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The Morphology of Lipid Aggregates based on the Interplay among Molecular Architectures, Hydrophobic-Hydrophilic and Coulombic Interactions and their Kinetics

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Lipids resemble amphiphilic diblock copolymers in the many ways in terms of rich resultant structures, which are controlled by spontaneous curvature and molecular interaction, except that the molecular length scale of interest is smaller. One of the most commonly studied systems is so-called "bicelle" ("bilayered micelle"), which is composed of a long- and a short- chain lipid, spontaneously forming discoidal micelles in aqueous solutions under certain conditions. The lamellae of "bicellar mixtures" have been used as magnetically alignable templates for structural study of membrane-associated proteins since they provide a native bilayered environment for the proteins in study. In this talk, I will summarize how and why a variety of morphology can be obtained from the "bicellar" system based on the molecular architectures (spontaneous curvatures) of the lipids, inter-particle Coulombic interaction and hydrophobic-hydrophilic interaction. Most interestingly, many of these structures are kinetically controlled but have robust formation mechanisms and high stability. Currently, we are particularly interested in how the exchange rate of the lipid molecules affects the kinetics.