Ionera's MECA bilayer array and Nanion's automated bilayer platform Orbit 16 enable the functional analysis of synthetic DNA-origami nanopores

Munich & Freiburg, Germany, November 29, 2012; In a landmark publication in Science, research on artificially designed DNA origami nanopores has been published this week using Nanion's new ORBIT 16 platform running Ionera's MECA bilayer array chip. The team of Prof. Simmel from the Technical University Munich has created nanometer-scale transmembrane ion channels by means of self-assembled DNA-based nanostructures. These "designer pores" have been reconstituted in lipid bilayers for functional characterization using the Orbit 16 for automated formation of, and recordings from 16 bilayers in parallel on Ionera's MECA array.

Recently, interest in using ion channels as molecular Coulter counters or nanopores for analytical techniques has strongly grown. The ORBIT platform, running the MECA bilayer array, is an enabling element for nanopore research and ion channel reconstitution. In the ground-breaking work of Simmel et al., published in the current issue of Science, artificial ion channels have been designed based on DNA origami nanostructures. This technique employs DNA molecules as programmable building materials for custom-designed, self-assembling, nanometer-scale structures, basically allowing for the design of the complex structures on a standard computer. The researchers present evidence that their nature-inspired nanostructures may also behave like biological ion channels. They indeed show for the first time the potential for functional use of DNA nanotechnology in applications of synthetic membrane channels as molecular sensors, antimicrobial agents, and drivers of novel nanodevices.
To test one potential application, the researchers used them as nanopores for several different molecular sensing experiments. These confirmed that it is possible, by observing changes in the electrical characteristics, to record the passage of single molecules through synthetic membrane channels made from DNA. Because this approach allows both geometric and chemical tailoring of the membrane channels, it might offer advantages over two other families of molecular sensors, based on biological and solid-state nanopores respectively.
This new type of highly exciting "designer nanopores" has been efficiently and precisely analysed with the automated bilayer recording platform from Nanion. The Orbit 16 employs recording chips containing a microelectrode cavity array (MECA) provided by Ionera, a spin-off project from the University of Freiburg and speeds up the entire analytical process by the rapid and simultaneous formation of 16 highly stable micrometer-sized bilayers for parallel analysis. To automatically and simultaneously form bilayers on all 16 cavities, the Orbit uses a proprietary method (Ionera-SPREAD) which essentially is a 100%-yield, no-waiting time automated version of the classical Müller-Rudin (painting) procedure.

Prof. Dr. Fritz Simmel, Technical University of Munich, Germany comments:

"The parallel Nanion Orbit 16 setup was crucial for the success of our project, as it allowed us to increase throughput and more quickly screen for optimal conditions for the incorporation of our synthetic DNA channels into lipid bilayer membranes. The small cavity volume of the MECA chips used on the Orbit 16 also helped us to directly prove the translocation of molecules through the channels (from cis to trans side of the membrane), as we could easily demonstrate the accumulation of molecules in the small trans compartment."

Dr. Niels Fertig, CEO of Nanion Technologies, continues:
"We are delighted to see the Orbit 16 displaying its great potential for nanopore research in the exciting development of DNA origami channels. As anticipated, the enabling features of the Orbit such as

automation, low noise at high bandwidth and parallel recordings make the technology appealing to the ion channel- and nanopore-communities. We only introduced the Orbit this year and started shipping a few months ago, so it is fantastic to already see user publications in such high ranked journals as Science so early on!"

Dr. Gerhard Baaken, project leader Ionera at the University of Freiburg, enjoins:
"Prof. Simmel's group has been among the earliest alpha-testers of the MECA chip. We were always glad to see how happy they are with its performance and are now extremely gratified by the prominent publication in Science, in which the MECA device and the Ionera-SPREAD automated bilayer formation have played a decisive enabling role in facilitating and speeding up research. Nanion's Orbit 16 is the ideal platform in which to bring the MECA to market, and we are looking forward to our full commercial release in 2013.

The Orbit 16 has been launched earlier in 2012 and the first units are being installed at customer sites. The system will be on display at the Biophysical Society Annual Meeting, in Philadelphia, PA, USA, February 2 – 6, 2013. The Orbit 16 can be used to form and record from solvent-containing lipid bilayers using Ionera's MECA[1] or solvent-free bilayers using Nanion's GUV-derived bilayer formation protocols, as already used on the Port-a-Patch.

About Nanion:

Nanion Technologies GmbH is a German Private Limited Company and was founded in 2002 as a spin-off from the Center for Nanoscience (CeNS) of the University of Munich. Nanion's team has developed and globally established two highly successful automated patch clamp instruments as enabling tools for sophisticated and high throughput applications for ion channel research and drug discovery. Nanion's instruments use planar patch clamp chips which replace the traditional glass pipette used in the technique of patch clamping. Nanion was nominated in 2007 for Germany's most prestigious innovation award the **Deutscher Zukunftspreis** (German Future Prize, Federal President's Award for Technology and Innovation).

About Ionera:

Ionera is a spin-off project at the University of Freiburg to commercialize a proprietary Multi-Electrode Cavity Array (MECA) technology for parallel bilayer recording. The basis of this technology was jointly developed in the labs of Prof. Behrends (Department of Physiology) and Prof. Rühe (Department of Microsystems Technology) of the University of Freiburg.

Original publication:

Martin Langecker, Vera Arnaut, Thomas G. Martin, Jonathan List, Stephan Renner, Michael Mayer, Hendrik Dietz, and Friedrich C. Simmel. Synthetic lipid membrane channels formed by designed DNA nanostructures. Science, vol. 338, issue 6109, pp. 932-936. DOI: 10.1126/science.1225624

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[1] Ionera's MECA technology is commercially available for beta-testing using a dedicated module for the Orbit 16.