



NSF Convergence Accelerator's 2023 Cohort Phase 1 Award

Project Title

AI-designed microbial strains for efficient food protein production

Awardee

Terraferma Foods, Inc

Award/Contract

24C0019

Award Contract Type

R&D

Award Date

January 24, 2024

Principal Investigator

Victoria Mo

victoria@terrafermafoods.com

Co-Principal Investigators

Ruby Yu

NSF Funded Program

NSF Convergence Accelerator

NSF Program Director

Chris Sanford

Track M: Bio-Inspired

Design Innovations

Convergence Accelerator

Directorate of Technology,

Innovation and Partnerships

csanford@nsf.gov

PROJECT ABSTRACT

The rapid growth of the world's population has led to an urgent need to meet its equally growing nutritional demands. At the heart of this issue lies access to essential nutrients, with protein being the primary driver of cost. While nutritionally invaluable, animal proteins have become economically and environmentally challenging to source. Their cost has risen steeply, led by factors such as feed prices, environmental regulations, land use, and disease outbreaks. Animal-sourced proteins also cause significant environmental issues such as deforestation, overuse of freshwater resources, and methane emissions, contributing to climate change. These factors are pushing the limits of what our planet and societies can bear.

We propose an AI-based platform capable of quickly designing high-yielding strains in silico. We seek to reduce the cost of precision fermentation of complete animal proteins that are identical to natural proteins, increasing accessibility to nutrition at a fraction of the environmental impact. Our long-term goal is the climate-friendly manufacturing of food proteins enabled by synthetic biology. Additionally, we seek to promote food sovereignty and biosecurity by achieving commercial-scale protein manufacturing with domestic facilities. With cutting-edge AI, we are designing microbial factories to produce protein at the lowest possible cost, increasing accessibility to nutrition for all.

Our goal is to converge synthetic biology, artificial intelligence, scale-up fermentation, food science and manufacturing, with a team spanning multiple academic and industry stakeholders. The specific deliverables are as follows: (1) To collect a proprietary dataset of microbial mutants, (2) to generate candidate strain variants in silico via our AI platform, (3) to validate these strains in-vitro from bench up to 10,000L in scale, and (4) to produce our flagship product, including characterizing our protein ingredient and pilot manufacturing.