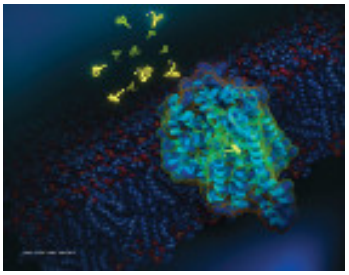

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Hydrostatic Pressure Effects on the Structure and Stability of Lipid Membranes

We have studied the effects of pressure on the gel-fluid transition in sphingomyelin bilayer membranes, and have found that the ordering of the chains and the development of the ripples on forming the gel phase occur on different timescales.
We have demonstrated by x-ray diffraction that fluid-fluid phase separation in ternary DOPC / DPPC / cholesterol mixtures can be induced in bulk phases by hydrostatic pressure. We have been able to image directly this pressure-induced phase separation in lipid vesicles by using high pressure optical microscopy.
By incorporation of charged phospholipids, we have been able to swell inverse bicontinuous cubic phases to approx. 500 Å, with water channels of approx. 220 Å diameter, potentially expanding the range of usefulness of such phases for applications].
We studied the effect of hydrostatic pressure on the structure and stability of the inverse micellar cubic phase Fd3m, and have discovered a number of novel effects. We have also studied the structure of this phase by contrast variation neutron scattering, and showed that the more weakly amphiphilic diacylglycerol component is preferentially located in the smaller, more highly curved inverse micelles. We discovered a lyotropic phase of space group P63/mmc, whose structure is based upon an hcp packing of quasi-spherical inverse micelles, in a hydrated mixture of DOPC, dioleoyl glycerol, and cholesterol. This phase is expected to have a greater chain packing frustration than the Fd3m cubic phase, and it appears that the cholesterol is able to relieve the chain packing frustration within the hydrophobic region of this phase, allowing the P63/mmc phase to form.
We also discovered a novel inverse ribbon phase in the branched-chain polyoxyethylene surfactant system C14C16EO4 in excess water. This phase is stabilised by the application of hydrostatic pressure, with the structure becoming increasingly distorted away from 2-D hexagonal symmetry with increasing pressure.

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