Keynote Speakers

Thomas Sinkjær: "Medical Technology in Neurorehabilitation", Tuesday Oct. 3rd, 8:30-9:30

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Professor Thomas Sinkjær is Director of SMI (Center for Sensory-Motor Interaction) at Aalborg University, Denmark. His research interests within Motor Control include the interaction of central control with reflex circuitry of the spinal cord and the intrinsic mechanical properties of the skeletal muscle system. Within Neural Rehabilitation research, his interest is in development of methods to restore sensory-motor function through neural prostheses and methods which enhance functional neural plastic changes.

Abstract:
Interaction with and modulation of the nervous system through external and implantable electronics have enormous potential for the diagnosis and rehabilitation of individuals with neurological disorders. The socio-economic burden of neurological disorders is considerable and will increase as the population ages. In industrial countries, by the year 2020, there will be 28% more people above 65 years of age as compared to today, and many will have age-related neurological disorders.

Technological approaches to the treatment of central nervous disorders are based on: (1) *replacement* of lost neural activity; (2) *retraining* of the central nervous system by repetitive practice; and (3) *neuromodulation*, i.e., artificial restoration of the balance of activity in affected regions of the central nervous system. The requisite neural inputs can be generated by electrical, mechanical, or magnetic stimulation, with or without pharmacological intervention. The potential benefits include restoration of function, prevention of secondary problems arising from reduced activity, increased independence, improvement in the quality of life, reinstatement of employment prospects, and associated reductions in the costs of health care and income support. Therefore, these neurorehabilitation technologies have great potential.

The goal of our neurorehabilitation research is to restore motor function in people with injury, disease, or age-related change of the central nervous system. In my lecture I will address new bio electronic systems within

1. *Replacement*: Here we investigate the use of electrical stimulation to replace the motor control lost in people as a result of injuries to CNS, specifically to restore bladder and bowel function, to re-establish control of lower limb muscles, and to provide movement therapy
2. *Retraining:* Here we investigate the potential of patterned peripheral electrical neuromuscular stimulation, mechanical stimulation using gentle robots and repetitive transcranial magnetic stimulation for retraining the central nervous system after stroke and incomplete spinal cord injury
3. *Neuromodulation:* Here we investigate the potential of continuous electrical stimulation of peripheral nerves, cortical, or subcortical regions of the brain for re-establishing the balance of neural activity with a view to restoring motor functions and suppressing disturbing sensory responses such as pain

Terry L. Jernigan: "The Inconstant Brain: MR Imaging of the Lifespan", Wednesday Oct. 4th, 9:30-10:30

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Terry Jernigan is Professor in Residence of Psychiatry and Radiology at UCSD, and Professor in Neuroimaging at the University of Copenhagen's Danish Research Centre for Magnetic Resonance. She directs research programs at both institutions and divides her time between the two locations. She is Co-Director (with Gregory Brown) of the Laboratory of Cognitive Imaging (LOCI), a UCSD research group interested in human brain function, particularly as it is affected in neuropsychiatric disorders. The primary investigative tools employed in this work are magnetic resonance imaging and cognitive activation paradigms. Dr. Jernigan is principal investigator or co-investigator for 7 funded studies of neurobehavioral aspects of brain maturation and aging, dementia, substance abuse, and HIV infection.

Dr. Jernigan is trained as a cognitive neuroscientist and she has been conducting studies of human cognition using in vivo brain imaging techniques since the 1970's. She has published 87 original research articles and 32 invited contributions, of which 79 of these are listed in PubMed. Dr. Jernigan is Imaging Section Editor for the journal Neurobiology of Aging, and serves on the editorial boards of 4 other journals, and she is a regular consultant and reviewer for the National Institutes of Health.

Abstract:
Twenty-five years ago, when MR imaging was first applied in brain research, it was thought that an initial post-natal growth spurt was followed by a protracted period of relative stability in brain structure (in the absence of disease) across several decades of life, until finally the involutional changes of old age occurred. In the first systematic studies of healthy individuals across the age-range, however, MRI revealed an unsuspected degree of dynamic change in brain tissues. These observations with MRI, some of which will be reviewed in the presentation, have had a major impact on how we now view the brain both in children and in adults. Recent findings regarding age-related and neuroadaptive brain alterations have important and wide-ranging implications. The new information also raises a number of new questions that have yet to be fully explored, especially regarding the nature of individual differences. For example, although progress has been made in mapping the protracted course of brain maturation, little attention has been given to individual differences in developmental trajectories. The degree, nature, and malleability of such trajectory differences may relate to phenotypic personality, temperament, and intellectual abilities and, hence may have social, medical, and educational relevance.

In summary, a lifespan perspective on MRI studies of brain structure will be developed in the presentation, and some speculation will be offered regarding the individual difference variability hidden in most MRI studies.