Title: Metabolome Meets Microbiome: Systems Chemistry of Health and Disease

Speaker: Palok Aich

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Abstract

While we continue to do great R&D, it is now time to think more deeply about impact, without compromising the quality and integrity of the science. In a nutshell we should think how to balance between knowledge and utility in our research. My venture during this talk will be to walk you through the curves of metabolome and microbiome to reach the surface in maintaining health.

The microbiome and metabolome together form the most dynamic, responsive and irreducible layer of human biology—an evolving interface where microbial chemistry intersects with host physiology. Advances in high-resolution mass spectrometry, isotope tracing, and computational metabolomics now allow us to capture this interface with unprecedented precision. Yet, the deeper challenge lies in translating these molecular insights into actionable biology and therapeutic innovation.

In this talk, I will discuss recent systems-level approaches that integrate **host–microbiome metabolic interactions in Aichlab**, focusing on **metabolome-microbiome communication by perturbing host resident microbial milieu**, and **microbial metabolite modulation under high-fat and inflammatory stress**. Using experimental models spanning microbial perturbation, immune–neural crosstalk, and metabolic adaptation, our work identifies candidate microbial metabolites and host pathways that can be leveraged for **biomarker discovery**, **diet-based interventions**, and **metabolite-inspired therapeutics**.

These findings underscore a paradigm shift—from merely cataloging microbial species to decoding their chemical function in the context of human physiology. Ultimately, this integrative metabolome–microbiome research offers a blueprint for **translational strategies** that couple molecular understanding with preventive and precision health applications, aligning well with DAE's mission of fostering **science-driven innovation for societal benefit**.

Session Summary (50 words)

This talk explores the chemical dialogue between the metabolome and microbiome that shapes host metabolism, immunity, and neural signaling. By integrating metabolomics, microbial perturbation, and systems modeling, the work translates molecular insights into the **Gut Function Test**, advancing precision and preventive medicine through actionable understanding of host–microbe metabolic health.

Speaker Bio-sketch

Dr. Palok Aich is Professor and Dean (Research & Development) at the **National Institute of Science Education and Research (NISER)**. His research focuses on the **microbiome–metabolome interface**, exploring molecular communication between microbes and host systems through metabolomics, neuroimmune signaling, and systems biology. Prof. Aich's group has contributed to the development of the **Gut Function Test**, translating fundamental microbial metabolite research into applications in **precision and preventive medicine**. A recipient of multiple national and international recognitions, he also served as **Convener of the 1st DAE Conclave (2024)** held at NISER, Bhubaneswar, promoting mission-oriented science across DAE institutions.