Rose F. Kennedy Intellectual and Developmental Disabilities Research Center (IDDRC)
Seminar Series

Director: Steven U. Walkley, DVM, Ph.D. Associate Director: John J. Foxe, Ph.D.

Multisensory Fusion and Human Balance Control

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Kennedy Center (Room 901): Friday, April 6, 2012, 1:30pm

Biographical notes: Dr. Jeka received his Ph.D. in Neuroscience from Florida Atlantic University and was an NIH NRSA postdoctoral fellow at Brandeis University. He is currently a professor at the University of Maryland, with appointments in the Department of Kinesiology, the Bioengineering graduate program and the Neuroscience and Cognitive Science graduate program. His research interests include multisensory fusion and human postural control/locomotion and its application to rehabilitation of individuals with balance disorders.

Abstract: The evolutionary development of bipedal stance, which freed the hands from locomotion, is considered the fundamental distinction between humans and our closest relatives. Accompanying that development is the problem of stability. Engineered devices, such as cars and robots, solve the stability problem by having a wide base of support and/or concentrating the bulk of its weight lower down. However, the human body has evolved with more than just upright stability as a constraint, with most of its mass concentrated higher up in the trunk, making it inherently unstable and prone to falls. This "mechanically unstable" design has been matched with a sophisticated control system to maintain upright stance, lending itself to many fundamental questions about how the nervous system solves this complex control problem. Moreover, the neural and biomechanical subsystems that enable standing are subject to injury and dysfunction, leading to many disease populations with limited options based upon current medical treatments. My research group aims to bridge the basic and applied science underlying balance control. Combined with techniques that precisely manipulate input from visual, vestibular and proprioceptive sensory systems, postural control mechanisms are studied with particular regard for the processes involved in fusing information from different sensory systems to provide an overall estimate of body dynamics. Computational methods combine mechanisms of multisensory fusion with biomechanical investigations of multilink body dynamics to develop realistic models of human postural control. The combination of experimental studies with computational models is then applied to the development of new techniques and assistive devices for treatment of patient populations with balance disorders including individuals with the loss of inner ear (vestibular) function and fall-prone older adults.