Anionic lipid influences the response of bicellar dispersions to pressure

Ashkan Rahmani, MSc candidate
Department of Physics and Physical Oceanography
Memorial University

DATE: Thursday, July 11, 2013
TIME: 2:00 PM
PLACE: C3024

ABSTRACT: Lipid dispersions with planar regions enriched in long chain lipids and highly curved regions enriched in short chain lipids can exhibit complex phase behaviour. Such "bicellar" mixtures provide insight into how the morphology of self-assembled soft structures are determined by component heterogeneity. Bicellar dispersion properties can be affected both by surface charge and the application of pressure. Variable pressure deuterium nuclear magnetic resonance (2H- NMR) studies were carried out on bicellar lipid mixtures comprising the short chain lipid 1,2-dihexanoyl-sn- glycero-3-phosphocholine (DHPC), the long chain lipid 1,2-dimyristoyl-sn- glycero-3-phosphocholine (DMPC) and the anionic lipid 1,2-dimyristoyl-sn-glycero-3-phospho-(1'-rac-glycerol) (sodium salt) (DMPG). Samples of DMPC d54/DMPG/DHPC (3:1:1) and, for comparison, DMPC-d54/DHPC (4:1) were prepared and hydrated in HEPES buffer at lipid weight fractions of 10%. Spectra and quadrupole echo decays were obtained, between 4°C and 65°C, for both warming and cooling at ambient pressure, 42.5 Mpa and 85 Mpa. At ambient pressure, both mixtures form isotropically reorienting small particles at low temperature. On warming past the DMPC gel-to-liquid crystal transition temperature, the particles coalesce into larger structures that can be magnetically oriented. At higher temperatures, the dispersions form more randomly oriented lamellar phases. On cooling at ambient pressure, the lamellar phase persists to lower temperature where it transforms directly to the isotropic phase. Application of pressure raises the transition temperatures for DMPC-d54/DHPC (4:1) but does not significantly change the phases observed. For DMPC-d54/DMPG/DHPC (3:1:1), pressure can stabilize the isotropically reorienting phase to higher temperature on warming. On cooling under pressure, DMPC-d54/DMPG/DHPC (3:1:1) can reorganize into a highly ordered gel phase with spectra similar to those of the high pressure interdigitated gel phases of some phospholipids. Once nucleated, the highly ordered gel phase appears to be stable even at ambient pressure. These observations demonstrate the sensitivity of dispersion morphology to details of mixed-lipid sample's thermal and pressure history.
Supported by NSERC.

ALL ARE WELCOME!!!