373f Hybrid Materials Based on Silica/Lipid Assemblies with Incorporation of Transmembrane Proteins

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Lipid bilayer membranes (LBMs), transmembrane proteins and their assemblies are essential components of all cellular systems that enable a variety of functions including compartmentalization, passive and active transport, signal transduction, cell recognition and energy utilization. They have a broad range of potential applications including biosensing for medical diagnosis and environmental monitoring, chemical and biological warfare agent sequestration, actuator development and bio-fuel cell development. The fragility of lipid bilayers has precluded the realization of the goal of incorporation of these versatile assemblies into many types of functional devices. We have synthesized a family of robust hybrid bio / inorganic materials that incorporate lamellar lipid bilayer assemblies containing transmembrane proteins into thin films and membranes by evaporation induced self assembly (EISA) and fabricated via spin coating. Lamellar structures were obtained for the lipids used in the study. Effect of the concentration of the lipids on the d-spacing of the silica-lipid assemblies was also studied. Mixing of lipids results in different periodicities in the resulting assembly. Bacteriorhodopsin and gramicidin are the two transmembrane proteins which were incorporated into silica-lipid assemblies. Addition of cholesterol increases the long-range observed for the EggPC lipid-silica assemblies. Sonication of lipids at different stages in the synthetic protocol yields different structures. Incorporation of liposomes in the silica matrices was also achieved successfully.