Bilayers at the ILL

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Coupling of leaflet structure in asymmetric lipid vesicles

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Lipid asymmetry is a hallmark of biological membranes [1]. In particular, prototypical mammalian plasma membranes are known to be composed of an outer leaflet enriched in cholinephospholipids, while the majority of the aminophospholipids are confined to the inner leaflet [2]. Asymmetric large unilamellar lipid vesicles (aLUVs), produced via cyclodextrin-mediated lipid exchange [3], are a new platform for more realistic mimics of biological membranes . These systems were shown to be stable over several days [4] and have already been investigated by elastic scattering techniques (small-angle neutron and X-ray scattering; SANS/SAXS), providing insight into structural properties of the individual leaflets [5]. One of the enduring questions concerning plasma membrane architecture and lipid asymmetry is the possibility of bilayer leaflets being coupled to each other, which may influence a number of physiological processes that require communication between interior and exterior of the cell [6]. However, in the physiologically relevant fluid phase no evidence of structural coupling has yet been reported from scattering studies. In this work, we explore the role of hydrocarbon chain interdigitation as a potential trigger for transleaflet coupling.
We use combinations of dipalmitoylphosphatidylcholine (DPPC) in the inner leaflet and mixed lipids with varying chain length mismatch in the outer leaflet, in particular C16:0/C18:1 PC (POPC), C18:0/C18:1 PC (SOPC), C18:0/C14:0 (SMPC), C14:0/C18:0 (MSPC) and C16:0/C14:0PC (PMPC). This entails different interdigitation states of the mixed-chain lipids into the inner leaflet. We present consequences on transbilayer coupling as observed from leaflet specific structural data and thermotropic behavior of these systems.

References

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