MAR10-2009-008237

Abstract for an Invited Paper
for the MAR10 Meeting of
the American Physical Society

Exploring the Underlying Biophysics of Eukaryotic Plasma Membrane Asymmetry by Sum-Frequency Vibrational Spectroscopy

JOHN CONBOY, University of Utah

A central issue in molecular biology is the movement of lipids across the cellular membrane. The translocation of lipids is involved in cell apoptosis, the viral infection of living cells, the functioning of antibiotics, antiseptics and drugs, and the regulation and growth of cells. There have been a number of studies attempting to find the putative proteins responsive for lipid transbilayer movement in eukaryotic cells. This has led to a large number of theories about the mechanism of transbilayer movement of lipids in cellular systems and the physical process by which lipid compositional asymmetry in the plasma membrane of eukaryotic cells is maintained. Using methods of classical surface chemistry coupled with nonlinear optical methods, we have developed a novel analytical approach, using sum-frequency vibrational spectroscopy (SFVS), to selectively probe lipid compositional asymmetry in a planar supported lipid bilayer. This new method allows for the detection of lipid flip-flop kinetics and compositional asymmetry without the need for a fluorescent or spin-labeled lipid species. The effect of lipid composition, headgroup and fatty acid chemical structure, on the rate and thermodynamics of lipid transbilayer migration and the electrostatic induction of lipid asymmetry will be discussed.