. While HHS and FDA have announced their intention to require premarket review of COVID-19 LDTs, either agency may change its position in the future.

Medical products, including COVID-19 tests, that are granted an EUA or other marketing authorization must comply fully with the terms and conditions provided in the EUA or other marketing authorization. For example, EUAs for COVID-19 tests may include conditions of authorization applicable to the EUA holder, authorized distributors and authorized laboratories. Noncompliance with applicable requirements could result in negative consequences, including adverse publicity, judicial or administrative enforcement, warning letters or untitled letters from the FDA, mandated corrective promotional materials, advertising or communications with doctors, and civil or criminal penalties, among others. The FDA can also withdraw marketing authorization for the applicable product, and in the case of a product subject to an EUA, the authorization to market the product under the EUA lasts only as long as the declared public health emergency.

DEA regulation

We are engaged in the research, development, and export of certain products that may be regulated as controlled substances, including microbes designed to generate precursors to cannabinoids or other chemical intermediates. The Controlled Substances Act of 1970, as amended from time to time, establishes registration, security, recordkeeping, reporting, storage, distribution and other requirements administered by the DEA. The DEA is concerned with the control of handlers of controlled substances, and with the equipment and raw materials used in their manufacture and packaging, in order to prevent loss and diversion into illicit channels of commerce. The DEA regulates controlled substances as Schedule I, II, III, IV or V substances. Schedule I substances by definition have no established medicinal use, and may not be marketed or sold in the United States. Schedule I substances are considered to present the highest risk of abuse, and Schedule V substances the lowest relative risk of abuse among controlled substances. Marijuana is classified as a Schedule I controlled substance. However, the term does not include "hemp," which means the cannabis plant and any part of that plant, including the seeds and all derivatives, extracts, cannabinoids, isomers, acids, salts, and salts of isomers, whether growing or not, with a delta-9 THC concentration of not more than 0.3% on a dry weight basis.

Annual registration is required for any facility that manufactures, distributes, dispenses, imports or exports any controlled substance. The registration is specific to the particular location, business activity and controlled substance schedule. For example, separate registrations are needed for import and manufacturing, and each registration will specify which controlled substance schedule is authorized for that activity.

The DEA typically inspects a facility to review its security measures prior to issuing a registration. The DEA requires "effective controls and procedures" to guard against theft and diversion of controlled substances. Security requirements vary by controlled substance schedule (with the most stringent requirements applying to Schedule I and Schedule II substances), type of business activity conducted, quantity of substances handled, and a variety of other factors. Required security measures include background checks on employees and physical control of inventory. While the specific means by which effective controls and procedures are achieved may vary, security practices may include use of cages, surveillance cameras and inventory reconciliations. Records must be maintained for the handling of all controlled substances, and, in certain scenarios, periodic reports made to the DEA. Reports must also be made for thefts or losses of any controlled substance, and disposal of controlled substances must adhere to various methods authorized by the regulations. In addition, special authorization and notification requirements apply to imports and exports.

Failure by registered establishments to maintain compliance with applicable requirements, particularly as manifested in loss or diversion, can result in enforcement action. The DEA may seek civil penalties, refuse to renew necessary registrations, or initiate proceedings to revoke those registrations. In certain circumstances, violations could eventuate in criminal proceedings. Individual states also regulate controlled substances.

Laboratory Licensing and Certification Requirements

The clinical laboratories we partner with for our COVID-19 testing program are subject to federal oversight under the Clinical Laboratory Improvement Amendment of 1988 ("CLIA"), which requires all clinical laboratories to meet certain quality assurance, quality control and personnel standards. Laboratories also must undergo proficiency testing and are subject to inspections. Standards for testing under CLIA are based on the complexity of the tests performed by the laboratory, with tests classified as "high complexity," "moderate complexity," or "waived." Laboratories performing high complexity testing are required to meet more stringent requirements than moderate complexity laboratories. Certain of our partner laboratories must undergo on-site surveys at least every two years, which may be conducted by the Centers for Medicare and Medicaid Services ("CMS") under the CLIA program or by a private CMS-approved accrediting agency. In addition, we hold CLIA Certificates of Waiver and may perform certain CLIA-waived tests on behalf of our clients, which subjects us to certain CLIA requirements. The sanction for failure to comply with CLIA requirements may be suspension, revocation or limitation of a laboratory's CLIA certificate, which is necessary to conduct business, as well as significant fines and criminal penalties.

The operations of our partner laboratories and our laboratories holding CLIA Certificates of Waiver are also subject to state and local laboratory regulation. CLIA provides that a state may adopt laboratory regulations different from or more stringent than those under federal law, and a number of states have implemented their own laboratory regulatory requirements. State laws may require that laboratory personnel meet certain qualifications, specify certain quality controls, or require maintenance of certain records. No assurances can be given that we or our partner laboratories will pass all future licensure or certification inspections.

Our facilities and laboratories hold local, state and federal permits, licenses and registrations necessary for compliance in specific work and operations, including from the Massachusetts Water Resource Authority, Boston Fire Department, Massachusetts Department of Environmental Protection, Boston Public Health Commission, Cambridge Biosafety Committee, Massachusetts Department of Public Health, USDA and DEA.

Federal Select Agent Regulations

Our research facilities that synthesize DNA sequences or perform other activities could become subject to the FSAP, which involves rules administered by the CDC and the USDA Animal and Plant Health Inspection Service ("APHIS"). The FSAP regulates the possession, use, and transfer of biological select agents and toxins that have the potential to pose a severe threat to public health, animal or plant health, or animal or plant products. FSAP regulatory requirements include: (i) registration with the CDC and/or APHIS for research facilities that deal with the select agents and toxins; (ii) submission to periodic biosafety and security inspections; and (iii) reporting of theft, loss or release of select agents. Federal agency enforcement actions for violations of FSAP regulations can include the initiation of corrective actions, complete or partial suspension or revocation of select agent registrations or civil or criminal liability.

Genetically Modified Materials Regulations

Our technologies and the technologies of our customers involve the use of genetically modified cells, organisms and biomaterials, including, without limitation, GMOs and genetically modified microorganisms ("GMMs"), and their respective products. In the United States, the FDA, the USDA through its APHIS, and the EPA are the primary agencies that regulate the use of GMOs, GMMs and potential products derived from GMOs or GMMs or Genetically Modified Materials, pursuant to the Coordinated Framework for the Regulation of Biotechnology.

The FDA reviews the safety of food consumed by humans and of feed consumed by animals under the Federal Food, Drug and Cosmetic Act ("FDCA"). Under the FDCA, food and feed manufacturers are responsible for ensuring that the products they market, including those developed through genetic engineering, are safe and properly labeled. In addition, the FDA must approve the use of any food additives, including GMOs, before marketing.

USDA's APHIS examines whether a plant itself presents a "plant pest" risk under the Plant Protection Act ("PPA"). Specifically, APHIS is responsible for regulating the introduction (i.e., importation, interstate movement or release into the environment) of certain GMOs and plants under the plant pest provisions in the PPA to ensure that they do not pose a plant pest risk. APHIS finalized changes to the PPA's implementing regulations with respect to certain GMOs in May 2020. A person or organization may request a regulatory status review from APHIS to determine whether a GMO is unlikely to pose a plant pest risk and, therefore, is not regulated under the plant pest provisions of the PPA or the regulations codified at 7 C.F.R. Part 340; requesting a regulatory status review tends to assume the GMO at issue does not otherwise fall within a regulatory exemption. If the GMO does not qualify for an exemption or if the APHIS regulatory status review process finds that the plant poses a plausible plant pest risk, then the GMO may require an APHIS permit, i.e., be a regulated article under Part 340. A regulated article may be subject to APHIS for the environmental release, importation, or interstate movement of the GMO or its progeny.

EPA regulates, under the Federal Insecticide, Fungicide and Rodenticide Act ("FIFRA"), the pesticides (including plant incorporated protectants) that are used with crops, including GMO herbicide-tolerant crops. FIFRA generally requires all pesticides to be registered before distribution or sale, unless they are exempted. Under FIFRA, a pesticide registrant must demonstrate that the pesticide at issue, when used pursuant to its specifications, "will not generally cause unreasonable adverse effects on the environment" to secure a registration. EPA must approve each distinct pesticide product, each distinct use pattern, and each distinct use site. In addition to EPA's FIFRA authority, EPA also regulates potential human health impacts from pesticides under the FDCA. EPA does so by establishing "tolerance levels" (i.e., "the amount of pesticide that may remain on food products") under the FDCA.

Certain genetically modified microorganisms that are not otherwise regulated under FIFRA and FDCA may be subject to EPA regulation under the Toxic Substances Control Act ("TSCA"). New microorganisms that are formed by combining genetic material from organisms in different genera (known as intergeneric microorganisms) may be subject to reporting requirements prior to production or distribution in commerce (Microbial Activity Commercial Activity Notice), or use in research and development (TSCA Experimental Release Application), unless the entity can meet all required criteria to obtain an exemption under TSCA.

Telehealth regulation

Our telehealth provider partner is subject to various federal, state and local certification and licensing laws, regulations and approvals, relating to, among other things, the adequacy of health care, the practice of medicine and other health professions (including the provision of remote care and cross-coverage practice), equipment, personnel, operating policies and procedures and the prerequisites for ordering laboratory tests. Some states have enacted regulations specific to providing services to patients via telehealth. Such regulations include, among other things, informed consent requirements that some states require providers to obtain from their patients before providing telehealth services. Health professionals who provide professional services using telehealth modalities must, in most instances, hold a valid license to practice the applicable health profession in the state in which the patient is located. In addition, certain states require a physician providing telehealth to be physically located in the same state as the patient. Any failure to comply with these laws and regulations could result in civil or criminal penalties against telehealth providers.

State corporate practice of medicine and fee splitting laws

Our relationship with our telehealth provider partner, who provides physician oversight and support to individuals seeking COVID-19 diagnostic or screening testing, including evaluating each request for testing, communicating and providing consultation services for certain test results, is subject to various state laws, which are intended to prevent unlicensed persons

from interfering with or influencing a physician's professional judgment, and prohibiting the sharing of professional services income with non-professional or business interests. These laws vary from state to state and are subject to broad interpretation and enforcement by state regulators. A determination of non-compliance could lead to adverse judicial or administrative action against us and/or our telehealth provider partner, civil or criminal penalties, receipt of cease and desist orders from state regulators, loss of provider licenses, or a restructuring of our arrangement with our telehealth provider partner.

Healthcare fraud and abuse laws

Although none of our COVID-testing offerings are currently billed to any third-party payor, including any commercial payor or government healthcare program, by us or any of our laboratory or telehealth provider partners, we may nonetheless be subject to a number of federal and state healthcare regulatory laws that restrict business practices in the healthcare industry. These laws include, but are not limited to, federal and state anti-kickback, false claims, and other healthcare fraud and abuse laws.

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

The federal physician self-referral prohibition, commonly known as the Stark Law, prohibits a physician, in the absence of an applicable exception, from making a referral for certain designated health services covered by the Medicare or Medicaid program, including clinical laboratory services, if the physician or an immediate family member of the physician has a financial relationship with the entity providing the designated health services. The Stark Law also prohibits the entity furnishing the designated health services from billing, presenting or causing to be presented a claim for the designated health services furnished pursuant to the prohibited referral.

The federal civil and criminal false claims laws, including the civil False Claims Act, and civil monetary penalties laws prohibit, among other things, any individual or entity from knowingly presenting, or causing to be presented, a false claim for payment to the federal government, knowingly making, using or causing to be made or used a false record or statement material to a false or fraudulent claim to the federal government, or from knowingly making a false statement to avoid, decrease or conceal an obligation to pay money to the federal government. In addition, the government may assert that a claim including items or services resulting from a violation of the federal Anti-Kickback Statute or the Stark Law, constitutes a false or fraudulent claim for purposes of the civil False Claims Act.

In addition to the Anti-Kickback Statute and the Stark Law, the United States recently enacted a law known as the Eliminating Kickbacks in Recovery Act ("EKRA"), which created a new federal crime for knowingly and willfully: (i) soliciting or receiving any remuneration in return for referring a patient to a recovery home, clinical treatment facility, or laboratory; or (ii) paying or offering any remuneration to induce such a referral or in exchange for an individual using the services of a recovery home, clinical treatment facility, or laboratory. Unlike the Anti-Kickback Statute, EKRA is not limited to services reimbursable under a government health care program, but instead extends to all services reimbursed by "health care benefit programs."

The federal Health Insurance Portability and Accountability Act of 1996 and its implementing regulations, as amended ("HIPAA") created additional federal criminal statutes that prohibit, among other things, knowingly and willfully executing a scheme to defraud any healthcare benefit program, including private third-party payors and knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false, fictitious or fraudulent 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.

Similar state and local laws and regulations may also restrict business practices in the medical device and clinical laboratory industries, such as state anti-kickback and false claims laws, which may apply to business practices, including but not limited to, research, distribution, sales and marketing arrangements and claims involving healthcare items or services reimbursed by non-governmental third-party payors, including private insurers, or by patients themselves; and state laws that require companies to comply with the industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the federal government, or otherwise restrict payments that may be made to healthcare providers and other potential referral sources.

Violation of any of such laws or any other governmental regulations that apply may result in significant criminal, civil and administrative penalties including damages, fines, imprisonment, disgorgement, additional reporting requirements and oversight if we become subject to a corporate integrity agreement or similar agreement to resolve allegations of non-compliance with these laws, contractual damages, reputational harm, diminished profits and future earnings, disgorgement, exclusion from participation in government healthcare programs and the curtailment or restructuring of our operations.

Federal and state data privacy and security regulations

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, including HIPAA, and federal and state consumer protection laws and regulations (e.g., Section 5 of the FTC 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. HIPAA, and its respective implementing regulations, imposes obligations on "covered entities," including certain health care providers, health plans, and health care clearinghouses, and their respective "business associates" that create, receive, maintain or transmit individually identifiable health information for or on behalf of a covered entity, as well as their covered subcontractors with respect to safeguarding the privacy, security and transmission of individually identifiable health information. Violations of the HIPAA privacy and security regulations may result in civil and criminal penalties. HHS is required to conduct periodic compliance audits of covered entities and their business associates. HIPAA also authorizes state attorneys general to bring civil actions seeking either an injunction or damages in response to violations of HIPAA privacy and security regulations.

In addition, certain state laws, such as the California Confidentiality of Medical Information Act, the CCPA and the CPRA govern the privacy and security of personal information, including health-related information in certain circumstances, some of which are more stringent than HIPAA and many of which differ from each other in significant ways and may not have the same effect, thus complicating compliance efforts. Failure to comply with these laws, where 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 (thus complicating compliance efforts), and can result in investigations, proceedings, or actions that lead to significant civil or criminal penalties and restrictions on data processing.

Ginkgo Corporate Information

Ginkgo's principal executive office is located at 27 Drydock Avenue, Boston, Massachusetts 02210, and Ginkgo's telephone number is (877) 422-5362. Ginkgo's corporate website address is www.ginkgobioworks.com. We make available on the Investor Relations section of our website, free of charge, our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K, proxy statements, and Forms 3, 4 and 5, and amendments to those reports as soon as reasonably practicable after filing such documents with, or furnishing such documents to, the U.S. Securities and Exchange Commission (the "SEC"). The SEC maintains a website (*www.sec.gov*) that contains reports, proxy and information statements and other information regarding issuers that file electronically with the SEC.

The information contained on, or accessible through, our corporate website is not incorporated into this Annual Report and should not be considered part of this Annual Report. The inclusion of the corporate website address is an inactive textual reference only.

Item 1A. Risk Factors.

An investment in our securities involves a high degree of risk. You should carefully consider the following risk factors, together with all of the other information included in this Annual Report, before making an investment decision. Our business, prospects, financial condition or operating results could decline due to any of these risks and, as a result, you may lose all or part of your investment.

Unless the context otherwise requires, all references in this section to the "Company," "we," "us" or "our" refer to the business of Ginkgo and its subsidiaries.

Risks Related to Ginkgo's Business

We have a history of net losses. We expect to continue to incur losses for the foreseeable future, and we may never achieve or maintain profitability.

We have incurred significant operating losses since our inception. Our net loss attributable to our stockholders was approximately $2,104.9 million, $1,830.0 million and $126.6 million for the fiscal years ended December 31, 2022, 2021 and 2020, respectively. As of December 31, 2022, we had an accumulated deficit of approximately $4,397.7 million. We may incur losses and negative cash flow from operating activities for the foreseeable future as we continue to invest significant additional funds toward further developing our platform, the cell programs we perform on behalf of our customers and otherwise growing our business, including our biosecurity and public health unit, Concentric by Ginkgo. Our operating expenses have increased as a result of becoming a public company, and we expect that our operating expenses will continue to increase as we grow our business. We have derived a significant portion of our revenues from fees and milestone payments from technical development services provided to customers to advance programs, as well as a significant portion of our revenues from Concentric by Ginkgo. Historically, these fees have not been sufficient to cover the full cost of our operations. Additionally, if our customers terminate their agreements or development plans with us, our near-term revenues could be adversely affected. In addition, certain of our customer agreements provide for milestone payments, future royalties and other forms of contingent consideration, the payment of which are uncertain, as they are dependent on our ability to successfully develop engineered cells, bioprocesses, or other deliverables and our customers' ability and willingness to successfully develop and commercialize products and processes.

Our expenses may exceed revenues for the foreseeable future and we may not achieve profitability. 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 expand or continue our business, and the value of our common stock could be negatively impacted. Our ability to achieve or sustain profitability is based on numerous factors, many of which are beyond our control, including the development of our platform, the initiation of new programs with new and existing customers, the commercial terms of our programs, the realization of any potential downstream value from our programs, our ability to advance cell engineering programs in a timely and cost-effective manner, our ability to extend new offerings to customers, our customers' ability to scale up bioprocesses, the ability of our customers to produce and sell products, the impact of market acceptance of our customers' products, and our customers' market penetration and margins. Even if we do achieve profitability, we may not be able to sustain or increase profitability on a quarterly or annual basis.

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

We have consumed considerable amounts of capital to date, and we expect to incur continued net losses over the next several years as we continue to develop our business, advance our programs, expand and enhance our platform, and make the capital investments necessary to scale up our Foundry operations and Codebase assets. We have used, and may continue to use, additional capital for Concentric by Ginkgo, strategic investments and acquisitions. We believe that our cash and cash equivalents, short-term investments, and interest earned on investments will be sufficient to meet our projected operating requirements for several years and until we reach profitability. However, these assumptions may prove to be incorrect and we could exhaust our available capital resources sooner than we currently expect. Because of the numerous risks and uncertainties associated with our programs, including risks and uncertainties that could impact the rate of progress of our programs, we are unable to estimate with certainty the amounts of capital outlays and operating expenditures associated with these activities.

We do not currently have any commitments for future funding. We may receive fees, milestones, and royalty payments under our customer agreements, but these are not guaranteed, and we may receive non-cash consideration which involves estimations of fair market value. The initial fair market value of the non-cash consideration may decrease after contract inception and the amount of cash proceeds eventually realized may be less than the revenue recognized. Additionally, we

may sell our equity interests in certain subsidiaries or collaborations but most of these equity stakes are in private companies and we may not be able to find a buyer or may incur significant impairment if we sell these positions for liquidity. We may not receive any further funds under those agreements, the funds we receive may be lower than projected and/or disclosed as potential downstream value, or our program costs may be higher than projected. In addition, we may not be able to sign new customer agreements or enter into new development plans with existing customers with adequate funds to cover program development expenses. As a result of these and other factors, we do not know whether additional financing will be available when needed, or, if available, whether such financing would be on terms favorable to our stockholders or us.

If future financings involve the issuance of equity securities, our existing stockholders would suffer dilution. If we raise debt financing in the future, we may be subject to restrictive covenants that limit our ability to conduct our business. Our ability to raise funds may be adversely impacted by current or future economic conditions. If we fail to raise sufficient funds and continue to incur losses, our ability to fund our operations, take advantage of strategic opportunities, or otherwise respond to competitive pressures could be significantly limited. If adequate funds are not available, we may not be able to successfully execute our business plan or continue our business.

We have experienced rapid growth and expect our growth to continue, and if we fail to effectively manage our growth, then our business, results of operations, and financial condition could be adversely affected.

We have experienced substantial growth in our business since inception, including as a result of our recent acquisitions, which has placed and may continue to place significant demands on our company culture, operational infrastructure, and management. We believe that our culture has been a critical component of our success. We have invested substantial time and resources in building our team and nurturing a culture of empowerment of, and active engagement by, our employees. As we expand our business, integrate employees and technology from our recent acquisitions, and mature as a public company, we may find it difficult to maintain our culture while managing this growth. Any failure to manage our anticipated growth and organizational changes in a manner that preserves the key aspects of our culture could be detrimental to future success, including our ability to recruit and retain personnel, and effectively focus on and pursue our objectives. This, in turn, could adversely affect our business, results of operations, and financial condition.

In addition, in order to successfully manage our rapid growth, our organizational structure has become more complex and is likely to continue to become more complex. In order to manage these increasing complexities, we will need to continue to scale and adapt our operational, financial, and management controls, as well as our reporting systems and procedures. The expansion of our systems and infrastructure will require us to commit substantial financial, operational, and management resources before our revenue increases and without any assurances that our revenue will increase.

Finally, continued growth could strain our ability to maintain reliable service levels and offerings for our customers. If we fail to achieve the necessary level of capacity, quality and efficiency in performing services and other development activities, or the necessary level of efficiency in our organizational structure as we grow, then our business, results of operations, and financial condition could be adversely affected.

Our limited operating history makes it difficult to evaluate our current business and future prospects.

We have a portfolio of cell engineering programs which vary in start date, duration, complexity, and revenue potential. Additionally, our downstream economics in the form of equity interests, milestone payments, or royalty streams add an additional level of uncertainty to our possible future performance. Consequently, predictions about our future success or viability are highly uncertain and may not be as accurate as they could be if we had a longer company history of successfully developing, commercializing and generating revenue from our programs and/or downstream economic participation. With respect to Concentric by Ginkgo, prior to 2020, we had no experience developing or commercializing testing services. Moreover, as described above, given the limited operating history of this offering, our reliance on government funding for testing, potential disruptions from vaccine rollout generally, the availability of COVID-19 therapeutics, the impact of summer vacation and other school breaks, and the increased availability of over-the-counter testing options, the future performance of our COVID-19 testing program is unpredictable. Moreover, the White House announced that the public health emergency will end in May 2023, therefore, we cannot predict the duration of the revenue stream, which will likely diminish significantly, from our COVID-19 testing services.

Our long-term objective is to generate free cash flow from the commercialization of programs by customers across a variety of industries, as well as from our biosecurity-focused offerings. Our estimated costs and timelines for the completion of programs are based on our experiences to date and our expectations for each stage of the program in development. Given the variety of types of programs we support and the continued growth of our platform, there is variability in timelines and costs

for launching and executing programs, and completion dates can change over the course of a customer engagement. Our costs and timelines may be greater or subject to variability where regulatory requirements lead to longer timelines, such as in agriculture, food, and therapeutics. In addition, we have equity interests in certain companies and there is and will continue to be variability in the financial performance of these other companies or future companies in which we may have equity interests.

As a business with a limited operating history, we may encounter unforeseen expenses, difficulties, complications, delays, and other known and unknown obstacles. We have encountered in the past, and will encounter in the future, risks and uncertainties frequently experienced by growing companies with limited operating histories in emerging and rapidly changing industries. If our assumptions regarding these risks and uncertainties, which we use to plan and operate our business, are incorrect or change, or if we do not address these risks successfully, our results of operations could differ materially from our expectations, and our business, financial condition, and results of operations could be adversely affected.

We could become involved in securities or shareholder litigation and other related matters, which could be expensive and time-consuming. Such litigation and related matters could harm our business.

We may be a target for securities and shareholder lawsuits in the future, including lawsuits filed in connection with the Zymergen Acquisition. In addition, shareholder litigation is pending against Zymergen and certain of its former officers and directors in connection with Zymergen's April 2021 initial public offering. The outcome of such pending and potential litigation is uncertain. Such disputes, including any related governmental or regulatory investigations, could result in an adverse effect on our business, results of operations, financial condition, reputation and cash flows, and could adversely impact the market price of our common stock. Although the results of lawsuits and claims cannot be predicted with certainty, defending against such claims could be costly and could impose a significant burden on management and employees. Any litigation to which we become a party may result in an onerous or unfavorable judgment, or may be resolved with a monetary payment.

If we cannot maintain and expand current customer partnerships and enter into new customer partnerships, our business could be adversely affected.

We do not generate substantial revenue from our own products, and instead generate revenue from customer collaborations in which we provide services, and also typically receive downstream value in the form of royalties, equity, or milestone payments. As a result, our success depends on our ability to expand the number, size and scope of our customer collaborations. Our ability to win new business depends on many factors, including our reputation in the market, the quality of our service offerings relative to alternatives, the pricing and efficiency of our services relative to alternatives, our technical and operational capabilities, our sales team effectiveness, and the customer's ability to fund new work. If we fail to maintain a position of strength in any of these factors, our ability to deliver on customer programs, sign new customer collaborations, and/or launch new programs with existing customers may suffer and this could adversely affect our prospects. Additionally, in the process of developing programs, we generate Foundry know-how and accumulate meaningful biological and data assets, including optimized proteins and organisms, characterized genetic parts, enhanced understanding of metabolic pathways, biological, chemical, and genetic libraries, and other elements of biological data. Data and know-how generated from our programs provide the basis for expanded capabilities that we believe further supports our customer collaborations. As a result, in addition to reducing our revenue or delaying the development of our programs, the loss of one or more of our customer relationships or the failure to add new customers or programs may hinder our accumulation of such information, thus hindering our efforts to advance our technological differentiation and improve our platform.

We engage in conversations with companies regarding potential customer collaborations on an ongoing basis. We may spend considerable time and money engaging in these conversations and feasibility assessments, including understanding the technical approach to a program, customer concerns and limitations, and legal or regulatory landscape of a potential program or offering, which may not result in a commercial agreement. Even if an agreement is reached, the resulting relationship may not be successful for many reasons, including our inability to complete a program to our customers' specifications or within our customers' time frames, or unsuccessful development or commercialization of products or processes by our customers. In such circumstances, our revenues and downstream value potential from such a collaboration might be meaningfully reduced.

We currently own and may in the future own equity interests in other operating companies, including with respect to certain of our customers and we may receive non-cash consideration which involves estimations of fair market value. The initial fair market value of the non-cash consideration may decrease after contract inception and the amount of cash

proceeds eventually realized may be less than the revenue recognized. Consequently, we have exposure to the volatility and liquidity risks inherent in holding their equity and overall operational and financial performance of these businesses.

We currently own equity interests in several of our customers, and we may receive non-cash consideration for our services, which involves estimations of fair market value. The initial fair market value of the non-cash consideration may decrease after contract inception and the amount of cash proceeds eventually realized may be less than the revenue recognized. In the future, we may also own equity interests in other companies. The process by which we receive equity interests and the factors we consider in deciding whether to accept, hold or dispose of these equity positions may differ significantly from those that an independent investor would evaluate when considering equity interests in a company. Owning equity increases our exposure to the risks of the other company and, in the case of customers, beyond the products of our collaborations. Our equity ownership positions expose us to market volatility and the potential for negative returns. We may have restrictions on resale or limited markets to sell our equity ownership. In many cases, our equity position is a minority position which exposes us to further risk, as we are not able to exert control over the companies in which we hold securities.

In connection with future collaborations or joint ventures, we may, from time to time, receive warrants or options, all of which involve special risks. To the extent we receive warrants or options in connection with future collaborations or joint ventures, we would be exposed to risks involving pricing differences between the market value of underlying securities and our exercise price for the warrants or options, a possible lack of liquidity, and the related inability to close a warrant or option position, all of which could ultimately have an adverse effect on our financial position.

We leverage our own resources and partner with strategic and financial investors in order to help early stage companies and innovators secure funding and benefit from our platform, which exposes us to a number of risks.

Since our founding, we have helped to launch new companies (such as BiomEdit, LLC, Motif FoodWorks, Inc., Allonnia LLC, Arcaea, LLC, Ayana Bio, LLC and Verb Biotics, LLC) by bringing together strategic and financial investors to secure funding for these early stage and small companies. Going forward, we intend to continue to leverage our own balance sheet and partner with investors to enable companies at all stages to benefit from our platform.

Partnering with and investing in early stage and small companies may expose us to a number of risks, including that early stage and small companies may have:

- shorter operating histories, narrower product lines and smaller market shares than larger businesses, which tend to render small companies more vulnerable to competitors' actions and market conditions, as well as general economic downturns;
- more limited access to capital and higher funding costs, may be in a weaker financial position and may need more capital than originally anticipated to expand, compete and operate their business;
- the inability to obtain financing from the public capital markets or other traditional sources, such as commercial banks, in part because loans made to these types of companies entail higher risks than loans made to companies that have larger businesses, greater financial resources or are otherwise able to access traditional credit sources on more attractive terms;
- a higher likelihood of holding cash deposits or maintaining lines of credit with banks focused on providing banking services to early stage or venture-backed companies, such as Silicon Valley Bank, which recently failed;
- a higher likelihood of depending on the management talents and efforts of a small group of persons; therefore, the death, disability, resignation or termination of one or more of these persons could have a material adverse impact on such company and, in turn, on us;
- less predictable operating results, may be engaged in rapidly changing businesses with products subject to a substantial risk of obsolescence, and may require substantial additional capital to support their operations, finance expansion or maintain their competitive position;
- particular vulnerabilities to changes in customer preferences and market conditions, depend on a limited number of customers, and face intense competition, including from companies with greater financial, technical, managerial and marketing resources; and
- fewer administrative resources, which can lead to greater uncertainty in their ability to generate accurate and reliable financial data, including their ability to deliver audited financial statements.

Any of these factors or changes thereto could impair an early stage or small company's financial condition, results of operation, cash flow or result in other adverse events, such as bankruptcy. This, in turn, could result in losses in our investments and a change in our income (loss) on investments.

We may be unable to complete future strategic acquisitions or successfully integrate strategic acquisitions which could adversely affect our business and financial condition.

Our inability to complete any future strategic acquisitions or to successfully integrate any new or previous strategic acquisitions could have a material adverse effect on our business. Our business strategy includes the acquisition of technologies and businesses that complement or augment our existing products and services. We may continue to seek attractive opportunities to acquire businesses, enter into joint ventures and make other investments that are complementary to our existing strengths. There are no assurances, however, that any strategic acquisition opportunities will arise or, if they do, that they will be consummated. Certain acquisitions may be difficult to complete for a number of reasons, including the need to satisfy customary closing conditions, the need for antitrust and/or other regulatory approvals, as well as disputes or litigation. In addition, any strategic acquisition we may complete may be made at a substantial premium over the fair value of the net identifiable assets of the acquired company and thus our realization of this value relies on successful integration and continued operations. We may not be able to integrate acquired businesses successfully into our existing businesses, make such businesses profitable, retain key employees or realize anticipated cost savings or synergies, if any, from these acquisitions, which could adversely affect our business and financial condition. Further, our ongoing business may be disrupted, and our management's attention may be diverted by acquisitions, investments, transition and/or integration activities. See "*Risk Factors–Risks Related to the Zymergen Acquisition*."

We have in the past, and in the future may continue to pursue strategic acquisitions and investments that are dilutive to our stockholders, and such strategic acquisitions or investments could have an adverse impact on our business if they are unsuccessful.

We have made acquisitions in the past and, as appropriate opportunities become available, we may acquire additional businesses, assets, technologies, or products to enhance our business in the future, but our ability to do so successfully cannot be ensured. We have also made investments in companies that we view as synergistic with our business. Although we conduct due diligence on these acquisitions and investments, such processes may underestimate or fail to reveal significant liabilities and we could incur losses resulting from liabilities of the acquired business that are not covered by indemnification we may obtain from the seller. Even if we identify suitable opportunities, including pending transactions, we may not be able to complete such acquisitions on favorable terms or at all, which could damage our business. Additionally, pursuing acquisitions, whether successful or unsuccessful, could result in civil litigation and regulatory penalties. Any acquisitions we make may not strengthen our competitive position, and these transactions may be viewed negatively by customers or investors. We may decide to incur debt or spend cash in connection with a strategic acquisition, which may cause us to face liquidity concerns or be subject to restrictive covenants in the future. We have issued, and in the future may issue, common stock or other equity securities to the stockholders of the acquired company, which could constitute a material portion of our then-outstanding shares of common stock and may reduce the percentage ownership of our existing stockholders.

In addition, we may not be able to successfully integrate the acquired personnel, assets, technologies, products and/or operations into our existing business in an effective, timely, and non-disruptive manner or retain acquired personnel following an acquisition. Acquisitions may also divert management's attention from day-to-day responsibilities, increase our expenses and reduce our cash available for operations and other uses. In addition, we may not be able to fully recover the costs of such acquisitions or be successful in leveraging any such strategic transactions into increased business, revenue, or profitability. We also cannot predict the number, timing, or size of any future acquisitions or the effect that any such transactions might have on our operating results.

Accordingly, although there can be no assurance that we will undertake or successfully complete any future acquisitions, any transactions that we have completed or in the future do complete may not yield the anticipated benefits and may be subject to the foregoing or other risks and have a material and adverse effect on our business, financial condition, results of operations, and prospects. Conversely, any failure to pursue or delay in completing any acquisition or other strategic transaction that would be beneficial to us, including those caused by competing parties, could delay the development of our platform or advancement of our programs and, thus, potential commercialization of our customer's products.

Our programs may not achieve milestones and other anticipated key events on the expected timelines or at all, which could have an adverse impact on our business and could cause the price of our common stock to decline.

We may adopt various technical, manufacturing, regulatory, commercial, and other objectives for our programs. These milestones may include our or our customers' expectations regarding the commencement or completion of technical development, the achievement of manufacturing targets, the submission of regulatory filings, or the realization of other development, regulatory, or commercialization objectives by us or our customers. The achievement of many of these

milestones may be outside of our control. All of these milestones are based on a variety of assumptions, including assumptions regarding capital resources, constraints, and priorities, progress of and results from research and development ("R&D") activities, and other factors, including impacts resulting from the COVID-19 pandemic, any of which may cause the timing of achievement of the milestones to vary considerably. If we, our collaborators, or our customers fail to achieve milestones in the expected timeframes, the commercialization of our programs may be delayed, our credibility may be undermined, our expectations with respect to potential future downstream value may be inaccurate, our business and results of operations may be harmed, and the trading price of our common stock may decline.

We must continue to secure and maintain sufficient and stable supplies of laboratory reagents, consumables, equipment, and laboratory services. We depend on a limited number of suppliers, some of which are single-source suppliers, and contract manufacturers for critical supplies, equipment, and services for research, development, and manufacturing of our products and processes. Our reliance on these third parties exposes us to risks relating to costs, contractual terms, supply, and logistics, and the loss of any one or more of these suppliers or contract manufacturers or their failure to supply us with the necessary supplies, equipment, or services on a timely basis, could cause delays in our research, development, or production capacity and adversely affect our business.

The COVID-19 pandemic has caused substantial disruption in global supply chains and the ability of third parties to provide us services on a timely basis or at all. The Ukraine War is further disrupting global supply chains. Additionally, widespread inflationary pressures exist across global economies, resulting in disruptions or higher costs for disposable lab equipment, raw materials and synthetic biology materials and services, and significant increases in the future could adversely affect our results of operations. We have experienced shortages in some of our key equipment and supplies, including those required in our labs, as well as disruptions in services provided by third parties, and may continue to do so in the future as a result of the pandemic, or otherwise. We may also experience price increases, quality issues and longer lead times due to unexpected material shortages, service disruptions, and other unanticipated events, which may adversely affect our supply of lab equipment, lab supplies, chemicals, reagents, supplies, and lab services. For some suppliers, we do not enter into long-term agreements and instead secure our materials and services on a purchase order basis. Our suppliers may reduce or cease their supply of materials or services to us at any time in the future. If the supply of materials or services is interrupted, our programs may be delayed.

We depend on a limited number of suppliers for critical items, including lab consumables and equipment, for the development of our programs. Some of these suppliers are single-source suppliers. We do not currently have the infrastructure or capability internally to manufacture these items at the necessary scale or at all. Although we have a reserve of supplies and although alternative suppliers exist for some of these critical products, services, and equipment, our existing processes used in our Foundry have been designed based on the functions, limitations, features, and specifications of the products, services, and equipment that we currently utilize. While we work with a variety of domestic and international suppliers, our suppliers may not be obligated to supply products or services or our arrangements may be terminated with relatively short notice periods. Additionally, we do not have any control over the process or timing of the acquisition or manufacture of materials by our manufacturers and cannot ensure that they will deliver to us the items we order on time, or at all.

In particular, we rely on Twist for custom DNA synthesis and Thermo Fisher Scientific Inc. and others for certain instruments and consumables. The price and availability of DNA, chemicals, reagents, equipment, consumables, and instruments have a material impact on our ability to provide Foundry services. We may rely on contract manufacturers like Fermic, s.a. de.c.v for scale-up fermentation development, fermentation, and manufacturing of products for some customers.

The loss of the products, services, and equipment provided by one or more of our suppliers could require us to change the design of our research, development, and manufacturing processes based on the functions, limitations, features, and specifications of the replacement items or seek out a new supplier to provide these items. Additionally, as we grow, our existing suppliers may not be able to meet our increasing demand, and we may need to find additional suppliers. We may not be able to secure suppliers who provide lab supplies at, or equipment and services to, the specification, quantity, and quality levels that we demand (or at all) or be able to negotiate acceptable fees and terms of services with any such suppliers.

As described above, some lab equipment, lab consumables, and other services and materials that we purchase are purchased from single-source or preferred suppliers, which limits our negotiating leverage and our ability to rely on additional or alternative suppliers for these items. Our dependence on these single-source and preferred suppliers exposes us to certain risks, including the following:

- our suppliers may cease or reduce production or deliveries, raise prices, or renegotiate terms;

- we may be unable to locate a suitable replacement on acceptable terms or on a timely basis, if at all;
- if there is a disruption to our single-source or preferred suppliers' operations, and if we are unable to enter into arrangements with alternative suppliers, we will have no other means of continuing the relevant research, development, or manufacturing operations until they restore the affected facilities or we or they procure alternative sources of supply;
- delays caused by supply issues may harm our reputation, frustrate our customers, and cause them to turn to our competitors for future programs; and
- our ability to progress the development of existing programs and the expansion of our capacity to begin future programs could be materially and adversely impacted if the single-source or preferred suppliers upon which we rely were to experience a significant business challenge, disruption, or failure due to issues such as financial difficulties or bankruptcy, issues relating to other customers such as regulatory or quality compliance issues, or other financial, legal, regulatory, or reputational issues.

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

For the year ended December 31, 2022, our cost of lab equipment, lab supplies, and lab services accounted for a significant portion of our total R&D expenses. In the event of price increases by suppliers, whether as a result of inflationary pressures or otherwise, we may attempt to pass the increased costs to our customers. However, we may not be able to raise the prices of our Foundry services sufficiently to cover increased costs resulting from increases in the cost of our materials and services, or the interruption of a sufficient supply of materials or services. As a result, materials and services costs, including any price increase for our materials and services, may negatively impact our business, financial condition, and results of operations.

Some of our suppliers and contract manufacturers are foreign entities. We may face disruptions due to the inability to obtain customs clearances in a timely manner or restrictions on shipping or international travel due to the COVID-19 pandemic. As a result of ongoing global supply chain challenges resulting in very long lead times for certain products and equipment, we may order in larger volumes in order to secure the supplies we require for our future operations, which may negatively impact our financial conditions, especially if we are unable to use the supplies ordered.

We use biological, hazardous, flammable and/or regulated materials that require considerable training, expertise and expense for handling, storage and disposal and may result in claims against us.

We work with biological and chemical materials that could be hazardous to human, animal, or plant health and safety or the environment. Our operations produce hazardous and biological waste products, and we largely contract with third parties for the disposal of these products. Federal, state, and local laws and regulations govern the use, generation, manufacture, storage, handling, and disposal of these materials and wastes. Compliance with applicable laws and regulations is expensive, and current or future laws and regulations may restrict our operations. If we do not comply with applicable laws and regulations, we may be subject to fines and penalties.

In addition, we cannot eliminate the risk of (a) accidental or intentional injury or (b) release, or contamination from these materials or wastes, which could expose us to liability. Furthermore, laws and regulations are complex, change frequently, and have tended to become more stringent. We cannot predict the impact of such changes and cannot be certain of our future compliance. Accordingly, in the event of release, contamination, or injury, we could be liable for the resulting harm or penalized with fines in an amount exceeding our resources and our operations could be suspended or otherwise adversely affected. These liabilities could also include regulatory actions, litigation, investigations, remediation obligations, damage to our reputation and brand, supplemental disclosure obligations, loss of customer, consumer, and partner confidence in the safety of our laboratory operations, impairment to our business, and corresponding fees, costs, expenses, loss of revenues, and other potential liabilities, as well as increased costs or loss of revenue or other harm to our business.

The release of GMOs or Genetically Modified Materials, whether inadvertent or purposeful, into uncontrolled environments could have unintended consequences, which may result in increased regulatory scrutiny and otherwise harm our business and financial condition.

The genetically engineered organisms and materials that we develop may have significantly altered characteristics compared to those found in the wild, and the full effects of deployment or release of our genetically engineered organisms and materials into uncontrolled environments may be unknown. In particular, such deployment or release, including an unauthorized

release, could impact the environment or community generally or the health and safety of our employees, our customers' employees, and the consumers of our customers' products.

In addition, if a high profile biosecurity breach or unauthorized release of a biological agent occurs within our industry, our customers and potential customers may lose trust in the security of the laboratory environments in which we produce GMOs and Genetically Modified Materials, even if we are not directly affected. Any adverse effect resulting from such a release, by us or others, could have a material adverse effect on the public acceptance of products from engineered cells and our business and financial condition. Such a release could result in increased regulatory scrutiny of our facilities, platform, and programs, and could require us to implement additional costly measures to maintain our regulatory permits, licenses, authorizations and approvals. To the extent such regulatory scrutiny or changes impact our ability to execute on existing or new programs for our customers, or make doing so more costly or difficult, our business, financial condition, or results of operations may be adversely affected. In addition, we could have exposure to liability for any resulting harm, as well as to regulatory actions, litigation, investigations, remediation obligations, damage to our reputation and brand, supplemental disclosure obligations, loss of customer, consumer, and partner confidence in the safety of engineered cells materials and organisms, impairment to our business, and corresponding fees, costs, expenses, loss of revenues, and other potential liabilities, as well as increased costs or loss of revenue or other harm to our business.

We could synthesize DNA sequences or engage in other activity that inadvertently contravenes biosecurity requirements, or regulatory authorities could promulgate more far-reaching biosecurity requirements that our standard business practices cannot accommodate, which could give rise to substantial legal liability, impede our business, and damage our reputation.

The Federal Select Agent Program ("FSAP") involves rules administered by the Centers for Disease Control and Prevention and the USDA's APHIS that regulate possession, use, and transfer of biological select agents and toxins that have the potential to pose a severe threat to public, animal, or plant health or to animal or plant products. In accordance with the International Gene Synthesis Consortium's ("IGSC") Harmonized Screening Protocol for screening of synthetic DNA sequence orders, we follow biosafety and biosecurity industry practices and avoid DNA synthesis activities that implicate FSAP rules by screening synthetic DNA sequence orders against the IGSC's Regulated Pathogen Database; however, we could err in our observance of compliance program requirements in a manner that leaves us in noncompliance with FSAP or other biosecurity rules. In addition, authorities could promulgate new biosecurity requirements that restrict our operations. One or more resulting legal penalties, restraints on our business or reputational damage could have material adverse effects on our business, financial condition, or results of operations.

Third parties may use our engineered cells, materials, and organisms and accompanying production processes in ways that could damage our reputation.

After our customers have received our engineered cells, materials, and organisms and accompanying production processes, we do not have any control over their use and our customers may use them in ways that are harmful to our reputation. In addition, while we have established biosecurity offerings designed to comply with biosafety and biosecurity requirements and export control requirements in an effort to ensure that third parties do not obtain our engineered cells or other biomaterials for malevolent purposes, we cannot guarantee that these preventative measures will eliminate or reduce the risk of the domestic and global opportunities for the misuse or negligent use of our engineered cells materials, organisms and production processes. Accordingly, in the event of such misuse or negligent use, our reputation, future revenue, and operating results may suffer.

International expansion of our business exposes us to business, regulatory, political, operational, financial, and economic risks associated with doing business outside of the United States.

We currently market our services and deliver our programs, materials, and processes outside of the United States and may market future offerings outside of the United States. We, and our suppliers, collaborators, and customers, currently conduct business outside of the United States. From time to time, our services may include the hiring or secondment of our employees outside the United States at third party facilities or require the hiring or secondment of foreign persons within our facilities, including as a result of foreign acquisitions. Accordingly, we are subject to a variety of risks inherent in doing business internationally, and our exposure to these risks will increase as we continue to expand our operations and customer base. These risks include:

- political, social and economic instability;
- fluctuations in currency exchange rates;
- higher levels of credit risk, corruption, and payment fraud;

- enhanced difficulties of integrating any foreign acquisitions;
- increased expenses and diversion of our management's attention from advancing programs;
- regulations that might add difficulties in repatriating cash earned outside the United States and otherwise prevent us from freely moving cash;
- import and export controls and restrictions and changes in trade regulations;
- compliance with the U.S. Foreign Corrupt Practices Act, the U.K. Bribery Act, and similar laws in other jurisdictions;
- multiple, conflicting and changing laws and regulations such as privacy, security and data use regulations, tax laws, tariffs, trade regulations, economic sanctions and embargoes, employment laws, anti-corruption laws, regulatory requirements, reimbursement or payor regimes and other governmental approvals, permits and licenses;
- failure by us, our collaborators or our customers to obtain regulatory clearance, authorization or approval for the use of our services in various countries;
- additional potentially relevant third-party patent rights;
- complexities and difficulties in obtaining intellectual property protection and enforcing our intellectual property;
- difficulties in staffing and managing foreign operations, including difficulties related to the increased operations, travel, infrastructure and legal compliance costs associated with international locations;
- logistics and regulations associated with shipping chemicals, biomaterials and product samples, including infrastructure conditions and transportation delays;
- financial risks, such as longer payment cycles, difficulty collecting accounts receivable, the impact of local and regional financial crises, on demand and payment for our products and exposure to foreign currency exchange rate fluctuations;
- natural disasters, political and economic instability, including wars (including the Russian invasion of Ukraine), terrorism and political unrest, the outbreak of disease, or public health epidemics/pandemics, such as COVID-19, which could have an adverse impact on our employees, contractors, customers, partners, travel and the global economy;
- breakdowns in infrastructure, utilities and other services;
- boycotts, curtailment of trade and other business restrictions; and
- the other risks and uncertainties described in this Annual Report on Form 10-K.

Additionally, as part of our growth strategy, we will continue to evaluate potential opportunities for international expansion. Operating in international markets requires significant resources and management attention and will subject us to regulatory, economic and political risks in addition to those we face in the United States. However, our international expansion efforts may not be successful, which could limit the size of our market or the ability to provide services or programs internationally.

In addition, due to potential costs from any international expansion efforts and potentially higher supplier costs outside of the United States, our international operations may operate with a lower margin profile. As a result, our margins may fluctuate as we expand our operations and customer base internationally.

Any of these factors could significantly harm our future international expansion and operations and, consequently, our revenue and results of operations.

Risks Related to Our Customers

We rely on our customers to develop, produce and manufacture products using the engineered cells and/or biomanufacturing processes that we develop. If these initiatives by our customers are not successful or do not achieve commercial success, or if our customers discontinue their development, production and manufacturing efforts using our engineered cells and/or biomanufacturing processes, our future financial position may be adversely impacted.

We operate as a platform company. As such, we rely on our customers to commercialize products that may be enabled by our engineered cells and/or biomanufacturing processes. A portion of the value in our customer collaborations is typically earned through downstream value sharing in the form of equity, royalty streams, or milestone payments. If our customers are not successful in bringing these products to market, or if these products are not successful once on the market, the downstream portion of our value will be adversely impacted. Because we do not directly control manufacturing, product or downstream process development or commercialization, we have limited ability to impact the quality of our partners' production processes and ultimate commercial success.

In addition, our customers may simply choose not to develop or commercialize a product we have enabled in which we are entitled to downstream value sharing. In our current relationships, we would have limited or no recourse to find alternative methods to monetize these products without the original customer. Because this industry is still nascent and the regulatory

environment is evolving, we have limited historical information on the probability of commercial success for bioengineered products or biomanufacturing processes in the market and have limited ability to underwrite the likelihood that our customers will be able to create valuable products or processes in their market using the results of their programs with us. If we overestimate the probability or scale of commercial success, the price of our common stock may be adversely impacted as a result of lower expectations for future cash flows from customer collaborations.

Our revenue is concentrated in a limited number of customers, some of which are related parties, and our revenue, results of operations, cash flows and reputation may suffer upon the loss of a significant customer.

We have derived, and may continue to derive, a significant portion of our revenue from a limited number of large customers. During the year ended December 31, 2022, two customers each represented more than 10% of our total revenue and cumulatively represented 22% of our total revenue. Due to the significant time required to acquire new customers, to plan and develop new programs for customers, and to satisfactorily execute on existing programs, the loss of any of these customers, or the loss of any other significant customer or a significant reduction in the amount of demand from a significant customer would adversely affect our revenue, results of operations, cash flows and reputation in the marketplace. There is always a risk that existing customers will not elect to do business with us in the future or will experience financial difficulties. If our customers experience financial difficulties or business reversals which reduce or eliminate the need for our services, they may be unable or unwilling to fulfill their contracts with us. There is also the risk that our customers will attempt to impose new or additional requirements on us that reduce the profitability of the services performed by us. Our customer concentration also increases the concentration of our accounts receivable and our exposure to payment defaults by key customers, which could expose us to substantial and potentially unrecoverable costs if we do not receive payment from key customers. Additionally, the loss of any significant customer could pose reputational harm to us and make it more challenging to acquire new customers.

In addition, while our customer collaborations are typically multi-year, we generally do not require our customers to generate a minimum amount of annual demand and without such contracts, our customers are not obligated to use our services beyond the amounts they choose to incur. Our customers may choose to use fewer of our services depending on program progress, their own technological capabilities, market demand for their products and/or their own internal budget cycles. As a result, we cannot accurately predict our customers' decisions to reduce or cease utilizing our services. Even where we enter into long-term contracts with our customers, there is no guarantee that such agreements will be negotiated on terms that are commercially favorable to us in the long-term. In addition, existing customers may choose to perform some or all of the services they expect from us internally, with another third-party partner or by using capabilities from acquisitions of assets.

In certain cases, our business partners may have discretion in determining when and whether to make announcements about the status of our collaborations, including about developments and timelines for advancing programs, and the price of our common stock may decline as a result of announcements of unexpected results or developments.

Generally, we and our customers must mutually agree on determining when and whether to make announcements about the status of our collaborations, including developments in our programs and timelines for commercialization of or improvements to products using engineered cells developed using our platform. However, in some cases our customers may report or otherwise may be obligated to disclose certain matters without our consent. Our partners may also wish to report such information more or less frequently than we intend to or may not wish to report such information at all. We or our partners may announce a collaboration or partnership even if there is no guarantee that we will recognize program fees. The price of our common stock may decline as a result of a public announcement of unexpected results or developments in our partnerships, or as a result of our partners not consenting to an announcement or withholding information.

Risks Related to the Zymergen Acquisition

We may fail to realize the benefits and synergies expected from the Zymergen Acquisition, which could adversely affect our stock price.

The anticipated benefits and synergies Ginkgo expects from the Zymergen Acquisition are, necessarily, based on projections and assumptions about the combined businesses of Ginkgo and Zymergen, which may not materialize as expected or which may prove to be inaccurate. The value of our Class A Common Stock could be adversely affected if we are unable to realize the anticipated benefits and synergies from the Zymergen Acquisition on a timely basis or at all. The benefits and synergies expected from the Zymergen Acquisition, which may not materialize or may prove to be inaccurate include the following:

- productivity improvements and corresponding decreases in unit costs as a result of Zymergen's robotic automation and material conveyance technology;
- ability to accelerate scaling efforts while minimizing incremental run-rate operating expenses;
- acceleration of Ginkgo's software development goals, including higher utilization and efficiency, due to Zymergen's proprietary software and data stack;
- improvements and additions to Ginkgo's Codebase;
- increased probability of program success and lower costs for customers;
- increased strain engineering expertise from knowledgeable Zymergen employees; and
- a pro forma cost structure that is materially less than the combined standalone cost structure of Ginkgo and Zymergen.

We cannot predict with certainty if or when these benefits and synergies will be realized, or the extent to which they will actually be achieved. Realization of any benefits or synergies could be affected by the factors described in other risk factors and a number of factors beyond our control, including, without limitation, general economic conditions, increased operating costs and regulatory developments.

We may be unable to appropriately integrate the business, operations and assets of Zymergen into our existing business.

Achieving the benefits of the Zymergen Acquisition will depend, in part, on our ability to integrate the business, operations and assets of Zymergen successfully and efficiently with our business. The challenges involved in this integration, which will be complex and time-consuming, include the following:

- difficulties integrating new and existing technologies, systems and processes into our platform and operations;
- successfully managing relationships with the combined supplier and customer base of Ginkgo and Zymergen;
- coordinating and integrating independent research and development and engineering teams across platforms while reducing costs;
- consolidating and integrating procurement, research, development and engineering activities and processes and customer and technical support and management and administrative functions;
- the ability to find partnerships, complete a potential sale or spin-out of Zymergen's advanced materials and drug discovery businesses on favorable terms or at all;
- coordinating sales and marketing efforts to effectively position our capabilities and the direction of our platform;
- limitations or encumbrances on certain Zymergen intellectual property or other difficulties integrating Zymergen intellectual property into Ginkgo's portfolio;
- the increased scale and complexity of our operations resulting from the Zymergen Acquisition;
- managing Zymergen's real estate cost commitments;
- retaining key employees of Ginkgo and Zymergen;
- managing employee transition and severance costs;
- integrating and managing Ginkgo's other acquisitions in addition to the Zymergen Acquisition; and
- minimizing the diversion of Ginkgo's management's attention from other important business objectives.

If we do not successfully manage these issues and the other challenges inherent in integrating an acquired business of the size and complexity of Zymergen, then Ginkgo may not achieve the anticipated benefits of the Zymergen Acquisition and its revenue, expenses, operating results and financial condition could be materially adversely affected.

There may be limited market interest in the product portfolio developed by Zymergen, which may limit our ability to create value from these assets.

Zymergen's business model involved developing products internally in areas as diverse as materials, drug discovery, agriculture, and consumer products. We plan to seek partners for these programs but we may not be successful. Furthermore, Zymergen's strategy, in part, involves building a laboratory automation business, which may not be successful. Zymergen's assumptions regarding and the data underlying the estimates of the total annual addressable markets and serviceable addressable markets may not be correct, and the conditions supporting assumptions or estimates may change at any time, thereby reducing the accuracy of the estimates. The future growth of current and any future products and solutions depends on many factors, including factors that are beyond our control. If demand for current and future products and solutions is smaller than estimated or does not develop as we expect, our growth may be limited and our business, financial condition and operational results may be adversely affected.

The acquisition of Zymergen may result in significant charges or other liabilities that could adversely affect the financial results of the combined company.

The financial results of the combined company may be adversely affected by cash expenses and non-cash accounting charges incurred in connection with Ginkgo's integration of the business and operations of Zymergen. The amount and timing of these possible charges are not yet known. Our failure to identify or accurately assess the magnitude of certain liabilities, including in connection with Zymergen's pending legal proceedings, could result in unexpected costs, including through litigation or regulatory exposure. Further, if we are unable to manage Zymergen's real estate cost commitments or if we incur unfavorable accounting charges, unexpected increases in taxes due, a loss of anticipated tax benefits or other adverse effects **,** it may negatively impact Ginkgo's business, operating results or financial condition. The price of our Class A Common Stock could decline to the extent the combined company's financial results are materially affected by any of these events. For example, Zymergen incurred cash-based severance and stock-based compensation costs of approximately $7.9 million and approximately $3.5 million, respectively, related to the reduction in force it announced in October 2022 (the "October 2022 Reduction in Force") and an aggregate of approximately $17.7 million in cash-based severance costs when combined with the initial reductions in force that were announced on July 25, 2022 and August 25, 2022, including $2.3 million of additional cash-based severance costs that were dependent on the consummation of a change in control event.

Ginkgo's future results will suffer if it does not effectively manage its expanded operations and geographic footprint following the Zymergen Acquisition.

The size and scope of operations of the business of the combined companies has increased beyond the size and scope of operations of either Ginkgo's or Zymergen's businesses prior to the acquisition. Our future success depends, in part, upon our ability to manage our expanded business, which may pose substantial challenges for our management related to the management and monitoring of new operations and locations and associated increased costs and complexity. There can be no assurances that we will be successful in managing such expanded business or that we will realize the expected synergies and other benefits currently anticipated from the Zymergen Acquisition.

Risks Related to the COVID-19 Pandemic

The COVID-19 pandemic and the global attempt to contain it may harm our business and results of operations.

The full impact of the continuing COVID-19 pandemic and related public health measures on our business will depend largely on future developments, including the duration and future severity of the pandemic, which remains highly uncertain. Extraordinary actions have been taken by international, federal, state and local public health and governmental authorities to contain and combat the outbreak and spread of COVID-19 throughout the world, including travel bans, quarantines, capacity limitations at facilities, "stay-at-home" orders and similar mandates for many individuals to substantially restrict daily activities and for many businesses to curtail or cease normal operations. Additionally, our operations rely on the availability of laboratory scientists, engineers and facility, safety, quality and compliance personnel to work on-site. If a critical team member falls ill or needs to quarantine, or if a critical mass of our personnel falls ill or needs to quarantine, we may not be able to continue operations. The COVID-19 pandemic has also had an adverse effect on our ability to attract, recruit, interview and hire at the pace we would typically expect to support our rapidly expanding operations, as well as on our ability to build out facilities to accommodate expanding operations.

The COVID-19 pandemic has had, and is expected to continue to have, an adverse impact on our operations, particularly as a result of preventive and precautionary measures that we, other businesses, and governments are taking or may take in the future. We have continued to operate within the rules and guidance applicable at various points to our business during the pandemic and operations at third-party facilities have been similarly impacted by governmental mandates and guidelines; however, a continuing implementation of these restrictions, or the implementation of additional restrictions, could further impact our ability to operate effectively and conduct ongoing R&D, laboratory operations, sales and marketing activities or other activities or operations, or lead to further compliance costs.

We have also incurred expenses associated with our efforts to accommodate personnel during the COVID-19 pandemic, including costs associated with the provision of COVID-19 testing to our personnel, safety accommodations, providing on-site amenities and enhanced on-site cleaning efforts, and we will continue to incur such expenses associated with our operations.

The pandemic has also caused substantial disruption in global supply chains. These interruptions may require us to suspend operations or delay programs. If we continually delay programs with existing customers, we may be in breach of our

contracts with existing customers or customers may decide to cease doing business with us or have decreased demand for our products. We may also experience a slow-down in our pipeline of new programs or a termination of existing programs if our customers or potential customers face disruptions during the pandemic. Difficulties and delays such as those we have experienced and may experience in the future may prevent us from meeting our operating and financial goals, both in general and within our targeted timelines, and may cause our revenues and operating results to fluctuate from period to period.

Uncertainty regarding the ongoing demand and/or capacity (including capacity at third party clinical testing laboratories) of our COVID-19 individual and pooled sample tests and passive monitoring programs could materially adversely affect our business.

Our biosecurity and public health offering Concentric by Ginkgo, consists of COVID-19 testing and passive monitoring programs, which are subject to inherent risks of commercial viability, such as demand for tests, price or market share erosion due to competition and the duration of the COVID-19 pandemic. We are in a highly competitive market – many companies have launched or are seeking to launch COVID-19 testing products and many of these companies already have an existing commercial and technical infrastructure to market and commercialize such offerings. We have limited experience marketing or commercializing diagnostic or pooled sample testing programs and may not be able to sufficiently support operations with our current base of personnel or recruit enough experienced personnel who are in high demand, particularly healthcare professionals. Moreover, as vaccines for COVID-19 and at-home or over-the-counter COVID-19 tests continue to be widely available, and as infection rates decrease, demand for COVID-19 testing may also decrease.

Our COVID-19 testing business relies heavily on the adoption of pooled testing in schools, which may be hesitant to adopt COVID-19 testing without positive support from parents or teachers. Although we make test validation results and protocols available to parents and teachers, they may not trust the accuracy of the tests or may have concerns about how the tests are performed, how samples are used or tracked and whether appropriate privacy measures are being taken with respect to individually identifiable health information, including genetic information. The ability for schools to pay for COVID-19 testing relies heavily on the availability of federal, state or local funding for testing. If such funding is depleted, discontinued or otherwise becomes unavailable, or if there are restrictions on the use of such funding for our pooled sample test offerings, our COVID-19 testing business may not be commercially viable. Our COVID-19 testing business is subject to seasonality, and the demand for COVID-19 testing in schools has significantly diminished, particularly in light of the White House's announcement that the public health emergency will end in May 2023. In addition, as a result of the recent FDA EUA of a COVID-19 vaccine for children five through eleven years of age, the demand for COVID-19 testing in schools could diminish significantly or be eliminated.

Creating the commercial and technical infrastructure to test on a mass scale is expensive. We may also be limited in our ability to scale up based on expense or unavailability of the required materials, equipment, personnel and infrastructure necessary to deliver diagnostic or pooled sample tests on a mass scale. We may not be able to recover our investment expenses with sufficient revenue generated by our diagnostic and pooled sample testing efforts.

Our ability to commercialize our testing programs is also subject to regulatory or governmental controls, decisions or actions. If the HHS terminates its Declaration Justifying Emergency Use of Medical Countermeasures because the circumstances justifying emergency use no longer exist and, if the third-party COVID-19 tests that are used in our testing services are not able to obtain premarket approval, clearance or other marketing authorization from the FDA, we may be unable to market or distribute these COVID-19 tests, fulfill our contractual testing requirements or generate revenues from our test offerings. We may also experience price erosion if federal or state governments implement price controls or if the price of supply inputs increase.

Finally, the sale of each test is dependent on the supply of the appropriate collection devices authorized for use with the COVID-19 tests we utilize in our testing programs. Disruptions in this supply chain will have a material adverse effect on our ability to sell tests.

Uncertainty regarding the sales and delivery of our COVID-19 individual and pooled sample tests could materially adversely affect our business.

Although we have partnerships with third party clinical testing laboratories to support a high volume of pooled sample testing for COVID-19 nationally, pooled testing has not yet been adopted by all states nor have we established partnerships with clinical testing laboratories in all states. We are continuing to develop processes to scale capacity of COVID-19 pooled sample collection and testing. However, we can give no assurance that we will be able to successfully scale the pooled sample collection and test capacity or that we will be able to establish or maintain the collaborative third party relationships

that support such testing capacity. In addition, even if we are able to scale to high volume testing nationwide, there can be no assurance that the testing capacity will be used.

We may be subject to tort liability if the COVID-19 tests we utilize in our testing programs provide inaccurate results.

The Public Readiness and Emergency Preparedness Act (the "PREP Act") provides immunity for manufacturers, distributors, program planners, qualified persons, and their officials, agents, and employees from certain claims under state or federal law for a "loss" arising out of the administration or use of a "covered countermeasure" in the United States. Distributors are certain persons or entities engaged in the distribution of drugs, biologics, or devices. Program planners include persons who supervise or administer a program with respect to the administration, distribution, provision, or use of a Covered Countermeasure (as defined in the PREP Act). Covered Countermeasures include security countermeasures and "qualified pandemic or epidemic products," including products intended to diagnose or treat pandemic or epidemic disease, such as COVID-19 diagnostic tests, as well as treatments intended to address conditions caused by such products. Covered Countermeasures must also be approved, cleared, or authorized for emergency use, or otherwise authorized for investigational use, by the FDA in order to be considered Covered Countermeasures under the PREP Act.

For these immunities to apply, the Secretary of HHS must issue a declaration in cases of public health emergency or "credible risk" of a future public health emergency. On March 10, 2020, the Secretary of HHS issued a declaration under the PREP Act and has issued subsequent amendments thereto to provide liability immunity for activities related to certain countermeasures against the COVID-19 pandemic.

We act as the authorized distributor of certain third-party COVID-19 tests and collection kits that have received an EUA and supervise testing programs for our COVID-19 testing customers. There can be no assurance that our test distribution and program planning activities regarding these programs would be covered under the provisions of the PREP Act. Also, there can be no assurance that the U.S. Congress will not act in the future to reduce coverage under the PREP Act or to repeal it altogether.

Furthermore, some of the third-party tests used as part of our pooled testing program are not covered by an EUA and, at this time, we do not believe that such testing services, administration, or program planning related to our pooled testing program will qualify for PREP Act immunity. If product liability lawsuits are brought against us in connection with allegations of harm connected to our COVID-19 testing services, we may incur substantial liabilities and may be required to limit our testing services. The PREP Act is a complex law with limited judicial precedent, and thus even for the third-party COVID-19 tests and collection kits used in our testing services that are subject to EUAs, we may have to expend significant time and legal resources to obtain dismissal of a lawsuit on the basis of PREP Act immunity.

If we cannot successfully defend ourselves against claims that our COVID-19 testing services caused injuries and if we are not entitled to immunity under the PREP Act, or the U.S. Congress limits or eliminates coverage under the PREP Act, or if the liability protections under the PREP Act are not adequate to cover all claims, we may incur substantial liabilities. Regardless of merit or eventual outcome, product liability claims may result in decreased demand for our services, injury to our reputation, costs to defend litigation, loss of revenue, and substantial money awards to customers.

We are dependent on our relationships with our telehealth partner to provide healthcare services, and our business would be adversely affected if those relationships were disrupted or if our telehealth partner's business model is affected by legal challenges.

Our contractual relationships with our telehealth partner who provides physician authorization for COVID-19 diagnostic and screening testing may implicate certain state laws in the United States that generally prohibit non-physician entities from practicing medicine, exercising control over physicians or engaging in certain practices such as fee-splitting with physicians. The ability to conduct telehealth services in a particular state is directly dependent upon the applicable laws governing remote healthcare, the practice of medicine and healthcare delivery in general in such location which are subject to changing political, regulatory and other influences. There can be no assurance that these laws will be interpreted in a manner consistent with our practices or that other laws or regulations will not be enacted in the future that could have a material and adverse effect on our business, financial condition and results of operations. Additionally, during the COVID-19 public health emergency, many states enacted waivers and adopted other temporary measures that lifted certain restrictions on out-of-state providers and relaxed licensure requirements to allow greater access to telehealth services during the public health emergency period. At this time, we cannot predict whether these waivers or temporary measures will remain in place after the end of the public health emergency period. Accordingly, we must monitor compliance with laws in every jurisdiction in which we operate, and we cannot provide assurance that government authorities may nonetheless challenge our activities and arrangements with our telehealth partner and consider them non-compliant.

Risks Related to the Synthetic Biology Industry

Rapidly changing technology and emerging competition in the synthetic biology industry could make the platform, programs, and products we and our customers are developing obsolete or non-competitive unless we continue to develop our platform and pursue new market opportunities.

The synthetic biology industry is still emerging and is characterized by rapid and significant technological changes, frequent new product introductions and enhancements, and evolving industry demands and standards. Our future success will depend on our ability to sign and initiate new programs that address the evolving needs of our customers on a timely and cost-effective basis, to advance existing programs and to pursue new market opportunities that develop as a result of technological and scientific advances. Additionally, our customers may face significant competition or other risks which may adversely impact our business and results of operations.

There are a number of companies in the broader synthetic biology industry, and our future success will depend on our ability to maintain a competitive position with respect to technological advances. Technological development by others may result in our platform becoming obsolete. Our ability to compete successfully will depend on our ability to develop proprietary technologies that enable our customers to develop products using our platform in a manner that is either less expensive, faster, superior or otherwise differentiated from what a competitor's technologies and products might enable. If we are unable to continue to successfully advance our platform or the services it provides at scale, or if our customers are unable to commercialize the products or processes made or improved upon by using our platform, our business and results of operations will be adversely impacted.

Due to the significant lead time involved in launching a new program or developing a new product or process using our platform, our customers are required to make a number of assumptions and estimates regarding the commercial feasibility of a new product, including assumptions and estimates regarding the size of an emerging product category and demand for those end-products and processes which will use our technology, the ability to scale-up manufacturing processes to produce a product on a commercial scale, the ability to penetrate that emerging product category, customer adoption of a downstream product, the existence or non-existence of products being simultaneously developed by competitors, potential market penetration and obsolescence, planned or unplanned. As a result, it is possible that we may commence a new program with a customer who wishes to develop a product or process that has been displaced by the time of launch, addresses a market that no longer exists or is smaller than previously thought, that end-consumers do not like or otherwise is not competitive at the time of launch, in each case, after the incurrence of significant opportunity costs on our part to develop such product. The ultimate success of the products developed by our customers using our services may be dependent on the success of other markets in which we or our customers do not operate in or have knowledge or expertise or which, in each case, may not reach the size anticipated by us or our customers or may be replaced by another emerging product category or eliminated entirely.

The market, including customers and potential investors, may be skeptical of our ability to deliver on programs because they are based on a relatively novel and complex technology.

The market, including customers and potential investors, may be skeptical of the viability and benefits of bioengineered products as well as our enabling abilities, including our platform and programs, because they are based on a relatively novel approach and the adoption of complex technology and because we are still demonstrating to the market the value of our platform. There can be no assurance that our platform and programs will be understood, approved, or accepted by customers, regulators and potential investors or that we will be able to sell our services profitably at competitive prices and with features sufficient to establish demand.

In addition, in order for novel products from our programs to be successfully commercialized, support from the entire relevant supply chain is needed. Relationships with all parts of the supply chain are important in order to gain visibility into market trends and feature and specification requirements and in order to ensure customers are able to successfully manufacture their products, obtain regulatory approval and gain access to key distribution channels. If we are unable to convince these potential customers, their suppliers, or the consumers who purchase products containing or made or developed using engineered cells and/or biomanufacturing processes, of the utility and value of such products or that such products are superior to the products they currently use, we will not be successful in entering these markets and our business and results of operations will be adversely affected. If potential investors are skeptical of the success of our platform or cell programs, our ability to raise capital and the value of our common stock may be adversely affected.

Ethical, legal and social concerns about GMOs and Genetically Modified Materials and their resulting products could limit or prevent the use of products or processes using our technologies, limit public acceptance of such products or processes and limit our revenues.

Our technologies and the technologies of our customers involve the use of genetically modified cells, organisms and biomaterials, including, without limitation, GMOs, GMMs, Genetically Modified Materials and their respective products. The use, production and marketing of Genetically Modified Materials, are subject to laws and regulations in many countries, some of which are new and some of which are still evolving. In the United States, the FDA, the EPA and the USDA are the primary agencies that regulate the use of GMOs, GMMs and potential products derived from GMOs or GMMs. If regulatory approval of the Genetically Modified Materials or resulting products is not secured, our business operations, financial condition and our ability to grow as a business could be adversely affected. We expect to encounter regulations regarding Genetically Modified Materials in most, if not all, of the countries in which our customers may seek to establish production capabilities or sell their products and the scope and nature of these regulations will likely be different from country to country. Governmental authorities could, for safety, social or other purposes, impose limits on, or implement regulation of, the use, production or marketing of Genetically Modified Materials. If our customers cannot meet the applicable requirements in other countries in which they intend to produce or sell their products, or if it takes longer than anticipated to obtain such approvals, our business could be adversely affected.

In addition, public perception regarding the safety and environmental hazards of, and ethical concerns over, Genetically Modified Materials or the processes used to create them, including gene editing or gene regulating technologies, could influence public acceptance of our and our customers' technologies, products, and processes. For instance, certain advocacy groups engage in efforts that include regulatory legal challenges and labeling campaigns for genetically modified products, as well as application of pressure to consumer retail outlets seeking a commitment not to carry genetically modified foods. These groups in the past have pressured retail food outlets and grocery store chains to publicly state that they will not carry genetically modified foods and have pressured food brands to publicly state that they will not use ingredients produced by genetically modified microbes. In addition, certain labeling-related initiatives have heightened consumer awareness of GMOs, which may make consumers less likely to purchase products containing GMO ingredients, and could have a negative impact on the commercial success of our customers' products and programs. These concerns could result in increased expenses, regulatory scrutiny, delays or other impediments to our programs. The subject of Genetically Modified Materials has received negative publicity, which has aroused public debate. This adverse publicity has led to, and could continue to lead to, greater regulation and trade restrictions on imports of Genetically Modified Materials or their resulting products. In addition, with the acquisitions of Dutch DNA Biotech B.V., FGen, and Altar, we are expanding into the European Union market, which has increased government regulation and scrutiny over genetically modified products. There is a risk that products produced using our technologies could cause adverse health effects or other adverse events, which could also lead to negative publicity, regulatory action or private litigation. If we are unable to overcome the ethical, legal and social concerns relating to genetic engineering, our programs could face increased expenses, regulatory scrutiny, delays or other impediments to deliver our programs or the commercialization of resulting products and processes.

Finally, the COVID-19 pandemic may increase biosecurity concerns by public and/or governmental stakeholders regarding genetic engineering technologies and risks around engineered viruses, microbes and organisms. Such concerns, restrictions, or governmental restrictions could limit the use of Genetically Modified Materials in our customers' products, which could have a material adverse effect on our business, financial condition and results of operations.

Risks Related to Intellectual Property

If we are unable to obtain, maintain and defend patents protecting our intellectual property, our competitive position will be harmed.

Our success depends in part on our ability to obtain and maintain intellectual property protection for our proprietary technologies. We protect our proprietary technologies through patents and trade secrets, both of which entail risk. If we are unable to obtain, maintain or protect intellectual property rights related to our technology, or if our intellectual property rights are inadequate, our competitive position, business, financial conditions, results of operations and prospects may be harmed.

Because of the volume and nature of our inventions, patent protection may not be practicable, available, or appropriate for some aspects of our proprietary technologies. While we own patents and pending patent applications in the United States and in foreign jurisdictions, these applications do not ensure the protection of our intellectual property. There may be prior art of which we are not aware. Additionally, obtaining, maintaining, defending and enforcing patents is costly, time consuming and complex, and we may not be able to file and prosecute all necessary or desirable patent applications, or maintain and enforce any patents that may issue from such patent applications at a reasonable cost or in a timely manner. It is also possible that we

will fail to identify patentable aspects of our technologies before it is too late to obtain patent protection. Although we enter into confidentiality agreements with parties who have access to confidential or patentable aspects of our R&D output, such as our employees, collaborators, consultants, advisors and other third parties, any of these parties may breach the agreements and disclose such output before a patent application is filed, thereby jeopardizing our ability to seek patent protection.

Further, pending applications may not be issued or may be issued with claims significantly narrower than we currently seek. Patents for which claims have been allowed may be successfully challenged and invalidated. Unless and until our pending applications issue, their protective scope is impossible to determine and, even after issuance, their protective scope may be limited.

Recent changes in patent law have made patents covering life science inventions more difficult to obtain and enforce. Further legislative changes or changes in the interpretation of existing patent law could increase the uncertainty and cost surrounding the prosecution of our owned patent applications and the maintenance, enforcement or defense of our owned patents. The Leahy-Smith America Invents Act ("the Leahy-Smith Act") included changes that affect the way patent applications are prosecuted; redefine prior art; enable third-party submission of prior art to the United States Patent and Trademark Office ("USPTO") during patent prosecution; and provide cost-effective avenues for competitors and other third parties to challenge the validity of patents at USPTO-administered post-grant proceedings, including post-grant review, inter partes review, and derivation proceedings. Thus, the Leahy-Smith Act and its continued implementation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents, all of which could have a material adverse effect on our business, financial condition, results of operations, and prospects.

Other changes in the law may further detract from the value of life science patents and facilitate challenges to our patents. In some cases, we use genetic sequence information from naturally occurring organisms, which may not be patentable. Recent U.S. Supreme Court rulings have narrowed the scope of patent protection for naturally occurring sequences and for inventions based on the observation and exploitation of natural phenomena. These decisions have weakened the rights of patent owners in certain situations. The U.S. Court of Appeals for the Federal Circuit has also issued a series of rulings that create obstacles to the patenting of groups of genetic sequences that share functional characteristics, making it more difficult to obtain claims to certain genetic constructs, particularly antibodies. These changes in the law have created uncertainty with respect to the validity and enforceability of patents covering natural and engineered sequences. Depending on future actions by the U.S. Congress, the federal courts and the USPTO, the laws and regulations governing patents could change in unpredictable ways that could have a further material adverse effect on our patent rights and our ability to protect, defend and enforce our patent rights in the future.

Further, the issuance of a patent is not conclusive as to its inventorship, scope, validity or enforceability, and our patents may be challenged in the courts or patent offices in the United States and abroad. An adverse determination in any such challenge could result in loss of exclusivity, or patent claims being narrowed, invalidated or held unenforceable, in whole or in part. Any of these results could limit our ability to stop others from using or commercializing similar or identical technology to compete directly with us. In addition, if the breadth or strength of protection provided by our patents or patent applications is threatened, regardless of the outcome, it could dissuade companies from collaborating with us. Such proceedings also may result in substantial cost and require significant time from our scientists and management, even if the eventual outcome is favorable to us.

The laws of some foreign countries do not protect intellectual property rights to the same extent as do the laws of the United States or may apply different rules concerning the assignment of intellectual property rights. Many companies have encountered significant problems in protecting and defending intellectual property rights in certain foreign jurisdictions. We may encounter similar difficulties, particularly as we expand to work with foreign employees and contractors and expand our collaboration activities into foreign markets. The legal systems of certain countries, particularly certain developing countries, do not favor the enforcement of patents by foreign holders and, in some cases, do not favor the enforcement of patents at all, particularly patents in the life sciences. This could make it difficult for us to stop the infringement of our patents. 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 and could be unsuccessful.

Reductions in the scope or enforceability of our patent protection may adversely affect our customers' ability to commercialize their products and may thus reduce our downstream value from royalties, equity, or commercial milestone payments.

If we are unable to protect the confidentiality of our trade secrets, our business and competitive position will be harmed.

Because patent protection may not be available or appropriate for significant aspects of the technology we are developing, our success may depend in large part on our proprietary information, including genetic and other chemical and biological data, processes, know-how, and other trade secrets developed over years of R&D, some of which are embodied in proprietary software. We rely heavily on trade secret protections, especially in cases where we believe patents or other forms of registered intellectual property protection may not be appropriate or obtainable. However, trade secrets are difficult to protect. The secrecy of the Company's trade secrets must be maintained for them to retain their status and protection as trade secrets. While we strive to protect the secrecy of our trade secrets and other proprietary information, including by requiring our employees, customers, consultants, and contractors to enter into confidentiality agreements and instituting multilayered protections covering our digital environment and biomaterials, we may not be able to adequately protect our trade secrets or other proprietary information. We cannot guarantee that we have entered into such agreements with every party that may have or has had access to our trade secrets, biomaterials or proprietary technology and processes. Further, despite these efforts, any of these parties may breach the agreements and disclose our proprietary information, including our trade secrets, and we may not be able to obtain adequate remedies for such breaches.

We seek to preserve the integrity and confidentiality of our information by maintaining physical security of our premises and physical and electronic security of our information technology systems, but it is possible that these security measures could be breached. We also rely on systems provided by third parties, which may suffer security breaches or incidents. Such security breaches may be inadvertent or may come about due to intentional misconduct or other malfeasance or by human error or technical malfunctions, including those caused by hackers, employees, contractors, or vendors. It may be difficult or impossible to recover trade secrets or other confidential information once it is hacked, and hackers may operate from jurisdictions that will not cooperate with such efforts. Enforcing any claim that a third party unlawfully obtained and is using any of our trade secrets is expensive and time consuming, and the outcome is unpredictable. In addition, courts in some jurisdictions are less willing or unwilling to protect trade secrets even when a hacker or thief can be identified.

Our competitors may lawfully obtain or independently develop knowledge that is equivalent to one or more of our trade secrets. Were they to do so, we would be unable to prevent them from using that independently developed knowledge. Such a competitor could claim that we had learned the trade secret from them and bring an action against us on that basis. If any of our trade secrets were to be disclosed to or independently developed by a competitor or other third party, our competitive position could be materially and adversely harmed. Moreover, a competitor could file for patent protection covering intellectual property that we have chosen to protect as a trade secret. In such a case, we might be restricted or excluded from using that intellectual property even if we had developed it before our competitor did.

Our facilities hold large collections of microbial strains, cell lines and other biomaterials. Failure to implement adequate controls and protections, failure to implement adequate disposal procedures, unauthorized visitors in the labs, or customers' failure to adequately protect biological materials can put us and our customers at risk of losing valuable assets through negligence or theft and enabling the use of those lost materials by our competitors. While we believe that we take reasonable measures to protect the security of biomaterials owned by us or our customers, it is possible that our security controls and practices may not prevent unauthorized or other improper access to such genetic material. Any unauthorized access, acquisition, use, destruction, or release of the GMOs we engineer could result in our having exposure to significant liability under our contracts, as well as to regulatory actions, litigation, investigations, remediation obligations, damage to our reputation and brand, supplemental disclosure obligations, loss of customer, consumer, or partner confidence in the security of our platform, impairment to our business, and corresponding fees, costs, expenses, loss of revenues, and other potential liabilities.

Our customers sometimes provide organisms, genetic material and/or data to us in connection with our collaborations. In the event that we fail to protect customer materials or data or inadvertently use such materials or data for unauthorized purposes, we could be liable to our customers under trade secret laws or contractual provisions.

There could be unintended consequences to the environment generally or the health and safety of our employees or the public as a result of an unauthorized release of Genetically Modified Materials into uncontrolled environments. In addition, if a biosecurity breach or unauthorized release of genetic material were to occur within our industry, our customers and potential customers might lose trust in the security of the laboratory environments in which we produce GMOs, even if we are not directly affected. Any adverse effect resulting from such a release, by us or others, could have a material adverse effect on the public acceptance of our products and business and our financial condition. Such a release could result in enhanced regulatory activity, and we could have exposure to liability for any resulting harm.

We may be subject to claims challenging the inventorship or ownership of our patents, biomaterials and other intellectual property.

Certain of our employees, consultants and contractors were previously employed at universities or other software or biotechnology companies, including our competitors or potential competitors. Additionally, some of our consultants or contractors may have ongoing relationships with universities. Although we try to ensure that our employees, consultants and contractors do not use the intellectual property of others in their work for us, we may be subject to claims that these individuals or other contractors have used or disclosed intellectual property, including trade secrets or other proprietary information, of another. Litigation may result from these claims.

While it is our policy to require that our employees, consultants and contractors who may be involved in the development of intellectual property for us execute agreements assigning such intellectual property to us, we may be unsuccessful in executing such an agreement with each party who in fact develops intellectual property that we regard as our own. Our intellectual property assignment agreements with them may not be self-executing or may be breached, and we may be forced to bring claims against third parties, or defend claims they may bring against us, to determine the ownership of what we regard as our intellectual property. Such claims could have a material adverse effect on our business, financial condition, results of operations and prospects.

If we are unsuccessful in litigating any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel, which could have a material adverse effect on our competitive business position and prospects. Such intellectual property rights could be awarded to a third party, and we could be required to obtain a license from such third party to use or commercialize our technology or products, which license might not be available on commercially reasonable terms, or at all. Even if we are successful in prosecuting or defending against such claims, litigation could result in substantial costs and be a distraction to our management and employees.

The life science academic and research community has abided by norms of free exchange of biomaterials, but recently, norms have begun to change so that parties may assert ownership and control over biomaterials that they permitted to be freely disseminated in the past. Thus, despite our best efforts to confirm our right to use biomaterials in our possession, we may use organisms that we believe to be free of encumbrance that are, in fact, subject to claims of title by others. In such a situation, litigation may be required to clear title, if it can be cleared at all. Similarly, we may be subject to claims that we have used biomaterials obtained from licensors or repositories for unauthorized purposes, or purposes not consistent with the licensing terms of the providing organization.

We may become involved in lawsuits or other enforcement proceedings to protect or enforce our patents or other intellectual property, which could be expensive, time consuming and potentially unsuccessful.

Competitors and other third parties may infringe or otherwise violate our issued patents or other intellectual property. In addition, our patents may become involved in inventorship, ownership, or priority disputes. We may also become subject to claims by collaboration partners that intellectual property or biomaterials that we believe to be owned by us are actually owned by them. Any litigation concerning any of these issues would be expensive, time consuming and uncertain. There can be no assurances that we would prevail in any suit brought by us or against us by third parties, or successfully settle or otherwise resolve those claims. Significant litigation would have substantial costs, even if the eventual outcome were favorable to us, and would divert management's attention from our business objectives.

Under certain circumstances, we may share or lose rights to intellectual property developed under U.S. federally funded research grants and contracts.

Some of our inventions, data, or other intellectual property have been or may be developed during the course of research funded by the U.S. government. The U.S. government may have the right to take title to government-funded inventions if we fail to disclose the inventions to the government in a timely manner or fail to file a patent for the intellectual property within specified time limits. Further, in consequence of our receiving government funding, the U.S. government may have certain rights to intellectual property that we use in our platform or programs pursuant to the Bayh-Dole Act of 1980, as amended (the "Bayh-Dole Act"). Under the Bayh-Dole Act, U.S. government rights in certain "subject inventions" developed under a government-funded program may include a non-exclusive, irrevocable worldwide license to use inventions for any governmental purpose. In some circumstances, the U.S. government may acquire unlimited rights in data we generate. In addition, the U.S. government has the right to require us, or an assignee or exclusive licensee to U.S. Government-funded inventions, to grant licenses to any of these inventions to the government or a third party if the government determines that: (i) adequate steps have not been taken to commercialize the invention; (ii) government action is necessary to meet public health or safety needs; (iii) government action is necessary to meet requirements for public use under federal regulations; or

(iv) the right to use or sell such inventions is exclusively licensed to an entity within the United States and substantially manufactured outside the United States without the U.S. government's prior approval. Additionally, we may be restricted from granting exclusive licenses for the right to use or sell such inventions unless the licensee agrees to comply with relevant Bayh-Dole Act restrictions (e.g., manufacturing substantially all of the invention in the United States) and reporting requirements. In addition, the U.S. government may acquire title in any country in which a patent application is not filed. Certain technology and inventions are also subject to transfer restrictions during the term of these agreements with the U.S. government and for a period thereafter. These restrictions may limit sales of products or components, transfers to foreign subsidiaries for the purpose of the relevant agreements, and transfers to certain foreign third parties. If any of our intellectual property becomes subject to any of the rights or remedies available to the U.S. government or third parties pursuant to the Bayh-Dole Act, this could impair the value of our intellectual property and could adversely affect our business.

The use of digital genetic sequence information may be subject to the Nagoya Protocol, which could increase our costs and adversely affect our business.

The Nagoya Protocol is a supplemental agreement to the Convention on Biological Diversity ("CBD"). The Nagoya Protocol is designed to provide for equitable sharing of benefits arising from the utilization of genetic resources and traditional knowledge. Under the Nagoya Protocol, countries possessing genetic resources ("source countries") are tasked with setting up procedures and institutional infrastructure for researchers to obtain prior informed consent, both from the source country and from any relevant indigenous or traditional communities, for biological research. Many have been slow to adopt workable institutions permitting the rational negotiation of benefit-sharing agreements. Many source countries are now asserting that the use of digital genetic sequence information is subject to the constraints of the Nagoya Protocol or similar national- or local-level benefit-sharing requirements. It is unclear whether this position will ultimately be adopted or what the implications of such adoption might be. It is unclear what a source country might assert if we used genetic sequences (i) extracted by a third party from a natural resource that was removed from its source country before that source country ratified the CBD or signed the Nagoya Protocol (ii) extracted by a third party and uploaded to public sequence databases after the source country ratified the CBD; (iii) in a heterologous host organism; or (iv) as a base for further engineering, so that the sequence we use no longer conforms to the natural sequence on which it was based.

We make extensive use of public and proprietary sequence databases to support our work. While we undertake efforts to identify and comply with laws and international protocols relating to the use of genetic resources, the uncertainty surrounding the use of digital sequence information and the lack of workable institutions in many source countries for the efficient negotiation of benefit-sharing agreements may limit our use or cause uncertainty in our use of certain sequences that we obtain from public access databases or natural sources. New financial obligations may arise regarding our use of sequence information. Customers that must certify their compliance with Nagoya Protocol obligations may be reluctant to do business with us unless we engage in expensive and time-consuming benefit-sharing negotiations with source countries of publicly available genetic sequences. These changes could increase our R&D costs and adversely affect our business, financial condition, and results.

Third party patents may limit our freedom to operate in certain areas, which may adversely affect our business.

There may be patents that affect our freedom to operate in certain areas, and we may as a result choose to design around or license such patents from third parties. If we must spend significant time and money designing around or licensing patents held by others, our business and financial prospects may be harmed. We may be restricted from carrying out certain operations in our Foundry, or we may be limited in our ability to design new products for our customers. We may become subject to claims by third parties alleging that we are infringing, misappropriating, or otherwise violating their intellectual property rights.

If we are sued for infringing, misappropriating, or otherwise violating intellectual property rights of third parties, such litigation could be costly and time consuming and could prevent or delay us from using our platform and technologies.

Any litigation arising from any dispute relating to the intellectual property of third parties would be expensive, time-consuming, and uncertain. There can be no assurance that we would prevail in any such dispute. Parties making claims against us might be able to obtain injunctive or other relief, which could block our or our customers' ability to develop, commercialize and sell products or use our technologies, and could result in the award of substantial damages against us, including treble damages, attorney's fees, costs and expenses if we were found to have willfully infringed. In the event of a successful claim against us, we or our customers might be required to pay damages and ongoing royalties, and obtain licenses from third parties, or be prohibited from selling certain products or using certain technologies. We may not be able to obtain these licenses on acceptable or commercially reasonable terms, if at all. In addition, we or our customers could encounter delays in product or service introductions while we attempt to develop alternative designs or redesign existing products or

technologies to avoid or resolve these claims. Our loss in any lawsuit or failure to obtain a license could prevent us from using our platform and technologies. Such a loss or failure could materially affect our business and reputation. Any litigation pertaining to these issues would have substantial costs, even if the eventual outcome were favorable to us, and would divert management's attention from our business objectives.

If our trademarks and trade names are not adequately protected, then we may not be able to build name recognition in our markets of interest and our business may be adversely affected.

Our registered or unregistered trademarks or trade names may be challenged, infringed, diluted, tarnished, circumvented or declared generic or determined to be infringing on other marks. We may not be able to protect our rights to these trademarks and trade names, which we need to build name recognition among potential collaborators or customers in our markets of interest. At times, competitors may adopt trade names or trademarks similar to ours, thereby impeding our ability to build brand identity and possibly leading to market confusion. In addition, there could be potential trade name or trademark infringement, dilution or tarnishment claims brought by owners of other trademarks or trademarks that incorporate variations of our registered or unregistered trademarks or trade names. Over the long term, if we are unable to establish name recognition based on our trademarks and trade names, then we may not be able to compete effectively and our business may be adversely affected. Our efforts to enforce or protect our proprietary rights related to trademarks, trade names, trade secrets, domain names, copyrights or other intellectual property may be ineffective and could result in substantial costs and diversion of resources and could adversely affect our business, financial condition, results of operations and prospects.

Any claims or lawsuits relating to infringement of, misappropriating, or otherwise violating intellectual property rights brought by or against us will be costly and time consuming and may adversely affect our business, financial condition and results of operations.

Any of the risks identified above could result in significant litigation. In addition to the specific litigation-related risks identified above, litigation of any kind carries certain inherent risks. Because of the substantial amount of discovery required in connection with litigation in U.S. courts, there is a risk that some of our confidential information could be compromised in the discovery process. There could be public announcements of the results of hearings, motions or other interim proceedings or developments. If securities analysts or investors perceive these results to be negative, it could have a substantial adverse effect on our share price.

Further, our agreements with some of our customers, suppliers or other entities require us to defend or indemnify these parties if they become involved in infringement claims that target our products, services or technologies, or in certain other situations. If we must defend or indemnify third parties, we could incur significant costs and expenses that could adversely affect our business, operating results or financial condition.

Intellectual property rights do not necessarily address all potential threats to our business.

The degree of future protection afforded by our intellectual property rights is uncertain because intellectual property rights have limitations and may not adequately protect our business or permit us to maintain our competitive advantage. The following examples are illustrative:

- we may choose not to file a patent in order to maintain certain intellectual property as trade secrets or know-how, and a third party may subsequently file a patent covering such intellectual property;
- others may independently develop similar or alternative technologies or duplicate any of our technologies without infringing our owned or licensed intellectual property rights;
- the patents of others may harm our business;
- we might not have been the first to make the inventions covered by the issued patents or pending patent applications that we own;
- we might not have been the first to file patent applications covering certain of our inventions; and
- issued patents that we hold rights to may fail to provide us with any competitive advantage, or may be held invalid or unenforceable, including as a result of legal challenges by our competitors.

Should any of these events occur, they could harm our business, financial condition, results of operations and prospects.

Intellectual property disputes of third parties and customers could have a material adverse effect on our business, financial condition, and results.

We rely, and expect to continue to rely on, certain capital equipment, machinery, consumables, reagents, software, services and intellectual property that we purchase or license from third parties for use in our operations, platform, products, services and offerings. We cannot be certain that our vendors, suppliers, and licensors are not infringing upon the intellectual property rights of others or that they have sufficient rights to the third-party technology used in our business in all jurisdictions in which we may operate. Disputes with any of these third parties over uses or terms could result in the payment of additional royalties or penalties by us, cancellation or non-renewal of the underlying license, termination of supplies or rights to use, or litigation. In the event that we cannot resolve issues of this kind, we may be required to discontinue or limit our use of the operations, platform, products, services or offerings that include or incorporate the licensed intellectual property. Any such discontinuation or limitation could have a material and adverse impact on our business, financial condition and results of operation.

Our customers may become involved in intellectual property disputes with third parties that are related or unrelated to any products or services we have supplied or rendered to them. Such disputes could result in a customer being unable to market its products, thus depriving us of license, milestone, or other revenues. Such deprivation could have a material adverse impact on our financial condition and results.

Our use of "open-source" software could negatively affect our ability to market or provide our services and could subject us to possible litigation.

We have used "open-source" software in connection with the development and deployment of our software platform, and we expect to continue to use open-source software in the future. Open-source software is licensed by its authors or other third parties under open-source licenses, which in some instances may subject us to certain unfavorable conditions, including requirements that we offer our products that incorporate the open-source software for no cost, that we make publicly available all or part of the source code for any modifications or derivative works we create based upon, incorporating or using the open-source software, or that we license such modifications or derivative works under the terms of the particular open-source license.

Companies that incorporate open-source software into their products have, from time to time, faced claims challenging the use of open-source software and compliance with open-source license terms. We could be subject to similar suits by parties claiming ownership of what we believe to be open-source software or claiming noncompliance with open-source licensing terms. While we monitor our use of open-source software and try to ensure that none is used in a manner that would require us to disclose our proprietary source code or that would otherwise breach the terms of an open-source agreement, we cannot guarantee that we will be successful, that all open-source software is reviewed prior to use in our platform, that our developers have not incorporated open- source software into our products that we are unaware of or that they will not do so in the future.

Furthermore, there are an increasing number of open-source software license types, almost none of which have been interpreted by U.S. or foreign courts, resulting in a dearth of guidance regarding the proper legal interpretation of such licenses. As a result, there is a risk that open-source software licenses could be construed in a manner that imposes unanticipated conditions or restrictions on our ability to market or provide our products and services. If we are held to have breached or failed to fully comply with all the terms and conditions of an open-source software license, we could face infringement claims or other liability, or be required to seek costly licenses from third parties to continue providing our offerings on terms that are not economically feasible, if at all, to re-engineer all or a portion of our platform, to discontinue or delay the provision of our offerings if re-engineering could not be accomplished on a timely basis or to make generally available, in source code form, our proprietary code. Further, in addition to risks related to license requirements, use of certain open-source software carries greater technical and legal risks than does the use of third-party commercial software. For example, open-source software is generally provided without any support or warranties or other contractual protections regarding infringement or the quality of the code, including the existence of security vulnerabilities. To the extent that our platform depends upon the successful operation of open-source software, any undetected errors or defects in open-source software that we use could prevent the deployment or impair the functionality of our systems and injure our reputation. In addition, the public availability of such software may make it easier for others to compromise our platform. Any of the foregoing risks could materially and adversely affect our business, financial condition and results of operations.

Risks Related to Personnel, IT and Physical Infrastructure

Loss of key personnel, including our founders and senior executives, and/or failure to attract, train and retain additional key personnel could delay our cell engineering programs, harm our platform development efforts, limit our biosecurity and public health offerings, and harm our ability to meet our business objectives, particularly given the substantial investment required to recruit, hire and train our employees.

Our business involves complex, global operations across a variety of markets and requires a management team and employee workforce that is knowledgeable in the many areas in which we operate. Our future success depends upon our ability to attract, train, retain and motivate highly qualified management, scientific, engineering, information technology, operations, business development and marketing personnel, among others. In addition, the market for qualified personnel is very competitive because of (a) the limited number of people available who have the necessary technical skills and understanding of our technology and products and (b) the nature of our industry which requires certain of our technical personnel to be on-site in our facilities. We compete for qualified technical personnel with other life sciences and information technology companies, as well as academic institutions and research institutions in the markets in which we operate, including: Massachusetts, USA; California, USA; The Netherlands; France; and Switzerland. In addition, as we add international operations, we will increasingly need to recruit qualified personnel outside the United States. However, doing so may also require us to comply with laws to which we are not currently subject, which could cause us to allocate or divert capital, personnel and other resources from our organization, which could adversely affect our business, financial condition, results of operations, prospects and reputation. Establishing international operations and recruiting personnel has been, and may continue to be, impacted by COVID-19 travel and operational restrictions. Our senior leadership team is critical to our vision, strategic direction, platform development, operations and commercial efforts. Our employees, including members of our leadership team, could leave our company with little or no prior notice and would be free to work for a competitor. We also do not maintain "key person" life insurance on any of our employees. The departure of one or more of our founders, senior leadership team members or other key employees could be disruptive to our business until we are able to hire qualified successors.

Our continued platform development, growth and commercial success depends, in part, on recruiting and retaining highly-trained personnel across our various target industries and markets with the necessary background and ability to develop and use our platform and to effectively identify and sell to current and new customers. New hires and employees onboarded as a result of any of our recent acquisitions may require significant training and, in most cases, take significant time before they achieve full productivity. Our failure to successfully hire and integrate these key personnel into our business could adversely affect our business. To attract top talent, we believe we will need to offer competitive compensation and benefits packages, including equity incentive programs, which may require significant investment. If we are unable to offer competitive compensation this may make it more difficult for us to attract and retain key employees. Moreover, if the perceived value of our equity awards declines, it may adversely affect our ability to attract and retain key employees. If we do not maintain the necessary personnel to accomplish our business objectives, we may experience staffing constraints that adversely affect our ability to support our programs and operations.

In addition, some of our personnel are qualified foreign nationals whose ability to live and work in the U.S. is contingent upon the continued availability of appropriate visas and whose ability to work on some of our technologies may require the procurement of appropriate export licenses. Due to the competition for qualified personnel in the key markets in which we operate, we expect to continue to utilize foreign nationals to fill part of our recruiting needs. As a result, changes to United States immigration policies have restrained, and could further restrain, the flow of technical and professional talent into the United States and adversely affect our ability to hire and retain qualified personnel.

Our business and results of operations are dependent on adequate access to laboratory and office space and suitable physical infrastructure, including electrical, plumbing, HVAC and network infrastructure, to conduct our operations. Our headquarters and certain of our laboratories are located in a flood zone in Boston's Seaport District. Other facilities are located in active earthquake and tsunami zones or in active hurricane or wildfire zones. If we are unable to access enough space or we experience failures of our physical infrastructure, including due to natural disaster affecting us or our suppliers, our business and results of operations could be adversely affected.

Our business depends on providing customers with technical services. In order to properly conduct our business, we need access to sufficient laboratory space and equipment to perform the activities necessary to advance and complete our programs. Additionally, we need to ensure that our laboratories and corporate offices remain operational at all times, which includes maintaining suitable physical infrastructure, including electrical, plumbing and HVAC, logistics and transportation systems and network infrastructure. We own certain properties in California and lease most of our laboratories and office spaces. We rely on the landlords for basic maintenance of our leased laboratories and office buildings. If one of our landlords

has not maintained a leased property sufficiently, we may be forced into an early exit from the facility, which could be disruptive to our business. Furthermore, we may continue to acquire laboratories not built by us in order to sufficiently scale and expand our output capacity. If we discover that these buildings and their infrastructure assets are not in the condition we expected when they were acquired, we may be required to incur substantial additional costs to repair or upgrade the laboratories.

Problems in and around one or more of our laboratories or corporate offices, whether or not within our control, could result in service interruptions or significant infrastructure or equipment damage. These could result from numerous factors, including:

- human error;
- equipment failure;
- physical, electronic and cybersecurity breaches;
- fire, earthquake, hurricane, flood, tornado and other natural disasters;
- extreme temperatures;
- flood and/or water damage;
- fiber cuts;
- power loss;
- terrorist acts, including acts of bioterrorism;
- sabotage, vandalism and cyberattacks; and
- local epidemics or global pandemics such as the COVID-19 pandemic.

Certain of our facilities are located in an active earthquake and tsunami zone, and certain of our suppliers conduct their operations in the same region or in other locations that are susceptible to natural disasters. The occurrence of a natural or other disaster, such as an earthquake, tsunami, hurricane, drought, flood, fire, wildfire or any potential effects of climate change or localized extended outages of critical utilities or transportation systems, or any critical resource shortages affecting us or our suppliers or manufacturers could cause a significant interruption in our business, damage or destroy our facilities, production equipment or inventory or those of our suppliers and cause us to incur significant costs or result in limitations on the availability of our raw materials, any of which could harm our business, financial condition and results of operations.

We have timeline obligations to certain customers with respect to their programs. As a result, service interruptions or significant equipment damage in our laboratories could result in difficulty maintaining program timelines for these customers and potential claims related to such failures. Because the services we provide in our laboratories are critical to many of our customers' businesses, service interruptions or significant equipment damage in our laboratories could also result in lost revenue or other indirect or consequential damages to our customers. We cannot guarantee that a court would enforce any contractual limitations on our liability in the event that one of our customers brings a lawsuit against us as a result of a problem at one of our laboratories and we may decide to reach settlements with affected customers irrespective of any such contractual limitations. In addition, any loss of service, equipment damage or inability to meet our service obligations could reduce the confidence of our customers and could consequently impair our ability to obtain and retain customers, which would adversely affect both our ability to generate revenues and our operating results.

Furthermore, we are dependent upon internet service providers, telecommunications carriers and other website operators, some of which have experienced significant system failures and electrical outages in the past.

Our customers may, in the future, experience difficulties due to system failures unrelated to our systems and offerings. If, for any reason, these providers fail to provide the required services, our business, financial condition and results of operations could be materially and adversely impacted.

Risks Related to Financial Reporting

We rely on our customers, joint venturers, equity investees and other third parties to deliver timely and accurate information in order to accurately report our financial results in the time frame and manner required by law.

We need to receive timely, accurate, and complete information from a number of third parties in order to accurately report our financial results on a timely basis. If the information that we receive is not accurate or complete, or if a third party differs from us in its interpretation of accounting rules, our consolidated financial statements may be materially incorrect and may require restatement, or we may otherwise be required to correct our prior financial reporting. Although we have audit rights with third parties, performing such an audit could be expensive and time consuming and may not be adequate to reveal any discrepancies in a time frame consistent with our reporting requirements. We have had, and in the future may have, difficulty

completing accurate and timely financial disclosures, which could have an adverse effect on our business. For example, we amended our 2021 Annual Report on Form 10-K to include significant investee financial statements in connection with one of our equity method investments.

We use estimates in determining the fair value of certain assets and liabilities. If our estimates prove to be incorrect, we may be required to write down the value of these assets or write up the value of these liabilities, which could adversely affect our financial position.

Our ability to measure and report our financial position and operating results is influenced by the need to estimate the fair value of an asset or liability. Fair value is estimated based on a hierarchy that maximizes the use of observable inputs and minimizes the use of unobservable inputs. Observable inputs are inputs that reflect the assumptions that market participants would use in pricing the asset or liability developed based on market data obtained from sources independent of the reporting entity. Unobservable inputs are inputs that reflect the reporting entity's own assumptions about the assumptions market participants would use in pricing the asset or liability developed based on the best information available in the circumstances. We estimate the impact or outcome of future events on the basis of information available at the time of the financial statements. An accounting estimate is considered critical if it requires that management make assumptions about matters that were highly uncertain at the time the accounting estimate was made. If actual results differ from management's judgments and assumptions, then they may have an adverse impact on our results of operations and cash flows.

Our ability to use our net operating loss carryforwards and certain other tax attributes may be limited.

We have incurred net losses since our inception and we may never achieve or sustain profitability. Generally, for U.S. federal income tax purposes, net operating losses incurred will carry forward. However, net operating loss carryforwards generated prior to January 1, 2018 are subject to expiration for U.S. federal income tax purposes. As of December 31, 2022, we had federal net operating loss carryforwards of approximately $1,838.0 million, of which $139.2 million begin to expire in 2029 and $1,698.8 million can be carried forward indefinitely. As of December 31, 2022, we had state net operating loss carryforwards of approximately $734.1 million, of which $661.9 million begin to expire in 2030 and $72.2 million can be carried forward indefinitely. As of December 31, 2022, we had foreign net operating losses of approximately $1.4 million, of which $0.5 million will begin to expire in 2030 and $0.9 million can be carried forward indefinitely. As of December 31, 2022, we had federal research and development tax credit carryforwards of approximately $30.3 million which begin to expire in 2029. As of December 31, 2022, we also had state research and development and investment tax credit carryforwards of approximately $55.7 million which begin to expire in 2030.

Under Sections 382 and 383 of the Internal Revenue Code of 1986, as amended, if a corporation undergoes an "ownership change," generally defined as a greater than 50% change by value in its equity ownership by certain stockholders over a three-year period, the corporation's ability to use its pre-ownership change net operating loss carryforwards and other pre-ownership change tax attributes, such as research tax credits, to offset its post- ownership change income or taxes may be limited. Similar provisions of state tax law may also apply to limit the use of our state net operating loss carryforwards and other state tax attributes. We have not performed an analysis to determine whether our past issuances of stock and other changes in our stock ownership may have resulted in one or more ownership changes. If it is determined that we have in the past experienced an ownership change, or if we undergo one or more ownership changes as a result of future transactions in our stock, which may be outside our control, then our ability to utilize our net operating loss carryforwards and other tax attributes may be materially limited. As a result, even if we earn taxable income, we may be unable to use a material portion of our net operating loss carryforwards and other tax attributes, which could adversely affect our future cash flows. There is also a risk that regulatory changes, such as suspensions on the use of net operating losses or other unforeseen reasons, may result in our existing net operating loss carryforwards expiring or otherwise becoming unavailable to offset future taxable income. For these reasons, we may not be able to utilize a material portion of our net operating loss carryforwards and other tax attributes even if we attain profitability.

We have identified material weaknesses in our internal controls over financial reporting, and we may identify additional material weaknesses in the future. A failure to maintain an effective system of internal control over financial reporting, may result in failure to accurately report our financial results or prevent fraud. As a result, stockholders could lose confidence in our financial and other public reporting, which would harm our business and the trading price of our common stock.

SEC and New York Stock Exchange ("NYSE") rules and regulations require, among other things, that we establish and periodically evaluate procedures with respect to our internal control over financial reporting. In addition, we are required to document and test our internal control over financial reporting pursuant to Section 404 of the Sarbanes-Oxley Act of 2002 so that our management can certify as to the effectiveness of our internal control over financial reporting. Likewise, our

independent registered public accounting firm is required to attest to the effectiveness of our internal control over financial reporting.

As disclosed in Part II—Item 9A, "Controls and Procedures", of this Annual Report on Form 10-K, in connection with the audit of our financial statements for the year ended December 31, 2022, we concluded that there were two material weaknesses in our internal controls over financial reporting: (1) we did not have effective management review controls to address the risks of material misstatement of various significant accounts, and we relied on external resources and specialists and did not maintain a sufficient complement of internal personnel with appropriate knowledge, experience and/or training commensurate with our technical accounting and financial reporting requirements in order to provide sufficient review and oversight over the level of precision, evidence and/or timeliness of management review controls; and (2) we did not have effective controls over the existence, completeness, and accuracy of data used in our controls and failed to maintain adequate information technology general controls over various key systems. The material weaknesses identified in Item 9A did not result in any material misstatement of our financial statements for any period presented.

Our remediation efforts with respect to our identified material weaknesses may be inadequate, and we may in the future discover other areas of our internal controls that require remediation.

We cannot provide assurances that there will not be additional material weaknesses or significant deficiencies in our internal control over financial reporting in the future. Any failure to maintain internal control over financial reporting could severely inhibit our ability to accurately report our financial condition, or results of operations. Any material weaknesses or significant deficiencies in our internal control over financial reporting could cause investors to lose confidence in the accuracy and completeness of our financial reports, the market price of shares of our common stock to decline, and result in sanctions or investigations by NYSE, the SEC or other regulatory authorities. Failure to remedy material weaknesses in our internal control over financial reporting or to implement or maintain other effective control systems could also restrict our future access to the capital markets.

Our cash and cash equivalents could be adversely affected if the financial institutions in which we hold our cash and cash equivalents fail.

We regularly maintain cash balances at third-party financial institutions, including Silicon Valley Bank, in excess of the Federal Deposit Insurance Corporation insurance limit. Silicon Valley Bank's failure to return certain of our deposits has impacted access to our invested cash or cash equivalents, and a similar failure of a depository institution to return these deposits, or if a depository institution is subject to other adverse conditions in the financial or credit markets, could further impact access to our invested cash or cash equivalents and could adversely impact our operating liquidity and financial performance.

Risks Related to Governmental Regulation and Litigation

Failure to comply with federal, state, local and international laws and regulations could adversely affect our business and our financial condition.

A variety of federal, state, local and international laws and regulations govern certain aspects of our business. For example, we maintain a registration from the DEA for the research of certain controlled substances and permits from the Boston Public Health Commission to conduct work with recombinant DNA. Some of our programs or products made or developed using our engineered cells and/or biomanufacturing processes are subject to regulations, including those promulgated by the FDA, DEA, EPA or USDA. Products utilized in our COVID-19 testing services are subject to regulations promulgated by the FDA, the Centers for Medicare and Medicaid Services, and certain state governments. In addition, we are subject to laws relating to, among other things, anti-bribery, insider trading, sourcing of biological materials and data privacy. The legal and regulatory requirements that apply to our business may be interpreted and applied in a manner that is inconsistent from one jurisdiction to another or may conflict with other rules or our practices. As a result, our practices may not comply, or may not comply in the future with all such laws, regulations, requirements and obligations. Any failure, or perceived failure, by us to comply with any federal, state, local or international laws, regulations, industry self-regulatory principles, industry standards or codes of conduct, regulatory guidance, orders to which we may be subject or other legal obligations could adversely affect our reputation, brand and business, and may result in claims, proceedings or actions against us by governmental entities or others or other liabilities or require us to change our operations. We may also be contractually required to indemnify and hold harmless third parties from the costs or consequences of non-compliance with any laws, regulations or other legal obligations.

We may also become subject to increasing regulation in the future as we expand our business. As we continue to expand our operations and offerings domestically and globally, we will have to expend significant management and financial resources to maintain compliant practices in those locations. Non-compliance could lead to litigation, which would require substantial management and financial resources.

We may incur significant costs complying with environmental, health and safety laws and regulations, and failure to comply with these laws and regulations could expose us to significant liabilities.

We use hazardous chemical and biological materials in our business and are subject to a variety of federal, state, local and international laws and regulations governing, among other matters, the use, generation, manufacture, transportation, storage, handling, disposal of, and human exposure to these materials, including regulation by governmental regulatory agencies, such as the Occupational Safety and Health Administration and the EPA. We have incurred, and will continue to incur, capital and operating expenditures and other costs in the ordinary course of our business in complying with these laws and regulations.

Although we have implemented safety procedures for storing, handling and disposing of these materials and waste products in an effort to comply with these laws and regulations, we cannot be sure that our safety measures will be compliant or capable of eliminating the risk of injury or contamination from the generation, manufacturing, use, storage, transportation, handling, disposal of and human exposure to hazardous materials and/or flammable chemicals. Failure to comply with environmental, health and safety laws could subject us to liability and resulting damages. There can be no assurance that violations of environmental, health and safety laws will not occur as a result of human error, accident, equipment failure, contamination, intentional misconduct 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, regulatory oversight costs, 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 imposed for the full amount of damages without regard to comparative fault for the investigation and cleanup of contamination and impacts to human health and for damages to natural resources. Contamination at properties we may own and operate and at properties to which we send hazardous materials, may result in liability for us under environmental laws and regulations.

Our business and operations may be affected by other new environmental, health and safety laws and regulations, which may require us to change our operations, or result in greater compliance costs and increasing risks and penalties associated with violations, which could impair our research, development or production efforts and harm our business.

If we fail to comply with healthcare and other governmental regulations, we could face substantial penalties and our business, financial condition and results of operations could be adversely affected.

Our business activities may be subject to regulation and enforcement by the FDA, U.S. Department of Justice, HHS, Office of Inspector General, and other federal and state governmental authorities. Although our offerings are not currently billed to any third-party payor, including any commercial payor or government healthcare program, we may, in the future, submit claims for our COVID-19 testing services to third-party payors, including government healthcare programs. If we submit claims to third-party payors, such activity will expand the scope of federal and state healthcare laws applicable to us.

Federal and state healthcare laws and regulations that may affect our ability to conduct business include, without limitation:

- the federal Anti-Kickback Statute, which prohibits, among other things, persons or entities from knowingly and willfully soliciting, offering, receiving or paying any remuneration, directly or indirectly, overtly or covertly, in cash or in kind, to induce or reward either the referral of an individual for, or the purchase, lease, order, or arranging for or recommending the purchase, lease or order of, any item or service, for which payment may be made, in whole or in part, under federal 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 federal physician self-referral prohibition, commonly known as the Stark Law, which prohibits a physician, in the absence of an applicable exception, from making a referral for certain designated health services covered by the Medicare or Medicaid program, including clinical laboratory services, if the physician or an immediate family member of the physician has a financial relationship with the entity providing the designated health services. The Stark Law also prohibits the entity furnishing the designated health services from billing, presenting or causing to be presented a claim for the designated health services furnished pursuant to the prohibited referral;
- the federal civil false claims laws, including without limitation the federal False Claims Act (which can be enforced through "qui tam," or whistleblower actions, by private citizens on behalf of the federal government), and civil monetary penalties laws, which prohibit, among other things, individuals or entities from knowingly presenting, or

causing to be presented, false or fraudulent claims for payment of government funds, or knowingly making, using or causing to be made or used, a false record or statement material to an obligation to pay money to the government or knowingly and improperly avoiding, decreasing or concealing an obligation to pay money to the federal government. In addition, the government may assert that a claim including items and services resulting from a violation of the federal Anti-Kickback Statute or Stark Law constitutes a false or fraudulent claim for purposes of the civil False Claims Act;

- the EKRA, which created a new federal crime for knowingly and willfully: (1) soliciting or receiving any remuneration in return for referring a patient to a recovery home, clinical treatment facility, or laboratory; or (2) paying or offering any remuneration to induce such a referral or in exchange for an individual using the services of a recovery home, clinical treatment facility, or laboratory. Unlike the Anti-Kickback Statute, EKRA is not limited to services reimbursable under a government health care program, but instead extends to all services reimbursed by "health care benefit programs";
- the healthcare fraud statutes under HIPAA, which impose 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 by a healthcare benefit program, which includes both government and privately funded benefits programs. Similar to the federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;
- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act ("HITECH") enacted as part of the American Recovery and Reinvestment Act of 2009, and its implementing regulations, and as amended again by the Modifications to the HIPAA Privacy, Security, Enforcement and Breach Notification Rules Under HITECH and the Genetic Information Nondiscrimination Act; Other Modifications to the HIPAA Rules, commonly referred to as the Final HIPAA Omnibus Rule, published in January 2013, which imposes certain obligations, including mandatory contractual terms, on covered entities subject to HIPAA (i.e., health plans, healthcare clearinghouses and certain healthcare providers), as well as their business associates that perform certain services for or on their behalf involving the use or disclosure of individually identifiable health information, to safeguard the privacy, security and transmission of individually identifiable health information from any unauthorized use or disclosure;
- the FDCA which imposes civil and criminal liability for engaging in any of a number of Prohibited acts, including distributing drugs, devices and foods that are adulterated or misbranded. To charge a criminal misdemeanor violation of the FDCA, no intent need be shown;
- federal consumer protection and unfair competition laws, which broadly regulate platform activities and activities that potentially harm consumers; and
- state law equivalents of each of the above federal laws, such as anti-kickback, self-referral, and fee-splitting, and false claims laws which may apply to items or services reimbursed by any third-party payor, including commercial insurers and self-pay patients.

Because of the breadth of these laws and the narrowness of available statutory and regulatory exemptions, exceptions, and safe harbors, it is possible that some of our activities could be subject to challenge under one or more of such laws. We may face claims and proceedings by private parties, and claims, investigations and other proceedings by governmental authorities, relating to allegations that our business practices do not comply with current or future laws or regulations involving applicable fraud and abuse or other healthcare laws and regulations, and it is possible that courts or governmental authorities may conclude that we or any of our partners have not complied with them, or that we may find it necessary or appropriate to settle any such claims or other proceedings. Any action brought against us for violation of these or other laws or regulations, even if we successfully defend against it, could cause us to incur significant legal expenses and divert our management's attention from the operation of our business. If our operations are found to be in violation of any federal or state laws described above or any other current or future fraud and abuse or other healthcare laws and regulations that apply to us, we may be subject to claims and proceedings by private parties, investigations and other proceedings by governmental authorities, as well as penalties, including significant criminal, civil and administrative penalties, damages and fines, disgorgement, additional reporting requirements and oversight if we become subject to a corporate integrity agreement or similar agreement to resolve allegations of noncompliance with these laws or regulations, imprisonment for individuals and exclusion from participation in government programs, such as Medicare and Medicaid, as well as contractual damages and reputational harm. We could also be required to curtail or cease our operations. In addition, if any customers, healthcare professionals we engage, laboratory partners or other entities with whom we do business are found not to be in compliance with applicable laws, they may be subject to the same criminal, civil or administrative sanctions, including exclusion from government-funded healthcare programs. Any of the foregoing could seriously harm our business and financial results.

We may become subject to the comprehensive laws and rules governing billing and payment, noncompliance with which could result in non-payment or recoupment of overpayments for our services or other sanctions.

We may, in the future, submit claims for our COVID-19 testing services to third-party payors. Payors typically have differing and complex billing and documentation requirements. If we fail to comply with these payor-specific requirements, we may not be paid for our services or payment may be substantially delayed or reduced. Numerous state and federal laws would also apply to our claims for payment, including but not limited to (i) "coordination of benefits" rules that dictate which payor must be billed first when a patient has coverage from multiple payors, (ii) requirements that overpayments be refunded within a specified period of time, (iii) "reassignment" rules governing the ability to bill and collect professional fees on behalf of other providers, (iv) requirements that electronic claims for payment be submitted using certain standardized transaction codes and formats, and (v) laws requiring all health and financial information of patients to be maintained in a manner that complies with stringent security and privacy standards.

Audits, inquiries and investigations from government agencies and health network partners can occur from time to time in the ordinary course of our business, and could result in costs to us and a diversion of management's time and attention. New regulations and heightened enforcement activity also could negatively affect our cost of doing business and our risk of becoming the subject of an audit or investigation. If we bill for our service in the future, our failure to comply with rules related to billing or adverse findings from audits by government and private payors could result in, among other penalties, non-payment for services rendered or recoupments or refunds of amounts previously paid for such services. We cannot predict whether any future audits, inquiries or investigations, or the public disclosure of such matters, likely would negatively impact our business, financial condition, results of operations, cash flows and the trading price of our securities. See also "*Risk Factors—Risks Related to Governmental Regulation and Litigation—If we fail to comply with healthcare and other governmental regulations, we could face substantial penalties and our business, financial condition and results of operations could be adversely affected*."

We and our laboratory partners are subject to a variety of laboratory testing standards, compliance with which is an expensive and time-consuming process, and any failure to comply could result in substantial penalties and disruptions to our business.

We and the third-party laboratories that we partner with are subject to the CLIA. CLIA is a federal law that regulates clinical laboratories that perform testing on specimens derived from humans for the purpose of providing information for the diagnosis, prevention or treatment of disease. CLIA requires certain clinical laboratories to be certified by the federal government and mandates compliance with various operational, personnel, facilities administration, quality and proficiency testing requirements depending on the level of complexity for which the laboratory is certified. CLIA certification is also a prerequisite to be eligible to bill state and federal healthcare programs, as well as many private third-party payors, for laboratory testing services. Our partner laboratories hold CLIA certifications for high complexity testing, which mandate compliance with various operational, personnel, facilities administration, quality and proficiency testing requirements depending on the level of complexity for which the laboratory is certified. Sanctions for failure to comply with CLIA requirements may include suspension, revocation, or limitation of a laboratory's CLIA certificate, as well as the imposition of significant fines or criminal penalties. Any sanction imposed under CLIA, its implementing regulations, or state or foreign laws or regulations governing licensure, or our partner laboratories' failure to renew a CLIA certificate, a state or foreign license, or accreditation, could have a material adverse effect on our business.

In addition, our partner laboratories and our laboratories holding CLIA Certificates of Waiver are subject to state laws and regulations governing laboratory licensure. Some states have enacted state licensure laws that are more stringent than CLIA. Our ability to successfully deploy COVID-19 testing at large scale may be adversely impacted if our partner laboratories do not maintain the required regulatory licensure and operate in accordance with CLIA standards. In certain markets such as California, New York, and Pennsylvania, we or our partner laboratories may also need to obtain and maintain additional licensure from such states. It is uncertain that our partner laboratories will be granted such licensure and, in such cases, we cannot offer testing to patients located in those states, which could limit our ability to offer testing on a wide scale.

It is possible that additional states may enact laboratory licensure requirements in the future, which could further limit our ability to expand our services.

We rely on third-party laboratories in the conduct of our biosecurity and public health business offerings. If any of our partners cease working with us, or face supply chain disruptions or other difficulties, our business could be harmed. Specifically, if any of our partners were to lose or fail to obtain or renew their CLIA certifications or state laboratory licenses, whether as a result of a revocation, suspension or limitation, such laboratories would no longer be able to run the COVID-19

tests we offer to our customers, and our ability to successfully deploy a COVID-19 pooled sample testing program nationwide may be adversely impacted.

The testing industry is subject to complex and costly regulation and if government regulations are interpreted or enforced in a manner adverse to us, we may be subject to enforcement actions, penalties, exclusion, and other material limitations on our operations.

We offer COVID-19 testing services by partnering with third-party laboratories, diagnostic test manufacturers and manufacturers of collection kits, which are subject to extensive and frequently changing federal, state and local laws and regulations governing various aspects of our business, including significant governmental certification and licensing regulations. New laws, regulations and judicial decisions, or new interpretations of existing laws, regulations and decisions, may also limit our potential revenues, and we may need to revise our R&D or commercialization programs. The costs of defending claims associated with violations, as well as any sanctions imposed, could significantly adversely affect our financial performance.

We are required to comply with federal and state genetic testing and privacy laws. We have measures in place to collect clinical data and genetic and other biological samples, and disclose test results, from subjects who have provided appropriate informed consents. However, informed consents could be challenged in the future, and those informed consents could prove invalid, unlawful or otherwise inadequate for our purposes. Any legal challenges could consume our management and financial resources.

Current regulations governing the testing services we offer are shifting and in some cases unclear. In addition, our laboratory partners may be unsuccessful in validating, or obtaining or maintaining authorizations for, the tests we rely on to provide our COVID-19 testing services. If any third-party manufacturers or laboratories offering tests that we use in our testing services are deemed by the FDA or other regulatory authorities to have violated applicable law or if the tests or test components are marketed, processed or distributed in violation of applicable law, we may be subject to enforcement action or litigation, or we may be required to find alternative tests to support our testing services, which could increase our costs and prevent us from successfully commercializing our COVID-19 testing services.

In addition, we are required to comply with applicable FDA regulations with respect to our distribution of certain COVID-19 diagnostic test kits and collection kits, including, for certain kits, compliance with applicable terms and conditions of an EUA. Such conditions may include requirements related to collection of information on the performance of the product, reporting of adverse events, recordkeeping requirements, and labeling and promotional activities. To the extent that we market or promote third-party tests or test kits outside of the uses authorized for these products or in a false or misleading manner, the tests or collection kits could be considered misbranded or adulterated and distributing them in interstate commerce could violate the FDCA. Violations of applicable FDA requirements could result in enforcement actions, such as warning or "untitled" letters, revocation of EUAs, seizures, injunctions, civil penalties and criminal prosecutions and fines, and violation of the FTC Act could result in injunctions and other associated remedies, all of which could have a material adverse effect on our business. Most states also have similar regulatory and enforcement authority for laboratory testing and distribution of related collection kits. For example, many state laws require us to hold a specific form of license to distribute COVID-19 diagnostic test kits and collection kits into such states. These requirements vary from one state to another and frequently change. Complying with state laws and regulations may subject us to similar risks and delays as those we could experience under federal regulation.

Our surveillance testing efforts do not collect identifying individual data and do not return a diagnostic result, but some surveillance methods, such as double collection, require samples from individuals. Regulatory authorities could take issue with our characterization of such testing as surveillance and/or impose additional requirements or restrictions.

Advertising for any of the tests or collection kits we distribute or the testing services we offer is also subject to regulation by the Federal Trade Commission ("FTC"), under the Federal Trade Commission Act ("FTC Act"). The FTC may take enforcement action for advertising claims that are not adequately substantiated or that are false or misleading.

We are subject to federal and state laws and regulations governing the protection, use, and disclosure of health information and other types of personal information, and our failure to comply with those laws and regulations or to adequately secure the information we hold could result in significant liability or reputational harm.

Numerous state and federal laws, regulations, standards and other legal obligations, including consumer protection laws and regulations, which govern the collection, dissemination, use, access to, confidentiality, security and processing of personal information, including health-related information, could apply to our operations or the operations of our partners. For

example, HIPAA imposes privacy, security and breach notification obligations on certain healthcare providers, health plans, and healthcare clearinghouses, known as covered entities, as well as their business associates that perform certain services that involve creating, receiving, maintaining or transmitting individually identifiable health information for or on behalf of such covered entities, and their covered subcontractors. HIPAA requires covered entities and business associates to develop and maintain policies with respect to the protection of, use and disclosure of protected health information ("PHI"), including the adoption of administrative, physical and technical safeguards to protect such information, and certain notification requirements in the event of a breach of unsecured PHI. If in the future we engage in certain types of standard electronic transactions involving payors, including billing the Medicare or Medicaid programs or commercial health plans, we will be subject to HIPAA as a "covered entity." We are currently subject to HIPAA as a "business associate" because we perform certain services involving the use or disclosure of PHI on behalf of covered entity customers with respect to our COVID-19 testing service offerings. Implementation of the infrastructure necessary to meet HIPAA standards requires substantial investment. Being subject to HIPAA as a covered entity or business associate exposes us to significant fines and penalties, including criminal fines and penalties.

Additionally, under HIPAA, covered entities must report breaches of unsecured PHI to affected individuals without unreasonable delay, not to exceed 60 days following discovery of the breach by a covered entity or its agents. Notification also must be made to the HHS Office for Civil Rights and, in certain circumstances involving large breaches, to the media.

Business associates must report breaches of unsecured PHI to covered entities within 60 days of discovery of the breach by the business associate or its agents. A non-permitted use or disclosure of PHI is presumed to be a breach under HIPAA unless the Covered Entity or Business Associate establishes that there is a low probability the information has been compromised consistent with requirements enumerated in HIPAA.

Entities that are found to be in violation of HIPAA as the result of a breach of unsecured PHI, a complaint about privacy practices or an audit by HHS, may be subject to significant civil, criminal and administrative fines and penalties and/or additional reporting and oversight obligations if required to enter into a resolution agreement and corrective action plan with HHS to settle allegations of HIPAA non-compliance. HIPAA also authorizes state attorneys general to file suit on behalf of their residents. Courts may award damages, costs and attorneys' fees related to violations of HIPAA in such cases. While HIPAA does not create a private right of action allowing individuals to sue us in civil court for violations of HIPAA, its standards have been used as the basis for duty of care in state civil suits such as those for negligence or recklessness in the misuse or breach of PHI.

Even when HIPAA or a state law does not apply, according to the FTC, violating consumers' privacy rights or failing to take appropriate steps to keep consumers' personal information secure may constitute unfair and/or deceptive acts or practices in violation of Section 5(a) of the FTC 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.

Several states have enacted privacy laws governing the use and disclosure of health information, such as the California Confidentiality of Medical Information Act; these laws are not preempted by HIPAA to the extent they are more stringent than HIPAA. 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 partners. Further, in recent years, there have been a number of well-publicized data breaches involving the improper dissemination of personal information of individuals both within and outside of the healthcare industry. Laws in all 50 states require businesses to provide notice to individuals whose personally identifiable information has been disclosed as a result of a data breach. The laws are not consistent, and compliance in the event of a widespread data breach is costly. States are also constantly amending existing laws, and creating new data privacy and security laws, requiring attention to frequently changing regulatory requirements. For example, the California Consumer Privacy Act of 2018 ("CCPA") went into effect on January 1, 2020. The CCPA creates new transparency requirements and grants California residents several new rights with respect to their personal information. Failure to comply with the CCPA may result in, among other things, significant civil penalties and injunctive relief, or potential statutory or actual damages. On November 3, 2020, California voters passed a ballot initiative for the California Privacy Rights Act ("CPRA"), which will significantly expand the CCPA. Most CPRA provisions will take effect on January 1, 2023, though the obligations will apply to any personal information collected after January 1, 2022. 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 will go into effect on January 1, 2023, and additional compliance investment and potential business process changes may be required. Similar laws have been proposed

or passed in other states, including the Virginia Consumer Data Protection Act, which will take effect on January 1, 2023. We will need to invest substantial resources in putting in place policies and procedures to comply with these evolving state laws.

As our operations and business grow, we may become subject to or affected by new or additional data protection laws and regulations and face increased scrutiny or attention from regulatory authorities. For example, the European Union General Data Protection Regulation ("GDPR"), which went into effect in May 2018, imposes strict requirements for processing the personal data of individuals within the European Economic Area. Companies that must comply with the GDPR face increased compliance obligations and risk, including more robust regulatory enforcement of data protection requirements and potential fines for noncompliance of up to €20 million or 4% of the annual global revenues of the noncompliant company, whichever is greater. 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 2016, the EU and United States agreed to a transfer framework for data transferred from the EU to the United States, called the Privacy Shield, but the Privacy Shield was invalidated in July 2020 by the Court of Justice of the European Union. Further, from January 1, 2021, companies have to comply with the GDPR and also the United Kingdom GDPR (the "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 (£17.5 million) or 4% of global turnover. The relationship between the United Kingdom and the European Union in relation to certain aspects of data protection law remains unclear, and it is unclear how United Kingdom data protection laws and regulations will develop in the medium to longer term. On June 28, 2021, the European Commission 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 United Kingdom adequacy decision will automatically expire in June 2025 unless the European Commission renews or extends that decision and remains under review by the Commission during this period. These changes may lead to additional costs and increase our overall risk exposure.

Although we work to comply with applicable laws, regulations and standards, 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 Ginkgo must comply. Recently, there has been an increase in public awareness of privacy issues in the wake of revelations about the data-collection activities of various government agencies and in the number of private privacy-related lawsuits filed against companies. Any failure or perceived failure by us or our employees, representatives, contractors, consultants, collaborators, or other third parties to comply with such requirements or adequately address privacy and security concerns, even if unfounded, could result in additional cost and liability to us, damage our reputation, and adversely affect our business and results of operations.

Our employees, agents, contractors, research partners, consultants or vendors may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements.

We are exposed to the risk that our employees, agents, contractors, research partners, consultants or vendors may engage in fraudulent or other illegal activity or misconduct. Misconduct by these parties could include intentional, reckless and/or negligent conduct or disclosure of unauthorized activities to us that causes us to breach our contracts and/or violates applicable laws and regulations, including but not limited to laws:

- applicable to the provision of health care services;
- governing the storage and handling of controlled substances;
- requiring the reporting of true, complete and accurate information to the FDA, USDA, and other government agencies;
- specifying vendor qualification standards and recordkeeping requirements;
- international, federal and state fraud and abuse laws and regulations;
- protecting the privacy and security of personally identifiable information and requiring breach notification;
- relating to anti-corruption, anti-bribery, and anti-money laundering; and
- requiring the true, complete and accurate reporting of services, financial information, or data.

Specifically, the health care industry and government contractors are subject to extensive laws and regulations intended to prevent fraud, kickbacks, self-dealing and other abusive practices. These laws and regulations may restrict or prohibit a wide range of pricing, discounting, marketing and promotion, sales commission, and other business arrangements. Additionally, activities that involve the improper use or misrepresentation of information obtained in the course of research or creating fraudulent data could result in breach of contract, regulatory sanctions, and serious harm to our reputation. It is not always possible to identify and deter misconduct by our employees and other third parties, and the precautions we take to detect and prevent this kind of activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us

from governmental investigations, other actions, or lawsuits stemming from a failure to be in compliance with such laws or regulations. Additionally, we are subject to the risk that a person could allege such fraud or other misconduct, even if none occurred. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, including the imposition of civil, criminal and administrative penalties, damages, monetary fines, possible exclusion from participation in Medicare, Medicaid and other federal health care programs, debarment under 21 U.S.C. § 335a or a comparable foreign law, contractual damages, reputational harm, diminished potential profits and future earnings, and curtailment of our operations, any of which could adversely affect our business, financial condition, results of operations or prospects.

Distribution and use of screening and/or diagnostic tests marketed under an EUA from the FDA are subject to certain limitations, and the continued availability of such authorizations is subject to government discretion.

Screening and/or diagnostic tests used in the testing programs and services of our affiliated company Concentric by Ginkgo are subject to EUAs granted by the FDA to the manufacturers or laboratories marketing such tests. Each EUA requires compliance with certain conditions, including specific workflow requirements, and imposes other limitations on the test's marketing, distribution, and use. We rely on our laboratory and telehealth partners to maintain compliance with the terms of the applicable EUAs; if they fail to do so we may be in breach of certain customer contracts and may become subject to an FDA enforcement action or experience other adverse effects on our business.

In some cases we may rely on our telehealth partners to provide physician services as required by the terms and conditions of a COVID-19 test's EUA and in order to comply with applicable state laws. If our telehealth partners are unable to or cease providing these physician services for any reason, we may be required to suspend the associated COVID-19 testing services. Our business, prospects and results of operations may be materially harmed if we are required to suspend the provision of any COVID-19 testing services in order to meet EUA requirements due to an issue with a vendor or for any other reason.

We have pursued in the past and may pursue additional U.S. Government contracting and subcontracting opportunities in the future and as a U.S. Government prime contractor and subcontractor, we are subject to a number of procurement rules and regulations.

We have entered into agreements with governmental entities and contractors in the past to serve as a U.S. government prime contractor or subcontractor and may do so again in the future. U.S. government procurement contractors and subcontractors must comply with specific procurement regulations and other requirements. These requirements, although customary in U.S. government contracts, could impact our performance and compliance costs, including by limiting or delaying our ability to share information with business partners, customers and investors. The U.S. government has in the past and may in the future demand contract terms that are less favorable than standard arrangements with private sector customers and may have statutory, contractual, or other legal rights to terminate contracts with us for convenience or for other reasons. Generally, U.S. government contracts contain provisions permitting unilateral termination or modification, in whole or in part, at the government's convenience. Under general principles of government contracting law, if the government terminates a contract for convenience, the government contractor may recover only its incurred or committed costs, settlement expenses and profit on work completed prior to the termination. If the government terminates a contract for default, the government contractor is entitled to recover costs incurred and associated profits on accepted items only and may be liable for excess costs incurred by the government in procuring undelivered items from another source. Any termination for default may also adversely affect our ability to contract with other government customers and agencies, as well as our reputation, business, financial condition and results of operations. In addition, changes in U.S. government budgetary priorities could lead to changes in the procurement environment, affecting availability of U.S. government contracting, subcontracting or funding opportunities, which could lead to modification, reduction or termination of our U.S. government contracts or subcontracts. If and to the extent such changes occur, they could impact our results and potential growth opportunities.

Furthermore, our U.S. government contracts grant the government the right to use technologies developed by us under the government contract or the right to share data related to our technologies, for or on behalf of the government. Under our government contracts, we may not be able to limit third parties, including our competitors, from accessing certain of these technology or data rights, including intellectual property, in providing products and services to the government.

In addition, failure by us, our employees, representatives, contractors, partners, agents, intermediaries, other customers or other third parties to comply with these regulations and requirements could result in reductions of the value of contracts, contract modifications or termination, claims for damages, refund obligations, the assessment of civil or criminal penalties and fines, loss of rights in our intellectual property and temporary suspension or permanent debarment from government contracting, all of which could negatively impact our results of operations and financial condition. Any such damages,

penalties, disruptions or limitations in our ability to do business with the public sector could result in reduced sales of our products, reputational damage, penalties and other sanctions, any of which could harm our business, reputation and results of operations.

We are engaged in certain research activities involving controlled substances, including cannabinoids and other chemical intermediates, the making, use, sale, importation, exportation, and distribution of which may be subject to significant regulation by the DEA, FDA, and other regulatory agencies.

We are engaged in certain research activities involving the development of microbes designed to generate cannabinoids, their precursors and other chemical intermediaries, some of which may be regulated as controlled substances in the United States. Controlled substances are subject to state, federal, and foreign laws and regulations regarding their manufacture, use, sale, importation, exportation, and distribution. Among other laws, controlled substances are regulated under the federal Controlled Substances Act of 1970 and implementing regulations of the DEA. The DEA regulates controlled substances as Schedule I, II, III, IV or V substances. Schedule I substances by definition have no established medicinal use and may generally not be marketed or sold in the United States. Schedule I substances are subject to the most stringent controls and Schedule V the least controls of the five schedules, based on their relative risk of abuse.

Cannabinoids are naturally occurring compounds found in the cannabis plant. The cannabis plant and its derivatives are highly regulated by the DEA and the USDA. Specifically, marihuana, which is defined as all parts of the plant *Cannabis sativa L.*, whether growing or not, the seeds thereof, the resin extracted therefrom, and every compound, manufacture, salt, derivative, mixture, or preparation, is classified as a Schedule I controlled substance. However, the term does not include "hemp," which means the cannabis plant and any part of that plant, including the seeds and all derivatives, extracts, cannabinoids, isomers, acids, salts, and salts of isomers, whether growing or not, with a delta-9 tetrahydrocannabinol ("THC") concentration of not more than 0.3% on a dry weight basis. Thus, depending on the THC concentration of the product, the product may or may not be regulated as a controlled substance. The DEA has historically regulated synthetic cannabinoids similarly to naturally-derived cannabinoids. Consequently, even though our cannabinoids that could be produced from microbes may not be derived from the cannabis plant, the DEA may consider them to be controlled substances subject to stringent regulatory controls.

Regulations associated with controlled substances govern manufacturing, labeling, packaging, testing, dispensing, production and procurement quotas, recordkeeping, reporting, handling, shipment and disposal. These regulations include required security measures, such as background checks on employees and physical control of inventory and increase the personnel needs and the expense associated with development and commercialization of products or product candidates including controlled substances. Regulators conduct periodic inspections of entities involved in handling, manufacturing, or otherwise distributing controlled substances, and have broad enforcement authorities. If we are found to be non-compliant with applicable controlled substance registrations and related requirements, we may need to modify its business activities and/or stop handling or producing the products regulated as controlled substances, and could be subject to enforcement action, significant fines or penalties, and/or adverse publicity, among other consequences.

Various states also independently regulate controlled substances. Though state-controlled substances laws often mirror federal law, because the states are separate jurisdictions, they may separately schedule substances, as well. The failure to comply with applicable regulatory requirements could lead to enforcement actions and sanctions from the states in addition to those from the DEA or otherwise arising under federal law.

Changes in government regulations may materially and adversely affect our sales and results of operations.

The markets where we provide our services are heavily influenced by foreign, federal, state and local government regulations and policies. The U.S. or foreign governments may take administrative, legislative, or regulatory action that could materially interfere with our customer's ability to sell products derived from engineered cells in certain countries and/or to certain customers. The uncertainty regarding future standards and policies may also affect our ability to develop our programs or to license engineered cells to customers and to initiate new programs with our customers, which could have a material adverse effect on our business, financial condition and results of operations.

Changes in U.S. trade policy more generally could trigger retaliatory actions by affected countries, which could impose restrictions on our ability to do business in or with affected countries or prohibit, reduce or discourage purchases of our services by foreign customers, leading to increased program costs, increased costs of developing or manufacturing our customers' products and higher prices for their products in foreign markets. Changes in, and responses to, U.S. trade policy could reduce the competitiveness of our services or our customers' products, cause our services to be less in demand and our

sales to decline and adversely impact our ability to compete, which could materially and adversely impact our business, financial condition and results of operations.

We are subject to certain U.S. and foreign anti-corruption, anti-bribery and anti-money laundering laws and regulations. We can face serious consequences for violations.

We are subject to the U.S. Foreign Corrupt Practices Act of 1977, as amended (the "FCPA"), the U.S. domestic bribery statute contained in 18 U.S.C. § 201, the U.S. Travel Act, the U.K. Bribery Act and possibly other anti-corruption, anti-bribery and anti-money laundering laws and regulations in the jurisdictions in which we do business, both domestic and abroad. Anti-corruption and anti-bribery laws have been enforced aggressively in recent years. The FCPA and other anti-corruption laws generally prohibit companies, their employees, agents, representatives, business partners and third-party intermediaries from corruptly promising, authorizing, offering, or providing, directly or indirectly, anything of value to government officials, political parties, or candidates for public office for the purpose of obtaining or retaining business or securing an improper business advantage. The UK Bribery Act and other anti-corruption laws also prohibit commercial bribery not involving government officials, and requesting or accepting bribes; and anti-money laundering laws prohibit engaging in certain transactions involving criminally-derived property or the proceeds of criminal activity.

We and our third-party business partners, representatives and agents may have direct or indirect interactions with officials and employees of government agencies or state-owned or -affiliated universities or other entities (for example, to obtain necessary permits, licenses, patent registrations and other regulatory approvals), which increases our risks under the FCPA and other anti-corruption laws. We also engage contractors, consultants and other third parties from time to time to conduct business development activities abroad. We may be held liable for the corrupt or other illegal activities of our employees or third parties even if we do not explicitly authorize such activities. We have increased and, in the future, expect our non-U.S. activities to increase over time, which may also increase our exposure under these laws.

The FCPA also requires that we keep accurate books and records and maintain a system of adequate internal controls. While we have controls to address compliance with such laws and will continue to review and enhance our compliance program, we cannot assure you that our employees, agents, representatives, business partners or third-party intermediaries will always comply with our policies and applicable law, for which we may be ultimately held responsible.

Any allegations or violation of the FCPA or other applicable anti-bribery, anti-corruption laws and anti-money laundering laws may result in whistleblower complaints, sanctions, settlements, investigations, prosecution, enforcement actions, substantial criminal fines and civil penalties, disgorgement of profits, imprisonment, debarment, tax reassessments, breach of contract and fraud litigation, loss of export privileges, suspension or debarment from U.S. government contracts, adverse media coverage, reputational harm and other consequences, all of which may have an adverse effect on our reputation, business, financial condition, results of operations and prospects. Responding to an investigation or action can also result in a materially significant diversion of management's attention and resources and significant defense costs and other professional fees.

Significant disruptions to our and our service providers' information technology systems or data security incidents could result in significant financial, legal, regulatory, business and reputational harm to us.

We are increasingly dependent on information technology systems and infrastructure, including services licensed, leased or purchased from third parties such as cloud computing infrastructure and operating systems, to operate its business. In the ordinary course of business, we collect, store, process and transmit large amounts of sensitive information, including intellectual property, proprietary business information, personal information and other confidential information. It is critical that we do so in a secure manner to maintain the confidentiality, integrity and availability of such sensitive information. We have also outsourced elements of our operations (including elements of its information technology infrastructure) to third parties, and as a result, we manage a number of third-party vendors who may have access to our networks or our confidential information. While we take measures to safeguard and protect this information, threats to network and data security are increasingly diverse and sophisticated. We may also face increased cybersecurity risks due to our reliance on internet technology and the number of our employees working remotely, which may create additional opportunities for cybercriminals to exploit vulnerabilities. Despite our efforts, training and processes to prevent security breaches and incidents, our information technology systems, servers, and those of third parties that we use in our operations are vulnerable to cybersecurity risks, including cyberattacks such as viruses and worms, phishing attacks and other forms of social engineering, denial-of-service attacks, ransomware attacks, physical or electronic break-ins, third-party or employee theft or misuse, and other negligent actions, errors or malfeasance by employees or other third parties, and similar disruptions from unauthorized tampering with its servers and computer systems or those of third parties that we use in its operations, which could lead to interruptions, delays, loss or corruption of critical data, unauthorized access to or acquisition of health-related

and other personal information. In addition, we may be the target of email scams and other social engineering attacks that attempt to acquire personal information or company assets or access to our systems. Despite our efforts to create security barriers to such threats, we may not be able to entirely mitigate these risks. Our third-party service providers face similar risks. Any cyberattack that attempts to obtain our data or assets, including data that we maintain on behalf of its customers, disrupt its service, or otherwise access its systems, or those of third parties we use, or any other security breach or incident, could adversely affect our business, financial condition and operating results, be expensive to remedy, and damage our reputation. We and our third-party service providers may face difficulties or delays in identifying or otherwise responding to any attacks or actual or potential security breaches or security incidents. We may incur significant costs and operational consequences of investigating, remediating, eliminating and putting in place additional tools and devices designed to prevent actual or perceived security breaches and other security incidents, including in response to any actual or perceived incident we may suffer, and substantial costs to comply with any notification or other legal obligations resulting from any security breaches or other security incidents. In addition, any such breaches or incidents, or the perception that they have occurred, may result in negative publicity, and could have an adverse effect on our business, financial condition, and operating results.

Although we maintain insurance coverage that may cover certain liabilities in connection with security breaches and other security incidents, we cannot be certain our insurance coverage will be adequate for liabilities actually incurred, that insurance will continue to be available to us on commercially reasonable terms (if at all) or that any insurer will not deny coverage as to any future claim.

Governmental trade controls, including export and import controls, sanctions, customs requirements and related regimes, could subject us to liability or loss of contracting privileges or limit our ability to compete in certain markets.

Our programs and technologies are subject to U.S. and non-U.S. export controls. Export authorizations may be required for biotechnology products, technologies, or services to be exported outside of the United States, to a foreign person, or outside of a foreign jurisdiction. Our current or future programs or technologies are, and may in the future, be subject to the Export Administration Regulations ("EAR"). If a program, technology, or service meets certain criteria for control under the EAR, then that engineered cell, production process, resulting product, technology, or service would be exportable outside the United States or to a foreign person or from one foreign jurisdiction to another foreign jurisdiction only if we obtain the applicable export license or other applicable authorization including qualifying for a license exception, if required. Compliance with the U.S. and foreign export laws and regulations and other applicable regulatory requirements regarding the sales, shipment and use of our engineering cells, bioprocesses and other technology may affect our ability to work with foreign partners, affect the speed at which we can introduce new products into non-U.S. markets, or limit our ability to sell programs or services or license technologies into some countries.

Additionally, certain materials that we use in our programs are subject to U.S. import controls. We currently have, and may in the course of business need to procure, certain import authorizations, for example, related to plant pests, chemicals, biological agents and other controlled materials, including from the USDA, EPA and CDC. Compliance with applicable regulatory requirements regarding the import of such materials may limit our access to materials critical to our development activities or affect the speed at which we can advance new programs.

Our activities are also subject to the economic sanctions laws and regulations of the United States and other jurisdictions. Such controls prohibit certain transactions, potentially including financial transactions and the transfer of products, technologies and services, to sanctioned countries, governments and persons, without a license or other appropriate authorization. U.S. sanctions policy changes could affect our or our customers' ability to interact, directly and indirectly, with targeted companies or companies in sanctioned countries.

While we take precautions to comply with U.S. and non-U.S. export control, import control and economic sanctions laws and regulations, we cannot guarantee that such precautions will prevent violations of such laws, including transfers to unauthorized persons or destinations, and including inadvertent violations as a result of a misclassification of a product, technology or service under export control laws. Violations could result in our business being subject to government investigations, denial of export or import privileges, significant fines or penalties, denial of government contracts and reputational harm. Any limitation on our ability to export our engineered cells, production processes, resulting products, technology, or services, or import materials critical to our programs would likely adversely affect our business and financial condition.

Changes in U.S. and foreign tax laws could have a material adverse effect on our business, cash flow, results of operations or financial condition.

We are subject to income and non-income based taxes in the U.S. and foreign jurisdictions. Changes in tax laws, regulations and policies, or their interpretation and application, in the jurisdictions where we are subject to tax, could have a material adverse effect on our business, cash flow, results of operations or financial condition. The U.S. Congress frequently debates changes to U.S. corporate income tax laws and the Group of Twenty (G20), the Organization for Economic Co-operation and Development (OECD), the European Commission (EC) and individual taxing jurisdictions have published proposals covering various international tax-related issues, including country-by-country reporting, permanent establishment rules, transfer pricing and tax treaties. It is possible that any future tax legislation which may be enacted could materially impact our effective tax rate and cash tax liability as well as tax credits and incentives.

We may become subject to lawsuits or indemnity claims in the ordinary course of business, which could materially and adversely affect our business and results of operations.

From time to time, we may in the ordinary course of business be named as a defendant in lawsuits, indemnity claims and other legal proceedings. These actions may seek, among other things, compensation for alleged product liability, personal injury, employment discrimination, breach of contract, property damage and other losses or injunctive or declaratory relief.

The marketing, sale and use of our services engineered cells, production processes and resulting products could lead to the filing of product liability claims were someone to allege that our services, engineered cells, production processes or resulting products failed to perform as designed or intended or caused injury or other harms. A product liability claim could result in substantial damages and be costly and time-consuming for us to defend.

Regardless of merit or eventual outcome, product liability claims may result in:

- decreased demand for programs and resulting products;
- loss of revenue;
- substantial monetary payments;
- significant time and costs to defend related litigation;
- the inability to commercialize any products from our programs; and
- injury to our reputation and significant negative media attention.

In the event that such actions, claims or proceedings are ultimately resolved unfavorably to us at amounts exceeding our accrued liability, or at material amounts, the outcome could materially and adversely affect our business and results of operations. In addition, payments of significant amounts, even if reserved, could adversely affect our liquidity position. We maintain product liability insurance, but this insurance may not fully protect us from the financial impact of defending against product liability claims. Any product liability claim brought against us, with or without merit, could increase our insurance rates or prevent us from securing insurance coverage in the future. Additionally, any product liability lawsuit could cause current collaborators to terminate existing agreements or potential collaborators to seek other companies, any of which could impact our business and results of operations.

Zymergen is a party to a mitigation agreement with the Committee on Foreign Investment in the United States ("CFIUS") and can face penalties or further restrictions if it fails to comply with that agreement.

When we acquired Zymergen, Zymergen was subject to a preexisting agreement with CFIUS relating to an investor in Zymergen (who, following the Zymergen Acquisition, became a Ginkgo shareholder). This agreement requires Zymergen to adhere to certain information and technology protection requirements. This agreement will remain in place until the parties to the agreement agree to terminate it. Zymergen has incurred incremental additional costs in implementing and complying with the agreement, and because the agreement will remain in place, we will continue to incur costs following the Zymergen acquisition, and ensure compliance to avoid any penalties, injunctive action, additional mitigation conditions or other restrictions.

Risks Related to our Common Stock, Organizational Structure and Governance

We are not, and do not intend to become, regulated as an "investment company" under the Investment Company Act, and if we were deemed an "investment company" under the Investment Company Act, applicable restrictions could make it impractical for us to continue our business as contemplated and could have a material adverse effect on our business.

An entity generally will be deemed to be an "investment company" for purposes of the Investment Company Act if:

- it is an "orthodox" investment company because it is or holds itself out as being engaged primarily, or proposes to engage primarily, in the business of investing, reinvesting or trading in securities; or
- it is an inadvertent investment company because, absent an applicable exemption, (i) it owns or proposes to acquire investment securities having a value exceeding 40% of the value of its total assets (exclusive of U.S. government securities and cash items) on an unconsolidated basis, or (ii) it owns or proposes to acquire investment securities having a value exceeding 45% of the value of its total assets (exclusive of U.S. government securities and cash items) and/or more than 45% of its income is derived from investment securities on a consolidated basis with its wholly owned subsidiaries.

We believe that we are engaged primarily in the business of providing cell engineering services to customers from across a variety of industries and not in the business of investing, reinvesting or trading in securities. We hold ourselves out as a synthetic biology company and do not propose to engage primarily in the business of investing, reinvesting or trading in securities. Accordingly, we do not believe that we are an "orthodox" investment company as defined in Section 3(a)(1)(A) of the Investment Company Act of 1940, as amended (the "Investment Company Act") and described in the first bullet point above. Furthermore, we believe that less than 40% of our total assets (exclusive of U.S. government securities and cash items) on an unconsolidated basis will be composed of assets that could be considered investment securities. Accordingly, we do not believe that we are an inadvertent investment company by virtue of the 40% tests in Section 3(a)(1)(C) of the Investment Company Act as described in the second bullet point above. In addition, we believe that we are not an investment company under Section 3(b)(1) of the Investment Company Act because we are primarily engaged in a non-investment company business.

The Investment Company Act and the rules thereunder contain detailed parameters for the organization and operation of investment companies. Among other things, the Investment Company Act and the rules thereunder limit or prohibit transactions with affiliates, impose limitations on the issuance of debt and equity securities, generally prohibit the issuance of options and impose certain governance requirements. We intend to conduct our operations so that we will not be deemed to be an investment company under the Investment Company Act or otherwise conduct our business in a manner that does not subject us to the registration and other requirements of the Investment Company Act. In order to ensure that we are not deemed to be an investment company, we may be limited in the assets that we may continue to own and, further, may need to dispose of or acquire certain assets at such times or on such terms as may be less favorable to us than in the absence of such requirement. If anything were to happen which would cause us to be deemed to be an investment company under the Investment Company Act (such as significant changes in the value of our programs or a change in circumstance that results in a reclassification of our interests in our programs for purposes of the Investment Company Act), the requirements imposed by the Investment Company Act could make it impractical for us to continue our business as currently conducted, which would materially adversely affect our business, financial condition and results of operations. In addition, if we were to become inadvertently subject to the Investment Company Act, any violation of the Investment Company Act could subject us to material adverse consequences, including potentially significant regulatory penalties and the possibility that certain of our contracts could be deemed unenforceable.

Only our employees and directors are entitled to hold shares of Class B common stock (including shares of Class B common stock granted or otherwise issued to our employees and directors in the future), which shares have ten votes per share. This limits or precludes other stockholders' ability to influence the outcome of matters submitted to stockholders for approval, including the election of directors, the approval of certain employee compensation plans, the adoption of certain amendments to our organizational documents and the approval of any merger, consolidation, sale of all or substantially all of our assets, or other major corporate transaction requiring stockholder approval.

Shares of our Class B common stock have ten votes per share, whereas shares of our Class A common stock have one vote per share and shares of our Class C common stock have no voting rights (except as otherwise expressly provided in our amended and restated certificate of incorporation (the "Charter") or required by applicable law). As of December 31, 2022, our directors and executive officers hold in the aggregate approximately 47.4% of the total voting power of our outstanding capital stock, and our directors, founders and executive officers hold in the aggregate approximately 66.1% of the total voting power of our outstanding capital stock. Accordingly, holders of shares of Class B common stock are able to significantly

influence the outcome of matters submitted to our stockholders for approval, including the election of directors, the approval of certain employee compensation plans, the adoption of amendments to our organizational documents and the approval of any merger, consolidation, sale of all or substantially all of our assets or other major corporate transaction requiring stockholder approval. This concentrated voting power limits or precludes other stockholders' ability to influence the outcome of these matters. Holders of Class B common stock may have interests that differ from holders of Class A common stock and may vote in a way with which holders of Class A common stock disagree and which may be adverse to the interests of holders of Class A common stock. This concentrated voting power is likely to have the effect of limiting the likelihood of an unsolicited merger proposal, unsolicited tender offer or proxy contest for the removal of directors. As a result, our governance structure and Charter may have the effect of depriving our stockholders of an opportunity to sell their shares at a premium over prevailing market prices and make it more difficult to replace our directors and management. Furthermore, this concentrated voting power could discourage a potential investor from acquiring Class A common stock due to the limited voting power of such stock relative to Class B common stock, which could also adversely affect the trading price of Class A common stock.

Our multi-class stock structure is intended to preserve our existing founder-led governance structure, to promote employee retention and engagement, to facilitate continued innovation and the risk-taking that it requires, to permit us to continue to prioritize our long-term goals rather than short-term results, to enhance the likelihood of continued stability in the composition of our board of directors and its policies, and to discourage certain types of transactions that may involve an actual or threatened acquisition of the company, all of which we believe are essential to the long-term success of our company and to long-term stockholder value. We expect to maintain this concentrated voting power among our founders and employees for the foreseeable future, including by issuing additional shares of Class B common stock to our employees pursuant to our equity compensation plans and allowing our employees and directors to exchange shares of Class A common stock for shares of Class B common stock.

Future transfers of shares of Class B common stock to persons other than Ginkgo directors and employees, or trusts or legal entities through which the right to vote the shares of Class B common stock held thereby is exercised exclusively by one or more of Ginkgo's directors or employees (any such director, employee, trust or legal entity, an "Eligible Holder"), or the holder of shares of Class B common stock ceasing to be an Eligible Holder, will generally result in those shares converting to shares of Class A common stock on a one-to-one basis, subject to certain exceptions and unless a majority of the independent directors of our board of directors determine that such transfer or event will not result in such automatic conversion. Each share of Class B common stock is also convertible at any time at the option of the holder into one share of Class A common stock. The conversion of Class B common stock to Class A common stock over time will have the effect of increasing the relative voting power of those holders of Class B common stock who retain their shares of Class B common stock in the long term. As a result, the relative voting power of holders of Class A common stock is expected to remain limited for a significant period of time, and it is possible that one or more of the persons or entities holding Class B common stock could gain significant voting control as other holders of Class B common stock sell or otherwise convert their shares into Class A common stock. In addition, the conversion of Class B common stock to Class A common stock would dilute holders of Class A common stock in terms of voting power within the Class A common stock. Because holders of Class C common stock have no voting rights (except as otherwise expressly provided in the Charter or required by applicable law), the holders of Class B common stock may be able to significantly influence the outcome of matters submitted to our stockholders for approval for a longer period of time than would be the case if we issued Class A common stock rather than Class C common stock in such transactions.

Our share price may change significantly over time, and you may not be able to resell our common stock at or above the price you paid or at all, and you could lose all or part of your investment as a result.

The trading price of our Class A common stock has been in the past and is likely to continue to be volatile. Such volatility may be, in part, attributable to:

- future sales of our common stock or other securities by us or our existing stockholders, or the perception of such future sales;
- results of operations of the company or our competitors that vary from the expectations of securities analysts and investors;
- changes in expectations as to our future financial performance and growth, including assessments of our business, prospects, financial estimates and investment recommendations by securities analysts, investors and short sellers;
- additions or departures of key management personnel or members of our board of directors;
- announcements by us or our competitors of significant contracts, new products, acquisitions, joint marketing relationships, joint ventures, other strategic relationships or capital commitments;

- announcements relating to actual or potential civil and non-civil litigation, as well as governmental or regulatory investigations or inquiries;
- guidance that we provide to the public, any changes in this guidance or our failure to meet this guidance;
- changes in the perception of our offerings or the synthetic biology industry more general including changes in regulatory conditions;
- the development and sustainability of an active trading market for our common stock;
- changes in accounting principles;
- changes in general economic or market conditions or trends in our industry or markets;
- other events or factors, including those resulting from natural disasters, pandemics, epidemics, war (including Russia's invasion of Ukraine), acts of terrorism or responses to these events.

These factors among others may materially adversely affect the market price of our Class A common stock, regardless of our actual operating performance. In addition, price volatility may be greater if the public float and trading volume of our common stock are low.

In the past, following periods of market volatility, stockholders have instituted securities class action litigation. If we were involved in securities litigation, it could have a substantial cost and divert resources and the attention of executive management from our business regardless of the outcome of such litigation.

Future sales, or the perception of future sales, by us or our stockholders in the public market could cause the market price for our securities to decline.

The sale of our securities in the public market, including by entities to which we have issued shares in connection with transactions, or the perception that such sales could occur, could harm the prevailing market price of our securities. These sales, or the possibility that these sales may occur, also might make it more difficult for us to sell equity securities in the future at a time and at a price that we deem appropriate.

There are up to approximately 206 million shares of common stock that may be earned if the trading price is greater than or equal to certain earnout price thresholds ranging from $12.50 to $20.00 for any point in a trading day during 20 trading days in a 30 consecutive trading day period, of which approximately 51.5 million shares were earned as of December 31, 2022. The vast majority of the shares that are part of the earnout will not be subject to lock-up once the earnout conditions are met.

In connection with the SRNG Business Combination, in September 2021, Jason Kelly, Reshma Shetty, Austin Che and Bartholomew Canton were granted restricted stock units, which vested, along with certain related earnout shares that achieved the $12.50 price threshold, on October 1, 2022. Certain of such shares have been sold into the market (including to cover the income tax obligations associated with their vesting and distribution or otherwise), and such sales and any future sales could harm the prevailing market price of our securities.

We have also issued shares of our common stock in connection with certain of our acquisitions, which issuances dilute our existing shareholders. In addition, the shares of our common stock reserved for future issuance under our equity incentive plans will become eligible for sale in the public market once those shares are issued, subject to provisions relating to various vesting agreements and, in some cases, limitations on volume and manner of sale applicable to affiliates under Rule 144, as applicable. Our compensation committee of our board of directors may determine the exact number of shares to be reserved for future issuance under our equity incentive plans at its discretion. We have filed, and expect to file in the future, one or more registration statements on Form S-8 under the Securities Act to register shares of Class A common stock or securities convertible into or exchangeable for shares of Class A common stock issued pursuant to our equity incentive plans. Any such Form S-8 registration statements automatically become effective upon filing. Accordingly, shares registered under such registration statements will be available for sale in the open market.

Short sellers may engage in manipulative activity intended to drive down the market price of our Class A common stock, which could also result in related regulatory and governmental scrutiny, among other effects.

Short selling is the practice of selling securities that the seller does not own but rather has borrowed or intends to borrow from a third party with the intention of later buying lower priced identical securities to return to the lender. Accordingly, it is in the interest of a short seller of our Class A common stock for the price to decline. At any time, short sellers may publish, or arrange for the publication of, opinions or characterizations that are intended to create negative market momentum. Issuers, like us, whose securities have historically had limited trading history or volumes and/or have been susceptible to relatively high volatility levels can be vulnerable to such short seller attacks. Short selling reports can cause increased volatility in an

issuer's stock price, and result in regulatory and governmental inquiries. On October 6, 2021, such a report was published about us. Shortly after, we received a preliminary and informal inquiry from the U.S. Department of Justice related to this report. Any related inquiry or formal investigation from a governmental organization or other regulatory body, including any inquiry from the SEC, is not within the control of the Company. Although we have received confirmation from the SEC that it concluded its inquiry into Ginkgo Bioworks Holdings, Inc. begun in October 2021 or soon after with no recommendation of enforcement action, any inquiry or formal investigation by any governmental organization or regulatory body could result in a material diversion of our management's time and could have a material adverse effect on our business and results of operations.

Our Charter authorizes a large number of shares of Class B common stock for issuance in the future. The future issuance of shares of Class B common stock may have the effect of further concentrating voting power with our employees and other Class B stockholders, and could have an adverse effect on the trading price of Class A common stock.

Under our Charter, we are authorized to issue 4,500,000,000 shares of Class B common stock, which are entitled to ten votes per share. We currently intend to issue additional shares of Class B common stock in the future to existing and newly hired employees pursuant to our equity compensation plans. Our authorized but unissued shares of Class B common stock are available for issuance to Eligible Holders with the approval of our board of directors without stockholder approval, except as may be required by the Listing Rules of the NYSE. In addition, our authorized but unissued shares of Class B common stock are available for issuance to persons other than Eligible Holders only with the approval of a majority of our directors elected by the holders of Class B common stock, voting separately as a class. If we issue additional shares of Class B common stock in the future, holders of shares of Class A common stock, which are entitled to one vote per share, will experience disproportionate voting power dilution relative to economic dilution, and the holders of Class B common stock may be able to significantly influence the outcome of matters submitted to our stockholders for approval for a longer period of time than would be the case if we issued shares of Class A common stock.

See *"Risk Factors—Risks Related to Our Organizational Structure and Governance—Only our employees and directors are entitled to hold shares of Class B common stock (including shares of Class B common stock granted or otherwise issued to our employees and directors in the future), which shares have ten votes per share. This limits or precludes other stockholders' ability to influence the outcome of matters submitted to stockholders for approval, including the election of directors, the approval of certain employee compensation plans, the adoption of amendments to our organizational documents and the approval of any merger, consolidation, sale of all or substantially all of our assets or other major corporate transaction requiring stockholder approval."*

Under our Charter, we are authorized to issue 800,000,000 shares of Class C common stock, which have no voting rights (except as otherwise expressly provided in the Charter or required by applicable law). Outstanding Class C common stock may have the effect of extending voting power in Class B common stock, and may discourage potential acquisitions of our business and could have an adverse effect on the trading price of Class A common stock.

Under our Charter, we are authorized to issue 800,000,000 shares of Class C common stock, which have no voting rights (except as required by law). Class C common stock may be used for a variety of corporate purposes, including financings, acquisitions and investments. Our authorized but unissued shares of Class C common stock are available for issuance with the approval of our board of directors without stockholder approval, except as may be required by the Listing Rules of the NYSE. Because the Class C common stock carries no voting rights (except as otherwise expressly provided in the Charter or required by applicable law), is not convertible into any other capital stock, and is not listed for trading on an exchange or registered for sale with the SEC, shares of Class C common stock may be less liquid and less attractive to any future recipients of these shares than shares of Class A common stock, although we may seek to list the Class C common stock for trading and register shares of Class C common stock for sale in the future. In addition, because our Class C common stock has no voting rights (except as otherwise expressly provided in the Charter or required by applicable law), the holders of Class B common stock may be able to significantly influence the outcome of matters submitted to our stockholders for approval for a longer period of time than would be the case if we issued Class A common stock rather than Class C common stock in such transactions. In addition, further issuances of Class C common stock would have a dilutive effect on the economic interests of Class A common stock and Class B common stock. Any such issuance could also cause the trading price of Class A common stock to decline.

We cannot predict the effect the multi-class structure of our common stock may have on the trading price of our Class A common stock.

The holding of low-voting stock, such as Class A common stock, may not be permitted by the investment policies of certain institutional investors or may be less attractive to the portfolio managers of certain institutional investors. In addition, certain

index providers have announced restrictions on including companies with multiple-class share structures in certain of their indices. In July 2017, S&P Dow Jones announced that they would cease to allow most newly public companies with dual- or multi-class capital structures to be included in their indices. Affected indices include the S&P 500, S&P MidCap 400 and S&P SmallCap 600, which together make up the S&P Composite 1500. Under the announced policies, our multi-class capital structure would make our Class A common stock ineligible for inclusion in certain indices, and as a result, mutual funds, exchange-traded funds and other investment vehicles that attempt to passively track those indices would not invest in our common stock. These policies may depress our valuation compared to those of other similar companies that are included. Because of our multi-class stock structure, our Class A common stock will likely continue to be excluded from certain of these indices, and we cannot assure you that other stock indices will not take similar actions. Given the sustained flow of investment funds into passive strategies that seek to track certain indices, exclusion from stock indices would likely preclude investment by many of these funds in our Class A common stock and could make shares of our Class A common stock less attractive to other investors. As a result, the trading price of shares of our Class A common stock could be adversely affected.

Our focus on the long-term best interests of our company and our consideration of all of our stakeholders, including our stockholders, workforce, customers, suppliers, academic researchers, governments, communities and other stakeholders that we may identify from time to time, may conflict with short-term or medium-term financial interests and business performance, which may adversely impact the value of our common stock.

We believe that focusing on the long-term best interests of our company and our consideration of all of our stakeholders, including our stockholders, workforce, customers, suppliers, academic researchers, governments, communities and other stakeholders we may identify from time to time, is essential to the long-term success of our company and to long-term stockholder value. Therefore, we have made decisions, and may in the future make decisions, that we believe are in the long-term best interests of our company and our stockholders, even if such decisions may negatively impact the short- or medium-term performance of our business, results of operations, and financial condition or the short- or medium-term performance of our Class A common stock. Our commitment to pursuing long-term value for the company and its stockholders, potentially at the expense of short- or medium-term performance, may materially adversely affect the trading price of our Class A common stock, including by making owning our Class A common stock less appealing to investors who are focused on returns over a shorter time horizon. Our decisions and actions in pursuit of long-term success and long-term stockholder value, which may include our multi-class stock structure, making investments in R&D and our employees, and investing in and introducing new products and services, may not result in the long-term benefits that we expect, in which case our business, results of operations and financial condition, as well as the trading price of our Class A common stock, could be materially adversely affected.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

Ginkgo's headquarters are located in the Seaport district of Boston, Massachusetts and comprise a set of non-cancellable operating leases within a facility totaling over 325,000 square feet of office and laboratory space. These lease agreements expire on dates ranging from 2030 to 2036 and each contain one option to extend the lease for a five-year period at then-market rates. We also lease approximately 584,000 square feet of office and lab space in Cambridge, Massachusetts, New York, New York, Emeryville, California, and Utrecht, Netherlands.

In anticipation of expanding facility needs to support future growth, in April 2021, we entered into a lease, as amended, consisting of approximately 260,000 rentable square feet of new office and laboratory space being developed in Boston, Massachusetts near our headquarters. The lease commencement date is estimated to be June 1, 2024, subject to certain extensions, and expires on the fifteenth anniversary of the lease commencement date. The lease includes one option to extend the lease for ten years at then-market rates as well as an expansion option if the owner constructs an additional building on the property.

We also own approximately 193,000 square feet of real property in West Sacramento, California. We believe our facilities are adequate and suitable for our current needs and that the new lease described above provides significant expansion space. To support future organic growth or merger and acquisition activity, we may enter into new leases, assume lease obligations or acquire property both domestically and internationally and believe that, if needed, suitable or alternative space will be available.

Item 3. Legal Proceedings.

From time to time, the Company may in the ordinary course of business be named as a defendant in lawsuits, indemnity claims and other legal proceedings. Except as described below, the Company does not believe any pending litigation to be material, or that the outcome of any such pending litigation, in management's judgment based on information currently available, would have a material adverse effect on the Company's results of operations, cash flows or financial condition.

As disclosed in Note 3, the Company completed its acquisition of Zymergen on October 19, 2022. On August 4, 2021, a putative securities class action was filed on behalf of purchasers of the common stock of Zymergen, pursuant to or traceable to the registration statement for Zymergen's initial public offering ("IPO"). The action is pending in the United States District Court for the Northern District of California, and is captioned Wang v. Zymergen Inc., et al., Case No. 3:21-cv-06028-VC. The action alleges violations of Sections 11 and 15 of the Securities Act of 1933, as amended (the "Securities Act") in connection with Zymergen's IPO, names Zymergen, certain of its former officers and directors, and its IPO underwriters, as defendants and seeks damages in an unspecified amount, attorneys' fees, and other remedies. Zymergen intends to defend vigorously against such allegations.

On November 9, 2021, one of Zymergen's then purported shareholders filed a putative derivative lawsuit in the United States District Court for the Northern District of California that is captioned Mellor v. Hoffman, et al., Case No. 3:21-cv-08723-VC. The complaint names certain of Zymergen's former officers and directors as defendants and Zymergen as nominal defendant based on allegations substantially similar to those in the securities class action. The complaint purports to assert claims on Zymergen's behalf for breach of fiduciary duty, unjust enrichment, abuse of control, gross mismanagement, corporate waste,

and contribution under the federal securities laws and seeks corporate reforms, unspecified damages and restitution, and fees and costs. Zymergen intends to defend vigorously against such allegations.

On or about February 7, 2023, a complaint was filed by Fortis Advisors LLC, solely in its capacity as Stockholders' Representative for the holders of convertible promissory notes of Lodo Therapeutics Corporation ("Lodo"), against our subsidiary, Zymergen, in Delaware Superior Court. The complaint purports to allege violations of California securities laws based on Zymergen's exchange of its common stock for convertible promissory notes issued by Lodo in connection with Zymergen's May 2021 acquisition of Lodo. The complaint seeks damages in an unspecified amount, attorneys' fees, and other remedies. Zymergen intends to defend vigorously against such allegations.

In addition, certain government agencies, including the SEC, have requested information related to Zymergen's August 3, 2021 disclosure. Zymergen is cooperating fully.

See Note 11, Commitments and Contingencies, to the consolidated financial statements included elsewhere in this Annual Report on Form 10-K.

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 Class A common stock and Public Warrants began trading on the NYSE under the symbols "DNA" and "DNA.WS," respectively on September 17, 2021. Prior to that date, there was no public trading market for our Class A common stock and Public Warrants.

Holders of Record

As of December 31, 2022, there were approximately 359 stockholders of record of our Class A common stock, 432 stockholders of record of our Class B common stock and 1 stockholder of record of our Class C common stock, which does not include persons whose stock is held in nominee or "street name" accounts through brokers, banks and intermediaries.

Securities Authorized for Issuance Under Equity Compensation Plans

	Number of securities to be issued upon exercise of outstanding options and vesting of outstanding restricted stock units (#)		Weighted-average exercise price of outstanding options ($)	Number of securities remaining available for future issuance under equity compensation plans (excluding securities reflected in the first column) (#)	
Equity compensation plans approved by security holders (1)	129,503,568	(2)	$ 0.28	185,432,349	(3)
Equity compensation plans not approved by security holders (4)	17,838,875		—	7,161,125	
Total	147,342,443		$ 0.28	192,593,474	

(1) Includes the Ginkgo Bioworks Holdings, Inc. 2021 Equity Incentive Plan.

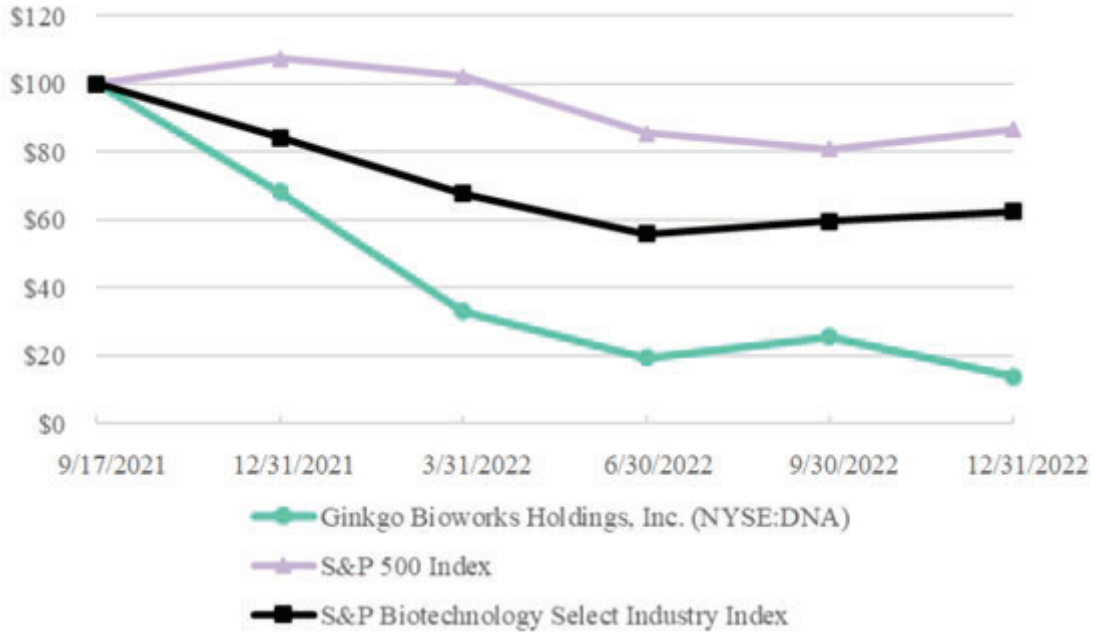
(2) Includes 12,906,001 shares of common stock issuable upon the exercise of outstanding stock options and 116,597,567 shares of common stock issuable upon settlement of outstanding restricted stock units.

(3) The Plan provides that the number of shares of common stock reserved and available for issuance under the Plan shall be cumulatively increased on January 1 of each year. The number of shares of common stock increased each year will be equal to the lesser of: (i) 4% of the number of shares of common stock issued and outstanding on the immediately preceding December 31 or (ii) such lesser amount as determined by our board of directors.

(4) Includes the Ginkgo Bioworks Holdings, Inc. 2022 Inducement Plan.

Performance Graph

The following graph compares the cumulative total stockholder return on our Class A common stock relative to the cumulative total returns of the S&P 500 Index and the S&P Biotechnology Select Industry Index between September 17, 2021 (the date our common stock began trading on the NYSE after the SRNG Business Combination) through December 31, 2022. All values assume a $100 initial investment at market close on September 17, 2021 and data for the S&P 500 and the S&P Biotechnology Select indices assume reinvestment of all dividends.



Recent Sales of Unregistered Securities

On October 4, 2022, we issued a total of 4,501,165 shares of Class A Common Stock to certain equity holders of Circularis Biotechnologies, Inc. ("Circularis"), valued at approximately $13.6 million, as consideration in connection with the acquisition of the outstanding equity interests of Circularis, in a private placement transaction exempt from the registration requirements of the Securities Act pursuant to Section 4(a)(2) of the Securities Act.

On October 4, 2022, we issued a total of 2,450,982 shares of Class A Common Stock to certain equity holders of Altar SAS ("Altar"), valued at approximately $7.5 million, as consideration in connection with the acquisition of the outstanding equity interests of Altar, in a private placement transaction exempt from the registration requirements of the Securities Act pursuant to Section 4(a)(2) of the Securities Act.

On October 28, 2022, we issued a total of 327,289 shares of our Class A common stock to Allen & Company LLC ("Allen & Company") and certain of its employees, valued at approximately $1.0 million, in partial satisfaction of the transaction fee payable to Allen & Company as our financial advisor in connection with the Zymergen Acquisition, in a private placement transaction exempt from the registration requirements of the Securities Act pursuant to Section 4(a)(2) of the Securities Act.

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 discussion and analysis of our financial condition and results of operations should be read in conjunction with the consolidated financial statements and related notes thereto included elsewhere in this Annual Report on Form 10-K. This discussion contains forward-looking statements that reflect our plans, estimates and beliefs that involve risks and uncertainties. As a result of many factors, such as those set forth under "Risk Factors" and "Cautionary Note Regarding Forward Looking Statements" sections elsewhere in the Form 10-K, our actual results may differ materially from those anticipated in these forward-looking statements as a result of many factors, including those discussed in Item 1A "Risk Factors" of this Annual Report on Form 10-K. Further, this section of this Form 10-K generally discusses 2022 and 2021 items and year-to-year comparisons between 2022 and 2021. For discussion related to 2020 items and year-to-year comparisons between 2021 and 2020 that are not included in this Form 10-K, please refer to Part II, Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations in our 2021 Form 10-K, filed with the United States Securities and Exchange Commission on March 29, 2022.

Overview

Our mission is to make biology easier to engineer.

Ginkgo is the leading platform for cell programming, providing flexible, end-to-end services that solve challenges for organizations across diverse markets, from food and agriculture to pharmaceuticals to industrial and specialty chemicals. Ginkgo's biosecurity and public health unit, Concentric by Ginkgo, is building global infrastructure for biosecurity to empower governments, communities, and public health leaders to prevent, detect and respond to a wide variety of biological threats.

We use our platform to program cells on behalf of our customers. These "cell programs" are designed to enable biological production of products as diverse as novel therapeutics, key food ingredients, and chemicals currently derived from petroleum. Biology did not evolve by end market. All of these applications run on cells which have a common code—DNA—and a common programming platform can enable all of them. Because of this shared platform, we are able to drive scale and learning efficiencies while maintaining flexibility and diversity in our program areas. Ultimately, customers come to us because they believe we maximize the probability of successfully developing their products.

The foundation of our cell programming platform includes two core assets that execute a wide variety of cell programs for customers according to their specifications: our Foundry and our Codebase.

- Our Foundry wraps proprietary software and automation around core cell engineering workflows—designing DNA, writing DNA, inserting that DNA into cells, testing cells to measure performance—and leverages data analytics and data science to inform each iteration of design. The software, automation and data analysis pipelines we leverage in the Foundry drive a strong scale economic that we refer to as "Knight's Law." We expect Foundry output, which we currently measure by daily strain tests, to increase year over year, while the cost per strain test decreases. We expect to be able to pass these savings along to our customers, allowing them to take more "shots on goal" with their programs.
- Our Codebase includes both our physical (engineered cells and genetic parts) and digital (genetic sequences and performance data) biological assets. Codebase accumulates as we execute more cell programs on the platform. Every program, whether successful or not, generates valuable Codebase and helps inform future experimental designs and provides reusable genetic parts, making our cell program designs more efficient. Historically, we have augmented our Codebase via acquisition of assets such as microbial strains, sample collections, and sequence data. In 2022, our Codebase grew to over two billion proprietary protein sequences as a result of recent acquisitions

As the platform scales, we have observed a virtuous cycle between our Foundry, our Codebase, and the value we deliver to customers. We believe this virtuous cycle sustains Ginkgo's growth and differentiated value proposition.

- Foundry: As we take on more work in the Foundry, we benefit from scale economics, which over time may lead to lower program costs. We expect that these lower costs, in turn, will drive additional demand for our cell programming capabilities.

- Codebase: Cell programs also generate Codebase, which can drive better experimental direction and improve the odds of technical success, further increasing our customer value proposition, which we believe will result in additional demand.

Put simply: we believe that as we scale, the platform improves. We believe that this in turn yields better program execution and customer outcomes, ultimately driving more demand, which drives further investments in scale and platform improvements, and so on. We believe this positive feedback loop has the potential to drive compounding value creation in the future, as every new program we add contributes to both near-term revenues and has the potential to add significant downstream economics and more positive impact.

Our cell programming business model mirrors the structure of our platform and we are compensated in two primary ways. First, we charge usage fees for services, in much the same way that cloud computing companies charge usage fees for utilization of computing capacity or CROs charge for services. Additionally, we negotiate a value share with our customers (typically in the form of royalties, milestones, and/or equity interests) in order to align our economics with the success of the programs enabled by our platform. As we add new programs, our portfolio of programs with this "downstream" value potential grows.

With a mission to make biology easier to engineer, we have always recognized the need to invest in biosecurity as a key component of our platform. We're building the future bioeconomy with our customers and partners, and we envision the future of biosecurity as a global immune system equipped with the capabilities to prevent, detect, and respond to biological threats. The first, critical step in realizing this future is to build a robust early warning system for biological threats—this is the primary focus of Ginkgo's biosecurity and public health unit, Concentric by Ginkgo.

In the second quarter of 2020, in response to the COVID-19 pandemic, we launched our commercial offering of COVID-19 testing products and services for businesses, academic institutions, and other organizations in which we generate product and service revenue. We generate product revenue through the sale of lateral flow assay ("LFA") diagnostic test kits, PCR sample collection kits and pooled test kits, all of which we sell to our customers on a standalone basis. We generate service revenue primarily through the sale of our end-to-end COVID-19 testing services which consist of multiple promised goods and services including sample collection kits, physician authorizations, onsite test administration, outsourced laboratory PCR analysis, and access to results reported through a web-based portal.

Beginning in the first quarter of 2021, we launched our pooled testing initiative which focuses on providing end-to-end COVID-19 testing and reporting services to public health authorities. We are currently offering pooled testing and reporting services for K-12 schools across the United States, at airports through our partnership with XpresCheck and the CDC, as well as through other congregate settings such as our partnership with Eurofins. Our COVID-19 testing business is subject to seasonality, and the demand for COVID-19 testing in schools is diminished, particularly in light of the White House's announcement that the public health emergency will end in May 2023. Over time, Concentric by Ginkgo has added new offerings such as wastewater monitoring and bioinformatic support and has expanded internationally. These expanded offerings were not a material portion of our revenue in 2022, but we expect their relative value to increase in future years.

Prior to 2022, we operated as a single reportable segment. In the first quarter of 2022, we reorganized our operations into two operating and reportable segments: Foundry and Biosecurity. The reorganization reflects changes made to our internal management structure and how our chief operating decision makers evaluate operating results and make decisions on how to allocate resources. Our two operating and reportable segments are described below:

- Foundry consists of research and development services performed under collaboration and license agreements relating to our cell programming platform. Our cell programming platform includes two core assets: the Foundry, highly efficient biology lab facilities, enabled by investment in proprietary workflows, custom software, robotic automation, and data science and analytics, which is paired with our Codebase, a collection of biological "parts" and a database of biological data used to program cells. The Foundry segment includes costs incurred for the development, operation, expansion and enhancement of the Foundry and Codebase. Foundry revenue, which we may also refer to as cell engineering revenue, is derived from Foundry usage fees and downstream value share in the form of milestone payments, royalties or equity interests.
- Biosecurity consists of COVID-19 testing products and services primarily provided to public health authorities. Biosecurity revenue is derived from sales of test kits and testing and reporting services fees.

Generating Economic Value Through Cell Programs

Our cell programming platform is a key enabling technology and source of intellectual property for our customers' products. We earn Foundry revenue for our R&D services as well as through a share of the value of products created using our platform.

We structure Foundry revenue to include some combination of the following:

- Foundry usage fees, which may comprise cash and/or non-cash consideration, in the form of:
  - upfront payments upon consummation of an agreement or other fixed payments that are generally recognized over our period of performance;
  - reimbursement for costs incurred for R&D services;
  - milestone payments upon the achievement of specified technical criteria;

plus,

- downstream value share payments in the form of:
  - milestone payments, which may comprise cash and/or non-cash consideration, upon the achievement of specified commercial criteria;
  - royalties on sales of products from or comprising engineered organisms;
  - royalties related to cost of goods sold reductions realized by our customers;

or,

- downstream value share in the form of equity interests in our customer.
  - downstream value share in the form of equity interest appreciation is not recognized as revenue but is expected to contribute to future cash flows upon liquidation, the amount and timing of which is inherently unpredictable.

Customer arrangements which involve non-cash consideration generally fall into two categories: Platform Ventures and Structured Partnerships.

Platform Ventures

Platform Ventures allow Ginkgo to partner with leading multinationals and financial investors to form new ventures in identified market segments with potential to benefit from synthetic biology. In exchange for an equity position in the venture, we contribute license rights to our proprietary cell programming technology and intellectual property, while our partners contribute relevant industry expertise, other resources and venture funding. We also provide R&D services for which we receive cash consideration on a fixed-fee or cost-plus basis. Platform Ventures include:

Motif FoodWorks, Inc.

Founded in 2018, Motif FoodWorks, Inc. ("Motif") was formed to focus on the application of synthetic biology to reduce the reliance on animal products in the food industry. We entered into an intellectual property contribution agreement that granted Motif rights to our intellectual property, subject to mutually agreed upon technical development plans. In return for our contribution of intellectual property and access to our platform, we received shares of common stock in Motif. The initial fair value of our common stock investment in Motif was $65.1 million which has subsequently been reduced to a carrying value of zero as a result of the allocation of losses under our accounting for equity method investments. Motif was capitalized through Series A preferred stock financings that raised approximately $119 million in gross proceeds from an investor group which included certain of our investors, Louis Dreyfus Company and Fonterra Co-operative Group Limited. In June 2021, Motif raised an additional $226 million through a Series B preferred stock financing. Ginkgo also entered into a Technical Development Agreement with Motif under which we provide R&D services in return for cash consideration on a cost-plus fixed margin basis. Motif launched its first product, HEMAMI, in 2021.

Allonnia, LLC

Founded in 2019, Allonnia, LLC ("Allonnia") was formed to focus on the application of synthetic biology in the waste bioremediation and biorecovery industries. We entered into an intellectual property contribution agreement that granted Allonnia rights to our intellectual property, subject to mutually agreed upon technical development plans. In return for our contribution of intellectual property and access to our platform, we received common units in Allonnia with a right to additional units subject to additional closings of Allonnia's Series A preferred units. The initial fair value of our common units received in Allonnia was $24.5 million, subsequently increased by $12.7 million in 2021, all of which has been reduced to a carrying value of zero as a result of the allocation of losses under our accounting for equity method investments. Allonnia was capitalized through Series A preferred unit financings that raised approximately $52 million in gross proceeds from an investor group which included certain of our investors and Battelle Memorial Institute. Ginkgo also entered into a Technical Development Agreement with Allonnia under which we provide R&D services in return for cash consideration on a fixed fee or cost-plus basis.

Arcaea, LLC

Founded in 2021, Arcaea, LLC ("Arcaea") was formed to focus on the application of synthetic biology in the beauty and personal care products industry. In March 2021, we entered into an intellectual property contribution agreement that granted Arcaea rights to our intellectual property, subject to mutually agreed upon technical development plans. In return for our contribution of intellectual property and access to our platform, we received common units in Arcaea with a right to additional units subject to additional closings of Arcaea's Series A preferred units. The initial fair value of our common units received in Arcaea was $11.9 million which has subsequently been reduced to a carrying value of zero as a result of the allocation of losses under our accounting for equity method investments. Arcaea was capitalized through a Series A preferred unit financing that raised approximately $77 million in gross proceeds from an investor group which included certain of our investors, CHANEL and Givaudan. Upon the closing of the Series A preferred unit financing in July 2021, we received an additional 5,229,900 common units in Arcaea. The fair value of our Arcaea common units received in July 2021 of $35.5 million has subsequently been reduced to a carrying value of zero as a result of the allocation of losses under our accounting for equity method investments. Ginkgo also entered into a Technical Development Agreement with Arcaea under which we provide R&D services in return for cash consideration on a fixed fee or cost-plus basis.

Ayana Bio, LLC

Founded in September 2021, Ayana Bio, LLC ("Ayana") was formed to identify and design new bioactive compounds for use as complementary medicine to support human health and wellness. Ayana was capitalized through a Series A funding that raised $30 million in gross proceeds from an investor group comprising certain of our investors. We hold an interest in 9,000,000 common units (representing 100% of common units at inception) of Ayana and have also provided Ayana with certain licenses to our intellectual property for use in the development or production of products that we have agreed to research and develop under technical development plans. Prior to the third quarter of 2022, we consolidated Ayana as a variable interest entity. In the third quarter of 2022, we deconsolidated Ayana and began accounting for our retained investment in Ayana as an equity method investment. The initial carrying value of the equity method investment in Ayana was equal to the fair value of our retained interest of $16.0 million as of the deconsolidation date which has been subsequently reduced to a carrying value of zero due to a basis difference associated with in-process research and development identified as part of the initial accounting for the equity method investment. Ginkgo also entered into a Technical Development Agreement with Ayana under which we provide R&D services in return for cash consideration on a fixed fee or cost-plus basis.

Verb Biotics, LLC

Founded in September 2021, Verb Biotics, LLC ("Verb") was formed to identify and design new strains of probiotic bacteria with advanced properties for human nutrition, health, and wellness. Verb was capitalized through a Series A funding that raised $30 million in gross proceeds from an investor group comprising certain of our investors. We hold an interest in 9,000,000 common units (representing 100% of common units at inception) of Verb and have also provided Verb with certain licenses to our intellectual property for use in the development or production of products that we have agreed to research and develop under technical development plans. Prior to the first quarter of 2022, we consolidated Verb as a variable interest entity. In the first quarter of 2022, we deconsolidated Verb and began accounting for our retained investment in Verb as an equity method investment. The initial carrying value of the equity method investment in Verb was equal to the fair value of our retained interest of $15.9 million as of the deconsolidation date which has been subsequently reduced to a carrying value of zero due to a basis difference associated with in-process research and development identified as part of the

initial accounting for the equity method investment. Ginkgo also entered into a Technical Development Agreement with Verb under which we provide R&D services in return for cash consideration on a fixed fee or cost-plus basis.

BiomEdit, LLC

Founded in April 2022, BiomEdit, LLC ("BiomEdit") was formed to discover, design and develop novel probiotics, microbiome derived bioactives and engineered microbial medicines in the animal health industry. BiomEdit was capitalized through a Series A preferred unit financing that raised approximately $32.5 million in gross proceeds from an investor group which included one of our investors. In April 2022, we entered into an intellectual property contribution agreement that granted BiomEdit rights to our intellectual property, subject to mutually agreed upon technical development plans and, in return, we received 3.9 million voting common units in BiomEdit. In addition, Elanco Animal Health also contributed intellectual property in exchange for 3.9 million non-voting common units in BiomEdit. The initial fair value of our common units received in BiomEdit was $8.9 million which has subsequently been reduced to a carrying value of $0.4 million as a result of the allocation of losses under our accounting for equity method investments. Ginkgo also entered into a Technical Development Agreement with BiomEdit under which we provide R&D services in return for cash consideration on a fixed fee or cost-plus basis.

Structured Partnerships

Structured Partnerships allow Ginkgo to: (i) partner with early stage synthetic biology product companies to adopt our Foundry as their cell programming R&D platform, in which we offer flexible commercial terms on the Foundry usage fees including the ability to pay a portion or all of such upfront fees in the form of non-cash consideration (convertible financial instruments and/or equity securities), in addition to downstream value share consideration ("Startup Structured Partnership"); and (ii) partner with existing entities with complementary assets for high potential synthetic biology applications in a large-scale, multi-program collaboration ("Legacy Structured Partnership"). In 2022, we entered into 12 Startup Structured Partnerships, which provided for prepayments of Foundry usage fees in the form of equity securities or convertible financial instruments in the aggregate amount of $30.7 million, that is recognized as revenue over our period of performance. In 2021, we entered into five Startup Structured Partnerships in which we received $16.5 million in upfront consideration in the form of equity securities that is recognized as revenue over our period of performance. Our Legacy Structured Partnerships are described below:

Genomatica, Inc.

Genomatica, Inc. ("Genomatica") is a biotechnology company specializing in the development and manufacturing of intermediate and specialty chemicals from both sugar and alternative feedstocks. In 2016 and 2018, we entered into separate preferred stock purchase agreements in which we offered cash and R&D services to Genomatica in exchange for its preferred shares. The initial cost of the investment in Genomatica's preferred stock was $55.0 million. As of December 31, 2022, the carrying value of the investment is $44.9 million and reflects the historical cost less an impairment loss recognized in the second quarter of 2022.

Synlogic, Inc.

Synlogic, Inc. ("Synlogic") is a publicly traded clinical-stage biopharmaceutical company focused on advancing drug discovery and development for synthetic biology-derived medicines. In 2019, we entered into several agreements with Synlogic whereby we purchased Synlogic common stock and warrants to purchase Synlogic common stock and agreed to provide R&D services to Synlogic. At inception, the fair value of Synlogic common stock and warrants was recorded at $35.8 million and $14.4 million, respectively. As of December 31, 2022, the fair value of Synlogic common stock and warrants was $4.8 million and $1.9 million, respectively.

See Notes 5 and 16 of our audited consolidated financial statements included elsewhere in this Annual Report on Form 10-K for further details of our investments in and the material terms of our agreements with our Platform Ventures and Structured Partnerships.

Key Business Metrics

A cell program (or "program") is the work we do for our customers to enable their product(s) of interest. Programs are defined by a technical development plan or objective. We generally exclude proof-of-concept projects and other exploratory work undertaken on a customer's behalf from the program count. In the near-term, programs deliver multi-year revenue from

platform usage fees. Over the long-term, program growth drives a physical infrastructure scale economic through our Foundry, a data and learning scale economic through our Codebase and accumulation of downstream value share. Our key business metrics comprise New Programs, Current Active Programs, and Cumulative Programs.

	Years Ended December 31,	
	2022	2021
New Programs	59	31
Current Active Programs	112	71
Cumulative Programs	164	105

New Programs

New Programs represent the number of unique programs commenced within the reporting period. As new programs have multi-year durations, we view this metric as an indication of future Foundry revenue growth, which we may also refer to as cell engineering revenue growth.

Current Active Programs

Current Active Programs represent the number of unique programs for which we performed R&D services in the reporting period. We view this metric as an indication of current period and future Foundry revenue.

Cumulative Programs

Cumulative Programs represent the cumulative number of unique programs Ginkgo has commenced. We view this metric as an indication of our competitive advantage and as a leading indicator of the mid- to long-term potential economic value derived from downstream value share arrangements. The cumulative number of programs also contributes to Codebase, which accumulates with each additional program we conduct over time and drives better experimental direction and improves the odds of technical success in current and future programs.

We believe the preceding metrics are important to understand our current business. These metrics may change or be substituted for additional or different metrics as our business develops. For example, as our program mix changes, our data gathering abilities expand or our understanding of key business drivers develops, we anticipate updating these metrics or their definitions to reflect such changes.

Zymergen Acquisition

On October 19, 2022, we completed the previously announced acquisition contemplated by that certain Agreement and Plan of Merger, dated as of July 24, 2022 (the “Zymergen Merger Agreement”), among Zymergen Inc., (“Zymergen”), Ginkgo, and Pepper Merger Subsidiary Inc., an indirect wholly owned subsidiary of Ginkgo (“Merger Subsidiary”). Pursuant to the Zymergen Merger Agreement, Merger Subsidiary merged with and into Zymergen (the “Zymergen Acquisition”), with Zymergen surviving the Zymergen Acquisition as a wholly owned subsidiary of Ginkgo. As consideration for the transaction, we delivered to Zymergen common stockholders 99,422,907 shares of Ginkgo Class A common stock for an aggregate purchase price of $231.8 million. See Note 3 of our audited consolidated financial statements included elsewhere in this Annual Report on Form 10-K for additional information.

Bayer Asset Purchase

On October 17, 2022, we closed the previously announced transaction with Bayer, under which we acquired certain assets and liabilities of Bayer, including Bayer's 175,000-square-foot West Sacramento Biologics Research & Development site, team, and internal discovery and lead optimization platform. As part of the acquisition, we plan to integrate certain research and development platform assets of Joyn Bio, LLC ("Joyn"), the joint venture created by Ginkgo and Bayer in 2017, and initiated the dissolution of Joyn. The acquisition is expected to expand our platform capabilities in agricultural biologicals. As consideration for the assets acquired, we paid Bayer $80.0 million in cash at closing. Concurrently with the closing, we entered into a multi-year collaboration with Bayer to advance multiple cell programs in exchange for quarterly installments and royalty-based downstream value. See Note 3 of our audited consolidated financial statements included elsewhere in this Annual Report on Form 10-K for additional information.

SRNG Business Combination

We entered into the Merger Agreement with Soaring Eagle Acquisition Corp. ("SRNG") on May 11, 2021. On September 14, 2021, the SRNG shareholders approved and adopted the Merger Agreement and the other proposals described in SRNG's definitive proxy statement/prospectus included in SRNG's registration statement on Form S-4 (File No. 333-256121), which was declared effective by the SEC on August 11, 2021. Upon the consummation of the business combination on September 16, 2021, SEAC Merger Sub Inc., a wholly owned subsidiary of SRNG ("SRNG Merger Sub"), merged with and into Ginkgo, the separate corporate existence of SRNG Merger Sub ceased, and Ginkgo survived the merger as a wholly owned subsidiary of SRNG, which was renamed "Ginkgo Bioworks Holdings, Inc" (the "SRNG Business Combination").

The SRNG Business Combination was accounted for as a reverse recapitalization in accordance with accounting principles generally accepted in the United States of America ("GAAP"). Under the guidance in ASC 805*, Business Combinations*, SRNG was treated as the "acquired" company for accounting and financial reporting purposes. We were deemed the accounting predecessor of the combined business, and as the parent company of the combined business, are the successor SEC registrant, meaning that our financial statements for previous periods will be disclosed in future periodic reports filed with the SEC. The SRNG Business Combination resulted in proceeds of $1,509.6 million, net of transaction costs of $108.1 million, and included $760.0 million in proceeds from the PIPE Investment (as defined below) that was consummated substantially simultaneously with the closing of the SRNG Business Combination.

As the successor to an SEC-registered and publicly listed company, we will need to hire additional personnel and implement procedures and processes to address public company regulatory requirements and customary practices. We expect to incur additional expenses as a public company for, among other things, directors' and officers' liability insurance, director fees, and additional internal and external accounting, legal and administrative resources.

Modification of Equity Awards in Connection with SRNG Business Combination

Prior to the SRNG Business Combination, our restricted stock units ("RSUs") were granted with both a service-based vesting condition and a performance-based vesting condition. We have historically not recognized any stock-based compensation expense associated with these awards as the achievement of the performance condition required a change in control or an initial public offering (both as defined in the underlying award agreement) that was not deemed probable of occurring. The SRNG Business Combination did not meet the performance condition required for vesting of our RSUs.

On November 17, 2021 our board of directors modified the vesting terms of RSUs to allow 10% of the RSUs that met the service condition as of the closing of the SRNG Business Combination (the "10% RSUs") to vest with respect to the performance condition, effective as of November 19, 2021, the date on which the Form S-8 registration statement covering such shares became effective. The remaining RSUs vested in full with respect to the performance condition on or before March 15, 2022. The change to the vesting terms was accounted for as a modification and resulted in approximately $1,678.4 million and $1,492.2 million of stock-based compensation expense recognized in 2022 and 2021, respectively, related to the modified RSUs. The 10% RSUs representing approximately 5.7 million shares were settled in cash for a total cash payment of $76.5 million equal to the fair value of the stock on the Form S-8 effective date. Stock-based compensation expense also included $193.3 million and $173.5 million in 2022 and 2021, respectively, related to RSU earnout shares which were subject to the same performance condition as the underlying RSUs, in addition to achieving certain target stock price thresholds. The first target stock price of $12.50 per share was achieved on November 15, 2021.

Components of Results of Operations

Revenue

Foundry Revenue

We generate Foundry revenue, which we may also refer to as cell engineering revenue, through the execution of license and collaboration agreements whereby customers obtain license rights to our proprietary technology and intellectual property for use in the development and commercialization of engineered organisms and derived products. Under these agreements, we typically provide R&D services for cell programming with the goal of producing an engineered cell that meets a mutually agreed specification. Our customers obtain license rights to the output of our services, which are primarily the optimized strains or cell lines, in order to manufacture and commercialize products derived from that licensed strain or cell line. Generally, the terms of these agreements provide that we receive some combination of: (1) Foundry usage fees in the form of (i) upfront payments upon consummation of the agreement or other fixed payments, (ii) reimbursement for costs incurred for R&D services and (iii) milestone payments upon the achievement of specified technical criteria, plus (2) downstream value share payments in the form of (i) milestone payments upon the achievement of specified commercial criteria, (ii) royalties on

sales of products from or comprising engineered organisms arising from the collaboration or licensing agreement and (iii) royalties related to cost of goods sold reductions realized by our customers. Royalties did not comprise a material amount of our revenue during any of the period presented.

Foundry revenue includes transactions with Platform Ventures and Legacy Structured Partnerships where, as part of these transactions, we received an equity interest in such entities. Specifically related to the Platform Ventures, in these transactions, we received upfront non-cash consideration in the form of common equity interests in these entities, while the Platform Ventures each received cash equity investments from strategic partners and financial investors. We view the upfront non-cash consideration as prepayments for licenses which will be granted in the future as we complete mutually agreed upon technical development plans. In these instances, we also receive cash consideration for the R&D services performed by us on a fixed fee or cost-plus basis. We are not compensated through additional milestone or royalty payments under these arrangements. Our transactions with Genomatica and Synlogic included the purchase of equity securities and the provision of R&D services. As we perform R&D services under the mutually agreed upon development plans, we recognize a reduction in the prefunded obligation on a cost-plus basis. These arrangements are further described in Notes 5, 6, 16 and 20 of our audited consolidated financial statements included elsewhere in this Annual Report on Form 10-K.

Foundry revenue also includes transactions with Startup Structured Partnerships where, as part of these transactions, we received upfront non-cash consideration in the form of current equity interests or financial instruments that are convertible into equity upon a triggering event. We grant the customer a prepaid Foundry services credit in exchange for the upfront non-cash consideration, which can be drawn down as payment for R&D services performed under mutually agreed upon development plans.

Downstream value share in the form of equity interest appreciation is not recognized as revenue but is expected to contribute to future cash flows upon liquidation, the amount and timing of which is inherently unpredictable. Equity investees are accounted for as equity method investments, cost method investments or carried at fair value.

Biosecurity Revenue

In the second quarter of 2020, in response to the COVID-19 pandemic, we launched our commercial offering of COVID-19 testing products and services for businesses, academic institutions, and other organizations in which we generate product and service revenue. We generate product revenue through the sale of lateral flow assay (“LFA”) diagnostic test kits, polymerase chain reaction (“PCR”) sample collection kits and pooled test kits, all of which we sell to our customers on a standalone basis. We generate service revenue primarily through the sale of our end-to-end COVID-19 testing services which consist of multiple promised goods and services including sample collection kits, physician authorizations, onsite test administration, outsourced laboratory PCR analysis, and access to results reported through a web-based portal.

Generally, the terms of these agreements provide that we are entitled to compensation: (i) upon delivery of diagnostic test kits when no service is provided and (ii) when services are included, upon the reporting of results to the customer.

Beginning in the first quarter of 2021, we launched our pooled testing initiative which focuses on providing end-to-end COVID-19 testing and reporting services to public health authorities. We are currently offering pooled testing and reporting services for K-12 schools across the United States, at airports through our partnership with XpresCheck and the CDC, as well as through other congregate settings such as our partnership with Eurofins. Our COVID-19 testing business is subject to seasonality, and the demand for COVID-19 testing in schools is diminished, particularly in light of the White House's announcement that the public health emergency will end in May 2023. Over time, Concentric by Ginkgo has added new offerings such as wastewater monitoring and bioinformatic support and has expanded internationally. These expanded offerings were not a material portion of our revenue in 2022, but we expect their relative value to increase in future years.

Costs and Operating Expenses

Cost of Biosecurity Product Revenue

Cost of Biosecurity product revenue consists of costs associated with the sale of diagnostic and sample collection test kits which includes costs incurred to purchase test kits from third parties.

Cost of Biosecurity Service Revenue

Cost of Biosecurity service revenue consists of costs associated with the provision of our end-to-end COVID-19 testing services, which includes costs incurred to provide sample collection kits, physician authorizations, onsite test administration, outsourced laboratory PCR analysis, access to results reported through our proprietary web-based portal and reporting of results to public health authorities.

Research and Development Expenses

The nature of our business, and primary focus of our activities, generates a significant amount of R&D expenses. R&D expenses represent costs incurred by us for the following:

- development, operation, expansion and enhancement of our Foundry and Codebase; and
- development of new offerings, such as Biosecurity.

The activities above incur the following expenses:

- laboratory supplies, consumables and related services provided under agreements with third parties and in-licensing arrangements;
- personnel compensation and benefits; and
- rent, facilities, depreciation, software, professional fees and other direct and allocated overhead expenses.

We expense R&D costs as incurred. As we grow our active programs and customer base and invest in our Foundry and Codebase through organic and inorganic growth initiatives, we anticipate that our R&D expenses will continue to increase. The nature, timing, and estimated costs required to support our growth will be dependent on advances in technology, our ability to attract new customers and the rate of market penetration within our existing customer industries.

Beginning in the fourth quarter of 2021, R&D expenses included a significant charge for stock-based compensation expense as a result of the modification of vesting terms of RSUs and the vesting of certain earnout shares (as further described above in "*Modification of Equity Awards in Connection with SRNG Business Combination*").

General and Administrative Expenses

General and administrative ("G&A") expenses consist primarily of costs for personnel in executive, business development, finance, human resources, legal and other corporate administrative functions. G&A expenses also include legal fees incurred relating to corporate, intellectual property and patent matters, professional fees incurred for accounting, auditing, tax and administrative consulting services, insurance costs, and facility-related costs not otherwise included in R&D expenses.

We expect our G&A expenses will continue to increase as we pursue organic and inorganic growth initiatives. The increases will likely relate to additional personnel, system costs and increased costs related to business development, finance and legal matters, along with increased expenses related to operating as a publicly traded company, such as fees related to audit, legal and tax services, regulatory compliance programs and investor relations.

Beginning in the fourth quarter of 2021, G&A expenses included a significant charge for stock-based compensation expense as a result of the modification of vesting terms of RSUs and the vesting of certain earnout shares (as further described above in "Modification of Equity Awards in Connection with SRNG Business Combination").

Interest Income

Interest income consists primarily of interest earned on our cash and cash equivalents.

Interest Expense

Interest expense consists primarily of interest related to our lease financing obligation.

Loss on Equity Method Investments

Loss on equity method investments includes our share of losses from certain of our equity method investments under the Hypothetical Liquidation at Book Value ("HLBV") method.

Loss on Investments

Loss on investments includes the change in fair value of our marketable equity securities in publicly traded companies and impairment losses recognized on non-marketable equity securities in privately held companies.

Change in Fair Value of Warrant Liabilities

Change in fair value of warrant liabilities includes the change in fair value of private placement warrants ("Private Placement Warrants") and publicly traded warrants ("Public Warrants"), which are classified as liabilities and were assumed as part of the SRNG Business Combination. Warrant liabilities are marked to market at each balance sheet date.

Gain on Settlement of Partnership Agreement

Gain on settlement of partnership agreement includes payments made by Amyris, Inc. ("Amyris") under a settlement agreement.

Gain on Deconsolidation of Subsidiaries

Gain on deconsolidation of subsidiaries relates to our deconsolidation of variable interest entities, Verb and Ayana, in the first and third quarters of 2022, respectively. The deconsolidation resulted in the removal of Verb and Ayana's assets, liabilities and non-controlling interest balances from our balance sheet and the recognition of our retained interest in each entity measured at fair value as of the deconsolidation date.

Other Income (Expense), Net

Other income (expense), net primarily consists of changes in fair value of our convertible notes with Access Bio, Inc. ("Access Bio Convertible Notes") and promissory note with Glycosyn, LLC ("Glycosyn Promissory Note"), each accounted for under the fair value option, sublease rent income and loss on disposal of equipment.

Provision for Income Taxes

Income taxes are recorded in accordance with ASC 740*, Income Taxes* ("ASC 740"), which provides for deferred taxes using an asset and liability approach. We recognize deferred tax assets and liabilities for the expected future tax consequences of events that have been included in our audited consolidated financial statements or tax returns. Deferred tax assets and liabilities are determined based on the difference between the financial statement and tax bases of assets and liabilities using enacted tax rates in effect for the year in which the differences are expected to reverse. A valuation allowance against deferred tax assets is recorded if, based on the weight of the available evidence, it is more likely than not that some or all the deferred tax assets will not be realized. For all periods presented, we have recorded a valuation allowance against the deferred tax assets that are not expected to be realized.

We account for uncertain tax positions using a more-likely-than-not threshold for recognizing and resolving uncertain tax positions. The evaluation of uncertain tax positions is based on factors, including, but not limited to, changes in the law, the measurement of tax positions taken or expected to be taken in tax returns, the effective settlement of matters subject to audit, new audit activity and changes in facts or circumstances related to a tax position.

As of December 31, 2022, we had federal net operating loss carryforwards of approximately $1,838.0 million, of which $139.2 million begin to expire in 2029 and $1,698.8 million can be carried forward indefinitely. As of December 31, 2022, we had state net operating loss carryforwards of approximately $734.1 million, of which $661.9 million begin to expire in 2030 and $72.2 million can be carried forward indefinitely. As of December 31, 2022, we had foreign net operating losses of approximately $1.4 million, of which $0.5 million will begin to expire in 2030 and $0.9 million can be carried forward indefinitely. As of December 31, 2022, we had federal research and development tax credit carryforwards of approximately $30.3 million which begin to expire in 2029. As of December 31, 2022, we also had state research and development and investment tax credit carryforwards of approximately $55.7 million which begin to expire in 2030.

Income taxes are determined at the applicable tax rates adjusted for non-deductible expenses, R&D tax credits and other permanent differences. Our income tax provision may be significantly affected by changes to our estimates.

Results of Operations

Comparison of the Years Ended December 31, 2022 and 2021

The following table summarizes our consolidated statements of operations for each period presented:

	Year Ended December 31,		
(in thousands)	2022	2021	Change
Foundry revenue	$ 143,666	$ 112,989	$ 30,677
Biosecurity revenue:			
Product	35,455	23,040	12,415
Service	298,585	177,808	120,777
Total revenue	477,706	313,837	163,869
Costs and operating expenses:			
Cost of Biosecurity product revenue	20,646	20,017	629
Cost of Biosecurity service revenue	183,570	109,673	73,897
Research and development [(1)]	1,052,643	1,149,662	(97,019)
General and administrative [(1)]	1,429,799	862,952	566,847
Total operating expenses	2,686,658	2,142,304	544,354
Loss from operations	(2,208,952)	(1,828,467)	(380,485)
Other income (expense):			
Interest income	20,262	837	19,425
Interest expense	(106)	(2,373)	2,267
Loss on equity method investments	(43,761)	(77,284)	33,523
Loss on investments	(53,335)	(11,543)	(41,792)
Change in fair value of warrant liabilities	124,970	58,615	66,355
Gain on settlement of partnership agreement	—	23,826	(23,826)
Gain on deconsolidation of subsidiaries	31,889	—	
Other income (expense), net	7,634	(1,733)	9,367
Total other income (expense), net	87,553	(9,655)	97,208
Loss before income taxes	(2,121,399)	(1,838,122)	(283,277)
Income tax (benefit) provision	(15,027)	(1,480)	(13,547)
Net loss	(2,106,372)	(1,836,642)	(269,730)
Loss attributable to non-controlling interest	(1,443)	(6,595)	5,152
Net loss attributable to Ginkgo Bioworks Holdings, Inc. stockholders	$ (2,104,929)	$ (1,830,047)	$ (274,882)

[(1)] R&D and G&A expenses included a significant charge for stock-based compensation expense as a result of the modification of the vesting terms of RSUs and all related earnout shares (as further described above in "Modification of Equity Awards in Connection with SRNG Business Combination"). Total stock-based compensation expense inclusive of employer payroll taxes was allocated as follows (in thousands):

	Year Ended December 31,	
	2022	2021
Research and development	$ 738,821	$ 930,360
General and administrative	1,202,099	757,247
Total	$ 1,940,920	$ 1,687,607

Foundry Revenue

Foundry revenue increased $30.7 million in 2022 compared to 2021. The increase was primarily due to progress of Current Active Programs with existing and new customers, including an increase of $10.1 million in downstream value share payments received upon the achievement of commercial milestones. Additionally, revenue increased due to the launch of New Programs and was partially offset by the completion of certain programs. Programs typically require a ramp-up period and/or the achievement of technical and/or commercial milestones before contributing in a meaningful way to revenue.

As discussed above in Components of Results of Operations, Foundry revenue comprises both cash and non-cash consideration. Foundry revenue recognized relating to non-cash consideration increased from $39.9 million in 2021 to $75.8 million in 2022, inclusive of downstream value share milestone payments received in the form of equity securities.

The total number of Current Active Programs increased from 71 in 2021 to 112 in 2022. In 2022, 59 New Programs commenced compared to 31 New Programs in 2021. Cumulative Programs increased from 105 in 2021 to 164 in 2022. The number of customers increased from 33 in 2021 to 56 in 2022.

While the majority of Foundry revenue today is made up of Foundry usage fees, as we increase Cumulative Programs and to the extent our customers successfully commercialize products built on our platform, downstream value share is expected to comprise a larger proportion of Foundry revenue. Downstream value share in the form of equity interest appreciation is not recognized as revenue but is expected to contribute to future cash flows upon liquidation, the amount and timing of which is inherently unpredictable.

Biosecurity Revenue

Biosecurity revenue increased $133.2 million in 2022 compared to 2021 and was comprised of an increase in service revenue of $120.8 million and an increase in product revenue of $12.4 million.

The amount and components of Biosecurity revenue are dependent on the demand for COVID-19 testing products and services which is uncertain in 2023 and beyond. In particular, the demand for COVID-19 testing in schools has significantly diminished, with further uncertainty particularly in light of the White House's announcement that the public health emergency will end in May 2023.

Cost of Biosecurity Product and Service Revenue

Cost of Biosecurity product and service revenue increased $74.5 million in 2022 compared to 2021. The increase was driven by increased demand for our COVID-19 testing products and services.

Research and Development Expenses

Research and development expenses decreased $97.0 million in 2022 compared to 2021. The decrease was primarily attributable to a decrease in stock-based compensation expense of $191.5 million (inclusive of employer payroll taxes), partially offset by increases, driven by organic and inorganic growth initiatives, in personnel-related compensation and benefits expense of $36.8 million, rent and facilities expense of $21.3 million, professional fees of $15.3 million, depreciation and amortization expense of $10.9 million, and software and technology expense of $9.2 million. Stock-based compensation decreased due to vesting of RSUs and certain earnout shares that were modified in the fourth quarter of 2021, resulting in a cumulative catch-up adjustment recorded in 2021 for the portion of the employee's requisite service provided as of the modification date (refer to above section "Modification of Equity Awards in Connection with SRNG Business Combination").

General and Administrative Expenses

General and administrative expenses increased $566.8 million in 2022 compared to 2021. The increase was primarily attributable to increases, as a result of becoming a public company and supporting business scaling through organic and inorganic growth initiatives, in professional fees of $49.8 million, personnel-related compensation and benefits expense of $46.8 million, insurance expense of $8.6 million, travel and entertainment expense of $4.9 million, rent and facilities expense of $4.8 million, depreciation and amortization expense of $3.5 million, and marketing expense of $2.7 million. The remaining increase was attributable to stock-based compensation expense of $444.9 million (inclusive of employer payroll taxes) primarily due to founder equity awards granted in January 2020 and September 2021, which vested in full in October 2022. These awards were also subject to the same modification described above in "Modification of Equity Awards in Connection with SRNG Business Combination".

Interest Income

Interest income increased $19.4 million in 2022 compared to 2021, primarily due to higher average cash balances in interest bearing accounts and increases in interest rates on cash held in money market accounts.

Interest Expense

Interest expense decreased $2.3 million in 2022 compared to 2021, primarily due to non-cash interest expense on a build-to-suit lease financing obligation, which was derecognized upon the adoption of Financial Accounting Standards Board Accounting Standard Update No 2016-02, Leases (Topic 842) on January 1, 2022 and is now recorded as operating lease expense on the consolidated statements of operations and comprehensive loss.

Loss on Equity Method Investments

Loss on equity method investments decreased $33.5 million in 2022 compared to 2021. The decrease was primarily attributable to our equity method investments in BiomEdit, Verb, Ayana, Joyn, Arcaea and Allonnia.

In 2022, we launched our new Platform Venture, BiomEdit, and recorded a $8.5 million loss on our equity method investment in BiomEdit as a result of the application of the HLBV method during 2022. Upon the deconsolidation of Verb and Ayana in 2022, we recorded an aggregate $31.9 million loss on our retained investments in Verb and Ayana due to a basis difference associated with in-process research and development identified as part of the initial accounting for the equity method investments. Our share of Joyn's losses under the HLBV method decreased by $14.2 million in 2022 compared to 2021, primarily as a result of a $14.0 million gain on the remeasurement of our 50% equity interest in Joyn at fair value as of the business combination date.

The increase in losses related to BiomEdit, Verb and Ayana were offset by a decrease in losses related Allonnia and Arcaea. The fair value of the additional equity we received in Allonnia of $12.7 million in 2021 was reduced to zero during the period as a result of the application of the HLBV method. The fair value of the initial equity we received in Arcaea of $47.4 million in 2021 was also reduced to zero during the period as a result of the application of the HLBV method.

Under the HLBV method, we absorb losses as a common unit holder prior to preferred unit holders due to a substantive profit-sharing agreement where the preferred unit holders receive preferential distribution rights. Because we have no commitment to fund the losses of Verb, Ayana, Arcaea or Allonnia, no further losses on these equity method investments were recognized during the periods presented.

Loss on Investments

Loss on investments increased $41.8 million in 2022 compared to 2021. The increase was driven by fluctuations in the stock prices of our marketable equity securities, a $10.1 million impairment loss recognized on our investment in Genomatica preferred stock in 2022 and mark-to-market adjustments on equity securities received as downstream value share payments upon the achievement of commercial milestones. Non-cash consideration from customers is initially measured at the fair value of the non-cash consideration at contract inception.

Change in Fair Value of Warrant Liabilities

The gain on the change in fair value of warrant liabilities increased $66.4 million in 2022 compared to 2021. The change in fair value of warrant liabilities is primarily driven by a decline in the value of our common stock during the periods, which decreased the fair value of the liability classified warrants.

Gain on Settlement of Partnership Agreement

Gain on settlement of partnership agreement decreased $23.8 million in 2022 compared to 2021 and consisted of a payment received from Amyris in 2021 in full settlement of all amounts due under the partnership agreement.

Gain on Deconsolidation of Subsidiaries

Gain on deconsolidation of subsidiaries relates to our deconsolidation of Verb and Ayana and consisted of $15.9 million and $16.0 million retained interests in Verb and Ayana, respectively, measured at fair value as of the deconsolidation date.

Other Income (Expense), Net

Other income (expense), net increased $9.4 million in 2022 compared to 2021. The increase was primarily attributable to changes in fair value of the Access Bio Convertible Notes and Glycosyn Promissory Note which are marked to market at each period-end, a $5.3 million gain on the convertible promissory notes from Joyn which were remeasured to fair value as of

the business combination date, a $3.9 million increase in sublease rent income, partially offset by loss on disposal of equipment.

Non-GAAP Information

In addition to our results determined in accordance with GAAP, we use EBITDA and Adjusted EBITDA internally to evaluate our performance and make financial and operational decisions. We believe these non-GAAP measures, when viewed with our GAAP results, may be helpful to investors in assessing our operating performance.

We define EBITDA as net loss attributable to Ginkgo Bioworks Holdings, Inc. stockholders before the impact of interest income, interest expense, provision for income taxes and depreciation and amortization.

We define Adjusted EBITDA as EBITDA adjusted for stock-based compensation expense, gain or loss on equity method investments, gain or loss on investments, change in fair value of warrant liabilities, gain on settlement of partnership agreement, gain on deconsolidation of subsidiaries, acquired in-process research and development in connection with asset acquisitions and other income and expenses. In 2022, we redefined Adjusted EBITDA to exclude transaction and integration costs associated with planned, completed or terminated mergers and acquisitions. We believe that the use of EBITDA and Adjusted EBITDA provides an additional tool for investors to use in evaluating ongoing operating results and trends because it eliminates the effect of financing activities, investing activities, and certain non-cash charges and other items that are not related to our core operating performance or affect comparability period over period.

Our non-GAAP financial measures have limitations as analytical tools and should not be considered in isolation or as a substitute for performance measures calculated in accordance with GAAP. In addition, our presentation of these measures should not be construed as an inference that our future results will be unaffected by future income or future expenses similar to those excluded when calculating these measures. Our computation of these measures, especially Adjusted EBITDA, may not be comparable to similarly titled measures of other companies because not all companies calculate these measures in the same way. We compensate for these limitations by providing a reconciliation of EBITDA and Adjusted EBITDA to their most directly comparable GAAP financial measure.

The following table reconciles net loss attributable to Ginkgo Bioworks Holdings, Inc. stockholders to EBITDA and Adjusted EBITDA for the years ended December 31, 2022 and 2021, respectively:

	Year Ended December 31,	
(in thousands)	**2022**	**2021**
Net loss attributable to Ginkgo Bioworks Holdings, Inc. stockholders	$ (2,104,929)	$ (1,830,047)
Interest income	(20,262)	(837)
Interest expense	106	2,373
Income tax benefit	(15,027)	(1,480)
Depreciation and amortization	42,552	29,076
EBITDA	(2,097,560)	(1,800,915)
Stock-based compensation [(1)]	1,940,920	1,687,607
Loss on equity method investments [(2)]	45,315	74,445
Loss on investments	53,335	11,543
Change in fair value of warrant liabilities	(124,970)	(58,615)
Gain on settlement of partnership agreement	—	(23,826)
Gain on deconsolidation of subsidiaries	(31,889)	—
Merger and acquisition related expenses [(3)]	46,229	—
Other [(4)]	(4,153)	3,712
Adjusted EBITDA	$ (172,773)	$ (106,049)

(1) For the years ended December 31, 2022 and 2021, includes $10.3 million and $5.0 million, respectively, in employer payroll taxes.

(2) Represents losses on equity method investments under the HLBV method, net of losses attributable to non-controlling interests.

(3) Represents transaction and integration costs directly related to mergers and acquisitions including (i) due diligence, legal, consulting and accounting fees associated with acquisitions, (ii) post-acquisition employee retention bonuses and

severance payments, (iii) the fair value adjustments to contingent consideration liabilities resulting from acquisitions, and (iv) acquired intangible assets expensed to research and development associated with an asset acquisition.

(4) For the year ended December 31, 2022, includes $1.2 million in mark-to-market loss on the Access Bio Convertible Notes and Glycosyn Promissory Note and a $5.3 million fair market value remeasurement gain on the convertible promissory notes from Joyn. For the year ended December 31, 2021, includes $3.7 million in mark-to-market adjustments on the Access Bio Convertible Notes and Glycosyn Promissory Note.

Liquidity and Capital Resources

Sources of Liquidity

Prior to the SRNG Business Combination, our sources of liquidity have been predominantly from proceeds from equity offerings, convertible notes offerings, payments received for R&D services under license and collaboration arrangements including those received on an upfront basis and upon accomplishment of milestones, payments received from Biosecurity product sales and services, and government grants. Upon the closing of the SRNG Business Combination in September 2021, we received net proceeds totaling approximately $1,509.6 million, inclusive of $760.0 million from the PIPE Investment. As of December 31, 2022, we had cash and cash equivalents of $1,315.8 million which we believe will be sufficient to enable us to fund our projected operations through at least the next 12 months from the date of filing of this Annual Report on Form 10-K.

Our wholly-owned subsidiary Zymergen was impacted by the closure of Silicon Valley Bank ("SVB") on March 10, 2023. At the time of closing, Zymergen had a total cash balance of approximately $74 million held in deposit accounts at SVB. Zymergen does not maintain any other material accounts or lines of credit with SVB. The cash balance with SVB represents approximately 6% of our cash and cash equivalents as of December 31, 2022, which is considered to be immaterial to our liquidity.

Material Cash Requirements

We anticipate that our expenditures will increase significantly in connection with our ongoing activities, as we:

- continue our R&D, activities under existing and new programs and further invest in our Foundry and Codebase;
- hire additional personnel and secure facilities to support our expanding R&D efforts;
- develop and expand our offerings, including Biosecurity;
- upgrade and expand our operational, financial and management systems and support our operations;
- acquire and integrate companies, assets or intellectual property that advance our company objectives;
- maintain, expand, and protect our intellectual property; and
- incur additional costs associated with operating as a public company.

Leases

We have various noncancelable operating leases for office and laboratory space that begin to expire on dates ranging from 2030 through 2036. As of December 31, 2022, we have minimum rental commitments under noncancelable operating leases of $58.1 million in 2023 and $606.7 million thereafter. See Note 8 to the consolidated financial statements in Part II, Item 8 of this Annual Report on Form 10-K for more information.

Purchase Obligations

In March 2022, we entered into a four-year noncancelable supply agreement with Twist for the purchase of diverse products including synthetic DNA. Under this agreement, we are obligated to spend a minimum of $58.0 million over the four-year term, with approximately $10.0 million payable in the next 12 months and $48.0 million thereafter.

Capital Expenditures

We anticipate our cumulative spending on capital expenditures to be in the range of $60.0 million over the next twelve months, subject to management's ongoing reassessment, to support our commercial plan as we strategically invest in capacity and technology to deliver new cell programs.

Cash Flows

The following table provides information regarding our cash flows for each period presented:

	Year Ended December 31,	
(in thousands)	2022	2021
Net cash (used in) provided by:		
Operating activities	$ (252,198)	$ (253,818)
Investing activities	(67,394)	(73,257)
Financing activities	95,337	1,534,145
Effect of exchange rate changes	908	(19)
Net (decrease) increase in cash, cash equivalents and restricted cash	$ (223,347)	$ 1,207,051

Operating Activities

Net cash used in operating activities for the year ended December 31, 2022 consisted of net loss of $2,106.4 million, adjusted for net change in operating assets and liabilities of $37.0 million and non-cash charges of $1,891.2 million. The net change in operating assets and liabilities was primarily due to a decrease in accounts receivable of $55.0 million from increased Biosecurity collections partially offset by increase in prepaid expense and other current assets of $8.7 million primarily due to prepaid insurance for directors and officers, decrease in accounts payable of $10.8 million due to timing of invoices, decrease in accrued expenses and other current liabilities of $39.6 million, decrease in deferred revenue of $36.4 million, and lease incentives received of $13.2 million offset by $10.8 million decrease in operating lease liabilities. Non-cash adjustments primarily consisted of depreciation and amortization of $42.6 million, stock-based compensation expense of $1,930.6 million, loss on investments and equity method investments of $97.1 million, non-cash lease expense of $19.1 million associated with operating lease right-of-use assets, partially offset by deferred income tax benefit of $14.6 million related to acquisitions, gain on the change in fair value of warrant liabilities of $125.0 million, non-cash equity consideration of $34.3 million from commercial milestones associated with a customer collaboration arrangement, and $31.9 million gain on the deconsolidation of Verb and Ayana.

Net cash used in operating activities for the year ended December 31, 2021 consisted of net loss of $1,836.6 million, adjusted for net change in operating assets and liabilities of $61.5 million and non-cash charges of $1,644.4 million. The net change in operating assets and liabilities was primarily due to an increase in accounts receivable of $114.1 million driven by an increase in Biosecurity revenue and a decrease in deferred revenue of $10.5 million, partially offset by an increase in accrued expenses and other current liabilities of $44.8 million primarily due to Biosecurity revenue accruals, an increase in deferred rent of $6.0 million as a result of entering into new leases and expanding the terms of existing leases and an increase in other non-current liabilities of $18.6 million primarily due to a $20.0 million customer deposit liability. Non-cash adjustments primarily consisted of depreciation and amortization of $29.1 million, stock-based compensation expense of $1,606.0 million, loss on equity method investments of $77.3 million and loss on investments of $11.5 million, partially offset by gain on change in fair value of warrant liabilities of $58.6 million and non-cash equity consideration of $24.2 million from milestones associated with a customer collaboration arrangement.

Investing Activities

Net cash used in investing activities for the year ended December 31, 2022, primarily consisted of purchases of property and equipment of $52.3 million associated with Foundry capacity and capability investments, purchases of notes receivable and marketable equity securities of $43.7 million, relinquishment of $55.7 million in cash upon the deconsolidation of Verb and Ayana, partially offset by $10.0 million cash redemption of our Access Bio Convertible Note and net cash received from business and asset acquisitions of $74.7 million.

Net cash used in investing activities for the year ended December 31, 2021, primarily consisted of purchases of property and equipment of $56.5 million associated with Foundry capacity and capability investments, purchase of non-marketable equity securities of $5.0 million and acquisition of Dutch DNA for $12.0 million.

Financing Activities

Net cash provided by financing activities for the year ended December 31, 2022, primarily consisted of $99.3 million in net cash proceeds from our underwritten public offering in November, the proceeds of which will be used to offset the cash used to finance the acquisition of certain assets of Bayer and for other general corporate purposes.

Net cash provided by financing activities for the year ended December 31, 2021, primarily consisted of net proceeds received from the SRNG Business Combination of $1,509.6 million, non-controlling interest contributions of $59.9 million related to our then consolidated variable interest entities ("VIEs"), Ayana and Verb, partially offset by repurchases of common stock from our founders of $25.0 million and tax withholding payments related to net share settlement of equity awards of $9.5 million.

Critical Accounting Estimates

Our management's discussion and analysis of our financial condition and results of operations is based on our consolidated financial statements, which have been prepared in accordance with GAAP. The preparation of these consolidated financial statements requires us to make judgments and estimates that affect the reported amounts of assets, liabilities, revenues and expenses and the disclosure of contingent assets and liabilities in our consolidated financial statements. We base our estimates on historical experience, known trends and events and various other factors that we believe to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions. On an ongoing basis, we evaluate our judgments and estimates in light of changes in circumstances, facts and experience. The effects of material revisions in estimates, if any, are reflected in our consolidated financial statements prospectively from the date of change in estimates.

While our significant accounting policies are described in more detail in Note 2 to our audited consolidated financial statements appearing elsewhere in this Annual Report on Form 10-K, we believe the following accounting policies used in the preparation of our consolidated financial statements require the most significant judgments and estimates.

Revenue Recognition

We account for revenue in accordance with ASC 606, *Revenue from Contracts with* Customers ("ASC 606"). Under ASC 606, we recognize revenue when the customer obtains control of the promised goods or services, at an amount that reflects the consideration we expect to receive in exchange for those goods or services. To determine revenue recognition for arrangements that are within the scope of ASC 606, we perform the following five steps: (i) identify the contract(s) with a customer, (ii) identify the promises and distinct performance obligations in the contract, (iii) determine the transaction price, (iv) allocate the transaction price to the performance obligations in the contract, and (v) recognize revenue when (or as) we satisfy the performance obligations.

Foundry Revenue

We generate license and service revenue through the execution of license and collaboration agreements whereby customers obtain license rights to our proprietary technology and intellectual property for use in the research, development and commercialization of engineered organisms and derived products. Under these agreements, we typically provide R&D services, which includes the provision of a license to our intellectual property. Additionally, the customer obtains license rights to the output of our services in order to commercialize the resulting output of such services. Generally, the terms of these agreements provide that we receive some combination of: (1) Foundry usage fees in the form of (i) upfront payments upon consummation of the agreement or other fixed payments, (ii) reimbursement for costs incurred for R&D services and (iii) milestone payments upon the achievement of specified technical criteria, plus (2) downstream value share payments in the form of (i) milestone payments upon the achievement of specified commercial criteria, (ii) royalties on sales of products from or comprising engineered organisms arising from the collaboration or licensing agreement and (iii) royalties related to cost of goods sold reductions realized by our customers.

Our collaboration and licensing agreements often contain multiple promises, including (i) licenses and assignments of intellectual property and materials and (ii) R&D services, and we determine whether each of the promises is a distinct performance obligation based on the nature of each agreement. As we are generally performing R&D services that are highly integrated and interrelated to the licenses and assignments of intellectual property and materials, the promises are generally inseparable. As such, we typically combine the R&D services, licenses, and assignments into a single performance obligation. However, for certain agreements, we only grant licenses or effects such transfers and assignments upon the successful completion of the R&D services or delivery of a developed product. For these agreements, we typically consider (i) the R&D services and (ii) the licenses, transfers, and assignments as distinct performance obligations, as each is transferred separately and has a separately identifiable benefit. Options to acquire additional goods and services are evaluated to determine if such options provide a material right to the counterparty that it would not have received without entering into

the contract. If so, the option is accounted for as a separate performance obligation. If not, the option is considered a marketing offer which is accounted for as a separate contract upon the counterparty's election.

At contract inception, we determine the transaction price, including fixed consideration and any estimated amounts of variable consideration. Any upfront cash payment received upon consummation of the agreement is fixed and generally nonrefundable. Variable consideration is subject to a constraint, and amounts are included in the transaction price to the extent that it is probable that a significant reversal in the amount of cumulative revenue recognized will not occur when the uncertainty associated with the variable consideration is subsequently resolved. Variable consideration may include reimbursement for costs incurred for our R&D efforts, milestone payments upon the achievement of certain technical and commercial criteria, and royalties on sales of products from or comprising engineered organisms arising from the agreement. With respect to the R&D reimbursements and milestone payments, we use the most likely amount method to estimate variable consideration. With respect to agreements that include royalties on sales or other contingent payments based on sales, we apply the royalty recognition constraint which requires a constraint until the royalty or value-sharing transaction occurs.

Certain agreements contain payment in the form of shares of equity securities or other financial instruments that are convertible into equity upon a triggering event. Any non-cash consideration is measured at the estimated fair value of the non-cash consideration at contract inception. For equity securities and financial instruments received that are not actively traded, we generally engage a third-party valuation specialist to determine the estimated fair value of the upfront non-cash consideration. The fair value is generally determined based on a recent round of financing or by using a scenario-based valuation model. Significant unobservable inputs are used in the fair value measurements including expectations regarding future financings of the customer, scenario dates and probabilities, expected volatility, discount rates and recovery rates. Changes in these assumptions can materially affect the value of the non-cash consideration and the total amount of revenue recognized for the contract.

For agreements with promises that are combined into a single performance obligation, the entire transaction price is allocated to the single performance obligation. For agreements with multiple performance obligations, the transaction price is allocated to the performance obligations using the relative standalone selling price methodology. For agreements featuring variable consideration, we allocate variable consideration to one or more, but not all, performance obligations if certain conditions are met. Specifically, we assess whether the variable consideration relates solely to our efforts to satisfy the performance obligation and whether allocating such variable consideration entirely to the performance obligation is consistent with the overall allocation objective. If these conditions are not met, we allocate the variable consideration based on the relative standalone selling price methodology. The key assumptions utilized in determining the standalone selling price for each performance obligation include development timelines, estimated R&D costs, commercial markets, likelihood of exercise (in the case of options considered to be material rights), and probabilities of success.

For agreements where the licenses or assignments are considered separate performance obligations or represent the only performance obligation, we recognize revenue at the point in time that we effectively grant the license as the licenses or assignments represent functional intellectual property. For agreements where the licenses and the R&D services represent a combined performance obligation, we recognize revenue over the period of performance using a measure of progress based on costs incurred to date as compared to total estimated costs.

We evaluate our measure of progress to recognize revenue at each reporting period and, as necessary, adjust the measure of progress and related revenue recognition. Our measure of progress and revenue recognition involves significant judgment and assumptions, including, but not limited to, estimated costs and timelines to complete our performance obligations. We evaluate contract modifications and amendments to determine whether any changes should be accounted for prospectively or on a cumulative catch-up basis. We utilize the right to invoice practical expedient when we have a right to consideration in an amount that corresponds directly with the value of our performance to date.

Royalties are recognized as revenue when sales have occurred as we apply the sales or usage-based royalties recognition constraint. We have determined the application of this exception is appropriate because the license granted in the agreement is the predominant item to which the royalties relate.

As we receive upfront payments for technical services under certain of our arrangements, we evaluate whether any significant financing components exist given the term over which the fees will be earned may exceed one year. Based on the nature of our agreements, there are no significant financing components as the purpose of the upfront payment is not to provide financing, but rather to secure technical services, exclusivity rights, and Foundry capacity, or the timing of transfer of those goods or services is at the discretion of the customer.

Deferred revenue represents consideration received by us in excess of revenue recognized and primarily results from transactions where we receive upfront payments and non-cash equity consideration. In instances where we have received consideration in advance for an undefined number of technical development plans ("TDPs") under our customer agreements, we record the advance payments as deferred revenue, net of current portion on our consolidated balance sheets. Upon the execution of a specific TDP, we reclassify the estimated consideration to be earned under that TDP within the next twelve months as current deferred revenue. We also classify unexercised material rights related to future TDPs as deferred revenue, net of current portion on our consolidated balance sheets. When a TDP is executed, and the material right is exercised, the amount allocated to the material right, which will be earned within the next twelve months, is reclassified to current deferred revenue. All other deferred revenue is classified as current or non-current based on the timing of when we expect to earn the underlying revenue based upon the projected progress of activities under the TDP.

Variable Interest Entities

We evaluate our variable interests in VIEs and consolidate VIEs when we are the primary beneficiary. We determine whether we are the primary beneficiary of each VIE based on our assessment of whether we possess both (i) the power to direct the activities that most significantly affect the VIE's economic performance and (ii) the obligation to absorb losses that could be significant to the VIE or the right to receive benefits that could be significant to the VIE. We reevaluate the accounting for our VIEs upon the occurrence of events that could change the primary beneficiary conclusion.

With respect to our investments in Motif, Allonnia, Genomatica, Arcaea, BiomEdit, Verb and Ayana (subsequent to the deconsolidation of Verb and Ayana) (collectively, the "Unconsolidated VIEs"), we have concluded these entities represent VIEs. However, although we may have board representation and are involved in the ongoing development activities of the entities via participation on the JSC, we have concluded that we are not the primary beneficiary of these entities. This conclusion is supported by the fact that: (i) we do not control the board of directors of any of the Unconsolidated VIEs, and no voting or consent agreements exist between us and other members of each respective board of directors or other investors, (ii) the holders of preferred security interests in the Unconsolidated VIEs hold certain rights that require their consent prior to taking certain actions, which include certain significant operating and financing decisions, and (iii) our representation on the JSC of each respective entity does not give us control over the development activities of any of the Unconsolidated VIEs, as all JSC decisions are made by consensus and there are no agreements in place that would require any of the entities to vote in alignment with us. As our involvement with the Unconsolidated VIEs does not give us the power to control the decisions with respect to their development or other activities, which are their most significant activities, we have concluded that we are not the primary beneficiary of the Unconsolidated VIEs.

With respect to Cooksonia, we have concluded that we hold a variable interest in this entity through our equity interest and we are the primary beneficiary of Cooksonia as we control the most significant activities of Cooksonia, we control 100% of the board of directors of Cooksonia and we hold a controlling financial interest in Cooksonia. Additionally, with respect to Cooksonia's investment in Joyn prior to Joyn's dissolution in October 2022, as Cooksonia did not control Joyn's board of directors, it did not have the power to control the decisions related to the development activities of Joyn, which were the most significant activities of Joyn. Accordingly, Cooksonia was not the primary beneficiary of Joyn.

Impairment of Long-Lived Assets

We review our long-lived assets for impairment whenever events or changes in circumstances indicate that the carrying value of an asset may not be recoverable. Recoverability is measured by comparing the book values of the assets to the expected future net undiscounted cash flows that the assets are expected to generate. If such assets are considered to be impaired, the impairment to be recognized is measured by the amount by which the book value of the assets exceed their fair value.

Leases

We determine if an arrangement is or contains a lease at contract inception based on the terms and conditions in the contract. Lease right-of-use assets and liabilities are measured based on the present value of fixed lease payments that are unpaid as of the lease commencement date. As most of our leases do not provide an implicit rate, we use an incremental borrowing rate based on the information available at lease commencement date in determining the present value of lease payments and use the implicit rate when readily determinable. Our incremental borrowing rate is based on our estimate of the rate of interest we would have to pay to borrow on a fully collateralized basis over a similar term an amount equal to the lease payments in a similar economic environment.

Determination of Fair Value of Non-cash Consideration in Platform Ventures

The fair value of non-cash consideration received in relation to our Platform Ventures is in return for the license rights conveyed to the counterparty. We value the non-cash consideration, which is generally common stock or common units, at inception of the agreements using an option pricing method ("OPM"). The OPM uses a back-solve methodology to infer the total equity value based on the pricing of the preferred financing round associated with the formation of the respective Platform Ventures, which was contemporaneous with the intellectual property agreements that conveyed our license rights to such Platform Ventures.

Business Combinations

We account for business combinations using the acquisition method of accounting. We recognize the identifiable assets acquired and liabilities assumed at their acquisition-date fair values and recognize any excess of the total consideration paid over the fair value of the identifiable net assets as goodwill. Significant management judgments and assumptions are required in determining the fair value of acquired assets and liabilities assumed, particularly intangible assets and their estimated useful lives, the fair value of contingent consideration payable, and for business combinations achieved in stages, the acquisition-date fair value of our previously held equity interest in the acquiree. As a result, we obtain the assistance of third-party valuation specialists in developing these estimates. Significant assumptions used in the valuations include the estimated annual net cash flows (including projected future revenues and costs, terminal growth rates, royalty rates and obsolescence rates), the expected costs to reproduce an asset, useful lives, discount rates, and probabilities of achieving certain technical and commercial milestones. While management believes those expectations and assumptions are reasonable, they are inherently uncertain. Unanticipated market or macroeconomic events and circumstances may occur, which could affect the estimates and assumptions.

Stock-Based Compensation

Stock-based compensation expense is measured based on grant-date fair values and is recognized over the requisite service period. For awards that vest solely based on a service condition, we recognize stock-based compensation expense on a straight-line basis over the requisite service period. For awards that vest based on performance and market conditions, we recognize compensation expense using the accelerated attribution method on a tranche-by-tranche basis. We estimate the grant date fair value of stock options using the Black-Scholes option-pricing model. The Black-Scholes option-pricing model requires the input of certain assumptions, including fair value of common stock (for options granted prior to the SRNG Business Combination), expected term, expected volatility, risk-free interest rate and expected dividend yield. For awards with market conditions, we determine the grant date fair value using a Monte Carlo simulation model, which incorporates various assumptions including expected stock price volatility, risk-free interest rate, expected term, and expected dividend yield.

Following the SRNG Business Combination, the fair value of our common stock is based on the quoted market price on the NYSE. Prior to the SRNG Business Combination, the fair value of our common stock underlying our stock-based awards was determined considering our most recently available third-party valuations of common stock and our assessment of additional objective and subjective factors. These judgments and estimates included: (i) a discount for lack of marketability; (ii) external market data; (iii) historical activity by us in selling equity to outside investors; (iv) our stage of development; (v) rights and preferences of our equity securities that rank senior to common stock; and (vi) the likelihood of the various scenarios, among others. Changes to these assumptions could result in different fair values of common stock.

The assumptions underlying these valuations represent management's best estimates, which involve inherent uncertainties and the application of management judgment. As a result, if factors or expected outcomes change and we use significantly different assumptions or estimates, the fair value of our stock-based awards could be materially different.

Recently Issued Accounting Pronouncements

See Note 2, "Summary of Significant Accounting Policies," of our consolidated financial statements contained in Part II, Item 8 of this Annual Report on Form 10-K for a discussion of recently issued accounting pronouncements.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk.

Interest Rate Risk

We are exposed to market risk related to changes in interest rates. Our primary exposure to market risk is interest rate sensitivity, which is affected by changes in the general level of U.S. interest rates, particularly because our cash equivalents are invested in short-term U.S. Treasury obligations. However, because of the short-term nature of the instruments in our portfolio, an immediate change in market interest rates of 100 basis points would not have a material impact on the fair market value of our cash and cash equivalents or on our financial position or results of operations.

Foreign Currency Exchange Rate Risk

We are subject to foreign currency exchange rate risk from the translation of the financial statements of our foreign subsidiaries, whose financial condition and results of operations are reported in their local currencies and then translated into U.S. dollars at the applicable currency exchange rate for inclusion in our consolidated financial statements. Foreign currency translation adjustments were $0.9 million and $1.7 million for the years ended December 31, 2022 and 2021, respectively. Foreign currency translation adjustments are accounted for as a component of accumulated other comprehensive loss within stockholders' equity. Additionally, we have contracted with and may continue to contract with foreign vendors. We do not believe that an immediate 10% increase or decrease in the relative value of the U.S. dollar to other currencies would have a material effect on operating results or financial condition.

Inflation Risk

Inflation generally affects us by increasing our cost of labor, laboratory supplies, consumables and equipment. We do not believe that inflation had a material effect on our business, financial condition or results of operations during the years ended December 31, 2022 and 2021.

Item 8. Financial Statements and Supplementary Data.

Our consolidated financial statements, together with the report of our independent registered public accounting firm, appear beginning on page F-1 in Part IV, Item 15, "Exhibits, Financial Statement Schedules" and are incorporated herein by reference.

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

None.

Item 9A. Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

Under the supervision and with the participation of our management, including our Chief Executive Officer and Chief Financial Officer, we evaluated the effectiveness of our disclosure controls and procedures (as that term is defined in Rules 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934, as amended (the "Exchange Act")) as of December 31, 2022, which is the end of the period covered by this Annual Report. Based on this evaluation, our Chief Executive Officer and Chief Financial Officer concluded that the Company's disclosure controls and procedures were not effective as of December 31, 2022 as a result of material weaknesses in our internal control over financial reporting as described below.

Considering the material weaknesses in the Company's internal control over financial reporting, we performed additional procedures to ensure that our consolidated financial statements included in this Form 10-K were prepared in accordance with accounting principles generally accepted in the United States ("GAAP"). Following such additional procedures, our management, including our Chief Executive Officer and Chief Financial Officer, has concluded that our consolidated financial statements present fairly, in all material respects, our financial position, results of operations and cash flows for the periods presented in this Form 10-K, in conformity with GAAP.

Management's Annual Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting as such terms are defined in Exchange Act Rules 13a-15(f) and 15d-15(f). Our internal control over financial reporting is a framework designed under the supervision and with the participation of our management, including our Chief Executive Officer and Chief Financial Officer, and effected by our board of directors, management, and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of our financial statements for external purposes in accordance with GAAP. Our internal control over financial reporting includes those policies and procedures that: (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of our assets; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with GAAP, and that our receipts and expenditures are being made only in accordance with authorizations of management and our directors; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of our assets that could have a material effect on the financial statements.

As of December 31, 2022, our management conducted an evaluation of the effectiveness of our internal control over financial reporting based on the criteria established by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) in *Internal Control – Integrated Framework* (2013). Based on this evaluation, due to the material weaknesses described below, we concluded that the Company's system of internal control over financial reporting was not effective as of December 31, 2022.

A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the Company's annual or interim financial statements will not be prevented or detected on a timely basis. The following material weaknesses were identified by our management as of December 31, 2022:

(1) The Company did not have effective management review controls to address the risks of material misstatement of various significant accounts. The Company relied on external resources and specialists and did not maintain a sufficient complement of internal personnel with appropriate knowledge, experience and/or training commensurate with its technical accounting and financial reporting requirements in order to provide sufficient review and oversight over the level of precision, evidence and/or timeliness of management review controls.

(2) The Company did not have effective controls over the existence, completeness, and accuracy of data used in its controls and failed to maintain adequate information technology general controls over various key systems. As a result of these material weaknesses, the related process level controls were also ineffective.

These material weaknesses did not result in any material misstatements to the consolidated financial statements and there were no changes to previously released financial statements. Notwithstanding our material weaknesses, we have concluded that the financial statements and other financial information included in this Annual Report fairly present in all material respects our financial condition, results of operations and cash flows for the periods presented in conformity with accounting principles generally accepted in the United States.

The scope of management's assessment of the effectiveness of internal control over financial reporting excluded the business of Zymergen, which the Company acquired in a business combination on October 19, 2022 and is included in our consolidated financial statements as of and for the year ended December 31, 2022. The Zymergen business represented approximately 8% of total assets (excluding goodwill and intangible assets), 30% of total liabilities, 1% of total revenues, and 1% of total operating expenses, each as reflected in our consolidated financial statements as of and for the year ended December 31, 2022.

Planned Material Weakness Remediation Activities

Management is committed to the remediation of the material weaknesses described above, as well as the continued improvement of our internal control over financial reporting. Our planned remediation efforts related to the above identified material weaknesses include, but are not limited to:

- Insourcing certain accounting roles.
- Increasing resources dedicated to monitoring information technology general controls related to financial reporting.

- Enhancing training of employees involved in the execution of controls, including information technology general controls.
- Increasing the standardization of control support and documentation.
- Improving automation where possible and cost effective.

We plan to continue to assess our internal controls and procedures and intend to take further action as necessary or appropriate to address any other matters we identify.

Changes in Internal Control over Financial Reporting

There were no changes in our internal control over financial reporting (as such term is defined in Exchange Act Rule 13a–15(f) and 15d-15(f)) during the most recent fiscal quarter that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting. Our plans for remediating the material weaknesses, described above, will constitute changes in our internal control over financial reporting, prospectively, when such remediation plans are effectively implemented.

Report of Independent Registered Public Accounting Firm

To the Stockholders and the Board of Directors of Ginkgo Bioworks Holdings, Inc.

Opinion on Internal Control over Financial Reporting

We have audited Ginkgo Bioworks Holdings, Inc.'s internal control over financial reporting as of December 31, 2022, based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) (the COSO criteria). In our opinion, because of the effect of the material weaknesses described below on the achievement of the objectives of the control criteria, Ginkgo Bioworks Holdings, Inc. (the Company) has not maintained effective internal control over financial reporting as of December 31, 2022, based on the COSO criteria.

A material weakness is a deficiency, or combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the company's annual or interim financial statements will not be prevented or detected on a timely basis. The following material weaknesses have been identified and included in management's assessment. Management has identified material weaknesses related to the execution of management review controls, controls over the existence, completeness, and accuracy of data used in controls, and information technology general controls.

As indicated in the accompanying Management's Annual Report on Internal Control Over Financial Reporting, management's assessment of and conclusion on the effectiveness of internal control over financial reporting did not include the internal controls of Zymergen, Inc., which is included in the 2022 consolidated financial statements of Ginkgo Bioworks Holdings, Inc. and represented approximately 8% of total assets (excluding goodwill and intangible assets), 30% of total liabilities, 1% of total revenues, and 1% of total operating expenses, for the year then ended. Our audit of internal control over financial reporting of Ginkgo Bioworks Holdings, Inc. also did not include an evaluation of the internal control over financial reporting of Zymergen, Inc.

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 and comprehensive loss, stockholders' equity and cash flows for each of the three years in the period ended December 31, 2022, and the related notes. These material weaknesses were considered in determining the nature, timing and extent of audit tests applied in our audit of the 2022 consolidated financial statements, and this report does not affect our report dated March 13, 2023, which 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 Management's Report on Internal Control over Financial Reporting. 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 the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit 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, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and 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/ Ernst & Young LLP

Boston, Massachusetts
March 13, 2023

Item 9B. Other Information.

None.

Item 9C. Disclosure Regarding Foreign Jurisdictions that Prevent Inspections.

Not applicable.

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

The information required by this item is incorporated by reference to the relevant information from our definitive Proxy Statement for our 2023 Annual Meeting of Shareholders, which will be filed not later than 120 days after December 31, 2022.

Item 11. Executive Compensation.

The information required by this item is incorporated by reference to the relevant information from our definitive Proxy Statement for our 2023 Annual Meeting of Shareholders, which will be filed not later than 120 days after December 31, 2022.

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

The information required by this item is incorporated by reference to the relevant information from our definitive Proxy Statement for our 2023 Annual Meeting of Shareholders, which will be filed not later than 120 days after December 31, 2022.

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

The information required by this item is incorporated by reference to the relevant information from our definitive Proxy Statement for our 2023 Annual Meeting of Shareholders, which will be filed not later than 120 days after December 31, 2022.

Item 14. Principal Accounting Fees and Services.

The information required by this item is incorporated by reference to the relevant information from our definitive Proxy Statement for our 2023 Annual Meeting of Shareholders, which will be filed not later than 120 days after December 31, 2022.

PART IV

Item 15. Exhibits, Financial Statement Schedules.

(1) As part of this Annual Report on Form 10-K, the consolidated financial statements are listed in the accompanying index to financial statements on page F-1.

(2) Financial statement schedules have been omitted because they are either not required or not applicable or the information is included in the consolidated financial statements or the notes thereto.

(3) Exhibits:

Exhibit Number	Description
2.1†	Agreement and Plan of Merger, dated as of July 24, 2022, by and among Ginkgo Bioworks Holdings, Inc., Pepper Merger Subsidiary Inc. and Zymergen Inc. (incorporated by reference to Exhibit 2.1 of the Company's Current Report on Form 8-K filed with the SEC on July 25, 2022)
2.2	Merger Agreement, dated as of May 11, 2021, by and among Soaring Eagle Acquisition Corp., SEAC Merger Sub Inc. and Ginkgo Bioworks, Inc. (incorporated by reference to Exhibit 2.1 of SRNG's Current Report on Form 8-K filed with the SEC on May 11, 2021)
2.3	Amendment to the Agreement and Plan of Merger, dated as of May 14, 2021, by and among Soaring Eagle Acquisition Corp., SEAC Merger Sub Inc. and Ginkgo Bioworks, Inc. (incorporated by reference to Exhibit 2.1 to SRNG's Quarterly Report on Form 10-Q (File No. 001-40097) for the quarter ended March 31, 2021, filed with the SEC on May 24, 2021)
3.1	Certificate of Incorporation of Ginkgo Bioworks Holdings, Inc. (incorporated by reference to Exhibit 3.1 of the Company's Current Report on Form 8-K filed with the SEC on September 20, 2021)
3.2	Amendment to Certificate of Incorporation of Ginkgo Bioworks Holdings, Inc. (incorporated by reference to Exhibit 3.2 of the Company's Current Report on Form 8-K filed with the SEC on September 20, 2021)
3.3	Bylaws of Ginkgo Bioworks Holdings, Inc. (incorporated by reference to Exhibit 3.3 of the Company's Current Report on Form 8-K filed with the SEC on September 20, 2021)
4.1	Specimen Class A Common Stock Certificate of Ginkgo Bioworks Holdings, Inc. (incorporated by reference to Exhibit 4.5 to Amendment No. 3 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on August 4, 2021)
4.2*	Description of Securities of the Registrant
4.3	Warrant Agreement, dated as of February 23, 2021, by and among Soaring Eagle Acquisition Corp. and Continental Stock Transfer & Trust Company, as warrant agent (incorporated by reference to Exhibit 4.1 of SRNG's Current Report on Form 8-K (File No. 001-40097), filed with the SEC on February 26, 2021)
4.4	Assignment and Assumption Agreement, dated as of September 16, 2021, by and among Ginkgo Bioworks Holdings, Inc., Continental Stock Transfer & Trust Company and Computershare Trust Company, N.A. (incorporated by reference to Exhibit 4.4 of the Company's Annual Report on Form 10-K for the year ended December 31, 2021 filed with the SEC on March 29, 2022)
10.1+	Form of Ginkgo Bioworks Holdings, Inc. 2021 Incentive Award Plan (incorporated by reference to Annex E of SRNG's Form S-4/A (File No. 333-256121), filed with the SEC on August 4, 2021)
10.2+	Form of Ginkgo Bioworks Holdings, Inc. 2021 Employee Stock Purchase Plan (incorporated by reference to Annex F of SRNG's Form S-4/A (File No. 333-256121), filed with the SEC on August 4, 2021)

10.3	Registration Rights Agreement, dated as of September 16, 2021, by and among Ginkgo Bioworks Holdings, Inc., Eagle Equity Partners III, LLC and the other Holders signatory thereto. (incorporated by reference to Exhibit 10.4 of Ginkgo's Current Report on Form 8-K filed with the SEC on September 20, 2021)
10.4	Ginkgo Bioworks, Inc. 2008 Stock Incentive Plan, as amended as of June 18, 2014 (incorporated by reference to Exhibit 10.8 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.5	Ginkgo Bioworks, Inc. 2014 Stock Incentive Plan (incorporated by reference to Exhibit 10.9 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.6	Amendment to the Ginkgo Bioworks, Inc. 2014 Stock Incentive Plan, effective May 1, 2019 (incorporated by reference to Exhibit 10.10 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.7	Amendment to the Ginkgo Bioworks, Inc. 2014 Stock Incentive Plan, effective September 9, 2019 (incorporated by reference to Exhibit 10.11 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.8	Amendment to the Ginkgo Bioworks, Inc. 2014 Stock Incentive Plan, effective November 14, 2019 (incorporated by reference to Exhibit 10.12 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.9	Amendment to the Ginkgo Bioworks, Inc. 2014 Stock Incentive Plan, effective April 8, 2020 (incorporated by reference to Exhibit 10.13 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.10	Amendment to the Ginkgo Bioworks, Inc. 2014 Stock Incentive Plan, effective March 15, 2021 (incorporated by reference to Exhibit 10.14 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.11	Form of Incentive Stock Option Agreement, granted under the Ginkgo Bioworks, Inc. 2008 Stock Incentive Plan (incorporated by reference to Exhibit 10.15 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.12	Form of Restricted Stock Unit Agreement, granted under the Ginkgo Bioworks, Inc. 2014 Stock Incentive Plan (incorporated by reference to Exhibit 10.16 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.13	Form of Restricted Stock Agreement, granted under the Ginkgo Bioworks, Inc. 2014 Stock Incentive Plan (incorporated by reference to Exhibit 10.17 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.14	Form of Stock Option Agreement, granted under the Ginkgo Bioworks Holdings, Inc. 2021 Incentive Award Plan (incorporated by reference to Exhibit 10.1 of the Company's Quarterly Report on Form 10-Q, filed with the SEC on August 15, 2022)
10.15	Form of Global Restricted Stock Unit Agreement, granted under the Ginkgo Bioworks Holdings, Inc. 2021 Incentive Award Plan (incorporated by reference to Exhibit 10.2 of the Company's Quarterly Report on Form 10-Q, filed with the SEC on August 15, 2022)
10.16†‡	Lease Agreement, dated December 22, 2011, between Zoom Group LLC and Ginkgo Bioworks, Inc. (incorporated by reference to Exhibit 10.18 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)

10.17†	First Amendment to Lease Agreement, dated April 1, 2012 (incorporated by reference to Exhibit 10.19 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.18†	Second Amendment to Lease, dated August 1, 2014 (incorporated by reference to Exhibit 10.20 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.19	Third Amendment to Lease, dated August 15, 2014 (incorporated by reference to Exhibit 10.21 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.20†	Fourth Amendment to Lease, dated May 1, 2016 (incorporated by reference to Exhibit 10.22 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.21†	Fifth Amendment to Lease, dated May 31, 2016 (incorporated by reference to Exhibit 10.23 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.22	Sixth Amendment to Lease, dated August 5, 2016 (incorporated by reference to Exhibit 10.24 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.23†	Seventh Amendment to Lease, dated July 31, 2017 (incorporated by reference to Exhibit 10.25 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.24†	Eighth Amendment to Lease, dated March 23, 2018 (incorporated by reference to Exhibit 10.26 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.25†	Ninth Amendment to Lease, dated September 6, 2018 (incorporated by reference to Exhibit 10.27 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.26†	Tenth Amendment to Lease, dated July 29, 2020 (incorporated by reference to Exhibit 10.28 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.27†	Eleventh Amendment to Lease, dated August 14, 2020 (incorporated by reference to Exhibit 10.29 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.28†	Twelfth Amendment to Lease, dated January 13, 2021 (incorporated by reference to Exhibit 10.30 to Amendment No. 1 to the Registration Statement on Form S-4 (File No. 333-256121), filed with the SEC on June 28, 2021)
10.29†	Thirteenth Amendment to Lease, dated September 6, 2021 (incorporated by reference to Exhibit 10.31 to the Registration Statement on Form S-1 (File No. 333-258712), filed with the SEC on September 15, 2021)
10.30	Fourteenth Amendment to Lease Agreement, dated June 1, 2022, by and between BCP-CG 27 Property LLC and Ginkgo Bioworks, Inc. (incorporated by reference to Exhibit 10.3 of the Company's Quarterly Report on Form 10-Q, filed with the SEC on August 15, 2022)
10.31†‡	Lease Agreement, dated March 18, 2016, by and between Jamestown 21-23-25 Drydock, L.P. and Ginkgo Bioworks, Inc. (incorporated by reference to Exhibit 10.31 to Amendment No. 1 to the Registration Statement (File No. 333-256121), filed with the SEC on June 28, 2021)
10.32†	First Amendment to Lease Agreement, dated August 13, 2018 (incorporated by reference to Exhibit 10.32 to Amendment No. 1 to the Registration Statement (File No. 333-256121), filed with the SEC on June 28, 2021)

10.33	Second Amendment to Lease Agreement, dated August 10, 2022, by and between IDB 21-25 Drydock Limited Partnership and Ginkgo Bioworks, Inc. (incorporated by reference to Exhibit 10.4 of the Company's Quarterly Report on Form 10-Q, filed with the SEC on August 15, 2022)
10.34†‡	Sublease, dated December 10, 2019, by and between Stanley Convergent Security Solutions, Inc., and Ginkgo Bioworks, Inc. (incorporated by reference to Exhibit 10.33 to Amendment No. 1 to the Registration Statement (File No. 333-256121), filed with the SEC on June 28, 2021)
10.35†	License Agreement, dated September 11, 2020, by and between Jamestown 21-23-25 Drydock, L.P. and Ginkgo Bioworks, Inc. (incorporated by reference to Exhibit 10.35 to Amendment No. 1 to the Registration Statement (File No. 333-256121), filed with the SEC on June 28, 2021)
10.36	Offer Letter, dated October 7, 2020, between Ginkgo Bioworks, Inc. and Mark Dmytruk (incorporated by reference to Exhibit 10.38 to Amendment No. 1 to the Registration Statement (File No. 333-256121), filed with the SEC on June 28, 2021)
10.37	Ginkgo Bioworks Holdings, Inc. Non-Employee Director Compensation Program (incorporated by reference to Exhibit 10.39 to Amendment No. 1 to the Registration Statement (File No. 333-256121), filed with the SEC on June 28, 2021)
10.38	Form of Founder Equity Grant Agreement (incorporated by reference to Exhibit 10.40 of SRNG's Form S-4/A (File No. 333-256121), filed with the SEC on August 4, 2021)
10.39	Form of Director and Officer Indemnification Agreement (incorporated by reference to Exhibit 10.41 of SRNG's Form S-4/A (File No. 333-256121), filed with the SEC on August 4, 2021)
10.40	Sponsor Support Agreement, dated as of May 11, 2021, by and among Eagle Equity Partners III, LLC, Ginkgo Bioworks, Inc., Soaring Eagle Acquisition Corp. and certain of its shareholders (incorporated by reference to Exhibit 10.4 of SRNG's Current Report on Form 8-K (File No. 001-40097), filed with the SEC on May 11, 2021)
10.41	Voting Agreement, dated as of July 24, 2022, entered into by SVF Excalibur (Cayman) Limited (incorporated by reference to Exhibit 10.1 of the Company's Current Report on Form 8-K filed with the SEC on July 25, 2022)
10.42	Voting Agreement, dated as of July 24, 2022, entered into by Data Collective II, L.P. and certain of its affiliates (incorporated by reference to Exhibit 10.2 of the Company's Current Report on Form 8-K filed with the SEC on July 25, 2022)
10.43	Voting Agreement, dated as of July 24, 2022, entered into by True Ventures IV, L.P. and certain of its affiliates (incorporated by reference to Exhibit 10.3 of the Company's Current Report on Form 8-K filed with the SEC on July 25, 2022)
16.1	Letter regarding change in accountant (incorporated by reference to Exhibit 16.1 of the Company's Current Report on Form 8-K filed with the SEC on September 20, 2021)
21.1*	Subsidiaries of the Registrant
23.1*	Consent of Ernst & Young LLP, Independent Registered Public Accounting Firm
31.1*	Certification of Principal Executive Officer Pursuant to Rules 13a-14(a) and 15d-14(a) under the Securities Exchange Act of 1934, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002
31.2*	Certification of Principal Financial Officer Pursuant to Rules 13a-14(a) and 15d-14(a) under the Securities Exchange Act of 1934, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002

32.1*	Certification of Principal Executive Officer Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002
32.2*	Certification of Principal Financial Officer Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002
101.INS	Inline XBRL Instance Document – the instance document does not appear in the Interactive Data File because XBRL tags are embedded within the Inline XBRL document
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	Cover Page Interactive Data File (embedded within the Inline XBRL document)

* Filed herewith.

† The annexes, schedules, and certain exhibits to this Exhibit have been omitted pursuant to Item 601(b)(2) of Regulation S-K. The Registrant hereby agrees to furnish supplementally a copy of any omitted annex, schedule or exhibit to the SEC upon request.

‡ Certain confidential information contained in this Exhibit has been omitted because it is (i) not material and (ii) of the type that the registrant treats as private or confidential.

\+ Indicates a management contract of compensatory plan.

Item 16. Form 10-K Summary

None.

SIGNATURES

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

GINKGO BIOWORKS HOLDINGS, INC.

Date: March 13, 2023

By: /s/ Jason Kelly
Jason Kelly
Chief Executive Officer

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

Name	Title	Date
/s/ Jason Kelly **Jason Kelly**	Chief Executive Officer and Director (Principal Executive Officer)	March 13, 2023
/s/ Mark Dmytruk **Mark Dmytruk**	Chief Financial Officer (Principal Financial Officer)	March 13, 2023
/s/ Marie Fallon **Marie Fallon**	Chief Accounting Officer (Principal Accounting Officer)	March 13, 2023
/s/ Marijn Dekkers **Marijn Dekkers**	Director, Chair of the Board	March 13, 2023
/s/ Arie Belldegrun **Arie Belldegrun**	Director	March 13, 2023
/s/ Kathy Hopinkah Hannan **Kathy Hopinkah Hannan**	Director	March 13, 2023
/s/ Christian Henry **Christian Henry**	Director	March 13, 2023
/s/ Reshma Kewalramani **Reshma Kewalramani**	Director	March 13, 2023
/s/ Shyam Sankar **Shyam Sankar**	Director	March 13, 2023
/s/ Reshma Shetty **Reshma Shetty**	President, Chief Operating Officer and Director	March 13, 2023
/s/ Harry E. Sloan **Harry E. Sloan**	Director	March 13, 2023

GINKGO BIOWORKS HOLDINGS, INC.

Index to Consolidated Financial Statements as of December 31, 2022 and 2021 and for the Years Ended December 31, 2022, 2021 and 2020

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Stockholders and the Board of Directors of Ginkgo Bioworks Holdings, Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Ginkgo Bioworks Holdings, Inc. (the Company) as of December 31, 2022 and 2021, the related consolidated statements of operations and comprehensive loss, 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 U.S. generally accepted accounting principles.

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 issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) and our report dated March 13, 2023 expressed an adverse opinion thereon.

Adoption of New Accounting Standard

As discussed in Note 2 to the consolidated financial statements, the Company changed its method for accounting for leases in 2022 due to the adoption of Accounting Standards Update (ASU) No. 2016-02 *Leases* (ASC 842), and the related amendments.

Basis for Opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matters

The critical audit matters communicated below are matters arising from the current period audit of the financial statements that were communicated or required to be communicated to the audit committee and that: (1) relate to accounts or disclosures that are material to the 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 matters below, providing separate opinions on the critical audit matters or on the accounts or disclosures to which they relate.

Description of the Matter Consolidation - Variable Interest Model

The Company holds variable interests in various variable interest entities ("VIEs"). As described in Note 2 and Note 6 to the consolidated financial statements, the Company evaluates its variable interests in VIEs and consolidates VIEs when the Company is the primary beneficiary. The Company reevaluates the accounting for its VIEs upon the occurrence of events that could change the primary beneficiary conclusion.

Auditing management's consolidation analyses for VIEs was especially complex and required significant judgment. This was primarily due to the subjectivity in assessing which activities most significantly impact a VIE's economic performance based on the purpose and design of the

entity over the duration of its expected life and assessing which party has power to direct those activities.

How We Addressed the Matter in Our Audit

To test the Company's consolidation analysis related to VIEs, our procedures included, among others, comparing the rights of each party to underlying legal documents, articles of incorporation and relevant board of directors' minutes related to each VIE and discussing with management the purpose and design of each VIE. We evaluated management's analysis of significant activities of each VIE such as capital decisions, financing decisions and operating decisions, and which party, if any, has the power to direct such activities. In our evaluation, we considered the purpose and design of the entity, the composition of the board of directors and other legal rights of the parties, including the significance of the decision-making rights of each party in assessing which party has power to direct the activities that most significantly affect the economic performance of the VIE, as well as the substance of the arrangements. We also considered whether there were indicators that other parties to the arrangement were acting in the role of agents or de facto agents.

Description of the Matter

Foundry Revenue Recognition

Foundry revenues were $143.7 million for the year ended December 31, 2022. As discussed in Note 2 to the consolidated financial statements, for certain Foundry revenue agreements, the Company recognizes revenue over the period of performance using a measure of progress based on costs incurred to date as compared to total estimated costs. The Company evaluates its measure of progress to recognize revenue for these agreements at each reporting date and, as necessary, adjusts the measure of progress and related revenue recognition.

Auditing Foundry revenue recognized using a measure of progress is especially challenging because the determination of the measure of progress involves significant management judgment and assumptions related to the estimated costs to satisfy the applicable performance obligation under the agreement.

How We Addressed the Matter in Our Audit

To test the measure of progress used to recognize revenue for certain Foundry revenue agreements, our audit procedures included, among others, evaluating the identified measure of progress by reviewing customer contracts and the contract analyses prepared by management. We also evaluated the accuracy and completeness of the underlying data used in management's determination of the measure of progress. We tested management's estimate of costs by performing inquiries of individuals responsible for managing the execution of the Foundry revenue agreements and inspecting evidence related to the progress under the agreement. We also performed analytical comparisons of actual costs incurred compared to estimated remaining costs, compared management's historical estimates of remaining costs to actual costs incurred, and performed sensitivity analyses over management's estimates of costs.

/s/ Ernst & Young LLP

We have served as the Company's auditor since 2018.

Boston, Massachusetts
March 13, 2023

Ginkgo Bioworks Holdings, Inc.
Consolidated Balance Sheets
(in thousands, except share and per share data)

	As of December 31,	
	2022	2021
Assets		
Current assets:		
Cash and cash equivalents	$ 1,315,792	$ 1,550,004
Accounts receivable, net	80,907	131,544
Accounts receivable - related parties	1,558	4,598
Inventory, net	4,364	3,362
Prepaid expenses and other current assets	47,458	33,537
Total current assets	1,450,079	1,723,045
Property, plant, and equipment, net	314,773	145,770
Operating lease right-of-use assets	400,762	—
Investments	112,188	102,037
Equity method investments	1,543	13,194
Intangible assets, net	111,041	21,642
Goodwill	60,210	21,312
Other non-current assets	88,725	43,990
Total assets	$ 2,539,321	$ 2,070,990
Liabilities and Stockholders' Equity		
Current liabilities:		
Accounts payable	$ 10,451	$ 8,189
Deferred revenue (includes $10,309 and $12,502 from related parties)	47,817	33,240
Accrued expenses and other current liabilities	114,694	93,332
Total current liabilities	172,962	134,761
Non-current liabilities:		
Deferred rent, net of current portion	—	18,746
Deferred revenue, net of current portion (includes $131,188 and $148,319 from related parties)	174,767	155,991
Operating lease liabilities, non-current	413,256	—
Lease financing obligation	—	22,283
Warrant liabilities	10,868	135,838
Other non-current liabilities	31,191	35,992
Total liabilities	803,044	503,611
Commitments and contingencies (Note 11)		
Stockholders' equity:		
Preferred stock, $0.0001 par value; 200,000,000 shares authorized; none issued	—	—
Common stock, $0.0001 par value (Note 12)	190	161
Additional paid-in capital	6,136,378	3,804,844
Accumulated deficit	(4,397,659)	(2,297,925)
Accumulated other comprehensive loss	(2,632)	(1,715)
Total Ginkgo Bioworks Holdings, Inc. stockholders' equity	1,736,277	1,505,365
Non-controlling interest	—	62,014
Total stockholders' equity	1,736,277	1,567,379
Total liabilities and stockholders' equity	$ 2,539,321	$ 2,070,990

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

Ginkgo Bioworks Holdings, Inc.
Consolidated Statements of Operations and Comprehensive Loss
(in thousands, except share and per share data)

	Year Ended December 31,		
	2022	2021	2020
Foundry revenue [1]	$ 143,666	$ 112,989	$ 59,221
Biosecurity revenue:			
Product	35,455	23,040	8,707
Service	298,585	177,808	8,729
Total revenue	477,706	313,837	76,657
Costs and operating expenses:			
Cost of Biosecurity product revenue	20,646	20,017	6,705
Cost of Biosecurity service revenue	183,570	109,673	8,906
Research and development	1,052,643	1,149,662	159,767
General and administrative	1,429,799	862,952	38,306
Total operating expenses	2,686,658	2,142,304	213,684
Loss from operations	(2,208,952)	(1,828,467)	(137,027)
Other income (expense):			
Interest income	20,262	837	2,582
Interest expense	(106)	(2,373)	(2,385)
Loss on equity method investments	(43,761)	(77,284)	(396)
Loss on investments	(53,335)	(11,543)	(3,733)
Change in fair value of warrant liabilities	124,970	58,615	—
Gain on settlement of partnership agreement	—	23,826	8,286
Gain on deconsolidation of subsidiaries	31,889	—	—
Other income (expense), net	7,634	(1,733)	7,839
Total other income (expense), net	87,553	(9,655)	12,193
Loss before income taxes	(2,121,399)	(1,838,122)	(124,834)
Income tax (benefit) provision	(15,027)	(1,480)	1,889
Net loss	(2,106,372)	(1,836,642)	(126,723)
Loss attributable to non-controlling interest	(1,443)	(6,595)	(114)
Net loss attributable to Ginkgo Bioworks Holdings, Inc. stockholders	$ (2,104,929)	$ (1,830,047)	$ (126,609)
Net loss per share attributable to Ginkgo Bioworks Holdings, Inc. common stockholders [2]:			
Basic	$ (1.25)	$ (1.35)	$ (0.10)
Diluted	$ (1.25)	$ (1.39)	$ (0.10)
Weighted average common shares outstanding [2]			
Basic	1,679,061,465	1,359,848,803	1,274,766,915
Diluted	1,679,838,849	1,360,373,343	1,274,766,915
Comprehensive loss:			
Net loss	$ (2,106,372)	$ (1,836,642)	$ (126,723)
Other comprehensive loss:			
Foreign currency translation adjustment	(917)	(1,715)	—
Total other comprehensive loss	(917)	(1,715)	—
Comprehensive loss	$ (2,107,289)	$ (1,838,357)	$ (126,723)

(1) Includes related party revenue of $38,813, $47,161, and $42,535 for the years ended 2022, 2021, and 2020, respectively.
(2) Amounts for the year ended December 31, 2020 have been retroactively restated for the reverse recapitalization as described in Note 2.

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

Ginkgo Bioworks Holdings, Inc.
Consolidated Statements of Stockholders' Equity
(in thousands, except share data)

	Common Stock						
	Shares	Amount	Additional Paid-In Capital	Accumulated Deficit	Accumulated Other Comprehensive Loss	Non-Controlling Interest	Total Stockholders' Equity
Balance as of December 31, 2019	1,255,562,032	$ 126	$ 834,206	$ (341,269)	$ —	$ 8,790	$ 501,853
Issuance of common stock upon exercise or vesting of equity awards	2,178,779	—	26	—	—	—	26
Issuance of Series E convertible preferred stock	30,855,065	3	94,417	—	—	—	94,420
Stock-based compensation expense	—	—	476	—	—	—	476
Net loss	—	—	—	(126,609)	—	(114)	(126,723)
Balance as of December 31, 2020	1,288,595,876	129	929,125	(467,878)	—	8,676	470,052
Issuance of common stock upon exercise or vesting of equity awards	91,080,290	9	167	—	—	—	176
Vesting of restricted stock - earnouts	38,798,801	4	(4)	—	—	—	—
Tax withholdings related to net share settlement of equity awards	(797,313)	—	(9,463)	—	—	—	(9,463)
Founder shares repurchase	(2,707,280)	—	(24,998)	—	—	—	(24,998)
Issuance of warrants to purchase Series D convertible preferred stock	—	—	300	—	—	—	300
Issuance of Series D and B convertible preferred stock upon exercise of warrants	1,013,708	—	—	—	—	—	—
Issuance of Series E convertible preferred stock in exchange for warrants	408,497	—	—	—	—	—	—
Issuance of common stock for a business acquisition	1,633,937	—	15,160	—	—	—	15,160
Issuance of common stock upon reverse recapitalization, net of offering costs (Note 3)	193,365,636	19	1,509,610	—	—	—	1,509,629
Assumption of Public and Private Placement Warrants	—	—	(194,453)	—	—	—	(194,453)
Contributions from non-controlling interests	—	—	—	—	—	59,933	59,933
Stock-based compensation expense	—	—	1,579,400	—	—	—	1,579,400
Foreign currency translation	—	—	—	—	(1,715)	—	(1,715)
Net loss	—	—	—	(1,830,047)	—	(6,595)	(1,836,642)
Balance as of December 31, 2021	1,611,392,152	161	3,804,844	(2,297,925)	(1,715)	62,014	1,567,379
Issuance of common stock upon exercise or vesting of equity awards	124,651,014	13	239	—	—	—	252
Tax withholdings related to net share settlement of equity awards	(295,621)	—	(981)	—	—	—	(981)
Issuance of common stock upon exercise of Public Warrants	30	—	—	—	—	—	—
Issuance of common stock for business and asset acquisitions, net of issuance costs	114,517,223	12	279,733	—	—	—	279,745
Issuance of common stock pursuant to public offering, net of issuance costs	41,383,877	4	98,906	—	—	—	98,910
Issuance of common stock in exchange for services	327,289	—	1,000	—	—	—	1,000
Deconsolidation of subsidiaries	—	—	—	—	—	(55,408)	(55,408)
Acquisition of non-controlling interests	—	—	7,390	—	—	(7,390)	—
Adoption of ASC 842	—	—	—	5,195	—	—	5,195
Stock-based compensation expense	—	—	1,945,247	—	—	2,227	1,947,474
Foreign currency translation	—	—	—	—	(917)	—	(917)
Net loss	—	—	—	(2,104,929)	—	(1,443)	(2,106,372)
Balance as of December 31, 2022	1,891,975,964	$ 190	$ 6,136,378	$ (4,397,659)	$ (2,632)	$ —	$ 1,736,277

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

Ginkgo Bioworks Holdings, Inc.
Consolidated Statements of Cash Flows
(in thousands)

	Year Ended December 31,		
	2022	2021	2020
Cash flows from operating activities:			
Net loss	$ (2,106,372)	$ (1,836,642)	$ (126,723)
Adjustments to reconcile net loss to net cash used in operating activities:			
Depreciation and amortization	42,552	29,076	13,864
Stock-based compensation	1,930,641	1,606,020	476
Non-cash customer consideration	(34,263)	(24,185)	—
Loss on equity method investments	43,761	77,284	396
Loss on investments	53,335	11,543	3,733
Change in fair value of notes receivable	(3,757)	3,508	(1,061)
Change in fair value of warrant liabilities	(124,970)	(58,615)	—
Gain on deconsolidation of subsidiaries (Note 6)	(31,889)	—	—
Deferred income tax benefit	(14,609)	—	—
Loss on disposal of equipment	3,091	—	—
Non-cash lease expense	19,082	—	—
Amortization of finance lease right-of-use assets	1,871	—	—
Non-cash severance and retention bonus expense associated with an acquisition	6,152	—	—
Other non-cash activity	183	(270)	—
Changes in operating assets and liabilities:			
Accounts receivable ($3,040, $614 and ($995) from related parties)	55,024	(114,094)	(14,228)
Prepaid expenses and other current assets	(8,687)	(2,981)	(11,352)
Inventory	164	(626)	(2,736)
Operating lease right-of-use assets	13,233	—	—
Other non-current assets	921	(539)	1,834
Accounts payable	(10,844)	(2,247)	7,019
Accrued expenses and other current liabilities	(39,639)	44,796	8,665
Deferred revenue, current and non-current (($19,324), $40,743 and ($22,253) from related parties)	(36,417)	(10,498)	(19,423)
Operating lease liabilities, current and non-current	(10,792)	—	—
Deferred rent, non-current	—	6,032	1,045
Other non-current liabilities	31	18,620	2,661
Net cash used in operating activities	(252,198)	(253,818)	(135,830)
Cash flows from investing activities:			
Purchases of property and equipment	(52,271)	(56,521)	(57,821)
Deconsolidation of subsidiaries - cash	(55,721)	—	—
Business acquisitions, net of cash acquired	82,367	(12,040)	—
Asset acquisitions, net of cash acquired	(7,639)	—	—
Purchases of notes receivable (2022: $10,000 from related party)	(40,000)	—	(10,100)
Proceeds from notes receivable	10,000	304	800
Purchase of investment in equity securities	(3,691)	(5,000)	—
Other	(439)	—	—
Net cash used in investing activities	(67,394)	(73,257)	(67,121)
Cash flows from financing activities:			
Proceeds from reverse recapitalization, net of redemptions of $867,253 and offering costs of $108,118 (Note 3)	—	1,509,629	—
Proceeds from exercise of stock options	240	167	26
Repurchases of common stock	—	(24,998)	—
Taxes paid related to net share settlement of equity awards	(981)	(9,463)	—
Principal payments on finance/capital leases and lease financing obligation	(1,237)	(1,123)	(748)
Contributions from non-controlling interests	—	59,933	—
Proceeds from public offering, net of issuance costs	99,303	—	—
Proceeds from issuance of Series E convertible preferred stock, net of issuance costs	—	—	91,040
Contingent consideration payment	(521)	—	—
Payment of equity issuance costs	(1,467)	—	—
Net cash provided by financing activities	95,337	1,534,145	90,318
Effect of foreign exchange rates on cash and cash equivalents	908	(19)	—
Net (decrease) increase in cash, cash equivalents and restricted cash	(223,347)	1,207,051	(112,633)
Cash and cash equivalents, beginning of period	1,550,004	380,801	495,287
Restricted cash, beginning of period	42,924	5,076	3,223
Cash, cash equivalents and restricted cash, beginning of period	1,592,928	385,877	498,510
Cash and cash equivalents, end of period	1,315,792	1,550,004	380,801
Restricted cash, end of period	53,789	42,924	5,076
Cash, cash equivalents and restricted cash, end of period	$ 1,369,581	$ 1,592,928	$ 385,877

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

Ginkgo Bioworks Holdings, Inc.
Consolidated Statements of Cash Flows
(in thousands)

Supplemental disclosure of cash flow information:			
Cash paid for interest	$ 92	$ 2,370	$ 2,572
Cash paid for income taxes	$ —	$ 61	$ —
Supplemental disclosure of non-cash investing and financing activities:			
ROU assets obtained in exchange for new operating lease liabilities upon adoption of ASC 842	$ 147,744	$ —	$ —
ROU assets obtained in exchange for new finance lease liabilities upon adoption of ASC 842	$ 3,397	$ —	$ —
ROU assets obtained in exchange for new operating lease liabilities	$ 79,984	$ —	$ —
ROU assets obtained in exchange for new finance lease liabilities	$ 1,729	$ —	$ —
Purchase of minority interest in Cooksonia	$ 7,390	$ —	$ —
Purchases of equipment through capital leases	$ —	$ 1,981	$ —
Lease financing obligation for build-to-suit lease	$ —	$ 6,120	$ —
Purchases of property and equipment included in accounts payable and accrued expenses	$ 12,881	$ 1,815	$ 14,458
Equity received in related parties	$ 8,873	$ 61,554	$ —
Convertible financial instruments received for Foundry services	$ 29,074	$ —	$ 375
Equity securities and warrants received for Foundry services	$ 3,423	$ 10,000	$ —
Conversion of convertible promissory notes to preferred stock	$ —	$ 195	$ —
Non-cash consideration paid for the acquisition of Zymergen	$ 231,750	$ —	$ —
Common stock issued for acquisitions	$ 40,382	$ 15,087	$ —
Acquisition date fair value of contingent consideration	$ 19,912	$ 8,760	$ —
Acquisition date fair value of warrant liabilities	$ —	$ 194,453	$ —
Equity issuance costs in accounts payable and accrued expenses	$ 578	$ —	$ —

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

1. Organization and Basis of Presentation

Business

The mission of Ginkgo Bioworks Holdings, Inc. ("Ginkgo" or the "Company") is to make biology easier to engineer. The Company designs custom cells for customers across multiple markets. Since inception, the Company has devoted its efforts to improving its platform for programming cells to enable customers to leverage biology to create impactful products across a range of industries. The Company's platform comprises (i) equipment, robotic automation, software, data pipelines and tools, and standard operating procedures for high throughput genetic engineering, fermentation, and analytics (referred to collectively as the "Foundry"), (ii) a library of proprietary genetic assets and associated performance data (referred to collectively as "Codebase"), and (iii) the Company's team of expert users, developers and operators of the Foundry and Codebase.

On September 16, 2021, Soaring Eagle Acquisition Corp. ("SRNG") consummated the merger transaction contemplated by the agreement and plan of merger, dated as of May 11, 2021, and amended on May 14, 2021 (the "Merger Agreement"), by and among SRNG, SEAC Merger Sub Inc., a wholly owned subsidiary of SRNG ("Merger Sub"), and Ginkgo Bioworks, Inc. ("Old Ginkgo"), whereby Merger Sub merged with and into Old Ginkgo, the separate corporate existence of Merger Sub ceased and Old Ginkgo survived the merger as a wholly owned subsidiary of SRNG (the "SRNG Business Combination"). In connection with the consummation of the SRNG Business Combination, SRNG changed its name to "Ginkgo Bioworks Holdings, Inc." and, among other transactions contemplated by the Merger Agreement, the existing equity holders of Old Ginkgo exchanged their equity interests of Old Ginkgo for equity interests of Ginkgo.

As a result of the SRNG Business Combination, the shares and corresponding capital amounts and loss per share related to Old Ginkgo's outstanding convertible preferred stock and common stock prior to the SRNG Business Combination have been retroactively restated to reflect the Exchange Ratio established in the Merger Agreement. See Note 3 for additional information on the SRNG Business Combination.

2. Summary of Significant Accounting Policies

Basis of Presentation

The accompanying consolidated financial statements have been prepared in conformity with the rules and regulations of the Securities and Exchange Commission ("SEC") and generally accepted accounting principles in the United States of America ("GAAP"). Any reference in these notes to applicable guidance is meant to refer to the authoritative GAAP as found in the Accounting Standards Codification ("ASC") and Accounting Standards Updates ("ASU") of the Financial Accounting Standards Board ("FASB").

The SRNG Business Combination was accounted for as a reverse recapitalization, in accordance with GAAP (the "Reverse Recapitalization"). Under this method of accounting, SRNG was treated as the "acquired" company for financial reporting purposes. Accordingly, for accounting purposes, the Reverse Recapitalization was treated as the equivalent of Old Ginkgo issuing stock for the net assets of SRNG, accompanied by a recapitalization. The net assets of SRNG are stated at historical cost, with no goodwill or other intangible assets recorded. The determination of Old Ginkgo as the accounting acquirer was primarily based on the fact that Old Ginkgo's former shareholders currently have the largest voting interest in Ginkgo, all of the management of Ginkgo is comprised of Old Ginkgo's former executive management, Old Ginkgo's former directors and individuals designated by, or representing, Old Ginkgo shareholders constitute a majority of the initial Ginkgo Board, and the operations of Old Ginkgo comprise all of the ongoing operations of Ginkgo.

The consolidated assets, liabilities and results of operations prior to the Reverse Recapitalization are those of Old Ginkgo. The shares and corresponding capital amounts and loss per share prior to the Reverse Recapitalization have been retroactively restated to reflect the Exchange Ratio established in the Merger Agreement.

Principles of Consolidation

The accompanying consolidated financial statements include the accounts of the Company, its wholly owned subsidiaries, majority owned subsidiaries and variable interest entities if the Company is the primary beneficiary. All intercompany accounts and transactions have been eliminated.

Reclassifications

Certain prior year amounts have been reclassified for consistency with the current year presentation. These reclassifications had no effect on the reported results of operations.

Variable Interest Entities

The Company evaluates its variable interests in variable interest entities ("VIE") and consolidates VIEs when the Company is the primary beneficiary. The Company determines whether it is the primary beneficiary of each VIE based on its assessment of whether the Company possesses both (i) the power to direct the activities that most significantly affect the VIE's economic performance and (ii) the obligation to absorb losses that could be significant to the VIE or the right to receive benefits that could be significant to the VIE. The Company reevaluates the accounting for its VIEs upon the occurrence of events that could change the primary beneficiary conclusion. As of December 31, 2022 and 2021, the maximum risk of loss related to the Company's VIEs was limited to the carrying value of its investment in such entities.

Use of Estimates

The preparation of financial statements in conformity with GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, revenues and expenses, and the disclosure of contingent liabilities in the consolidated financial statements. Estimates used in the preparation of these consolidated financial statements include, among others, revenue recognition, stock-based compensation, the fair value of assets acquired and liabilities assumed in a business combination, the fair value of non-cash consideration received from customers, the fair value of certain notes receivable, the fair value of certain investments including equity method investments, the fair value of warrant liabilities, the allocation of equity method investment losses under the hypothetical liquidation at book value ("HLBV") method, the incremental borrowing rate used in determining lease liabilities, allowance for credit losses, accrued expenses and income taxes.

The Company bases its estimates on historical experience and other market-specific or relevant assumptions that it believes to be reasonable under the circumstances. Reported amounts and disclosures reflect the overall economic conditions that management believes are most likely to occur, and the anticipated measures management intends to take. Actual results could differ materially from those estimates. All revisions to accounting estimates are recognized in the period in which the estimates are revised.

Segment Information

Prior to 2022, the Company operated as a single reportable segment. In the first quarter of 2022, the Company reorganized its operations into two operating and reportable segments: Foundry and Biosecurity. The reorganization reflects changes made to the Company's internal management structure and how the Company's chief operating decision makers ("CODMs"), comprised of the Chief Executive Officer and the Chief Operating Officer, evaluate operating results and make decisions on how to allocate resources. All prior-period comparative segment information was recast to reflect the current reportable segments in accordance with ASC 280, *Segment Reporting*. The Company's CODMs do not evaluate operating segments using asset information.

Concentrations of Credit Risk

Financial instruments that potentially subject the Company to concentrations of credit risk primarily consist of cash and cash equivalents, restricted cash, accounts receivable, and notes receivable. The Company's cash and cash equivalents and restricted cash are maintained in bank deposit accounts and money market funds that regularly exceed federally insured limits. The Company is exposed to credit risk on its cash, cash equivalents and restricted cash in the event of default by the financial institutions to the extent account balances exceed the amount insured by the Federal Deposit Insurance Corporation ("FDIC"). The Company believes that it is not exposed to significant credit risk as its deposits are generally held in financial institutions that management believes to be of high credit quality; however, the Company is exposed to loss of its uninsured deposits held at Silicon Valley Bank (see Note 21). The Company's accounts receivable primarily consists of amounts due under its Biosecurity contracts; however, concentrations of credit risk associated with these contracts are limited because the customer base is largely made up of state government agencies. The Company has not experienced any material write-offs related to its accounts receivable since inception. The Company's maximum credit risk exposure with respect to notes receivable is equivalent to the carrying value of the notes as of the balance sheet date. The Company mitigates this risk by requiring collateral for certain notes and monitoring the counterparty's financial condition. Refer to Note 21 for further discussion regarding the potential impacts of the closure of Silicon Valley Bank to the Company's accounts and notes receivable.

For the year ended December 31, 2022, two customers within the Biosecurity segment each account for 11% of the Company's total revenue. For the year ended December 31, 2021, one customer within the Foundry segment and one customer within the Biosecurity segment accounted for 11% and 17%, respectively, of the Company's total revenue. For the year ended December 31, 2020, two customers within the Foundry segment accounted for 27% and 12% of the Company's total revenue. No other customer exceeded 10% of the Company's total revenue in any period presented.

Cash and Cash Equivalents

The Company's cash is comprised of bank deposits, overnight sweep accounts and money market funds. The Company considers all highly liquid investments with original maturities of three months or less at the date of purchase to be cash equivalents. The carrying value of the Company's cash and cash equivalents approximate fair value due to their short-term maturities.

Restricted Cash

Restricted cash primarily includes cash balances collateralizing letters of credit associated with the Company's facility leases and a customer prepayment requiring segregation and restrictions in its use in accordance with the customer agreement. Restricted cash is included in prepaid expenses and other current assets and other non-current assets on the consolidated balance sheet.

Accounts Receivable, net

Accounts receivable consists of credit extended to customers in the normal course of business and is reported at the estimated net realizable value. Accounts receivable includes unbilled amounts that have been recognized in revenue but have not yet been invoiced based on timing differences and the terms of the underlying arrangements. Prior to the Company's adoption of ASU 2016-13, *Financial Instruments-Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments* ("ASU 2016-13"), the Company maintained an allowance for doubtful accounts to provide for the estimated amounts of accounts receivable that would not be collected. The allowance was based upon an assessment of customer creditworthiness, historical payment experience, the age of outstanding receivables and collateral to the extent applicable. Subsequent to the adoption of ASU 2016-13, the Company maintains an allowance for credit losses for its outstanding accounts receivable.

Allowance for Credit Losses

The Company maintains an allowance for credit losses to provide for the estimated amounts of receivables that will not be collected over the estimated life of the assets. The allowance is calculated by considering previous loss history, delinquency of receivables balances, current economic conditions and anticipated future economic conditions in the geographies and industries in which the Company's customers operate. To the extent an individual customer's credit quality deteriorates, the Company measures an allowance based on the risk characteristics of the individual customer. Once a receivable is deemed to be uncollectible, such balance is charged against the allowance. The allowance is calculated at each reporting period with changes recorded to general and administrative expense in the consolidated statements of operations and comprehensive loss.

Inventory, net

Inventories are stated at the lower of cost or net realizable value. Inventory in the Biosecurity segment mainly consists of diagnostic testing kits purchased from suppliers, testing program supplies and the costs of assembling sample collection kits. The cost of finished goods inventory for lateral flow assay ("LFA") and polymerase chain reaction ("PCR") tests is determined using the first-in first-out method. The cost of raw materials, work in process and finished goods inventory for pooled tests is determined using the average cost method. Inventory in the Biosecurity segment has been reduced by an allowance for excess and obsolete inventory using the specific identification method.

Notes Receivable

The Company has elected the fair value option under ASC 825, *Financial Instruments,* to account for its notes receivable. Notes receivable accounted for under the fair value option are marked to market as of each balance sheet date with changes in fair value recorded in other income (expense), net in the consolidated statements of operations and comprehensive loss.

The Company classifies the current portion of the notes receivable balance as a component of prepaid expenses and other current assets on the consolidated balance sheet based on the principal balance of the note that matures within one year from the balance sheet date. The long-term portion is included in other non-current assets.

Property, Plant, and Equipment, net

Property, plant and equipment are stated at cost less accumulated depreciation and amortization. Land is stated at cost. Depreciation and amortization are computed using the straight-line method over the estimated useful lives of the assets or the remaining lease term for leasehold improvements. Estimated lives of property, plant and equipment are as follows:

	Estimated Useful Life
Computer equipment and software	2 to 5 years
Furniture and fixtures	7 years
Lab equipment	1 to 5 years
Buildings and facilities	15 to 30 years
Vehicles	5 years
Leasehold improvements	Shorter of useful life or remaining lease term

Expenditures for maintenance and repairs are expensed as incurred. When assets are retired or otherwise disposed of, the related cost and accumulated depreciation or amortization is removed from the balance sheet and any resulting gain or loss is reflected in other income (expense), net in the consolidated statements of operations and comprehensive loss.

Construction in progress relates to assets which have not been placed in service as of period end. As of December 31, 2021, facilities included assets acquired under a build-to-suit lease arrangement, which was derecognized upon the adoption of ASU 2016-02, Leases (Topic 842) ("ASC 842") on January 1, 2022.

Equity Method Investments

The Company utilizes the equity method to account for its investments in common stock, or in-substance common stock, when it possesses the ability to exercise significant influence, but not control, over the operating and financial policies of the investee. The Company uses judgment when determining the level of influence over the operating and financial policies of the investee considering key factors including, among others, the Company's ownership interest, representation on the board of directors, participation in policy-making decisions and material contractual arrangements and obligations. Income and losses are allocated based upon relative ownership interest unless there is a substantive profit-sharing agreement in place.

For investments with a substantive profit-sharing agreement, the Company utilizes the HLBV method to allocate income and losses from the equity method investment. Under the HLBV method, the Company utilizes the capital account at the end of the period assuming the book value of the entity was liquidated or sold minus the same calculation at the beginning of the period. The difference is the share of earnings or losses attributable to the equity method investment.

Under the equity method, if there is a commitment for the Company to fund the losses of its equity method investees, the Company would continue to record its share of losses resulting in a negative equity method investment, which would be presented as a liability on the consolidated balance sheet. Commitments may be explicit and may include formal guarantees, legal obligations, or arrangements by contract. Implicit commitments may arise from reputational expectations, intercompany relationships, statements by the Company of its intention to provide support, a history of providing financial support or other facts and circumstances. When the Company has no commitment to fund the losses of its equity method investees, the carrying value of its equity method investments will not be reduced below zero. The Company had no commitment to fund additional losses of its equity method investments during the years ended December 31, 2022, 2021 and 2020, other than dissolution costs for Joyn Bio, LLC (see Note 3 and 6).

The Company evaluates its equity method investments for impairment whenever events or circumstances indicate that the carrying value of the investment may not be recoverable. The Company considers the investee's financial position, forecasts and economic outlook, and the estimated duration and extent of losses to determine whether a recovery is anticipated. An impairment that is other-than-temporary is recognized in the period identified. The Company has not recognized an impairment loss related to its equity method investments for the years ended December 31, 2022, 2021 and 2020. Refer to

Note 21 for further discussion regarding the potential impacts of the closure of Silicon Valley Bank to the Company's equity method investments.

The Company may elect the fair value option for its equity method investments on an investment-by-investment basis. For all equity method investments accounted for under the fair value option, the Company carries the equity method investment at fair value and records all subsequent changes in fair value as a component of loss on equity method investments in the consolidated statements of operations and comprehensive loss.

Investments

Investments include warrants, marketable equity securities in publicly-traded companies, non-marketable equity securities in privately-held companies and Simple Agreement for Future Equity ("SAFEs"), in each case, in which the Company does not possess the ability to exercise significant influence over the investee.

Investments in warrants and marketable equity securities of publicly-traded companies are measured at fair value with subsequent changes in fair value recorded in loss on investments in the consolidated statements of operations and comprehensive loss.

Investments in non-marketable equity securities of privately-held companies and SAFEs, which do not have readily determinable fair values, are carried at cost, less any impairments, plus or minus changes resulting from observable price changes in orderly transactions for the identical or a similar investment of the same issuer. Each period the Company assesses relevant transactions to identify observable price changes, and the Company regularly monitors these investments to evaluate whether there is an indication of impairment. The Company evaluates whether an investment's fair value is less than its carrying value using an estimate of fair value, if such an estimate is available. For periods in which there is no estimate of fair value, the Company evaluates whether an event or change in circumstances has occurred that may have a significant adverse effect on the value of the investment. The Company has not recognized any upward or downward adjustments resulting from observable price changes in identical or similar investments for the years ended December 31, 2022, 2021 and 2020. Refer to Note 21 for further discussion regarding the potential impacts of the closure of Silicon Valley Bank to the Company's investments.

Fair Value Measurements

The Company categorizes its assets and liabilities measured at fair value in accordance with the authoritative accounting guidance that establishes a consistent framework for measuring fair value and requires disclosures for each major asset and liability category measured at fair value on either a recurring or nonrecurring basis.

ASC 820, *Fair Value Measurement* ("ASC 820"), establishes a fair value hierarchy for instruments measured at fair value that distinguishes between assumptions based on market data (observable inputs) and the Company's own assumptions (unobservable inputs). Observable inputs are inputs that market participants would use in pricing the asset or liability based on market data obtained from sources independent of the Company. Unobservable inputs are inputs that reflect the Company's assumptions about the inputs that market participants would use in pricing the asset or liability and are developed based on the best information available in the circumstances.

ASC 820 identifies fair value as the exchange price, or exit price, representing the amount that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants. As a basis for considering market participant assumptions in fair value measurements, ASC 820 establishes a three-tier fair value hierarchy that distinguishes among the following:

- Level 1- Quoted prices (unadjusted) in active markets for identical assets or liabilities;
- Level 2- Inputs other than quoted prices included within Level 1 that are either directly or indirectly observable; and
- Level 3- Unobservable inputs in which little or no market activity exists, therefore requiring an entity to develop its own assumptions about the assumptions that market participants would use in pricing.

To the extent that the valuation is based on models or inputs that are either less observable or unobservable in the market, the determination of fair value requires more judgment. Accordingly, the degree of judgment exercised by the Company in

determining fair value is greatest for instruments categorized in Level 3. A financial instrument's level within the fair value hierarchy is based on the lowest level of any input that is significant to the fair value measurement.

The Company valued its money market fund holdings, notes receivable, marketable equity securities, warrant liabilities and contingent consideration liability at fair value on a recurring basis. The carrying amounts of the Company's other financial instruments, which include accounts receivable, certain prepaid expenses and other current assets, accounts payable and accrued expenses and other current liabilities approximate their fair values due to their short-term nature.

Impairment of Long-Lived Assets

The Company reviews its long-lived assets for impairment whenever events or changes in circumstances indicate that the carrying value of an asset may not be recoverable. Recoverability is measured by comparing the book values of the assets to the expected future net undiscounted cash flows that the assets are expected to generate. If such assets are considered to be impaired, the impairment to be recognized is measured by the amount by which the book values of the assets exceed their fair value. The Company has not recognized an impairment loss for the years ended December 31, 2022, 2021 and 2020.

Business Combinations

The Company accounts for business combinations using the acquisition method of accounting. The Company recognizes the identifiable assets acquired and liabilities assumed at their acquisition-date fair values and recognizes any excess of the total consideration paid over the fair value of the identifiable net assets as goodwill. Any purchase price that is considered contingent consideration is measured at its estimated fair value at the acquisition date and remeasured at each reporting period, with changes in estimated fair value recorded in general and administrative expenses on the consolidated statements of operations and comprehensive loss. Acquisition transaction costs are expensed when incurred. The operating results of an acquisition are included in the Company's consolidated financial statements as of the acquisition date.

Intangible Assets, net

Intangible assets, net consist of certain definite-lived assets including patents, processes and know-how related to technology acquired through business combinations. The Company amortizes such intangible assets on a straight-line basis over their estimated useful life.

The Company reviews intangible assets for impairment whenever events or changes in circumstances have occurred which could indicate that the carrying value of the assets are not recoverable. Recoverability is measured by comparing the carrying value of the intangible assets to the future undiscounted cash flows expected to be generated by the asset. In determining the expected future cash flows, the Company uses assumptions believed to be reasonable, but which are unpredictable and inherently uncertain. Actual future cash flows may differ from the estimates used in impairment testing. The Company recognizes an impairment loss when and to the extent that the estimated fair value of an intangible asset is less than its carrying value. The Company has not recognized an impairment loss for the years ended December 31, 2022, 2021 and 2020.

Goodwill

Goodwill represents the excess of acquisition cost over the fair market value of the net assets acquired. Goodwill is tested for impairment on an annual basis during the fourth quarter or whenever events or changes in circumstances indicate the carrying amount may not be recoverable. The Company considers various qualitative factors that could indicate impairment such as macroeconomic conditions, industry and market environment, technological obsolescence, overall financial performance of the Company, cash flow from operating activities and market capitalization. If the qualitative assessment indicates that it is more likely than not that the fair value of the reporting unit is less than its carrying amount, the Company performs a quantitative assessment to compare the fair value of the reporting unit to its carrying value, including goodwill. If the carrying value of the reporting unit exceeds the fair value, an impairment loss is recognized. A combination of the income approach and the market approach may be used to determine fair value of the reporting unit. The Company has not recognized an impairment loss for the years ended December 31, 2022, 2021 and 2020.

Leases

The Company determines if an arrangement is or contains a lease at contract inception based on the terms and conditions in the contract. A contract contains a lease if there is an identified asset and the Company has the right to control the asset. For

leases with terms greater than 12 months, the Company recognizes a right-of-use asset ("ROU asset") and a lease liability as of the lease commencement date on the balance sheet. ROU assets represent the Company's right to use an underlying asset over the lease term and lease liabilities represent the Company's obligation to make lease payments arising from the lease. Lease ROU assets and liabilities are measured based on the present value of fixed lease payments that are unpaid as of the lease commencement date. The Company's ROU assets balance is reduced by any prepaid rent balances, initial direct costs and lease incentives received or expected to be received. Some of the Company's leases include options to extend or terminate the lease; these options are included in the lease term for calculations of its ROU assets and liabilities when it is reasonably certain that the Company will exercise those options.

The Company's leases are classified as either operating or finance, as determined at inception, with the classification affecting the pattern of expense recognition in the statement of operations. A lease is classified as a finance lease if risks and rewards are conveyed without the transfer of control. For operating leases, expense is generally recognized on a straight-line basis over the lease term. For finance leases, interest on the lease liability is recognized using the effective interest method, while the ROU asset is amortized on a straight-line basis from the commencement date to the earlier of the end of the useful life of the ROU asset or the end of the lease term. Leases with an initial term of 12 months or less which meet the definition of a short-term lease are not recorded on the balance sheet and the lease expense for these leases is recognized on a straight-line basis over the lease term. In limited instances, the Company acts as a lessor, primarily with certain real estate subleases. Finance leases, short-term leases and subleases are not a significant component of the Company's financial condition or results of operations. The current portion of the Company's operating lease liabilities is included in accrued expenses and other current liabilities on the balance sheet.

The Company has lease agreements with both lease and non-lease components (such as real estate taxes, insurance and common area maintenance charges) and has elected the practical expedient to combine these lease and non-lease components for its real estate leases and non-lab equipment leases. The Company has not elected this practical expedient for lab equipment leases and the lease and non-lease components are accounted for separately. Non-lease components are typically variable in nature and are recognized as lease expense in the period in which they arise.

As most of the Company's leases do not provide an implicit rate, the Company uses an incremental borrowing rate based on the information available at lease commencement date in determining the present value of lease payments and uses the implicit rate when readily determinable. The Company's incremental borrowing rate is based on management's estimate of the rate of interest the Company would have to pay to borrow on a fully collateralized basis over a similar term an amount equal to the lease payments in a similar economic environment.

Deferred Rent

Prior to the adoption of ASC 842, deferred rent represented the difference between cash paid and rent expense recognized on a straight-line basis for the facilities that the Company occupied under operating leases. The Company classified the current portion of deferred rent as a component of accrued expenses and other current liabilities on the consolidated balance sheet.

Revenue Recognition

The Company accounts for revenue in accordance with ASC 606, *Revenue from Contracts with Customers* ("ASC 606"). Under ASC 606, the Company recognizes revenue when the customer obtains control of the promised goods or services at an amount that reflects the consideration the Company expects to receive in exchange for those goods or services. To determine revenue recognition for arrangements that are within the scope of ASC 606, the Company performs the following five steps: (i) identify the contract(s) with a customer, (ii) identify the promises and distinct performance obligations in the contract, (iii) determine the transaction price, (iv) allocate the transaction price to the performance obligations in the contract, and (v) recognize revenue when (or as) the Company satisfies the performance obligations.

Foundry Revenue

The Company generates license and service revenue through the execution of license and collaboration agreements whereby customers obtain license rights to the Company's proprietary technology and intellectual property for use in the research, development and commercialization of engineered organisms, and derived products. Under these agreements, the Company typically provides research and development services, which includes the provision of a license to the Company's intellectual property. Additionally, the customer obtains license rights to the output of the Company's services in order to commercialize the resulting output of such services. Generally, the terms of these agreements provide that the Company receives some combination of: (1) Foundry usage fees in the form of (i) upfront payments upon consummation of the agreement or other fixed payments, (ii) reimbursement for costs incurred for research and development services and (iii) milestone payments

upon the achievement of specified technical criteria, plus (2) downstream value share payments in the form of (i) milestone payments upon the achievement of specified commercial criteria, (ii) royalties on sales of products from or comprising engineered organisms arising from the collaboration or licensing agreement and (iii) royalties related to cost of goods sold reductions realized by customers.

The Company's collaboration and licensing agreements often contain multiple promises, including (i) licenses and assignments of intellectual property and materials and (ii) research and development services, and the Company determines whether each of the promises is a distinct performance obligation based on the nature of each agreement. As the Company is generally performing research and development services that are highly integrated and interrelated to the licenses and assignments of intellectual property and materials, the promises are generally inseparable. As such, the Company typically combines the research and development services, licenses, and assignments into a single performance obligation. However, for certain agreements, the Company only grants licenses or effects such transfers and assignments upon the successful completion of the research and development services or delivery of a developed product. For these agreements, the Company typically considers (i) the research and development services and (ii) the licenses, transfers, and assignments as distinct performance obligations, as each is transferred separately and has a separately identifiable benefit.

Options to acquire additional goods and services are evaluated to determine if such options provide a material right to the counterparty that it would not have received without entering into the contract. If so, the option is accounted for as a separate performance obligation. If not, the option is considered a marketing offer which is accounted for as a separate contract upon the counterparty's election.

At contract inception, the Company determines the transaction price, including fixed consideration and any estimated amounts of variable consideration. Any upfront cash payment received upon consummation of the agreement is fixed and generally non-refundable. Variable consideration is subject to a constraint, and amounts are included in the transaction price to the extent that it is probable that a significant reversal in the amount of cumulative revenue recognized will not occur when the uncertainty associated with the variable consideration is subsequently resolved. Variable consideration may include reimbursement for costs incurred for the Company's research and development efforts, milestone payments upon the achievement of certain technical and commercial criteria, and royalties on sales of products from or comprising engineered organisms arising from the agreement. With respect to the research and development reimbursements and milestone payments, the Company uses the most likely amount method to estimate variable consideration. With respect to agreements that include royalties on sales or other contingent payments based on sales, the Company applies the royalty recognition constraint which requires a constraint until the royalty or value-sharing transaction occurs.

Certain agreements contain payment in the form of shares of equity securities or other financial instruments that are convertible into equity upon a triggering event. Any non-cash consideration is measured at the estimated fair value of the non-cash consideration at contract inception. For equity securities and financial instruments received that are not actively traded, the Company generally engages a third-party valuation specialist to determine the estimated fair value of the upfront non-cash consideration. The fair value is generally determined based on a recent round of financing or by using a scenario-based valuation model. Significant unobservable inputs are used in the fair value measurements including expectations regarding future financings of the customer, scenario dates and probabilities, expected volatility, discount rates and recovery rates. Changes in these assumptions can materially affect the value of the non-cash consideration at contract inception and, accordingly, the total amount of revenue recognized for the contract.

For agreements with promises that are combined into a single performance obligation, the entire transaction price is allocated to the single performance obligation. For agreements with multiple performance obligations, the transaction price is allocated to the performance obligations using the relative standalone selling price methodology. For agreements featuring variable consideration, the Company allocates variable consideration to one or more, but not all, performance obligations if certain conditions are met. Specifically, the Company assesses whether the variable consideration relates solely to its efforts to satisfy the performance obligation and whether allocating such variable consideration entirely to the performance obligation is consistent with the overall allocation objective. If these conditions are not met, the Company allocates the variable consideration based on the relative standalone selling price methodology. The key assumptions utilized in determining the standalone selling price for each performance obligation include development timelines, estimated research and development costs, commercial markets, likelihood of exercise (in the case of options considered to be material rights), and probabilities of success.

For agreements where the licenses or assignments are considered separate performance obligations or represent the only performance obligation, the Company recognizes revenue at the point in time that the Company effectively grants the license

as the licenses or assignments represent functional intellectual property. For agreements where the licenses and the research and development services represent a combined performance obligation, the Company recognizes revenue over the period of performance using a measure of progress based on costs incurred to date as compared to total estimated costs.

The Company evaluates its measure of progress to recognize revenue at each reporting period and, as necessary, adjusts the measure of progress and related revenue recognition. The Company's measure of progress and revenue recognition involves significant judgment and assumptions, including, but not limited to, estimated costs and timelines to complete its performance obligations. The Company evaluates contract modifications and amendments to determine whether any changes should be accounted for prospectively or on a cumulative catch-up basis. The Company utilizes the right to invoice practical expedient when it has a right to consideration in an amount that corresponds directly with the value of the Company's performance to date.

Royalties are recognized as revenue when sales have occurred as the Company applies the sales or usage-based royalties recognition constraint. The Company has determined the application of this exception is appropriate because the license granted in the agreement is the predominant item to which the royalties relate.

As the Company receives upfront payments for technical services under certain of its arrangements, the Company evaluates whether any significant financing components exist given the term over which the fees will be earned may exceed one year. Based on the nature of the Company's agreements, there are no significant financing components as the purpose of the upfront payment is not to provide financing, but rather to secure technical services, exclusivity rights, and Foundry capacity, or the timing of transfer of those goods or services is at the discretion of the customer.

Deferred revenue represents consideration received by the Company in excess of revenue recognized and primarily results from transactions where the Company receives upfront payments and non-cash equity consideration. In instances where the Company has received consideration in advance for an undefined number of technical development plans ("TDPs") under its customer agreements, the Company records the advance payments as deferred revenue, net of current portion on the consolidated balance sheet. Upon the execution of a specific TDP, the Company reclassifies the estimated consideration to be earned under that TDP within the next twelve months as current deferred revenue. The Company also classifies unexercised material rights related to future TDPs as deferred revenue, net of current portion on the consolidated balance sheet. When a TDP is executed, and the material right is exercised, the amount allocated to the material right, which will be earned within the next twelve months, is reclassified to current deferred revenue. All other deferred revenue is classified as current or non-current based on the timing of when the Company expects to earn the underlying revenue based upon the projected progress of activities under the TDP.

Collaboration Arrangements

For arrangements that do not represent contracts with a customer, the Company analyzes its collaboration transactions to assess whether they are within the scope of ASC 808, *Collaborative Arrangements* ("ASC 808"), to determine whether such arrangements involve joint operating activities performed by parties that are both active participants in the activities and exposed to significant risks and rewards that are dependent on the commercial success of such activities. To the extent the arrangement is within the scope of ASC 808, the Company assesses whether aspects of the arrangement between the Company and its collaboration partner are within the scope of other accounting literature. If the Company concludes that some or all aspects of the arrangement represent a transaction with a customer, the Company accounts for those aspects of the arrangement within the scope of ASC 606.

Biosecurity Revenue

In 2020, the Company launched its commercial offering of COVID-19 testing products and services for businesses, academic institutions, and other organizations in which the Company generates product and service revenue. Beginning in the first quarter of 2021, the Company launched its pooled testing initiative which focuses on providing end-to-end COVID-19 testing services to public health authorities. The Company currently offers pooled testing and reporting services for K-12 schools across the United States, at airports through its partnership with XpresCheck and the CDC, as well as through other congregate settings such as its partnership with Eurofins. The Company sells COVID-19 test kits on a standalone basis or as part of an end-to-end testing service. The Company records product revenue from sales of LFA, PCR, and pooled test kits. The Company records service revenue from sales of its end-to-end COVID-19 testing services, which consist of multiple promised goods and services including sample collection kits, physician authorizations, onsite test administration, outsourced

laboratory PCR analysis, and access to results reported through the Company's proprietary web-based portal. The Company recognizes its product and service revenue using the five-step model under ASC 606.

Product revenue is recognized when the test kits are shipped and risk of loss is transferred to the carrier. The Company's test kits are generally not subject to a customer right of return except for product recalls under the rules and regulations of the U.S. Food and Drug Administration ("FDA"). The Company has elected to include shipping and handling fees billed to customers as a component of Biosecurity revenue.

Service revenue from the Company's end-to-end COVID-19 testing services is recognized upon completion of the tests and release of the test results on the web-based portal. The Company has identified one performance obligation in its testing services contracts that represents a series of distinct goods or services that are substantially the same and that have the same pattern of transfer to the customer, with each test as a distinct service within the series. As the price for the testing services is fixed under each customer contract, the Company has elected the practical expedient to recognize revenue at the amount to which it has the right to invoice for services performed. The Company's testing services contracts are generally one year or less in length and contain fixed unit pricing. Under typical payment terms for testing services, amounts are billed monthly in arrears for services performed or in advance based on contractual billing terms.

Cost of Biosecurity Revenue

Cost of Biosecurity product revenue consists of costs associated with the sale of diagnostic and sample collection test kits which includes costs paid to purchase test kits from third parties. Cost of Biosecurity service revenue consists of costs associated with the provision of the Company's end-to-end COVID-19 testing services, which includes costs paid to provide sample collection kits, physician authorizations, onsite test administration, outsourced laboratory PCR analysis, access to results reported through a web-based portal and reporting of results to public health authorities.

Research and Development Costs

Research and development costs are expensed as incurred. Research and development costs consist of direct and indirect internal costs related to specific projects and initiatives, acquired intellectual property deemed to be in-process research and development, as well as fees paid to other entities that conduct certain research and development activities on the Company's behalf.

Patent Costs

The Company expenses all costs as incurred in connection with the filing, prosecution, maintenance, defense, and enforcement of patent applications, including direct application fees and related legal and consulting expenses. Patent costs are included in general and administrative expenses within the consolidated statements of operations and comprehensive loss.

Stock-Based Compensation

The Company measures and recognizes compensation expense for all stock-based awards based on estimated grant-date fair values recognized over the requisite service period. For awards that vest solely based on a service condition, the Company recognizes compensation expense on a straight-line basis over the requisite service period. For awards that vest based on multiple conditions, the Company recognizes compensation expense using the accelerated attribution method on a tranche-by-tranche basis over the requisite service period such that the amount of compensation expense recognized at each reporting period is at least equal to the vested tranches at that date. For awards with a performance-based vesting condition, the Company recognizes stock-based compensation when achievement of the performance condition is deemed probable, and upon achieving a performance condition that was not previously considered as probable, records a cumulative catch-up adjustment to reflect the portion of the grantee's requisite service that has been provided to date. For awards with market conditions, the compensation expense recognized over the requisite service period is not reversed if the market condition is not satisfied. The Company recognizes forfeitures as they occur.

The Company estimates the grant date fair value of stock options using the Black-Scholes option-pricing model. The Black-Scholes option-pricing model requires the input of subjective assumptions, including fair value of common stock (for options granted prior to the SRNG Business Combination), expected term, expected volatility, risk-free interest rate and expected dividend yield. The expected term is determined using the "simplified" method, which estimates the expected term as the average of the vesting term plus the contractual term. The Company uses the "simplified" method as it does not have

sufficient historical data regarding employee exercise behavior. Expected volatility is based on the historical volatility of the stock prices of similar publicly traded peer companies. The risk-free interest rate is based on the yield available on U.S. Treasury zero-coupon issues similar in duration to the expected term of the stock options. The Company has not paid, and does not expect to pay, dividends in the foreseeable future.

For awards with market conditions, the Company determines the grant date fair value using a Monte Carlo simulation model, which incorporates various assumptions including expected stock price volatility, risk-free interest rates, expected term, and expected dividend yield. The Company determines expected volatility using the historical volatility of the stock prices of similar publicly traded peer companies. The risk-free interest rate is based on the yield available on U.S. Treasury zero-coupon issues similar in duration to the expected term of the awards. The expected term is equal to the contractual term and a dividend yield of zero is assumed.

For awards granted prior to the SRNG Business Combination, the Company utilized the hybrid method to estimate the grant date fair value of its common stock underlying its stock-based awards. The hybrid method is a probability-weighted expected return method ("PWERM") where the equity value in at least one scenario is allocated using an option pricing method ("OPM"). Under the PWERM, the value of the common stock is estimated based on the probability-weighted present value of expected future investment returns considering various liquidity events and the rights and privileges of each class of equity. Under the OPM, each class of stock is treated as a call option on the Company's equity value, with exercise prices based on the liquidation preferences of the convertible preferred stock. The Black-Scholes model is used to price the call options which includes assumptions for the time to liquidity and volatility of equity value. A discount for lack of marketability is then applied to the common stock value. There are significant judgments and estimates inherent in determining the fair value of the common stock. These judgments and estimates include factors, both subjective and objective, including: (i) a discount for lack of marketability; (ii) external market data; (iii) historical activity by the Company in selling equity to outside investors; (iv) the Company's stage of development; (v) rights and preferences of the Company's equity securities that rank senior to common stock; and (vi) the likelihood of various liquidity events, among others. Changes to these assumptions could result in different fair values of common stock.

Income Taxes

The Company accounts for income taxes using the asset and liability method, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of events that have been recognized in the consolidated financial statements or in the Company's tax returns. Under this method, deferred tax assets and liabilities are determined based on differences between the financial statement carrying amounts and the tax bases of the assets and liabilities using the enacted tax rates in effect in the years in which the differences are expected to reverse. A valuation allowance against deferred tax assets is recorded if, based on the weight of the available evidence, it is more likely than not that some or all of the deferred tax assets will not be realized. Potential for recovery of deferred tax assets is evaluated by considering several factors, including estimating the future taxable profits expected, estimating future reversals of existing taxable temporary differences, considering taxable profits in carryback periods, and considering prudent and feasible tax planning strategies.

The Company accounts for uncertain tax positions using a more-likely-than-not threshold for recognizing and resolving uncertain tax positions. The evaluation of uncertain tax positions is based on factors including, but not limited to, changes in the law, the measurement of tax positions taken or expected to be taken in tax returns, the effective settlement of matters subject to audit, new audit activity, and changes in facts or circumstances related to a tax position. The Company evaluates uncertain tax positions on an annual basis and adjusts the level of the liability to reflect any subsequent changes in the relevant facts surrounding the uncertain positions. The Company accounts for interest and penalties related to uncertain tax positions as part of its provision for income taxes. As of December 31, 2022 and 2021, the Company did not have any uncertain tax positions and no accrued interest or penalties related to uncertain tax positions. The Company does not expect a material change in unrecognized tax benefits in the next twelve months.

Warrant Liabilities

The Company classifies Private Placement Warrants and Public Warrants (both defined and discussed in Note 9) as liabilities. At the end of each reporting period, changes in fair value during the period are recognized as change in fair value of warrant liabilities on the consolidated statements of operations and comprehensive loss. The Company will continue to adjust the warrant liability for changes in the fair value until the earlier of (a) the exercise or expiration of the warrants or (b) the redemption of the warrants, at which time the warrants will be reclassified to additional paid-in capital.

Foreign Currency Translation

The functional currency of the Company's foreign subsidiaries is their local currency. The Company translates the non-United States dollar-denominated assets and liabilities using the exchange rates prevailing at the end of each reporting period and translates revenues and expenses using the average exchange rates in the reporting period. Foreign currency translation adjustments are recorded as a component of other comprehensive loss on the consolidated statements of operations and comprehensive loss and accumulated in other comprehensive loss in stockholders' equity.

Comprehensive Loss

Comprehensive loss is defined as the change in equity during a period from transactions and other events and circumstances from non-owner sources. Other comprehensive loss consists of foreign currency translation adjustments.

Net Loss per Share

The Company follows the two-class method when computing net loss per share attributable to Ginkgo Bioworks Holdings, Inc. common stockholders as the Company has issued shares that meet the definition of participating securities. The two-class method determines net loss per share for each class of common and participating securities according to dividends declared or accumulated and participation rights in undistributed earnings. The two-class method requires earnings for the period to be allocated between common and participating securities based upon their respective rights to share in the earnings as if all earnings for the period had been distributed. During periods of loss, there is no allocation required under the two-class method since the participating securities do not have a contractual obligation to fund the losses of the Company.

Basic net loss per share is computed by dividing the net loss attributable to Ginkgo Bioworks Holdings, Inc. common stockholders by the weighted average number of common shares outstanding for the period. Diluted net loss per share is equal to the net loss attributable to Ginkgo Bioworks Holdings, Inc. common stockholders less the gain (if any) on the change in fair value of warrant liabilities, divided by the weighted average number of common shares outstanding for the period, including the effect of potentially dilutive common shares. For purposes of this calculation, outstanding options to purchase shares of common stock, unvested restricted stock awards, unvested restricted stock units, warrants to purchase shares of common stock and contingently issued earnout shares are considered potentially dilutive common shares.

Recent Accounting Pronouncements

Recently Adopted Accounting Pronouncements

In February 2016, the FASB issued ASU 2016-02, *Leases (Topic 842): Amendments to the FASB Accounting Standards Codification*, which has been clarified and amended by various subsequent updates. ASC 842 requires lessees to record a right-of-use asset and a lease liability on the balance sheet for all leases with a lease term of more than 12 months. ASC 842 also requires additional disclosures about the amount, timing and uncertainty of cash flows arising from leases. The Company adopted ASC 842 on January 1, 2022 (the "effective date"), using the modified retrospective approach with a cumulative-effect adjustment to the opening balance of accumulated deficit in the period of adoption. The Company has elected to apply the package of practical expedients that allows for not reassessing (i) whether any expired or existing contracts are or contain leases, (ii) the lease classification of any expired or existing leases, and (iii) the accounting for initial direct costs for any existing leases. The Company has also elected, by class of underlying asset, not to apply the recognition requirements of ASC 842 to short-term leases.

Upon adoption of ASC 842 on January 1, 2022, the Company (i) recognized $147.7 million of operating lease ROU assets and $166.7 million of operating lease liabilities, (ii) reclassified the previously recognized liabilities for deferred rent of $8.5 million and lease incentives of $10.5 million to operating lease ROU assets, (iii) derecognized build-to-suit assets of $17.8 million previously presented within property, plant, and equipment, net, derecognized the build-to-suit lease financing obligation of $22.6 million, and (iv) recorded a cumulative-effect adjustment of $5.2 million to accumulated deficit as of January 1, 2022. Finance leases are not significant to the Company's financials. The adoption of ASC 842 did not have a material impact on the Company's results of operations and cash flows.

In June 2016, the FASB issued ASU 2016-13, *Financial Instruments-Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments*, and subsequently issued multiple amendments to the standard (collectively, "ASU 2016-13"). The provisions of ASU 2016-13 modify the impairment model to utilize an expected loss model in place of the incurred loss model and require a consideration of a broader range of reasonable and supportable information to inform credit loss

estimates. The Company adopted ASU 2016-13 effective January 1, 2022. The adoption of ASU 2016-13 did not have a material impact on the Company's consolidated financial statements and related disclosures.

In December 2019, the FASB issued ASU 2019-12, *Simplifying the Accounting for Income Taxes (*"ASU 2019-12"). The provisions of ASU 2019-12 eliminate certain exceptions related to the approach for intraperiod tax allocation and deferred tax liabilities for outside basis differences and clarify when a step-up in the tax basis of goodwill should be considered part of a business combination or a separate transaction. It also clarifies and simplifies other aspects of the accounting for income taxes. The Company adopted ASU 2019-12 on January 1, 2022. The adoption of ASU 2019-12 did not have a material impact on the Company's consolidated financial statements and related disclosures.

In January 2020, the FASB issued ASU 2020-01, *Investments—Equity Securities (Topic 321), Investments—Equity Method and Joint Ventures (Topic 323), and Derivatives and Hedging (Topic 815)—Clarifying the Interactions between Topic 321, Topic 323, and Topic 815 (a consensus of the FASB Emerging Issues Task Force)* ("ASU 2020-01"). ASU 2020-01 addresses accounting for the transition into and out of the equity method and clarifies the interaction of rules for equity securities, the equity method of accounting, and forward contracts and purchase options on certain types of securities. The Company adopted ASU 2020-01 on January 1, 2022. The adoption of ASU 2020-01 did not have a material impact on the Company's consolidated financial statements and related disclosures.

In November 2021, the FASB issued ASU 2021-10, *Government Assistance (Topic 832): Disclosures by Business Entities about Government Assistance* ("ASU 2021-10"). This update requires annual disclosures about transactions with a government that are accounted for by applying a grant or contribution accounting model by analogy including: (1) the types of transactions; (2) the accounting for the transactions; and (3) the effect of the transactions on a business entity's financial statements. The Company adopted ASU 2021-10 on January 1, 2022. The adoption of ASU 2021-10 did not have a material impact on the Company's consolidated financial statements and related disclosures.

Recently Issued Accounting Pronouncements

In June 2022, the FASB issued ASU 2022-03, *Fair Value Measurement of Equity Securities Subject to Contractual Sale Restrictions*. This standard clarifies that a contractual restriction on the sale of an equity security is not considered part of the unit of account of the equity security, and therefore is not considered in measuring fair value. It also introduces required disclosures for equity securities subject to contractual sale restrictions. This standard becomes effective for the Company on January 1, 2024, with early adoption permitted. The Company is considering the impact of this pronouncement on the financial statements.

In August 2020, the FASB issued ASU 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)* ("ASU 2020-06") which simplifies the accounting for convertible instruments by reducing the number of accounting models and the number of embedded conversion features that could be recognized separately from the host contract. Additionally, ASU 2020-06 removes certain settlement conditions that are required for contracts in an entity's own equity to qualify for the derivatives scope exception. The guidance also modifies diluted earnings per share calculations by requiring entities to use the if-converted method for convertible instruments and to assume share settlement when an instrument can be settled in cash or shares. The guidance is effective for the Company on January 1, 2024 with early adoption permitted. The Company is currently evaluating the impact that the implementation of this standard will have on its consolidated financial statements and related disclosures.

3. Business Combinations and Acquisitions

Fiscal 2022 Acquisitions

Zymergen

On October 19, 2022 (the "Zymergen Closing Date"), the Company acquired all of the outstanding equity of Zymergen Inc. ("Zymergen"), a company that specializes in integrating computational and manufacturing technologies to design, develop, and commercialize bio-based breakthrough products in a broad range of industries (the "Zymergen Acquisition"). The Zymergen Acquisition is expected to enhance the Company's platform for cell programming by integrating strong automation and software capabilities as well as providing a wealth of experience across diverse biological engineering approaches. Under the merger agreement ("Agreement and Plan of Merger"), on the Zymergen Closing Date, each share of Zymergen common stock that was issued and outstanding as of immediately prior to the effective time was automatically

cancelled, extinguished and converted into the right to receive 0.9179 shares of the Company's Class A common stock and cash in lieu of any fractional shares.

The following table summarizes the acquisition date fair value of the consideration transferred for Zymergen (in thousands):

Fair value of Class A common stock issued to Zymergen shareholders [(1)]	$	236,331
Fair value of replacement Ginkgo RSUs and Ginkgo Class A common stock issued under Zymergen RIFs attributable to pre-combination services [(2)]		1,571
Less: Cash severance and retention bonuses incurred for the benefit of the combined company [(3)]		(6,152)
Total Zymergen consideration	$	231,750

(1) As consideration for the Zymergen Acquisition, the Company delivered to Zymergen stockholders 99,422,907 shares of its Class A common stock, of which approximately 96,859,594 represents consideration transferred for the Zymergen Acquisition under ASC 805. The fair value of the Company's Class A common stock issued as consideration transferred was determined based on $2.44 per share, which was the closing price of the Company's Class A common stock on the Zymergen Closing Date. An immaterial amount related to the incremental value received by the holders of Zymergen stock options was excluded from total consideration transferred and recognized as post-combination compensation expense.

(2) Represents the fair value of the replacement Ginkgo RSUs and Ginkgo Class A common stock issued under the Zymergen RIFs attributable to pre-combination services. The remaining portion of the fair value is associated with future service and will be recognized as stock-based compensation expense in the period subsequent to the Zymergen Acquisition over the remaining service period.

(3) Represents cash bonuses payable to Zymergen employees in accordance with Zymergen severance and retention plans at the Zymergen Closing Date. These payments were determined to be for the benefit of the combined company, and accordingly, a portion of the fair value otherwise recognized as consideration transferred was allocated to post-combination compensation expense.

The Zymergen Acquisition was accounted for as a business combination in accordance with ASC 805, *Business Combinations* ("ASC 805"). The Company allocated the consideration transferred to the tangible and identifiable intangible assets acquired and liabilities assumed based on their respective estimated fair values on the acquisition date. The excess consideration transferred was recorded as goodwill, none of which is expected to be deductible for tax purposes. The goodwill is primarily attributed to Zymergen's assembled workforce and the expected synergies from combining operations and has been assigned to the Foundry segment.

The following table summarizes the preliminary acquisition date fair value of the consideration transferred for Zymergen (in thousands):

Cash and cash equivalents	$	150,553
Accounts receivable		980
Inventory		1,166
Prepaid expenses and other current assets		11,592
Property and equipment		97,194
Operating lease right-of-use assets		205,349
Intangible assets		18,600
Goodwill		12,874
Other non-current assets		11,898
Accounts payable		(13,907)
Deferred revenue		(8,189)
Accrued expenses and other current liabilities		(55,917)
Operating lease liabilities		(194,582)
Deferred tax liability		(5,690)
Other non-current liabilities		(171)
Net assets acquired	$	231,750

The allocation of the purchase price, including the valuation of certain tangible and intangible assets acquired and the related tax effects, is preliminary and subject to revision during the one-year measurement period from the date of acquisition if any new information is obtained about facts and circumstances that existed as of the acquisition date.

The fair value of intangible assets was determined using the relief from royalty method of the income approach. The fair value measurements were primarily based on significant inputs not observable in the market and thus represent a Level 3 measurement. The significant inputs used included the estimated annual net cash flows (including projected revenues attributable to the asset, royalty rates and obsolescence rates), and the discount rate that reflects the risks inherent in the future cash flows. Property and equipment is mostly comprised of lab equipment, leasehold improvements and construction in progress. The fair value of property and equipment was primarily determined using the cost approach, which estimates fair value by determining the replacement or reproduction cost of an asset of comparable utility, adjusted for loss in value due to depreciation and economic obsolescence.

Based on the preliminary valuation, intangible assets are as follows (in thousands):

	Estimated fair value	Estimated useful life (in years)
Developed technology	$ 14,900	10
Database	3,700	7
Total	$ 18,600	

In conjunction with the Agreement and Plan of Merger, Zymergen initiated a reduction-in-workforce implemented in stages (each a "RIF") for the benefit of the combined company. Under the RIFs, employees received enhanced severance benefits consisting of cash bonuses and accelerated vesting of their outstanding Zymergen restricted stock units ("Zymergen RSU"). These benefits were triggered upon a change in control occurring within twelve months of the employee's termination date. The Company recognized $11.1 million in cash-based severance and stock-based compensation costs in the consolidated statements of operations and comprehensive loss for the year ended December 31, 2022 related to RIFs.

In August and September 2022, Zymergen also approved the grant of retention bonuses to certain employees denominated in cash and/or Zymergen RSUs designed to retain and reward key talent of Zymergen during the pendency of the proposed Zymergen Acquisition and thereafter. These retention bonuses were deemed for the benefit of the combined company. A portion of the retention bonuses vested and became payable upon the closing of the Zymergen Acquisition, with the remaining portion recognized as post-combination compensation expense over the requisite service period. The Company recognized $7.4 million in cash-based retention and stock-based compensation costs in the consolidated statements of operations and comprehensive loss for the year ended December 31, 2022.

The Company's revenue and net loss for the year ended December 31, 2022 included $2.2 million and $26.0 million, respectively, from Zymergen since the Zymergen Closing Date.

The Company incurred transaction and integration costs of $11.9 million which were recorded in general and administrative expenses, inclusive of a success fee which was partly paid in 327,289 shares of Ginkgo Class A common stock. Additionally, the Company incurred $1.7 million of equity issuance costs, which were recorded in additional paid-in capital in the consolidated balance sheet.

Supplemental Pro Forma Information (unaudited)

The following supplemental pro forma financial information presents the combined results of operations of the Company and Zymergen as if the acquisition had occurred on January 1, 2021. The pro forma financial information is presented for informational purposes only and is not necessarily indicative of the operating results that would have been realized if the Zymergen Acquisition had been completed on January 1, 2021, or of future operating results. The pro forma financial information reflects pro forma adjustments to give effect to certain events the Company believes to be directly attributable to the Zymergen Acquisition, including depreciation and amortization expense related to acquired tangible and intangible assets, acquisition-related costs, stock-based compensation expense, retention and severance bonuses, and adjustments to align inventory and leasing accounting policies.

	Year Ended December 31,	
(in thousands)	2022	2021
Total revenue	$ 489,670	$ 330,580
Net loss	$ (2,366,005)	$ (2,235,586)

Bayer Acquisition and Joint Venture Dissolution

On October 17, 2022, the Company completed an asset purchase under the Asset Purchase Agreement ("APA") with Bayer CropScience LP, a Delaware limited partnership ("Bayer"). Pursuant to the APA, the Company acquired certain assets and liabilities of Bayer, including Bayer's 175,000-square-foot West Sacramento Biologics Research & Development site, team, and internal discovery and lead optimization platform.

Concurrently with the APA, Bayer and Ginkgo entered into the Joint Venture Termination Agreement ("JV Termination Agreement") and the Technical Development Agreement ("Bayer TDA"). The JV Termination Agreement initiated the dissolution of Joyn Bio, LLC ("Joyn"), the joint venture created by Ginkgo and Bayer in 2017, and provided for the disbursement of contributed intellectual property back to the respective owners, the disbursement of joint ownership of certain intellectual property rights created by Joyn, including with respect to Joyn's nitrogen fixation technology to each party, the disbursement of property and equipment as agreed to by the parties, the assumption by Ginkgo of Joyn's two real estate leases and the transfer of certain employees to Ginkgo. Under the Bayer TDA, (i) Ginkgo will grant Bayer exclusive licenses to Ginkgo's joint ownership right, title and interest to Joyn's nitrogen fixation intellectual property, (ii) for a three-year period, the parties will research, develop and produce microbial strains and related processes to enable the research, development, production, manufacturing and commercialization of Bayer products in agriculture as part of cell programs pursuant to TDPs agreed to by the parties, including one targeted to nitrogen fixation and (iii) for a three-year period, Ginkgo will provide certain non-cell-engineering services to Bayer related to product support as described in statements of work agreed to by the parties. In consideration for all programs, services and related licenses, Ginkgo will receive $90.0 million in equal quarterly installments over the three-year term plus royalties on worldwide net sales of certain Bayer products developed under the Bayer TDA.

The APA, JV Termination Agreement and Bayer TDA were accounted for as a single transaction as they were entered into at the same time and in contemplation of one another, the occurrence of each agreement was dependent on the occurrence of the other agreements, and the work performed under the Bayer TDA will utilize the tangible assets acquired from Bayer under the APA and the IP distributed to Ginkgo under the JV Termination Agreement.

The assets acquired under the APA and JV Termination Agreement meet the definition of a business and were accounted for under ASC 805. The Bayer TDA was accounted for under ASC 606. A summary of the purchase price relating to the business combination is as follows (in thousands):

Cash	$	79,825
Fair value of previously held equity interest in Joyn		14,000
Fair value of notes receivable from Joyn		10,119
Total purchase consideration	$	103,944

Prior to the completion of the business combination, the Company, through its majority-owned holding company Cooksonia, LLC ("Cooksonia"), held a 50% equity interest in Joyn that was accounted for as an equity method investment. The Company remeasured its 50% equity interest in Joyn at fair value as of the acquisition date and recorded a gain of $14.0 million equal to the difference between the carrying value of its equity method investment in Joyn of zero and the fair value of $14.0 million on the acquisition date. The gain is included within loss on equity method investments in the consolidated statements of operations and comprehensive loss for the year ended December 31, 2022. Additionally, prior to the completion of the business combination, Joyn had issued to Ginkgo a series of convertible promissory notes in the aggregate principal amount of $10.0 million (see Note 20). The notes were effectively settled as part of the business combination and were included as part of the consideration transferred for the business combination. The carrying value of the notes prior to the acquisition was $4.8 million due to losses attributable to the equity method investment being allocated to the notes receivable as a result of the equity method investment being reduced to zero during the year ended December 31, 2022. The Company recorded a gain on the notes receivable of $5.3 million within other income (expense), net in the consolidated statements of operations and comprehensive loss for the year ended December 31, 2022 for the excess of the $10.1 million outstanding principal and accrued interest over their carrying value of the notes.

The following table summarizes the preliminary fair value of assets acquired as of the acquisition date (in thousands):

Property, plant, and equipment	$	83,951
Intangible assets		11,500
Goodwill		11,172
Deferred tax liability		(2,679)
Net assets acquired	$	103,944

The allocation of the purchase price, including the valuation of certain tangible and intangible assets acquired and the related tax effects and management's validation of the historical cost basis of certain tangible assets provisionally valued using the cost method, is preliminary and subject to revision during the one-year measurement period from the date of acquisition if any new information is obtained about facts and circumstances that existed as of the acquisition date.

The fair value of Ginkgo's equity interest in Joyn pre-dissolution was determined using a discounted cash flow method. The fair value of intangible assets, which consists of Joyn's developed technology, was determined using the relief from royalty method of the income approach. Significant assumptions used in the valuations included the estimated annual net cash flows (including projected future revenues and costs, terminal growth rates, royalty rates and obsolescence rates), and a discount rate that reflects the risks inherent in the future cash flows. Property, plant, and equipment consists of land, buildings, site improvements and personal property. The fair value of land was determined using the sales comparison approach and the fair value of the buildings, site improvements and personal property was determined using the cost and sales comparison approaches. Under the cost approach, the Company estimated the cost to acquire or construct comparable assets and made adjustments for physical deterioration. Intangible assets consist of Joyn's developed technology and have an estimated useful life of five years. Goodwill primarily reflects the value of future programs expected to arise after the acquisition and the assembled workforce. Goodwill is not expected to be deductible for tax purposes.

The Company incurred $3.0 million in costs associated with the winding up and dissolution of Joyn during the year ended December 31, 2022, which were recorded within operating expenses. Dissolution costs are shared equally between Ginkgo and Bayer. The joint venture is expected to be fully dissolved in early 2023. The Company incurred transaction and integration costs of $12.0 million related to the business combination, which were recorded in general and administrative expenses in the consolidated statements of operations and comprehensive loss. The transaction does not represent a material business combination and, therefore, pro forma financial information is not provided. Operating results of the acquired business have been included in the consolidated statements of operations and comprehensive loss since the date of acquisition and were not material to the Company's results of operations for the year ended December 31, 2022.

Altar

On October 3, 2022, the Company acquired all of the outstanding shares of capital stock of Altar SAS ("Altar"), a French biotechnology company with a proprietary adaptive evolution platform. A fleet of Altar's automated adaptive laboratory evolution instruments will be integrated into Ginkgo's Foundry to serve customers across various industries. The total purchase consideration was $12.0 million and consisted of $2.8 million in cash, $1.4 million in restricted shares of Ginkgo Class A common stock subject to forfeiture if certain vesting conditions are not met, $5.6 million in unrestricted shares of Ginkgo Class A common stock, $1.6 million in contingent consideration and $0.6 million in assumed liabilities. The Company accounted for the transaction as a business combination under ASC 805. The net assets acquired primarily consisted of $8.4 million of intangible assets related to Altar's developed technology and $4.7 million of goodwill, which is not deductible for tax purposes. The business is reported as part of the Company's Foundry reportable segment. The Company incurred $2.3 million in acquisition related costs which were recorded in general and administrative expenses. Pro forma information has not been presented because it is not material to the financial statements. Altar's results of operations have been included in the consolidated statements of operations and comprehensive loss since the date of acquisition and were not material to the Company's results of operations for the year ended December 31, 2022.

FGen

On April 1, 2022, the Company acquired all of the outstanding equity interests of FGen AG ("FGen"), a company organized under the laws of Switzerland that specializes in strain development and optimization. FGen has developed an ultra-high-throughput screening platform built on nanoliter reactor technology which the Company believes will enhance its cell screening capabilities and potentially increase the likelihood of finding enzymes, pathways, and strains or cell lines that perform to diverse cell program specifications.

The Company accounted for the transaction as a business combination under ASC 805. Accordingly, the assets and liabilities acquired were recorded at their estimated fair value on the date of acquisition. FGen's results of operations have been included in the consolidated statements of operations and comprehensive loss since the date of acquisition and were not material to the Company's results of operations for the year ended December 31, 2022. The FGen acquisition does not represent a material business combination and, therefore, pro forma financial information is not provided.

The consideration paid was comprised of common stock and contingent consideration as follows (in thousands):

Fair value of Class A common stock	$	17,015
Contingent consideration - restricted stock		3,842
Contingent consideration - milestones		8,464
Total FGen consideration	$	29,321

The Company issued 5,749,957 shares of its Class A common stock on the acquisition date comprised of 4,051,107 unrestricted shares valued at $17.0 million based on the closing market price of $4.20 and 1,698,850 restricted shares classified as contingent consideration and subject to vesting conditions. The contingent consideration in the form of restricted stock was valued at $3.8 million as of the acquisition date based on management's estimate of the number of shares expected to vest and the closing market price of $4.20. The restricted shares were issued in three tranches with separate vesting conditions. Tranches 1 and 2 vest based on the price difference between the 15-day volume weighted average price ("VWAP") of Ginkgo's Class A common stock calculated on the date immediately prior to closing and the 15-day VWAP calculated on the date immediately prior to Ginkgo's filing of the registration statement to register the unrestricted shares. The contingency was resolved on April 4, 2022 when the Company filed its Form S-1 registration statement and a total of 461,200 shares vested and 584,246 shares were forfeited related to tranches 1 and 2. The remaining 653,404 tranche 3 restricted shares will vest on the 24-month anniversary of the closing, provided, however, that the number of shares that vest will be reduced by any post-closing purchase price adjustments and indemnity claims. The estimated fair value of tranche 1 and 2 shares on the registration statement date was $1.9 million, which was reclassified from a liability into stockholders' equity upon the determination of the number of shares that vested. The Company recognized a $0.8 million loss on the change in fair value of the contingent consideration related to tranche 1 and 2, which is included in general and administrative expenses in the consolidated statements of operations and comprehensive loss for the year ended December 31, 2022.

As part of the acquisition, the Company is required to make milestone payments up to a maximum of $25.0 million, with $20.0 million payable based on the successful integration and deployment of the FGen technology across the Company's programs over a 36-month period and $5.0 million payable to certain employees based on continuing service. The milestones are payable in cash or Class A common stock at the election of the Company. The $5.0 million payable to employees is accounted for separately from the business combination as post combination compensation expense to be recognized over the requisite service period. The fair value of the $20.0 million in contingent consideration on the acquisition date was determined using a scenario-based method. The significant assumptions used include the expected time of achievement and probability of success related to each milestone and a discount rate.

The Company allocated the purchase price to the tangible and identifiable intangible assets acquired and liabilities assumed based on their respective estimated fair values on the acquisition date. The fair value estimates for the purchase price allocation are considered preliminary and subject to adjustment during the measurement period, not to exceed one year after the date of acquisition. During the year ended December 31, 2022, the Company recorded certain measurement period adjustments related to tangible assets acquired and estimated tax liabilities, with a corresponding net decrease to goodwill.

The intangible assets acquired consist of FGen's developed technology which was measured at fair value using the multi-period excess earnings method under the income approach. Under this method, an intangible asset's fair value is equal to the present value of the incremental after-tax cash flows attributable only to the intangible asset after deducting charges representing the contribution of other assets to those cash flows. The significant assumptions used include the estimated annual net cash flows (including revenue growth rates, EBITDA and EBIT margins, applicable tax rate, and contributory asset charges), a discount rate, and the tax amortization benefit. Goodwill represents the amount by which the purchase price exceeds the estimated fair value of the net assets acquired and primarily reflects the value of future programs expected to arise after the acquisition.

The Company incurred $1.7 million of acquisition-related costs which were included in general and administrative expenses in the consolidated statements of operations and comprehensive loss.

The following table summarizes the preliminary fair value of assets acquired and liabilities assumed as of the acquisition date (in thousands):

	Preliminary Allocation	Measurement Period Adjustment	Adjusted Allocation
Cash and cash equivalents	$ 1,430	$ —	$ 1,430
Accounts receivable	144	—	144
Other non-current assets	10	—	10
Property and equipment	146	(112)	34
Intangible assets [1]	21,100	—	21,100
Goodwill [2]	11,001	(386)	10,615
Accounts payable and accrued expenses	(29)	—	(29)
Deferred revenue	(104)	—	(104)
Deferred tax liability	(4,377)	498	(3,879)
Net assets acquired	$ 29,321	$ —	$ 29,321

(1) Estimated useful life of 15 years.
(2) Non-deductible for tax purposes.

Asset Acquisitions

On October 3, 2022, the Company completed the acquisition of all of the outstanding equity interests in Circularis Biotechnologies, Inc., ("Circularis"), a biotechnology company with a proprietary circular RNA and promoter screening platform. The aggregate purchase consideration was $18.6 million, of which $4.3 million was paid in cash, $10.2 million was paid in Ginkgo Class A common stock, $3.7 million represents contingent consideration and $0.4 million represents direct transaction costs. The Company accounted for the transaction as an asset acquisition as substantially all of the value received was concentrated in the acquired developed technology. The Company allocated the purchase consideration primarily to the developed technology intangible asset, which is being amortized over a useful life of five years. Additionally, the purchase agreement includes $2.5 million of employee retention payments, which will be recognized as compensation expense over the requisite service period.

On August 17, 2022, the Company acquired certain epidemiological data infrastructure assets from Baktus, Inc., a Delaware-based public benefit corporation. The Company accounted for the transaction as an asset acquisition as the value being acquired primarily relates to a single identifiable intangible asset. The total purchase consideration was $11.1 million and consisted of $2.0 million in cash, $8.4 million in Ginkgo Class A common stock and $0.7 million of direct transaction costs. Of the shares issued, 258,781 are restricted shares that will vest on the 18-month anniversary of the closing and will be reduced by any indemnity claims. The restricted shares are classified as contingent consideration liability in the consolidated balance sheet (see Note 4). Additionally, the purchase agreement includes $1.0 million of employee retention payments, which will be recognized as compensation expense over the requisite service period. As a result of the acquisition, the Company recognized $11.2 million in intangible assets consisting of developed technology, customer relationships and assembled workforce and $0.1 million in deferred revenue.

On June 1, 2022, the Company acquired substantially all of the assets of Bitome, Inc. ("Bitome"), a privately held company with an integrated metabolite monitoring platform that is expected to support accelerated product development timelines across Ginkgo's portfolio of cell programs. The Company accounted for the transaction as an asset acquisition as substantially all of the value received was concentrated in the intellectual property acquired. The consideration for the transaction was structured as (i) a repayment of Bitome's outstanding convertible debt pursuant to the issuance of 388,649 shares of Class A common stock (valued at approximately $1.2 million as of the acquisition date), (ii) a repayment of a portion of Bitome's outstanding convertible debt in cash in the amount of $0.1 million and (iii) assumption of certain of Bitome's liabilities and wind-down expenses up to a maximum cap of $0.4 million. The total purchase consideration was expensed as in-process research and development expense in the consolidated statements of operations and comprehensive loss for the year ended December 31, 2022 as the technology requires continued development efforts and has no alternative future use.

Fiscal 2021 Acquisitions

SRNG Business Combination

On September 16, 2021 (the "Closing Date"), the Company and SRNG completed the merger transaction contemplated by the Merger Agreement (the "Closing"), with Old Ginkgo surviving the merger as a wholly owned subsidiary of SRNG.

Pursuant to the Merger Agreement, SRNG acquired all of the outstanding equity interests of Old Ginkgo for approximately $15.8 billion in aggregate consideration in the form of common stock of Ginkgo valued at $10 per share (the "Base Equity

Consideration"). The Base Equity Consideration was allocated among Old Ginkgo equity holders based on an exchange ratio of 49.080452 ("Exchange Ratio"). Accordingly, upon the closing of the SRNG Business Combination, all shares of Old Ginkgo Class A common stock and Old Ginkgo Class B common stock issued and outstanding immediately prior to the SRNG Business Combination converted into Ginkgo Class A common stock and Ginkgo Class B common stock, respectively, each with a par value of $0.0001 per share, based on the Exchange Ratio. All equity awards under Old Ginkgo's stock incentive plans were assumed by the Company and converted into comparable equity awards that are settled or exercisable for shares of the Company's common stock. As a result, (i) each outstanding stock option to acquire Old Ginkgo common stock was converted into an option to purchase approximately 49.080452 shares of Ginkgo common stock, (ii) each outstanding share of restricted common stock was converted into approximately 49.080452 shares of restricted common stock of Ginkgo and (iii) each outstanding award of restricted stock units was assumed and converted into a restricted stock unit having the same terms and conditions as applied to the Old Ginkgo restricted stock unit so converted but relating to approximately 49.080452 shares of common stock of Ginkgo.

In addition to the Base Equity Consideration, the equity holders of Old Ginkgo received approximately 188.7 million shares of Ginkgo common stock (the "Earnout Consideration"), which are subject to forfeiture to the extent that the vesting conditions described below are not satisfied on or before the fifth anniversary of the Closing (the "Earnout Period"). If at any point during the trading hours of a trading day, for any 20 trading days within any period of 30 consecutive trading days during the Earnout Period, the trading price per share of the Company's Class A common stock is greater than or equal to:

- $12.50, then 25% of the Earnout Consideration will immediately vest;
- $15.00, then an additional 25% of the Earnout Consideration will immediately vest;
- $17.50, then an additional 25% of the Earnout Consideration will immediately vest; and
- $20.00, then the remaining 25% of the Earnout Consideration will immediately vest.

The Company evaluated the earnout shares and concluded that they qualify for the scope exception from derivative accounting in ASC 815-10-15-74 and meet the criteria for equity classification under ASC 815-40. The Company determined that the earnout shares underlying rollover equity awards (i.e., restricted stock awards, restricted stock units and options) granted under the Company's stock incentive plans (together the "Rollover Equity Awards") that are unvested as of the Closing Date are within the scope of ASC 718 (see Note 13). The remaining earnout shares issued to holders of Old Ginkgo common stock and those earnout shares underlying vested Rollover Equity Awards were initially measured at fair value at Closing and recorded within additional paid-in-capital ("APIC") and had no net impact on APIC. Since those earnout shares are equity-classified, there is no remeasurement unless reclassification is required. Upon meeting an earnout target, the earnout shares delivered to the equity holders are recorded in equity as shares outstanding with the appropriate allocation to par value of common stock and APIC. The first earnout target of $12.50 was met on November 15, 2021 and, as a result, approximately 38.8 million earnout shares became vested and outstanding.

In connection with the entry into the Merger Agreement, Eagle Equity Partners III, LLC, a Delaware limited liability company (the "Sponsor"), forfeited 11,534,052 of its shares of Ginkgo Class A common stock and an additional 16,737,183 of its shares of Ginkgo Class A common stock (the "Sponsor Earnout Shares") became subject to vesting and forfeiture conditions identical to those applicable to the Earnout Consideration issued to Old Ginkgo equity holders. Similar to the Earnout Consideration, the Sponsor Earnout Shares were accounted for as equity classified instruments and were included as merger consideration and recorded in additional paid-in capital. The Sponsor Earnout Shares are considered legally issued and outstanding shares of common stock subject to restrictions on transfer and do not participate in the earnings or losses of the Company prior to vesting.

The SRNG Business Combination is accounted for as a reverse recapitalization, in accordance with GAAP. Under this method of accounting, SRNG was treated as the "acquired" company for financial reporting purposes. Accordingly, the SRNG Business Combination was treated as the equivalent of Old Ginkgo issuing stock for the net assets of SRNG, accompanied by a recapitalization. The net assets of SRNG are stated at historical cost, with no goodwill or other intangible assets recorded.

PIPE Investment

On May 11, 2021, concurrently with the execution of the Merger Agreement, SRNG entered into subscription agreements with certain accredited investors (the "PIPE Investors"). In connection with the consummation of the SRNG Business Combination on September 16, 2021, the PIPE Investors collectively consummated investments for 76,000,000 shares of the

Company's Class A common stock at a price of $10.00 per share (the "PIPE Shares") for an aggregate amount of $760.0 million (the “PIPE Investment”).

Summary of Net Proceeds

The following table summarizes the elements of the net proceeds from the SRNG Business Combination (in thousands):

Cash - SRNG Trust and cash (net of redemptions)	$	857,747
Cash - PIPE Investment		760,000
Less: Payment of underwriter fees and other offering costs		(108,118)
Net proceeds from the SRNG Business Combination	$	1,509,629

Summary of Shares Issued

The following table summarizes the number of shares of common stock outstanding immediately following the consummation of the SRNG Business Combination:

SRNG shares outstanding prior to the SRNG Business Combination	215,625,000
Less: redemption of SRNG shares prior to the SRNG Business Combination	(86,725,312)
Less: SRNG shares forfeited	(11,534,052)
Common stock of SRNG (1)	117,365,636
Shares issued pursuant to the PIPE Investment	76,000,000
SRNG Business Combination and PIPE Investment shares	193,365,636
Conversion of Old Ginkgo Series B preferred stock to common stock	203,346,152
Conversion of Old Ginkgo Series C preferred stock to common stock	228,641,430
Conversion of Old Ginkgo Series D preferred stock to common stock	302,464,716
Conversion of Old Ginkgo Series E preferred stock to common stock	170,227,108
Conversion of Old Ginkgo common stock (2)	387,016,194
Total shares of Ginkgo common stock outstanding immediately following the SRNG Business Combination	1,485,061,236

(1) Includes 16,737,183 shares of Class A common stock, the Sponsor Earnout Shares, that are subject to forfeiture if certain earnout conditions are not met, as the shares are legally outstanding as of the Closing of the SRNG Business Combination.

(2) Excludes 283,396,094 shares of Class A and Class B common stock underlying rollover equity instruments (i.e., restricted stock units and stock options) and 259,440 shares of Class A and Class B common stock underlying unvested restricted stock awards.

Dutch DNA

On July 1, 2021, the Company acquired 100% of the outstanding capital stock of Dutch DNA Biotech B.V. (“Dutch DNA”), a company based in the Netherlands with a proprietary platform technology focused on the development of fungal strains and fermentation processes for the production of proteins and organic acids. Dutch DNA's significant expertise and fungal strain assets for the large-scale production of proteins is expected to add a valuable set of tools to the Company's Codebase and broader platform for cell programming.

The following table summarizes the preliminary acquisition date fair value of the consideration transferred for Dutch DNA (in thousands):

Cash	$	11,451
Fair value of Class A common stock		15,087
Contingent consideration		8,760
Total Dutch DNA consideration	$	35,298

The fair value of the Class A common stock issued as part of the consideration paid for Dutch DNA was determined using the then-most recently available third-party valuation of the Company's common stock. The contingent consideration arrangement requires the Company to pay up to a maximum of $20.0 million to the seller upon the achievement of certain technical and commercial milestones by Dutch DNA pursuant to a Technical Development Agreement executed between the

Company and Dutch DNA prior to the close of the acquisition. Refer to Note 4 for a discussion of the fair value of the contingent consideration liability.

The acquisition was accounted for in accordance with ASC 805. Dutch DNA's results of operations have been included in the Consolidated Statements of Operations and Comprehensive Loss since the date of acquisition, which were not material. The Dutch DNA acquisition does not represent a material business combination, and therefore pro forma financial information is not provided. The Company allocated the purchase price to the tangible and identifiable intangible assets acquired and liabilities assumed based on their respective estimated fair values on the acquisition date. The fair value of the intangible assets was determined using the replacement cost method which estimates the cost the Company would incur in rebuilding the technology. The excess purchase price consideration was recorded as goodwill and is made up of the future potential value of the acquired intellectual property and the assembled workforce. The Company incurred $0.6 million of acquisition-related costs which were included in general and administrative expenses in the consolidated statements of operations and comprehensive loss.

The following table presents the final allocation of the purchase price to the assets acquired and liabilities assumed as of the acquisition date (in thousands):

	Preliminary Allocation	Measurement Period Adjustments [3]	Final Allocation
Cash	$ 387	$ —	$ 387
Accounts receivable	149	—	149
Prepaid expenses and other current assets	170	—	170
Property and equipment	234	—	234
Intangibles [1]	20,500	—	20,500
Goodwill [2]	15,177	4,839	20,016
Accounts payable	(194)	—	(194)
Accrued expenses and other current liabilities	(137)	(49)	(186)
Deferred tax liability	—	(4,790)	(4,790)
Other non-current liabilities	(988)	—	(988)
Net assets acquired	$ 35,298	$ —	$ 35,298

(1) Estimated useful life of 15 years.

(2) Non-deductible for tax purposes.

(3) Represents adjustment related to deferred income taxes and the final determination of net-working capital as of the acquisition date.

4. Fair Value Measurements

The following tables present information about the Company's financial assets and liabilities measured at fair value on a recurring basis (in thousands):

		As of December 31, 2022			
		Total	Level 1	Level 2	Level 3
Assets:					
Money market funds	Cash and cash equivalents	$ 1,089,026	$ 1,089,026	$ —	$ —
Synlogic, Inc. warrants [1]	Investments	1,937	—	1,937	—
Marketable equity securities [2]	Investments	25,714	21,312	4,402	—
Notes receivable	Other non-current assets	37,660	—	30,000	7,660
Total assets		$ 1,154,337	$ 1,110,338	$ 36,339	$ 7,660
Liabilities:					
Public Warrants	Warrant liabilities	$ 6,900	$ 6,900	$ —	$ —
Private Placement Warrants	Warrant liabilities	3,968	—	108	3,860
Contingent consideration	Accrued expenses and other current liabilities	6,378	—	—	6,378
Contingent consideration	Other non-current liabilities	18,095	—	—	18,095
Total liabilities		$ 35,341	$ 6,900	$ 108	$ 28,333

		As of December 31, 2021			
	Classification	Total	Level 1	Level 2	Level 3
Assets:					
Money market funds	Cash and cash equivalents	$ 1,482,063	$ 1,482,063	$ —	$ —
Synlogic, Inc. warrants [1]	Investments	6,166	—	6,166	—
Marketable equity securities [2]	Investments	25,676	15,345	10,331	—
Notes receivable	Prepaid expenses and other current assets	11,559	—	—	11,559
Total assets		$ 1,525,464	$ 1,497,408	$ 16,497	$ 11,559
Liabilities:					
Public Warrants	Warrant liabilities	$ 77,280	$ 77,280	$ —	$ —
Private Placement Warrants	Warrant liabilities	58,558	—	—	58,558
Contingent consideration	Other non-current liabilities	8,467	—	—	8,467
Total liabilities		$ 144,305	$ 77,280	$ —	$ 67,025

(1) The fair value of Synlogic, Inc. warrants is calculated as the quoted price of the underlying common stock, less the unpaid exercise price of the warrants.
(2) Marketable equity securities classified as Level 2 reflect a discount for lack of marketability due to regulatory sales restrictions, which lapsed on a portion of the shares held during the year ended December 31, 2022 and were reclassified as Level 1.

Transfers to/from Levels 1, 2 and 3 are recognized at the end of the reporting period in which a change in valuation technique or methodology occurs. The estimated fair value of a portion of the Private Placement Warrants was transferred from Level 3 to Level 2 fair value measurement as of December 31, 2022, as the transfer of Private Placement Warrants to anyone other than the initial purchasers or any of their permitted transferees results in the Private Placement Warrants having substantially the same terms as the Public Warrants. The Company determined that the fair value of the transferred Private Placement Warrants is equivalent to that of Public Warrants. There were no other transfers to/from Level 3 during any of the periods presented.

Notes Receivable

Notes receivable measured at fair value on a recurring basis primarily consist of a $30.0 million senior secured note ("Senior Secured Note") purchased from Bolt Threads, Inc., a series of convertible promissory notes issued by a customer as payment for Foundry R&D services, a revolving promissory note with Glycosyn, LLC ("Glycosyn" and "Glycosyn Promissory Note") and a series of convertible notes with Access Bio, Inc. ("Access Bio Convertible Notes"). The fair value of notes receivable, other than the Senior Secured Note, is based on significant inputs not observable in the market, which represent a Level 3 measurement within the fair value hierarchy. Significant changes in these unobservable inputs in isolation could have resulted in a significantly lower or higher fair value measurement.

The Company used the yield method to value the Senior Secured Note. Under this method, the estimated future cash flows, consisting of principal and interest payments, are discounted to present value using an applicable market yield or discount rate. Increases or decreases in the market yield or discount rate would result in a decrease or increase, respectively, in the fair value measurement. The market yield is determined using a corporate bond yield curve corresponding to the credit rating category of the issuer. The fair value of the Senior Secured Note is based on observable market inputs, which represents a Level 2 measurement within the fair value hierarchy.

The Company used a scenario-based method to value the series of convertible promissory notes from a customer. Under the scenario-based method, future cash flows are evaluated under a qualified financing, maturity and dissolution scenarios, probability-weighted and discounted to present value. The significant unobservable inputs used in the fair value measurement were scenario probabilities of 15% and 55%, a discount rate of 12.5% and estimated time to event date of one to three years.

As of December 31, 2021, the Company estimated the fair value of the Glycosyn Promissory Note using a probability-weighted discounted cash flow model under a dissolution scenario with partial recovery and no recovery as Glycosyn was in default on that date. The significant assumptions used in valuing the Glycosyn Promissory Note were scenario probabilities of 50%, a recovery rate on first lien debt of 63% and a discount rate of 15%. The Glycosyn Promissory Note had an amended maturity date of December 31, 2022 and was in default on that date. The Company wrote off the Glycosyn Promissory Note

on December 31, 2022 as it was deemed uncollectible and recorded a loss on notes receivable of $1.9 million in other income (expense), net on the consolidated statements of operations and comprehensive loss.

As of December 31, 2021, the Company estimated the fair value of the Access Bio Convertible Notes using a binomial lattice model with the following key assumptions: 85.5% equity volatility, 0.88 years to maturity, 0.3% risk-free rate, 30.9% risk-adjusted rate and 0% dividend yield. Upon maturity in November 2022, the Company collected in cash the $10.4 million outstanding principal and accrued interest balance of the Access Bio Convertible Notes.

The following table provides a reconciliation of notes receivable measured at fair value using Level 3 significant unobservable inputs (in thousands):

	2022	2021
Balance at January 1	$ 11,559	$ 15,566
Additions	7,660	—
Proceeds from notes receivable	(10,404)	(304)
Conversion of notes to preferred stock	—	(195)
Change in fair value	705	(3,508)
Write-off	(1,860)	—
Balance at December 31	$ 7,660	$ 11,559

Refer to Note 21 for further discussion regarding the potential impacts of the closure of Silicon Valley Bank to the Company's notes receivable.

Warrant Liabilities

The fair value of the Public Warrants is based on the observable quoted price of such warrants on the New York Stock Exchange. The fair value of the Private Placement Warrants is estimated using the Black-Scholes option pricing model, which is considered to be a Level 3 fair value measurement. The primary unobservable input used in the valuation of the Private Placement Warrants is expected stock-price volatility. As of December 31, 2022, the Company estimated the volatility of its Private Placement Warrants using a Monte-Carlo simulation of the redeemable Public Warrants that assumes optimal exercise of the Company's redemption option at the earliest possible date. The risk-free interest rate is based on the U.S. Treasury zero-coupon yield curve for a maturity similar to the expected remaining life of the warrants. The expected life of the warrants is assumed to be equivalent to their remaining contractual term. The dividend yield is based on the historical rate, which the Company anticipates remaining at zero. Refer to Note 9 for additional details on the Company's warrant liabilities.

The following table provides quantitative information regarding Level 3 inputs used in the recurring valuation of the Private Placement Warrants as of their measurement dates:

	December 31, 2022	December 31, 2021
Exercise price	$ 11.50	$ 11.50
Stock price	$ 1.69	$ 8.31
Volatility	71.5%	58.7%
Term (in years)	3.71	4.71
Risk-free interest rate	4.11%	1.25%

The following table provides a reconciliation of the Private Placement Warrants measured at fair value using Level 3 inputs (in thousands):

	2022	2021
Balance at January 1	$ 58,558	$ —
Additions pursuant to the SRNG Business Combination	—	90,263
Transfer to Level 2	(125)	—
Change in fair value	(54,573)	(31,705)
Balance at December 31	$ 3,860	$ 58,558

Contingent Consideration

In connection with the acquisition of FGen, the Company may be required to make contingent earnout payments up to $20.0 million primarily related to the successful integration and deployment of the FGen technology across the Company's programs. The Company also issued restricted stock that is subject to vesting conditions and is classified as contingent consideration liability. A portion of the restricted shares vested during the year ended December 31, 2022 and $1.9 million of the liability was settled as discussed in Note 3.

In connection with the acquisition of Dutch DNA, the Company may be required to make contingent earnout payments up to a maximum of $20.0 million payable upon the achievement of certain technical and commercial milestones by Dutch DNA pursuant to a Technical Development Agreement executed between the Company and Dutch DNA prior to the close of the acquisition. In 2022, the Company made a payment of $0.7 million upon the achievement of a technical development milestone and recorded a corresponding $0.7 million decrease in the fair value of the contingent consideration liability.

In connection with the acquisition of Circularis, the Company may be required to make contingent earnout payments up to a maximum of $40.0 million payable primarily upon the achievement of certain clinical trial milestones over a five-year period.

In connection with the acquisition of Altar, the Company may be required to make contingent earnout payments up to $2.5 million upon the successful transfer of the Altar technology to Ginkgo's sites in the U.S.

The fair value of contingent consideration related to restricted stock issued for acquisitions was estimated using the quoted price of Ginkgo's Class A common stock, an estimate of the number of shares expected to vest, probability of vesting, and a discount rate. The fair value of contingent consideration related to earnout payments from acquisitions was estimated using unobservable (Level 3) inputs as illustrated in the table below. Material increases or decreases in these inputs could result in a higher or lower fair value measurement. Changes in the fair value of contingent consideration are recorded in general and administrative expense in the consolidated statements of operations and comprehensive loss.

The following table provides quantitative information regarding Level 3 inputs used in the fair value measurements of contingent consideration liabilities as of the periods presented:

Contingent Consideration Liability	Valuation Technique	Unobservable Input	December 31, 2022 Range	December 31, 2021 Range
Earnout payments (FGen, Dutch DNA, Circularis and Altar acquisitions)	Probability-weighted present value	Probability of payment	2%-100%	10% - 80%
		Discount rate	12.20%-13.11%	10.7% - 11.3%
Earnout payments (Dutch DNA acquisition)	Discounted cash flow	Projected years of payments	2025-2028	2022 - 2037
		Discount rate	12.0%	9%

The following table provides a reconciliation of the contingent consideration liability measured at fair value using Level 3 inputs (in thousands):

	2022	2021
Balance at January 1	$ 8,467	$ —
Additions	19,912	8,760
Change in fair value	(1,262)	(293)
Settlements and payments	(2,644)	—
Balance at December 31	$ 24,473	$ 8,467

Nonrecurring Fair Value Measurements

The Company measures the fair value of certain assets, including investments in privately held companies without readily determinable fair values, on a nonrecurring basis when events or changes in circumstances indicate that the carrying amount of the asset may not be recoverable.

In the second quarter of 2022, the Company recorded a $10.1 million impairment charge, included as a component of loss on investments in the consolidated statements of operations and comprehensive loss, due to the decline in the fair value of the Company's investment in Genomatica preferred stock. The fair value estimates used to determine the impairment charge were determined using enterprise value analyses which include an equal weighing between discounted cash flow analyses and guideline public company and involve significant unobservable (Level 3) inputs. The significant unobservable inputs include

the estimated annual net cash flows (including revenue and expense growth rates and capitalization rates), the weighted-average cost of capital used to discount the future cash flows, and the selection of guideline public company multiples for revenue and EBITDA. Material increases or decreases in these inputs could result in a higher or lower fair value measurement.

The Company used a scenario-based method to value SAFEs received from customers in 2022. Under the scenario-based method, future cash flows were evaluated under qualified financing and dissolution scenarios with partial recovery and no recovery in dissolution. The cash flows under each scenario was probability-weighted and discounted to present value. The significant unobservable (Level 3) inputs used in the fair value measurement were scenario probabilities of 18% to 65%, discount rate of 13% and estimated time to event date of one to two years.

5. Investments and Equity Method Investments

The Company partners with other investors to form business ventures, including Motif FoodWorks, Inc. (“Motif”), Allonnia, LLC (“Allonnia”), Arcaea, LLC (“Arcaea”), Verb Biotics, LLC (“Verb”), BiomEdit, LLC (“BiomEdit”) and Ayana Bio, LLC (“Ayana”) (collectively “Platform Ventures”). The Company also partners with existing entities, including Genomatica, Inc. (“Genomatica”) and Synlogic, Inc. (“Synlogic”) (collectively, “Structured Partnerships”) with complementary assets for high potential synthetic biology applications. The Company holds equity interests in these Platform Ventures and Structured Partnerships. The Company also holds equity interests in other public and private companies as a result of entering into collaboration and license revenue arrangements with these entities.

The Company accounts for its investments in Platform Ventures under the equity method. The Company's marketable equity securities consist of Synlogic common stock, Synlogic warrants and the shares of common stock of other publicly traded companies. Marketable equity securities are measured at fair value with changes in fair value recorded in other (expense) income in the consolidated statements of operations and comprehensive loss. The Company’s non-marketable equity securities consist of preferred stock of Genomatica and other privately held companies without readily determinable fair values. Non-marketable equity securities are initially recorded using the measurement alternative at cost and subsequently adjusted for any impairment and observable price changes in orderly transactions for the identical or a similar security of the same issuer. During the year ended December 31, 2022, the Company recorded a $10.1 million impairment charge, included as a component of loss on investments in the consolidated statements of operations and comprehensive loss, due to the decline in the fair value of the Company's investment in Genomatica preferred stock. There were no impairments recorded during the years ended December 31, 2021 and 2020 and no adjustment from observable price changes has been recognized during any of the periods presented.

Beginning in 2022, the Company also holds investments in early-stage synthetic biology product companies via SAFEs. The Company enters into SAFE agreements in conjunction with a revenue contract with a customer under which the Company grants the customer a prepaid Foundry services credit equal to the principal amount of the SAFE (the “Purchase Amount”), which may be used and drawn down as payment for the Company’s research and development activities. The SAFEs will automatically convert into shares of preferred stock equal to the Purchase Amount divided by the discount price, which is calculated as the price per share sold in the equity financing multiplied by a discount rate. The SAFEs also provide the Company with the right to future equity of the entity in a liquidation scenario or the cash-out amount in liquidation and dissolution scenarios or at the election of the SAFE issuer prior to an agreed outside date. The Company initially records SAFEs at fair value (see Note 4) and adjusts the carrying value of the instrument at each reporting period for any impairment, plus or minus changes resulting from observable price changes in orderly transactions for an identical or similar instrument of the same issuer. There were no impairment charges or observable price changes related to SAFEs during any of the periods presented.

Refer to Note 21 for further discussion regarding the potential impacts of the closure of Silicon Valley Bank to the Company’s investments.

Investments and equity method investments consisted of the following (in thousands):

	As of December 31,	
	2022	2021
Investments:		
Genomatica, Inc. preferred stock	$ 44,885	$ 55,000
Synlogic, Inc. common stock	4,819	15,345
Synlogic, Inc. warrants	1,937	6,166
Marketable equity securities	20,895	10,331
Non-marketable equity securities	17,544	15,195
SAFEs	22,108	—
Total	$ 112,188	$ 102,037
Equity method investments [1]:		
Joyn Bio, LLC	$ —	$ 11,694
BiomEdit, LLC	369	—
Other	1,174	1,500
Total	$ 1,543	$ 13,194

(1) Equity method investments in Platform Ventures with a carrying value of zero as of December 31, 2022 and 2021 were excluded from the table above.

(Loss) gain on investments and equity method investments consisted of the following (in thousands):

	Year Ended December 31,		
	2022	2021	2020
(Loss) gain on investments:			
Synlogic, Inc. common stock	$ (10,526)	$ 1,649	$ (2,663)
Synlogic, Inc. warrants	(4,230)	662	(1,070)
Genomatica, Inc.	(10,115)	—	—
Marketable equity securities	(28,269)	(13,854)	—
Non-marketable equity securities	(195)	—	—
Total	$ (53,335)	$ (11,543)	$ (3,733)
Loss on equity method investments:			
Joyn Bio, LLC [1]	$ (3,043)	$ (17,230)	$ (396)
Allonnia, LLC	—	(12,698)	—
Arcaea, LLC	—	(47,356)	—
Verb Biotics, LLC	(15,900)	—	—
BiomEdit, LLC	(8,503)	—	—
Ayana, LLC	(15,989)	—	—
Other	(326)	—	—
Total	$ (43,761)	$ (77,284)	$ (396)

(1) Comprised of $14.0 million gain on the remeasurement of the Company's equity interest in Joyn at fair value as of the acquisition date offset by a $17.0 million loss on the equity method investment. The loss on equity method investment in Joyn in excess over the carrying value of zero of the equity method investment in Joyn during the year ended December 31, 2022 was recorded as a reduction in the convertible promissory notes receivable from Joyn (see Note 20).

6. Variable Interest Entities

Consolidated Variable Interest Entities

As of December 31, 2021, the Company had consolidated three variable interest entities ("VIEs"): Cooksonia, LLC ("Cooksonia"), Verb and Ayana, as the Company held variable interests in and was deemed to be the primary beneficiary of the VIEs. The other investors' equity interests in the consolidated VIEs are presented as non-controlling interests in the accompanying consolidated financial statements.

The Company initially held a 70% equity interest in Cooksonia, which was formed by the Company and certain other investors for the purposes of holding the Company's investment in Joyn. The Company concluded that it held a variable interest in and was the primary beneficiary of Cooksonia as it controlled the most significant activities of Cooksonia by controlling 100% of the board of directors of Cooksonia and held a controlling financial interest in Cooksonia. During the fourth quarter of 2022, in conjunction with the termination of the Joyn joint venture (Note 3), the Company acquired the

remaining 30% non-controlling interest in Cooksonia. The acquisition of the non-controlling interest did not result in a change of control, accordingly, the Company accounted for the acquisition as an equity transaction with no gain or loss recognized in the consolidated statements of operations and comprehensive loss. The carrying amount of the non-controlling interest in Cooksonia was adjusted to zero and Cooksonia became a wholly owned subsidiary of the Company as of December 31, 2022.

As of December 31, 2021, the Company held an interest in 9,000,000 common units (representing 100% of common units at inception) in each of Ayana and Verb, two Platform Ventures formed in September 2021 by the Company and certain of its investors. The Company has agreed to provide Ayana and Verb with certain licenses to intellectual property for use in the development or production of products that the parties agree to research and develop under technical development plans ("TDPs"). Additionally, in September 2021, Ayana and Verb entered into a Series A Preferred Unit Purchase Agreement under which each entity sold 9,000,000 Series A preferred units to certain of the Company's investors for aggregate proceeds of approximately $30.0 million each. During 2021, the Company concluded that it held a variable interest in and was the primary beneficiary of Ayana and Verb as it controlled the most significant activities of these entities. These conclusions were reached because, as of the primary beneficiary assessment dates in 2021, for both Verb and Ayana: (i) the Company had substantive control of the board of directors; (ii) all capital contributions were made by related parties of Ginkgo; and (iii) Ginkgo or its related parties comprised the entirety of the joint steering committee ("JSC"), the governing body which holds significant oversight with respect to the entities' research and development programs.

2022 Deconsolidation

During 2022, Verb and Ayana each hired a new chief executive officer who was not an affiliate, related party or agent of Ginkgo. The chief executive officer was also appointed to each entity's JSC and board of directors. As a result, the Company concluded it no longer had substantive control of each entity's JSC and board of directors. Accordingly, the Company concluded that it was no longer the primary beneficiary of Verb and Ayana as it no longer controlled the most significant activities of the entities. As a result of this change in the primary beneficiary determination, the Company deconsolidated Verb in the first quarter of 2022 and Ayana in the third quarter of 2022 and recorded a gain on deconsolidation of $31.9 million for the year ended December 31, 2022, in the consolidated statements of operations and comprehensive loss. The gain on deconsolidation was equal to the fair value of the retained interest in each entity as of the deconsolidation date and was calculated using the option pricing method. The option pricing method used a back-solve methodology to infer the total equity value based on the pricing of the Series A preferred unit financing, which is the most recent financing transaction to the deconsolidation event.

The JSC, with equal representation from each of Verb or Ayana and Ginkgo, governs the TDPs under which the Company will perform agreed-upon research and development services in return for consideration on a cost-plus basis for all services provided. Ginkgo has agreed to provide Verb and Ayana with licenses to certain of its intellectual property for use in the development, production and commercialization of each entity's products under the TDPs. The Company's common unit investment in Verb and Ayana is accounted for as an equity method investment, and accordingly, Verb and Ayana are related parties of Ginkgo. The initial carrying value of the equity method investment was equal to the fair value of the retained interest of $15.9 million for Verb and $16.0 million for Ayana as of the applicable deconsolidation date. The Series A preferred units issued by Verb and Ayana receive a liquidation preference prior to common units. As such, the Company concluded that this represents a substantive profit-sharing arrangement and the Company is recognizing earnings and losses on the equity method investment using the HLBV method. The Company recorded a loss on its equity method investment in Verb and Ayana of $31.9 million in the year ended December 31, 2022, due to a basis difference associated with in-process research and development identified as part of the initial accounting for the equity method investment. This loss reduced the carrying value of the equity method investment in each of Verb and Ayana to zero. There is no commitment for the Company to provide further financial support to Verb and Ayana, and therefore the carrying value of the equity method investment will not be reduced below zero.

The aggregate carrying value of total assets and liabilities included on the consolidated balance sheet for consolidated VIEs as of December 31, 2021 was $58.0 million in cash and cash equivalents, $0.7 million in prepaid expense and other current assets, $11.7 million in equity method investments and $0.6 million in current liabilities.

Unconsolidated Variable Interest Entities

With respect to the Company's investments in Motif, Allonnia, Genomatica, Arcaea, BiomEdit, Verb and Ayana (subsequent to the deconsolidation of Verb and Ayana) (collectively, the "Unconsolidated VIEs"), the Company has concluded these

entities represent VIEs. However, although the Company may have board representation and is involved in the ongoing development activities of the entities via its participation on the JSC, the Company has concluded that it is not the primary beneficiary of these entities. This conclusion is supported by the fact that: (i) the Company does not control the board of directors of any of the Unconsolidated VIEs, and no voting or consent agreements exist between the Company and other members of each respective board of directors or other investors, (ii) the holders of preferred security interests in the Unconsolidated VIEs hold certain rights that require their consent prior to taking certain actions, which include certain significant operating and financing decisions, and (iii) the Company's representation on the JSC of each respective entity does not give it control over the development activities of any of the Unconsolidated VIEs, as all JSC decisions are made by consensus and there are no agreements in place that would require any of the entities to vote in alignment with the Company. As the Company's involvement in the Unconsolidated VIEs does not give it the power to control the decisions with respect to their development or other activities, which are their most significant activities, the Company has concluded that it is not the primary beneficiary of the Unconsolidated VIEs.

With respect to Cooksonia's investment in Joyn prior to the joint venture's termination on October 17, 2022 (see Note 3), as Cooksonia did not control Joyn's board of directors, it did not have the power to control the decisions related to the development activities of Joyn, which were its most significant activities. Accordingly, the Company has concluded that Cooksonia was not the primary beneficiary of Joyn. The Company has provided $10.0 million in financial support to Joyn during the year ended December 31, 2022 in the form of convertible promissory notes (see Note 20), which were deemed necessary to fund Joyn's operations pre-dissolution. The Company expects to incur general and administrative expenses associated with the winding up and dissolution of Joyn.

Additionally, the Company holds equity interests in certain privately-held companies that are not consolidated as the Company is not the primary beneficiary. As of December 31, 2022 and 2021, the maximum risk of loss related to the Company's unconsolidated VIEs was limited to the carrying value of its investments in such entities.

Refer to Notes 5 and 16 for additional details on the Company's investments and equity method investments.

7. Goodwill and Intangible Assets, net

All goodwill is allocated to the Foundry reporting unit and segment identified in Note 15. Changes in the carrying amount of goodwill consisted of the following (in thousands):

	As of December 31,	
	2022	2021
Beginning balance	$ 21,312	$ 1,857
Goodwill acquired in acquisitions	39,712	15,177
Impact of foreign currency translation	(266)	(722)
Measurement period adjustments	(548)	5,000
Ending balance	$ 60,210	$ 21,312

Intangible assets, net consisted of the following (in thousands):

	Gross Carrying Value [1]	Accumulated Amortization [1]	Net Carrying Value	Weighted Average Amortization Period
December 31, 2022:				
Developed technology	$ 115,824	$ (8,825)	$ 106,999	9.4
Database	3,700	(107)	3,593	6.8
Customer relationships	380	(71)	309	1.6
Assembled workforce	190	(50)	140	1.0
Total intangible assets	$ 120,094	$ (9,053)	$ 111,041	
December 31, 2021				
Developed technology	$ 25,038	$ (3,396)	$ 21,642	13.3

(1) Gross carrying value and accumulated amortization include the impact of cumulative foreign currency translation adjustments.

Amortization expense was $5.6 million, $1.2 million and $0.5 million for the years ended December 31, 2022, 2021 and 2020, respectively. The estimated future amortization expense for intangible assets remaining as of December 31, 2022 is as follows (in thousands):

2023	$	15,769
2024		15,289
2025		15,165
2026		15,165
2027		12,158
Thereafter		37,495
Total	$	111,041

8. Leases

The Company leases real estate for office and lab space as well as equipment used in research and development activities under operating and finance leases.

The Company's real estate leases have initial lease terms ranging from 13 months to 14.4 years and are all classified as operating. Real estate leases may contain periods of free rent, tenant improvement incentives, expansion options, rent escalation clauses at pre-determined rates or at the prevailing market rates at the time of the increase, and options to extend or terminate the lease without cause at the option of either party during the lease term. The Company is not reasonably certain to exercise these options at the commencement of the lease. Equipment leases have initial lease terms ranging from 12 to 60 months and are classified as operating or finance if the lease contains bargain purchase options which the Company is reasonably certain to exercise.

Variable lease cost for real estate leases primarily consists of certain non-lease components such as real estate taxes, insurance and common area maintenance charges. These non-lease components are typically variable in nature and are recognized as lease expense in the period in which they arise. None of the Company's lease agreement contain material restrictive covenants or residual value guarantees.

The components of total lease cost were as follows:

	Year ended December 31, 2022	
Operating lease cost	$	35,242
Finance lease cost:		
Amortization of ROU assets		1,871
Interest on lease liabilities		104
Finance lease cost		1,975
Variable lease cost		8,879
Sublease income		(5,190)
Total lease cost	$	40,906

Rent expense under operating leases was $17.7 million and $7.0 million for the years ended December 31, 2021 and 2020, respectively.

Supplemental cash flow information related to the Company's operating leases were as follows:

	Year ended December 31, 2022	
Cash paid for amounts included in the measurement of lease liabilities:		
Operating cash flows from finance leases	$	92
Operating cash flows from operating leases	$	13,587
Financing cash flows from finance leases	$	1,237

Supplemental balance sheet information related to operating leases were as follows:

	December 31, 2022
Weighted average remaining lease term - operating leases (in years)	10.3
Weighted average remaining lease term - finance leases (in years)	2.3
Weighted average discount rate - operating leases	8.1%
Weighted average discount rate - finance leases	3.7%

The following table summarizes the maturity of the Company's lease liabilities (in thousands):

Years Ending December 31,	Operating leases	Finance leases
2023	$ 58,111	$ 1,374
2024	62,125	1,079
2025	62,300	452
2026	57,300	19
2027	58,010	—
Thereafter	366,924	—
Total undiscounted payments	664,770	2,924
Less: imputed interest	(223,482)	(119)
Total lease liability	441,288	2,805
Less: current portion of lease liability	(28,032)	(1,300)
Lease liabilities, non-current	$ 413,256	$ 1,505

In addition to the lease liabilities in the table above, as of December 31, 2022, the Company had $420.9 million of undiscounted commitments related to operating real estate leases that were signed but not yet commenced. These leases are expected to commence in 2023 and 2024 with lease terms of 13 to 15 years.

The Company subleases a portion of its office and lab space to certain of its equity method investees, which are considered related parties. These lease agreements generally have lease terms of up to 5 years and may include renewal options. Related party sublease income for the years ended December 31, 2022, 2021 and 2020 were $3.5 million, $1.1 million and $0.4 million reported within other income (expense), net on the consolidated statements of operations and comprehensive loss.

9. Warrant Liabilities

Upon the closing of the SRNG Business Combination, the Company assumed 34,499,925 publicly-traded warrants ("Public Warrants") and 17,325,000 private placement warrants (the "Private Placement Warrants") held by the Sponsor. Both the Public Warrants and the Private Placement Warrants were issued in conjunction with the consummation of SRNG's initial public offering on February 26, 2021. Each whole warrant entitles the holder to purchase one share of the Company's Class A common stock at a price of $11.50 per share, subject to adjustments. The warrants will expire five years from the completion of the SRNG Business Combination, or earlier upon redemption or liquidation.

No Public Warrants will be exercisable for cash unless the Company has an effective and current registration statement covering the issuance of the shares of common stock issuable upon exercise of the Public Warrants. On November 23, 2021, the Company's registration statement covering such shares became effective. The Company may redeem the outstanding Public Warrants:

- in whole and not in part
- at a price of $0.01 per Public Warrant;
- upon not less than 30 days' prior written notice of redemption to each warrant holder; and
- if, and only if, the reported closing price of the ordinary shares equals or exceeds $18.00 per share (as adjusted for share sub-divisions, share capitalizations, reorganizations, recapitalizations and the like) for any 20 trading days within a 30-trading day period ending three business days before the Company sends the notice of redemption to the warrant holders.

If the Company calls the Public Warrants for redemption, as described above, its management will have the option to require any holder that wishes to exercise the Public Warrants to do so on a "cashless basis," as described in the warrant agreement. The exercise price and number of ordinary shares issuable upon exercise of the Public Warrants may be adjusted in certain circumstances including in the event of a share dividend, extraordinary dividend or recapitalization, reorganization, merger or consolidation. However, except as described above, the Public Warrants will not be adjusted for issuances of ordinary shares at a price below its exercise price. Additionally, in no event will the Company be required to net cash settle the Public Warrants.

The Private Placement Warrants are identical to the Public Warrants, except that (i) the Private Placement Warrants will be exercisable on a cashless basis and be non-redeemable so long as they are held by the initial purchasers or their permitted transferees and (ii) the Private Placement Warrants and the Class A ordinary shares issuable upon exercise of the Private Placement Warrants were entitled to registration rights, which was satisfied on November 23, 2021 when the Company's registration statement covering such shares became effective. If the Private Placement Warrants are held by someone other than the initial purchasers or their permitted transferees, the Private Placement Warrants will be redeemable by the Company and exercisable by such holders on the same basis as the Public Warrants.

As of December 31, 2022, the aggregate values of the Public Warrants and the Private Placement Warrants was $6.9 million and $4.0 million, respectively, representing warrants outstanding to purchase 35.0 million shares and 16.8 million shares, respectively, of the Company's Class A common stock. The warrants are accounted for as liabilities in accordance with ASC 815-40 and are presented within warrant liabilities on the consolidated balance sheet. The warrant liabilities are measured at fair value at inception and on a recurring basis, with changes in fair value presented within change in fair value of warrant liabilities on the consolidated statements of operations and comprehensive loss. See Note 4 for additional information.

10. Supplemental Balance Sheet Information

Cash, Cash Equivalents and Restricted Cash

The reconciliation of cash, cash equivalents and restricted cash reported within the consolidated balance sheet to the totals shown within the consolidated statements of cash flows is as follows (in thousands):

	2022	2021	2020
Cash and cash equivalents	$ 1,315,792	$ 1,550,004	$ 380,801
Restricted cash included in prepaid expenses and other current assets (1)	8,221	—	—
Restricted cash included in other non-current assets (1)	45,568	42,924	5,076
Total cash, cash equivalents and restricted cash	$ 1,369,581	$ 1,592,928	$ 385,877

(1) Includes cash balances collateralizing letters of credit associated with the Company's facility leases and a customer prepayment requiring segregation and restrictions in its use in accordance with the customer agreement.

Prepaid Expenses and Other Current Assets

Prepaid expenses and other current assets consisted of the following (in thousands):

	As of December 31,	
	2022	2021
Prepaid expenses	$ 18,145	$ 9,739
Prepaid insurance	16,960	9,199
Prepaid inventory	—	144
Notes receivable	—	11,559
Other receivables	1,561	2,198
Security deposits	2,084	—
Restricted cash	8,221	—
Other current assets	487	698
Prepaid expenses and other current assets	$ 47,458	$ 33,537

Inventory, net

Inventory, net consisted of the following (in thousands):

	As of December 31,	
	2022	2021
Finished goods	$ 6,556	$ 3,264
Raw materials	1,590	64
Work in process	—	50
Less: Inventory reserve	(3,782)	(16)
Inventory, net	$ 4,364	$ 3,362

Property, Plant, and Equipment, net

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

	As of December 31,	
	2022	2021
Buildings and facilities	$ 46,019	$ 12,762
Furniture and fixtures	8,206	4,617
Lab equipment	183,292	113,963
Computer equipment and software	15,219	10,129
Leasehold improvements	125,307	55,033
Construction in progress	23,426	10,278
Land	6,060	—
Vehicles	—	40
Total property, plant, and equipment	407,529	206,822
Less: Accumulated depreciation and amortization	(92,756)	(61,052)
Property, plant, and equipment, net	$ 314,773	$ 145,770

As of December 31, 2021, lab equipment recorded under capital leases in accordance with ASC 840, *Leases*, totaled $4.1 million, with accumulated depreciation of $2.1 million. Upon the adoption of ASC 842 on January 1, 2022, the Company reclassified capital leases as finance lease ROU assets, which are included in other non-current assets on the consolidated balance sheet as of December 31, 2022. Amortization expense associated with assets recorded under capital leases was included with depreciation and amortization expense for the year ended December 31, 2021.

Additionally, upon the adoption of ASC 842, the Company derecognized build-to-suit assets of $12.8 million classified as facilities as of December 31, 2021, with related accumulated amortization of $1.1 million, and build-to-suit assets of $6.1 million classified as construction in progress as of December 31, 2021.

Depreciation and amortization expense for the years ended December 31, 2022, 2021 and 2020 totaled $36.9 million, $26.9 million and $12.6 million, respectively.

Other Non-Current Assets

Other non-current assets consisted of the following (in thousands):

	As of December 31,	
	2022	2021
Restricted cash	$ 45,568	$ 42,924
Notes receivable	37,660	—
Finance lease right-of-use assets, net	3,256	—
Other assets	2,241	1,066
Other non-current assets	$ 88,725	$ 43,990

Accrued Expenses and Other Current Liabilities

Accrued expenses and other current liabilities consisted of the following (in thousands):

	As of December 31,	
	2022	2021
Employee compensation and benefits	$ 19,441	$ 6,257
Professional fees	12,178	14,871
Property and equipment	11,624	991
Cost of Biosecurity product revenue accruals	12	4,565
Cost of Biosecurity service revenue accruals	15,401	28,726
Inventory related accruals	1,048	3,538
Lab supplies	3,434	560
External research and development expenses	1,844	11
Contingent consideration liability	6,378	—
Liability classified stock-based compensation	—	26,612
Finance lease liabilities	1,300	747
Operating lease liabilities	28,032	—
Other current liabilities	14,002	6,454
Accrued expenses and other current liabilities	$ 114,694	$ 93,332

11. Commitments and Contingencies

Purchase Obligations

On March 31, 2022, the Company entered into a four-year supply agreement with Twist for the purchase of diverse products including synthetic DNA. The agreement is effective as of April 1, 2022 and obligates the Company to spend a minimum of $58.0 million over the four-year term with the following minimum annual commitments (each annual year is defined as April 1 to March 31): year 1, $10.0 million; year 2, $13.0 million; year 3, $16.0 million; and year 4, $19.0 million.

Legal Proceedings

From time to time, the Company may in the ordinary course of business be named as a defendant in lawsuits, indemnity claims and other legal proceedings. Except as described below, the Company does not believe any pending litigation to be material, or that the outcome of any such pending litigation, in management's judgment based on information currently available, would have a material adverse effect on the Company's results of operations, cash flows or financial condition.

On August 4, 2021, a putative securities class action was filed on behalf of purchasers of the common stock of Zymergen, pursuant to or traceable to the registration statement for Zymergen's initial public offering ("IPO"). The action is pending in the United States District Court for the Northern District of California, and is captioned Wang v. Zymergen Inc., et al., Case No. 3:21-cv-06028-VC. The action alleges violations of Sections 11 and 15 of the Securities Act of 1933, as amended (the "Securities Act") in connection with Zymergen's IPO, names Zymergen, certain of its former officers and directors, and its IPO underwriters, as defendants and seeks damages in an unspecified amount, attorneys' fees, and other remedies. Zymergen intends to defend vigorously against such allegations.

On November 9, 2021, one of Zymergen's then purported shareholders filed a putative derivative lawsuit in the United States District Court for the Northern District of California that is captioned Mellor v. Hoffman, et al., Case No. 3:21-cv-08723-VC. The complaint names certain of Zymergen's former officers and directors as defendants and Zymergen as nominal defendant based on allegations substantially similar to those in the securities class action. The complaint purports to assert claims on Zymergen's behalf for breach of fiduciary duty, unjust enrichment, abuse of control, gross mismanagement, corporate waste, and contribution under the federal securities laws and seeks corporate reforms, unspecified damages and restitution, and fees and costs. Zymergen intends to defend vigorously against such allegations.

On or about February 7, 2023, a complaint was filed by Fortis Advisors LLC, solely in its capacity as Stockholders' Representative for the holders of convertible promissory notes of Lodo Therapeutics Corporation ("Lodo"), against our subsidiary, Zymergen, in Delaware Superior Court. The complaint purports to allege violations of California securities laws

based on Zymergen's exchange of its common stock for convertible promissory notes issued by Lodo in connection with Zymergen's May 2021 acquisition of Lodo. The complaint seeks damages in an unspecified amount, attorneys' fees, and other remedies. Zymergen intends to defend vigorously against such allegations.

In addition, certain government agencies, including the SEC, have requested information related to Zymergen's August 3, 2021 disclosure. Zymergen is cooperating fully.

Indemnification Agreements

The Company enters into standard indemnification agreements and has agreements with indemnification clauses in the ordinary course of business. Under such arrangements, the Company indemnifies, holds harmless and agrees to reimburse the indemnified party for losses suffered or incurred by the indemnified party, who are generally the Company's business partners. The terms of these indemnification arrangements are generally perpetual and effective any time after contract execution. The maximum potential liability resulting from these indemnification arrangements may be unlimited. The Company has never incurred costs to defend lawsuits or settle claims as a result of such indemnifications and the Company is not aware of any indemnification arrangements that could have a material effect on its financial position, results of operations or cash flows, and it has not accrued any liabilities related to such obligations as of December 31, 2022.

Registration Rights

In connection with the closing of the SRNG Business Combination, the Company entered into an amended and restated registration rights agreement (the "Registration Rights Agreement") among the Company, SRNG and certain Old Ginkgo stockholders. Pursuant to the Registration Rights Agreement, the Company will be required to register for resale securities held by the stockholders. The Company will have no obligation to facilitate more than two demands per calendar year for each of the SRNG or the Ginkgo Holders (as defined in the Registration Rights Agreement) that the Company register such stockholders' securities. In addition, the holders have certain "piggyback" registration rights with respect to registrations initiated by the Company. The Company will bear the expenses incurred in connection with the filing of any registration statements pursuant to the Registration Rights Agreement.

12. Stockholders' Equity

Capitalization

The following table presents the Company's authorized, issued, and outstanding common stock as of the dates indicated:

	Authorized	Issued	Outstanding
Common stock as of December 31, 2022:			
Class A	10,500,000,000	1,448,234,796	1,337,498,554
Class B	4,500,000,000	383,648,604	354,477,410
Class C	800,000,000	200,000,000	200,000,000
	15,800,000,000	2,031,883,400	1,891,975,964
Common stock as of December 31, 2021:			
Class A	10,500,000,000	1,326,146,808	1,273,976,963
Class B	4,500,000,000	364,844,007	337,415,189
Class C	800,000,000	—	—
	15,800,000,000	1,690,990,815	1,611,392,152

Shelf Registration Statement

On October 4, 2022, the Company filed with the Securities and Exchange Commission ("SEC") a shelf registration statement on Form S-3 (File No. 333-267743), which was declared effective on October 14, 2022. Under the shelf registration, the Company may offer and sell from time to time, in one or more series or issuances and on terms determined at the time of the offering, any combination of its Class A common stock, preferred stock, warrants and/or units up to an aggregate amount of $500 million. As of December 31, 2022, approximately $400 million remain available under the shelf registration.

Underwritten Public Offering

On November 15, 2022, the Company entered into an underwriting agreement (the "Underwriting Agreement") with BTIG, LLC (the "Underwriter"), pursuant to which the Company agreed to issue and sell to the Underwriter an aggregate of 41,383,877 shares at a public offering price of $2.4164 per share, representing an underwriting discount of 9%. Under the terms of the Underwriting Agreement, the Company granted the Underwriter an option exercisable for 30 days to purchase up to an additional 6,207,581 shares of its Class A common stock, which expired unexercised. The shares were sold pursuant to an effective shelf registration statement on Form S-3 (File No. 333-267743) and a related prospectus supplement filed with the SEC. The net proceeds to the Company from the offering was approximately $98.9 million, after deducting estimated offering expenses. The Company intends to use the net proceeds of this offering to offset the cash used to finance the acquisition of certain of the assets and liabilities of Bayer and for other general corporate purposes.

Old Ginkgo Convertible Preferred Stock

In May and July of 2020, the Company received gross proceeds of $94.4 million from the issuance of 30,855,065 shares of Series E convertible preferred stock to various investors at a price of $3.06 per share.

Immediately prior to the closing of the SRNG Business Combination on September 16, 2021, all outstanding Series B, C, D, and E convertible preferred stock converted into shares of Old Ginkgo common stock on a one-for-one basis. Upon closing of the SRNG Business Combination, those shares converted into an aggregate 904.7 million shares of Ginkgo's Class A common stock pursuant to the Exchange Ratio established in the Merger Agreement. All fractional shares were rounded down.

Preferred Stock

The Company is authorized to issue 200,000,000 shares of preferred stock with a par value $0.0001 per share. The Company's board of directors are authorized, without stockholder approval, to issue such shares of preferred stock in one or more series, to establish from time to time the number of shares to be included in each such series, and to fix the designations, powers, voting, and other rights, preferences and privileges of the shares. There were no issued and outstanding shares of preferred stock as of December 31, 2022.

Common Stock

As a result of the SRNG Business Combination, the Company has retroactively restated the shares issued and outstanding prior to September 16, 2021 to give effect to the Exchange Ratio.

The Company is authorized to issue 15,800,000,000 shares of common stock, including 10,500,000,000 shares of Class A common stock, par value $0.0001 per share, 4,500,000,000 shares of Class B common stock, par value $0.0001 per share, and 800,000,000 shares of Class C common stock, par value $0.0001 per share.

Voting

Holders of Class A common stock are entitled to one vote per share and holders of Class B common stock are entitled to ten votes per share. Holders of Class C common stock are not entitled to vote except as otherwise expressly provided in the certificate of incorporation or required by applicable law.

Dividends

Common stockholders are entitled to receive dividends, as may be declared by the board of directors. Different classes of common stock are legally entitled to equal per share distributions whether through dividends or liquidation. No dividends have been declared to date.

Conversion

Each share of Class B common stock is convertible at any time at the option of the holder into one share of Class A common stock. Generally, shares of Class B common stock will convert automatically into Class A common stock upon the holder ceasing to be an Eligible Holder (i.e., director, employee, trust or legal entity of Ginkgo), unless otherwise determined by affirmative vote of a majority of independent directors of Ginkgo.

Common Stock Reserved for Future Issuances

The Company had the following common stock reserved for future issuance as of the date indicated:

	December 31, 2022
Stock options issued and outstanding	12,906,001
Restricted stock units outstanding	134,436,442
Shares available for grant under the 2021 Plan	185,532,349
Shares available for grant under the ESPP	20,000,000
Shares available for grant under the 2022 Inducement Plan	7,161,125
Warrants to purchase Class A common stock	51,824,895
Total common stock reserved for future issuances [(1)]	411,860,812

(1) Excludes unvested earnout shares which are restricted shares issued to equity holders of Old Ginkgo as part of the SRNG Business Combination (Note 3) and are recorded in equity as shares outstanding upon satisfying the vesting conditions.

13. Stock-Based Compensation

The following table summarizes stock-based compensation expense by financial statement line item in the Company's consolidated statements of operations and comprehensive loss for the periods presented (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Research and development	$ 731,996	$ 926,730	$ 79
General and administrative	1,198,645	755,835	397
Total	$ 1,930,641	$ 1,682,565	$ 476

2022 Inducement Plan

On October 16, 2022, the Company's Board of Directors adopted the Ginkgo Bioworks Holdings, Inc. 2022 Inducement Plan (the "2022 Inducement Plan"), which is a non-shareholder approved equity incentive plan adopted pursuant to the "inducement exception" provided under NYSE Listed Company Manual Section 303A.08. Pursuant to the terms of the 2022 Inducement Plan, the Company may grant nonstatutory stock options, stock appreciation rights, restricted stock units, restricted stock and other stock-based awards as an inducement material to individuals being hired or rehired following a bona fide period of interruption of employment, as an employee of the Company or any of its subsidiaries, including in connection with a merger or acquisition. The terms of the 2022 Inducement Plan are substantially similar to the terms of the Company's 2021 Incentive Award Plan. The Company has reserved 25.0 million shares of the Company's common stock (which may be shares of Class A common stock or Class B common stock) for issuance under the 2022 Inducement Plan. As of December 31, 2022, 7,161,125 shares are available for future issuance under the 2022 Inducement Plan.

2021 Incentive Award Plans

On September 16, 2021, the 2021 Incentive Award Plan (the "2021 Plan") became effective. The 2021 Plan provides for the grant of stock options, including incentive stock options ("ISOs") and nonqualified stock options, stock appreciation rights, restricted stock, dividend equivalents, RSUs and other stock or cash-based awards to employees, consultants and directors of Ginkgo and its subsidiaries.

The aggregate number of shares of common stock available for issuance under the 2021 Plan, which may be issued as Class A common stock and/or Class B common stock, was initially 200,440,957 shares. As of December 31, 2022, 185,532,349 shares are available for future issuance under the 2021 Plan. The number of shares of common stock reserved for issuance under the 2021 Plan will automatically increase for ten years on January 1 of each year in an amount equal to the lesser of (a) 4.0% of the aggregate number of shares of common stock outstanding on the final day of the immediately preceding calendar year and (b) such smaller number of shares as is determined by the Board. The maximum number of shares of common stock that may be issued pursuant to the exercise of incentive stock options granted under the 2021 Plan is 200 million shares. Shares issued under the 2021 Plan may consist of authorized but unissued shares, shares purchased on the open market or treasury shares.

2021 Employee Stock Purchase Plan

On September 16, 2021, the 2021 Employee Stock Purchase Plan (the "ESPP") became effective. The ESPP authorizes (i) the grant of options that are intended to qualify for favorable U.S. federal tax treatment under Section 423 of the Internal Revenue Code of 1986 (the "Section 423 Component") and (ii) the grant of options that are not intended to be tax-qualified (the "Non-Section 423 Component"). All of the Company's employees are expected to be eligible to participate in the ESPP. However, with respect to the Section 423 Component, an employee may not be granted rights to purchase stock under the ESPP if the employee, immediately after the grant, would own (directly or through attribution) stock possessing 5% or more of the total combined voting power or value of all classes of the Company's common stock.

The ESPP permits the Company to deliver up to 20 million shares of common stock pursuant to awards issued under the ESPP, which may be Class A common stock and/or Class B common stock. The number of shares of common stock reserved for issuance under the ESPP will automatically increase each January 1 by an amount equal to the lesser of (a) 1% of the aggregate number of shares of common stock outstanding on the final day of the immediately preceding calendar year and (b) such smaller number of shares as is determined by the Board, provided that no more than 100 million shares may be issued under the Section 423 Component. Prior to or in connection with issuing any shares of common stock under the ESPP, the ESPP administrator may convert awards covering shares of Class B common stock to Class A common stock. As of December 31, 2022, no awards have been granted under the ESPP.

2014 Stock Incentive Plan

The 2014 Stock Incentive Plan (the "2014 Plan") provided for the Company to grant options, stock appreciation rights, restricted stock, restricted stock units ("RSUs") and other stock-based awards. From and after the effective date of the 2021 Incentive Award Plan, the Company ceased granting awards under the 2014 Plan. However, the 2014 Plan continues to govern the terms and conditions of the outstanding awards previously granted thereunder. Shares of common stock underlying any awards that are forfeited, cancelled, repurchased, or otherwise terminated by the Company under the 2014 Plan will be added back to the shares available for issuance under the 2021 Incentive Award Plan.

2008 Stock Incentive Plan

The 2008 Stock Incentive Plan (the "2008 Plan") provided for the Company to grant options and restricted stock awards ("RSAs"). From and after the effective date of the 2014 Stock Incentive Plan, the Company ceased granting awards under the 2008 Plan. However, the 2008 Plan continues to govern the terms and conditions of the outstanding awards previously granted thereunder. Shares of common stock underlying any awards that are forfeited, cancelled, repurchased, or otherwise terminated by the Company under the 2008 Plan will be added back to the shares available for issuance under the 2021 Incentive Award Plan.

Stock Options

Options outstanding under the 2008 Plan and 2014 Plan are fully vested. Options outstanding under the 2021 Plan consist of awards granted to non-employee directors and are of two types: (i) initial awards granted to newly elected or appointed directors, which vest in three equal annual installments, and (ii) subsequent awards, which vest on the earlier of the first anniversary of the grant date or the day prior to the next annual shareholder meeting. All stock options expire no later than ten years after the grant date. The exercise price of each option under the 2021 Plan is equal to the closing price of the Company's common stock on the date of grant.

A summary of stock option activity for the year ended December 31, 2022 is presented below:

	Number of Shares	Weighted Average Exercise Price per Share	Weighted Average Remaining Contractual Term	Aggregate Intrinsic Value [1]
			(in years)	(in thousands)
Outstanding as of December 31, 2021	22,454,663	$ 0.05		
Granted	922,227	$ 2.87		
Exercised	(12,876,227)	$ 0.02		
Outstanding as of December 31, 2022	10,500,663	$ 0.34	2.06	$ 15,902
Exercisable as of December 31, 2022	9,543,914	$ 0.06	1.31	$ 15,902

(1) The aggregate intrinsic value is calculated as the difference between the Company's closing stock price on the last trading day of the year and the exercise prices, multiplied by the number of in-the-money stock options.

The aggregate intrinsic value of stock options exercised during the years ended December 31, 2022, 2021 and 2020 was $21.5 million, $91.0 million and $5.3 million, respectively. The weighted-average fair value of options granted during the years ended December 31, 2022 and 2021 was $1.92 and $8.97 per share, respectively, and was calculated using the following assumptions. No options were granted during 2020.

	Year Ended December 31, 2022	Year Ended December 31, 2021
Risk-free interest rate	3.13%	0.11%
Dividend yield	0%	0%
Expected volatility	76.9%	88.6%
Expected term	5.6 years	0.96 years

As of December 31, 2022, there was $1.2 million of unrecognized compensation expense related to stock options to be recognized over a weighted-average period of 1.4 years.

Restricted Stock and Restricted Stock Units

RSAs granted under the 2014 Plan are subject to a service-based vesting condition and generally vest in equal monthly installments over four years. RSUs granted under the 2014 Plan are subject to two vesting conditions: (i) a service-based vesting condition that is generally met over four years with 25% of the shares vesting on the first anniversary of the grant date with monthly vesting thereafter, and (ii) a performance-based vesting condition that is met through a liquidity event in the form of either a change of control or an initial public offering ("the performance condition"). RSUs granted under the 2021 Plan are subject to a service-based vesting condition only that is generally met over four years with 25% of the shares vesting on the first anniversary of the grant date with monthly vesting thereafter.

Prior to the SRNG Business Combination, no stock-based compensation expense had been recognized related to RSUs granted under the 2014 Plan as the performance condition was not probable of being met and the SRNG Business Combination did not meet the definition of a liquidity event as defined in the 2014 Plan. As a result of the SRNG Business Combination, on November 17, 2021 ("Modification Date") the Board of Directors modified the vesting terms of RSUs granted under the 2014 Plan to allow 10% of the RSUs that met the service condition as of the closing of the SRNG Business Combination (the "10% RSUs") to vest with respect to the performance condition, effective as of November 19, 2021, the date on which the Form S-8 registration statement covering such shares became effective. In addition, on November 17, 2021 the Board of Directors modified the vesting terms of the remaining RSUs granted under the 2014 Plan such that they will vest in full with respect to the performance condition on or before March 15, 2022 (the original service-based vesting condition is still applicable). As a result of these modifications, the performance condition for all RSUs granted under the 2014 Plan became probable of being met during the fourth quarter of 2021. As the performance condition was not probable of being met prior to the modification, the RSU awards were remeasured using the price of $13.59 per share as of the Modification Date pursuant ASC 718 and the Company recorded a cumulative-catch up adjustment to reflect the change in the probability assessment. The modification resulted in approximately $1,492.2 million of incremental stock-based compensation expense recognized in the fourth quarter of 2021 based on the Modification Date fair value. The Company cash settled the 10% RSUs for a total cash payment of $76.5 million equal to the fair value of the stock on the Form S-8 effective date. Subsequent to the modification, compensation expense for the modified RSUs is recognized using an accelerated attribution method over the requisite service period for each employee award. The Company recognized $1,678.4 million of compensation expense related to the modified RSUs in the year ended December 31, 2022.

In September 2021, the Board of Directors modified the terms of RSUs granted to non-employee directors by adding a cash settlement feature to the awards which allowed the non-employee directors to elect to settle in cash up to 50% of their RSUs that were vested with respect to the service condition on or prior to December 31, 2021 (the "50% RSUs"). The director RSUs were subject to the same performance condition as all other RSUs granted under the 2014 Plan. In the fourth quarter of 2021, all directors elected to cash settle the 50% RSUs. As a result, the 50% RSUs are classified as liability awards and the liability is measured at fair value at the reporting date. The aggregate fair value of the liability classified awards was $26.6 million as of December 31, 2021 which is included in accrued expenses and other current liabilities on the consolidated balance sheet. In the first quarter of 2022, the Company cash settled the 50% RSUs, or approximately 3.2 million RSUs, for a total cash payment of $9.8 million.

A summary of the RSU and RSA activity for the year ended December 31, 2022 is presented below:

	Restricted Stock Units		Restricted Stock Awards	
	Number of Shares	Weighted Average Grant Date Fair Value	Number of Shares	Weighted Average Grant Date Fair Value
Nonvested as of December 31, 2021	168,321,952	$ 13.58	182,622	$ 1.99
Granted	111,541,317	$ 3.19	—	
Vested	(136,182,791)	$ 13.10	(178,531)	$ 1.99
Forfeited	(9,244,036)	$ 7.79	—	
Nonvested as of December 31, 2022	134,436,442	$ 5.84	4,091	$ 1.99

The weighted average grant date fair value of RSUs granted during the years ended December 31, 2022, 2021 and 2020 was $3.19, $13.53 and $2.68, respectively. The weighted average grant date fair value of RSUs granted during the year ended December 31, 2021 of $13.53 per share represents the weighted average of the Modification Date fair value and any post modification grant date fair values. The weighted average grant date fair value of RSUs granted during the year ended December 31, 2020 of $2.68 per share is no longer relevant for expense recognition due to the modification in the fourth quarter of 2021. No RSAs were granted during 2022, 2021, and 2020.

The aggregate fair value of the RSUs that vested during the years ended December 31, 2022 and 2021 was $1,783.8 million and $1,149.5 million, respectively. No RSUs vested during 2020 as the performance condition was not probable of being met. The aggregate fair value of the RSAs that vested during the years ended December 31, 2022, 2021 and 2020 was $0.4 million, $0.5 million and $0.5 million, respectively.

As of December 31, 2022, there was $462.2 million of unrecognized compensation expense related to RSUs to be recognized over a weighted-average period of 3.2 years and less than $0.1 million of unrecognized compensation expense related to RSAs to be recognized over a weighted-average period of 0.2 years.

Earnouts

As described in Note 3, the holders of Rollover Equity Awards outstanding immediately prior to the effective time of the SRNG Business Combination received a proportional amount of the Earnout Consideration, which is divided into four equal tranches subject to vesting during the five years after the Closing Date (the "Earnout Period"). The earnout shares in respect of the Rollover Equity Awards are subject to the same terms and conditions as the underlying Rollover Equity Awards (including with respect to vesting and termination-related provisions). Additionally, the earnout shares in respect of the Rollover Equity Awards are subject to a market condition that will be met when the trading price of the Company's common stock is greater than or equal to $12.50, $15.00, $17.50 and $20.00 for any 20 trading days within any period of 30 consecutive trading days during the Earnout Period (collectively, the "Earnout Targets"). To the extent that the Earnout Targets are not achieved during the Earnout Period, the portion of the Earnout Consideration that remains subject to vesting and forfeiture at the end of the Earnout Period will be forfeited to Ginkgo for no consideration and cancelled.

As described above, the earnout shares related to Old Ginkgo RSUs ("Earnout RSUs") are subject to the same performance condition as the underlying RSUs. As a result of the November 2021 modification to the RSUs described above, the performance condition became probable of being met in the fourth quarter of 2021. The modification resulted in approximately $173.5 million of incremental stock-based compensation expense recognized in the fourth quarter of 2021 related to the Earnout RSUs based on the Modification Date fair value. The first earnout target of $12.50 per share was met on November 15, 2021 and the earnout shares related to the first tranche of the Earnout Consideration for which the service condition had also been met became vested and were settled, less shares withheld to cover tax withholding obligations. The Company recognized $193.3 million of compensation expense related to the modified Earnout RSUs in the year ended December 31, 2022.

The grant date fair value of Earnout RSUs was estimated on the Closing Date and remeasured on the Modification Date using a Monte Carlo simulation model with the following assumptions:

	Year Ended December 31, 2021
Risk-free interest rate	0.84% - 1.21%
Expected volatility	53.1% - 81%
Expected term (in years)	4.83 - 5
Dividend yield	—

A summary of activity during the year ended December 31, 2022 for the Earnout RSUs and the earnout shares underlying Old Ginkgo RSAs ("Earnout RSAs") is presented below:

	Number of Shares	Weighted Average Grant Date Fair Value
Nonvested as of December 31, 2021	27,863,125	$ 12.87
Vested	(3,899,088)	$ 13.33
Forfeited	(444,075)	$ 12.92
Nonvested as of December 31, 2022	23,519,962	$ 12.79

The aggregate fair value of the Earnout RSUs and Earnout RSAs that vested during the year ended December 31, 2022 was $52.0 million.

As of December 31, 2022, there was $21.2 million of unrecognized compensation expense related to earnout shares to be recognized over a weighted-average period of 2.0 years.

14. Revenue Recognition

Disaggregation of Revenue

The following table sets forth the percentage of total Foundry revenue by industry:

	Year Ended December 31,		
	2022	2021	2020
Consumer and technology	45%	36%	12%
Pharma and Biotech	22%	8%	2%
Industrial and environment	12%	16%	29%
Food and nutrition	9%	25%	35%
Agriculture	8%	8%	13%
Government and Defense	4%	7%	9%
Total Foundry revenue	100%	100%	100%

The Company’s revenue is derived from customers located primarily in the United States. For the years ended December 31, 2022, 2021, and 2020, the Company’s revenue from customers within the United States comprised 88%, 86% and 88%, respectively, of total revenue.

Contract Balances

The Company recognizes a contract asset when the Company transfers goods or services to a customer before the customer pays consideration or before payment is due, excluding any amounts presented as accounts receivable. The Company did not have any contract assets as of December 31, 2022 and 2021.

Contract liabilities, or deferred revenue, primarily consist of payments received in advance of performance under the contract or when the Company has an unconditional right to consideration under the terms of the contract before it transfers goods or services to the customer. The Company’s collaborative arrangements with its equity investees and related parties typically include upfront payments consisting of cash or non-cash consideration for future research and development services and non-

cash consideration in the form of equity securities for licenses that will be transferred in the future. The Company records the upfront cash payments and fair value of the equity securities as deferred revenue.

The Company also invoices customers based on contractual billing schedules, which results in the recording of deferred revenue to the extent payment is received prior to the Company's performance of the related services. Contract liabilities are recognized as revenue as (or when) the Company performs under the contract.

During the year ended December 31, 2022, the Company recognized $45.6 million of revenue that was included in the contract liabilities balance of $189.2 million as of December 31, 2021. During the year ended December 31, 2021, the Company recognized $28.8 million of revenue that was included in the contract liabilities balance of $128.5 million as of December 31, 2020.

Performance Obligations

The aggregate amount of the transaction price that was allocated to performance obligations that have not yet been satisfied or are partially satisfied as of December 31, 2022 and 2021 was $123.5 million and $21.1 million, respectively. The Company has elected the practical expedient not to provide the remaining performance obligation disclosures related to contracts for which the Company recognizes revenue on a cost-plus basis in the amount to which it has the right to invoice and for contracts with a term of one year or less. As of December 31, 2022, of the performance obligations not yet satisfied or partially satisfied, nearly all is expected to be recognized as revenue during the years 2023 to 2025. When a milestone subject to the variable consideration constraint is achieved, the Company updates its estimate of the transaction price to include the milestone payment and records a cumulative catch-up in revenue. During the years ended December 31, 2022 and 2021, the Company recorded $10.0 million and $6.4 million, respectively, of cumulative catch-up in revenue primarily due to recognition of previously constrained variable consideration related to milestones. The cumulative catch-up adjustment in 2020 was not material.

15. Segment Information

Prior to 2022, the Company operated as a single reportable segment. In the first quarter of 2022, the Company reorganized its operations into two operating and reportable segments: Foundry and Biosecurity. The reorganization reflects changes made to the Company's internal management structure and how the Company's chief operating decision makers ("CODMs") evaluate operating results and make decisions on how to allocate resources. All prior-period comparative segment information was recast to reflect the current reportable segments in accordance with ASC 280, *Segment Reporting*. The Company's reportable segments are described as follows:

- Foundry consists of research and development services performed under collaboration and license agreements relating to the Company's cell programming platform. The Company's cell programming platform includes two core assets: the Foundry, highly efficient biology lab facilities, enabled by investment in proprietary workflows, custom software, robotic automation, and data science and analytics, which is paired with the Company's Codebase, a collection of biological "parts" and a database of biological data used to program cells. The Foundry segment includes costs incurred for the development, operation, expansion and enhancement of the Foundry and Codebase. Foundry revenue, which we may also refer to as cell engineering revenue, is derived from Foundry usage fees and downstream value share in the form of milestone payments, royalties or equity interests.
- Biosecurity consists of COVID-19 testing products and services primarily provided to public health authorities. Biosecurity revenue is derived from sales of test kits and testing and reporting services fees.

The reportable segments are the segments of the Company for which discrete financial information is available and for which segment results are regularly reviewed by the Company's CODMs, comprised of the Chief Executive Officer and the Chief Operating Officer, for purposes of allocating resources and assessing financial performance. The Company's CODMs evaluate the financial performance of the Company's segments based upon segment revenues and operating income. The Company's measure of segment operating income for management reporting purposes excludes the impact of stock-based compensation expense, depreciation and amortization and changes in fair value of certain contingent liabilities. The Company's CODMs do not evaluate operating segments using asset information. The accounting policies used in the preparation of reportable segments financial information are the same as those used in the preparation of the Company's consolidated financial statements.

The following table presents summary results of the Company's reportable segments for the periods indicated (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Revenue:			
Foundry	$ 143,666	$ 112,989	$ 59,221
Biosecurity	334,040	200,848	17,436
Total revenue	477,706	313,837	76,657
Segment cost of revenue:			
Biosecurity	204,216	129,690	15,611
Segment research and development expense:			
Foundry	273,356	160,634	84,755
Biosecurity	1,937	31,035	62,219
Total segment research and development expense	275,293	191,669	146,974
Segment general and administrative expense:			
Foundry	168,586	74,407	32,698
Biosecurity	56,353	31,039	4,813
Total segment general and administrative expense	224,939	105,446	37,511
Segment operating income (loss):			
Foundry	(298,276)	(122,052)	(58,232)
Biosecurity	71,534	9,084	(65,207)
Total segment operating loss	(226,742)	(112,968)	(123,439)
Operating expenses not allocated to segments:			
Stock-based compensation [(1)]	1,940,920	1,687,607	476
Depreciation and amortization	42,552	28,185	13,112
Change in fair value of contingent consideration liability	(1,262)	(293)	—
Loss from operations	$ (2,208,952)	$ (1,828,467)	$ (137,027)

(1) Includes $10.3 million and $5.0 million in employer payroll taxes for the years ended December 31, 2022 and 2021. Employer payroll taxes for the year ended December 31, 2020 were not material.

16. Significant Collaboration Transactions

BiomEdit, LLC

In April 2022, the Company, along with one of its investors and third-party investors, including Elanco Animal Health Inc. ("Elanco"), launched BiomEdit, LLC ("BiomEdit"), a microbiome innovation company that intends to discover, design and develop novel probiotics, microbiome derived bioactives and engineered microbial medicines in the field of animal health. Concurrently with the launch, the Company entered into (i) an Intellectual Property Contribution Agreement ("BiomEdit IP Agreement") that granted BiomEdit a license to certain of the Company's intellectual property, (ii) a Technical Development Agreement ("BiomEdit TDA") that establishes the terms under which the Company will provide technical research and development services, and (iii) a Common Unit Issuance Agreement ("BiomEdit CUIA") which compensates the Company for its intellectual property contribution. Contemporaneous with these agreements, BiomEdit entered into a Series A Preferred Unit Purchase Agreement under which it sold 6,662,500 Series A preferred units to one of the Company's investors and a third-party investor, for aggregate proceeds of approximately $32.5 million. After the initial closing, BiomEdit may issue up to an additional 1,537,500 Series A preferred units (the "Additional Units") to one or more purchasers reasonably acceptable to the existing holders of Series A preferred units.

Under the BiomEdit IP Agreement, the Company licensed certain intellectual property to BiomEdit for use in the development or production of BiomEdit's products that the parties will subsequently agree to research and develop under technical development plans ("TDP"). The license rights provide BiomEdit with the ability to commercialize the specified products from the corresponding TDP under the BiomEdit TDA. In return for the license to the intellectual property, BiomEdit issued the Company 3,900,000 common units upon execution of the BiomEdit CUIA. In the event BiomEdit does not sell all of the Additional Units, up to 731,250 common units held by Ginkgo will be forfeited. Under the BiomEdit TDA, the parties jointly agree on TDPs, through equal representation on a joint steering committee, under which the Company will perform agreed-upon research and development services in return for consideration on a fixed fee or cost-plus basis for all services provided.

Accounting Analysis

The common unit investment in BiomEdit is considered an equity method investment as a result of the Company's ability to exercise significant influence over BiomEdit's financial and operating policies through its ownership of common units. The initial carrying value of the equity method investment in BiomEdit is the fair value of the nonforfeitable common units of $8.9 million received in exchange for the BiomEdit IP Agreement which, as discussed below, is being accounted for as non-cash consideration under ASC 606. The Company determined that the 731,250 common units held by Ginkgo subject to forfeiture are considered variable consideration that is fully constrained at contract inception until the contingencies related to the issuance of the additional shares are resolved. The fair value of BiomEdit's common units was determined at inception of the agreements using the option pricing method. The option pricing method used a back-solve methodology to infer the total equity value based on the pricing of the Series A preferred unit financing, which was contemporaneous with the BiomEdit IP Agreement.

The Series A preferred units issued by BiomEdit receive a liquidation preference prior to common units. As such, the Company concluded that this represents a substantive profit-sharing arrangement, and the Company is recognizing earnings and losses on the equity method investment using the HLBV method. The Company recorded a $8.5 million loss on its equity method investment in BiomEdit during the year ended December 31, 2022. As of December 31, 2022, the carrying value of the equity method investment in BiomEdit was $0.4 million.

The relationship with BiomEdit is a vendor-customer relationship and is within the scope of ASC 606, as the provision of services and corresponding license rights are considered a part of the Company's ordinary activities. The common units issued to the Company represent non-cash consideration. While the BiomEdit TDA has been executed by the parties and provides the payment terms for future services, the BiomEdit TDA does not provide for any transfer of goods or services between the parties. However, the Company will provide licenses and services upon execution of the contemplated TDPs. Accordingly, the Company concluded that the BiomEdit TDA, in combination with the BiomEdit CUIA, met the definition of a contract under ASC 606. Each TDP executed under the BiomEdit TDA will be accounted for in accordance with ASC 606.

The Company's performance obligations under the BiomEdit TDA consist of four material rights to future technical research and development services and commercial licenses under individual TDPs that the Company expects to execute. The material rights represent an advance payment for the license rights, which will be granted upon the execution of future TDPs. As there is no additional payment for these license rights when future TDPs are executed, the Company has determined that there is a material right associated with each of the contemplated TDPs under the BiomEdit TDA. The Company has allocated approximately $2.2 million of the upfront non-cash consideration to each of the four material rights based on the estimated standalone selling price of the performance obligations.

Upon the execution of a TDP underlying a material right, the Company is obligated to provide technical research and development services under the TDP and a license to applicable patents and other intellectual property designed and developed under the TDP. The technical research and development services and license provided under a TDP are highly interdependent and interrelated with one another. Without the Company's knowledge, expertise, and platform, there would not be a licensable strain or other commercializable product to transfer to BiomEdit. Further, BiomEdit has rights to intellectual property created as part of each TDP, irrespective of the result of the development. Therefore, each executed TDP underlying a material right consists of one combined performance obligation for the technical research and development services and license to be provided by the Company.

For each TDP underlying a material right, the transaction price consists of (i) either a fixed fee or, if a cost-plus arrangement, variable consideration for the most likely amount of estimated consideration to be received and (ii) non-cash consideration allocated to the material rights. As the services performed by the Company under a TDP create or enhance an asset that BiomEdit controls as the asset is created or enhanced, the Company satisfies the performance obligation and recognizes revenue over time. The Company uses an input method that compares total costs incurred relative to total estimated cost to complete to estimate progress under the contract. Any revisions to the estimated total budgeted costs to complete, and the resulting impact to revenue recognition, are reflected in the period of the change through a cumulative catch-up adjustment.

As of December 31, 2022, the Company had a deferred revenue balance of $8.1 million with BiomEdit. During the year ended December 31, 2022, the Company recognized revenue of $1.0 million from services provided to BiomEdit.

Arcaea, LLC

Summary of Arrangement

Arcaea was formed in March 2021 to focus on the application of synthetic biology in the personal care products industry. In March 2021, the Company entered into (i) an Intellectual Property Contribution Agreement ("Arcaea IP Agreement") that granted Arcaea a license to certain of the Company's intellectual property, (ii) a Technical Development Agreement ("Arcaea TDA") that establishes the terms under which the Company will provide technical research and development services, and (iii) a Common Unit Issuance Agreement ("Arcaea CUIA") which compensates the Company for its intellectual property contribution. Contemporaneous with these transactions, Arcaea entered into a Series A Preferred Unit Purchase Agreement under which it sold 1,755,000 Series A preferred units to certain of the Company's investors, for aggregate proceeds of approximately $19.5 million. The Series A Preferred Unit Purchase Agreement provided for the sale and issuance of up to an additional 7,245,000 Series A preferred units subsequent to the initial closing. In subsequent closings during 2021, Arcaea issued an additional 5,139,900 Series A preferred units to existing and third-party investors for aggregate proceeds of approximately $57.1 million and closed its Series A preferred unit financing. As a result, the Company received an additional 5,229,900 common units in Arcaea for total consideration of $35.5 million.

Under the Arcaea IP Agreement, the Company licensed certain intellectual property to Arcaea for use in the development or production of Arcaea's products that the parties will subsequently agree to research and develop under TDPs. The license rights provide Arcaea with the ability to commercialize the specified products from the corresponding TDP under the Arcaea TDA. In return for the license to the intellectual property, Arcaea has agreed to issue the Company up to 9,000,000 common units in accordance with certain terms and conditions set forth within the agreements. The Company received 1,755,000 common units upon execution of the Arcaea CUIA and an additional 5,229,900 common units upon subsequent closings of the Series A preferred unit financing in 2021 (as discussed above). No additional common units are expected to be issued to the Company.

Under the Arcaea TDA, the parties jointly agree on TDPs, through equal representation on a joint steering committee, under which the Company will perform agreed-upon research and development services in return for consideration on a cost-plus basis for all services provided.

Accounting Analysis

The common unit investment in Arcaea is considered an equity method investment as a result of the Company's ability to exercise significant influence over Arcaea's financial and operating policies through its ownership of common units. The initial carrying value of the equity method investment in Arcaea is the fair value of the common units of $11.9 million received in exchange for the Arcaea IP Agreement which, as discussed below, was accounted for as deferred revenue at inception. The fair value of Arcaea's common units was determined at inception of the agreements using the option pricing method. The option pricing method used a back-solve methodology to infer the total equity value based on the pricing of the Series A preferred unit financing, which was contemporaneous with the Arcaea IP Agreement. Further, the Company determined the rights to up to an additional 7,245,000 common units did not meet the definition of a freestanding financial instrument and are not representative of a derivative. The right to the additional common units is considered variable consideration that is fully constrained at inception and until the contingencies related to the issuance of the additional shares are resolved.

The Series A preferred units issued by Arcaea receive a liquidation preference prior to common units. As such, the Company concluded that this represents a substantive profit-sharing arrangement, and the Company is recognizing earnings and losses on the equity method investment using the HLBV method. The Company recorded a $11.9 million loss on its equity method investment in Arcaea in 2021. The loss allocated to the Company primarily relates to Arcaea's accounting for the non-cash consideration related to the Arcaea IP Agreement as in-process research and development, which resulted in the full value of the Company's intellectual property contribution being expensed in 2021. As of December 31, 2021, the carrying value of the equity method investment in Arcaea has been reduced to zero. There is no commitment for the Company to provide further financial support to Arcaea, and therefore the carrying value of the equity method investment will not be reduced below zero.

The relationship with Arcaea is a vendor-customer relationship and is within the scope of ASC 606, as the provision of services and corresponding license rights are considered a part of the Company's ordinary activities. The common units issued to the Company represent non-cash consideration. While the Arcaea TDA has been executed by the parties and provides the payment terms for future services, the Arcaea TDA does not provide for any transfer of goods or services between the parties. However, the Company will provide licenses and services upon execution of the contemplated TDPs.

Accordingly, the Company concluded that the Arcaea TDA, in combination with the Arcaea CUIA, met the definition of a contract under ASC 606. Each TDP executed under the Arcaea TDA will be accounted for in accordance with ASC 606.

The Company's performance obligations under the contract consist of ten material rights to future technical research and development services and commercial licenses under individual TDPs that the Company expects to execute under the Arcaea TDA. The material rights represent an advance payment for the license rights, which will be granted upon the execution of future TDPs. As there is no additional payment for these license rights when future TDPs are executed, the Company has determined that there is a material right associated with each of the contemplated additional TDPs under the Arcaea TDA. The Company has allocated approximately $1.2 million of the upfront non-cash consideration to each of the ten material rights based on the estimated standalone selling price of the performance obligations. During the year ended December 31, 2021, the additional $35.5 million of non-cash consideration, which represents previously constrained variable consideration, was allocated to each of the ten performance obligations under the arrangement with Arcaea of $3.6 million each consistent with the initial relative selling price allocation. Unexercised material rights are recorded as non-current deferred revenue until such time as the parties execute a TDP conveying a commercial license.

Upon the execution of a TDP underlying a material right, the Company is obligated to provide technical research and development services under the TDP and a license to applicable patents and other intellectual property designed and developed under the TDP. The technical research and development services and license provided under a TDP are highly interdependent and interrelated with one another. Without the Company's knowledge, expertise, and platform, there would not be a licensable strain or other commercializable product to transfer to Arcaea. Further, Arcaea has rights to intellectual property created as part of each TDP, irrespective of the result of the development. Therefore, each executed TDP underlying a material right consists of one combined performance obligation for the technical research and development services and license to be provided by the Company.

For each TDP underlying a material right, the transaction price consists of variable consideration for the most likely amount of estimated consideration to be received under the cost-plus arrangement and non-cash consideration allocated to the material rights. As the services performed by the Company under a TDP create or enhance an asset that Arcaea controls as the asset is created or enhanced, the Company satisfies the performance obligation and recognizes revenue over time. The Company uses an input method that compares total costs incurred relative to total estimated cost to complete to estimate progress under the contract. Any revisions to the estimated total budgeted costs to complete, and the resulting impact to revenue recognition, are reflected in the period of the change through a cumulative catch-up adjustment.

As of December 31, 2022 and 2021, the Company had a deferred revenue balance of $38.3 million and $47.4 million, respectively, with Arcaea. During the years ended December 31, 2022 and 2021, the Company recognized revenue of $13.5 and $3.7 million, respectively, from services provided to Arcaea.

Allonnia, LLC

Summary of Arrangement

In December 2019, the Company entered into (i) an Intellectual Property Contribution Agreement ("Allonnia IP Agreement") that granted Allonnia a license to certain of the Company's intellectual property, (ii) a Technical Development Agreement ("Allonnia TDA") that establishes the terms under which the Company is providing technical development services, and (iii) a Common Unit Issuance Agreement which provides for the issuance of common units of Allonnia to the Company in exchange for the license rights granted under the Allonnia IP Agreement. Contemporaneous with these agreements, Allonnia entered into a Series A Preferred Unit Purchase Agreement under which Allonnia sold 2,970,000 Series A Preferred Units to certain of the Company's investors, as well as a third-party investor, for aggregate proceeds of approximately $33.0 million. Allonnia also agreed to issue an additional 630,000 Series A Preferred Units to a strategic partner as compensation for the delivery of future services to Allonnia. The Series A Preferred Unit Purchase Agreement also provided for the sale and issuance of up to an additional 5,400,000 Series A Preferred Units subsequent to the initial closing. In 2020, Allonnia issued an additional 1,844,911 Series A Preferred Units, 1,664,911 of which were sold for aggregate proceeds of $18.5 million and 180,000 of which were issued in exchange for the rights to certain intellectual property which will vest based on the achievement of milestones associated with the development of the intellectual property received. In 2021, Allonnia issued an additional 22,500 Series A Preferred Units for aggregate proceeds of $0.2 million and closed their Series A Preferred Unit financing.

Under the Allonnia IP Agreement, the Company licensed intellectual property to Allonnia for use in the development or production of its products that the parties will subsequently agree to develop under TDPs. The license rights provide Allonnia

with the ability to commercialize the specified products from the corresponding strain or enzyme, which can only be developed by the Company under the Allonnia TDA. The Company received 3,600,000 common units as consideration for the license upon execution of the Allonnia IP Agreement and an additional 1,867,411 common units during the year ended December 31, 2021 in connection with the closing of the Series A preferred unit financing.

Under the Allonnia TDA, the parties jointly agree, through equal representation on a joint steering committee, on TDPs for specific strains and enzymes, in which the Company will perform agreed upon development services in return for consideration on a cost-plus basis for all services provided.

Accounting Analysis

The common unit investment in Allonnia is considered an equity method investment as a result of the Company's ability to exercise significant influence over Allonnia's financial and operating policies through its ownership of common units. The initial carrying value of the equity method investment in Allonnia is the fair value of the common units of $24.5 million received in exchange for the Allonnia IP Agreement which, as discussed below, was accounted for as deferred revenue at inception. The fair value of Allonnia's common units was determined at inception of the agreements using the option pricing method. The option pricing method used a back-solve methodology to infer the total equity value based on the pricing of the Series A Preferred Unit financing, which was contemporaneous with the Allonnia IP Agreement. Further, the Company determined the rights to up to an additional 5,400,000 common units did not meet the definition of a freestanding financial instrument and are not representative of a derivative. The right to the additional common units is considered variable consideration that is fully constrained at inception and until the contingencies related to the issuance of the additional shares are resolved. This contingency was resolved in 2021 when the Company received an additional 1,867,411 common units in connection with the closing of the Series A preferred unit financing.

The Series A Preferred Units issued by Allonnia receive a liquidation preference prior to common units. As such, the Company concluded that this represents a substantive profit-sharing arrangement and the Company is recognizing earnings and losses on the equity method investment using the HLBV method. The Company recorded a loss on equity method investment of $24.5 million in 2019 and $12.7 million in 2021 as a result of the application of the HLBV method. The loss allocated to the Company primarily relates to Allonnia's accounting for the non-cash consideration related to the Allonnia IP Agreement as in-process research and development, which resulted in the full value of the Company's intellectual property contribution being expensed in the year that the shares were issued. As of December 31, 2021, the carrying value of the equity method investment in Allonnia has been reduced to zero. There is no commitment for the Company to provide further financial support to Allonnia and therefore the carrying value of the equity method investment will not be reduced below zero.

The relationship with Allonnia is a vendor-customer relationship and is within the scope of ASC 606 as the provision of services and corresponding license rights are considered a part of the Company's ordinary activities and the common units represent non-cash consideration. While the Allonnia TDA has been executed by the parties and provides the payment terms for future services, the Allonnia TDA does not provide for any transfer of goods or services between the parties. However, the Company will provide licenses and services upon execution of the contemplated TDPs. Accordingly, the Company concluded that the Allonnia TDA met the definition of a contract under ASC 606 and each TDP executed under the Allonnia TDA will be accounted for in accordance with ASC 606.

The Company's performance obligations under the contract consist of ten material rights related to the estimated number of TDPs the parties expect to execute under the Allonnia TDA. The material rights represent an advance payment for the license rights which will be granted upon the execution of each TDP. As there is no additional payment for these license rights upon execution of a TDP, the Company has determined that there is a material right associated with each of the contemplated future TDPs. The Company has allocated $2.5 million of the upfront non-cash consideration to each of the ten performance obligations under the contract based on the estimated standalone selling price of the performance obligations. Unexercised material rights are recorded as non-current deferred revenue until such time as the parties execute a TDP.

Upon the execution of each TDP, the Company is obligated to provide development services under the TDP and a license to applicable patents and other intellectual property to the ingredient developed under the plan. The license and research and development services under a TDP are highly interdependent and interrelated with one another. Without the Company's knowledge, expertise, and platform, there would not be a licensable strain or other commercializable product to transfer to Allonnia. Further, Allonnia has rights to all development intellectual property created as part of each TDP, irrespective of the

result of the development. Therefore, each executed TDP consists of one combined performance obligation for the license and research and development services to be performed by the Company.

For each TDP, the transaction price consists of variable consideration for the most likely amount of estimated consideration to be received under the cost-plus arrangement and the $2.5 million allocation of the fixed non-cash consideration. As the services performed by the Company create or enhance an asset that Allonnia controls as the asset is created or enhanced, the Company satisfies the performance obligation and recognizes revenue over time. The Company uses an input method that compares total costs incurred relative to total estimated cost to complete to estimate progress under the contract. Any revisions to the estimated total budgeted costs to complete, and the resulting impact to revenue recognition, are reflected in the period of the change through a cumulative catch-up adjustment. In 2021, the additional non-cash consideration of $12.7 million, which represents previously constrained variable consideration, was allocated to all of the performance obligations consistent with the initial relative selling price allocation and a cumulative catch up was recognized for the TDPs in process.

As of December 31, 2022 and 2021, the Company had a deferred revenue balance of $35.9 million and $38.0 million, respectively, with Allonnia. During the years ended December 31, 2022, 2021 and 2020, the Company recognized revenue of $4.3 million, $5.1 million and $5.0 million, respectively, from services provided to Allonnia.

Motif FoodWorks, Inc.

Summary of Arrangement

In September 2018, the Company entered into (i) an Intellectual Property Contribution Agreement ("Motif IP Agreement") with Motif that granted Motif a license to certain of the Company's intellectual property and (ii) a Technical Development Agreement ("Motif TDA") that establishes the terms under which the Company is providing technical development services.

Under the Motif IP Agreement, the Company licensed intellectual property to Motif for use in strain development to produce ingredients that the parties will subsequently agree to develop under TDPs. The license rights provide Motif with the ability to commercialize the specified ingredients from the corresponding strain, which can only be developed by the Company under the Motif TDA. In return for the license to the intellectual property, Motif granted the Company 9,000,900 shares of common stock. Concurrent with the Motif IP Agreement, Motif also sold 8,100,720 shares of Series A preferred stock to certain of the Company's investors, as well as third-party investors, for aggregate proceeds of approximately $90.0 million.

The Motif TDA governs the procurement of the Company's expertise and technical development services to collaborate in the research, development, and commercialization of specified ingredients. Under the Motif TDA, the parties jointly agree on TDPs for specific ingredients, in which the Company will perform agreed upon development services in return for consideration on a cost-plus fixed margin basis for all services provided. At inception, the Company estimated that it would execute ten TDPs with Motif.

Accounting Analysis

The investment in Motif common stock is considered an equity method investment as a result of the Company's ability to exercise significant influence over the financial and operating policies through its common stock ownership. The initial carrying value of the equity method investment in Motif is the fair value of the common stock received in exchange for the Motif IP Agreement of $65.1 million which, as discussed below, is being accounted for as non-cash consideration under ASC 606. As Motif's Series A preferred stockholders receive a liquidation preference prior to common stock, the Company concluded that this represents a substantive profit-sharing arrangement. Accordingly, the Company is recognizing earnings and losses on the equity method investment using the HLBV method. The Company recorded a loss on equity method investment of $65.1 million from inception through December 31, 2018 which reduced the carrying value to zero. The loss allocated to the Company primarily relates to Motif's accounting for the non-cash consideration related to the Motif IP Agreement as in-process research and development, which resulted in the full value of Company's intellectual property contribution being expensed in the period ended December 31, 2018, at which time the carrying value of the equity method investment in Motif had been reduced to zero. There is no commitment for the Company to provide further financial support to Motif and therefore the carrying value of the equity method investment will not be reduced below zero. As a result, no loss was recognized during the years ended December 31, 2022, 2021 and 2020 on the equity method investment.

The overall arrangement with Motif is a vendor-customer relationship and is within the scope of ASC 606 as the provision of development services and corresponding license rights are considered a part of the Company's ordinary activities. The licenses contemplated under the Motif IP Agreement are contingent upon a TDP being agreed to by the parties under the

Motif TDA and only relate to strains that are developed under a TDP. While the TDPs require approval by the parties, the parties initially estimated that ten TDPs would be negotiated under the arrangement.

The Company's performance obligations under the Motif IP Agreement consist of ten material rights, related to the initial set of ingredients that the parties desired to develop in the first two years. The material rights represent an advance payment for the license rights which will be granted upon the execution of each TDP. As there is no additional payment for these license rights upon execution of a TDP, the Company has determined that there is a material right associated with each of the contemplated TDPs. The common stock received under the Motif IP Agreement is considered non-cash consideration and has been recognized at fair value. The Company determined the fair value of the common stock was $65.1 million at inception of the agreement with the assistance of a third-party valuation specialist, which was initially recorded as non-current deferred revenue. The option pricing model used a back-solve methodology to determine the total equity value based on the pricing of the Series A financing, which was contemporaneous with the Motif IP Agreement. The Company has allocated $6.5 million to each of the ten material rights. The Company allocated the transaction price based on the estimated standalone selling price of the material rights which is, in turn, based on the intrinsic value of the right and the probability of exercise.

Upon the execution of each TDP, the Company is obligated to provide development services under the TDP and a license to applicable patents and other intellectual property to the ingredient developed under the plan. The license and research and development services under a TDP are highly interdependent and interrelated with one another. Without the Company's knowledge, expertise and platform, there would not be a licensable strain or other commercializable product to transfer to Motif. Further, Motif has rights to all development intellectual property created as part of each TDP, irrespective of the result of the development. Therefore, each executed TDP consists of one combined performance obligation for the license and research and development services to be performed by the Company.

For each TDP, the transaction price consists of variable consideration for the most likely amount of estimated consideration to be received under the cost-plus arrangement and the $6.5 million which was allocated to the associated material right under the Motif IP Agreement. As the services performed by the Company create or enhance an asset (i.e., the specified ingredient) that Motif controls as the asset is created or enhanced, the Company satisfies the performance obligation and recognizes revenue over time. The Company uses an input method that compares total costs incurred relative to total estimated cost to complete to estimate progress under the contract. Any revisions to the estimated total budgeted costs to complete, and the resulting impact to revenue recognition, are reflected in the period of the change through a cumulative catch-up adjustment.

As of December 31, 2022 and 2021, the Company had a deferred revenue balance of $52.0 million and $52.2 million, respectively, with Motif. During the years ended December 31, 2022, 2021 and 2020, the Company recognized revenue of $1.9 million, $20.2 million and $20.8 million, respectively, from services provided to Motif.

Genomatica, Inc.

2016 Genomatica Agreement

In 2016, the Company purchased Series A preferred stock of Genomatica, Inc. ("Genomatica"), a biotechnology company specializing in the development and manufacturing of intermediate and specialty chemicals from both sugar and alternative feedstocks. The Company also entered into a Collaboration Agreement with Genomatica ("Genomatica Collaboration") in connection with the financing. The Genomatica Collaboration was entered into to share expertise on biotechnology solutions. Specifically, Genomatica provided the Company with scale-up and process optimization functions, and the Company has provided Genomatica with certain technology development functions generally centered on high throughput strain engineering capabilities. The Genomatica Collaboration's focus was on obtaining new customers for either party that could benefit from the combined expertise of both parties, and the agreement provides for profit-sharing allocations between Genomatica and the Company depending on the category of the potential product. Each party is responsible for their own costs incurred under an agreed upon TDP.

2018 Genomatica Agreement

In September 2018, the Company entered into a stock purchase agreement with Genomatica under which it received $40.0 million of Series B preferred stock from Genomatica. In lieu of cash consideration, the Company entered into a Foundry Terms of Service Agreement ("Genomatica FSA") with Genomatica in which the Company would provide up to $40.0 million in services at no charge to Genomatica ("Initial Prepayment"). The Genomatica FSA terminated the Genomatica Collaboration and changed the pricing terms for work performed under TDPs to a cost-plus fixed margin agreement.

Genomatica can apply a portion of the $40.0 million in prepaid services to outstanding invoices under the Genomatica FSA, subject to certain limitations that require cash payment for services over certain monthly thresholds. Further, while the Genomatica FSA replaced the Genomatica Collaboration, any fees that would have been paid to or by the Company under contracts previously governed by the Genomatica Collaboration continued to be shared between the parties. These amounts are either (i) added to, if payable to the Company, or (ii) reduced from, if payable to Genomatica, the balance of the prepaid services over the term of the arrangement, with certain restrictions. As of December 31, 2021 and 2020, the Company has received $8.3 million and $6.9 million, respectively, under the Genomatica FSA. All contracts previously governed by the Genomatica Collaboration have ended as of December 31, 2021, therefore, no additional payments are expected.

Accounting Analysis

The Company concluded the preferred stock investment was not in-substance common stock and therefore did not qualify for accounting as an equity method investment. Rather, the Company concluded the preferred stock investment should be accounted for as an equity security as it represents an ownership interest in Genomatica that is not mandatorily redeemable nor does the Company have the unilateral right to redeem the preferred stock. Genomatica's preferred stock is not exchange-traded and does not have a readily determinable fair value. Therefore, the Company accounts for the Genomatica preferred stock under the measurement alternative for equity investments that do not have a readily determinable fair value, which in this case is at historical cost. As of December 31, 2022 and 2021, the cost of the investment in Genomatica preferred stock was $44.9 million and $55.0 million, respectively, and is included in investments on the consolidated balance sheet.

Under the Genomatica Collaboration, the Company was entitled to receive a portion of fees earned from third party customers of Genomatica that were within the scope of the agreement. The Company accounted for the collaboration under ASC 808, however the Company applied ASC 606 by analogy for measurement and recognition purposes. Under the Genomatica Collaboration, the Company's promises consisted of (i) licenses to the Company's intellectual property, related to the specified development work, and (ii) research and development services. The Company determined that there was a single, combined performance obligation consisting of research services and licenses to certain intellectual property. The Company recognized the revenue for the combined performance obligation using an over-time input method, as the Company's performance under the contract created or enhanced the target product or strain as such product or strain was developed. The Company measured progress based on the cost incurred relative to total forecasted cost.

The Genomatica FSA represents a modification to the Genomatica Collaboration that resulted in a change in transaction price from milestones to a cost-plus fixed margin structure. The Genomatica FSA did not result in the addition of any distinct promised goods or services, and the Company's remaining obligation post-modification was to finish the partially satisfied development work that had commenced under the Genomatica Collaboration. This performance obligation was satisfied during the year ended December 31, 2019 and the parties have entered into subsequent TDPs under the Genomatica FSA.

As of December 31, 2022 and 2021, the Company had a deferred revenue balance of $6.3 million and $17.1 million, respectively, with Genomatica. During the years ended December 31, 2022, 2021 and 2020, the Company recognized revenue of $10.9 million, $12.9 million and $9.4 million, respectively, from services provided to Genomatica.

Joyn Bio, LLC

Summary of Arrangement

In September 2017, the Company and certain other investors formed Cooksonia for the purposes of holding the Company's investment in Joyn. Concurrently, Cooksonia entered into a commitment agreement with Bayer CropScience LP ("Bayer") to form Joyn. The purpose of Joyn was to research, develop, discover, and commercialize engineered microbes for use in agriculture. The initial program used advanced techniques in biology to study and engineer naturally occurring soil microbes and their nitrogen-fixing genes to enable crops to produce their own fixed nitrogen and reduce the nitrogen fertilizer required.

The Company contributed $5.0 million in cash and certain intellectual property to Cooksonia in exchange for a 70% equity interest in Cooksonia ("Class A Units"). Cooksonia received $20.0 million in cash from another investor, who is a related party of the Company, for a 20% equity interest in Cooksonia ("Class B Units"). Cooksonia also received certain intellectual property from Genomatica and issued Genomatica a 10% equity interest in Cooksonia ("Cooksonia Class C Units") and paid Genomatica $5.0 million in cash. Subsequently, Cooksonia contributed $20.0 million and all intellectual property received from the Company and Genomatica in exchange for a 50% equity interest in Joyn. Bayer contributed $20.0 million in cash funding plus specified intellectual property. In addition, Bayer committed to contribute up to an additional $60.0 million to

be paid subject to certain funding procedures. In return, Bayer obtained a 50% equity interest in Joyn. The agreements may be terminated by mutual agreement, following a change in control, and for breach.

Joyn was governed by a Board of Managers ("Joyn Board") comprised of equal representation of the Company and Bayer. The Joyn Board had all the rights, powers, obligations, and authority to manage the business and affairs of Joyn.

The Company also entered into a Foundry Services Agreement ("Joyn FSA") with Joyn under which the Company will provide Joyn with technical services and preferred access to the Company's facilities. Joyn paid the Company a non-refundable $20.0 million prepayment for services to be provided under the Joyn FSA ("Joyn Prepaid Services"). The Joyn Prepaid Services can be utilized for technical services performed by the Company, its subcontractors, and third parties involved in the performance of the overall technical services. Amounts due to the Company are applied to the balance of Joyn Prepaid Services as earned. During the year ended December 31, 2019, Joyn made an additional $15.0 million prepayment for services ("Joyn Additional Prepaid Services"). Under certain Joyn termination scenarios, any amount of unused Joyn Additional Prepaid Services shall be repaid by the Company to Joyn.

Accounting Analysis

From inception, the Company's investment in Cooksonia has represented a controlling financial interest, resulting in consolidation of Cooksonia within the Company's consolidated financial statements (see Note 6). The initial cash and in-kind contributions the Company made to Cooksonia have been recorded at carrying value as the transaction was with entities under common control. All assets of Cooksonia after the initial investments, net of the amounts paid to Genomatica, were contributed to Joyn for a 50% equity interest in Joyn. The initial carrying value of the Company's equity interest in Cooksonia was $13.1 million, comprised of the initial $5.0 million cash investment and an $8.1 million adjustment for Cooksonia's claim on net assets in accordance with ASC 810, *Consolidation,* recognized to reflect a certain investor's liquidation preference in a termination event that represents a substantive profit-sharing agreement. The initial carrying value of the non-controlling interest was comprised of cash and intellectual property contributions from the other investors of $29.7 million, less the $8.1 million adjustment for the non-controlling interest holders' claim on the net assets of Cooksonia.

Cooksonia accounted for its 50% equity interest in Joyn as an equity method investment based on the size of its equity interest and its influence on the board of directors. The equity method investment in Joyn was recorded at an initial carrying value of $97.9 million, which was the fair value of Cooksonia's interest in Joyn. The fair value was determined by management with the assistance of a third-party valuation specialist. The option pricing model used a back-solve methodology to determine the total equity value based on the pricing of the Class B Units which were exchanged for cash. The license of intellectual property to Joyn has been accounted for under ASC 606 as described below. Upon liquidation, the net assets of Joyn are not distributed in accordance with each party's respective ownership interest. Depending on the circumstances or type of liquidation event, Bayer or Cooksonia may receive certain preference payments or priority in the assets that are distributed. These preferences represent a substantive profit-sharing arrangement and, accordingly, Cooksonia recognized earnings and losses on its equity method investment using the HLBV method. Refer to Note 6 for additional details on Cooksonia's investment in Joyn.

The Company accounted separately under ASC 606 for Cooksonia's contribution of its intellectual property and the services performed by the Company under technical project plans governed by the Joyn FSA. The Company accounted for the intellectual property sale and the technical services separately as the two agreements were not negotiated with a single commercial objective, the consideration under each agreement was not interdependent, and the intellectual property contribution from Cooksonia was separate and distinct from the research and development services performed under the Joyn FSA.

The Company considers the granting of licenses to the Company's intellectual property as part of its ordinary business activities, and therefore Cooksonia's contribution of intellectual property to Joyn represented a contract with a customer. The intellectual property contained multiple licenses for which control transferred at inception and all revenue associated with the licenses was recognized during the year ended December 31, 2017.

The Joyn FSA functioned as a master services agreement that provided a framework for the research and development services relationship between the Company and Joyn. The Joyn FSA did not create a contract under ASC 606 as it did not identify goods or services to be performed nor did it define consideration under the contract. Upon the execution of a technical project plan under the Joyn FSA, the arrangement qualified as a contract under ASC 606.

The Company accounted for each technical project separately. Each technical project plan provided for distinct services in the context of the contract, was separately negotiated with Joyn, focused on different specified strains with separate scopes of work, and had its own budget. The sole performance obligation under each individual technical project plan consisted of the research and development services as the requisite licenses were transferred prior to the execution of the technical project plans. The transaction price for each technical project plan was determined at plan inception based on the consideration that the Company negotiated in exchange for the services to be provided. The Company's performance under each technical project plan created or enhanced assets under Joyn's control. Joyn received the benefits of the output of the research and development services which allowed Joyn to make strategic business decisions on the direction of each product candidate. Therefore, the Company satisfied the respective performance obligations and recognized revenue over time.

On October 17, 2022, Bayer and Ginkgo entered into the JV Termination Agreement, which initiated the dissolution of Joyn (see Note 3). Upon dissolution, the Company's deferred revenue balance with Joyn was applied to Bayer's Technical Development Agreement with the Company.

As of December 31, 2022 and 2021, the Company had a deferred revenue balance of $0 and $4.6 million, respectively, with Joyn, representing the remaining balance of the prepaid services. During the years ended December 31, 2022, 2021 and 2020, the Company recognized revenue of $2.9 million, $5.3 million and $7.3 million, respectively, from services provided to Joyn for which the balance was applied against deferred revenue.

Amyris, Inc.

During 2017, the Company terminated its collaborative relationship with Amyris, Inc. ("Amyris") as provided in the Amyris Collaboration Agreement and executed a settlement arrangement ("Partnership Agreement") under which the Company is entitled to receive (i) value share payments owed to the Company under the Amyris Collaboration Agreement, (ii) payments of $0.8 million each quarter commencing on December 31, 2018 through the quarter ended September 30, 2022, and (iii) payments due under an interest bearing $12.0 million promissory note.

The parties amended the agreements during the year ended December 31, 2020 to defer certain payments and provide Amyris waivers for noncompliance with certain covenants. As of December 31, 2020, the Company was owed (i) the $12.0 million principal balance on the promissory note which matures on October 19, 2022 and (ii) payments under the Partnership Agreement, as amended, which includes quarterly payments of $0.2 million to $0.3 million through September 2022 and an end of term payment of $9.8 million on October 19, 2022.

The Company concluded that all amounts due are a settlement for accounting purposes as the payments are being made without any obligation from the Company to Amyris. The balance due on the promissory note and right to payments due under the Partnership Agreement are not recognized in the Company's financial statements until the gain is realized. The Company recognizes any payments made under the Partnership Agreement and promissory note, including interest, when the cash is received as a component of other (expense) income. On November 15, 2021, the Company received a $22.8 million payment from Amyris in full settlement of all amounts due under the Partnership Agreement including (i) the $12.0 million principal balance on the promissory note and all interest due, (ii) all quarterly payments due under the Partnership Agreement through September 2022 and (iii) an end of term payment of $9.8 million. Payments received from Amyris are recorded as gain on settlement of partnership agreement in the consolidated statements of operations and comprehensive loss.

Synlogic, Inc.

Summary of Arrangement

In June 2019, the Company entered into several agreements with Synlogic, a publicly traded clinical-stage biopharmaceutical company focused on advancing drug discovery and development for synthetic biology-derived medicines. The Company entered into a Subscription Agreement with Synlogic whereby it purchased 6,340,771 shares of common stock at $9.00 per share for a total purchase price of $57.1 million, which represented a 19.9% equity interest in Synlogic. The Company also entered into a Warrant Agreement whereby it received the right to purchase 2,548,117 shares of common stock of Synlogic at an exercise price of $9.00 per share. The Company made a non-refundable prepayment related to the exercise price of the warrant equal to $8.99 per share for a total payment of $22.9 million. The warrant is only exercisable to the extent the Company's interest in Synlogic does not exceed 19.99%. The Company also entered into a Foundry Services Agreement ("Synlogic FSA") whereby Synlogic provided $30.0 million in cash as a non-refundable prepayment for Foundry services. The prepaid Foundry services can be utilized for development of collaboration strains. Services performed under the services agreement will be applied to the prepaid amount based on the contractual rates included in the contract, based on costs

incurred plus a fixed margin. Work will be performed under the Synlogic FSA pursuant to TDPs. Each TDP will pursue the development of a specific collaboration strain and/or production protocol. The Synlogic FSA will terminate upon the earlier of the exhaustion of the prepayment amount in full or the fifth anniversary of the effective date of the agreement and may be extended in certain circumstances.

Accounting Analysis

The overall arrangement with Synlogic includes the Subscription Agreement whereby the Company purchased shares of Synlogic common stock, the Warrant Agreement whereby the Company prepaid a significant portion of the exercise price of the warrant to purchase Synlogic common stock, which is non-refundable, and the Synlogic FSA whereby the Company will perform services for Synlogic. The Company concluded that these agreements should be considered one arrangement for accounting purposes as they were entered into at the same time and negotiated as a package with a single commercial objective.

At inception, the common stock investment in Synlogic was considered an equity method investment as the Company did not have a controlling financial interest in Synlogic but did have the ability to influence the financial and operating policies through its ownership of common stock. The Company elected to apply the fair value option to account for the equity method investment as the fair value of Synlogic's common stock is objectively determinable based on quoted market prices in an active market for the identical securities. At inception, the fair value of the equity method investment in Synlogic was recorded at $35.8 million as a component of equity method investments on the consolidated balance sheet. Beginning with the third quarter of 2021, due to a decrease in the level of ownership, the investment no longer qualifies for the equity method and was reclassified from equity method investments to investments on the consolidated balance sheet, and from loss on equity method investments to (loss) gain on investments on the consolidated statements of operations and comprehensive loss for all periods presented. However, the Company continues to apply the fair value option to account for its investments in Synlogic. The Company has also elected to apply the fair value option to account for the warrant to purchase Synlogic common stock, which at inception was recorded at $14.4 million as a component of investments on the consolidated balance sheet. See Note 4 for additional information related to the fair value measurements of Synlogic common stock and the Synlogic warrants and Note 5 for additional information related to the net gains and losses recognized during the periods presented related to these securities.

The Company concluded that the TDPs represent contracts with a customer and will be accounted for under ASC 606. At inception, Synlogic prepaid $30.0 million for services under the Synlogic FSA. The prepaid services were reduced by $29.8 million, which represents the excess of the aggregate $80.0 million the Company paid to purchase Synlogic's common stock and warrant over the respective fair values of those instruments. This resulted in a deferred revenue balance of $0.2 million at inception, which is being recognized over the period in which the Company will provide services to Synlogic. The Company recognized nominal amounts of revenue during each of the years ended December 31, 2022, 2021 and 2020 from services provided to Synlogic. As of December 31, 2022 and 2021, the Company had a deferred revenue balance of less than $0.1 million with Synlogic.

17. Employee Benefit Plan

The Company has a 401(k) retirement plan covering substantially all employees. Under the retirement plan, employees make voluntary contributions and the Company makes a 5% non-elective contribution for all employees based on compensation, subject to Internal Revenue Service contribution limits. For the years ended December 31, 2022, 2021 and 2020, the Company contributed $6.1 million, $3.7 million and $2.2 million, respectively, to the retirement plan.

18. Income Taxes

For the years ended December 31, 2022, 2021 and 2020, the loss before income taxes consisted of the following (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Domestic	$ (2,118,095)	$ (1,837,497)	$ (124,834)
Foreign	(3,304)	(625)	—
Total	$ (2,121,399)	$ (1,838,122)	$ (124,834)

For the years ended December 31, 2022, 2021 and 2020, the Company incurred the following income tax (benefit) expense (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Current:			
State	$ 271	$ 1	$ 26
Foreign	159	—	—
Total current	430	1	26
Deferred:			
Federal	(10,500)	(413)	581
State	(3,943)	(912)	1,282
Foreign	(1,014)	(156)	—
Total deferred	(15,457)	(1,481)	1,863
Income tax (benefit) expense	$ (15,027)	$ (1,480)	$ 1,889

A reconciliation of income tax (benefit) expense computed at the statutory corporate income tax rate to the effective income tax rate for the years ended December 31, 2022, 2021 and 2020 is as follows:

	Year Ended December 31,		
	2022	2021	2020
Federal income tax at statutory rate	21.0%	21.0%	21.0%
State income tax	—	4.5%	4.5%
Change in valuation allowance	0.8%	(23.9)%	(31.3)%
Stock-based compensation	(16.7)%	(0.2)%	—
Executive compensation	(5.3)%	(2.0)%	—
Tax credits	0.6%	0.9%	4.8%
Other	0.3%	(0.2)%	(0.5)%
Effective tax rate	0.7%	0.1%	(1.5)%

The Company's deferred tax assets and liabilities consist of the following (in thousands):

	Year Ended December 31,	
	2022	2021
Deferred tax assets:		
Net operating loss carryforwards	$ 434,020	$ 174,127
Tax credit carryforwards	74,336	37,455
Capitalized research and development costs	162,601	—
Accrued expenses	1,330	2,690
Deferred revenue	46,798	45,928
Stock-based compensation	124,126	318,049
Amortizable intangibles	6,010	3,834
Lease liabilities	113,665	—
Tenant allowance	—	2,927
Other	863	—
Deferred tax assets before valuation allowance	963,749	585,010
Valuation allowance	(833,086)	(583,107)
Deferred tax assets, net of valuation allowance	130,663	1,903
Deferred tax liabilities:		
Amortizable intangibles	(23,583)	(4,722)
Property, plant, and equipment	(13,405)	(830)
Lease right-of-use assets	(103,357)	—
Basis differences	—	(1,522)
Deferred tax liabilities	(140,345)	(7,074)
Net deferred taxes	$ (9,682)	$ (5,171)

Activity in the deferred tax assets valuation allowance is summarized as follows (in thousands):

	Beginning of Period	Additions	End of Period
Deferred tax assets valuation allowance:			
Year ended December 31, 2022	$ 583,107	$ 249,979	$ 833,086
Year ended December 31, 2021	$ 143,827	$ 439,280	$ 583,107

The Company has evaluated the positive and negative evidence bearing upon its ability to realize the deferred tax assets. The Company considered its history of cumulative net losses incurred since inception and has concluded that it is more likely than not that it will not realize the benefits of the deferred tax assets. Accordingly, a valuation allowance has been established against the deferred tax assets as of December 31, 2022 and 2021 that are not expected to be realized. The Company reevaluates the positive and negative evidence at each reporting period. The valuation allowance increased on a net basis by approximately $250.0 million during the year ended December 31, 2022 primarily due to an increase in the deferred tax asset related to capitalized research and development costs, as required by the Tax Cuts and Jobs Act of 2017, and the increase in the net operating losses and tax credits carryforwards.

As of December 31, 2022, the Company had federal net operating loss carryforwards of approximately $1,838.0 million, of which $139.2 million begin to expire in 2029 and $1,698.8 million can be carried forward indefinitely. As of December 31, 2022, the Company had state net operating loss carryforwards of approximately $734.1 million, of which $661.9 million begin to expire in 2030 and $72.2 million can be carried forward indefinitely. As of December 31, 2022, the Company had foreign net operating losses of approximately $1.4 million, of which $0.5 million begin to expire in 2030 and $0.9 million can be carried forward indefinitely.

As of December 31, 2022, the Company had federal research and development tax credit carryforwards of approximately $30.3 million which begin to expire in 2029. As of December 31, 2022, the Company also had state research and development and investment tax credit carryforwards of approximately $55.7 million which begin to expire in 2030.

Under Sections 382 and 383 of the U.S. Internal Revenue Code, if a corporation undergoes an ownership change, the corporation’s ability to use its pre-change net operating loss carryforwards and other pre-change tax attributes, such as research tax credits, to offset its post-change income and taxes may be limited. In general, an ownership change generally occurs if there is a cumulative change in its ownership by 5% stockholders that exceeds 50 percentage points over a rolling three-year period. Similar rules may apply under U.S. state tax laws. The Company may have experienced an ownership change in the past and may experience ownership changes in the future as a result of future transactions in its share capital, some of which may be outside of the Company’s control. As a result, if the Company earns net taxable income, the Company's ability to use its pre-change net operating loss carryforwards, or other pre-change tax attributes, to offset U.S. federal and state taxable income and taxes may be subject to significant limitations.

We assess the impact of various tax reform proposals and modifications to existing tax treaties in all jurisdictions where we have operations to determine the potential effect on our business and any assumptions we have made about our future taxable income. We cannot predict whether any specific proposals will be enacted, the terms of any such proposals or what effect, if any, such proposals would have on our business if they were to be enacted. On August 9, 2022, the U.S. government enacted the Creating Helpful Incentives to Produce Semiconductors (“CHIPS Act”), which includes an advanced manufacturing investment tax credit and tax incentives related to semiconductor manufacturing, among other provisions. On August 16, 2022, the U.S. government enacted the Inflation Reduction Act (“IRA”), which imposes a new corporate alternative minimum tax (“CAMT”), an excise tax on stock buybacks, and significant tax incentives for energy and climate initiatives, among other provisions. The CAMT is effective for tax years beginning after December 31, 2022, while the excise tax applies to repurchases of stock after December 31, 2022. The effective dates of the energy-related incentives vary. The Company evaluated the impacts of the CHIPS Act and the IRA and concluded that they do not have a material impact on the Company’s consolidated financial statements.

The Company files tax returns as prescribed by the tax laws of the jurisdictions in which the Company operates. In the normal course of business, the Company is subject to examination by U.S. federal, state, local, and foreign taxing authorities, where applicable. There are currently no tax examinations in progress. As of December 31, 2022, with few exceptions, the Company is no longer subject to U.S. federal, state, local, or foreign examinations by tax authorities for tax years before

2013. To the extent the Company has tax attribute carryforwards, the tax years in which the attribute was generated may still be adjusted upon examination by the Internal Revenue Service or state taxing authorities to the extent utilized in a future period.

The Company accounts for uncertain tax positions using a more likely than not threshold for recognizing and resolving uncertain tax positions. The evaluation of uncertain tax positions is based on factors that include, but are not limited to, changes in tax law, the measurement of tax positions taken or expected to be taken in tax returns, the effective settlement of matters subject to audit, new audit activity and changes in facts or circumstances related to a tax position. The Company evaluates uncertain tax positions on an annual basis and adjusts the level of the liability to reflect any subsequent changes in the relevant facts surrounding the uncertain positions. The Company accounts for interest and penalties related to uncertain tax positions as part of its provision for income taxes. As of December 31, 2022 and 2021, the Company had no recorded liabilities for uncertain tax positions and had no accrued interest or penalties related to uncertain tax positions. The Company does not expect a material change in unrecognized tax benefits in the next twelve months.

19. Net Loss per Share

As a result of the SRNG Business Combination, the Company has retroactively restated the weighted average shares outstanding prior to September 16, 2021 to give effect to the Exchange Ratio.

The Company computes net loss per share of the Class A common stock and Class B common stock using the two-class method required for participating securities. The earnings per share amounts are the same for the different classes of common stock because the holders of each class are legally entitled to equal per share distributions whether through dividends or liquidation. The calculation of basic and diluted earnings per common share are as follows (in thousands, except per share amounts):

	Year ended December 31,		
	2022	2021	2020
Numerator:			
Net loss attributable to Ginkgo Bioworks Holdings, Inc. stockholders, basic	$ (2,104,929)	$ (1,830,047)	$ (126,609)
Change in fair value of warrant liabilities	—	58,615	—
Change in fair value of contingent consideration common shares liability	3,143	—	—
Net loss attributable to Ginkgo Bioworks Holdings, Inc. stockholders, diluted	$ (2,108,072)	$ (1,888,662)	$ (126,609)
Denominator			
Weighted average common shares outstanding, basic	1,679,061,465	1,359,848,803	1,274,766,915
Effect of dilutive securities:			
Warrants	—	524,540	—
Contingent consideration common shares	777,384	—	—
Weighted average common shares outstanding, diluted	1,679,838,849	1,360,373,343	1,274,766,915
Basic net loss per share	$ (1.25)	$ (1.35)	$ (0.10)
Diluted net loss per share	$ (1.25)	$ (1.39)	$ (0.10)

The following potential common shares, presented based on amounts outstanding at each period end, were excluded from the calculation of diluted net loss per share attributable to Ginkgo Bioworks Holdings, Inc. common stockholders for the periods presented because including them would have been anti-dilutive:

	As of December 31,		
	2022	2021	2020
Warrants to purchase Class A common stock	51,824,895	—	1,020,187
Outstanding stock options	12,710,709	25,228,853	33,354,871
Unvested RSUs	134,436,442	168,321,952	124,932,207
Unvested RSAs	4,091	182,622	419,049
Ginkgo and Sponsor earnout shares [1]	156,780,675	160,995,237	—
	355,756,812	354,728,664	159,726,314

(1) Represents earnout shares for which the vesting conditions have not been satisfied.

20. Related Parties

Related party transactions included in the consolidated balance sheet, excluding the Company's investments and equity method investments, are summarized below (in thousands):

	As of December 31,	
	2022	2021
Accounts receivable:		
Joyn	$ —	$ 5
Motif	—	3,020
Allonnia	140	849
Arcaea	335	724
Verb	361	—
Ayana	403	—
BiomEdit	288	—
Other equity investees	31	—
	$ 1,558	$ 4,598
Deferred revenue, current and non-current:		
Joyn	$ —	$ 4,608
Motif	52,018	52,171
Genomatica	6,250	17,111
Allonnia	35,876	38,016
Arcaea	38,334	47,356
BiomEdit	8,144	—
Other equity investees	875	1,559
	$ 141,497	$ 160,821

Related party transactions included in the consolidated statements of operations and comprehensive loss, excluding the losses on the Company's investments and equity method investments, are summarized below (in thousands):

	Year Ended December 31,		
	2022	2021	2020
Foundry revenue:			
Joyn	$ 2,896	$ 5,254	$ 7,273
Motif	1,937	20,224	20,798
Genomatica	10,861	12,868	9,431
Allonnia	4,332	5,126	4,960
Arcaea	13,490	3,676	—
Verb	2,359	—	—
Ayana	1,266	—	—
BiomEdit	1,016	—	—
Other equity investees	656	13	73
	$ 38,813	$ 47,161	$ 42,535

Beginning in April 2022, the Company purchased a series of convertible promissory notes from its then equity method investee, Joyn, in the aggregate principal amount of $10.0 million for the purpose of financing Joyn's working capital needs. Each convertible promissory note was unsecured, had a maturity date of March 31, 2023 and an interest rate of 4.5% per annum. The notes were automatically convertible into equity at a 20% discount upon a qualifying equity financing. Additionally, the Company could elect to convert the notes into equity at a 20% discount upon a non-qualifying equity financing, at maturity, or elect to be repaid in cash upon a change in control or initial public offering. The Company evaluated the notes' conversion and redemption features for embedded derivatives and determined that there is no embedded derivative to record. The Company also determined that the convertible notes are not in-substance common stock and therefore are not considered an additional investment in the equity method investee. During the year ended December 31, 2022, the carrying amount of the notes was reduced by $5.3 million, which represented the excess loss on the equity method investment in Joyn over the carrying value of the investment, which has been reduced to zero during the period. The outstanding balance of the notes receivable was effectively settled as part of the business combination transaction with Bayer and Joyn described in Note 3 and was included as part of the consideration paid for the business combination.

Refer to Note 5 and 16 for additional details on the Company's investments and equity method investments held in its related parties.

21. Subsequent Events

On March 10, 2023, Silicon Valley Bank ("SVB"), based in Santa Clara, California, was closed by the California Department of Financial Protection and Innovation, which appointed the FDIC as receiver. At the time of closing, the Company's wholly-owned subsidiary Zymergen had a total cash balance of approximately $74 million held in deposit accounts at SVB, of which approximately $10 million is held as collateral for letters of credit under certain lease agreements. The Company does not maintain any other material accounts or lines of credit with SVB. The cash balance with SVB at the time of closing represents approximately 6% of the Company's cash and cash equivalents as of December 31, 2022. The Company is currently evaluating the potential impact of SVB's failure on its customers, vendors, investees and other third parties. To the extent that these counterparties are adversely affected, the Company may experience difficulty collecting accounts and notes receivable, loss of revenues, impairments to non-marketable equity securities and SAFEs, and a decrease in the fair value of investments and notes receivable. At this time, an estimate of the financial effect, if any, of SVB's closure on the Company's financial position, results of operations and cash flows cannot be made. The Company is continually monitoring developments related to the recovery of its uninsured funds at SVB as well as the potential impacts of SVB's closure on the Company's counterparties.