Speaker: Dr. Robert Gaunt (University of Pittsburgh)

Title: Artificial touch in brain-computer interfaces

Abstract: Over the past decade, several groups have implanted microelectrode arrays into the sensorimotor cortex of paralyzed individuals. At the University of Pittsburgh, we have worked with two volunteers and have shown that recording and decoding the activity of a few hundred neurons in motor cortex enables a person to control a prosthetic arm with up to 10 degrees-of-freedom continuously and simultaneously. However, we know that the somatosensory system is essential to regulate ongoing movement and enable controlled interactions with the environment. Five years ago, we implanted electrodes into area 1, a tactile region of somatosensory cortex, to try and restore artificial touch and create a bidirectional brain-computer interface. In this talk I will describe how cutaneous sensations can be restored through microstimulation of the somatosensory cortex. I will focus on what they feel like, how stable they can be, how these experiments can uncover basic organizational principles of the somatosensory cortex and how these tactile percepts can substantially improve task performance. Our ultimate goal is to understand the structure and function of the sensorimotor cortex and use biomimetic design principles to restore dexterous hand and arm movements, complete with the appropriate sensory experiences, to people who have lost their limbs or are unable to use them because of injury or disease.

Bio: Robert A. Gaunt is an Associate Professor in Physical Medicine and Rehabilitation at the University of Pittsburgh. Robert earned a B.Eng. degree in Mechanical Engineering from the University of Victoria (Victoria BC, Canada) and a Ph.D. in Biomedical Engineering at the University of Alberta (Edmonton AB, Canada). His primary research interests are in sensorimotor control of the hand and bladder. Specifically, this encompasses understanding the role that somatosensory feedback on control and how biomimetic design principles can be used to develop neuroprosthetic technologies aimed at restoring sensory, motor, and autonomic functions for people with disease or injuries including spinal cord injury and limb loss. The hand and bladder are scientifically linked by the powerful role that somatosensation has on reflex function and consciously mediated behaviors, while the functional importance of these two systems are frequently highlighted by people living with spinal cord injury. Active research topics include developing novel neural interfaces to regulate bladder function and developing bidirectional implantable brain computer interfaces to restore movement and sensation to people with upper-limb paralysis. He holds a number of patents and his work has been covered by numerous national and international media outlets.