Supervisor/Project Information Form

Due February 14 2018 by email to crems.programs@utoronto.ca

PLEASE SUBMIT IN WORD FORMAT ONLY. PDF will not be accepted

Supervisor Name: Robert Chen

Hospital/Research Institution: UHN/Krembil Research Institute

Email: robert.chen@uhn.ca

Field of Research (2 keywords): neuromodulation, non-invasive brain stimulation

Department: Department of Medicine, Division of Neurology

School of Graduate Studies Appointment (IMS, LMP, IHPME etc)? Yes

If YES, please name: IMS

Project Title: Effects of focused ultrasound on human cortical excitability and plasticity

Brief Project Description (<300 words):
Focused ultrasound (FUS) is an emerging method for non-invasive treatment and neuromodulation. It is approved for treatment of essential tremor to produce a lesion in the thalamus (thalamotomy) and is being investigated for other applications such as opening of the blood-brain barrier. However, low intensity FUS can also modulate the functions of brain tissues without inducing permanent damage. Preliminary studies have investigated the effects of low intensity FUS in the occipital cortex, somatosensory cortex and the thalamus in humans. However, despite the tremendous therapeutic potential of FUS for neuromodulation, the physiological effects of FUS on the human cortex are poorly understood.

Transcranial magnetic stimulation (TMS) is a non-invasive way to stimulate the human brain and can be used to assess cortical excitability and plasticity. The project will use a novel, custom build device to that will combine low frequency FUS and TMS. Low frequency FUS and TMS will be applied to the motor cortex in normal human subjects. Motor-evoked potentials (MEP) from TMS will be measured in contralateral hand muscles. We will systematically investigate the effect of low frequency FUS on cortical excitability, cortical inhibitory and facilitatory circuits, and plasticity. The effects of different durations, intensities, stimulation depths of low intensity FUS, as well as application of repeated pulses of FUS will be investigated. The results will lead to much better understanding of the physiological effects of FUS on the human cortex. The findings will be an essential step in the development of low intensity FUS as a non-invasive neuromodulation strategy for the treatment of neurological and psychiatric disorders. The student will play a primary role in study design, data acquisition, analysis and write up of the findings.