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Microfluidics for cell analysis and isolation

Microfluidics has emerged as a technology with significant impact on cell biology and medical research. The ability to manipulate fluids at the microscale has led to new methods to manipulate and study biological entities. During this talk, I will present microfluidic technologies for three different biological applications: (i) I will discuss our work on developing a simple microfluidic system for culturing mammalian cells and temporally-controlling the delivery of bio-reagents. We used the system to spatiotemporally control the distribution of Tumor Necrosis Factor (TNF) within the cell-culture channel, and HeLa cells were exposed to TNF pulses as short as 8 s. With this system, we measured for the first time the shortest required duration of TNF stimulation that elicits activation of the survival pathway (NF-kB) in cancer cells. Preliminary results suggested that short pulses of TNF stimulation can provoke early cancer cell apoptosis. Next, (ii) I will introduce our work with Microfluidic Quadrupoles (MQs), which constitutes the first experimental demonstration and characterization of fluidic quadrupoles. We used the MQ to manipulate concentration gradients of chemicals and established the concept of floating gradients. We used the MQ to apply floating gradients of Interleukin-8 to cultured human neutrophils in a Petri dish, and challenged neutrophils with stationary and moving gradients. The setup allowed us to observe dynamics of neutrophils during adhesion, polarization, and migration. Finally, (iii) I will discuss our recent experiments in using the herringbone microfluidic chip to capture circulating plasma cells from blood samples taken from multiple myeloma patients.

Biography

Mohammad A Qasaimeh is an Assistant Professor of Engineering at New York University Abu Dhabi (NYUAD). He directs the Advanced Microfluidics and Microdevices Laboratory (AMMLab), and his current research interests include developing microfluidic devices for biomedical applications. Prior to joining NYUAD, he was a Post-doctoral Associate at Massachusetts Institute of Technology and Harvard Medical School. He earned his PhD degree in Biomedical Engineering from McGill University, where he received several prestigious fellowships and awards including the NSERC Postdoctoral Fellowship. His research has been published in several peer-reviewed journals including *Nature Communications, PLOS Biology and Lab on a Chip*.

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