membranes as well as facilitates the formation of lipid membrane by an attractive electrostatic interaction between SUVs and gels. We expect these gel supports to allow the growth of a lipid monolayer (a thin layer of lipids), thus facilitating the formation of a membrane. Since the chemical composition of a gel is easily modified, we can obtain a gel array with desirable properties such as mechanical strength, electric charge, and responsiveness to a stimulus.

**3150-Pos Board B842**
Parallel Reconstitution of Bacterial Toxins, Porins and Ion Channels into Suspended Lipid Membrane Microarrays for High-Throughput Electrophysiology

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High-throughput electrophysiological recordings in artificial membranes have a great potential for pharmaceutical screening and nanopore analytics. In addition to parallelization and automation of lipid bilayers formation, different protein reconstitution protocols are required depending on the concrete application.

We report on functional reconstitutions of three classes of pore-forming proteins into suspended lipid bilayers on Micro Electrode Cavity Array (MECA). Three reconstitution strategies have been employed and optimized depending on the protein structure: self-insertion for pore-forming toxins, transfer from detergent micelles for porins and vesicle fusion for ion channels.

By optimizing protein concentration and facilitating spontaneous insertion with short voltage pulses just below the electroporation threshold, a controlled insertion of alpha-hemolysin was achieved. Exactly one pore per bilayer was inserted in over 50% of bilayers in the array, which is substantially higher than the 37% predicted by the Poisson distribution.

We investigated and optimized insertion of outer membrane porins OmpF, MspA and OmpC into biayer arrays via detergent dilution. Best strategy was to use mild nonionic detergents and sequentially dilute protein stock solution to minimize influence of the detergent on the membrane. Protein injection in the immediate vicinity of a bilayer array and thorough mixing of the solution were decisive factors for homogeneous distribution of functional porins.

Reconstitution via detergent micelles was found to be problematic for ion channels, but proteovesicle fusion was successful. The tetrameric potassium channel KcsA was expressed in vitro with cotranslational insertion into lipid vesicles or nanodiscs. Transfer from nanodiscs into suspended bilayers was shown to be inefficient. Additionally, the presence of nanodiscs substantially destabilized the membranes. For proteovesicles best fusion rates were achieved upon addition of negatively charged phospholipids followed by extrusion of the recovered proteovesicles through a polycarbonate filter.

**3151-Pos Board B843**
A Miniaturized Single Channel Amplifier for Various Different Electrophysiology Setup

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Different electrophysiology setups allow single ion channel recordings using Lipid Bilayer Membrane (BLM) for protein insertion. Ion channels are transmembrane proteins involved in many biological processes and cell life. They are used as target for drug discovery and single-molecule sensors.

Synthetic nanotubes can also be used as nano-cooler counters and very promising transducers for DNA sequencing. Complex protocols are under investigation to assembly ion channels on reconstituted lipid membranes.

The use different setups, ranging from suspended BLM, microfluidic and lab-on-a-chip devices, planar patch clamp, tip-dip method. These studies, combined to new emerging nanopore applications, require high sensitive and high resolution instrumentation, able to detect small currents in the pA range over large bandwidth (up to 100kHz), providing flexible voltage stimulation.

We present a compact and complete system for single ion channels and synthetic nanotubes experiment, useful for scientists and students for academic purposes, composed by:

- a miniaturized low noise single channel voltage-clamp amplifier and digitizer integrated into a single ASIC, with direct connection to a computer USB port;
- a software interface for real time data display and analysis featuring flexible voltage stimuli control;
- customised electrode interfaces for various different electrophysiology platforms and microfluidic devices.

As a proof of concept, we demonstrate the system performances using different test proteins (KcsA, Gramicidin, Alpha-hemolysin) embedded into reconstituted lipid membranes. The acquired data are presented.

**3152-Pos Board B844**
Design Principles for Nanoparticles Enveloped by a Polymer-Tethered Lipid Membrane Coat

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Nanoparticles enveloped by a lipid membrane, which is anchored to the particle by means of polymer tethers, are potentially valuable drug delivery vehicles, for instance due to their enhanced stability, monodispersity, and their wide range of functionalization possibilities. While both the creation of liposomes and that of membranes tethered to flat substrates is fairly well understood, the combined task of enclosing a nanoparticle inside a lipidosome that is anchored by flexible polymer tethers poses a number of design challenges. These will constrain the range within which typical parameters (such as nanoparticle size, polymer length, or tethering density) can be varied. For instance, the anchoring density of tethered lipids also enforces lower bounds for the tethering density on the nanoparticle or, alternatively, its size. Here we use a combination of polymer theory and geometric constraints to derive design criteria for such systems. These can for instance be used to control the size of the coated nanoparticle by a suitable choice of tethering density and degree of polymerization. These predictions are validated by coarse-grained simulations of coated nanoparticle constructs. We also extend these simulations to characterize the mechanisms by which a lipid envelope forms around polymer-coated nanoparticles, thereby providing valuable information about conceivable processes by which such particles could be experimentally produced.