Seminarankündigung

Dienstag, 26. November 2013
15:00 Uhr

WSI, Seminarraum S 101

“Nanodevices for on-chip neuroscience”

Functional chip-based devices that allow stimulation and recording of cellular activity provide tools for investigating neuronal communication. In particular, electrochemical real-time analysis of neurotransmitter release from individual cells is a powerful method for studying chemical communication in neuronal networks. Nanofabrication technologies can significantly enhance the efficiency of such chip-based functional interfaces. A good example is given by nanofluidic electrochemical redox cycling sensors, which boost the sensitivity of electrochemical detection by several orders of magnitude up to the single-molecule level. Such devices make use of repeated oxidation and reduction of target molecules at independently biased and closely-spaced electrodes, which can be easily integrated into chip-based arrays. We have previously demonstrated highly efficient redox cycling amplification during dopamine detection using nanocavity sensor arrays. Similar nanocavity devices can be also used for electrophysiological mapping of network activity on a single-cell level. Here, we introduce redox cycling devices based on nanoporous interfaces and cross-bar arrays. We show how the geometry and bulk coupling of such interfaces affects electrochemical sensing and present a concept for imaging activity at chemical synapses.
In addition to the detection of electrochemical signals, cross-bar architectures have the potential for highly-localized stimulation. By applying appropriate current pulses to the cross bar array, particles can be actuated in three dimensions via combined magnetic and dielectrophoretic forces. This approach offers precise control over the position of individual particles and has potential applications in a range of lab-on-a-chip experiments including localized drug delivery and mechanical stimulation of cells.

Prof. Bernhard Wolfrum
Institute of Bioelectronics,
Forschungszentrum Jülich
Germany