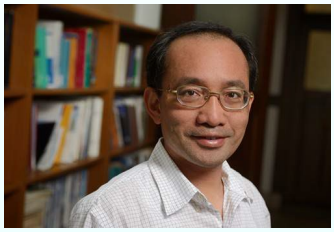
The Chinese University of Hong Kong
Department of Biomedical Engineering

Droplet Microfluidics Enables Rapid Diagnostics and Antimicrobial Susceptibility Testing



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Date : 6 August 2024 (Tuesday)
Time : 10:00am
Venue : Room 1122, William M W Mong Engineering Building, CUHK

Abstract

The talk describes the applications of droplet microfluidic-based platforms for pathogen detection and antimicrobial susceptibility testing (AST). I will first introduce droplet magnetofluidics, a technology that eliminates the need for large, complex instrumentation and fluidics typically associated with clinical laboratory nucleic acid amplification testing. Droplet magnetofluidics facilitates facile extraction and purification of nucleic acid targets from clinical samples and concentrates them into a small volume for amplification detection. The assay miniaturization helps maximize the thermocycling speed and minimize reagent consumption, thereby enabling a molecular test with a short turnaround time and a low assay cost. The magnetofluidic diagnostic platforms have demonstrated clinically relevant sensitivity and specificity for Hepatitis C viral infections, sexually transmitted diseases, COVID-19, and HIV. Furthermore, I will present a microfluidic single-cell biosensing platform that employs droplet microfluidics to enable pathogen detection without performing nucleic acid amplification via hybridization detection of 16S rRNA from single bacterial cells. In-droplet quantitative measurements of genetic contents or metabolites from single bacterial cells provide a surrogate for accelerating AST. When applied to urinary tract infections, the droplet-based single-cell platform achieved both pathogen identification and AST from urine samples in 30 minutes, as opposed to 2-3 days by conventional culture-based methods. Finally, I will introduce a versatile combinatorial droplet platform for automated high-throughput screening of antibiotic combinations. This platform significantly reduces reagent consumption compared to standard microtiter-based methods, enabling on-demand, scalable creation and examination of antibiotic combinations for therapeutic purposes.

Biography

Tza-Huei (Jeff) Wang is Louis M. Sardella Professor in Mechanical Engineering and Biomedical Engineering at the Johns Hopkins University, where he has served as faculty since 2002. He earned his doctorate in Mechanical Engineering from UCLA in 2002. His research focuses on the development of innovative micro- and nano-biotechnologies for molecular analysis and biomedical research. His vision is a healthier and more equitable world that is realized through new molecular analysis and diagnostic technologies that not only have unprecedented performances in sensitivity, specificity, speed, multiplexity, and temporal and spatial resolution, but are also affordable and accessible to the public. Dr. Wang is a prolific researcher and inventor. He has authored 200 journal articles and 120 conference papers and delivered 150 invited talks. He currently holds 26 US patents and 12 foreign patents. He has received numerous awards, including the NSF CAREER Award, the CRS Jorge Heller Award, the JALA Ten Award, and the Cohen Translational Engineering Award. He has been inducted as a Fellow of the American Association for the Advancement of Science (AAAS), the American Institute for Medical and Biological Engineering (AIMBE), the American Society of Mechanical Engineering (ASME), the Institute of Electrical and Electronics Engineers (IEEE), and the Royal Society of Chemistry (RSC).

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

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