College of Science and Engineering

Department of Biomedical Sciences

Seminar

Regulating Cell Microenvironment using Microengineering Technology

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Date: 24 November 2016 (Thursday)

Time: 12:00 nn – 1:30 pm (Reception with light sandwiches starts at 11:45 am. To facilitate the order of sandwiches, please register through email yyfung2222@cityu.edu.hk.)

Venue: G6302, Academic 1, City University of Hong Kong

Language: English

Abstract

The main theme of this seminar is about applications of microengineering technology for regulating microenvironments around cells to facilitate cell growth and phenotypic analyses. The speaker will discuss about strategies to control both soluble (e.g. nutrients and dissolved gases) and insoluble (e.g. force and substrate stiffness) factors for cell research, ranging from cell layers down to single-cells and subcellular scales.

The first part will be about the development of an automated multiplexed microfluidic platform, integrated with several recently reported components for mixing and long-term oxygenation for a broad range of high-throughput cell incubation and characterization applications. This device contains multiple microchambers for long-term cell culture with defined and dynamically adjustable microenvironmental factors including dissolved gasses, medium composition, and substrate surface molecules. Each of the chambers can be configured with a unique microenvironment independently; and therefore this platform can achieve high-throughput parallel cell culture and analysis with a matrix of different growth conditions that can contribute to the quantitative physiological studies.

The second part of this seminar will introduce a couple newly developed microfabricated tools for mechanobiology-related research, for revealing further mechanotransductive behaviors of cells. External forces are increasingly recognized as major regulators and effectors of cell structure and function, yet the underlying mechanisms by which cells sense force and transduce it into intracellular biochemical signals and behavioral responses ('mechanotransduction') are largely undetermined. We will report a membrane stretching device that incorporates a biocompatible elastomeric micropost array to obtain real-time observation of subcellular elasticity and transient traction forces in response to stretches. We will also introduce the integration of micropost substrate into microfluidics for quantifying the flow-mediated cell alignment. Furthermore, we will discuss application of confining microchannels to quantify whole-cell viscoelastic properties and surface proteins expression for deep phenotyping of floating cells, which covers rare cells in human blood. We will also discuss a sequential cell isolation scheme for capturing floating cells at defined positions in microfluidics, potentially for biomedical applications such as diagnosis of circulating tumor cells.

On the other hand, though it may be out of the main theme, we will introduce briefly other recently research works in the Speaker's team, including adopting microengineered stretchable conductive elastomeric electrodes in biopotential sensing such as acquisition of electrocardiogram and electroencephalogram. These electrodes are integrated in ambulatory electrophysiological systems for long-term and portable monitoring of epilepsy or heart disease patients.

Biography

Dr. Lam is currently working as an Assistant Professor in the Department of Mechanical and Biomedical Engineering in the City University of Hong Kong since Sept. 2011. He holds a first honor B.Eng. degree (2003) and an M.Phil. degree (2005) in Automation and Computer-aided Engineering from Chinese University of Hong Kong, and a Ph.D. degree (2010) in Mechanical Engineering from Massachusetts Institute of Technology. After graduation, he worked as a postdoctoral fellow in Mechanical Engineering Department in University of Michigan from Sept. 2010 to Aug. 2011. Raymond has interdisciplinary research experience in cell mechanobiology, bacteriology, microfluidics, microfabrication, computational methods, software development and circuit/device design. His overall research objective is to bridge science and engineering knowledge and currently he aims at developing/applying microengineering techniques to advance the cell biology research.

**** All ARE WELCOME ****

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