

CMET Seminar

- ▶ **Wednesday, May 7, 2008**
- ▶ **10:30 A.M.**
- ▶ **366 Colburn Laboratory**



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Paul Butler is a chemist at the Center for Neutron Research at the National Institute for Standards and Technology in Gaithersburg, Maryland. He oversees the Small-Angle Neutron Scattering (SANS) program. His broad interests are in characterization of the structure and dynamics of colloidal systems as a means of better understanding the physics and chemistry of these complex and fascinating systems.

“Self-Assembled Morphologies in Binary Mixtures of Phospholipids as Revealed by SANS: Bicelles, Ribbons and Vesicles, oh my...”

Binary mixtures of long and short chain phospholipids have recently been shown to form an isotropic discoidal phase at temperatures below the chain melting temperature, T_m , of the long tail lipid. The main criteria required for the formation of these discoidal micelles, usually called “bicelles” (bilayer micelles) in the phospholipid literature, appears to be the segregation upon mixing within the body of the aggregate of a bilayer forming long chain lipid and a second shorter micelle forming lipid component to stabilize the highly curved rim of the geometry.

Such relatively simple binary mixtures have been extensively used for NMR protein structural determinations and have been shown to be able to crystallize at least one protein, Bacteria Rhodopsin. Further, phospholipids are a key component of cell membranes in which they are mixed with a variety of other lipids, sterols, proteins, and enzymes. Segregation of components in these membranes to form so-called “rafts” is an area of increasing interest. However, without a detailed understanding of even such simple binary mixtures as these mixed phospholipids systems, it is difficult to see how the far more complex cellular environment can be quantitatively addressed.

We have used Small Angle Neutron Scattering (SANS) and isotopic labeling, complemented by a variety of other techniques such as SAXS, and DSC to demonstrate unambiguously the segregation and to begin to explore the complicated interplays at work in these important and fascinating systems. We wish to understand such things as what drives the normally entropically unfavored segregation, why the structure changes upon dilution despite maintaining a constant ratio of rim to bilayer lipid, what drives the range of stability of the bicelle vs. vesicle, how T_m and chain lengths influence the morphologies, and the evolution of these structures with temperature. The SANS technique will be briefly introduced along with our results on several different mixed systems, studied both at a fixed temperature well below T_m and as a function of temperature up to and slightly above T_m .