471-Pos Board B257
Investigation on the Synergism Between Sodium Dodecylsulphate and Dodecylphosphocholine in the Formation of Mixed Micelles
Giorgia Manzo, Maura Carboni, Andrea C. Rinaldi, Mariano Casu, **Mariano A. Scorciapino**.
University of Cagliari, Monserrato, Italy.
The complexity of biological membranes leads to the use of extremely simplified models in biophysical investigations of membrane proteins and peptides. Liposomes are among the most used, since it is possible to prepare vesicles with different charge, size and bilayer thickness, depending on lipids type and relative concentration. However, NMR, which is a very powerful technique to study proteins and peptides structure in solution, suffers from the lack of such a versatile model, because, even with the smallest liposomes, molecular tumbling is too slow, leading to resonances excessive broadening. Micelles represent a good compromise, and SDS and DPC are the most widely employed surfactants, to mimic prokaryotic and eukaryotic membranes, respectively. Nevertheless, they are always used separately and investigations as function of surface charge cannot be performed. In the literature, some examples of the use of SDS/DPC mixtures are reported but this binary system have been never characterized and it is merely assumed that they are synergic and form mixed micelles. Indeed, when electrostatics plays a major role in surfactants interactions, non ideal micellization behavior is often observed, either synergic or antagonist, depending whether attractive or repulsive interactions are favorite, respectively. In this work, we have applied the regular solution theory to characterize the micellization of different SDS/DPC mixtures, both in water and in the phosphate buffer saline. Critical micelle concentrations have been measured by following the chemical shift variation of selected 1H and 31P NMR resonances as a function of total surfactant concentration. Z potential and size of the mixed micelles have been measured with dynamic light scattering. Results showed that SDS and DPC are synergic in both the environments and can actually be used to prepare mixed micelles with different negative/zwitterionic surfactant ratio.

Membrane Physical Chemistry I

472-Pos Board B258
Physical Chemistry Properties of Liponucleosides Incorporated in Cell Membrane Models at the Air-Water Interface
Érica A. Montanha[1], **Luciano Caseli**[2], Oliver Kaczmarek[3], Juergen Liebscher[3], Daniel Huster[4], Osvaldo N. Oliveira Jr.[5].
[1]Universidade de São Paulo, São Carlos - SP, Brazil, [2]Universidade Federal de Sao Paulo, Diadema-SP, Brazil, [3]Institute of Chemistry, Humboldt University, Berlin, Germany, [4]Institute of Medical Physics and Biophysics, University of Leipzig, Leipzig, Germany, [5]Universidade de Sao Paulo, São Carlos - SP, Brazil.
Liponucleosides can help the anchoring of nucleic acid nitrogen bases into cell membranes for tailored nanobiotechnological applications. For that, specific knowledge on the biophysical details at the membrane surface is essential. Here, we employed lipid Langmuir monolayers as cell membrane models to investigate the insertion of five lipidated nucleosides, which varied in the type of the covalenty attached lipid group, the nucleobase, and the number of hydrophobic moieties attached. All five lipidated nucleosides were surface-active, forming stable monolayers, also being able to incorporate into dipalmitoylphosphatidylcholine (DPPC) monolayers. Four of them induced expansion in the surface pressure isotherm and caused the decrease in the surface compression modulus of DPPC. In contrast, one nucleoside with three alkyl chain modifications formed condensed monolayers and induced monolayer condensation and also an increase in the compression modulus for the lipid monolayer. These facts therefore reflected the importance of the ability of the nucleoside molecules to be accommodated in packed arrangements at the air-water interface. These results enable the possibility of tuning nucleic acid pairing by changing structural characteristics of the liponucleosides.

473-Pos Board B259
Calcium Ion Controlled Nanoparticle Induced Tubulation in Supported Flat Phospholipid Vesicles
Irep Gozen[1], Celine Billerit[1], Paul Dommersnes[1,2], Aldo Jesorka[1], Owe Orwar[1].
[1]Chalmers University of Technology, Gothenburg, Sweden, [2]Matieres et Systemes Complexes, Universite Paris Diderot, Paris, France.
Biological nanotubes (or tunneling nanotubes) accomplish important functions within the cell, for instance by supplying cell components and carrying signals, and transport virus particles and bacteria. Many functions are still not well understood, which has placed these nanostructures in the focus of recent investigation. We report here on our observations of transient tubulation in surface-supported flat giant unilamellar vesicles (FGUVs). The encapsulation of nanoparticles in FGUVs with low Ca^{2+} concentration (1-4 mM) in the ambient buffer solution caused reversible tubulation. Tubes extended from the FGUV up to a length of several hundred micrometers and exhibited, on some occasions, vesicle compartmentalization. Our experimental model represents key features of previously reported tube formation phenomena in biological and biomimetic systems.

474-Pos Board B260
Towards Better Cell Membrane Mimics: Cholesterol-Containing Supported Lipid Bilayers on TiO2
Ling Zhu[1,2], Danijela Gregurec[1,2], Ilya Reviakine[1,2].
[1]CIC biomaGUNE, San Sebastian, Spain, [2]University of the Basque Country, Leioa, Spain.
Membranes of cells are based on fluid bilayers containing complex mixtures of various lipids and cholesterol. Charged and biologically active species such as phosphatidyl serine (PS), phosphatidyl ethanolamine (PE) and phosphatidyl inositol (PI) are facing the inside of the cell while the zwitterionic, ''inert'' lipids and glycolipids facing the outside. 1 Cell membranes are also organized laterally. This lateral organization is thought to be captured in model systems containing high-melting and low-melting lipids and cholesterol. 2 Model systems capturing lipid asymmetry in cell membranes are scarce, however, due to the difficulties associated with controlling lipid self-assembly process. 3 In this context, we 4,5 have recently shown that PS is distributed asymmetrically in supported phospholipid bilayers (SLBs) prepared on titanium dioxide (titania, TiO2) from liposomes containing low-melting PC and PS. In this study, we introduce cholesterol and high-melting lipids into the system to prepare better cell membrane mimics. Their formation and properties are studied by atomic force microscopy, scanning laser confocal fluorescence microscopy, and fluorescence recovery after photobleaching (FRAP). Additional impetus for our studies stems from the desire to understand the interactions between the material commonly used in medical applications (TiO2) and lipid membranes.
References:
(1) Yeagle, P. L. The Membranes of Cells; Academic Press, Inc.: San Francisco, CA, USA, 1987.
(2) Stottrup, B. L.; Stevens, D. S.; Keller, S. L. Biophys. J. 2005, 88, 269-276.
(3) Collins, M. D.; Keller, S. L. Proc. Natl. Acad. Sci. U. S. A. 2008, 105, 124-128.
(4) Rossetti, F. F.; Textor, M.; Reviakine, I. Langmuir 2006, 22, 3467-3473.
(5) Reviakine, I.; Gallego, M.; Camarero, S.; Lütgebaucks, C.; Wacklin, H. P. Manuscript in preparation 2011.

475-Pos Board B261
Mimicking Endocytosis Inside Giant Unilamellar Vesicles
Ilona Wegrzyn, Gavin D.M. Jeffries, Owe Orwar, Aldo Jesorka.
Chalmers University of Technology, Gothenburg, Sweden.
Striving to further understanding of cellular processes and communication is one of the reasons for continuous progress in fields of synthetic biological systems, mimicking the functional components of cells. Through the controlled introduction of stimuli-responsive polymer into giant unilamellar vesicles (GUVs), we are able to represent macromolecular crowding and to achieve localized, reversible compartmentation, thus creating a pathway for more complex cell-like architecture.
Here we present a model composed of the aqueous solution of the thermoresponsive polymer, poly-(N-isopropyl acrylamide) (PNIPAAm) with copolymerized vinylferrocene (VFc) encapsulated inside giant unilamellar vesicle (GUV) for the study of cell-like compartmentation. Increased hydrophobicity of the polymer, achieved by incorporation of a hydrophobic ferrocene moiety, assures faster dynamics, reduced equilibrium compartment size and more homogenous hydrogels. During our investigation, we observed an exceptionally strong interaction between PNIPAAm-VFc and the vesicle boundary. After increasing the temperature above the lower critical solution temperature (LCST) of the polymer, numerous lipid nanotubes formed from the vesicle boundary, leading to spontaneous morphological changes of the vesicle. Moreover, internalization of biological molecules such as DNA, enzymes and nanoparticles, could be demonstrated through this process. Our currently available data strongly suggests association of membrane-spanning polymer chains with charged particles or molecules in the surrounding solution, which are pulled through the membrane as the polymer contracts.
Our results exhibit a strong potential for mimicking endocytosis of biological cells as well as intra/inter cellular transport. The presented model enhances our understanding of biophysical processes associated with transmembrane transport of molecules and particles, while expanding the current model for the formation and dynamics of lipid nanotubes.