THE UNIVERSITY OF ARIZONA
COLLEGE OF ENGINEERING
Biomedical Engineering

DEPARTMENT OF BIOMEDICAL ENGINEERING SEMINAR SERIES

PRESENTS

Kevin Otto, PhD

Professor and Senior Associate Chair,
J. Crayton Pruitt Family Department of Biomedical Engineering

"Engineering the Neuronal Response to Electrical Microstimulation"

ABSTRACT:

The loss of sensorimotor function has devastating consequences on quality of life. One approach to restoring lost sensorimotor abilities is to supply patients with implants that provide a direct interface with the central nervous system. For an amputee or tetraplegic patient, this interfacing could allow a patient's desired limb movement to be executed by a prosthetic limb, and convey to the patient, sensory information about the consequences of these movements. Highly sophisticated robotic limbs have been developed as have algorithms to decode motor commands from the brain. However, somatosensory feedback is critically important in activities of daily living. Furthermore, touch is important in emotional communication and in embodiment of our limbs. Without touch, the dexterity of the prostheses will be limited, as will the degree to which they are incorporated into the self-image. Given the importance of touch, upper limb neuroprostheses may not be clinically viable until they provide for informative tactile feedback.

Direct interfacing of micro-devices with the brain has the potential to provide sensory information feedback. However, chronic implantation and utilization of neural micro-devices results in a reactive tissue response that both functionally isolates the device from the tissue as well as triggers neuronal apoptosis or migration. The goal of our research is to understand and mitigate this limited functionality. Our research seeks to determine the interdependent effects of device design, electrophysiological recording, electrical stimulation, and the reactive tissue response on the efficacy of neural interfaces. We: 1) conduct psychophysical experiments using multi-channel cortical implants in the cortex, 2) collect longitudinal electrochemical and electrophysiological, 3) investigate several mitigation strategies, and 4) use advanced histological approaches to evaluate the device-tissue interface. Here we discuss the results of these various approaches and their implications for reliable chronic neural interfacing via micro-devices. We expect that these data will enable further neuroprosthetic development for many potential applications of neural interfaces.

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BIO:

Dr. Kevin J. Otto received the BS degree in chemical engineering from Colorado State University in 1997, the MS degree in Bioengineering in 2002 and the PhD Degree in Bioengineering in 2003 from Arizona State University, Tempe.

From 1997 to 2003 he was a Research Assistant in the Bioengineering Department, Arizona State University, where his work was in the areas of neural engineering and sensory neuroprostheses. From 2003 to 2004 he was a Research Fellow in the Department of Biomedical Engineering, University of Michigan, Ann Arbor where his work focused on brain-machine interface systems and implantable devices. From 2004 to 2006 he was a Post-Doctoral Fellow in the Central Systems Laboratory in the Kresge Hearing Research Institute in the Department of Otolaryngology at the University of Michigan, Ann Arbor where his work focused on cochlear implants.

His primary appointment is Professor in the J. Crayton Pruitt Family Department of Biomedical Engineering at the University of Florida. He is also the Senior Associate Chair of the same department. His research interests include neural engineering, device-tissue interfaces, neurostimulation.

Please join us on

Monday, February 22nd, 2021

12:00-12:50 pm, https://arizona.zoom.us/j/85468611706

Hosts: Dr. DK Kang and Dr. Russ Witte
dkkang@arizona.edu and rwitte@arizona.edu

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