

PHYSICS COLLOQUIUM

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3:50 PM, Room 111, Life Sciences

“Interaction of Cholesterol and Phospholipids in Cell Membranes”

David Gidalevitz
BCPS- Physics Division
Center for Molecular Study of Condensed Soft Matter

Cholesterol-enriched domains in cell membranes are involved in a wide variety of cellular activities including protein sorting, signal transduction, and host-pathogen interactions. In this talk I will present a systematic study of cholesterol-phospholipid interactions in lipid monolayers using Langmuir isotherms, epifluorescence microscopy, synchrotron X-ray reflectivity (XR), and grazing incident-angle X-ray diffraction (GIXD) techniques. I will discuss the results of detailed high resolution structure study of the lipid monolayers consisted of cholesterol-DPPC mixtures with various cholesterol mole fractions (χ_{CHOL} from 0 to 1). XR results demonstrate that cholesterol is located within DPPC acyl chains at low χ_{CHOL} 0.13-0.46 promoting the stretching of the phospholipid acyl chains region. Our X-ray data together with Langmuir isotherm results provide explanation for well-known “condensing” effect of cholesterol indicating that a sterol molecule aims to seize approximately 8-10.8 Å² of area from the acyl chains above neighboring phospholipid headgroups. Despite the significant tilt of the lipid headgroups, phospholipid molecules cannot provide cholesterol an adequate shielding from the aqueous media at χ_{CHOL} higher than 0.34-0.41. Thus, at high χ_{CHOL} cholesterol molecules require to shift towards the aqueous interface. GIXD reveals that at $\chi_{CHOL} \leq 0.13$ the packing mode of the mixture is the same as that of DPPC, and at $\chi_{CHOL} \geq 0.85$ the ordered part of the monolayer is pure cholesterol.