Joint Department of
BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

Rehabilitation Engineering

Synergizing Neuromodulatory Therapies: Leveraging Homeostatic Neuroplasticity to Facilitate Post-Stroke Motor Recovery

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David Cunningham is a neuroscientist specializing in the use of non-invasive brain stimulation for post-stroke rehabilitation and in understanding the mechanisms of post-stroke recovery. He holds the position of Assistant Professor in the Department of Physical Medicine and Rehabilitation (PM&R) at MetroHealth Center for Rehabilitation Research (MCRR) and at the Case Western Reserve University (CWRU) School of Medicine. He also holds a secondary appointment in Department of Biomedical Engineering at CWRU. His research primarily aims to enhance rehabilitative outcomes for patients with post-stroke hemiplegia by using repetitive transcranial magnetic stimulation and transcranial direct current stimulation. Dr. Cunningham integrates these methods with neuroimaging techniques, including diffusion tensor imaging, functional MRI, resting state connectivity, and both single and paired-pulse transcranial magnetic stimulation, to study neurophysiological changes following injury and during recovery in order to optimize rehabilitation protocols.

ABSTRACT

Hemiparesis of the upper-limb is one of the most serious impairments after a stroke. Paresis of the finger and thumb extensors is a frequently persisting consequence of stroke, impacting hand function. The recovery of voluntary movement involves reorganization of cortical control in the motor and higher motor areas of the brain. This presentation will discuss neuroplasticity patterns observed in chronic stroke patients, contrasting those with mild impairments to those with moderate-to-severe motor impairments and show how non-invasive brain stimulation can and cannot enhance these patterns to facilitate upper-limb recovery. We will also discuss the potential benefits of combining two neuromodulatory therapeutic strategies: functional electrical stimulation and non-invasive brain stimulation, emphasizing the need for understanding their neuromodulatory interaction to optimize the neuroplastic potential in the chronic stroke brain.

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