USC Institute for Technology and Medical Systems Innovation

Conformable Neuroelectronics

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Time: 11:15am – 12:30pm
Location: EEB 132 & Zoom

https://usc.zoom.us/j/95276627999?pwd=MnYvTUdSaE1IYUVNV0xqNS82NkVrUT09
Meeting ID: 952 7662 7999
Passcode: 250700

Abstract: The diversity of network disruptions that occur in patients with neuropsychiatric disorders creates a strong demand for personalized medicine. Such approaches often take the form of implantable bioelectronic devices that are capable of monitoring pathophysiological activity for identifying biomarkers to allow for local and responsive delivery of intervention. They are also required to transmit this data outside of the body for evaluation of the treatment's efficacy. However, the ability to perform these demanding electronic functions in the complex physiological environment with minimum disruption to the biological tissue remains a big challenge. An optimal fully implantable bioelectronic device would require each component from the front-end to the data transmission to be conformable and biocompatible. For this reason, organic material-based conformable electronics are ideal candidates for components of bioelectronic circuits due to their inherent flexibility, and soft nature. Throughout her research, Claudia pioneered the development of the first all-flexible, standalone neural recording device, composed entirely of soft, biocompatible components. This device enabled recordings at the level of individual neurons and facilitated real-time detection of epileptic discharges *in vivo*. The wireless data and power transfer system operated on an innovative ion-based communication method, allowing for wireless operation in freely moving animals. Unlike conventional silicon-based devices, every component of this system is soft, conformable, and biocompatible, ensuring long-term performance stability and low-voltage operation to prevent tissue damage. This fully soft and conformable implant enabled recording and transmission of high-resolution neural activity from both the cortical surface and deep within the brain.

Biography: Claudia Cea earned her B.S. in Biomedical Engineering from the University of Pisa and completed her M.Sc. in Bioengineering in San Diego, where she focused on developing innovative origami-based neural probes for both epidural and intradural recording and neurotransmitter detection. She then pursued a Ph.D. in Electrical Engineering at Columbia University, specializing in the creation of fast and sensitive soft bioelectronics that that interact with signals generated by the neural tissue. Notably, she developed the first fully-flexible, standalone neuroelectronic devices using organic electrochemical transistors, composed entirely of soft, biocompatible materials—including integrated power supply and data transmission—for high-resolution recordings. Currently, she is a postdoctoral associate in the Bioelectronics group under Professor Polina Anikeeva at MIT, working on developing novel soft bioelectronic devices to explore electrophysiology in the gut-brain axis.