

Robust and Tunable Polymer Cushioned Lipid Membranes

Content

Over the past several decades, supported lipid membranes have been used as model systems of cellular membranes, to investigate various membrane interactions, and as platforms for development of bio-sensors. In this talk, I will discuss some recent work on a robust polymer cushioned membrane system for biosensing applications that recapitulates many salient features of the plasma membrane including control over the fluidity of the membrane and thickness/density of the underlying, pH responsive polymer network. The system is readily fabricated from commercially available materials with commonly available laboratory equipment. The structure and properties of the biomembrane system were characterized by neutron reflectivity and fluorescence recovery after photobleaching (FRAP). High quality, high coverage lipid membranes were constructed using Langmuir-Blodgett and vesicle fusion deposition methods. The underlying polymer network or membrane cushion is a covalently grafted PAA cushion with nominal thickness controlled by spin coating conditions. The pH-sensitive structure of the PAA network and coupling to the membrane can be used to control the hydrated thickness of the film and membrane diffusivity. At low pH, when the PAA is collapsed, diffusivity is strikingly lower than at high pH when the PAA is swollen. Under physiological conditions, the diffusion rates of lipid membranes on the PAA network were indistinguishable from those on bare glass supports. Importantly, the PAA cushioned membrane structure is stable during cycling through acidic, neutral, and alkaline conditions.

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