

Asymmetry, Registration, Flip-Flop, and Phase Separation in Lipid Bilayers

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Lipid bilayers *in vivo* are multicomponent mixtures that are capable of phase separation. Model studies of bilayers often demonstrate complex phase behaviour, which in most cases is symmetric across the bilayer, so that the two leaflets locally have the same phase. However, physiological bilayers have very different compositions in the two leaflets, and the environments on either side of the bilayers are often very different (pH, ionic strength, different molecular species, ...). Hence there are numerous reasons to consider phase separation in which the two leaflets have different local phases and/or compositions. One can even have anti-registered phase separation, in which leaflets are locally *always* in different phases! I will explore the kinetics and equilibrium behaviour of these kinds of phase separation based on different levels of modeling, and discuss signatures of asymmetry and anti-registration in experiments in the literature, as well as challenges for scattering experiments.