Joint **MSk MEC** Seminar Series

Guest Speaker

Prof. Roger M. Enoka

University of Colorado

Title: **Measurement and Interpretation of the Electromyogram**

27th April, 2018, RSM Seminar Room G-01
Lunch :12 noon Talk: 12.45pm

Abstract: The electromyogram (EMG) corresponds to a recording of field potentials generated by the propagation of action potentials along muscle fibers. As no muscle action involves a single muscle fiber, the EMG emerges as the algebraic sum of the detectable waveforms. EMG signals are most often recorded with a pair of electrodes attached to the skin over a muscle interest, which can provide information about the timing of the activation signal and, when normalized to an appropriate reference, the relative amplitude of the signals. Computational models, however, have identified the significant limitations that constrain the interpretation of these signals. Nonetheless, advances in technology are expanding the opportunities to learn about the generation of control signals underlying the performance of some muscle actions.

pm	**Other Short talks**
1.45	Paul Strutton's Group: "Novel monitoring in vascular surgery: Could transcranial magnetic stimulation be used to detect spinal cord ischaemia in thoracic-abdominal aortic aneurysms surgery? " - Pav Sarai
2.05	Angela Kedgley's Group: "Muscle activity during dart throwing motion of the wrist" - Vasiliki Vardakastani
2.25	Dario Farina's Group: "New generation intramuscular EMG technology: High-density spatial sampling to interface and decode motor neuron behaviour" - Silvia Muceli
2.45	Anthony Bull's Group: "Validation of a musculoskeletal gait model to study the role of functional electrical stimulation" - Ziyun Ding
3.05	Etienne Burdet's Group: "EMG as a window to the brain"-Jonathan Eden/Mike Mace
3.25	Jonathan Jeffers: "New MSk MEC Equipment Success"
3.30	Anne Roques: "The MSk MEC Accelerator: A new Research Translation Programme"
3.35	Networking and drinks reception

To attend the seminar — **Register for free** on Eventbrite (Joint MSk MEC Seminar Series)

For any enquires or to arrange a meeting with the speakers, please contact:
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Abstracts for Other Short Talks on EMG

27th April 2018, RSM Seminar Room G-01
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Novel monitoring in vascular surgery: Could transcranial magnetic stimulation be used to detect spinal cord ischaemia in thoracic-abdominal aortic aneurysms surgery? - Pav Sarai

Abstract: Spinal cord ischaemia (SCI) following thoraco-abdominal aneurysm is a devastating complication leading to paralysis. Transcranial magnetic stimulation (TMS) is a simple, safe and painless alternative to electrical neuromonitoring of the spinal cord and could be used potentially be used intra-operatively and post-operatively to detect early and late SCI, respectively. The research aim is to develop a SCI-TMS management protocol. We will investigate the reliability of TMS in healthy volunteers and patients with peripheral disease and the effect effects prolonged limb ischaemia can have on cortical excitability in the healthy cohort. In addition, we will explore the use of TMS in the theatre environment and under anaesthesia, before using it to detect and prevent ischaemia spinal cord injury.

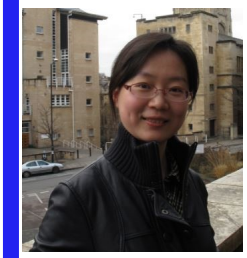
Muscle activity during dart throwing motion of the wrist - Vasiliki Vardakastani

Abstract: Dart throwing motion is an important functional motion of the wrist. Our aim was to investigate the activation patterns of wrist muscles during this motion. Synchronised wrist kinematics and muscle activation measurements were obtained from a group of healthy participants. Despite the inter-subject variability, our results show that there is a clear muscle activation pattern with co-activation of both flexor and extensor muscles during DTM in both groups.

New generation intramuscular EMG technology: High-density spatial sampling to interface and decode motor neuron behaviour - Silvia Muceli

Abstract: We have pioneered the development of high-density wire EMG technology for intramuscular in vivo recordings in humans. This technology is based on micromachining techniques that allow to build dense arrays of selective electrodes upon thin-films of polyimide substrates. Our first prototype included 16 electrodes arranged in a linear configuration and spaced 1 mm apart. Our latest developments resulted in high-density systems with 40 detection electrodes and 0.5 mm inter-electrode distance. Both systems can be used for acute implantation into muscles where they are inserted with a 25-gauge needle as classic intramuscular wires. We have used our technology for recording from various muscles of different size, architecture, and depth. Compared to traditional intramuscular wires, our systems allow the simultaneous detection of tens of motoneurons and thus an accurate and representative estimation of the neural drive to a muscle. The reproducible geometry of the electrodes has been exploited to identify motor unit position and size within the muscle. Moreover, the abundance of detection sites enables automatic decomposition of the multichannel intramuscular signals into the constituent motor unit activities. The talk will focus on the technological development of the electrodes and experimental results obtained with the new technology.

Validation of a musculoskeletal gait model to study the role of functional electrical stimulation - Ziyun Ding



Abstract: Functional electrical stimulation (FES) has been used clinically to restore muscular motor function by activating paralyzed muscles. However, quantifying the level of muscle activation through FES is challenging as conventional recording of muscle activity using electromyography (EMG) is not possible due to the stimulation artefacts. An alternative method to estimate muscle activation is through using a computational musculoskeletal model. The hypothesis of this study is that: FES-assisted activation of biceps femoris long head (BFLH) increases the activation of gluteus maximus during gait and the alteration of muscle activation pattern can be captured by a computational musculoskeletal model. Methods: Kinematics, kinetics and EMG of healthy subjects were measured during normal gait and FES gait with three different levels of stimulation. Kinematic and kinetic data were used as inputs to a computational musculoskeletal model. Predicted muscle activation and EMG measurement were used to study the activation alteration of BFLH and gluteus maximus from normal gait to FES gait. Results: Higher activation of BFLH resulted in higher activation of gluteus maximus as quantified by both the EMG experimental measurement and computational prediction. Conclusion: The activation of BFLH correlates with the activation of gluteus maximus. A musculoskeletal modelling method was validated which was representative of muscle activation alteration during FES gait.

EMG as a window to the brain- Etienne Burdet

Abstract: EMG is traditionally used as an interface to collect motor commands or for biomechanical modelling. In this talk I will present how EMG can be used to infer brain processes in computational neuroscience investigations and to facilitate neurorehabilitation.