International Conference on Micro Nano Fluidics
(ICOM 2025)

October 31 – November 2, 2025, IIT Guwahati

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Tentative topic of the invited talk

Millions of Test Tubes in a Milliliter: Scaling Discovery with Capped Nanovials

Abstract of the invited talk

Microscale compartmentalization technologies are enabling powerful new approaches to study single cells at scale. In this talk, I will introduce **nanovials**—engineered hydrogel microparticles with a bowl-shaped cavity that serve as miniature test tubes for individual cells. These suspended compartments support functional assays such as antibody secretion profiling and are compatible with standard flow cytometry and cell sorting instruments, allowing millions of single-cell experiments to be run in parallel.

Building on this platform, I will present **capped nanovials**, formed by docking spherical hydrogel particles onto nanovials to create sealed, semi-permeable compartments. This configuration retains secreted molecules and co-localizes multiple cells in a defined microenvironment, enabling new applications such as multi-cell functional screening and growth-based selection assays. We demonstrate the use of capped nanovials for function-first antibody discovery using reporter cell activation, as well as for identifying fast-growing clones of bacteria, yeast, and mammalian cells.
Together, nanovials and capped nanovials provide a flexible and accessible toolkit for probing diverse cellular phenotypes—extending the concept of the test tube into the microscale era of biology.