Grow
with Ginkgo
DISCLAIMER

Disclaimer
This confidential presentation (the “presentation”) is being delivered to you by Soaring Eagle Acquisition Corp. ("SRNG") and Ginkgo Bioworks, Inc. ("Ginkgo") for by SRNG and Ginkgo in connection with their proposed business combination and the offering of the securities of the post-business combination company in a private placement (the “Transaction”). This presentation is for information purposes only and is being provided to you solely in your capacity as a potential investor in considering an investment in Ginkgo. Any reproduction or distribution of this presentation, in whole or in part, or the disclosure of its contents, without the prior consent of Ginkgo is prohibited. By accepting this presentation, each recipient agrees (on behalf of itself and each of its directors, partners, officers, employees, attorneys, financial advisors, agents and representatives (each of the foregoing, a “representative”) agrees: (i) to maintain (and direct its representatives to maintain) the confidentiality of all information that is contained in this presentation and not already in the public domain; and (ii) to return or destroy (and direct its representatives to return or destroy) all copies of this presentation or portions thereof in its possession following the request for the return or destruction of such copies.

Neither this presentation nor any oral statements made in connection with this presentation shall constitute an offer to sell or the solicitation of an offer to buy any securities, or the solicitation of any proxy, vote, consent or approval, in any jurisdiction in connection with the proposed business combination, nor shall there be any sale of securities in any jurisdiction in which the offer, solicitation or sale would be unlawful prior to the registration or qualification under the securities laws of any such jurisdiction. This communication is restricted by law, it is not intended for distribution to, or use by any person in, any jurisdiction where such distribution or use would be contrary to local law or regulation.

No Representations or Warranties
This presentation is for informational purposes only and does not purport to contain all of the information that may be required to evaluate a possible investment decision with respect to Ginkgo. The recipient agrees and acknowledges that this presentation is not intended to form the basis of any investment decision by the recipient and does not constitute investment, tax or legal advice. No representation or warranty, express or implied, is or will be given by SRNG or Ginkgo or any of their respective affiliates, directors, officers, employees or advisers or any other person as to the accuracy or completeness of the information in this presentation or any other written, oral or other communications transmitted or otherwise made available to any party in the course of its evaluation of a possible transaction between SRNG and Ginkgo and no responsibility or liability whatsoever is accepted for the accuracy or sufficiency thereof or for any errors, omissions or misstatements, negligent or otherwise, relating thereto. The recipient also acknowledges and agrees that the information contained in this presentation is preliminary in nature and is subject to change, and any such changes may be material. SRNG and Ginkgo disclaim any duty to update the information contained in this presentation.

Forward-Looking Statements
This presentation includes “forward-looking statements” within the meaning of the “safe harbor” provisions of the Private Securities Litigation Reform Act of 1995. SRNG’s and Ginkgo’s actual results may differ from their expectations, estimates and projections, and, consequently, you should not rely on these forward-looking statements as predictions of future events. Words such as “expect,” “estimate,” “project,” “budget,” “forecast,” “anticipate,” “intend,” “plan,” “may,” “will,” “could,” “should,” “believes,” “predicts,” “potential,” “continue,” and similar expressions are intended to identify such forward-looking statements. These forward-looking statements include, without limitation, SRNG’s and Ginkgo’s expectations with respect to future performance and anticipated financial impacts of the Transaction, the satisfaction of closing conditions to the Transaction and the timing of the completion of the Transaction. These forward-looking statements involve significant risks and uncertainties that could cause the actual results to differ materially from the expected results. You should carefully consider the risks and uncertainties described in the “Risk Factors” section of SRNG’s registration statement on Form S-1. In addition, there will be risks and uncertainties described in the proxy statement/prospectus on Form S-4 relating to the Transaction, which is expected to be filed by Ginkgo with the Securities and Exchange Commission (the “SEC”), and other documents filed by SRNG from time to time with the SEC. These filings identify and address other important risks and uncertainties that could cause actual events and results to differ materially from those contained in the forward-looking statements. Most of these factors are outside SRNG’s and Ginkgo’s control and are difficult to predict. Factors that may cause such differences include, but are not limited to: (1) the outcome of any legal proceedings that may be instituted against SRNG or Ginkgo following the announcement of the Transaction; (2) the inability to complete the Transaction, including due to the inability to concurrently close the business combination and the private placement of common stock or due to failure to obtain approval of the stockholders of SRNG; (3) delays in obtaining, adverse conditions contained in, or the inability to obtain necessary regulatory approvals or delays in completing regulatory reviews, required to complete the Transaction; (4) the risk that the Transaction disrupts current plans and operations as a result of the announcement and consummation of the Transaction; (5) the inability to recognize the anticipated benefits of the Transaction, which may be affected by, among other things, competition, the ability of the combined company to grow and manage growth profitably, maintain relationships with customers and suppliers and retain key employees; (6) costs related to the Transaction; (7) changes in the applicable laws or regulations; (8) the possibility that the combined company may be adversely affected by other economic, business, and/or competitive factors; (9) the impact of the global COVID-19 pandemic; (10) the risks described in the Appendix hereto; and (11) other risks and uncertainties indicated from time to time described in SRNG’s registration on Form S-1, including those under “Risk Factors” therein, and in SRNG’s other filings with the SEC. SRNG and Ginkgo caution that the foregoing list of factors is not exclusive and not to place undue reliance upon any forward-looking statements, including projections, which speak only as of the date made. Neither SRNG nor Ginkgo undertakes or accepts any obligation to release publicly any updates or revisions to any forward-looking statements to reflect any change in its expectations or any change in events, conditions or circumstances on which any such forward-looking statement is based.

Industry and Market Data
In this presentation, SRNG and Ginkgo rely on and refer to certain information and statistics regarding the markets and industries in which Ginkgo competes. Such information and statistics are based on Ginkgo’s management’s estimates and/or obtained from third-party sources, including reports by market research firms and company filings. While Ginkgo believes such third-party information is reliable, there can be no assurance as to the accuracy or completeness of the indicated information. Neither Ginkgo nor SRNG has independently verified the accuracy or completeness of the information provided by the third-party sources.
with the completion of the audit for the fiscal year ended December 31, 2020. As such, Ginkgo’s actual results and financial condition as reflected in the financial statements that will be included in the proxy statement/prospectus on Form S-4 have been taken from or prepared based on historical financial statements of Ginkgo, including unaudited financial statements for its fiscal year ended December 31, 2020. This information is preliminary and subject to adjustment in connection with the completion of the audit for the fiscal year ended December 31, 2020. As such, Ginkgo’s actual results and financial condition as reflected in the financial statements that will be included in the proxy statement/prospectus on Form S-4 for the proposed Transaction may be adjusted or presented differently from the historical financial information herein, and the variations could be material.

Non-GAAP Financial Measures

Certain of the financial measures included in this presentation, including Foundry Billable Revenue, Foundry Billable Revenue Growth, Net Present Value (NPV) and Adjusted EBITDA, have not been prepared in accordance with generally accepted accounting principles (“GAAP”), and constitute “non-GAAP financial measures” as defined by the SEC. Ginkgo has included these non-GAAP financial measures (including on a forward-looking basis) because it believes they provide an additional tool for investors to use in evaluating the financial performance and prospects of Ginkgo or any successor entity in the Transaction. These non-GAAP financial measures should not be considered in isolation from, or as an alternative to, financial measures determined in accordance with GAAP. In addition, these non-GAAP financial measures may differ from non-GAAP financial measures with comparable names used by other companies. See the Appendix for a description of these non-GAAP financial measures and a reconciliation of the historic measures to Ginkgo’s most comparable GAAP financial measures. Note however, that to the extent forward-looking non-GAAP financial measures are provided herein, they are not reconciled to comparable forward-looking GAAP measures due to the inherent difficulty in forecasting and quantifying certain amounts that are necessary for such reconciliation.

Use of Projections

This presentation also contains certain financial forecasts, including projected Foundry Billable Revenue, Foundry Billable Revenue Growth, Foundry Revenue (GAAP), Biosecurity Revenue, Total GAAP Revenue, Adjusted EBITDA and CapEx. Neither SRNG’s nor Ginkgo’s independent auditors have studied, reviewed, compiled or performed any procedures with respect to the projections for the purpose of their inclusion in this presentation, and, accordingly, neither of them have expressed an opinion or provided any other form of assurance with respect thereto for the purpose of this presentation. These projections are for illustrative purposes only and should not be relied upon as being necessarily indicative of future results. In this presentation, certain of the above-mentioned projected information has been provided for purposes of providing comparisons with historical data. The assumptions and estimates underlying the prospective financial information are inherently uncertain and are subject to a wide variety of significant business, economic and competitive risks and uncertainties that could cause actual results to differ materially from those contained in the prospective financial information. Projections are inherently uncertain due to a number of factors outside of SRNG’s or Ginkgo’s control. While all financial projections, estimates and targets are necessarily speculative, SRNG and Ginkgo believe that the preparation of prospective financial information involves increasingly higher levels of uncertainty the further out the projection, estimate or target extends from the date of preparation. Accordingly, there can be no assurance that the prospective results are indicative of future performance of the combined company after the Transaction or that actual results will not differ materially from those presented in the prospective financial information. Inclusion of the prospective financial information in this presentation should not be regarded as a representation by any person that the results contained in the prospective financial information will be achieved.

Participation in Solicitation

SRNG and Ginkgo and their respective directors and executive officers may be deemed under SEC rules to be participants in the solicitation of proxies of SRNG’s shareholders in connection with the proposed Transaction. Investors and security holders may obtain more detailed information regarding the names and interests in the proposed Transaction of SRNG’s directors and officers in SRNG’s filings with the SEC, including SRNG’s registration statement on Form S-1, which was originally filed with the SEC on December 23, 2020. To the extent that holdings of SRNG’s securities have changed from the amounts reported in SRNG’s registration statement on Form S-1, such changes have been or will be reflected on Statements of Change in Ownership on Form 4 filed with the SEC. Information regarding the persons who may, under SEC rules, be deemed participants in the solicitation of proxies of SRNG’s shareholders in connection with the proposed Transaction will be set forth in the proxy statement/prospectus on Form S-4 for the proposed Transaction, which is expected to be filed by SRNG with the SEC.

DISCLAIMER

Trademarks

This presentation may contain trademarks, service marks, trade names and copyrights of other companies, which are the property of their respective owners, and SRNG’s and Ginkgo’s use thereof does not imply an affiliation with, or endorsement by, the owners of such trademarks, service marks, trade names and copyrights. Solely for convenience, some of the trademarks, service marks, trade names and copyrights referred to in this presentation may be listed without the TM, ® or © symbols, but SRNG and Ginkgo will assert, to the fullest extent under applicable law, the rights of the applicable owners, if any, to these trademarks, service marks, trade names and copyrights.

Private Placement

The securities to which this presentation relate have not been registered under the Securities Act of 1933, as amended (the “Securities Act”), or the securities laws of any other jurisdiction. This presentation relates to securities that SRNG intends to offer in reliance on exemptions from the registration requirements of the Securities Act and other applicable laws. These exemptions apply to offers and sales of securities that do not involve a public offering. The securities have not been approved or recognized by any federal, state or foreign securities authorities, nor have any of these authorities passed upon the merits of this offering or determined that this presentation is accurate or complete. Any representation to the contrary is a criminal offense.

Financial Information

This presentation contains certain estimated preliminary financial results and key operating metrics for the year ended December 31, 2020, and the historical financial information with respect to Ginkgo contained in this presentation has been taken from or prepared based on historical financial statements of Ginkgo, including unaudited financial statements for its fiscal year ended December 31, 2020. This information is preliminary and subject to adjustment in connection with the completion of the audit for the fiscal year ended December 31, 2020. As such, Ginkgo’s actual results and financial conditions as reflected in the financial statements that will be included in the proxy statement/prospectus on Form S-4 for the proposed Transaction may be adjusted or presented differently from the historical financial information herein, and the variations could be material.

Non-GAAP Financial Measures

Certain of the financial measures included in this presentation, including Foundry Billable Revenue, Foundry Billable Revenue Growth, Net Present Value (NPV) and Adjusted EBITDA, have not been prepared in accordance with generally accepted accounting principles (“GAAP”), and constitute “non-GAAP financial measures” as defined by the SEC. Ginkgo has included these non-GAAP financial measures (including on a forward-looking basis) because it believes they provide an additional tool for investors to use in evaluating the financial performance and prospects of Ginkgo or any successor entity in the Transaction. These non-GAAP financial measures should not be considered in isolation from, or as an alternative to, financial measures determined in accordance with GAAP. In addition, these non-GAAP financial measures may differ from non-GAAP financial measures with comparable names used by other companies. See the Appendix for a description of these non-GAAP financial measures and a reconciliation of the historic measures to Ginkgo’s most comparable GAAP financial measures. Note however, that to the extent forward-looking non-GAAP financial measures are provided herein, they are not reconciled to comparable forward-looking GAAP measures due to the inherent difficulty in forecasting and quantifying certain amounts that are necessary for such reconciliation.

Use of Projections

This presentation also contains certain financial forecasts, including projected Foundry Billable Revenue, Foundry Billable Revenue Growth, Foundry Revenue (GAAP), Biosecurity Revenue, Total GAAP Revenue, Adjusted EBITDA and CapEx. Neither SRNG’s nor Ginkgo’s independent auditors have studied, reviewed, compiled or performed any procedures with respect to the projections for the purpose of their inclusion in this presentation, and, accordingly, neither of them have expressed an opinion or provided any other form of assurance with respect thereto for the purpose of this presentation. These projections are for illustrative purposes only and should not be relied upon as being necessarily indicative of future results. In this presentation, certain of the above-mentioned projected information has been provided for purposes of providing comparisons with historical data. The assumptions and estimates underlying the prospective financial information are inherently uncertain and are subject to a wide variety of significant business, economic and competitive risks and uncertainties that could cause actual results to differ materially from those contained in the prospective financial information. Projections are inherently uncertain due to a number of factors outside of SRNG’s or Ginkgo’s control. While all financial projections, estimates and targets are necessarily speculative, SRNG and Ginkgo believe that the preparation of prospective financial information involves increasingly higher levels of uncertainty the further out the projection, estimate or target extends from the date of preparation. Accordingly, there can be no assurance that the prospective results are indicative of future performance of the combined company after the Transaction or that actual results will not differ materially from those presented in the prospective financial information. Inclusion of the prospective financial information in this presentation should not be regarded as a representation by any person that the results contained in the prospective financial information will be achieved.

Participation in Solicitation

SRNG and Ginkgo and their respective directors and executive officers may be deemed under SEC rules to be participants in the solicitation of proxies of SRNG’s shareholders in connection with the proposed Transaction. Investors and security holders may obtain more detailed information regarding the names and interests in the proposed Transaction of SRNG’s directors and officers in SRNG’s filings with the SEC, including SRNG’s registration statement on Form S-1, which was originally filed with the SEC on December 23, 2020. To the extent that holdings of SRNG’s securities have changed from the amounts reported in SRNG’s registration statement on Form S-1, such changes have been or will be reflected on Statements of Change in Ownership on Form 4 filed with the SEC. Information regarding the persons who may, under SEC rules, be deemed participants in the solicitation of proxies to SRNG’s shareholders in connection with the proposed Transaction will be set forth in the proxy statement/prospectus on Form S-4 for the proposed Transaction, which is expected to be filed by SRNG with the SEC.

Investors and security holders of SRNG and Ginkgo are urged to read the proxy statement/prospectus and other relevant documents that will be filed with the SEC carefully and in their entirety when they become available because they will contain important information about the proposed Transaction. Investors and security holders will be able to obtain free copies of the proxy statement and other documents containing important information about SRNG and Ginkgo through the website maintained by the SEC at www.sec.gov. Copies of the documents filed with the SEC by SRNG can be obtained free of charge by directing a written request to SRNG, 955 Fifth Avenue, New York, NY 10075.
Transaction Overview

**Transaction Summary**

- Ginkgo Bioworks has entered into a definitive agreement to merge with Soaring Eagle Acquisition Corp. (Nasdaq:SRNG), valuing Ginkgo at an enterprise value of $15 billion.
- All-primary transaction will result in gross proceeds of $2.5 billion, through a combination of:
  - SRNG’s $1,725 million cash in trust (1)
  - $775 million of committed PIPE financing at $10 / share including anchor commitments from Baillie Gifford, Putnam Investments, and funds and accounts managed by Counterpoint Global (Morgan Stanley Investment Management) and a $75 million investment by the Soaring Eagle sponsor group
  - 30% of sponsor promote converted to earnout; additionally, Ginkgo shareholders will be granted up to 180M earnout shares (11% seller earnout) vesting between $12.50 and $20/share
- Closing expected in Q3 2021

**Pro Forma Enterprise Value (4)**

<table>
<thead>
<tr>
<th>($M, except per share amount)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share Price</td>
</tr>
<tr>
<td>Pro Forma Shares Outstanding (M)</td>
</tr>
<tr>
<td><strong>POST-TRANSACTION EQUITY VALUE</strong></td>
</tr>
<tr>
<td>(-) Cash(6)</td>
</tr>
<tr>
<td><strong>PRO FORMA ENTERPRISE VALUE</strong></td>
</tr>
</tbody>
</table>

**Illustrative Sources & Uses**

<table>
<thead>
<tr>
<th>Sources</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRNG Cash Held in Trust(1)</td>
<td>Consideration Shares(2)</td>
</tr>
<tr>
<td>$1,725</td>
<td>$15,000</td>
</tr>
<tr>
<td>Cash Proceeds from PIPE</td>
<td>Cash to Balance Sheet(1)</td>
</tr>
<tr>
<td>775</td>
<td>2,365</td>
</tr>
<tr>
<td>Rollover by Equity Holders(2)</td>
<td>Parties’ Transaction Fees(3)</td>
</tr>
<tr>
<td>15,000</td>
<td>135</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>TOTAL</strong></td>
</tr>
<tr>
<td>$17,500</td>
<td>$17,500</td>
</tr>
</tbody>
</table>

**Illustrative Pro Forma Ownership (7)**

- 84%: Ginkgo Bioworks
- 10%: SRNG Shareholders
- 4%: PIPE Shareholders
- 2%: Sponsor Shares

---

(1) Assumes no redemptions
(2) Includes value attributable to all outstanding equity awards other than those subject to unsatisfied service-based vesting conditions; includes aggregate exercise prices of outstanding options and warrants.
(3) Represents estimated transaction expenses based on a $775M PIPE as of 5/6/2021.
(4) Enterprise value calculation excludes $18M in financing lease liabilities as of 12/31/2020.
(5) Includes 1.5B Consideration Shares to Ginkgo, 172.5M shares to SRNG shareholders, 77.5M shares to PIPE shareholders and 30.2M shares retained by SRNG sponsor (inclusive of 150,000 shares transferred to SRNG’s independent directors)
(6) Includes Ginkgo cash balance of $274M as of 4/30/2021; excludes restricted cash and any disbursements that may be made from US DFC loan under negotiation.
(7) Assumes no redemptions and excludes SRNG / Ginkgo earn-out shares and SRNG warrants.
Our Mission

Make biology easier to engineer
The founders have been working together for nearly 20 years on this vision of synthetic biology.
We can program cells like we program computers.
Cell programming is increasingly impacting our lives

Vaccines are developed and manufactured using cell programming tools

Ginkgo’s work to close raw material gaps in the mRNA vaccine supply chain was recently featured on 60 Minutes
Cell programming is addressing our most challenging environmental and social issues

**Pharma & Biotech**
- Antibody therapeutic development
- Nucleic acid vaccine production
- Antibiotic discovery and manufacturing
- Microbiome therapeutics
- Gene and cell therapies

**Industrials & Environment**
- Wastewater remediation
- Renewable chemicals
- PFAS degradation
- Sustainable building materials
- Carbon sequestration

**Food & Agriculture**
- Animal protein replacement
- Sugar reduction
- Brewing & baking
- Fertilizer reduction
- Pest control
- Animal feed and aquaculture

**Consumer & Technology**
- Plant extracts: flavors, fragrances, cannabinoids
- Haircare and skincare proteins
- Textiles and dyes
- Electronic coatings

and we’re just getting started...
Ginkgo provides program management and technical execution to product companies across all industries.

Ginkgo integrates standard hardware and wraps it in proprietary software and automation.

Ginkgo is building the leading horizontal platform for cell programming across all industries.

Ginkgo is the interface between a series of complex technologies and a customer spec.
We program cells for our customers **so they can develop new products**
Customers run their programs on Ginkgo’s platform to drive business value

Ginkgo partnered with Motif to develop more delicious and sustainable food.

In just 1 year, 6 prototype strains were developed, and product samples were produced for benchmarking and early application testing. Improved variants were designed, built and validated over the next 9 months.

The strain’s performance exceeded Motif’s specifications by >70%.
Ginkgo is critical to our success and development of synbio solutions needed for us to be successful.

Ginkgo is a valuable partner providing services to our R&D group that could not otherwise be done internally.

Our collaboration has been successful in large part because the Ginkgo team is thoughtful, creative, communicative, and willing to iterate as more data becomes available. As we grow, we hope to foster a similar culture.

We highly value the Ginkgo relationship and the window it provides into synthetic biology as an industry and national capability.

Ginkgo is addressing a foundational challenge that enables us to scale our antibody discovery platform. Prior to partnering, we had screened 173 antibodies on our own. Together, we are planning an initial screen of 5,000 antibodies and are jointly developing tools to screen tens of thousands at dramatically lower costs.

Ginkgo is opening new avenues for research programs. Early exploratory work, but critically important to support our pipeline.

Ginkgo is key enabler of scale up.

Ginkgo developed a process to give us a competitive advantage.
Combining an industry-defining founding team with proven executives who have built iconic public companies

Founding team has been working together for nearly 20 years

- Jason Kelly, CEO
- Reshma Shetty, COO
- Barry Canton, CTO
- Austin Che, Strategy
- Tom Knight, DNA Hacker

Soaring Eagle brings a track record of success in SPACs

- Harry Sloan, CEO, Chairman
- Jeff Sagansky, Partner
- Eli Baker, President, CFO
- Arie Belldegrun, Founder, Fmr CEO/Chairman, Kite Pharma, Founder, Chairman, Allogene

With long-term support from a deeply experienced, industry-leading independent board

- Marijn Dekkers, Chairman, Governance/Nominating Chair, Board member since 2019
  - Fmr Chairman, Unilever (NYSE:UL)
  - Fmr CEO, Bayer (XTRA:BYN)
  - Fmr CEO, Thermo Fisher (NYSE:TMO)

- Christian Henry, Audit Committee Chair, Board member since 2016
  - President/CEO, PacBio (Nasdaq:PACB)
  - Fmr CFO/CCO, Illumina (Nasdaq:ILMN)

- Shyam Sankar, Compensation Committee Chair, Board member since 2016
  - COO, Palantir (NYSE: PLTR)
We believe...

1. Programming cells will be as impactful as programming computers.

2. Ginkgo’s platform improves with scale.

3. Ginkgo is becoming the industry standard.

4. Our value increases with each new program added to the platform.

The same underlying technology can be used to create applications across all physical goods industries. Ginkgo is the first horizontal platform in this industry, supporting all end markets.

Each new program drives platform improvements, leading to more demand.

We believe Ginkgo’s ecosystem of services will make us the obvious partner in the enormous, and largely untapped, market for cell programming.

Each new program adds predictable near-term revenue from usage fees and provides Ginkgo upside through value share.
We believe...

1. Programming cells will be as impactful as programming computers

2. Ginkgo’s platform improves with scale

3. Ginkgo is becoming the industry standard

4. Our value increases with each new program added to the platform

The same underlying technology can be used to create applications across all physical goods industries. Ginkgo is the first horizontal platform in this industry, supporting all end markets.
The promise and power of biology has never been more apparent

APRIL 2019
“...permits the manufacture of all manner of things which used to be hard, even impossible, to make: pharmaceuticals, fuels, fabrics, foods, and fragrances can all be built molecule by molecule.”

11 MONTHS LATER: MARCH 2020
“Planet earth is shutting down... desperate governments are... handing out trillions of dollars in aid and loan guarantees”

1 YEAR LATER: MARCH 2021
“Now we have entered... a life-science revolution. Children who study digital coding will be joined by those who study genetic code.”
R&D spending alone accounts for nearly $40B in untapped demand

Existing market for cell engineering lab operations ($B)

- Cell Engineering Labor
- Cell Engineering Tools

Source: Piper Sandler Research

(1) Assumes approximately $2M annual expense per program, in line with current average annual spend per program at Ginkgo

Our scale dramatically reduces costs

We bring efficiency to scientists at the bench

This market represents over 20,000+ potential new cell programs (1)
$2 to $4 trillion emerging market for bioengineered products

Annual Direct Economic Impact By Domain
2030—2040 (partial estimate)

Programming biology is to the physical world what programming computers is to the information economy


Note: these estimates reflect the estimated biotechnology penetration of these end-markets
We believe...

1. Programming cells will be as impactful as programming computers

2. Ginkgo’s platform improves with scale

3. Ginkgo is becoming the industry standard

4. Our value increases with each new program added to the platform

Each new program drives platform improvements, leading to more demand.
Over 70 major customer programs across diverse industries have run on our platform.

Cumulative Major 3rd Party Programs

- **CONSUMER & TECHNOLOGY**
  - Early experimentation making fine chemicals for flavors & fragrances

- **INDUSTRIAL & ENVIRONMENT**
  - Experience in flavors & fragrances enabled expansion into industrial chemicals
  - Selection by Bayer for agriculture JV after significant industry vetting

- **AGRICULTURE**
  - Motif (Louis Dreyfus and Fonterra) launches portfolio of animal-free protein programs
  - Selection by Bayer for agriculture JV after significant industry vetting

- **FOOD & NUTRITION**
  - Motif (Louis Dreyfus and Fonterra) launches portfolio of animal-free protein programs

- **PHARMA & BIOTECH**
  - Mammalian capabilities & Synlogic partnership

PRE-2015: GOVERNMENT PROGRAMS
- First 5+ years of technology building funded through non-dilutive government programs (DARPA, SBIR, etc.)

Note: “Major” programs exclude proof of concept work and ancillary projects and typically have at least $500K actual / expected development costs on behalf of a customer.
Market defining customers have validated the platform across a wide range of end markets.

Note: Reflects a portion of current / completed programs; program codes have been anonymized.
The Foundry – Ginkgo’s physical infrastructure – drives a strong scale economic

Early stages of building higher scale workflows and testing automated techniques

2016

2018

2019

2020

Created scale modules by function (e.g. DNA synthesis, -omics, sequencing, fermentation, etc.)

Added mammalian cell engineering capabilities

Lab-scale automation and significantly increased NGS capacity

KNIGHT’S LAW – our scale theory

“The cost to genetically engineer a cell decreases by 50% and the number of designs tested increases by 3X+ per year in Ginkgo’s automated cell programming foundries.”
Ginkgo’s Foundry is scaling roughly 3x per year

**LAB OPERATIONS**: MEASURING WORK DONE ON THE PLATFORM

**STRAIN TESTS**: MEASURING THE OUTPUT OF THE PLATFORM


2–3x annual increase pre-COVID

3–4x annual increase pre-COVID

DEVELOPMENT AND ADOPTION OF NEW TECHNOLOGIES ENABLES ORDER OF MAGNITUDE IMPROVEMENTS IN CAPACITY
Unit costs to program cells have decreased by 50% per year

Note: Costs include all operational and R&D-related activities (i.e. both current programs and investments in future capacity)
**Codebase** - Ginkgo’s scale data asset - is a source of long-term competitive advantage

3.4B+ unique gene sequences pulled from all public databases

440M proprietary gene sequences acquired

And growing… codebase accumulates as we run new experiments in the foundry and build new:

“Ginkgo will organize the world’s biological code and make it useful.”

-GINGKO HEAD OF CODEBASE, PATRICK BOYLE
We learn from **wild biology** to grow our Codebase

Some crops, such as legumes, have symbiotic microbes that convert atmospheric nitrogen into fertilizer, delivered straight to the plant’s roots...

Joyn is working with Ginkgo to leverage this same Codebase for key cereal crops.

The $70B+ nitrogen-based fertilizer market\(^{(1)}\) accounts for approximately:

- **5%** of global greenhouse gas emissions\(^{(2)}\)
- **4%** of global natural gas production \(^{(3)}\)

...and local environmental problems from runoff.

---

\(^{(1)}\) Source: Grandview Research, as of 2018; imputed 2021 market shown.
\(^{(2)}\) Source: US Environmental Protection Agency, as of 2018.
CATTLE (BEEF & DAIRY) INDUSTRY:

$1 trillion global market(1)
9% of global greenhouse gas emissions(2)

We design codebase when working on programs

Organisms like yeast (shown above) are the biological factories for producing a wide range of molecules

(1) Note targets are illustrative as Motif has not announced specific products.
The **SAME YEAST** used to generate proteins for food can produce proteins used in personal care products, such as collagen, elastin, and keratin.

(1) Note targets are illustrative as Kalo has not announced specific products.
Ginkgo’s **virtuous cycle** drives platform growth
We believe...

1. Programming cells will be as impactful as programming computers

2. Ginkgo’s platform improves with scale

3. Ginkgo is becoming the industry standard

4. Our value increases with each new program added to the platform

We believe Ginkgo’s ecosystem of services will make us the obvious partner in the enormous, and largely untapped, market for cell programming.
Each new cell program can **accelerate adoption** within new markets and lead to further sales with existing customers.

### Ability to grow significantly within existing customer accounts

![Bar chart showing the number of active programs per year for a customer (Customer X).]

<table>
<thead>
<tr>
<th>Year</th>
<th># of Active Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>1 Major, 1 Minor, 1 Proof of Concept</td>
</tr>
<tr>
<td>Year 2</td>
<td>2 Major, 2 Minor, 2 Proof of Concept</td>
</tr>
<tr>
<td>Year 3</td>
<td>3 Major, 3 Minor, 3 Proof of Concept</td>
</tr>
<tr>
<td>Year 4</td>
<td>4 Major, 4 Minor, 4 Proof of Concept</td>
</tr>
<tr>
<td>Year 5</td>
<td>5 Major, 5 Minor, 5 Proof of Concept</td>
</tr>
</tbody>
</table>

### Early proof points within an industry can lead to follow-on demand

![Diagram showing a case study with Moderna.]

**[CONFIDENTIAL]**

In advanced discussions with leading pharmaceutical contract manufacturer.

**[CONFIDENTIAL]**

Optimizing pDNA production for another nucleic acid vaccine company.

---

(1) Major programs typically incur well over $500K of annual R&D spending, minor programs are typically smaller add-on programs that have less than $500K of annual R&D spend, proof-of-concept programs are typically small programs that are often set up as a business development effort.
Strong 2021 sales pipeline with mix of new customers and expanded relationships

New multi-product collaboration with top global flavors & fragrances customer, building on successful historical program execution

New relationship with top 5 agchem company, focused on discovery and development of crop protection agents

Launched a new spin-out in personal care space, with strategic and financial investors

[Key expansion areas]

- Cell & gene therapy
- Antibodies
- Nucleic acid therapeutics
- Antibiotic manufacturing
- Sugar reduction
- Protein availability and functionality
- Skin microbiome
- Sustainability
- Recycling
- Wastewater remediation
- Pulp/Paper
- Crop protection
- Renewable feedstocks

7 major programs launched as of 4/5/2021 (2 new logos accounted for 3 programs)
Our ecosystem will soon support hundreds of new cell programs a year.
Ginkgo is creating the industry standard ecosystem

Like other horizontal tech platforms, Ginkgo is building a strong developer community - wrapping services around the platform to drive industry growth and, ultimately, demand.

Launched Ginkgo Ferment, our annual conference, in 2018.
We will be greatly expanding our ecosystem of services for cell programmers running on the Ginkgo platform.
We believe...

1. Programming cells will be as impactful as programming computers.
2. Ginkgo’s platform improves with scale.
3. Ginkgo is becoming the industry standard.
4. Our value increases with each new program added to the platform.

Each new program adds predictable near-term revenue from usage fees and provides Ginkgo upside through value share.
Programs drive both **predictable near-term revenues and long-term value creation** with asymmetric upside potential.

**Foundry**

Upfront payments to cover R&D costs for customer programs

- **Highly predictable revenue stream independent of program success**

**Downstream Value**

Value sharing via customer equity and/or royalties on completed programs

**Royalty Stream**

Cash flows from value share are typically 100% contribution margin as Ginkgo incurs minimal ongoing support or delivery costs

**Equity**

Equity represents the risk-adjusted NPV of a potential royalty stream

The choice to structure downstream economics as royalties or equity is typically based on customer size

Note: Illustrative economics; variation exists between programs
Program unit economics are strong and improving

Ginkgo has steadily increased the portion of program R&D costs that are covered upfront by customers.

Ginkgo receives downstream value in multiple forms. The equity value per program provides context for the future value.

Ginkgo will recognize royalty revenues over time as programs are completed and commercialized. These should be roughly equivalent in value over the long run, but royalties take longer to materialize.

The current equity value of our major programs is over $500M...

...representing an average of $15M per program.

(1) Represents cumulative revenues from 2017-2020 for programs signed in the relevant year(s) divided by the total program expenses in 2017-2020.
(2) Adjusts out expenses associated with programs Ginkgo performed under our free $25M commitment to COVID programs in spring 2020.
(3) Includes one program for publicly-traded Cronos which is structured as a lump-sum equity payment upon delivery.
Growth in **foundry revenues** and **new programs** drives valuation

<table>
<thead>
<tr>
<th>Foundry Billable Revenue</th>
<th>2018</th>
<th>2019</th>
<th>2020 (1)</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>$30</td>
<td>$54</td>
<td>$64</td>
<td></td>
<td>$100</td>
<td>$175</td>
<td>$341</td>
<td>$628</td>
<td>$1,099</td>
</tr>
<tr>
<td>% growth</td>
<td>78%</td>
<td>18%</td>
<td></td>
<td>57%</td>
<td>75%</td>
<td>95%</td>
<td>84%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Memo: GAAP Adjustments

<table>
<thead>
<tr>
<th>GAAP Foundry Revenue</th>
<th>2018</th>
<th>2019</th>
<th>2020 (1)</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>$33</td>
<td>$54</td>
<td>$59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# New Programs 20-34

<table>
<thead>
<tr>
<th>Royalty</th>
<th>20</th>
<th>34</th>
<th>54</th>
<th>157%</th>
<th>127%</th>
<th>97%</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Risk-Adjusted NPV / Program ~$15M (2)

NPV of New Programs Signed ~$500M (2)

2017-2020

<table>
<thead>
<tr>
<th># New Programs</th>
<th>2017-2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royalty</td>
<td>20</td>
<td>34</td>
<td>54</td>
<td>157%</td>
<td>127%</td>
<td>97%</td>
</tr>
<tr>
<td>Equity</td>
<td>34</td>
<td>23</td>
<td>60</td>
<td>136</td>
<td>268</td>
<td>508</td>
</tr>
</tbody>
</table>

Growth in foundry revenues and new programs drives valuation.

- **Foundry Billable Revenue**
  - Actuals: $30, $54, $64
  - Projections: $100, $175, $341, $628, $1,099
- **% growth**: 78%, 18%, 57%, 75%, 95%, 84%, 75%
- Memo: GAAP Adjustments
  - Adjustments: $3, $0, ($4)
- **GAAP Foundry Revenue**
  - Actuals: $33, $54, $59
- **# New Programs**
  - 20-34
  - Actuals: 20, 34
  - Projections: 23, 60, 136, 268, 508
  - % growth: Royalty 78%, Equity 18%
- **Risk-Adjusted NPV / Program**
  - ~$15M (2)
- **NPV of New Programs Signed**
  - ~$500M (2)

Increases if: p(success) increases, value of programs increases
Decreases if: lower take rates, value of programs decreases

(1) 2020A financials are draft audited and subject to final adjustments and line-item classifications
(2) Based on management estimate of the average current equity value of our cumulative major programs from 2017 to 2020
These value streams support a **strong valuation** with **meaningful upside potential**

**FOUNDRY**

Revenue (2024E) $628M

Rev. Growth (21-24E) 84%

**DOWNSTREAM VALUE**

2025E New Programs 500+

**BIOSECURITY**

2021E Revenue $50M

Biosecurity may become a long-term revenue stream if governments decide to invest in pandemic preparedness and biosecurity more broadly.

**OTHER**

For example, licensing and/or manufacturing of vaccinia capping enzyme (VCE) strain may yield significant near-term royalty revenues.

---

(1) Source: CapitalIQ, multiples reflect median of peer set as of 5/3/2021
Leveraging capital to build the heart of the emerging cell programming ecosystem

**PLATFORM & CAPACITY**
We are accelerating growth in capacity by integrating new technologies across the existing footprint, building new foundry space, and investing in software and automation to increase utilization.

We strive to be the best place for the world’s top scientists, engineers, and software developers to build their careers.

**ECOSYSTEM ACCELERATION**
Capital availability centers Ginkgo at the heart of the next generation of programs by providing access to Foundry credits and capital.

**STRATEGIC ACQUISITIONS / PARTNERSHIPS**
Ginkgo has successfully acquired several technology and codebase assets. We plan to continue to selectively acquire assets in strategically important areas.
The most powerful technologies require the most care

Our culture is built on care, transparency, diversity, employee ownership and a deep, humble respect for biology.

We invest in our communities and their biosecurity as well as robust ESG practices.

We take care in considering which programs we pursue and which we do not, and explore the implications of biotechnologies through many forums, including our magazine: GROW

READ MORE ABOUT:

• The meaning of nature after biotechnology
• The legacy of eugenics in beauty
• The role of the philosopher in the life sciences
• The potential for synthetic biology to save coral reefs
• The impact of the pandemic on scientists and science
We believe...

1. Programming cells will be as impactful as programming computers

2. Ginkgo’s platform improves with scale

3. Ginkgo is becoming the industry standard

4. Our value increases with each new program added to the platform

We hope...

...that when technology meets biology, life finds a way.
Attractive entry valuation vs. peers

**CY 2021-24E Revenue CAGR**

- Median: 32%
- 38%, 36%, 32%, 32%, 29%, NM

**CY 2024 TEV / Revenue**

- Median: 18.7x
- 24.1x, 21.6x, 20.9x, 16.5x, 15.5x, 12.6x

**CY 2024 Growth Adjusted TEV / Revenue**

- Median: 0.48x
- 1.15x, 0.68x, 0.46x, 0.33x, NM, 0.11x

Source: Company filings and Capital IQ as of 5/3/2021

1. Includes Foundry Billable Revenues only
2. Excludes AbCellera
3. Includes Foundry Billable Revenues and one-fifth of cumulative 2017-2024 NPV from New Programs
4. Veeva CY2024 figures exclude SVB Leerink estimates
5. Calculated as CY 2024 revenue multiple divided by ‘21-’24 revenue CAGR

Adjusted for value share

- 24.1x, 21.6x, 20.9x, 16.5x, 15.5x, 12.6x
- 0.29x, 0.66x, 0.48x, 0.46x, 0.33x, NM

Life Science Leaders | Software and Data
# Projected P&L

<table>
<thead>
<tr>
<th></th>
<th>2020(1)</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundry Billable Revenue</td>
<td>$64</td>
<td>$100</td>
<td>$175</td>
<td>$341</td>
<td>$628</td>
<td>$1,099</td>
</tr>
<tr>
<td>% growth</td>
<td>18%</td>
<td>57%</td>
<td>75%</td>
<td>95%</td>
<td>84%</td>
<td>75%</td>
</tr>
</tbody>
</table>

**memo: GAAP Adjustments**

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>($4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Foundry Revenue (GAAP) | $59 | $100 | $175 | $341 | $628 | $1,099 |
| (+) Biosecurity       | $17 | $50  |      |      |      |        |

| Total GAAP Revenue    | $77  | $150 | $175 | $341 | $628 | $1,099 |
| Adjusted EBITDA(2)    | ($121) | ($157) | ($156) | ($136) | ($47) | $166 |
| Capital Expenditures(3)| ($72) | ($66) | ($118) | ($146) | ($193) | ($234) |

---

(1) 2020A financials are draft audited and subject to final adjustments and line item classifications.

(2) See slide 50 for a reconciliation of Net Income to Adjusted EBITDA for historical periods presented.

(3) 2020 CapEx of $72M includes $14M of CapEx that is included in Accounts Payable and Accrued Expenses at 12/31/2020.

Emerging business, projections not provided.

GAAP adjustments not projected.
# Summary of Historical Income Statements

<table>
<thead>
<tr>
<th>($ in M)</th>
<th>2019A</th>
<th>2020A&lt;sup&gt;(1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong>&lt;sup&gt;(2)&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Growth</td>
<td>66%</td>
<td>41%</td>
</tr>
<tr>
<td>Cost of Biosecurity product revenue</td>
<td>0.0</td>
<td>6.7</td>
</tr>
<tr>
<td>Cost of Biosecurity service revenue</td>
<td>0.0</td>
<td>8.9</td>
</tr>
<tr>
<td>Research &amp; development</td>
<td>96.3</td>
<td>159.8</td>
</tr>
<tr>
<td>General &amp; administrative</td>
<td>29.5</td>
<td>38.3</td>
</tr>
<tr>
<td><strong>Total Operating Expenses</strong></td>
<td>$125.8</td>
<td>$213.7</td>
</tr>
<tr>
<td><strong>Loss from Operations</strong></td>
<td>($71.6)</td>
<td>($137.0)</td>
</tr>
<tr>
<td>Net interest income</td>
<td>3.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Loss on equity method investments</td>
<td>(46.9)</td>
<td>(3.1)</td>
</tr>
<tr>
<td>Loss on investments</td>
<td>(7.8)</td>
<td>(1.1)</td>
</tr>
<tr>
<td>Other income, net</td>
<td>3.2</td>
<td>16.1</td>
</tr>
<tr>
<td><strong>Loss before provision for income taxes</strong></td>
<td>($119.8)</td>
<td>($124.8)</td>
</tr>
<tr>
<td>Provision for income taxes</td>
<td>0.0</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Net Loss and Comprehensive Loss</strong></td>
<td>($119.9)</td>
<td>($126.7)</td>
</tr>
<tr>
<td>(Loss) / Income attributable to NCI</td>
<td>(0.5)</td>
<td>(0.1)</td>
</tr>
<tr>
<td><strong>Net Loss Attributable to Ginkgo</strong></td>
<td>($119.3)</td>
<td>($126.6)</td>
</tr>
</tbody>
</table>

---

<sup>(1)</sup> 2020A draft audited financials subject to final adjustments and line item classifications.

<sup>(2)</sup> GAAP revenue includes transactions with platform ventures (Motif, Joyn, and Alonna) as well as other structured partnerships (Genomatica and Synlogic) where, as part of these transactions, Ginkgo received an equity interest in such entities. These equity investees are considered related parties due to the equity position Ginkgo received in these entities and generated total revenues of $42.5M and $35.3M in 2020 and 2019, respectively.
## Historical Net Loss to Adjusted EBITDA Reconciliation

### Year Ended December 31,

<table>
<thead>
<tr>
<th></th>
<th>2019A</th>
<th>2020A(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Loss Attributable to Ginkgo</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net interest income</td>
<td>(3.3)</td>
<td>($0.2)</td>
</tr>
<tr>
<td>Depreciation and amortization</td>
<td>10.8</td>
<td>$13.9</td>
</tr>
<tr>
<td>Loss attributable to equity method investments, net of NCI</td>
<td>46.4</td>
<td>$2.9</td>
</tr>
<tr>
<td>Loss on investments</td>
<td>7.8</td>
<td>$1.1</td>
</tr>
<tr>
<td>Provision for income taxes</td>
<td>0.0</td>
<td>$1.9</td>
</tr>
<tr>
<td>Stock compensation expense</td>
<td>0.8</td>
<td>$0.5</td>
</tr>
<tr>
<td>Other non-recurring transactions</td>
<td>(3.1)</td>
<td>($14.9)</td>
</tr>
<tr>
<td><strong>Adjusted EBITDA</strong></td>
<td>($60.0)</td>
<td>($121.4)</td>
</tr>
</tbody>
</table>

(1) 2020A draft audited financials subject to final adjustments and line item classifications.
### Historical Foundry GAAP to Billable Revenue Reconciliation

<table>
<thead>
<tr>
<th></th>
<th>2019A</th>
<th>2020A&lt;sup&gt;(1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foundry Revenue (GAAP)</strong></td>
<td>$54.2</td>
<td>$59.2</td>
</tr>
<tr>
<td>% Growth</td>
<td>66%</td>
<td>9%</td>
</tr>
<tr>
<td><strong>Synlogic Adjustment&lt;sup&gt;(2)&lt;/sup&gt;</strong></td>
<td>2.7</td>
<td>13.6</td>
</tr>
<tr>
<td><strong>Equity Investee Adjustment&lt;sup&gt;(3)&lt;/sup&gt;</strong></td>
<td>(3.2)</td>
<td>(9.3)</td>
</tr>
<tr>
<td><strong>Total Adjustments</strong></td>
<td>($0.4)</td>
<td>$4.3</td>
</tr>
<tr>
<td><strong>Foundry Billable Revenue</strong></td>
<td>$53.7</td>
<td>$63.5</td>
</tr>
<tr>
<td>% Growth</td>
<td>78%</td>
<td>18%</td>
</tr>
</tbody>
</table>

<sup>(1)</sup> 2020A draft audited financials subject to final adjustments and line item classifications.

<sup>(2)</sup> Adjustment to increase Foundry Billable Revenue for the value of services provided to Synlogic which are not reported under GAAP due to an attribution of the amount paid above fair value for the Synlogic equity to the services prepayment at the time of the investment.

<sup>(3)</sup> Adjustment to decrease Foundry Billable Revenue for non-cash revenue that is recognized under GAAP to account for equity received at the time of inception of the collaboration.
ADDITIONAL CASE STUDIES
A leading company for production of natural ingredients was looking for cost-saving opportunities. Ginkgo identified a plan to fine-tune existing pathways in yeast to produce multiple flavors more efficiently, then optimized the conditions for scale-up.

Ginkgo’s Foundry utilizes the ambr250 disposable reactor system to inform design of experiments and reduce operating costs via automation, allowing us to run hundreds of bioreactors simultaneously.

Using the information generated to rationally improve the strain and fermentation process conditions, Ginkgo exceeded the client’s desired product titer by 50%.
Ginkgo’s system enables high throughput screening without compromising quality of data. The conditions optimized at a volume of 250 mL were effectively translated into pilot and commercial scale, and the cultured ingredients reached commercial production with our manufacturing partners.
Using biomining techniques to recycle compounds

Some of the compounds in objects we use everyday are difficult to recycle. By identifying proteins that selectively bind to these compounds, we can recover them from post-manufacturing or recycled material, moving us closer to a circular economy.

The Ginkgo Foundry allows us to synthesize, screen, and test for these proteins at a scale unmatched by others. In our primary screen, we screened over 1000 unique proteins, testing a total of over 10,000 samples.

From that screen, we identified the best hits. In our secondary screen, we discovered a protein that binds hard-to-recycle compounds 5X more than previously seen in the market.
Foundries allow us to explore a broader range of biological diversity

Enzymes come from a wide variety of source organisms.

Powered by gigabase-scale DNA synthesis, Ginkgo explores biodiversity to identify novel or improved enzyme activities and design pathways programmatically.

Clusters of enzymes without any existing annotation, which Ginkgo can investigate further.

Cluster containing best-documented enzymes for this class.
Pathway design for a complex metabolic pathway

**Situation:** A client wished to decrease their reliance on expensive feedstocks and replace it with a low-cost substrate that the strain could not naturally assimilate. Ginkgo engineered a strain to assimilate the low-cost substrate, while maintaining productivity and yield.

**Approach:** By capitalizing on the capacity of the Foundry, Ginkgo could screen a large number of pathway architectures to construct the pathway.

2,719 pathways evaluated

7,717 enzymes screened

109,000,000 base pairs of synthetic DNA designed

9 promoters × 9 enzyme 1 enzymes × 8 enzyme 2 enzymes × 4 enzyme 3 enzymes = 1,152 synthons
Pathway design for a complex metabolic pathway

The strains transferred to the customer could assimilate the new feedstock **25 times** more than the original strain, achieving the target.
Making more sustainable foods with kilogram-scale protein production

Situation: Ginkgo partnered with Motif FoodWorks to develop commercial yeast strains and processes for protein production at the kilogram scale. The target protein would be used to make foods more delicious and sustainable.
Making more sustainable foods
with kilogram-scale protein production

**Discovery:** Leveraging our Codebase and Foundry, we identified and screened hundreds of distinct candidate proteins. Top performers were engineered with novel expression systems to maximize protein expression.

**In just 1 year,** 6 prototype strains were developed, and product samples were produced for benchmarking and early application testing. Improved variants were designed, built and validated over the next 9 months.
Making more sustainable foods with kilogram-scale protein production

Scale: Within 2 years, Ginkgo developed commercial strains from scratch, as well as fermentation and downstream purification processes that are now being used at kilogram-scale, with a total projected 3 years time-to-market for the final food ingredient product.

The strain’s performance exceeded Motif’s specifications by >70%.
Further, we identified a set of novel protein expression systems that exceed performance of best-in-class systems by 5-20 fold, thereby increasing productivity, reducing cost, and improving scalability over additional rounds of engineering.

Our Foundry can be easily repurposed to create additional food products, thereby shortening the time-to-market for each new product, and helping us forge the future of more sustainable and accessible foods.
Plants like cannabis hold many unique compounds that can have important health benefits, but many of those compounds are impractical and expensive to extract and purify. With our landmark partnership with Cronos Group, we are working to produce eight target cultured cannabinoids at high quality and purity. To scale manufacturing of products from this partnership, our deployment team supported the evaluation and build-out of an 84,000 square foot fermentation facility in Winnipeg, Canada.
Situation: For approximately 2 years, Synlogic had been prototyping a strain and pathway to consume leucine, but initial modeling suggested that more activity was needed for target therapeutic effect.

Approach: To optimize the complex pathway to increase consumption, Ginkgo sourced, synthesized and screened 3,600 enzymes to identify the best performing enzymes. Using the best enzymes, we designed and screened a combinatorial library of 350 pathways.
Rapid pathway development

Metagenomic enzyme sourcing and synthesis

High throughput screening of >1200 enzymes per class

Use top enzymes to design combinatorial library of 350 pathways

3-step leucine consumption pathway

High-throughput screening of pathways using targeted metabolomics
With a simpler biological design, Ginkgo improved the Synlogic strain’s ability to consume leucine by nearly $7x$.

Furthermore, the Synlogic-Ginkgo optimized strain SYN5941 lowers protein-induced leucine consumption in non-human primates.
CASE STUDY

Our client was seeking an enzyme that could enhance an underperforming, in-house program in the industrials space.

Ginkgo created a diverse library of 1,700+ enzyme variants, informed by our Codebase.

IMPACT

Our program reduced enzyme requirement by 80% and improved performance.

Without Ginkgo’s capacity for testing or broad Codebase, the best enzyme wouldn’t likely have been discovered or selected for testing.