UNIVERSITY of ROCHESTER

BME Colloquium

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"From Structure to Function: Immune Cells and Biomimicry in Vascularized Organs-on-a-Chip"

APRIL 15

Dr. Milica Radisic is a Professor at the University of Toronto, Tier 1 Canada Research Chair in Organ-on-a-Chip Engineering and a Senior Scientist at the Toronto General Research Institute. She is also Director of the NSERC CREATE Training Program in Organ-on-a-Chip Engineering & Entrepreneurship and a co-lead for the Center for Research and Applications in Fluidic Technologies. She is a Fellow of the Royal Society of Canada-Academy of Science, Canadian Academy of Engineering, the American Institute for Medical & Biological Engineering, Tissue Engineering & Regenerative Medicine Society as well as Biomedical Engineering Society. She was a recipient of the MIT Technology Review Top 35 Under 35, Queen Elizabeth II Diamond Jubilee Medal, NSERC E.W.R Steacie Fellowship, YWCA Woman of Distinction Award, Killam Fellowship, Acta Biomaterialia Silver Medal, and Humboldt Research Award to name a few.

Seminar Abstract:
Developing stable and functional vascularized cardiac tissue remains a major challenge. In this presentation, I will focus on how organ-on-a-chip technologies can replicate organ functions, with a particular emphasis on the Radisic lab's innovations, including the Biowire heart-on-a-chip, Angiochip and inVADE platforms for vascularizing heart and liver tissues as well as the substrates mimicking fractality of the glomerulus for kidney-on-a-chip applications. I will also discuss the integration of 3D printing and biofabrication to enhance the production throughput of organ-on-a-chip devices and to create new methods for cell cultivation on substrates that are soft, permeable, and mechanically stable. I will highlight the use of co-culture, specifically the combination of four human cell types—endothelial cells, stromal cells, pluripotent stem cell-derived cardiomyocytes, and primitive macrophages (MΦs)—to create stable microvascular vessel networks in the cardiac tissue. Using fibrin-based tissues, we evaluated cardiac and vascular function in microtissues with two organ-on-a-chip platforms, Biowire and iFlow plates. Our results highlight the critical role of primitive MΦs in enhancing the functionality of vascularized cardiac tissues through direct cellular interactions and the secretion of matrix metalloproteinases, as well as pro-angiogenic and cardiac-supportive factors. This approach led to the formation of perfusable tissues with improved cell viability, enhanced contractility, and functional microvasculature within the cardiac tissue.

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