Name of Organizer: Brett Fling **Affiliation:** Oregon Health & Science University

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Title of Symposium: Neural markers of motor dysfunction and movement rehabilitation in persons with MS

Description of submitted symposium: Sensorimotor dysfunction is frequent in persons with MS (PwMS) as impairments of the lower limbs affect mobility in 75% of PwMS leading to reduced walking speed, fear of falling, actual falls, and reduced quality of life. Further, dysfunction of the upper extremities occurs in 66% of PwMS, the severity of which greatly dictates one's ability to perform activities of daily living like eating, dressing, and grooming. Taken together, it is clear that improving sensorimotor control of both the upper and lower limbs are imperative targets for neurorehabilitation in PwMS. Further, the prediction of an individual's sensorimotor improvements following training (i.e. motor learning) via structural and functional neuroimaging may allow for identification of individuals who are particularly well-suited for a given rehabilitation intervention resulting in more efficacious therapeutics. At this symposium, speakers will present recent work providing compelling evidence regarding the neural markers of upper extremity, postural control, and mobility dysfunction as well as mechanisms underlying motor fatigue in PwMS. Moreover, we will discuss novel neuroimaging metrics that provide predictive and descriptive neural mechanisms underlying sensorimotor recovery in PwMS. In addition to standard biomechanical analyses of movement, attendees of this symposium will learn about cutting edge in vivo neuroimaging data collection and analysis techniques including resting-state functional MRI (rs-fcMRI), diffusion tensor imaging (DTI), transcranial magnetic stimulation (TMS), and electromyography (EMG). As a result, symposium attendees will be able to describe recent findings regarding the neuroanatomy and neurophysiology underlying movement impairment in PwMS and acquire a better understanding of current and future directions in sensorimotor neurorehabilitation.

Length of time required for symposium?: 90 minutes

Additional Presenters: Brett Fling, PhD (Organizer): Assistant Professor Department of Neurology Oregon Health & Science University fling@ohsu.edu Jessie Huisinga, PhD Assistant Professor Department of Physical Therapy and Rehabilitation Science University of Kansas Medical Center jhuisinga@kumc.edu Marco Bove, PhD Associate Professor Department of Experimental Medicine, Section of Human Physiology University of Genoa, Italy marco.bove@unige.it Kathy Zackowski, PhD, OTR, MSCS Kennedy Krieger Institute Associate Professor Departments of Physical Medicine & Rehabilitation and Neurology Johns Hopkins School of Medicine zackowski@kennedykrieger.org

What is the role of each presenter?: Dr. Fling will present recent work detailing the neural mechanisms underlying postural motor adaptation in PwMS. Improving postural control in people with MS (PwMS) is a vital target for neurorehabilitation. Further, the prediction of improvements in postural control through training (i.e. motor learning) via structural and functional neuroimaging may allow for identification of individuals who are particularly well suited for postural rehabilitation interventions resulting in more efficacious therapeutics. Dr. Huisinga will present work demonstrating how sensorimotor delays are related to postural control impairment and motor pathway integrity in PwMS. Understanding the neurophysiological mechanisms underlying problems with balance control can allow for targeted rehabilitation therapies that are most appropriate for an individual patient. Dr. Huisinga's on-going work is identifying whether white matter structural integrity in PwMS can predict which individuals will experience more motor performance disability with disease progression. Dr. Bove will

describe their recent work into the neural correlates of fatigue in PwMS. His laboratories recent findings indicate that abnormalities in motor and non-motor basal ganglia functions can contribute to fatigue in multiple sclerosis and that there are shared neural correlates of chronic subjective and motor-induced fatigue in this neurological disease. Dr. Zackowski will discuss her lab's recent work identifying the mechanisms of sensorimotor function and their role in predicting intervention responsiveness in PwMS. The linking of sensorimotor impairments with walking and the successful prediction of who will best respond to intervention will better define disability in PwMS and help guide therapists in designing and implementing rehabilitative interventions.

Objective 1: At the completion of this activity, participants will be able to: Describe recent findings from motor control and neuroimaging research detailing the neuroanatomy and neurophysiology underlying movement impairment, recovery and fatigue and potential for in persons with multiple sclerosis (PwMS).

Objective 2: At the completion of this activity, participants will be able to: Understand sensorimotor delays and proprioceptive dysfunction in PwMS and how these impact postural control during standing and walking.

Objective 3: At the completion of this activity, participants will be able to: Explain the interrelationships of sensorimotor function and behavior with neuroanatomy of the brain and spinal cord and discuss the consequences of damage and the implications for recovery leading to the generation of new hypotheses regarding sensorimotor neurorehabilitation approaches in PwMS.