such as a protein, across a lipid bilayer. To create a membrane, two sub-microliter, lipid-encased aqueous droplets are contacted - termed a droplet interface bilayer (DIB). The peptides adsorb to the protein cargo non-covalently and somehow "carry" the protein from one droplet to the other through the membrane. We then assay the translocated cargo through a fluorogenic assay. The DIB method recapitulates the findings of earlier studies involving Pep-1, including the dependence of protein transport on voltage and membrane charge, while also contributing new insights. Specifically, we found that the symmetry of the bilayer membrane may play a role in Pep-1-mediated protein translocation. In addition, we used a newly developed peptide transduction domain mimic (PTDM) as a protein carrier, which exhibited distinct differences compared to Pep-1's mechanism. We've also used the DIB system to monitor the translocation of proteins through pores, such as the anthrax toxin. We anticipate that the DIB method may be useful for a variety of transport-based studies; in particular those which must make use of tiny quantities of purified species.

1058-Pos Board B813

Cobaltabisdicarbollide Macroanion is able to Diffuse across the Lipid Membrane; Study of Kinetics and Transport

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The ability to form membranes is not restricted to polar lipid molecules or even to organic molecules, as the boron-based molecule cobaltabisdicarbollide, $[Co(C_2B_9H_{11})_2]^-$, (commonly known as cosan) can also form vesicles and membranes. Here we show that cosan and its derivatives can interact with phospholipid membranes.

Cosan is a monoanionic metallabisdicarbollide, which is soluble in both water and oils. Structurally, cosan has no similarity to the polarized lipid molecules that make up biological membranes. It comprises a cobalt atom sandwiched by two carboranyl clusters [1-3]. Although these clusters are hydrophobic, the metal ion imparts a dispersed negative charge spread over the whole molecule (fig.1). As a consequence of this, the exposed B-H and C-H bonds of the carboranyl clusters possess weak dipoles and form intermolecular attractions that give the molecule its unusual physico-chemical property of being simultaneously hydrophobic and hydrophilic. This duality allows cosan to interact with lipid membranes.

Using membrane electrophysiology recordings and direct measurements of COSAN concentrations by inductively coupled plasma mass spectrometry (ICP-MS) we show that COSAN transits cell-free artificial lipid membranes. We study the kinetics of the transport and try to get insights on the mechanism by which COSAN crosses planar phospholipid membranes.

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1059-Pos Board B814

Experimental Observation of Surface Charge Inversion in a Biological Nanopore in Presence of Monovalent and Multivalent Cations

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The electric double layer formed at the pore surface produces the exclusion of coions and the accumulation of counterions. A particularly captivating situation occurs when interfacial charges attract counterions in excess of their own nominal charge, thus leading to an effective charge inversion of the system. This phenomenon has been reported in such diverse systems like lipid vesicles, colloids, Langmuir monolayers, membranes, flexible polyelectrolytes and other synthetic nanodevices that are in contact with an aqueous solution containing multivalent ions. Here, we report experimental evidence of charge inversion in the bacterial channel OmpF of E. coli, not only in presence of multivalent cations but also in presence of monovalent ones. We perform reversal potential experiments in different conditions of pH and salt concentration to analyze both the effect of cation type and size in the selectivity changes.

1060-Pos Board B815

Influences on Cellular Adhesion of Nanoparticles under Blood Flow-Like Conditions

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Nanocarrier-mediated drug and gene delivery are novel strategies to treat diseases, for example cancer, neurological disorders, infectious and cardiovascular diseases. Sophisticated drug delivery and gene therapy systems are typically equipped with targeting ligands to improve the specific binding to diseased cells within the human body. These targeting moieties are usually small molecules, peptides or proteins which are able to specifically bind receptors on the cell surface. In many diseased cells certain receptors are overexpressed and therefore represent suitable targets.

In our experiments we focus on the specific adhesion of nanocarriers to target cells. Therefore, we use fluorescent labeled polystyrene beads as model particles, shield them with PEG (polyethylene glycol) and mount a ligand - the transferrin receptor (TfR) binding peptide B6 - to mimic the surface of therapeutical nanocarriers. The binding of these targeted beads is directly compared to the adhesion of non-targeted beads on TfR overexpressing HuH7 cells. As non-targeted beads we use three different types, one with hydroxyl groups on the surface, another with scrambled B6 peptide (same amino acids, but different order) and a third type with modified B6 peptide (all positively charged amino acids are replaced by neutral ones). To include dynamics and determine the impact of shear stress, the binding study is performed under laminar flow conditions, i.e. the beads are flushed over a cell monolayer within a microfluidic channel. After fixation of the cells, highly-sensitive fluorescence widefield microscopy is performed to analyze the adhesion of beads on a single cell level. With this approach we are able to directly analyze the effect of the targeting ligand. In addition, the influences of electrostatics and shear stress on cellular particle binding are investigated.

1061-Pos Board B816

Surface Interactions in Suspensions of Swimming Cells

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Interactions between swimming cells and surfaces are essential to many microbiological processes, from bacterial biofilm formation to human fertilization. However, despite their fundamental importance, relatively little is known about the physical mechanisms that govern the scattering of flagellated or ciliated cells from solid surfaces. A more detailed understanding of these interactions promises not only new biological insights into structure and dynamics of flagella and cilia but may also lead to new microfluidic techniques for controlling cell motility and microbial locomotion, with potential applications ranging from diagnostic tools to therapeutic protein synthesis and photosynthetic biofuel production. Due to fundamental differences in physiology and swimming strategies, it is an open question of whether microfluidic transport and rectification schemes that have recently been demonstrated for pusher-type microswimmers such as bacteria and sperm cells, can be transferred to puller-type algae and other motile eukaryotes, because it is not known whether long-range hydrodynamic or short-range mechanical forces dominate the surface interactions of these microorganisms. Here, using high-speed microscopic imaging, we present direct experimental evidence that the surface scattering of both mammalian sperm cells and unicellular green algae is primarily governed by direct ciliary contact interactions. Building on this insight, we predict and experimentally verify the existence of optimal microfluidic ratchets that maximize rectification of initially uniform Chlamydomonas reinhardtii suspensions. Because mechano-elastic properties of cilia are conserved across eukaryotic species, we expect that our results apply to a wide range of swimming microorganisms.

1062-Pos Board B817

Selective Growth of Neural Networks on Micro-Patterned Graphene

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Single crystal graphene is the ideal candidate for next generation of electronic devices and of biosensors. Interfacing graphene with neural cells could be highly advantageous in exploring their electrical behaviour and promising for several biomedical applications, including neural regeneration and artificial retina. Here, we present a straightforward fabrication technique based on laser ablation to obtain patterned substrates promoting ordered neuron growth. Chemical vapor deposition (CVD) single layer graphene (SLG) was machined by means of single pulse UV laser ablation technique at the lowest effective laser fluence in order to minimize laser damage effects (1). The obtained patterned substrates, with alternating micro-sized stripes of ablated and not-ablated SLG, were uniformly coated with poly-D-lysine; primary embryonic hippocampal neurons were cultured on the functionalized substrates. As monitored by time-lapse imaging, neurons adhered on both regions of the pattern,