工学系研究科専攻間横断型教育プログラム
「機械システム・イノベーション」

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THE UNIVERSITY OF TOKYO

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Fluid engineering for stem cell biomanufacturing and low-cost biosensors

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場 所: 東京大学工学部 2号館 3F 31A 会議室

Abstract:
This talk is going to introduce two ongoing research thrusts in my research group: stem cell biomanufacturing and low-cost biosensors. An overarching principle driving these seemingly distant efforts is fluid engineering – design, modeling, and exploitation of fluid flows to improve biomedical devices. First, I will discuss stirred suspension culture of human pluripotent stem cells, in which we use fluidic agitation to control the maintenance of undifferentiated stem cells and their differentiations. The fluidic agitation dictates the size of growing cell aggregates which is a critical parameter for transport of nutrients and metabolites. In addition, the fluidic agitation modulates key signaling pathways. We use this unique mechanical cue to achieve efficient derivation of cardiac phenotypes in suspension. Second, I will discuss paper-based microfluidic tools we develop for low-cost biosensor applications. It has been a decade since the original microfluidic paper-based analytical device (μPAD) was reported. Since then, the designs and functions of these low-cost biosensors have evolved. However, sophisticated sensor functions (e.g., sequential delivery, (de-)multiplexing) often require advanced fluid transport techniques. Our tools include origami-inspired 3-D paper-based microfluidics, laser-etched fast-wicking channels, as well as an imbibition model that takes into account the effects of humidity and channel dimensions. Finally, if time allows, I will introduce an injectable nanosensor we are currently developing for in planta detection of agricultural diseases.

Speaker Biography:
Hideaki Tsutsui is an Assistant Professor of the Department of Mechanical Engineering at the University of California, Riverside. He is also a participating faculty member of the Department of Bioengineering and the UCR Stem Cell Center. He received a B.E. from the University of Tokyo (2001), a M.S. from the University of California, San Diego (2003), and a Ph.D. from the University of California, Los Angeles (2009), all in Mechanical Engineering. He then conducted postdoctoral research during 2009-2011 at the Center for Cell Control and the Mechanical and Aerospace Engineering Department at UCLA. His current research interests include low-cost medical and agricultural biosensors, and macro- and micro-fluidic tools for cell-based biomanufacturing. He is a recipient of a Grand Challenges Explorations Phase I Award from the Bill & Melinda Gates Foundation (2012), a UCR Regents' Faculty Fellowship (2013), a Regents' Faculty Development Award (2017), and a Faculty Early Career Development Program (CAREER) Award from National Science Foundation (2017).

主催: 東京大学大学院工学系研究科「機械システム・イノベーション」プログラム（GMSI）
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