University of Rochester
Department of Biomedical Engineering
Ph.D. Defense Seminar

"Utilizing Mobile Brain-Body Imaging (MoBI) to identify biomarkers of cognitive load, aging and Parkinson's Disease"

By:

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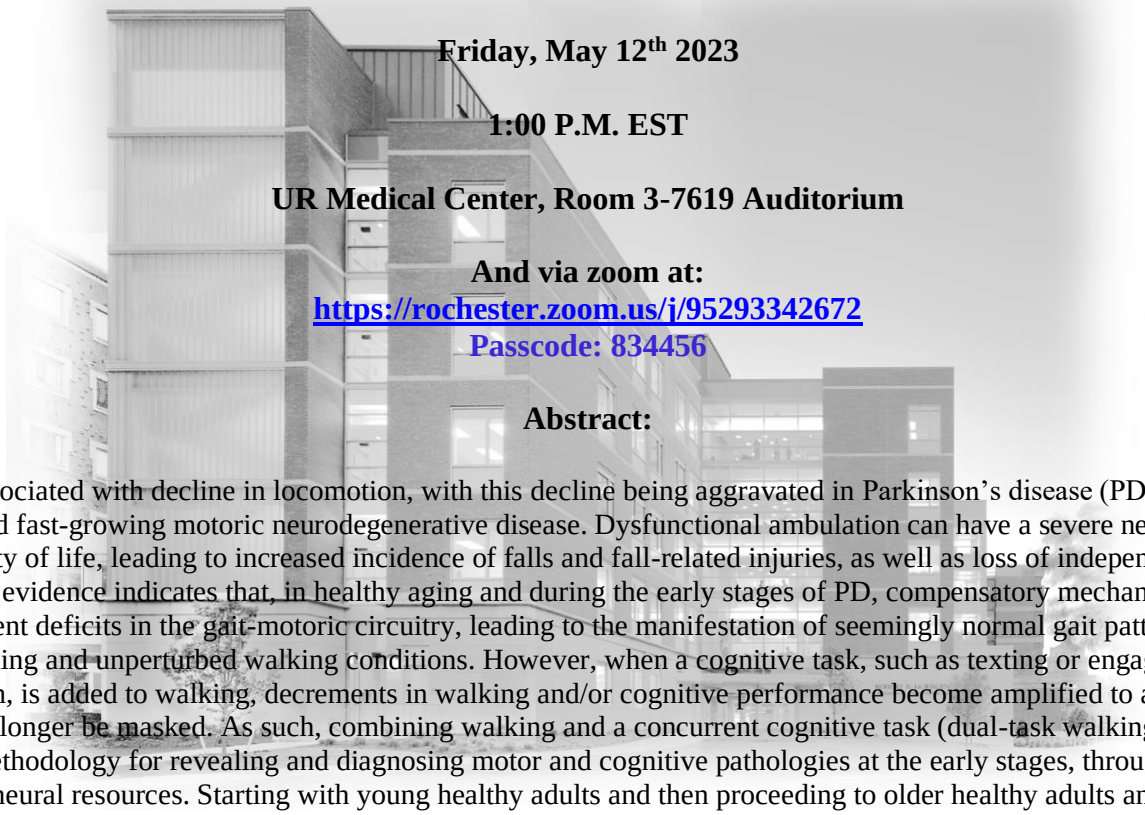
1:00 P.M. EST

UR Medical Center, Room 3-7619 Auditorium

And via zoom at:
https://rochester.zoom.us/j/95293342672
Passcode: 834456



Abstract:

Aging is associated with decline in locomotion, with this decline being aggravated in Parkinson's disease (PD), the most common and fast-growing motoric neurodegenerative disease. Dysfunctional ambulation can have a severe negative impact on the quality of life, leading to increased incidence of falls and fall-related injuries, as well as loss of independence. Converging evidence indicates that, in healthy aging and during the early stages of PD, compensatory mechanisms work to mask incipient deficits in the gait-motoric circuitry, leading to the manifestation of seemingly normal gait patterns under less demanding and unperturbed walking conditions. However, when a cognitive task, such as texting or engaging in a conversation, is added to walking, decrements in walking and/or cognitive performance become amplified to a degree that they can no longer be masked. As such, combining walking and a concurrent cognitive task (dual-task walking) may be an effective methodology for revealing and diagnosing motor and cognitive pathologies at the early stages, through taxing the underlying neural resources. Starting with young healthy adults and then proceeding to older healthy adults and PD patients with and without treatment, this dissertation used the MoBI modality to investigate the neural substrates of the interactions between walking and a cognitive task requiring inhibitory control, a core executive function known to weaken in aging and PD. Overall, our findings showed that, surprisingly, most young adults improve cognitive task performance during dual-task walking, and this improvement is subserved by more flexible recruitment of fronto-cortical neural circuits. Conversely, performance in most older adults declines under the same conditions, and this decline is associated with reduced ability to efficiently recruit multiple neural circuits during walking. However, a small—potentially 'super-aging'—group of older adults exhibited improvement during dual-task walking, underpinned by preserved flexibility in using the same frontal circuits linked to improvement in young adults. PD patients manifested pronounced decrements in cognitive and gait performance compared to healthy older adults, as well as pathological neural processing over multiple cortical regions, during dual-task walking. At the behavioral level, the combination of deep brain stimulation (DBS) with dopaminergic medication was the treatment approach that benefited gait and cognition the most. At the neural level, we found right-hemisphere prefrontal and parietal signatures of DBS, presumably reflecting DBS-related facilitation in neural processing.