SynCTI SEMINAR SERIES

NUS Synthetic Biology for Clinical and Technological Innovation (NUS SynCTI)
Member of Singapore Consortium for Synthetic Biology (Sinergy)

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Single Cell Clinical Analysis For Precision Medicine By Using Integrative Microfluidics

Precision medicine refers to giving the right therapeutics, to the right patient, at the right time. In the context of cancer, successful implementation of precision medicine, requires treatment individualization not only taking into account patient and tumor factors, but also tumor heterogeneity and tumor evolution over time. In this study, a continuous flow microfluidic device was developed as a functional flow cytometer (μ-FACS) to detect secreted multiplexed protease activities at single cell resolution (Fig. 1). The individual cells from patient samples are encapsulated within water-in-oil droplets for single cell multiplexed protease assay. We modified FRET (fluorescence resonance energy transfer)-based substrates to accommodate different fluorescent pairs with distinct excitation and emission wavelengths to obtain multiple signals from droplets containing single cells. Four substrate-protease reactions in a droplet were simultaneously monitored at three distinct pairs of fluorescent excitation (UV: 400nm, B: 470nm, G: 546nm, R: 635nm) and emission (B: 520nm, G: 580nm, R: 670nm) wavelengths. To infer a quantitative profile of multiple proteolytic activities from single cells, we applied the computational method Proteolytic Activity Matrix Analysis (PrAMA). The capability to determine multiple protease activities at single cell resolution has the potential to characterize tumor progress of individual patients for therapeutics.

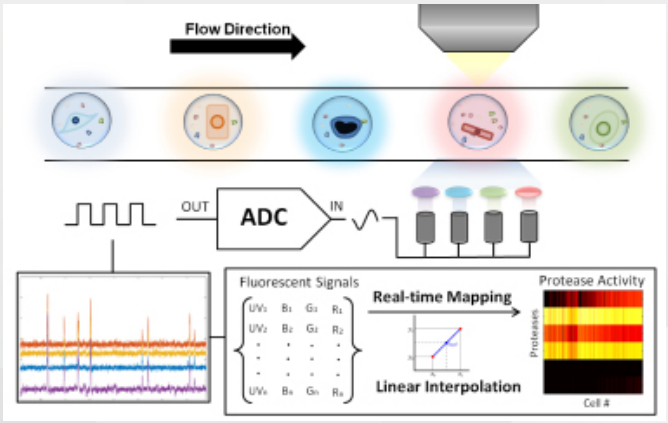

Fig 1: Continuous flow microfluidics for single cell enzyme measurement

Dr. Chen is developing a research program focused on integrative droplet microfluidic platforms for clinical enzyme measurement and single cell phenotype characterization for biomedical applications. Compared with most current fluidic platforms using gene sequence for diagnosis, microfluidic enzyme assay offers unique advantage in rapid measurement to characterize biological fluids for on-time precision medicine. With this program, he has delivered promising research outcomes, including 50 papers in international journals including Nature Communications, PNAS, JACS, Lab on a Chip, Advanced Materials, Advanced Functional Materials, Biosensors and Bioelectronics, and Analytical Chemistry. Dr. Chen has collaborated with clinicians/researchers at the National University Hospital of Singapore (NUHS) and Massachusetts General Hospital (MGH) to develop droplet device. Moreover, he has secured the external grants of ~6M SGD as a principle investigator to support the research activities and was nominated by the committee in Royal Society of Chemistry (RSC), as an Emerging Investigator in Lab on a Chip.

Friday, 31 May 2019 at 3pm
CeLS Seminar Room 2 #01-05
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hosted by: A/Prof Poh Chueh Loo

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