William H. Warren
Brown University, USA

William H. Warren is Chancellor's Professor of Cognitive, Linguistic, and Psychological Sciences at Brown University, and Director of the Virtual Environment Navigation Lab (VENLab). He received his Ph.D. from the University of Connecticut (1982) and did his post-doctoral work at the University of Edinburgh (1983). He uses virtual reality techniques to investigate the visual control of human action. His primary focus is developing a "pedestrian model" of locomotor behavior and collective crowd dynamics, with applications to visual-motor assessment and rehabilitation. A second line of research studies spatial navigation, including path integration, spatial learning, and the geometry of "cognitive maps". A third project investigates the dynamics of perceptual-motor control in tasks such as bouncing a (virtual) ball on a racket. Warren is author of over 90 scientific papers and the recipient of a Fulbright Research Fellowship, an NIH Research Career Development Award, and Brown's Elizabeth Leduc Teaching Award for Excellence in the Life Sciences.

Behavioral dynamics of visually-guided walking: From stepping to swarming

Locomotion is hierarchically organized, from the individual's step cycle to the collective behavior of human crowds and animal swarms. A behavioral dynamics approach argues that at each level, stable adaptive behavior emerges from the interaction between the individual and its environment, exploiting both physical and informational constraints. At the level of the step cycle, the passive gait dynamics are actively modulated by visual information, one step at a time, to adapt gait to the terrain (Matthis & Fajen, 2013). At the pedestrian level, locomotor trajectories emerge on-line from the agent-environment interaction, without appealing to an internal world model or explicit path planning. I will describe a pedestrian model of steering, obstacle avoidance, interception, and pedestrian interactions derived from experimental studies of walking in a virtual environment. Each basic behavior is modeled as a simple dynamical system, and they can be linearly combined to predict behavior in more complex settings. At the collective level, global crowd behavior emerges from local interactions between pedestrians. Using multi-agent simulation methods, we find that our pedestrian model can generate the patterns of crowd behavior we observe in several "swarm" scenarios (N=20) recorded with motion-capture techniques. I will discuss **(a)** ***Grand Central***, in which individuals criss-cross the room, **(b)** ***random swarm***, in which participants veer left and right while staying together as a group, and **(c)** ***counterflow***, in which two groups pass through each other. In each scenario, the individual trajectories and global traffic patterns can be simulated with just a few model components. Thus, at each level, locomotor behavior can be understood as emergent behavior, with its dynamics modulated by information to yield stable adaptive action patterns.

Jens Bo Nielsen
University of Copenhagen, Denmark

Jens Bo Nielsen is Professor and Head of the Section ´Neural control of Movement´ at University of Copenhagen, Denmark. After gaining his medical degree and PhD from the University of Copenhagen, Professor Nielsen became Professor and Head of the Physiology Institute at the University of Kiel, Germany in 1995. He returned to the University of Copenhagen in 2000. Professor Nielsen is interested in how the nervous system controls movement in health and disease. His research covers work at the cellular and integrative level in animal models, healthy human subjects and neurological patients. His main research interests are the central control of gait, motor learning and neuroplasticity, voluntary and involuntary contributions to movement, perception of movement and intentionality.

Professor Nielsen has authored or co-authored >160 papers in international peer-reviewed journals, as well as numerous book chapters, meeting abstracts, medical student textbooks and public science books.

Corticospinal control of gait in humans.

Non-invasive imaging and electophysiological techniques have revealed the contribution of the corticospinal tract to the control of human gait during the past 15 years. These techniques have also permitted an evaluation of the development of corticospinal control in children and the significance of corticospinal lesions for gait deficits in neurological patients. The lecture will review these findings with an emphasis on adaptation of corticospinal control of gait in relation to gait training and rehabilitation.

Tatiana Dellagina
Karolinska Institute, Sweden

In 1982, I got PhD degree in neurophysiology at Moscow State University (Russia), where I continued working untill 1990. Since 1990, I am working at Department of Neuroscience, Karolinska Institute (Stockholm, Sweden). My present position is Professor in neuroscience. The areas of my scientific interest are neural mechanisms of rhythmical movements, and interaction of neuronal networks responsible for different aspects of motor behavior. My recent investigations are focused on neural mechanisms of postural control, their impairment caused by damage to different parts of CNS and sensory organs, as well as on developing methods promoting recovery of postural functions. I have published more than 100 scientific papers in international journals and one monograph.

Neural mechanisms underlying feedback postural control

Maintenance of specific body orientation and equilibrium during standing and locomotion is evolutionary old motor function based on in-born neural mechanisms. Impairment of postural control is one of the major motor disorders following spinal cord injury, stroke, etc. Selection of appropriate rehabilitation strategies for compensation of postural deficits depends largely on elucidation of corresponding neural mechanisms. In my talk the recent advances in the studies of feedback mode of postural control in quadrupeds will be discussed. Specific topics include: distribution of postural networks within CNS, principles of their operation, their impairments caused by spinal cord injury, and neural mechanisms of balance control during locomotion

Brian Day
University College London, UK

Brian Day is Professor of Motor Neuroscience at the Institute of Neurology, University College London. After training in mechanical and bio-engineering, in 1978 he moved into the field of human sensorimotor control mechanisms in health and in neurological diseases that cause movement disorders. He has been at the forefront in the development and application of a number of non-invasive techniques for studying sensorimotor processes and circuitry in intact man, most notably transcranial cortical stimulation, and more recently vestibular stimulation. His current research is devoted to understanding multisensory processes that control and integrate whole-body motor activities.

Vestibular influence on whole-body actions revealed by virtual head rotation

The vestibular system is a 6-axis inertial sensor that provides the brain with unique information about motion and orientation of the head in space. It has great potential to influence a host of whole-body motor activities, but difficult to study with conventional tools. Here I describe an electrical vestibular stimulation method that is simple, produces a pure and functional vestibular input and can be applied during a wide range of activities without interference. I will show that it reveals vestibular influences on a host of normal perceptual and motor activities and may be used to probe vestibulomotor asymmetries in disease.