DEPARTMENT OF
MECHANICAL ENGINEERING

ME Spring Seminar 07

Seeing the Invisible: Bridging Clinical Microbiome Cohorts and Single-Cell Engineering for Precision Medicine

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While large-scale clinical cohort studies have successfully identified various microbial signatures associated with human diseases-ranging from metabolic disorders to the gut - liver axis - the field currently faces a critical transition from association to causation. Conventional bulk-sequencing approaches (16S rRNA and Shotgun Metagenomics) provide a population-level snapshot but often obscure the functional heterogeneity and metabolic activity of individual microbes within complex ecosystems.

In this seminar, I will present my research group's work on deciphering the complex interplay between the gut microbiome and host health, with a particular focus on the gut-liver axis and immune modulation. I will discuss our approach to managing high-dimensional clinical cohort data, integrating shotgun metagenomics and metabolomics, and our efforts to validate these findings through in vivo and in vitro models. We will explore how deconfounding analysis and multi-omics integration can reveal hidden microbial signatures that drive disease pathogenesis.

Finally, I will briefly share some 'Bridging Questions' regarding the current technical bottlenecks in microbiome research. From a clinical researcher's perspective, I will touch upon the potential of emerging single-cell technologies to address challenges such as functional heterogeneity and real-time metabolic activity, which remain largely invisible through conventional sequencing alone. This session aims to foster an interdisciplinary dialogue on how precision measurement tools might be integrated into large-scale clinical frameworks.

Bldg.110 #N105

16:00 - 17:15

Wednesday, **May 6**

Host:
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