Academy of Sciences, Trieste, Austria, [6]Laboratory of Clinical Biophysics, Faculty of Medicine, University of Ljubljana, Ljubljana, Slovenia, [7]Laboratory of Physics, Faculty of Electrical Engineering, University of Ljubljana, Ljubljana, Slovenia.

The role of phospholipid asymmetry in the transition from the lamellar (L_α) to the in-verted hexagonal (H_{II}) phase upon the temperature increase was considered. The equilibrium configuration of the system was determined by the minimum of the free energy including the contribution of the isotropic and deviatoric bending and the interstitial energy of phos-phospholipid monolayers. The shape and local interactions of a single lipid molecule were taken into account. The minimization with respect to the configuration of the lipid layers was performed by a numerical solution of the system of the Euler-Lagrange differential equations and by the Monte Carlo simulated annealing method. At high enough temperature the lipid molecules attain a shape exhibiting higher intrinsic mean and deviatoric curvatures which fits better into the H_{II} phase than into the L_α phase. Furthermore, the orientational order-ing of lipid molecules in the curvature field expressed as the deviatoric bending provides a considerable negative contribution to the free energy which stabilizes the non-lamellar H_{II} phase. The nucleation configuration for the L_α - H_{II} phase transition is tuned by the isotropic and deviatoric bending energies and the interstitial energy. For the mathematical model the deviations from sphericity of inverted hexagonal phase cross-section were calculated, resulting in lower energy in non-spherical cross-section than in spherical cross-sectin.

1795-Pos Board B639

Phase Behavior And Domain Structures Of Lipid Membranes Under Tension

Olav Garvik, John H. Ipsen.
University of Southern Denmark, Odense, Denmark.

The lateral domain structure of lipid membranes is mainly controlled by the thermodynamic characteristics, i.e. composition, temperature and tension. In this study we show experimentally by the combination of fluorescence microscopy and micropipette aspiration techniques and theoretically by phenomenological modeling that the lateral tension of the membrane provides a potent control parameter of the lateral phase behavior and domain structures in lipid membranes. The lateral tension can lead to significant distortions of the phase diagrams and modification of critical behavior, and hence enhancement or suppression of lateral domains.

1796-Pos Board B640

Phosphatidylinositol-4,5-bisphosphate Affects Ceramide 1-phosphate Phase Behavior

Zhiping Jiang, Roberta E. Redfern, Cheryl E. McCullough, **Katrice E. King**, Edgar E. Kooijman, Arne Gericke.
Kent State University, Kent, OH, USA.

Ceramide is a well-characterized sphingolipid metabolite and second messenger that participates in numerous biological processes. When ceramide is phosphorylated by ceramide kinase (CERK), ceramide-1-phosphate (Cer1P) is obtained. It has recently been proposed that Cer1P is involved in cell survival, cell proliferation, inflammation and phagocytosis. It has been observed that the CERK activity is dependent on the interaction with phosphatidyl inositol-4,5-bisphosphate ($PI(4,5)P_2$). In turn, Cer1P was found to affect the PI3K/AKT pathway. This suggests that $PI(4,5)P_2$ and Cer1P might co-localize and interact. To address this issue, giant unilamellar vesicles (GUVs) composed of POPC and 10% Cer1P were made with different concentrations of brain $PI(4,5)P_2$ (from 2%, 5%, 10% to 20 mol%), labeled with fluorescent lipids and analyzed by fluorescence microscopy. GUVs composed of POPC and 10% Cer1P showed irregular branch-shaped domains, which are characteristic for the Cer1P gel phase. In the presence of 2% brain $PI(4,5)P_2$, the irregularly branched domains took on a shape of beads on strings, i.e., the domains were round indicating increased fluidity. With increasing amount of $PI(4,5)P_2$ added, the bead region became larger and larger. In the presence of 10% $PI(4,5)P_2$; the gel type string regions can barely be seen. For 20% $PI(4,5)P_2$ only one fluid type region can be seen. Since the portion of Cer1P in the GUVs was fixed, (10% of the total lipids) the increasingly larger domains have to be the result of the incorporation of brain $PI(4,5)P_2$ in the Cer1P phase. This incorporation of $PI(4,5)P_2$ in the Cer1P phase leads to an increasing fluidity and increasing size of the domain. In conclusion, Cer1P and $PI(4,5)P_2$ co-localize into a domain when mixed with POPC and this domain exhibits fluid like properties at high $PI(4,5)P_2$ concentrations.

1797-Pos Board B641

Determination of Inter-Phase Line Tension in DMPC/D-Cholesterol mixed Langmuir Films

Fanindra Bhatta[1], Pritam Mandal[1], Andrew J. Bernoff[2], James C. Alexander[3], J. Adin Mann Jr.[3], Edgar E. Kooijman[1], David W. Allender[1], **Elizabeth K. Mann**[1].
[1]Kent State University, Kent, OH, USA, [2]Harvey Mudd College, Claremont, CA, USA, [3]Case Western Reserve University, Cleveland, OH, USA.

The hydrodynamic response of a thin fluid film, whether a Langmuir monolayer at the air/water interface or a cell membrane, is difficult to model, since it involves the coupling of both bulk and surfaces phases. However, such hydrodynamic response is not only intrinsically critical for transport within the layer, it also provides a major available means to evaluate an important parameter for phase-separated layers such as rafts, the line tension. We have developed a line-integral formulation of the hydrodynamic response of phase-separated layers with short-ranged forces, and tested it by comparisons between numerical simulations based on this model and experiment. These experiments both validate the model and demonstrate that the line tension can be determined with unprecedented accuracy and precision. Long-range dipole-dipole interactions are introduced into the model. The method is applied to coexistence between phases in binary phospholipid/cholesterol mixed layers. Data is evaluated for both Brewster and microscopy and fluorescence microscopy and implications of the use of fluorescent probes are discussed.

1798-Pos Board B642

On The Properties Of Surfactant Monolayers At Low Surface Tensions

Svetlana Baoukina[1], Sergei Mukhin[2], Matthias Amrein[1], D. Peter Tieleman[1].
[1]University of Calgary, Calgary, AB, Canada, [2]Moscow Institute of Steel and Alloys, Moscow, Russian Federation.

The properties of surfactant monolayers at the air/water interface depend strongly on the monolayer surface density. As the density increases, the monolayers undergo transitions from gas to liquid and condensed phases, and transform from 2D to 3D geometry as their stability limit is reached. For a given surfactant, the higher the surface density, the smaller is the monolayer area, and lower is the resulting surface tension at the interface. We found that for selected lipid mixtures and lung surfactant extracts, the monolayer surface tension - area isotherms deviate from the expected dependence. For these mixtures, the captive bubble surfactometer measurements show that at low surface tensions (< 20 mN/m) the reduction of surface tension is accompanied by an increase rather than a decrease of monolayer area. We used a combination of experimental techniques, theoretical models and computer simulations to investigate the properties of monolayers of varying composition at low surface tensions. We hypothesize that the observed effect originates from monolayer 2D-3D transformations. Monolayer wrinkling in particular leads to a decrease of monolayer apparent area and lowers the total surface tension.

1799-Pos Board B643

Effect Of A Water-soluble Polymer On Lamellar Surfactant Phases

Ramon Iñiguez Palomares[1], Ricardo López Esparza[2], Heriberto Acuña Campa[2], Amir Maldonado[2].
[1]Departamento de Investigación en Polímeros y Materiales, Universidad de Sonora, Hermosillo, Mexico, [2]Departamento de Física, Universidad de Sonora, Hermosillo, Mexico.

We study the effect of a water-soluble polymer, PEG, on the lamellar phases of different surfactants (non-ionic and ionic). Different experimental techniques (Polarized Light Microscopy, Freeze-Fracture Electron Microscopy, Small-Angle X Ray Scattering, Dynamic Light Scattering, Rheology) show that the polymer strongly affects the structural and physical properties of the membranes. In some cases, the polymer induces a phase of highly packed multilamellar vesicles. We present the effect of polymer concentration and polymer molecular weight.

1800-Pos Board B644

Measuring The Energetic Cost Of Burying An Arginine Sidechain Into A Lipid Bilayer Using A Transmembrane Protein

Preston Moon, Karen G. Fleming.
Johns Hopkins University, Baltimore, MD, USA.

Arginine is not a hydrophobic amino acid. On its own, an arginine sidechain would face a large energetic barrier to entry into the apolar core of a lipid bilayer. But, would a similarly high barrier also exist for an arginine if it were part of a whole transmembrane protein? Whether or not that barrier is high, how would such an arginine interact with a lipid bilayer? The answers to these questions will likely have implications on the normal functioning of some ion channels and also on the abnormal mis-folding of some other membrane proteins. Here we attempt to experimentally measure the free energy cost of burying an arginine into the apolar core of a lipid bilayer when that arginine is on the otherwise hydrophobic surface of a transmembrane protein. We also attempt to uncover some molecular details about how the misplaced arginine and its neighboring lipids behave. The transmembrane protein we use is the Outer Membrane Pospholipase A (OmpLa) of *E. Coli*. We engineered OmpLa to have an arginine at each of several positions that, in the crystal structure of