

Microelectrode cavity arrays (MECA) for highly parallel and low-noise recordings from ion channels and nanopores

GUEST SPEAKER

Prof. Jan C. Behrends
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When: **29th September 2010, 3.00 p.m. to 4.00 p.m.**
Where: **Institute of Microelectronics, Singapore**
11 Science Park Road Singapore Science Park II Singapore 117685

Abstract

The lack of highly parallel, low noise electrophysiological platforms for recordings of ionic currents through biological channels and nanopores is a problem for fields of research and biotechnological applications which require both high-throughput and high-sensitivity, such as single channel analysis of drug action, studies of antibiotics transport and nanopore analytics (molecular Coulter counter). Starting with an overview of the developments in this field and of the boundary conditions governing device performance, I will present a novel microsystems approach for such a platform which greatly simplifies the recording configuration and optimizes the electrical parameters governing noise. In contrast to traditional systems which are based on apertures in a dielectric layer separating two compartments, in this design, the lipid bilayer is formed on a picoliter cavity generated within a microstructured photochemical resist acting as a dielectric. Each microcavity contains an individual Ag/AgCl-microelectrode. Using standard photolithographical techniques this design allows for the generation of many such setups on one chip in a microarray (currently 16 assay locations), and is therefore well suited for highly parallel single channel recordings. Parallel low-noise recordings (<1 pA rms @ 10 kHz) of currents mediated by alamethicin are shown as a first proof of principle, illustrating the use of this novel approach towards high-throughput measurements of single membrane proteins. Further the potential of this approach is demonstrated by the reconstitution of the bacterial nanopore α -hemolysin in the lipid bilayer. The capability for molecular analysis with a high sample number is demonstrated by electrochemical detection of oligomers diffusing through the pores with the multiarray.

About the Speaker



Jan C. Behrends (b. 1963 in Göttingen, Germany) studied Medicine at the University of Munich, Germany, spending a year as a Research Student at the Dept. of Physiology of Kyushu University, Japan. In 1993, he defended a thesis on experimental neurophysiology titled "Mechanisms of calcium-dependent regulation of neuronal excitability" and was awarded the degree of Doctor of Medicine (summa cum laude). From 1992 to 1994 he was an INSERM fellow at the Institut Pasteur, Paris, France and from 1994 to 1995 a fellow of the German Research Council (DFG) at the Max-Planck Institute for Psychiatry in Martinsried near Munich. He then returned to the University of Munich as Research Associate and Assistant Professor (1997), obtained his Habilitation in Physiology with a Thesis on "Inhibitory synaptic transmission: elemental events and functional principles" in 2002 and was appointed Professor of Physiology at the University of Freiburg in 2003.

His research focuses on cellular electrophysiology and mechanisms of synaptic transmission as well as on the development of novel experimental tools for electrophysiology including automated higher-throughput patch-clamp and lipid bilayer recording systems. In 2002, he co-founded Nanion Technologies GmbH, now one of the leading manufacturers of automated patch clamp devices. He is a scientific member of the Freiburg Materials Research Center (FMF) and the Center for Nanoscience (CeNS) at the University of Munich. He shared the Genius Biotech Award Baden Württemberg in 2001, was a Finalist of the German Future Award 2007 (Federal President's Award for Science and Technology) and in 2009 shared the German Founder's Award.

Registration

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