The dynamics of microbiome interactions

Supervisory team:
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Project description:

Over the last decade, there has been growing recognition that the microbiome plays a crucial role in the sustained health and fitness of its host. Now there is increasing focus on developing novel strategies to manage the microbiome to solve some of the world's most pressing challenges – for example, using microbiome transplants to improve human and animal health, secure sustainable food production and even combat climate change. The key to effective management of microbiomes is in predicting how interactions between highly complex microbial communities will play out. The problem is we do not yet have a clear understanding of these processes and, moreover, how these interactions affect host fitness.

In this project we will use a model termite species, Zootermopsis angusticollis, that has a symbiotic relationship with its highly co-evolved gut microbiome to understand the dynamics of microbiome invasions. Microbiome transplants regularly occur in this species via trophallaxis among colony members and between colonies when competing colonies meet in the log resource in which they live and feed. Interacting colonies often fight to the death, but also regularly fuse into one cooperative team. We will use a combination of controlled experiments on our established lab population with ecological validation on wild colonies at field sites in California to understand complex interactions between microbial communities and the resultant effects on termite fitness. We will also develop and test new theory to formalise our predictions and underpin our empirical work.

The project will be supervised by world leading experts in social evolution, microbial ecology and evolution, mathematics and genomic techniques. The project will generate fundamental, conceptually rich bioscience research with potential applications to address some of the biggest challenges facing our planet.