SYMPOSIUM DESCRIPTION

Spasticity is one of the most common symptoms manifested following damage to the central nervous system (CNS), and is seen in individuals with neurological conditions, such as: stroke, spinal cord injury, and cerebral palsy. This symposium aims to review research updates in the pathophysiology of spasticity from anatomical and physiological changes in neuronal networks that lead to the development of spasticity to quantifications and measurements of spasticity.

Spasticity has been defined as a motor disorder characterized by a velocity-dependent increase in tonic stretch reflexes with exaggerated tendon jerks, resulting from hyperexcitability of the stretch-reflex. A panel discussion will focus on the electrophysiologic mechanisms that are responsible for the well-established increase in stretch reflex excitability in many muscles of stroke survivors. Observations addressing relative contributions of reflex gain versus reduced threshold in spastic muscles and the pivotal role of reticulospinal and other brainstem pathways in promoting spasticity following stroke will be addressed.

Lesions of descending motor pathways in the spinal cord in animals and humans are linked to the development of symptoms of hyperreflexia. Imbalanced contributions from corticospinal and reticulospinal pathways have been shown in humans with spasticity but not when spasticity is absent. New evidence links the extent of residual corticospinal connections to the presence of spasticity across muscles below the injury in humans with motor complete paralysis.

While spasticity has a neural origin, muscle properties change dramatically in response to the chronically altered neural input. Importantly, muscle function can be altered by surgically manipulating neuromuscular units. We will provide insights into what happens in the operating room! From intraoperative measurements of muscle microscopic structure and mechanical function to surgical nerve transfers and microneurectomy, presenters will provide practical insights into the adaptation of muscle to spasticity and novel surgical treatments for spasticity.

WHO SHOULD ATTEND

Scientists, Physical Therapists, Physical Therapist Assistants, Occupational Therapists, Occupational Therapy Assistants, Nurses, and Physicians

COURSE OBJECTIVES

Upon completion of this course, participants will be able to:

- Describe anatomical physiological changes leading to a spastic neural network
- Illustrate how regulatory functions of the spinal cord change with the development of spasticity
- Describe changes in muscle properties and muscle function accompanying spasticity
- Discuss how changes in descending motor pathways can affect the development of spasticity in individuals with CNS damage
- Review ways to quantify spasticity using electrophysiology and biomechanics following CNS damage
Dr. Lieber earned his Ph.D. in Biophysics from U.C. Davis developing a theory of light diffraction that was applied to mechanical studies of single muscle cells. He received his M.B.A. from the UCSD Rady School of Business and is currently Chief Scientific Officer and Senior Vice President at the Shirley Ryan AbilityLab and Professor of Physical Medicine & Rehabilitation at Northwestern University in Chicago, IL. Dr. Lieber’s work is characterized by its interdisciplinary nature—an approach that is relevant to those who study biomechanics and Orthopaedic Surgery. He has published over 300 articles in journals ranging from the very basic such as *The Biophysical Journal* and *The Journal of Cell Biology* to those more applied such as *The Journal of Hand Surgery* and *Clinical Orthopaedics and Related Research*. Dr. Lieber’s research focuses on design and plasticity of skeletal muscle.

Dr. Rymer received his medical training from the University of Melbourne and his Ph.D. in Neuroscience from Monash University. He served as the Vice President for Research and the John G. Searle Chair of Rehabilitation Research. Dr. Rymer currently has appointments as Professor of PM&R, Physiology, and Biomedical Engineering at Northwestern University. His research concerns the neural control and biomechanics of movement in human and animal models, and the disturbances of voluntary movement and their origins in people with neurological disabilities. He is currently Project Director of a NIDILRR-funded multi-center clinical trial to evaluate the effectiveness of intermittent hypoxia therapy in individuals with spinal cord injury.

Dr. Perez received a Ph.D. in physical therapy from the University of Miami School of Medicine. She attended the University of Copenhagen as a post-doctoral fellow where she studied transmission in spinal cord networks. She then completed a postdoctoral fellowship at the Human Motor Human Cortical Physiology and Stroke Neurorehabilitation Section at the National Institutes of Health, where she focused on studies of cortical physiology and plasticity. Her main research interests are in understanding how the brain and spinal cord contribute to the control of voluntary movements in healthy humans and in individuals with spinal cord injury. She uses this mechanistic knowledge to develop rehabilitation therapies following CNS damage.
AGENDA

Pathophysiology of Spasticity
DAY 1: NOVEMBER 11, 2021

9:00 - 9:30 AM  Introduction – Honoring Zev (Rick, Monica, Zev)

9:30 - 10:45 AM  Building a Spastic Neural Network
Speakers:
• CJ Heckman, PhD
• David Bennett, PhD
• Carmelo Bellardita, PhD

11:00 - 12:15 PM  A Surgical View of Muscle Changes with Spasticity
Speakers:
• Rick Lieber, PhD
• Peter Rhee, MD
• Olga Politikou, MD

12:15 - 1:30 PM  Lunch break

1:30 – 2:45 PM  Regulatory Functions of the Spinal Cord
Speakers:
• Richard Nichols, PhD
• Dena Howland, PhD
• Vicki Tysseling, PT, PhD

Pathophysiology of Spasticity
DAY 2: NOVEMBER 12, 2021

9:30 - 10:45 AM  Spasticity after Stroke
Speakers:
• Zev Rymer, MD, PhD
• Hans Hultborn, PhD
• Sheng Li, PhD

11:00 - 12:15 PM  Spasticity after Spinal Cord Injury and Cerebral Palsy
Speakers:
• Monica Perez, PhD
• Jack Martin, PhD
• Jens Nielsen, Phd

12:15 - 3:00 PM  Lunch break
3:00 - 4:15 PM  Spasticity Measurements

**Speakers:**
- Brian Schmidt, PhD
- Matthieu Chardon, PhD
- David Burke, MD

**LOCATION**

The program will be held online.

**Teaching modality/Delivery method**

This course is taught virtually using Zoom, an online meeting platform, and the Academy Learning Portal, and other online learning materials.

**TECHNOLOGY REQUIREMENTS**

To participate, you will need access to a computer with an Internet connection. High-speed broadband access (LAN, Cable or DSL) is highly recommended.

- Phone
- Internet connection
- Web browser: Latest stable version of Apple Safari, Google Chrome, or Mozilla Firefox
- JavaScript and Cookies enabled
- Speaker or headset to listen to audio files and participate in conference calls
- **Do NOT** use Internet Explorer or Microsoft Edge, as they are not supported.

**ACCESSIBILITY**

Please contact the Academy if you require special accommodations for this course.
Pathophysiology of Spasticity
A Symposium Honoring Dr. Zev Rymer

November 11-12, 2021

Mail to:  Academy
Shirley Ryan AbilityLab
355 E. Erie Street, Suite 12-West
Chicago, Illinois 60611

Please TYPE or PRINT your name and professional initials (MD, OT, PT, RN, etc.) as you would like them to appear on your continuing education certificate.

First Name _______________________________ Last Name _______________________________
Home Phone ( ) ____________________ Prof. Initials ____________________
Home Address ______________________________
City __________________________ State ____________ Zip ____________
Organization/Facility ______________________________
Work Address ______________________________
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Work Phone ( ) ____________________ Fax ( ) ____________________
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E-mail (required) ______________________________