2496-Pos
Thermal Fluctuations of Lipid Bilayers involving Dilation, Splay, Tilt and Twist
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Lipid bilayers may be deformed in numerous ways. On short length scales, the surfaces exposed to the solvent are subject to microscopic noise, altering the water structuring proximal to the membrane. On mesoscopic scales the bilayer is subject to bending and dilation. Quantities related to molecular orientation–tilt and twist–are also subject to perturbations. In dynamical situations, the surface separating the opposing leaflets deviates from the exact center of the bilayer. We present a unified model which incorporates all of these aspects. Using molecular dynamics simulations, we analyze the thermal fluctuations of a membrane in terms of the additional degrees of freedom. Elastic constants are then obtained by fitting the measured spectra to our model expressions.

2497-Pos
Measuring the Interfacial Rheological Properties of Lung Surfactant Monolayers
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Lung surfactant (LS) is essential to respiration because it reduces surface tension at the interface between water and air in the alveoli. In addition, LS stabilizes the alveoli against collapse during exhalation. LS is composed of lipids, mainly dipalmitoylphosphatidylcholine (DPPC), and proteins. We are interested in the rheological properties of a pure DPPC film as a first step towards understanding complex LS rheology. During exhalation, we hypothesize that a large surface tension gradient occurs between the alveolar sacs and the bronchioles which should cause LS to flow away from the alveoli. Because LS does not readily leave the alveoli through the trachea, there must be the drag effect with an opposing direction to the flow induced form the surface tension gradient. Previous work has shown that the surface shear viscosity of LS increases exponentially at low surface tensions, which may be sufficient to prevent the flow of surfactant out of the lungs. Additionally, a yield stress in the interfacial LS film would also help to prevent the flow. Here, we define the yield stress as a minimum stress below which no flow occurs. As a result, we have shown the existence of the yield stress in pure DPPC monolayer, and how to increase or decrease the yield stress based on the addition of other lipid molecules.

2498-Pos
Amphiphile-Regulation of Ion Channel Function by Changes in a Transferable Lipid Bilayer Spring Constant
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Amphiphilic compounds regulate membrane protein function by specific chemical interactions with their target receptor, as well as by adsorbing to and altering the physical properties of the host lipid bilayer, and thus the energetic cost of bilayer deformations associated with protein conformational changes at the protein-bilayer interface. Specific regulatory mechanisms may be investigated using well-described methodologies of ligand-receptor interactions. But the bilayer-mediated regulation, due to lack of transferable parameters to describe the complex effects of amphiphiles on the bilayer physical properties, has not matured into a quantitative, predictive field of science - which is problematic considering its ubiquitous consequences in biological research. Using measurements of the effects of amphiphiles on the lifetime of gramicidin (gA) channels of different lengths, we show that the *net* effects of amphiphiles, on the energetic cost of the bilayer deformation associated with a change in length of the bilayer-spanning part of an embedded protein, can be a characterized as changes in a phenomenological spring constant that summarizes the bilayer elastic properties. Moreover, amphiphile-induced changes in the spring constant, as measured using gA channels of a given length, are transferable and can be used to predict the effects of amphiphiles on the function of gA channels of another length, as well as on the gating of voltage-dependent sodium channels in living cells.

2499-Pos
Characterization of the Biophysical Properties of Novel Saturated Bis(monoacylglycero)phosphate Analogues
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Bis(monoacylglycero)phosphate ($BMP_{18:1}$) is an uniquely structured anionic phospholipid found in enriched concentrations in the internal membranes of the lysosome and late endosome.[1] $BMP_{18:1}$, differs from typical phospholipids, possessing two glycerol moieties each with a single oleoyl acyl-chain as well as an atypical *sn*-1:*sn*-1' stereoconfiguration. It has been suggested that the unusual structure of $BMP_{18:1}$ plays a role in lipid and protein trafficking, as well as glycosphingolipid degradation.[2,3] Dimyristoyl-BMP ($BMP_{14:0}$) and dipalmitoylphosphatidylcholine (DPPC) undergo a phase transition from the gel to liquid crystalline phase at 42 °C, whereas the phosphatidylcholine with myristoyl acyl-chains, dimyristoylphosphatidylcholine (DMPC), undergoes a gel to liquid crystalline phase transition at 23 °C. It is therefore of interest to investigate the thermotropic phase behavior of saturated BMP analogues. Temperature dependent ^{2}H-NMR was used to characterize analogues of BMP with lauroyl, myristoyl, palmitoyl, or stearoyl acyl-chains. First moment (M_1) analyses of ^{2}H-NMR spectra can be used to monitor the gel to liquid crystalline phase transition. The phase transition temperature for each BMP analogue was found to be higher than the phosphatidylcholine consisting of the corresponding acyl-chain. $BMP_{18:0}$ was studied under three different buffer conditions to determine the effects of pH and ionic strength on the phase transition.
1. Kobayshi et al., *J. Biol. Chem.*, **2002**, *277*, 32157.
2. Gruenberg, *Curr. Opin. Cell Biol.*, **2003**, *15*, 382.
3. Schulze, Kolter, and Sandhoff, *BBA*, **2009**, *1793*, 674.

2500-Pos
Analysis of Lateral Segregation Formed on DNA-Tethered Lipid Membranes by Varying Tether Lengths
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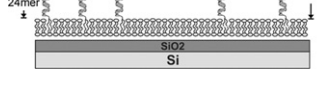
We recently described a strategy to prepare DNA-tethered lipid membranes either to fixed DNA on a surface or to DNA displayed on a supported bilayer*. An approach has been developed to improve the stability of the latter system, and with this it is possible to investigate the lateral segregation of DNA hybrids when different lengths are present (see Figure). The area fraction of the taller region is proportional to the mole percent of 48mer. The effects of DNA sequence (repeating vs. overlapping), length (72mer vs. 24mer) and salt concentration will be described. Starting from a theoretical model proposed by Qi et al.**, the effect of population, length and affinity of DNA complexes is simulated and described. This model system captures some of the essential physics of synapse formation and is a step toward understanding lipid membrane behavior in a cell-to-cell junction.



* Chung *et al., Journal of Structural Biology*, **168**, 190-199 (2009)
** Qi *et al., Proc. Natl. Acad. Sci.*, **98**, 6548 (2001)