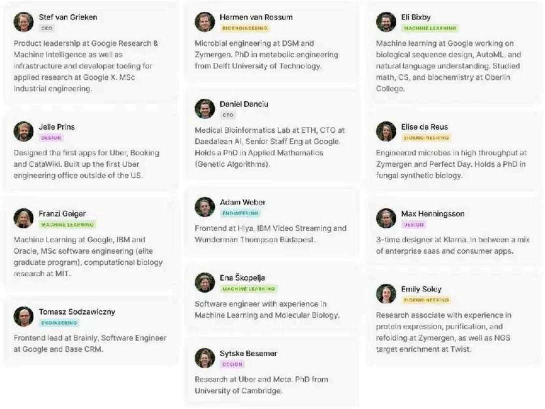
Seed

Design better proteins

https://www.cradle.bio



Our team

Bringing together the best in industrial biology, machine learning and user experience design.

LOCATIONS
Delft & Zurich

Stef van Grieken
CEO
Product leadership at Google Research & Machine Intelligence as well as infrastructure and developer tooling for applied research at Google X. MSc Industrial engineering.

Jelle Prins
DESIGN
Designed the first apps for Uber, Booking and CataWiki. Built up the first Uber engineering office outside of the US.

Franzi Geiger
MACHINE LEARNING
Machine Learning at Google, IBM and Oracle, MSc software engineering (elite graduate program), computational biology research at MIT.

Tomasz Sodzawiczny
ENGINEERING
Frontend lead at Brainly, Software Engineer at Google and Base CRM.

Harmen van Rossum
BIOENGINEERING
Microbial engineering at DSM and Zymergen. PhD in metabolic engineering from Delft University of Technology.

Daniel Danciu
CTO
Medical Bioinformatics Lab at ETH, CTO at Daedalean AI, Senior Staff Eng at Google. Holds a PhD in Applied Mathematics (Genetic Algorithms).

Adam Weber
ENGINEERING
Frontend at Hiya, IBM Video Streaming and Wunderman Thompson Budapest.

Ena Škopelja
MACHINE LEARNING
Software engineer with experience in Machine Learning and Molecular Biology.

Sytske Besemer
DESIGN
Research at Uber and Meta. PhD from University of Cambridge.

Eli Bixby
MACHINE LEARNING
Machine learning at Google working on biological sequence design, AutoML, and natural language understanding. Studied math, CS, and biochemistry at Oberlin College.

Elise de Reus
BIOENGINEERING
Engineered microbes in high throughput at Zymergen and Perfect Day. Holds a PhD in fungal synthetic biology.

Max Henningsson
DESIGN
3-time designer at Klarna. In between a mix of enterprise saas and consumer apps.

Emily Soley
BIOENGINEERING
Research associate with experience in protein expression, purification, and refolding at Zymergen, as well as NGS target enrichment at Twist.

Advisors & Angels

Index Ventures

Kindred Capital

Patrick Hsu
Professor Berkeley, Founder Arc Institute

Emily Leproust
CEO, Twist Biosciences. Savage Seed Fund managed by Emily Leproust

Feike Sijbesma
Former CEO Royal DSM, one of world's leading industrial biotech companies

Tim Geistlinger
Chief Scientific Officer, Perfect Day

Steve Crossan
SVP AI at GSK, former Head of Product at Deepmind and co-founder of Alphafold project

Sylvain Gariel
Founder & CEO, DNA Script

Mehdi Ghissassi
Director of Product, Deepmind

Bioinformatician

We are on a mission to make programming biology easy.

Project lead

Starting with finding, understanding and improving proteins & enzymes.

Protein engineer

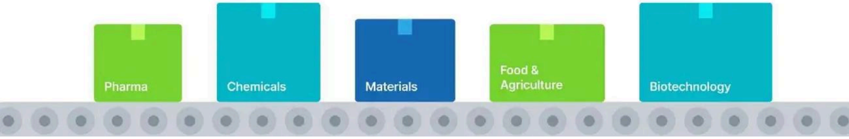
Imagine if biology could help us produce almost anything

Spoiler alert: It can

Cells are small factories of life.

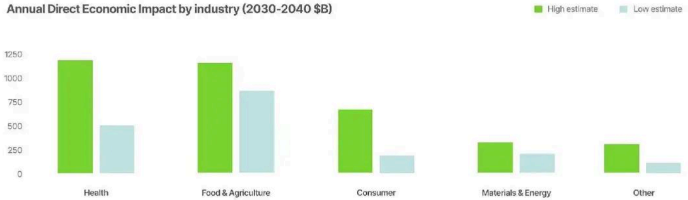
With biology, we can control what a factory produces by changing its instructions (DNA & RNA), optimizing its machines (Proteins & Enzymes) and supplying it with energy (Sugars).

Cradle helps bioengineers design and optimize these factories, starting with the machines (Proteins & Enzymes).



Next, imagine the market of "almost anything"

Hint: It's estimated between $2 to $4 trillion for bioengineered products, 60% of our current economic inputs


Annual Direct Economic Impact by industry (2030-2040 $B)

Source: McKinsey Global Institute; The Bio Revolution: Innovations transforming economies, societies, and our lives (May 13, 2020)

So what is almost anything?

Many industries and products have engineered proteins at their core.

Pharma
- Antibodies
- Gene therapies
- Short peptides
- Vaccines
- Cytokines

Chemicals & Materials
- Water Treatment
- Detergents
- Corrosion inhibitors
- Carbon fixators
- Packaging
- Degradation (i.e. plastic)
- Films
- Cosmetics
- Fabrics & Polymers
- Degradable plastics

Food & Agriculture
- Nutrients
- Insecticides
- Nitrogen fixation
- Brewing
- Baking
- Stabilisation
- Dairy
- Preservation
- Alternative protein
- Ingredients

Proteins are incredibly powerful but hard to design & engineer with today's tools

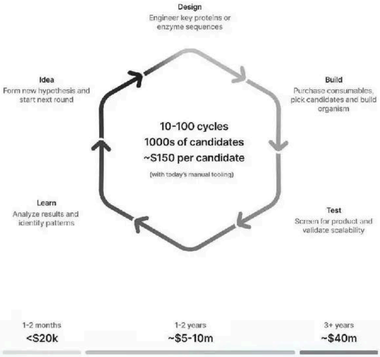
>95% of designs fail with current methods

In an ideal world, you could develop a protein in a matter of weeks.

In reality, this is an expensive iterative process, with a limited number of candidates that can be tested in every round that takes many years.

This is largely due to the fact that homology, evolution and energy based simulation methods used commonly today yield lead to lots of sequence candidates that don't hit their design goals

We believe that instead of increasing throughput, Improving the quality of new designs is the most efficient way to shorten the process, reduce cost and improve product outcomes.



Design
Engineer key proteins or enzyme sequences

Build
Purchase consumables, pick candidates and build organism

Test
Screen for product and validate scalability

Learn
Analyze results and identify patterns

Idea
Form new hypothesis and start next round

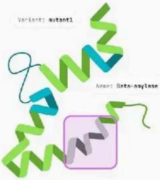
10-100 cycles
1000s of candidates
~$150 per candidate

(with today's manual tooling)

1-2 months	1-2 years	3+ years
<$20k	**~$5-10m**	**~$40m**

We use generative machine learning models to engineer better proteins

Think Dall·E, Stable Diffusion or Github Copilot – but for protein design.



3D Structure Prediction

Predict the 3D structures of any proteins using Nobel Prize nominated machine learning algorithms

Thermostability SOON

Generate more stable proteins

Codon Optimization SOON

Improve expression through optimizing codon use

Activity FUTURE

Improve the activity of your enzymes.

Specificity FUTURE

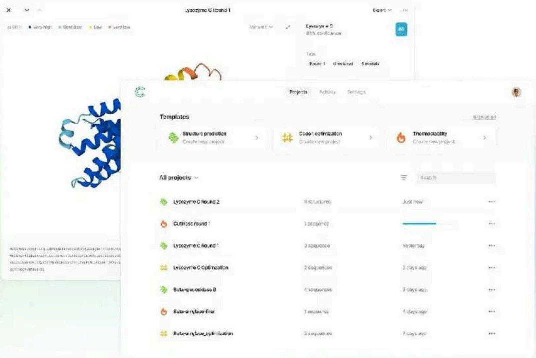
Make your enzymes more specific or more promiscuous

Stability FUTURE

Generate proteins with increased stability in harsh solvents

Affinity FUTURE

Improve binding affinity of your proteins with other proteins or small molecules



Templates

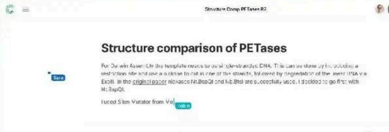
Structure prediction	Create new project
Codon optimization	Create new project
Thermostability	Create new project

All projects

Lysozyme C Round 2	3 structures	Just now
Cutinase round 1	1 sequence	
Lysozyme C Round 1	3 sequence	Yesterday
Lysozyme C Optimization	2 sequences	2 days ago
Beta-glucosidase B	4 sequences	2 days ago
Beta-amylase-first	1 sequence	4 days ago
Beta-amylase_optimization	2 sequences	7 days ago

Share your results with colleagues – or the world.

Teams can collaborate in a notebook to get from a starting point to a hyper-optimized protein.



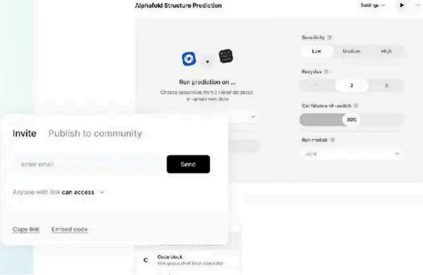
Structure comparison of PETases

For Darwin Assembly the template needs to be single-stranded DNA. This can be done by introducing a restriction site and use a nickase to cut in one of the strands, followed by degradation of the linear DNA via ExoIII. In the original paper nickases Nt.BspQI and Nb.BtsI are successfully used. I decided to go first with Nt.BspQI.

I used Slon Mutator from Vo

A notebook is shareable with your team, or the world. Like a Google Doc, or Figma Community file. Let them read it and learn from your steps, and collaborate on the next round.

It can function as a template for others to follow in your footsteps, or as documentation attached to your research paper.



Alphafold Structure Prediction

Run prediction on ...

Choose sequences from a linked database or upload new data

Sensitivity: Low

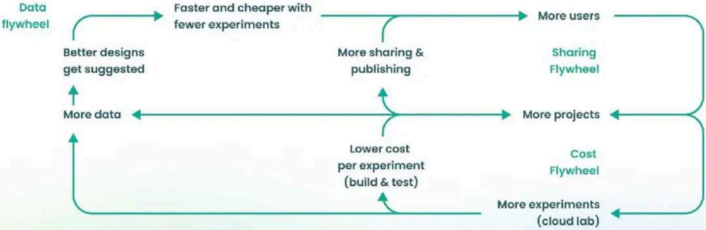
Recycles: 2

Confidence kill-switch: 80%

Invite | Publish to community

Anyone with link can access

We will grow this business through better predictions, cheaper experiments, sharing & publishing



Data flywheel

Better designs get suggested

Faster and cheaper with fewer experiments

More users

More sharing & publishing

Sharing Flywheel

More data

More projects

Lower cost per experiment (build & test)

Cost Flywheel

More experiments (cloud lab)

Why now?

Demand for bio-based products is going up

Bio-engineered products are becoming cheaper, have better performance and are environmentally friendly.

Cost of experimentation is going down

Biological experimentation (DNA synthesis, sequencing, screening) as well as compute cost are coming down rapidly.

10x

Machine learning is outperforming biologists

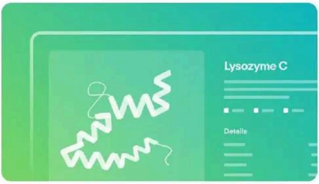
Machine learning is increasingly outperforming human biologists in predicting experimental outcomes.

Market and investments in the space are growing rapidly

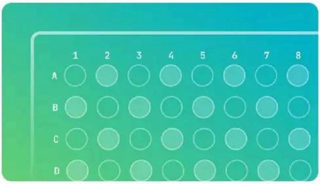
Investment and research is growing >2x yoy and still accelerating

We monetize the studio and common bio-services

But we may do some milestone & royalty deals early on



Studio
The software will be available to academics, startups, scaleups and enterprise. The studio can be used for free by academics.



Experiments & Experts
Experiments and Experts available on demand to speed up your project. – This will be introduced later.

Thank you!