

JST GteX seminar

## Microenvironments to microbes: utilizing microphysiological platforms and particle based sensing

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### ABSTRACT:

Predicting the impact of environmental factors, such as temperature changes or variations in chemical composition, on organisms is a complex challenge, particularly when studying microorganisms. These organisms display diverse phenotypes and metabolic abilities, leading to a wide range of responses to environmental shifts and resource availability. In this presentation, I will introduce research aimed at unraveling the complex interplay between environmental factors and metabolic heterogeneity. First, I will discuss microfabrication-based techniques that allow us to engineer custom abiotic environments. By integrating these techniques with physiologically relevant measurements, we can investigate how environmental conditions and cellular heterogeneity influence population dynamics and ecosystem-level responses. Next, I will present the use of chemical sensing particles for simultaneous measurement of oxygen levels and flow across complex biological surfaces, such as sinking marine particles and corals. This approach has uncovered, for the first time, how ciliary movements on coral surfaces mediate the transport of oxygen from production zones to areas of consumption, revealing intricate metabolic interactions within corals. By leveraging these advanced methodologies, I argue that we can start to disentangle the complex interactions between environmental conditions, biological heterogeneity, and material transport. This integrated perspective holds the potential to unlock new insights in fields such as environmental toxicology, adaptive evolution, and microbial ecology.

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