

# *Physical Intelligence: Soft Bioelectronics and Micromachines for Precision Health*



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## **Abstract**

Biological systems, such as the nervous and digestive systems, are soft and dynamic, characterized by complex electrical and molecular signaling, tissue development, and organ motion across broad time scales and physical dimensions. These challenges complicate the design of electronic interfaces and devices for biological interfacing in terms of mechanical compatibility, real-time responsiveness, and functional versatility. Advances in soft bioelectronics and micromachines leverage physical intelligence, the ability of materials, structures, and miniaturized machines to sense, respond to, and adapt to their physical environment without centralized computation. This presentation will discuss the design principles of soft bioelectronics and microrobotics and highlight several of our recent developments demonstrating how these technologies enable precision biological interfaces. Examples include an elastic graphene-based neurotransmitter sensor capable of multiplex neurotransmitter sensing in the brain and gut; an intrinsically stretchable, skin-mimicking polymeric electrode array for adaptive biopotential recording and signal decoding; microfabricated neural probe arrays for brain-wide circuit interrogation; and remotely actuated microrobots for precise targeting and localization. We envision these novel devices unlocking unprecedented ways to interface with biological, physical, and virtual systems.

## **Bio**

Jinxing Li is a Global Impact Initiative Assistant Professor in the Department of Biomedical Engineering and the Institute for Quantitative Health Science and Engineering at Michigan State University, where he has been a faculty member since 2021. He also holds adjunct appointments in the Department of Electrical and Computer Engineering and the Department of Chemical Engineering and Materials Science. He earned his Ph.D. in NanoEngineering from the University of California, San Diego, in 2017, followed by a summer visiting scholarship at Nokia Bell Labs and three years of postdoctoral training at Stanford University. Dr. Li received his M.S. from Fudan University and his B.S. from Huazhong University of Science and Technology, both in Electrical Engineering. His research focuses on developing biointegrated technologies, including implantable and wearable biosensors as well as micro/nanorobotics, with the goal of advancing precision and personalized healthcare. He has authored or co-authored over 80 peer-reviewed publications in journals such as Nature, Science, Science Robotics, Nature Electronics, IEEE Journal of Flexible Electronics, Advanced Materials, and Device, among others. He is a recipient of the NSF CAREER Award (ECCS Division), the NIH NIBIB Trailblazer Award, the inaugural DOE ARPA-E IGNIITE Award, the Siebel Scholar in Bioengineering, and the Dan David Scholarship, and was named to the MIT Technology Review Innovators Under 35 Global List.

## **Host**

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