Department of Biomedical Sciences
香港城市大學
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Body-on-a-Chip to recreate multicellular animals *in vitro*

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New York University Abu Dhabi (NYUAD)

DATE: 10 June 2025 (Tuesday)
TIME: 2:00 pm - 3:00 pm
VENUE: P4701, 4/F, Yeung Kin Man Academic Building, CityU

Biography:

Ken-ichiro Kamei is a stem cell engineer and an associate professor jointly appointed in the Biology and Bioengineering programs within the Divisions of Science and Engineering at New York University Abu Dhabi. He is also an affiliated associate professor at the Tandon School of Engineering, New York University, a visiting associate professor at the Institute of Integrated Cell-Material Sciences (iCeMS), Kyoto University, and a visiting professor in the Department of Pharmaceutics, Wuya College of Innovation, Shenyang Pharmaceutical University. He earned his BA (1998) and MS (2000) before obtaining his PhD from the Tokyo Institute of Technology in 2003. His career includes a postdoctoral fellowship at the Molecular Biology Institute at the University of California, Los Angeles (UCLA), a staff research associate position at the California NanoSystems Institute at UCLA, and roles as an assistant professor and later an associate professor at iCeMS, Kyoto University.

His research centers on developing a miniature, comprehensive device called "Body on a Chip," designed to mimic the physiological and pathological conditions of living systems in vitro. His current research focuses on advancing regenerative medicine and drug discovery for humans and endangered animals, with the ultimate goal of enhancing global healthcare.

Abstract

Reverse Bioengineering represents an approach aimed at replicating the complex architecture and functions of multicellular animals in vitro. The ultimate goal of Reverse Bioengineering is to create living models that mirror the dynamic interactions found in whole organisms, offering a deeper understanding of fundamental biological processes.

In my work, I have focused on developing "Body-on-a-Chip (BoC)" platforms, which integrate cutting-edge microfluidic technology with stem cell biology to simulate in vivo conditions. These platforms are designed to mimic the intricate physiological processes of living systems by creating interconnected networks of tissues and organs. The versatility of BoC platforms allows for precise study of inter-tissue communication, enabling a more accurate examination of systemic responses and disease progression. Importantly, these models present a powerful alternative to traditional animal experimentation, offering ethical and efficient tools for disease research, drug discovery, and therapeutic testing.

During my presentation, I will showcase two key applications of the BoC platforms: studying non-alcoholic fatty liver disease (NAFLD) and investigating early human embryogenesis. In our research on NAFLD, we established co-cultures of gut and liver cells to explore tissue-tissue interactions and their effects on disease outcomes. Remarkably, these co-cultured cells exhibited protective effects against apoptosis induced by free fatty acids, a stark contrast to the vulnerability observed in mono-cultured cells. This highlights the importance of cellular interactions in understanding disease mechanisms and could have significant implications for future therapeutic strategies targeting NAFLD.

In our embryogenesis studies, we utilized human blastoids derived from stem cells in a novel non-cell-adhesive hydrogel system. These blastoids closely resembled human blastocysts and exhibited differentiation into all three germ layers. The ability to mimic early developmental stages in vitro provides valuable insights into human embryogenesis and opens new doors for understanding congenital disorders and tissue development.

Ultimately, Reverse Bioengineering offers unprecedented opportunities to deepen our knowledge of both disease mechanisms and embryonic development. By reconstructing living systems in the lab, we can explore biological processes in ways that were previously unimaginable, paving the way for breakthroughs in regenerative medicine, personalized therapeutics, and beyond.

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