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Biofertilizer from Genetically-modified Azotobacter vinelandii (20140348, Dr. Brett Barney)

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Microbial Biofertilizer

Genetically modified *Azotobacter vinelandii* (*A. vinelandii*) bacteria excrete greater amounts of extracellular nitrogen-containing compounds, such as ammonia or urea, than their wild-type counterparts. Such terminal products could be used effectively as biofertilizers. Unlike many nitrogen-producing bacteria that only function in anaerobic environments, the aerobic properties of *A. vinelandii* make it an ideal nitrogen-producing biological factory that can support growth of algae or common agricultural crops.

Haber-Bosch Alternative

The Haber-Bosch industrial process, which produces most current fertilizers, comes with economic and energetic costs that are either significant (for developed countries that can afford to use the process) or prohibitive (for underdeveloped countries where such costs are a barrier). Furthermore, by burning fossil fuels to generate ammonia from molecular nitrogen (N2 gas), the process can account for up to five percent of world natural gas consumption. The in-situ nature of these genetically-modified diazotrophs for biofertilizer production could mitigate transportation costs and environmental impacts related to Haber-Bosch derived fertilizers, and biological assimilation of nutrients and the timed release of nitrogen compounds may address current agricultural residue runoff issues.

BENEFITS AND FEATURES OF SAFE AND EFFECTIVE MICROBIAL BIOFERTILIZER:

- Does not require an anaerobic environment
- Supports growth of other organisms in co-culture
- Produces urea as a terminal product
- Does not require fossil fuels or extreme heat and pressure; the biological process is effective at ambient temperatures and pressures
- Potential substitute for many current fertilizers
- Minimal infrastructure costs associated with production
- A combination of different cultures strains could utilize a range of waste products

Phase of Development Concept

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