

**Name of Organizer:** Mindy F. Levin, PT, PhD

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**Title of Symposium:** Rethinking spasticity and disordered muscle function in the context of motor control theory: Beyond the Ashworth Scale

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**Description of submitted symposium:** One of the most common impairments after a stroke is the presence of spasticity and disordered motor control. Spasticity is usually assessed as the amount of resistance to stretch of the passive muscle (obtained clinically or biomechanically). However, measures of resistance evaluate effects rather than neurological causes underlying spasticity that may affect motor recovery. Another approach to spasticity measurement is based on the Threshold Control Theory of motor control and describes how damage to the brain affects the ability of descending systems to regulate stretch reflex spatial thresholds. Deficits in SRT regulation define zones in shoulder-elbow angular space in which muscles have spasticity (spasticity zones) and in which altered agonist/antagonist muscle activation patterns characterize attempts at voluntary movement. This symposium will present an overview of the pathophysiology and measurement of spasticity as well as treatment approaches for spasticity management. SRT regulation and its relationship to disordered muscle activation patterns and motor learning, as well as the role of the corticospinal tract in modulating SRTs in patients with stroke will be discussed. We will also address whether applying Botulinum Toxin and Neuromuscular Electrical Stimulation early, i.e. before the effects of spasticity occur, can lead to better clinical outcomes. A better appreciation of underlying motor control concepts of spasticity will assist clinicians in identifying existing impairments and plan appropriate interventions.

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**Length of time required for symposium?:** 90 mins

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**Additional Presenters:** Anatol G. Feldman, PhD; [feldman@med.umontreal.ca](mailto:feldman@med.umontreal.ca) Anand Pandyan, PhD; [d.pandyan@keele.ac.uk](mailto:d.pandyan@keele.ac.uk) Sandeep Subramanian, PT, PhD; [sandeep.subramanian@mail.mcgill.ca](mailto:sandeep.subramanian@mail.mcgill.ca)

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**What is the role of each presenter?:** • Dr. Levin will introduce the topic and the speakers (3 minutes) • Dr. Pandyan will present an overview of spasticity including the pathophysiology and treatment options (18 minutes). • Dr. Levin will discuss underlying concepts related to spasticity measurement. The concept of SRT based on the Threshold Control theory of motor control will be described and used to explain the appearance of spasticity and disordered muscle activation in specific joint ranges in patients with stroke and cerebral palsy (18 minutes). • Dr. Feldman will describe the role of the corticospinal system in SRT regulation, spasticity and muscle activation disorders in the arm of patients with chronic stroke (18 min). • Dr. Subramanian will present results from a recently study assessing the influence of spasticity zones on motor learning in the more-affected arm of patients with chronic stroke (18 minutes). • Discussion (15 min)

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**Objective 1:** To gain a better understanding of the mechanisms underlying spasticity and disordered muscle activation patterns from the perspective of motor control theory;

**Objective 2:** To understand the role of spasticity in movement adaptability after stroke.

**Objective 3:** To describe and apply different approaches to spasticity measurement including muscle resistance and velocity/angle threshold measures.