BBB seminar (BMED380)

SCAN ME

Thursday, May 11, 14:30 at the BBB, Auditorium 4

Membrane asymmetry - coupling lipid structural dynamics to protein function

Georg Pabst
University of Graz, Austria

Cellular membranes are fascinating multifunctional interfaces within and around cells. The molecular composition of these membranes unfolds as an intriguingly complex, but tightly controlled assembly of lipids and proteins enabling numerous physiological processes. In this context, transbilayer lipid asymmetry emerges as a key feature of plasma membrane architecture. Moreover, proteins embedded within plasma membranes are also intrinsically asymmetric, suggesting the coevolution of lipid and protein asymmetries. Striving to reveal the biophysics pertaining to plasma membrane asymmetry, we have developed protocols to produce synthetic asymmetric lipid membranes, including reconstituted integral membrane proteins. These systems are amenable to detailed quantitative interrogation using an array of biophysical and functional techniques. Specifically, we exploit neutron and X-ray scattering techniques combined with compositional modeling to determine leaflet-specific structural and elastic properties. For example, we observed that an asymmetric lipid distribution can induce interleaflet coupling and a modulation of bilayer bending rigidity. Factors contributing to these effects include lipid charge, shape, packing density, and hydrocarbon chain interdigitation, all of which may also couple to protein function. In particular, we found a significant decrease in the activity of a membrane-embedded enzyme with increasing membrane asymmetry. A simple model allows us to explain this effect based on differential stresses that build up between the membrane leaflets. Thus, membrane asymmetry can allosterically mediate the function of an integral membrane protein. It is likely that this mechanism is also at play with many other proteins residing in plasma membranes.

Chair: Markus Miettinen <markus.miettinen@uib.no>, Dept. of Chemistry