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Multiplexed Protease activity assay for accurate diagnosis using droplet based microfluidics

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Abstract

The need for greater specificity and sensitivity in biomarker detection for diagnosis requires the amount of data to increase exponentially, resulting in complex experimental design and analysis. Existing methods, such as zymography, antibody probes, and mass-spectrometry-based methods, must balance the tradeoff between accuracy and throughput. Recently an integrated droplet based microfluidic platform was developed for accurate high throughput multiplexed bioassay. The droplet-based microfluidic technology enables the high-throughput screening of large number of biochemical reactions (~10^8 different reactions/10hours) by using small sample amount (30□L) to facilitate the monitoring of biomolecule activity for diagnosis. Previously, droplet-based microfluidics approaches have been widely applied to improve many analytical methods in biology, such as protein crystallization, cytotoxicity screen and enzymatic assays. However, the analysis of low-abundance biomolecules directly from clinical samples in droplets is challenging because of the limitations in adding multiple chemical reagents and the nonspecific loss of target biomolecules to droplet interfaces. To fully realize its advantages, an integrated microfluidic platform combining a droplet generator, a picoinjector and droplet library was designed to offer a multiplexing bioassay in the droplets. The ability to analyze clinical samples with high throughput will allow the accurate detections of biomarkers for diagnosis. We will specifically focus on detecting the important cancer biomarker, Proteases Matrix metalloproteinases (MMPs) and A Distintegrin and Metalloproteinases (ADAMs) which play key roles in several physiological processes. Clinical samples will be analyzed using the microfluidic platform with high throughput to make accurate diagnoses for point of care testing and drug discovery for pharmacy industry.

Biography

Dr Chia-Hung Chen obtained his PhD at University of Cambridge (2010), MS at Harvard University (2006) and BS at National Taiwan University (2004). He was a Postdoctoral Associate at the Department of Biological Engineering and Department of Electrical Engineering and Computer Science at MIT (2010-2012) before joining NUS. Dr. Chen's research focuses on developing microfluidic platform for biomarker determinations. He combined the droplet based technology and different microfluidic components to form the integrated platforms for endometrial related disease diagnosis, single cell assay and multiplexed biological assay to indicate the specific enzymatic activities in clinical samples for biomedical applications.

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