ENABLING SUM FREQUENCY GENERATION VIBRATIONAL SPECTROSCOPY OF A MODEL CELLULAR MEMBRANE SYSTEM COMPRISING A CUSHIONED PHOSPHOLIPID BILAYER

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Due to the broad biological significance of the correlation between phospholipid membrane structure and function, there is a great need for powerful tools to probe the distribution, kinetics, orientation and conformation of lipid and protein membrane constituents. Sum Frequency Spectroscopy (SFS) can simultaneously elucidate the absolute orientation and the detailed degree of conformational order of the alkyl chains of lipids comprising a membrane. To date, SFS studies of membrane structures have been performed on model membranes formed directly on solid substrates, at the oil/ solution interface, and at the air/ water interface. Such systems are not amenable to studies of membrane transport processes or incorporation of transmembrane proteins with intracellular domains. Thus, a model membrane system replicating, in a controlled manner, the cross-section of a biological membrane is being developed by building upon knowledge regarding 'cushioned' model membranes and utilizing a detailed understanding of non-linear interference effects in SF substrates. Specifically, a hydrogel layer of a well defined and controlled thickness is spun cast onto a thiolized gold surface. A lipid bilayer is subsequently deposited on the gel via Langmuir Blodgett/Langmuir Shäfer (LB/LS) deposition. Characterization of this model membrane system has begun using $ex-$ and $in-situ$ ellipsometry, atomic force microscopy (AFM), fluorescence microscopy, and SFS $in-situ$. It is intended that this model membrane will provide researchers with an alternative SFS amenable system that is of biological relevance, and will be employed in our laboratory for non-classical protein transport studies.