Queensland Micro- and Nanotechnology Centre

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Speaker: [Associate Professor Yi-Chin Toh](#)
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School of Mechanical, Medical and Process Engineering
Centre for Biomedical Technologies
Queensland University of Technology

Date: Monday 28 March 2022

Time: 11.00 am

Venue: Room 0.05 (N13), Griffith University, Nathan Campus

Title: **Engineering and measuring systemic multi-organ interactions**

Abstract

Human physiology and pathophysiology often involve systemic interactions between multiple organs or tissues. Microfluidic devices are attractive platforms to model these complex physiological processes due to their ability to control multi-cellular interactions spatio-temporally. However, for these engineered multi-organ systems to have translational applications in drug screening or disease modelling, the design of the microfluidic device must not only consider the biological crosstalk mechanisms but also the user requirement specifications (eg. throughput) for the intended application. In this talk, a design thinking approach to the conceptualization and development of microfluidic multi-organ systems will be presented in the context of several drug testing or disease modelling scenario. For example, microfluidic compartmentalized coculture arrays were developed to measure the responses of immune and dermal cellular targets of reactive drug metabolites generated in the liver. By combining the different cellular responses, we could accurately predict the skin-sensitization potential of 11 compounds. Interactions between microbes and mammalian cells as well as interactions between metabolic tissues eg. adipose-muscle-liver the complexity of human physiology. However, existing monolithic multi-organ culture platforms have limited flexibility in specifying the culture conditions, device architectures, and fluidic connectivity simultaneously. A modular microfluidic platform, which enables a ‘stick-n-play’ approach to assemble planar perfusion circuits, was developed to overcome these limitations. This modular design approach enables one to independently develop customized devices to support the optimal culture of mammalian tissues and microbial cells. In addition, specific tissue modules can be induced into a diseased phenotype, which can subsequently to be connected to another tissue module to examine causative or reversal mechanisms involved in their crosstalk. This platform greatly facilitates the integration of existing organs-on-chip models to provide an intuitive and flexible way for users to configure different multi-organ perfusion systems.

Biography

Yi-Chin Toh is a Future Fellow and Associate Professor at the Queensland University of Technology. She obtained her BEng in Chemical Engineering and PhD in Bioengineering from the National University of Singapore in 2001 and 2008 respectively. She did her post-doctoral training at the Massachusetts Institute of Technology in 2008 under Professor Joel Voldman's guidance. Before joining QUT, she led an independent research group as an Assistant Professor at the Department of Biomedical Engineering, National University of Singapore.

Yi-Chin's major scientific contribution is in the advancement of microfluidic tissue models for applications in drug testing and experimental biology. To date, she has published 49 papers, 5 book chapters and over 90 conference papers. She is on the editorial board of Biomicrofluidics, Micromachines and Frontiers in Digital Health. Her current research interest is in engineering multi-scale tissue models to mimic complex biological interactions during human development and diseases, as well as translating them into scalable platforms for disease modeling and drug testing applications. Her lab is also working on integrating microfluidics and biofabrication technologies to realize a new generation of human-on-chips. Dr Toh is a recipient of the Australia Research Council Future Fellowship, National University of Singapore Research Scholarship, A*STAR Graduate Scholarship and A*STAR International Fellowship.

For enquiries, please contact Assoc Prof Yulin Zhong

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