
**Bilayers at the ILL**

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# Lateral organization in bacterial cells and model membranes.

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The existence and role of lateral lipid organization in biological membranes has been studied and contested for more than 30 years. Lateral lipid domains, or rafts, are hypothesized as scalable compartments within biological membranes, providing appropriate physical environments to their resident membrane proteins. This implies that lateral lipid organization is associated with a range of biological functions, such as protein co-localization, membrane trafficking, and cell signaling; to name just a few. A 'classic' model of lipid rafts as sterol and sphingomyelin rich regions has emerged as a result of a 'mammalian' centric focus. However, lipid rafts also appear to be key features of microbial cell membranes, with recent results illustrating a functional connection between raft disruption and antibiotic resistance. Moreover, we have recently suggested that lipid rafts may also act to buffer membrane physical properties from changes in temperature and environmental perturbations – such as amphiphilic solvents.

Today, we will consider lateral lipid organization, primarily in bacterial cell membranes and bacterial cell membrane mimics. Though there are numerous approaches which are useful to investigate lateral organization, neutrons provide unique information about the structure and dynamics of biological systems on relevant time and length scales. Beyond this, neutrons possess a powerful sensitivity to the isotopes of hydrogen, enabling biodeuteration strategies to resolve lipid rafts in complex experimental systems. There has been significant progress in recent years observing lipid organization in these systems, with neutron scattering featuring as a particularly powerful approach for the characterization of biomolecules in model systems and in vivo. I will present the results of these direct observations of cell membrane transverse and lateral structure in the Bacillus subtilis cell membrane, and update these result with ongoing studies of the biological impacts of such deuteration strategies. Other studies utilizing membrane mimics and other neutron based techniques have isolated the structure and dynamics of lipid domains in greater detail. These results inform the physical mechanisms of domain formation and demonstrate the proposed buffering effect of bilayer physical properties, suggesting a physically based function for these biological structures.

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