Increasing fungal bioproduction efficiency

Aethergen: Investment Opportunity

- Aethergen aims to create efficient enzyme-producing fungi for biomanufacturing companies
- Revenue is generated from partnerships with large industrial chemical/enzyme manufacturers

- Co-founded by a global expert in the field of mycology
- Management-level expertise in a leading biomanufacturing firm
- Strong experimental background to advance past proof of concept

- A novel *Aspergillus* strain with diffuse morphology and little oxygen consumption
- Patent application filed

- Aim to validate proof-of-concept with first target enzyme before September 2020
- Seeking to build relationships with partners in enzyme production space in 2020/2021
- Seek to verify platform in various industrial strains before Jan 2021

Founding Team

UTHealth

DARTMOUTH

Elisa Vesely, PhD
Chief Scientific Officer

DARTMOUTH

Joshua Kerkaert
Senior Scientist

DARTMOUTH

Steven Ionov
VP, Business Development

TUCK

Alison Underwood
Strategy Advisor

DARTMOUTH

Caitlin Kowalski, PhD
Scientific Advisor

DARTMOUTH

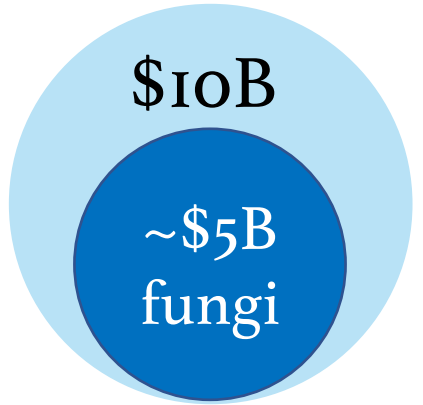
Robert Cramer, PhD
Scientific Advisor

Industrial Enzyme market summary

- Enzyme industry supplies active peptides for pharma, household cleaning, food and beverage, and biofuels
- A Highly Concentrated market: Top 3 players own 75% share
- **~50% of bioproduction is performed by fungi**
- Carbohydrases (cellulases, amylases, pectinases) and proteases are most popular enzymes

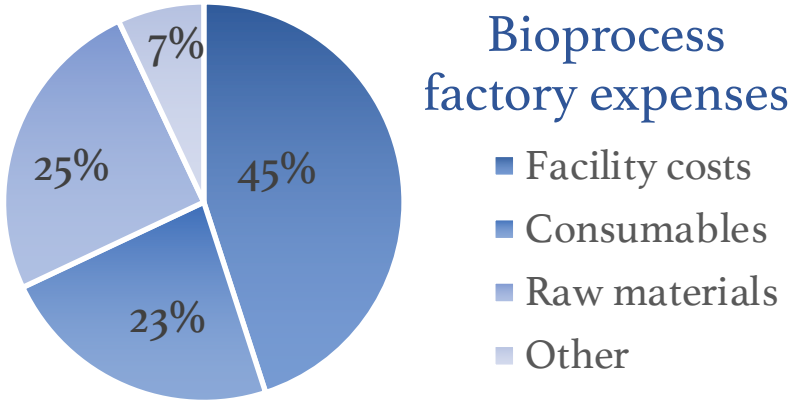
- Companies compete on production yields and efficiency of enzymes in portfolio
- Increasing yield of fermentation marginally may have significant impacts on bottom line
- Two important factors in fungal fermentation:
  - Fungal Morphology
  - Oxygen Transfer

Market Size



CAGR: 7.1%

Selected Market Shares of Major Players



Bioprocess factory expenses

- Facility costs
- Consumables
- Raw materials
- Other

Role of Morphology and Oxygen Transfer

Morphology

- Changing morphology changes production efficiency of filamentous fungi.
- Short fragments, small pellets
  - **Pro:** Decrease viscosity of culture
  - **Con:** Decrease mass transfer into pellet
- Diffuse mycelium
  - **Pro:** Benefits enzyme production
  - **Con:** Makes culture viscous and inhibits aeration.
- Beneficial morphology is a major goal of strain improvement companies.

Oxygen Transfer

- Aeration of culture is critical for manufacturing of the majority of fungal products: can be a linear relationship between aeration/productivity
- Viscous cultures decrease oxygen transfer and efficiency.
- Companies compensate for viscosity by keeping cultures less dense
- This results in a compromise in yield

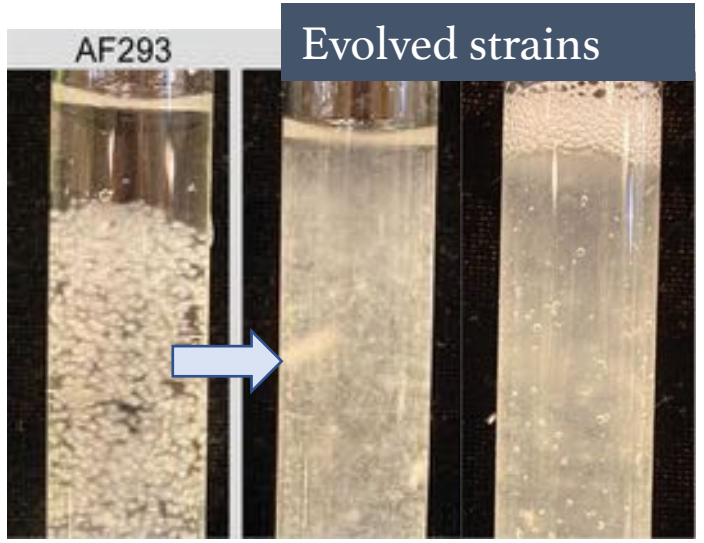
Mycelial Morphology and Oxygen Penetration directly compete, causing manufacturers to compromise.

Summary of Technology

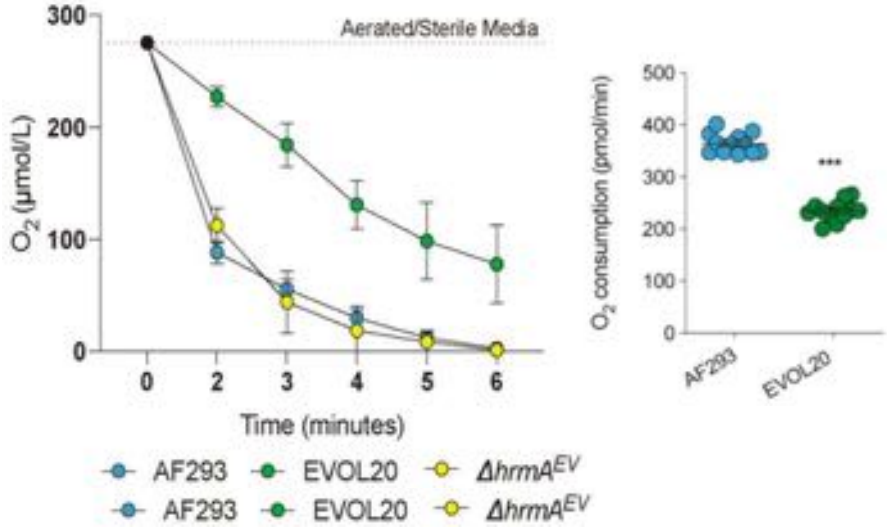
Aethergen has patented mutations that make fungi more desirable for biomanufacturing of enzymes.

- Our mutations convey a diffuse mycelial profile in culture, benefiting manufacture of enzymes.
- Strains consume less oxygen during fermentation, solving a clear problem for potential customers.
- We believe our cultures can produce high enzyme titers with low oxygen consumption, improving productivity for manufacturers.

We are currently negotiating a non-monetary partnership with a large strain improvement company to provide data in large-scale fermenters.



Diffuse mycelial morphology



Lower oxygen consumption

Business Model

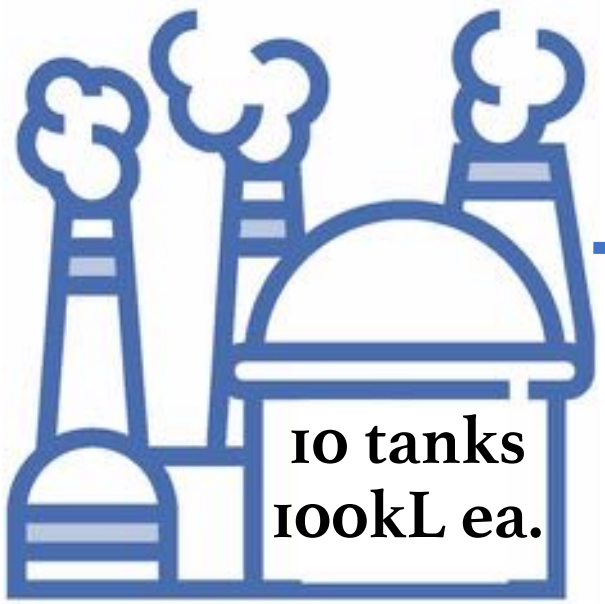
Customers:

- **In-house R&D teams** of enzyme manufacturing firms
- **Organism engineering** companies

Negotiate non-exclusive license deals to Aethergen's proprietary strains and mutations

Collect revenue from licenses and royalties

Revenue Model



CUSTOMER

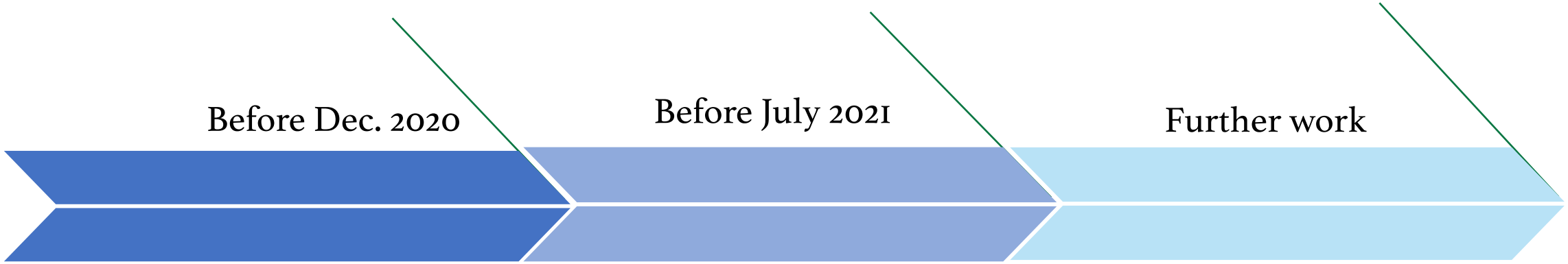
2M kg enzyme/yr

Improved productivity decreases cost to achieve production target

Aethergen

Productivity Improvement	Cost Savings	Achievable Revenue from target market (licensing + royalties)
10%	$590K/yr	$29.8M
20%	$1.1M/yr	$33.9M
50%	$2.2M/yr	$43.1M

Timeline



- Proof-of-concept with cellulase: entry
- Large-scale data from industry partner

- Proof-of-concept in multiple fungal strains
- Establish further partnerships
- Perform in-house bioreactor testing

- Cement customer relationships
- Founding lab to bring in more IP for strain improvement

Aethergen is looking for…

- Partnerships with customers involved in fungal bioproduction and/or strain improvement.
- A CEO to lead business development on this project full-time; preferably a serial entrepreneur with experience in the biomanufacturing space.
- Business mentorship from individuals with experience with the biomanufacturing space.