# NEURAL ENGINEERING SEMINAR SERIES

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## Cortical Computations for Postural Control: Developing a BMI for Paraplegia https://psu.zoom.us/j/94639233394

**March 29, 2023**
**12:15 -1:15 p.m. (E.T.)**
**W306 Millennium Science**


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**ABSTRACT**: Gait and balance disturbances are common, difficult to treat despite rehabilitation, and a cause of significant morbidity and mortality. Spinal cord injury is a common cause of gait and postural instability and, although it is defined pathologically as damage to spinal cord circuits, changes in supraspinal centers, and specifically the cortex, have been shown to be critical for improvement of function. Moreover, closed-loop brain-machine interfaces (CL-BMI) that use cortical signals to control spinal stimulation, have been suggested as an intervention to restore locomotion for paraplegia. However, all CL-BMI rely on lateral support systems to enable subjects to maintain balance while the spinal stimulation restores the stereotypic gait cycle. To address this, we studied the computations the brain performs to control balance and assessed the ability of using a cortical BMI to provide specific control signals to spinal stimulation that would enable postural control. We discovered unique neuronal classes that encode the response to postural perturbations with a substantial gain in motor cortex information relative to information in sensory cortex, demonstrating a role for higher-order computations during postural control. These neuronal classes contribute to a low dimensional manifold comprised of separate subspaces that define computations activating incongruent muscle synergies. Importantly, similar dynamics are identified after midthoracic spinal contusion in a rodent model. These results inform how the cortex engages in postural control, directing work aiming to understand postural instability after neurological disease and development of a CL-BMI for paraplegia that could restore independent locomotion.


**BIOGRAPHY:** Dr. Moxon is a Professor of Biomedical Engineering and Neurological Surgery at University of California, Davis. She is a pioneer in the field of neuroengineering and studies the implementation of brain-machine interfaces for those with paraplegia and epilepsy. She received her BS from the University of Michigan in Chemical Engineering and her PhD from the University of Colorado in Aerospace Engineering. Her research examines how neuronal circuits encode information and the impact of injury and disease on neural encoding. She is the founding director of the Center for Neuroengineering and Medicine at UC Davis and is now directing the NSF sponsored training grant *NeuralStorm, taking neural engineering by storm*. As part of her work to ensure equity and diversity in neuroengineering, she is the founder of the WINE Forum to provide vital peer-to-peer mentorship and networking opportunities for women in Neural Engineering. She is an elected fellow of the American Institute for Medical and Biological Engineers and the American Association for the Advancement of Science. You can view her publications here: KarenMoxonGoogleScholar. You can visit her website here: https://moxonlab.bme.ucdavis.edu/