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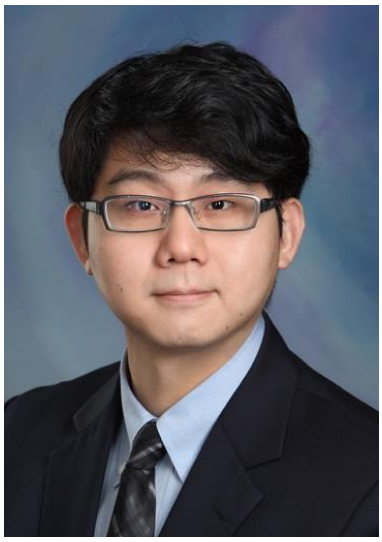

# BME Spring 2023 Seminar Series

## *Soft and flexible bioelectronics for stem cell engineering and brain-machine interfaces*


**Jia Liu, Ph.D.**

**Assistant Professor, School of Engineering and Applied Sciences**

**Harvard University, Massachusetts**


**Friday February 17, 2023 12pm – 1pm in MCHU 101**

**WebEx: Join here**


**Abstract:** High spatiotemporal resolution mapping of cell electrophysiological activity is critical for a variety of fields such as neuroscience, neuroengineering, developmental biology, and cell therapy. Ultimately, our goal is to simultaneously record activities from millions, if not billions, of cells at single-cell resolution, with millisecond temporal resolution and cell-type specificity, across three-dimensional (3D) tissues over the course of development, learning, and aging. In this talk, I will first introduce soft bioelectronics with tissue-like properties that can track electrical activity from the same neurons in the brain of behaving animals over their entire adult life. Specifically, I will discuss the fundamental limitations of the electrochemical stability of soft electronic materials in bioelectronics and present our strategies to overcome these limitations, enabling a scalable platform for large-scale brain mapping. Then, I will discuss the creation of "cyborg organisms", by embedding stretchable mesh-like electrode arrays in 2D sheets of stem/progenitor cells and reconfiguring them through 2D-to-3D organogenesis, enabling continuous 3D electrophysiology during the development of human stem cell derived organoids and animal embryos. Finally, I will discuss the potential for leveraging the soft bioelectronics-brain interface to integrate 3D single-cell spatial transcriptomics with electrical recording, enabling cell-type-specific activity mapping for the study of stem cell functional maturation and development of a functional brain cell atlas.


**Biography:** Professor Liu received his PhD in Chemistry from Harvard University in 2014, after which he completed postdoctoral research at Stanford University from 2015-2018. He joined the faculty at the Harvard School of Engineering and Applied Sciences as an Assistant Professor in 2019. At Harvard University, Professor Liu's lab focuses on the development of soft bioelectronics, cyborg engineering, genetic/genomic engineering, and computational tools for addressing questions in brain-machine interfaces, neuroscience, cardiac diseases, and developmental disorders. Professor Liu has pioneered in bioelectronics where he developed new paradigms for soft electronic materials and nanoelectronics architectures for "tissue-like electronics", as well as their applications for long-term stable brain-machine interface, high-density cardiac mapping, stem cell maturation, and multimodal spatial biology. His work has been recognized as a milestone in bioelectronics by *Science* in 2013 and 2017, and as Most Notable Chemistry Research and Top 10 World-Changing Ideas in 2015. He has received numerous awards for his independent career, including the 2022 Inventors Under 35 (Global List) by *MIT Technology Review*, the 2022 Young Investigator Program (YIP) Award from the Air Force Office of Scientific Research (AFOSR), the 2021 NIH/NIDDK Catalyst Award from the NIH Director's Pioneer Award Program, the 2020 William F. Milton Award, and the 2019 Aramont Award for Emerging Science Research Fellowship. He is also the cofounder and scientific advisor of Axoft, Inc., a brain-machine interface company.

For additional information, please visit **www.bme.uconn.edu** or contact Prof. Fayekah Assanah at fayekah.assanah@uconn.edu or Sarah Dunnack at sarah.dunnack@uconn.edu