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Advances in automated sample preparation for neutron reflectometry experiments

Neutron reflectometry is a powerful tool for interrogating the structure of thin films at interfaces. Surface-adsorbed lipid bilayers in liquid flow cells provide a platform for a wide range of biophysical measurements, from protein structures to antimicrobial peptide activity to interfacial forces. Lipid bilayers are chemically complex, with an enormous combinatorial space of compositions; as a result, bilayers of arbitrary lipid compositions cannot always be formed using conventional methods. A compounding factor is the even larger combinatorial space of protein or peptide binding partners. These factors conspire to significantly limit the scope of neutron reflectometry measurements relative to that required to answer the broadest biophysical questions and aid biotechnological development. In this talk, I will describe how sample environment developments at LIQREF have enabled progress towards automated lipid bilayer formation of a broad range of lipid compositions on various substrate chemistries. I will report on the formation of stable surface-adsorbed bilayers comprising primarily non-lamellar lipids such as those common in bacterial and mitochondrial membranes. Finally, I will introduce the NIST ROADMAP project for neutron reflectometry-driven autonomous discovery of membrane-active peptides and present results demonstrating how autonomous experimentation can drive increased measurement throughput in this space.

Topical Area

Biology and life sciences

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