



# International Conference on Micro Nano Fluidics (ICOM 2025)



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**Speaker/affiliation:** Dr. Nripen Chanda, Senior Principal Scientist, CSIR- Durgapur, India.

**Tentative topic of the invited talk**

*Integrated Microfluidic Systems for Electrochemical and Colorimetric Bioanalysis and On-Chip Energy Generation from Water*

**Abstract of the invited talk**

The convergence of microfluidic engineering with advanced bio-sensing and sustainable energy harvesting offers transformative potential for next-generation point-of-care diagnostics. In this study, we present a multifunctional microfluidic platform that integrates electrochemical detection of circulating tumor cells (CTCs) and exosomes, colorimetric bioanalysis using paper-based microfluidics, and on-chip energy generation from aqueous environments.

The platform employs screen-printed electrode arrays embedded within microchannels for the electrochemical quantification of cancer-associated biomarkers, utilizing nanomaterial-functionalized probes to ensure high sensitivity, selectivity, and clinical relevance. Simultaneously, paper-based microfluidic modules enable colorimetric detection via nanoparticle-substrate interactions, providing rapid, instrument-free readouts suitable for deployment in resource-limited or field settings.

Another distinctive feature of this platform is its energy harvesting capability, which utilizes electrokinetic mechanisms, including streaming potentials generated by fluid flow within microchannels, to produce usable electrical energy. This self-powered functionality may support autonomous operation of the sensing system, potentially eliminating the need for external power sources.