Biomathematics Seminar Series

Department of Mathematics and Statistics

Multiscale Modeling of the Human Neuromuscular System with Applications to Neurodegenerative Disease

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Zoom Meeting ID: 932 5205 3591
https://texastech.zoom.us/j/93252053591

This talk will present a multiscale computational model of the human neuromuscular system developed within the aims of the Neuromuscular Systems Laboratory to design novel therapeutics for Parkinson's disease.

A multicompartmental mathematical model of voltage and calcium signaling within skeletal muscle will first be presented, developed to investigate the role of extracellular potassium on force generation during fatiguing stimulation. An extension of this model to incorporate mitochondria is next presented, a first of its kind mathematical model offering a proof-of-principle simulation tool for probing consequences of calcium-driven mitochondrial dysfunction within skeletal muscle. The final portion of the presentation will introduce a multiscale model of the neuromuscular system which includes a model of the motor cortex, spinal motoneurons, and whole muscle validated against experimental recordings from the first dorsal interosseus muscle of the human hand. The model is used to understand how changes in intrinsic motoneuron excitability influence muscle activation and neural synchrony via visual force feedback control emulating a real-world motor experiment.

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