

Professor Fritjof Helmchen, University of Zurich

Mesoscale Brain Dynamics during Tactile Discrimination Behavior

Abstract: Through the combination of in vivo optical imaging and chronic expression of genetically encoded calcium indicators it is now feasible to directly 'watch' neuronal population dynamics in the neocortex of awake, head-restrained mice during specific behaviors. Here, Professor Helmchen will present results from calcium imaging experiments in mouse neocortex while the animal performs a whisker-based texture discrimination task. He uses wide-field calcium imaging to resolve activation patterns across large parts of the neocortex. These experiments revealed wide-spread, coordinated activation of multiple brain regions, which correlated with various behavioral aspects such as whisking, body movements, licking. In particular, he has identified completely distinct patterns of persistent activity during a working memory delay phase, with hot spots in secondary motor cortex and a lateral posterior region next to primary visual cortex, respectively. To additionally record from subcortical regions we establish multi-fiber photometry using a compact array of 12 optical fibers chronically implanted and targeting a subset of subcortical regions. Our results indicate that larger networks of neurons distributed across multiple cortical and subcortical regions are engaged in order to solve the task. Our data may help in understanding the principles of these large-scale activation patterns and the specific role of cross-regional interactions in sensory discrimination and the generation of the behavioral response.

Bio: Fritjof Helmchen is Professor of Neuroscience and Co-Director at the Brain Research Institute of the University of Zurich. His research focuses on the development and application of optical methods (in particular two-photon microscopy) to study neural activity on the single-cell and neural circuit level. His group has pioneered several microscopy techniques and contributed to recent advancements in the study of behavior-related microcircuit dynamics in the mouse brain. Most recently, they applied novel optical approaches to study mesoscale functional connectivity during a whisker-based texture discrimination behavior. Fritjof Helmchen is a recipient of several awards, including an ERC Advanced Grant and the Cloëtta Prize 2015. He serves as a member of scientific advisory and foundation boards and he is the current Director of the Neuroscience Center Zurich.