containing phosphatidylcholine (PC), an uncharged lipid; phosphatidylglycerol (PG), a charged lipid; and cholesterol. These phase diagrams have several interesting features. Miscibility in membranes containing charged lipids occurs over similar ranges of temperatures and lipid compositions as in membranes containing only uncharged lipids. The coexisting liquid phases differ primarily in their phospholipid content such that one phase has a high concentration of charged lipid. Adding salt to the system causes an increase in transition temperatures at some membrane compositions, consistent with electrostatic screening, whereas the transition temperatures at other compositions fall.

2550-Pos

Activity and Ordering of Mixed Phosphatidylethanolamine/Dihydrocholesterol Monolayers

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Cholesterol is thought to be important for the structure and assembly of lipid rafts, and its interaction with other membrane lipids has been a topic of great interest. This study focuses on the interactions between 1,2-dimyristoyl-*sn*-glycero-3-phosphoethanolamine (DMPE) and dihydrocholesterol (Dchol) in Langmuir monolayers using fluorescence microscopy (FM), beta-cyclodextrin (CD) desorption assays, and grazing incidence x-ray diffraction (GIXD). Similar to our previous results for 1,2-dimyristoyl-*sn*-glycero-3-phosphocholine (DMPC)/Dchol monolayers [Biophys. J. 2007, 93, 2038-2047], FM and CD assays show 2 regimes for the DMPE/Dchol system. Short-ranged lateral ordering was observed using GIXD that was also consistent with our recent work on sphingomyelin (SM)/Dchol monolayers [Phys. Rev. Lett. 2009, 103, 028103]. We investigate how the smaller headgroup of DMPE affects the surface morphology, Dchol chemical activity, and lateral structure compared to monolayers of Dchol with DMPC or SM.

2551-Pos

Group III Secretory Phospholipase A_2 Enhances Alpha-Secretase-Dependent Amyloid Precursor Protein Processing Through Alterations in Membrane Fluidity

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Phospholipases A_2 (PLA_2s) are responsible for maintenance of phospholipids homeostasis in cell membrane and implicated in neurodegenerative disease including Alzheimer's disease (AD). Among many types of secretory PLA_2s, type III secretory PLA_2 ($sPLA_2$-III) is expressed in neuronal cells and contributes to cell differentiation and survival. Yet the role of $sPLA_2$-III in AD has not been explored. We studied the effects of $sPLA_2$-III and its hydrolyzed products, including arachidonic acid (AA), palmitic acid (PA) and lysophosphatidylcholine (LPC), on cell membrane fluidity in relations to amyloid precursor protein (APP) processing, which is an important cellular process in AD to produce either neuroprotective α-secretase-cleaved soluble APP ($sAPP_\alpha$) or neurotoxic amyloid-β peptide (Aβ). Differentiated human neuroblastoma (SH-SY5Y cells) treated with $sPLA_2$-III and AA, not PA and LPC, was found to increase $sAPP_\alpha$ secretion and these changes were accompanied by increased membrane fluidity and accumulation of APP at the cell surface. All the treatments altered neither total APP expression nor expression of α-secretases, including ADAM 9, 10, and 17. Taken together, our results support the hypothesis that $sPLA_2$-III enhances $sAPP_\alpha$ secretion through its action to increase membrane fluidity and recruitment of APP at the cell surface. This study provides insights into potential therapeutic approaches for AD treatment.

2552-Pos

Nonlinear Effect of Sucrose on Lamellar-Hexagonal Phase Transition Kinetics

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The topological nature of the lamellar-hexagonal phase transition in lipids makes it a useful tool in the study of pore formation. This phase transition in lipid-water systems is sensitive to the addition of various solutes such as sucrose. In our study of lipid SOPE (1-stearoyl-2-oleoyl-*sn*-glycero-3-phosphoethanolamine), we find that equilibrium lamellar-hexagonal phase transition temperature decreases linearly with sucrose concentration. However, we find that the phase transition kinetics vary in a strikingly nonlinear fashion. The speed of the transition greatly slows with even small concentrations of sucrose and then plateaus as the concentration increases.

2553-Pos

Structure of a DOTAP Lipid Bilayer: A Concerted Neutron Scattering and Molecular Dynamics Study

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Non-phospholipid, cationic 1,2-dioleoyl-3-trimethylammonium propane (DOTAP) lipid based membranes fail to support the function of a voltage-dependent K+ channel due to the lack of a phosphate group (Schmidt et al., Nature 444, 775-779, 2006). However, the specific effects of the presence or absence of phosphate groups in the channel membrane environment on the voltage-sensing mechanism remain unknown. Before addressing the question of why DOTAP is not a suitable membrane environment for Kv channels, a detailed structural characterization of the pure DOTAP lipid bilayer system is required. Here, we employ molecular dynamics simulations in combination with neutron scattering experiments for a detailed atomistic study of a DOTAP lipid bilayer. All-atom molecular dynamics simulations of DOTAP bilayer at 9.4 waters/lipid were performed at constant pressure and temperature. One-dimensional structural data obtained from the neutron scattering experiments is used to validate the molecular dynamics simulations, which in turn provide the structural details at the atomistic level. We also compare the properties such as alkyl chain order parameter, area per lipid, and headgroup hydration, packing and orientation for a DOTAP lipid bilayer to zwitterionic phospholipid bilayers and propose the underlying physical-chemical reasons for the differences observed.

Acknowledgments: The work is supported in part by NIH grants GM74637 and GM86685, a NSF grant, and computational resources from TeraGrid project.

2554-Pos

The Effect of Fatty Acids with Different Unsaturations on Membrane Fluidity and Alpha-Secretase-Dependent Amyloid Precursor Protein Processing

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Fatty acids are important dietary ingredients, which are implicated in neurodegenerative disease including Alzheimer's disease (AD). Yet their roles are not fully understood. We investigated the effects of fatty acids with different unsaturations (number of double bonds) including stearic acid (SA, 18:0), oleic acid (OA, 18:1), linoleic acid (LA, 18:2), α-linolenic acid (ALA, 18:3), arachidonic acid (AA, 20:4), eicosapentaenoic acid (EPA, 20:5), docosahexaenoic acid (DHA, 22:6) on cell membrane fluidity in relations to amyloid precursor protein (APP) processing, which is an important cellular process in AD to produce either neuroprotective α-secretase-cleaved soluble APP ($sAPP_\alpha$) or neurotoxic amyloid-β peptide (Aβ). Differentiated human neuroblastoma (SH-SY5Y cells) treated with AA, EPA and DHA, not SA, OA, LA and ALA, increased $sAPP_\alpha$ secretion, which was accompanied by increased membrane fluidity. Our results showed that the fatty acids with four or more double bonds, including AA, EPA and DHA, promoted $sAPP_\alpha$ secretion through increasing membrane fluidity. This study provides the potential dietary strategies for the prevention of AD.

2555-Pos

PLA_2 Type IIA Increases Platelet Plasma Membrane Rigidity During Cold Induced Activation

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There is a wide discussion regarding the origin and function of lipid domains in human cells. An example in which lipid domains may play a functional role is the plasma membrane of human platelets. Platelets are susceptible to chilling, activating when the temperature falls below 20 °C. This limitation represents a crucial issue in terms of storage of platelets. It has been previously shown that cold-induced platelet activation is correlated with the formation of macroscopic lipid domains during cooling. This is a result of the fact that platelets present low cholesterol content (15 mol%), which results in the presence of a cooperative lipid melting transition centered at 15°C. This transition is responsible for the formation of the macroscopic lipid domains during cooling. Human secretory phopholipase A_2 type IIA ($sPLA_2$-IIA) catalyses the hydrolysis of the sn-2 ester bond in glycerolipids to produce fatty acids and lysolipids. Recently we have shown that its activity is triggered by the local enrichment of anionic lipids in fluid domains during phase coexistence. Since human platelets