Domain Growth in Fluid Membranes with Asymmetric Transbilayer Lipid Distribution

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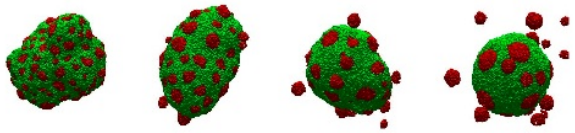
In contrast to the mosaic model for biological membranes, which assumes that biomembranes are homogeneous structures, many recent experiments have demonstrated that biomembranes of eukaryotic cells exhibit both compositional and conformational organization.

With the aim to achieve the understanding of the physical properties of these biomembranes, many experimental and theoretical investigations have been carried out on relatively simple model lipid membranes. These studies have shown that the dynamics of domain growth in membranes is affected by the interplay between composition, line tension between domains and the lateral tension on the membrane[1,2].

To the best of our knowledge, in all the studies on model membranes, both leaflets of the bilayer membranes have the same lipid composition in. The natural next step in complexity toward the understanding of biomembranes is to consider membranes with different lipid compositions in the two leaflets. An important question that arises is then: What role does the compositional asymmetry between the two leaflets play on the domain structure of lipid bilayers?

In particular, will this asymmetry result in a finite size of these domains? We use large scale dissipative particle dynamics simulations of two component membranes to answer these questions[3].



Time evolution of domain growth on a two component vesicle, from DPD simulations given in reference[1]

References

[1] Laradji, M. and Kumar, P.B.S., 2004. Dynamics of Domain Growth in Self-Assembled Fluid Vesicles, Phys. Rev. Lett. 93: 198105.

[2] Laradji, M. and Kumar, P.B.S., 2005. Domain growth, budding and fission in phase-separating self-assembled fluid bilayers, Jou. Chem. Phys. 123: 224902.

[3] Laradji, M. and Kumar, P.B.S., 2006. Anomalously slow domain growth in fluid membranes with asymmetric transbilayer lipid composition, Phys. Rev. E. 73: 040901.