

## **Lead project director**

I am not sure: this could be me as the person pushing the ideas, etc, but I don't they are accepting post-doctoral-type grants, according to the RFA ([here](#), pp64-65). They are accepting "new investigator" grants, but I think that implies new tenure-track hires, with their own labs? If not me, then I assume the most senior academic among us willing to accept the title. Please give me opinions about this if you have them.

## **Collaborators:**

*I haven't included full honorific titles. Please let me know if you think this would be something to do.*

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Department of Biology

## **The Program Area/Program Area Priority that is most closely addressed:**

Foundational and Applied Science Program, **Agricultural Microbiomes** (program Area priority code A1402)

**Title:**

Assessing the importance of adjacent ecosystems on microbiome-mediated resistance to coffee leaf rust by *Coffea arabica*.

**Rationale:**

Traditional breeding programs and host-genome-based approaches to improving coffee leaf rust resistance do not appear to be keeping pace with the evolution of new virulent strains of the coffee leaf rust. However, some evidence points to microbiome-mediated resistance to the coffee rust, specifically through the acquisition of natural antagonists by coffee plants, often in forested settings. We propose to investigate the spatial patterns and microbiological partners involved in this differential response by *C. arabica* to the coffee leaf rust.

**Overall hypothesis or goal**

Hypothesis: Complex ecosystems such as forests may act as sources of beneficial microbes, especially natural antagonists to pathogens, to the microbiomes of plants in surrounding ecosystems, such as farms. This ecosystem service of biocontrol diminishes with distance from forests due to dispersal limitation by microbes.

**Specific objectives**

- 1) Determine the importance of forests to the health of coffee farms in regions of the coffee leaf rust epidemic.
- 2) Uncover new beneficial microorganisms for the cultivation of coffee, survey their ecological patterns and relationships, and identify candidate molecular mechanisms of antagonism to the rust employed by these organisms.
- 3) Work with local communities, government, conservationists and coffee-growers to promote scientific, sustainable, and affordable agro-ecological pest management strategies

**Approach**

We propose to sample coffee trees, spore traps, and “bait” coffee seedlings, using DNA metabarcoding and direct PCR tests, to track changes in fungal communities with distance to forest edges and under varying disease loads. Culture efforts will accompany direct-PCR sampling to retain potential antagonists to the coffee leaf rust and other interesting fungi. We will concurrently estimate gene expression changes by the host (Coffee) using RNAseq methods and also by the coffee microbiome, using a novel subtractive approach of mining the unaligned transcriptome of coffee plants.

## Potential impact and expected outcomes

This study will increase the knowledge of ecological conditions for growing coffee that enhance resistance to the coffee leaf rust. It will also contribute new methods for investigating the role of the microbiome in mitigating pathogens.