

Organized Molecular Films at Electrode Surfaces

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transformations of the membranes. In addition, spectroscopic and neutron scattering techniques are employed to study conformational changes of organic molecules and their ordering within the membrane.

We will give a review of our studies of the structure and reactivity of monolayers and bilayers of amphiphilic neutral and ionic surfactants and model biomembranes deposited onto a metal electrode at the metal-solution interface. Specifically, we will describe how surfactant or phospholipid molecules aggregate to form monolayer or bilayer films. What the stability of these films is in the presence of electric fields that are comparable in magnitude to the fields acting on biological membranes. How these fields affect ordering of molecules within the membrane and how they cause a phase transition from the liquid crystalline to the gel state. We will also show how the electric field affects the stability of mixed bilayers composed of phospholipids and cholesterol, incorporation of proteins into the bilayer and electron and ion transfer through proteins incorporated into the supported bilayer.

In these studies we employ electrochemical methods, *in situ* infrared reflection refection absorption spectroscopy (IRRAS) and the neutron scattering technique. The metal electrode surface, covered by a film of surfactants or phospholipids, can be charged and electric fields on the order of 10^{10} V/m can be applied to these supported films. These fields have comparable magnitude to the fields acting on biological membranes. The field may be conveniently used to manipulate organic molecules within the monolayer and the bilayer membrane. By turning a knob on the control instrument one can force phase transitions in the film of organic molecules or force them to disperse or to aggregate at the surface. We use electrochemical techniques to control the physical state of the film and IRRAS and neutron reflectivity to study the field driven