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School of Biological Sciences
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Research topic

Understanding the role of resource fluctuations in structuring microbial communities

Outline of the research plan

1. Quantify the importance of resource fluctuations relative to other indirect (resource partitioning) and direct (cross-feeding and inhibition) drivers of microbial dynamics in an *in vitro* gut model.
   - Testing the prediction of Letten & Ludington (2023) via experiments in an *in vitro* gut model.
   - Parameterizing revised models to incorporate direct interactions
   - Decomposing the contributions of indirect and direct interactions across the communities with different species richness.

2. Test how manipulation of host feeding patterns modulates the maintenance of diversity within a real-world gut microbiome.
   - Using germ-free flies (*Drosophila melanogaster*) inoculated with diverse combinations of the core microbiota.
   - Leveraging a state-of-the-art fly feeding apparatus to manipulate feeding behavior and testing full model predictions.

Possible extension of the research

1. Incorporating other possible underlying mechanisms into the model framework. For instance, environment heterogeneity in the hosts' guts, the colonization-competition trade-off of the microbial players, and the feedback due to host behavior into the model framework.

2. Using the fruit fly system as the metacommunity system to investigate how host-microbiome associations differ from classic metacommunity systems due to host behavior.