University of Southern California

USC

Department of Biomedical Engineering    Division of Biokinesiology and Physical Therapy

**Engineering Neuroscience & Health**

**Seminar Series**

**Presents:**


**Dr. Kiisa Nishikawa**

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**Monday**
**September 22, 2008**
**4:00 p.m.**

**Refreshments will be served 3– 4 p.m.**

**Locations:**

*Seminar is simultaneously presented*

**UPC: HNB 100 - LIVE**
**Hedco Neurosciences Building**
UPC Campus Map/Directions:
http://www.usc.edu/about/visit/upc/

**HSC: 147 - Video Conference**
**Center for the Health Professional**
HSC Campus Map/Directions:
http://www.usc.edu/about/visit/hsc/

# Neuromechanics of elastic energy storage and recovery during ballistic movements.


***Abstract***

Muscle physiologists typically study the behavior of muscle under a limited set of conditions, such as isometric tetanus or isotonic shortening, which rarely apply to movements of freely behaving animals. While investigating ballistic prey capture behavior in toads, we re-discovered the usefulness of an old technique, the load-clamp, for quantifying contractile and elastic properties of muscles and their connective tissues under physiologically relevant conditions. This technique allows muscle properties to be studied under a wide range of conditions, particularly those in which muscles develop force against a resisting force, and shorten when the resisting force is reduced. Using this technique, we developed an elastic recoil model of muscles and connective tissues during ballistic movements. The model accurately predicts the observed amplitude and velocity of movements given *only* the duration of muscle activation prior to unloading and the external load. It predicts elastic behavior during active shortening for several muscles (depressor mandibulae, sartorius, extensor digitorum longus, soleus) in different species (frog, mouse). In addition, it predicts the elastic behavior of muscle under isometric and isotonic conditions. At the level of the whole organism, the model predicts that appendages of smaller animals will operate at higher stiffness, and hence at greater frequencies, than those of larger animals. The model demonstrates that actively shortening muscles exhibit dynamic stabilization to perturbations in load without requiring neural input. It also suggests that control of rapid movements may require specification of relatively few variables. Recent experiments demonstrate that mutant mice with shorter titin proteins exhibit increased stiffness both at rest and during active shortening.


***Bio sketch:***

Kiisa Nishikawa is a Regents' Professor of Biology at Northern Arizona University
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Miller Fellow, Museum of Vertebrate Zoology, University of California, Berkeley, 1985-1987
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**Web Cast**
http://capture.usc.edu/college/Catalog/?cid=af180d48-ceff-42b9-a35c-eb199daed320

**Information about all seminars can be found at**
http://www-clmc.usc.edu/~heiko/ENH