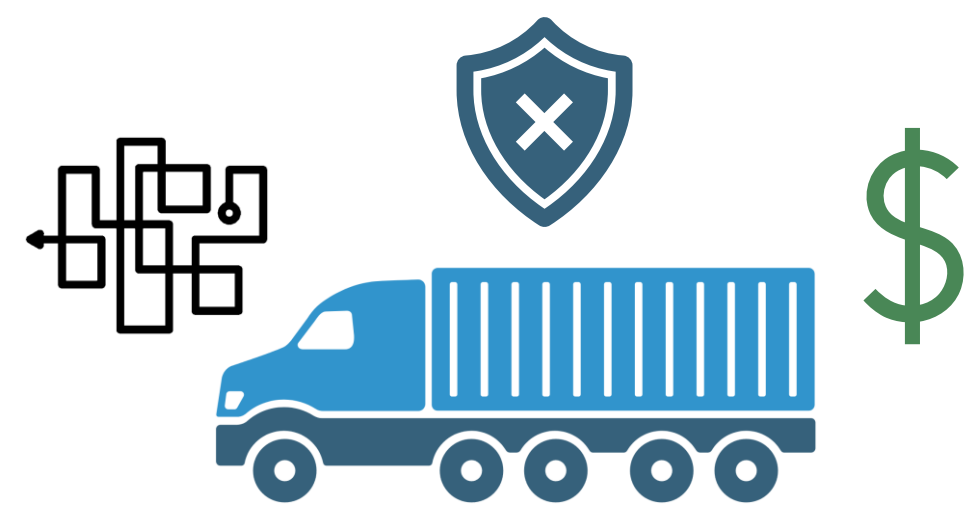


Emma Johnson, Sydney McGraw, Morgan Stephens  
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Dr. Nathan Crook

## 1. Motivation

Food availability is a **limiting factor** for military operations<sup>5</sup>.

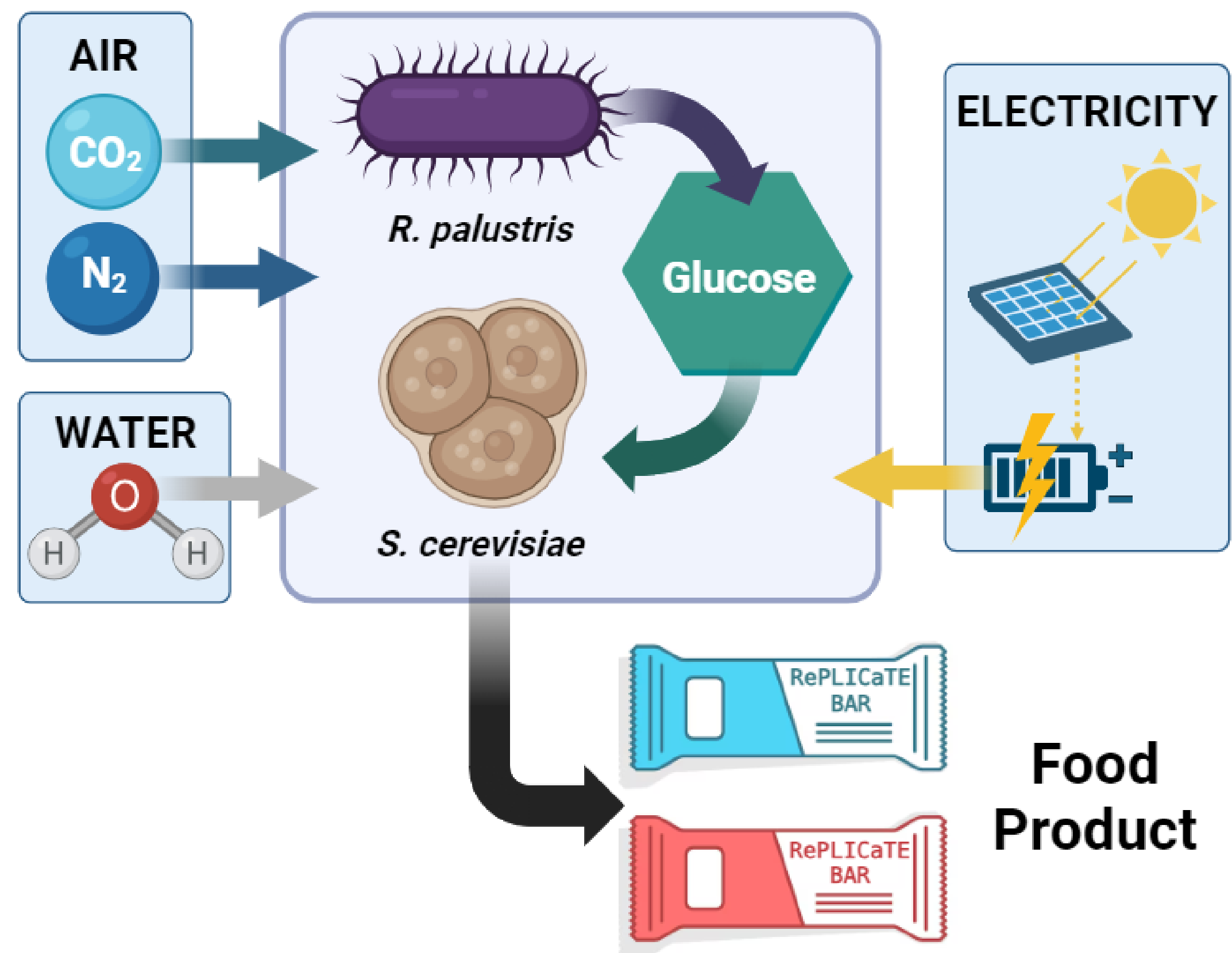


Food supply chains are a logistical **burden, vulnerable, and costly**<sup>5</sup>.

RePLiCaTE: Advancing **on-demand** food production!

## 2. Project Overview

**Goal:** To make *nutritionally sufficient food* from **air, water, and electricity** with the help of **microbes**<sup>5</sup>.



## Project Guidelines

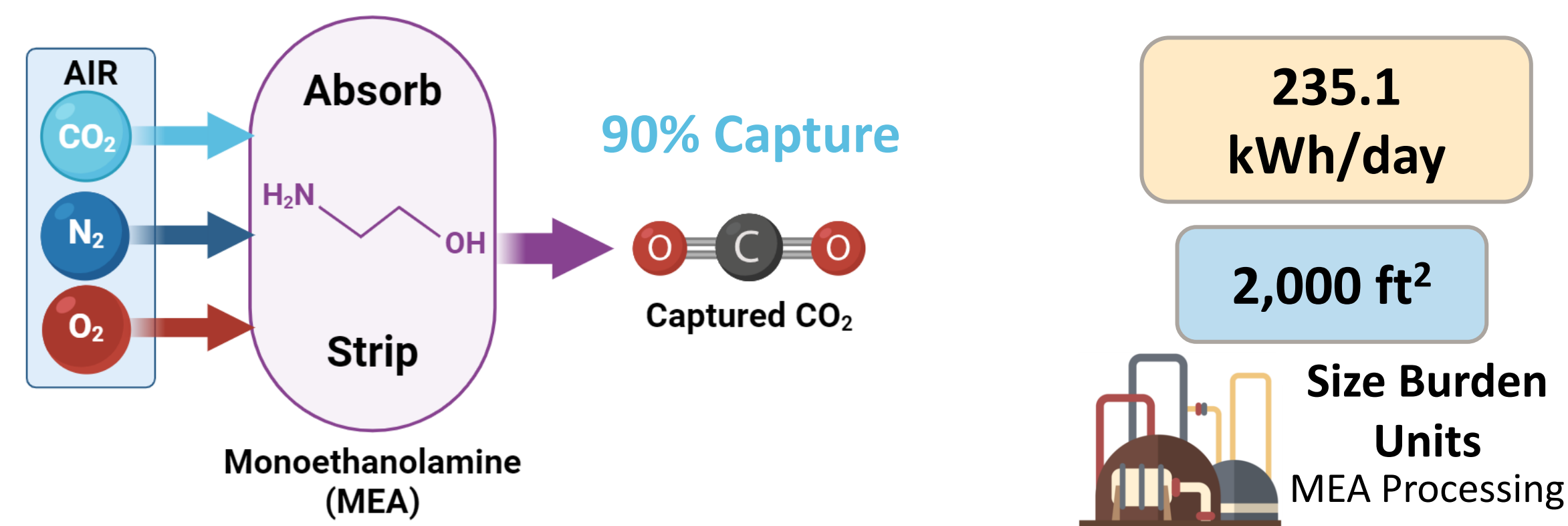
- <\$5M**
- Feed 14**
- 3 Weeks**
- Mobile**

### Nutritional Requirements<sup>1</sup>

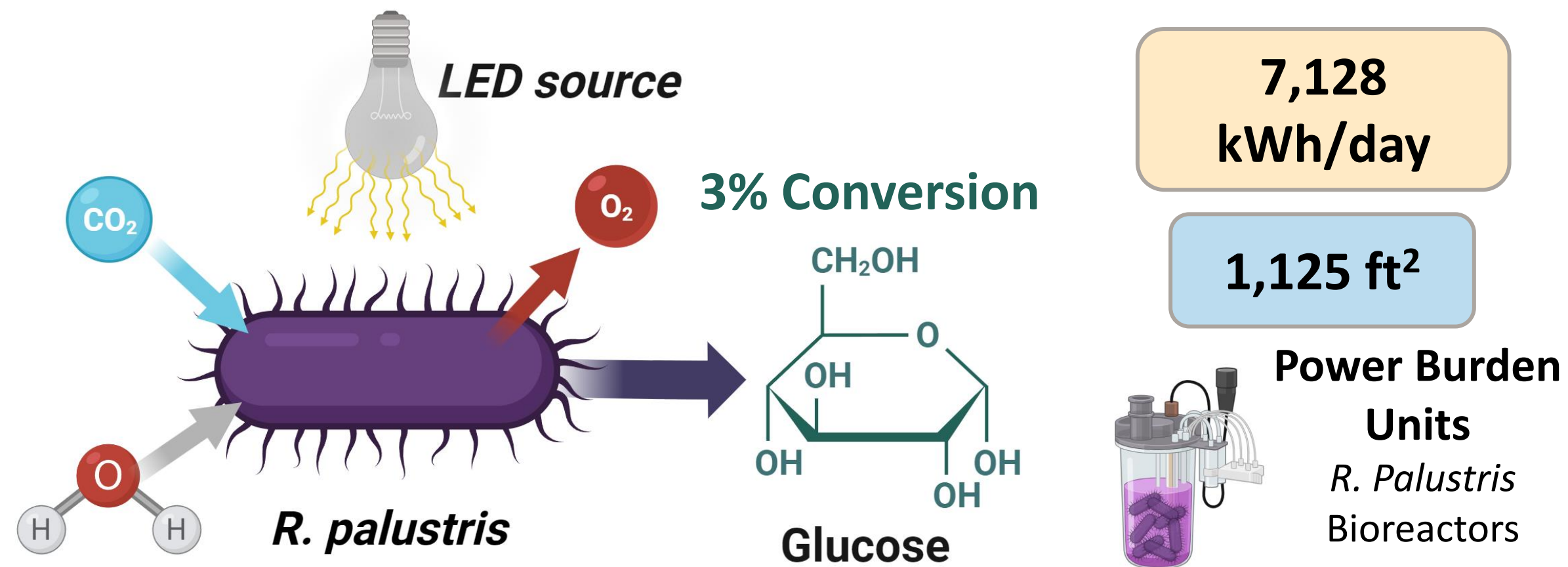
Vitamins	RDA
A	900 µg RAE
C	90 mg
K	120 µg
E	15 mg
D	15 µg

## 3. Methodology

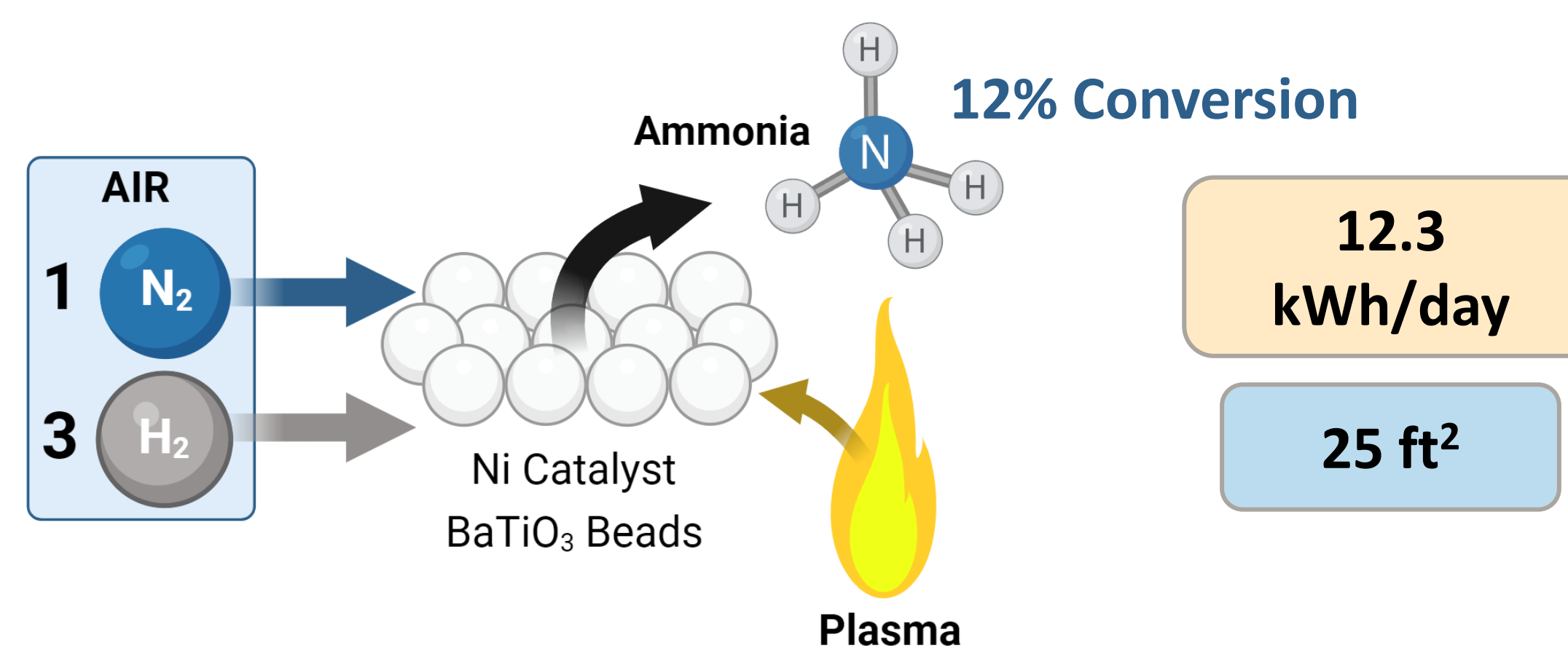
### Carbon Capture from the air into usable form for *R. palustris*<sup>6</sup>



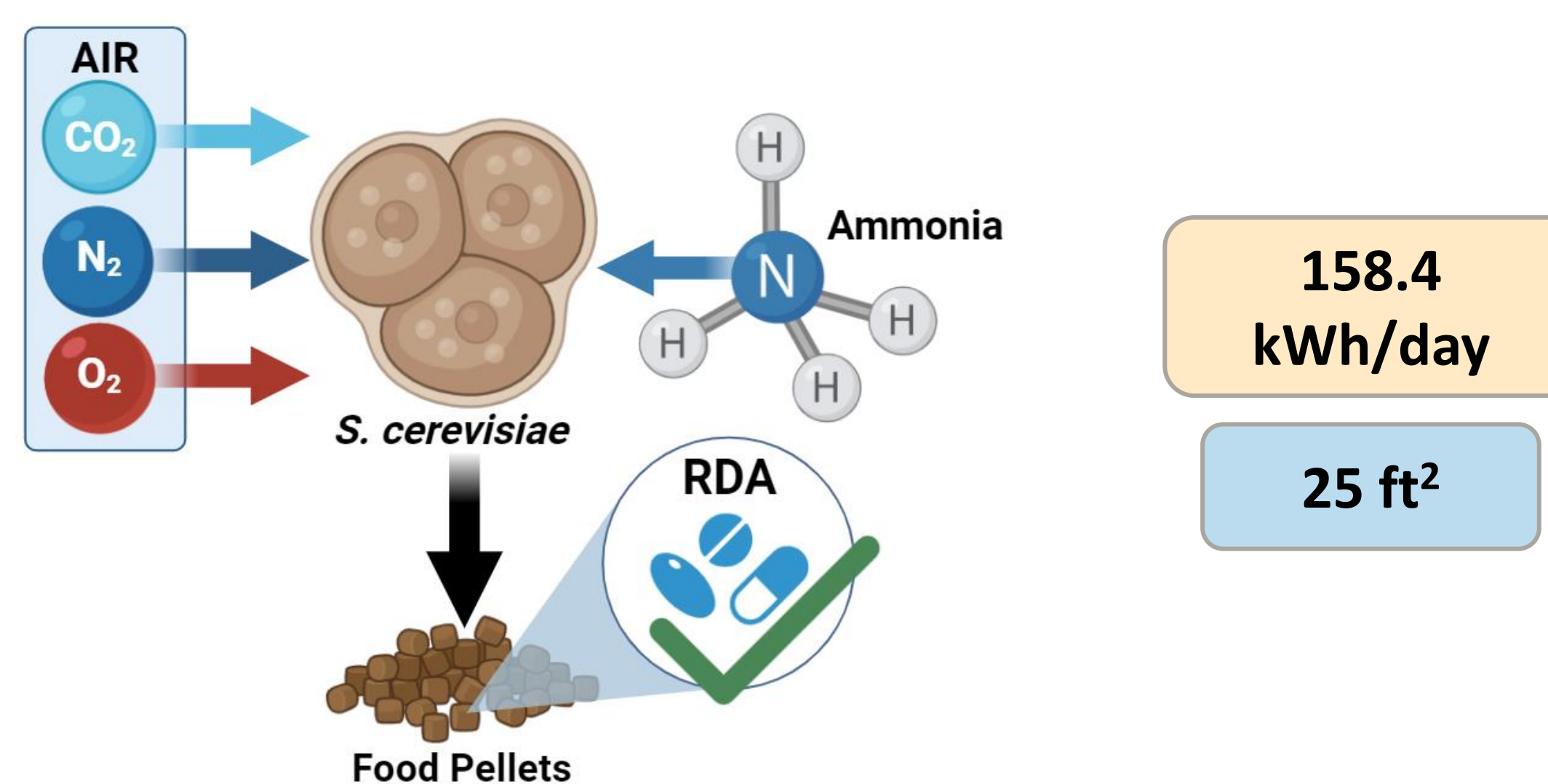
### Biotic Glucose Creation for *S. cerevisiae* feedstock<sup>8</sup>



### Nitrogen Fixation from the air into usable form for *S. cerevisiae*<sup>3</sup>

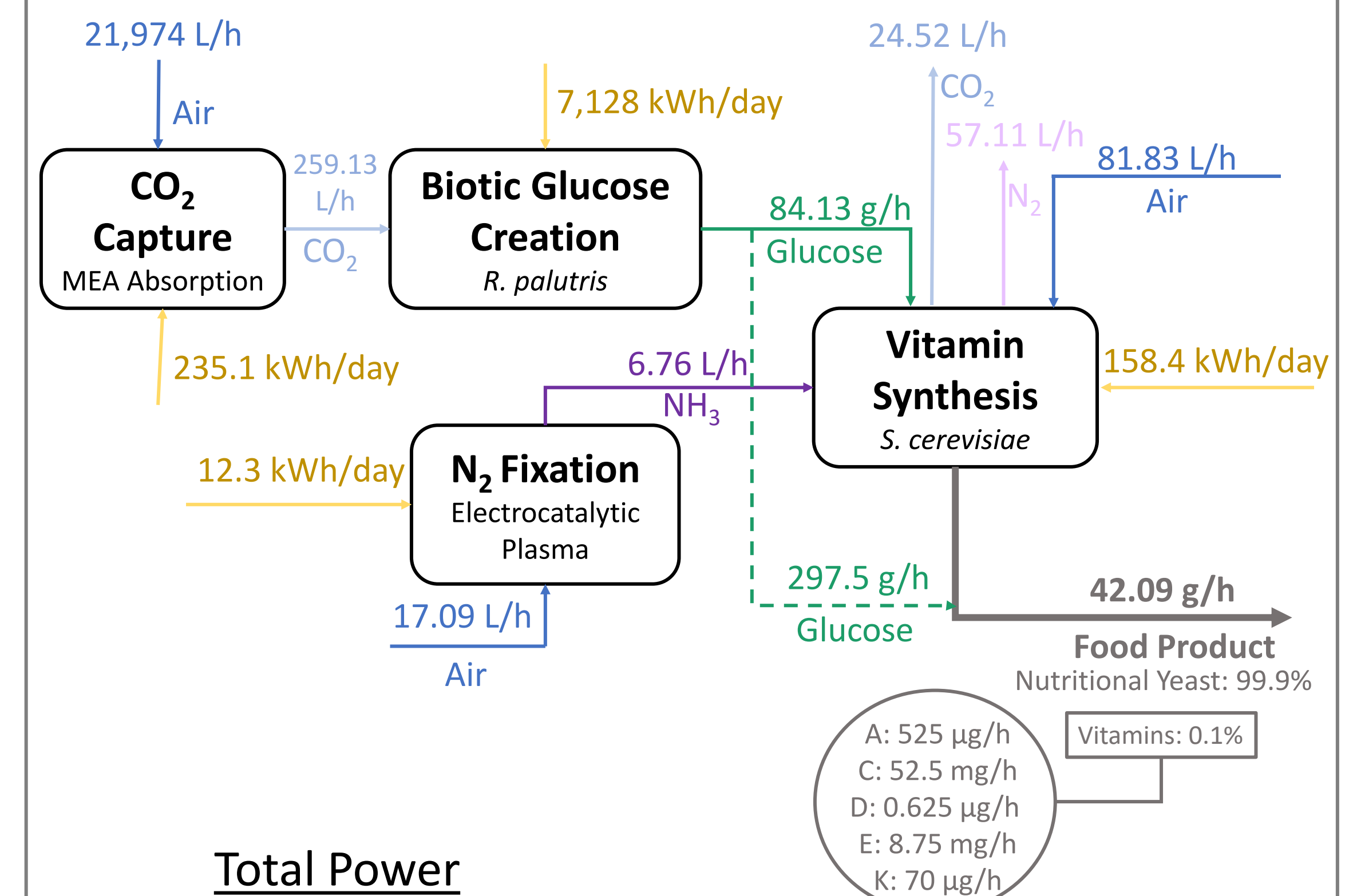


### Vitamin Synthesis for nutritionally complete food product<sup>5</sup>



## 4. Project Analysis

### Process Flow Diagram: 14 people for 3 weeks<sup>2,4,7</sup>



**Total Power:** 158,210 kWh (24,192 kWh Generator x7, 48 kW)

**Total Cost:** 4.3 Million

**Total Size:** 3,315 ft²

**Food Product:** 42.09 g/h (Nutritional Yeast: 99.9%)

**Vitamins:** A: 525 µg/h, C: 52.5 mg/h, D: 0.625 µg/h, E: 8.75 mg/h, K: 70 µg/h

Process Step	Energy Consumption (kWh)	Capital Cost (\$)	Size (ft²)
Carbon Capture	4,937	1,000,000	2,000*
Nitrogen Fixation	258	15,000	25
Biotic Glucose Creation	149,688*	3,150,000*	1,125
Vitamin Synthesis	3,326	10,000	25
			Generators: 140

\*indicates respective burden process units

## 5. Conclusions & Recommendations

- ✓ RePLiCaTE can feed 14 people for 3 weeks under \$5 million.
- x RePLiCaTE cannot meet size and power for mobility applications.

With Current Technology:

1. Set up **stationary** plant for a humanitarian food scarcity operation.
- For Future Direction:
2. Conduct more **research** for SWaP optimizing technologies.
    - Notably, MEA carbon capture **alternative** for size reduction.
  3. Implement portable **solar panels** for generator quantity reduction.

## 6. Acknowledgements

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