OIST SEMINAR

Professor Thomas Knöpfel

Laboratory of Neuronal Circuit Dynamics, Department of Medicine, Imperial College London

DATE: **Monday, June 5th, 2017**
TIME: **10:00 – 11:00**
VENUE: **C700 Seminar Room, Level C, Lab 3**

Cortical Circuit Dynamics Illuminated Using Genetically Encoded Voltage Indicators

Abstract:

Cortical networks are complex systems both in terms of their activity patterns and in terms of their connectivity patterns. Recent technical advances in high resolution mapping of cortical activities as well as of connectivity patterns will (i) enable a connectome-based registration of neuronal circuit dynamics and, (ii) allow us to directly combine theoretical and experimental approaches towards understanding of cortical mechanisms underlying cognition and emotions.

One of the most promising experimental approaches to map cortical activities in behaving rodents is via optical imaging using genetically encoded voltage- and calcium indicators (GEVIs and GECIs). GEVIs, in particular, offer the millisecond time resolution required to map the dynamics of large scale cortical networks while GECIs are a powerful tool to extract action potential patterns. In mice these dynamical activity maps can be directly related to the available mouse cortical connectome.

After introducing the current state-of-the-art GEVI-based mapping of mouse cortical activity, the presentation will focus on the dynamics of slow cortical waves, which propagate across the cerebral cortex forming large-scale spatiotemporal propagation patterns. These slow waves are a hallmark of non-REM sleep and of anesthesia, but also occur during resting wakefulness. The origin and direction of spread of slow cortical waves relate to known synaptic connectivity patterns. However, we also noted that the functional endogenous interactions between distant cortical areas are not only constrained by anatomical connectivity, but they are also modulated by the brain state. Thus, at the emergence of resting wakefulness cortical activity approaches features of a critical system with scale free dynamics. Processing of sensory information and generation of motor actions are associated with brain states that are distinct from resting wakefulness.

If you want to talk to the speaker, please contact Bernd Kuhn bkuhn@oist.jp