International Center for Scientific Debate BARCELONA

ARTHUR KONNERTH

CV

PARTICIPANT AT:

A DIALOGUE WITH THE CEREBRAL CORTEX: CORTICAL FUNCTION AND INTERFACING

April, 29th-30th, 2015, Barcelona

Arthur Konnerth, Professor of Neuroscience, Director, Principal Investigator in the **Munich Excellence Clusters CIPSM and SyNergy**, Munich, Germany

Arthur Konnerth is the Friedrich Schiedel Chair and Director of the Institute of Neuroscience at the Technical University Munich, Germany. His current research is concentrated on a better understanding of the mechanisms underlying brain function in health and disease. His lab studies different types of neurons and circuits in the cortex, cerebellum and hippocampus, and uses a variety of techniques, including electrophysiology, molecular biology, optogenetics, behavioral analyses and high-resolution optical imaging. A major focus of the work is directed towards an exploration of behavior-determined synaptic signaling and dendritic integration in neurons of defined circuits in vivo. He and his team pioneered in vivo two-photon functional imaging at scales ranging from single synapses to cortical circuits with single cell resolution. Arthur Konnerth is a member of the German Academy of Sciences Leopoldina, the Academia Europaea and the Bavarian Academy of Sciences and Humanities. He received several awards, including the Max Planck Research Award, the Gottfried Wilhelm Leibniz Award, Adolf Fick Award, the Feldberg Award, an ERC Advanced Grant and the Brain Prize.

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ABSTRACT

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Optogenetics and imaging Techniques in Cortical Circuits

Cortico-thalamic slow oscillations determine internal brain states, playing a major role in memory consolidation. Such oscillations occur spontaneously, but may also be evoked by sensory stimulation. They propagate over long distances in the brain and recruit both the cortex as well as the thalamus. Here we implemented an optogenetic approach to explore basic features of slow-oscillation generation and propagation in the in vivo mouse brain. We monitored the calcium transients associated with slow wave activity by using optic fiber-based fluorometric calcium recordings. We analyzed spontaneous slow waves as well as waves evoked by sensory or by local optogenetic (ChR2) stimulation. We demonstrate that pulse-like optogenetic stimulation (3 - 50 ms) of a small group layer 5 cortical neurons is sufficient for the induction of global brain Ca2+ waves. The temporal invariance and the globality of the Ca2+ waves suggest the presence of recurring large-scale neuronal 'signaling units' during which activity generated by local networks is distributed and processed throughout the cortex.

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