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Biomedical Engineering
Wallace H. Coulter Foundation
Seminar Series

Reading and Writing the Neural Code: Initial Steps toward Artificial Sensory Percepts and Implications for Neural Prostheses

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LECTURE: 9:00 AM - 10:00 AM

ENGINEERING CENTER
ROOM EC 2300
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Abstract: The transformation of sensory signals into spatiotemporal patterns of neural activity in the brain is critical in forming our perception of the external world. Physical signals, such as light and force, are transduced to neural electrical impulses, or spikes, at the periphery, and these spikes are subsequently transmitted to the brain through various stages of the sensory pathways, ultimately forming the representation of the sensory world. Deciphering the information conveyed in the spike trains is often referred to as "reading the neural code". On the other hand, prosthetic devices designed to restore lost sensory function, such as cochlear implants, rely primarily on the principle of artificially activating neural circuits to induce a desired perception, which we might refer to as "writing the neural code". This requires not only significant challenges in biomaterials and interfaces, but also in knowing precisely *what to tell the brain to do*.

My talk will focus on three topics. First, I will focus on the control of peripheral tactile sensations. Specifically, I will discuss the synthesis of virtual tactile sensations using a custom-built, high resolution tactile display, a device we designed to create high fidelity, computer-controlled tactile sensations on the fingertip similar to those arising naturally. Second, I will utilize a decoding paradigm to discuss the neural representations of tactile sensations and how they are encoded and transformed across early stages of processing in the somatosensory pathway. Finally, I will discuss the design of sub-cortical microstimulation to control cortical activation, using downstream cortical measurements as a benchmark of the fidelity of the surrogate signaling. Taken together, an understanding of how to read and write the neural code is essential not only for the development of technologies for translating thoughts into actions (motor prostheses), but also for the development of technologies for creating artificial sensory percepts (sensory prostheses).

Biography: Qi Wang received his Ph.D. in Robotics at Harbin Institute of Technology, China, and Ph.D. in Electrical and Computer Engineering at McGill University, Canada, in 1998 and 2007, respectively. He received postdoctoral training in Neuroscience at Harvard University in the School of Engineering & Applied Sciences from 2006 to 2008. Since 2008, he has been a research faculty in the Department of Biomedical Engineering at the Georgia Institute of Technology and Emory University. His research interests include neural signal processing, experimental and theoretical approaches for understanding neural coding in sensory systems, brain machine interfaces and biomedical instrumentation.

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