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Molecular Organization and Dynamics of Cholesterol Nanodomains in Fluid Lipid Bilayers KWAN CHENG, BRIAN CANNON, QING ZHU, MARK VAUGHN, JUYANG HUANG, Texas Tech University — The molecular organization and dynamics of cholesterol nanodomains in lipid bilayers containing phospholipid (PL) and cholesterol (CHOL) were examined using FTIR, time-resolved fluorescence and surface-acting cholesterol oxidase enzyme (COD). In binary PL/CHOL system, abrupt changes in the PL C=O frequency, fluorescence lifetime and rotation rate of chain labeled PL, and the rate of cholesterol oxidation by COD were observed at $\sim$ 40 mole% of CHO. For ternary PL_1/PL_2/CHOL system composed of two dissimilar PL's of different chain lengths or headgroup sizes, abrupt changes at $PL_1/PL_2 \sim 2$ were found. The above critical lipid compositions agree favorably with the theoretical compositions predicted by the lipid superlattice model, suggesting that PL of different structures and CHOL can form regularly distributed, or superlattice-like, nanodomains at the polar headgroup and the acyl chain levels, respectively. The feasibility of the coexistence of headgroup and acyl chain nanodomains was demonstrated by a spacing filling model and MD simulations. We speculate that lipid superlattice domains may play an important role in the regulation of protein/lipid interaction in cells.

Kwan Cheng
Texas Tech University

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