P.48 Immiscible lipids control the morphology of patchy emulsions

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We study the phase behavior of immiscible mixtures of phospholipids and cholesterol at the interface of oil-in-water emulsions. Such mixtures spontaneously decompose into domains on the surface of droplets, similar to the formation of lipid rafts in cells. Using a microfluidic device we control the production of monodisperse emulsions and map out a ternary immiscibility diagram allowing for the control of various surface morphologies, including spots, stripes, and hemispheres. While bilayer membranes require ternary mixtures for domain formation, all morphologies are found to be accessible using only binary mixtures of either cholesterol and DOPC or cholesterol and sphingomyelin on emulsion monolayers. By functionalizing those controlled patterns with biotinylated lipids, we also make useful candidates for directed self-assembly with specific interactions via streptavidin.

Using confocal microscopy and image analysis we find that domains grow to a maximum size and then remain stable against coarsening on a timescale of weeks. Surprisingly stability is not compromised by the presence of increasing amounts of salt, indicating that the stabilizing force is not electrostatic in origin. We investigate and discuss the potential driving forces for the stability of the domains and note that different lipid compositions could lead to different stabilization mechanisms.