

**Emergent Metabolic Dynamics in Microbial Communities**  
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Emerging research of the human microbiome has generated new insights into the role of human-associated microbes in health and disease. In particular, microbes that colonize the gastrointestinal tract play a central role in host metabolism, immunity, and homeostasis, and can change in response to external perturbations such as dietary alterations, chemical exposures, and physiological or psychological stressors. However, the microbiome field currently lacks essential knowledge for how microbial cell-to-cell interactions give rise to higher-order community behavior, which is a key roadblock in the path towards next-generation microbiome-based products and therapies. In this talk, I will describe our various efforts to address these challenges, including how our multi-scale microfluidic platform for microbial community analysis is contributing to the new field of bacterial electrophysiology. My lab is currently deciphering the underlying mechanisms of bacterial biofilm electrophysiology with the goal of better understanding and engineering natural microbial community behavior. These next-generation microbial community analysis and engineering tools provide a foundational platform for bridging synthetic biology technologies to the microbiome field.