Synthetic Biology for Recycling Human Waste into Food, Nutraceuticals, and Materials: Closing the Loop for Long-Term Space Travel

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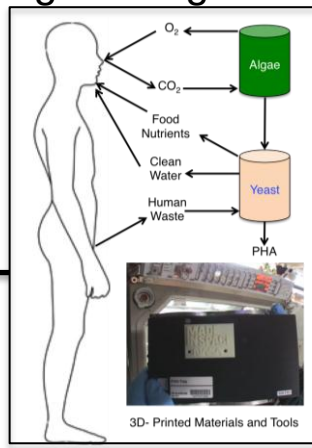
Research Objectives

- Goal: Convert human waste into omega-3 fats and plastic for 3-D printing.
- Innovation: Yeast are a flexible platform for converting algae captured CO_2 and human waste into food, nutraceuticals, and materials.
- SOA: We have engineered several metabolic engineering tools for *Y. lipolytica*.
- Transition from TRL1 (preliminary pathway engineering) to TRL3 (highly productive systems using waste substrates).



In-situ resource utilization of human waste to make food and 3D printable materials

Approach

- Fundamental investigation of algal biomass and urine as a feedstock for yeast.
- Forward and reverse systems engineering for tolerance to feedstock inhibitors.
- Metabolic engineering of omega-3 from lipids.
- Metabolic engineering of PHA from lipids.

Potential Impact

- Recycling of human waste for in-situ resource utilization may reduce the materials needed to sustain long-term space travel.
- A flexible yeast platform may enable the production of other nutrients, therapeutics, and materials during space travel.
- In the process of utilizing waste, water can be recycled as well.
- Waste utilization can positively impact terrestrial processes as well.