

CBTE/CBIMMS Invited Seminar

Spheres That Break Out in Spots: Immiscible Phases in Membranes of Lipids and Cholesterol

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Abstract

Mammalian cells are surrounded by an outer wall or "plasma membrane" of proteins and lipids arranged in opposing leaflets of a bilayer. There is growing evidence that this membrane is not uniform, but instead laterally separates into "raft" domains rich in particular lipids and proteins. We study a simpler model of cell membranes, giant unilamellar vesicles. We use fluorescence microscopy to directly observe liquid domains in the vesicles. We find a simple relationship between chain melting temperature and miscibility transition temperature. We experimentally cross miscibility boundaries both by changing temperature and by the depletion of cholesterol with cyclodextrin. Using results from both fluorescence microscopy and NMR studies, we quantitatively construct tie-lines on phase diagrams and estimate free energies to transfer lipids between phases. Liquid domains in vesicles exhibit interesting behavior: they collide and coalesce, can finger into stripes, and can bulge out of the vesicle. We also find that it is possible to capture the domains in asymmetric bilayers on glass substrates.