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Neural Prosthesis Seminar

Accessing Brain Circuitry in Freely Moving People to Advance Closed Loop Neurostimulation for Parkinson's Disease

Friday, September 30, 2016 • 3:00 PM

Note: afternoon seminar at 3:00 PM

Biomedical Research Building, Room 105
Case Western Reserve University

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Abstract

The overall goal of my research is to investigate how the brain controls human movement and what happens when it goes wrong. I was first interested in this question as a teenager and fairly serious ballet dancer, when I thought about how a ballet teacher/examiner would demonstrate an exercise with his/her hands (and a few French words), and how we would execute that with our feet, without any practice or delay, i.e. 'without thinking.' Indeed any trained athlete, musician etc needs to execute complex movements 'without thinking' as that causes delay and error.

After some training in mathematics and physics, bioengineering, medicine, neurology, movement disorders, and primate extracellular electrophysiology, I am now investigating the neurophysiology of motor control in human subjects, who have a disease (Parkinson's disease, PD), which robs them of that precise ability to 'automatically' execute well-learned movements. Unfortunately this extends to movements we take for granted, such as walking.

There are several challenges to this type of research: one needs valid, reproducible, objective measures of the behavior being studied, one needs to be able to access human brain circuitry in freely moving people, and one needs to develop interventions or perturbations of brain activity to answer hypothesis driven questions about causality between brain signals and human behavior. The outcomes of this research will lead to smarter therapies, where we can modulate brain networks, using feedback from the abnormal behavior or brain signals that are causally related to the behavior, so that people with Parkinson's disease (and potentially other neuropsychiatric diseases) enjoy precise, targeted therapy, when and only when they need it.

In this seminar I will discuss the insights we have learned from the development of objective, validated measures of human motor control, pertaining to PD, how the therapy of Deep Brain Stimulation (DBS), allowed us to access the sensorimotor networks and understand more about neuronal oscillations and synchrony in PD, how an investigational sensing neurostimulator (Activa® PC+S, Medtronic Inc, FDA IDE and IRB approved) has allowed us to record synchronous neural activity (Local Field Potentials LFPs) and quantitative kinematics in freely moving people with PD, and how we are using neurostimulation as a tool to modulate brain signals to investigate the causal role of brain signals and motor behavior. I will end with a brief summary of our closed loop or aDBS experiments in PD and future goals.

For more information, please contact Cheryl Dudek
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Live stream video link for each lecture at www.FEScenter.org/Seminar

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