Title: **Development of Artificial Roots and Synthetic Soils to Probe Mechanisms of Soil Organic Matter Cycling**

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BER Program: TES

Project: University Project: Leveraging synthetic root-soil systems to quantify relationships between plant traits and the formation of soil organic carbon

Project Abstract:

The balance between soil organic matter (SOM) formation and loss is regulated by dynamic interactions among plants, decomposer microorganisms, and soil minerals. However, these factors are often highly correlated in natural ecosystems, making it difficult to disentangle the mechanisms that determine the belowground fate of OM inputs. The overall goal of this project is to use artificial root-soil systems to study how C and N cycling are shaped by biotic and abiotic drivers. Data from synthetic soil incubation experiments will be used to parameterize and compare three 'microbially explicit' biogeochemical models, which make different assumptions about the dominant drivers of SOM cycling.

We present data from preliminary tests of the synthetic soils method, demonstrating that the chemical complexity of OM inputs to artificial soils regulates the size and growth efficiency of the microbial biomass. We have also developed an innovative, inexpensive, and high-throughput method to build artificial root systems that deliver customizable root exudate solutions at realistic rates in spatially discrete zones. These methods will underpin a large microcosm incubation experiment featuring a fully factorial manipulation of OM inputs, the microbial community composition, and soil mineralogical properties.