*Stephenson School of Biomedical Engineering*
*Seminar Series Presents*

# FUNCTIONAL NEURAL CONNECTIVITY IN HEMIPARETIC STROKE


## Yuan Yang, Ph.D.

Assistant Professor, Physical Therapy and Human Movement Sciences
Interdepartmental Neuroscience Program
Northwestern University Medical School


Thursday, Jan. 23, 2020 | 11 a.m.–Noon

*Live*
Tulsa Campus

zoom
Gallogly Hall, Room 126


## ABSTRACT:

The human sensorimotor system is a cooperative network comprised of different groups of neurons. Functional connectivity, i.e., synchronization of neuronal activity across these groups, is key to neural information transmission among those functionally related neuronal groups during the movement control. After a unilateral or hemiparetic stroke, damage to the direct corticospinal tract in the lesioned side increases the abnormal reliance on indirect descending motor pathways via the brain stem. This has been shown to be pathophysiological basis for post-stroke spasticity and related motor impairments, such as abnormal limb synergy and stretch reflex hyperexcitability. Based on realistic neural modeling and in vivo experiments, we developed a novel connectivity measure allows determination of the stroke-induced change to the usage of different motor pathways and its link with post-stroke motor impairments. Using an advanced dynamic brain connectivity method, we found the change to the motor pathway is likely associated and permitted by a hemispheric shift of sensory processing towards the contralesional sensorimotor areas. To combat these maladaptive functional changes in the sensorimotor system, we developed a novel high-definition tDCS intervention that allows targeting specific brain region in a more precise way than before. Testing on a few moderate-to-severe stroke individuals, our preliminary results indicate that this novel tDCS can effectively reduce the usage of indirect motor pathways and the associated post-stroke motor impairments.


## BIO:

Yuan Yang is Assistant Professor in Physical Therapy and Human Movement Sciences at Northwestern University Medical School and Affiliated Faculty in Northwestern University Interdepartmental Neuroscience Program. He received his Bachelor and Master's degree in Biomedical Engineering in China, and Ph.D. in Signal and Image Processing with a focus on brain-computer interface and motor rehabilitation in France. He had his postdoctoral training in BioMechanical Engineering with Dr. Frans van der Helm at Delft University of Technology, The Netherlands. From 2013-2017, he has received five times travelling awards from European, Australian, Japanese and Chinese Neuroscience Societies to visit world-leading labs such as Jen Bo Neilson's lab in Denmark and Mitsuo Kawato's lab in Japan. In 2017, he received Hojjat Adeli Award for Outstanding Contribution in Neural Systems for his contribution to neural connectivity study. His current research focuses on neuro-motor control and rehabilitation engineering. His research integrates computational and experimental approaches, based on neuro-imagining, brain stimulation, realistic neural modeling, and robotic devices, to advance neuroscience and stroke rehabilitation. His research is currently supported by an NIH R21 Award and a Dixon Translational Research Award from the Northwestern Memorial Foundation.

GALLOGLY COLLEGE OF ENGINEERING
STEPHENSON SCHOOL OF BIOMEDICAL ENGINEERING
*The* UNIVERSITY *of* OKLAHOMA