The Chinese University of Hong Kong
Department of Biomedical Engineering

Graduate Seminar – PhD Oral Defence

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Date : 14 April 2023
Time : 9:00-11:10 am
Zoom Link : https://cuhk.zoom.us/j/97019801044?pwd=QlVDaDVUZ1RSUVovZHd0RmNpRy80Zz09
Meeting ID : 970 1980 1044
Password : 590360

Title: An Integrated Centrifugal Microfluidic Platform for Bioanalysis

Microfluidics is a rapidly growing research discipline due to its highly attractive features. Its advantages include device miniaturization, drastic reduction in reagent consumption, portability, low cost, ease of volume production, and compatibility with conventional integrated circuit manufacturing processes. Despite the tremendous advancement in the last three decades, microfluidic systems for biomedical applications still suffer from limitations such as actuation complexity, cross-contamination, and limited ability to integrate multiple steps. Over the years, integrated centrifugal microfluidic systems have become a promising platform for all-in-one clinical diagnostics platforms due to the advantages of automation, pump-free, and enhanced throughput. This work aims to resolve the aforementioned issues by exploring several approaches, namely: a Lab-in-a-Tube (LIAT) ultra-centrifuge system for single cell analysis, and a Parafilm® -based rapid prototyping method, setting the foundation of integrated centrifugal platforms for advanced applications. The LIAT ultra-centrifuge system features the wireless transmission of real-time images and the rotational velocity precisely controlled by quantitative gravity force. The system has been validated by single-cell analysis including cell trapping and cell deformation. The multi-functional and biocompatible Parafilm®-based analytical microfluidic devices prototyping method was developed and optimized. With time consumption (2 hours) 12 times less than conventional photolithography (~24 hours) and stronger bonding strength, practical actuation devices including microvalves and micropumps that required high bonding strength were fabricated by this method with high performances. The biocompatibility was validated through 7-day Escherichia coli (*E. coli*) cultivation.

In summary, this thesis has demonstrated the performance merits of several integrated centrifugal microfluidic systems for complex biomedical applications, as well as a rapid prototyping method for microfluidic device fabrication. Further development of the reported designs into practical devices should lead to fully integrated microfluidic systems capable of completing sample-to-answer bioassays with short sample turnaround time, which sought to bring great benefit to biomedical applications as well as point-of-care diagnostics.

***** ALL ARE WELCOME *****

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