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Microfluidic tools for cellular analysis at physiological scale

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Over the past few decades, microfluidic technology has laid the foundation for developing advanced and importantly more physiologically-realistic *in vitro* models for manipulating and analyzing cellular behaviors at both the tissue-specific and single-cell levels. Microfluidic devices have attracted much attention for cell-based studies because of their ability to use small quantities of cells and reagents, precisely control spatial and temporal microenvironments and facilitate high-resolution visualization of cellular events in real-time. In this presentation, I will demonstrate the microfluidic-based analytical models, micro-fabrication methods, experimental validations and on-chip monitoring of cellular responses for a diverse set of biological studies namely nano toxicological analysis, synapse formation, surfactant secretion in the lung alveoli and neural activity in the brain. Multi compartmented microfluidic platforms are fabricated for analyzing cytotoxic effects of quantum dots under physiologically relevant conditions. Notably, such devices show their potential applications in continuous real-time monitoring of neuronal processes involved in synapse formation. The role of flow-induced shear stress on the mechanisms regulating surfactant secretion in pulmonary alveolar type II epithelial cells is also investigated using microfluidic models. Furthermore, a microfluidic model of neural tissue that closely mimics the realistic and complex three-dimensional (3D) brain's cyto-architecture is developed for measuring activity of the neurons in a 3D environment following site-specific chemical treatment of a brain-like neural network. Altogether, such integrated microfluidic platforms that combine bio-realistic growth conditions and optical access hold tremendous potential for high-throughput toxicity testing, tissue engineering and establishing mechanistic insights into respiratory physiology and neurodegenerative diseases.

Biography

Sanjeev Kumar Mahto has completed his PhD from Kongju National University, Republic of Korea and Postdoctoral studies from Technion-Israel Institute of Technology School of Biomedical Engineering, Israel and University of Calgary in the Department of Electrical and Computer Engineering, Canada. He is the Faculty of the School of Biomedical Engineering, Indian Institute of Technology (Banaras Hindu University) Varanasi, a premier Technological Institution of the Government of India and an Institute of the National importance. He has been granted one US and European patent, published more than 15 papers in reputed journals and has been serving as an Editorial Board Member of *American Journal of Bioscience and Bioengineering*.

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