Hybrid membranes of lipids and diblock copolymers : from homogeneity, raft, to phase separation[1]

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Hybrid lipid/polymer vesicles can integrate benefits of liposomes and polymersomes. In this work, the phase behavior of hybrid membranes containing lipids and diblock copolymers is explored by dissipative particle dynamics simulations. The influences of lipid unsaturation and thickness mismatch between lipids and polymers are considered. The transition from the mixing state (homogenous distribution) to demixing state (formation of bilayered lipid-rich domains) is always observed as the lipid concentration (φ_l) exceeds a critical value, which increases with the degree of unsaturation. It is found that phase separation is driven by weak energy incompatibility between the hydrophobic segments of lipids and polymers. When the effect of thickness mismatch becomes significant, the occurrence of the demixing state is retarded, and monolayer lipid rafts emerge before phase separation. Lipid fluidity associated with the physical state of a hybrid membrane can be characterized by lateral lipid diffusivity (D_l). In the polymer-rich membrane, D_l is higher in the mixing state, but decreases generally with φ_l due to lipid-lipid interactions and interdigitation.

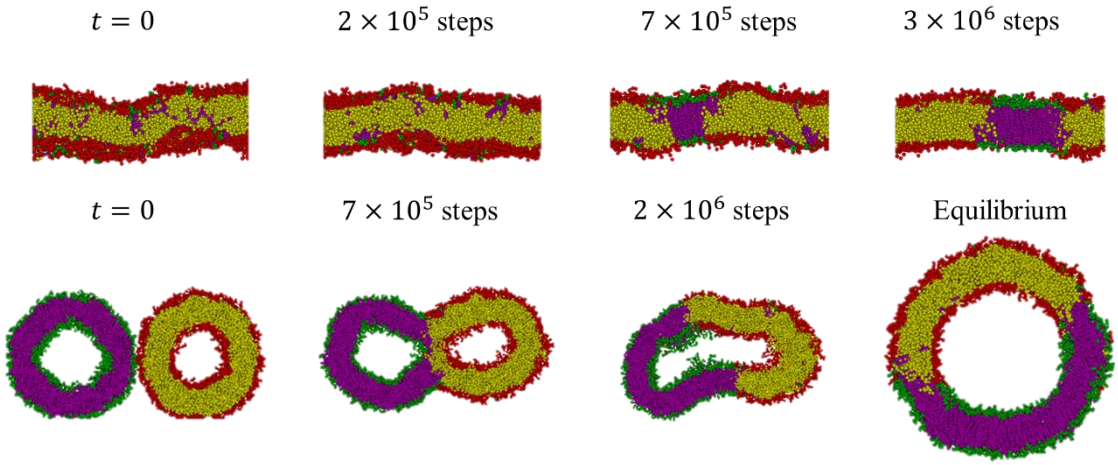

Figure 1: Time evolution of the development of phase separation in a hybrid bilayer membrane and a hybrid small unilamellar vesicle.

References

1. Ssu-Wei Hu, Chun-Yen Huang, Heng-Kwong Tsao, and Yu-Jane Sheng "Hybrid lipid/diblock copolymer membrane: from homogeneity, raft, to phase separation," *Phys. Rev. E* **99**, 012403 (2019).