Department of Biomedical Engineering
香港城市大學
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Next-generation Microphysiological Tissue Model for Human Health and Disease

Dr. Haijiao Liu

MONDAY
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TIME
10:00a.m.

VENUE
B6-619, 6/F Yeung Kin Man Academic Building

ABSTRACT

Progress in human biology and medicine is often limited by the lack of experimental systems that can faithfully model complex human tissues and predict therapeutic responses. My research aims to address this challenge by designing and building human-centric, predictive living systems at the interface of bioengineering and medicine to overcome technical barriers and accelerate next-generation therapeutics.

In this seminar, I will discuss my recent work on developing microphysiological tissue models to study human solid tumors during chimeric antigen receptor (CAR) T cell therapy. I will first present a vascularized model of human lung adenocarcinoma that enables controlled perfusion of tumor explants with CAR-T cells, allowing direct visualization and analysis of CAR-T cell trafficking, tumor recognition, and effector functions. I will then describe how this platform was used to test a chemokine-directed CAR-T cell engineering strategy in malignant pleural mesothelioma, with findings validated in a matched in vivo mouse model. Finally, I will present how single-cell RNA sequencing and global metabolomics identified a druggable target and predictive biomarkers that may enhance CAR-T cell efficacy in lung cancer.

Together, these studies establish microphysiological tissue models such as tumor-on-a-chip as powerful and promising in vitro platforms for advancing the development of cell-based therapies for cancer and other complex diseases. I will also briefly discuss how this work builds on my past training where I developed novel biomechanical system tools to address biomedical research problems by probing, controlling, and predicting mechanically regulated cellular and tissue behaviors.

BIOGRAPHY

Dr. Haijiao Liu received his Bachelor of Engineering degree in Precision Machinery and Precision Instrument from **University of Science and Technology of China**, then his Master and Ph.D. (2018) degrees in Mechanical and Biomedical Engineering from **University of Toronto**. He is currently a postdoc researcher in the Department of Bioengineering at **University of Pennsylvania**. Dr. Liu has long been engaged in research on advanced organ/organoid-on-a-chip technologies, tissue engineering, and novel microengineering platforms for mechanobiology, and has made a series of original contributions to the fields of microphysiological systems and mechanobiology. Dr. Liu has published more than 20 papers, including first-author articles in leading journals such as *Nature Biotechnology, Science Advances, Biomaterials, and ACS Nano*. He has been invited multiple times for talks and seminars at leading international conferences and institutions. Dr. Liu has received several awards at different stages of his academic training, including 2015 Chinese Government Award for Outstanding Students Abroad, 2016 World Biomaterials Congress Best Oral Abstract Award, and 2021 NSF Center for Engineering MechanoBiology Pilot Grant Award. His recent work on vascularized tumor-on-a-chip was recognized as one of top ten research advances in 2025 by *Nature Biotechnology*.