

Membranes and Lipids

Biophysical Chemistry 1, Fall 2009

Fundamentals of lipid/membrane structure

Membrane/protein interactions

Reading assignment: Chaps. 4 & 10

Back to the cell:

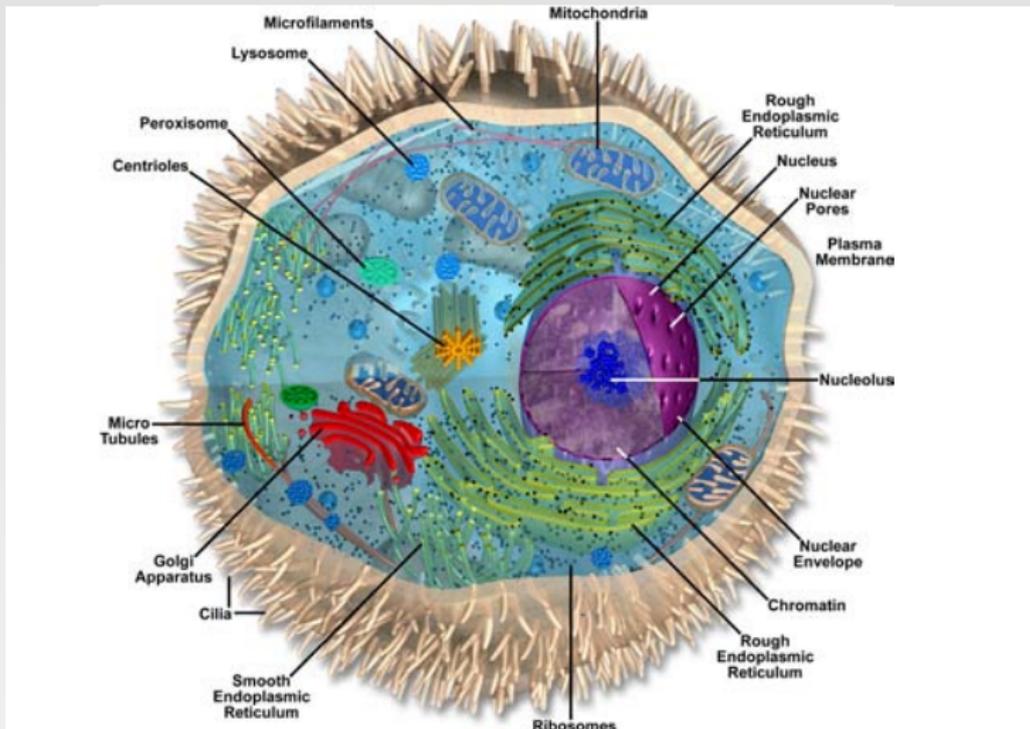


FIGURE 1.3 ■ A schematic picture of an animal cell showing sub-cellular structures, such as nucleus, membrane systems (ER), mitochondrion, etc. (Made by Michael W. Davidson, Florida State University.)

Basic chemistry of lipids

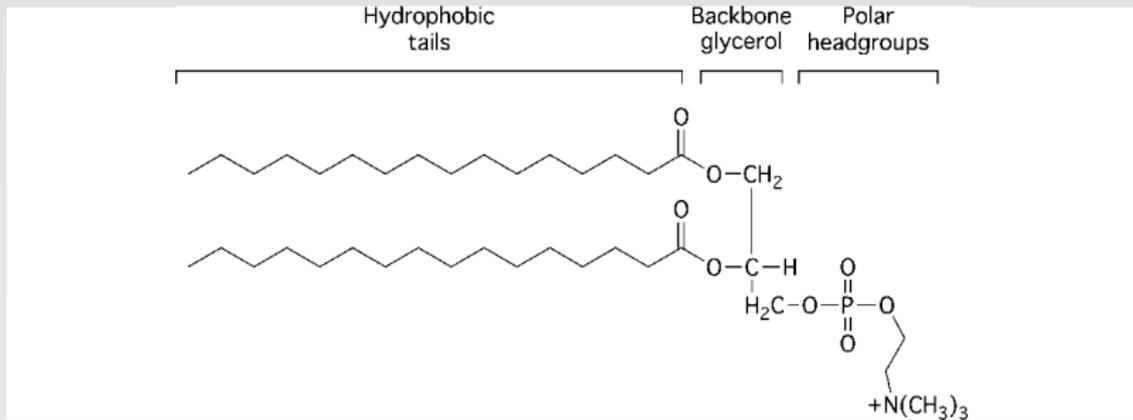
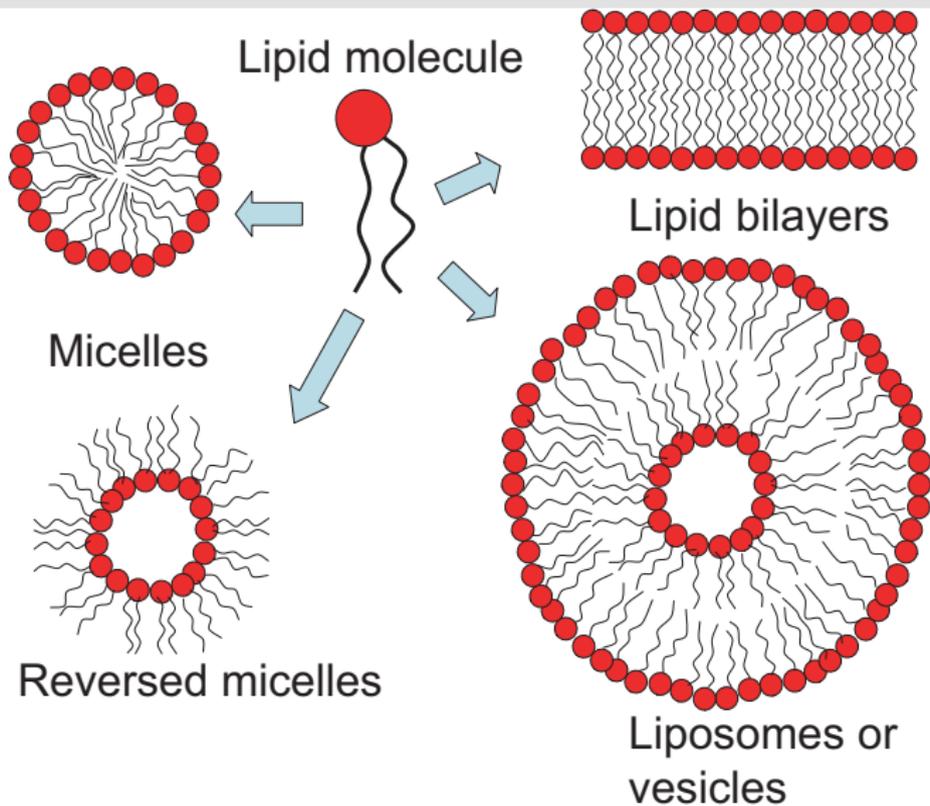
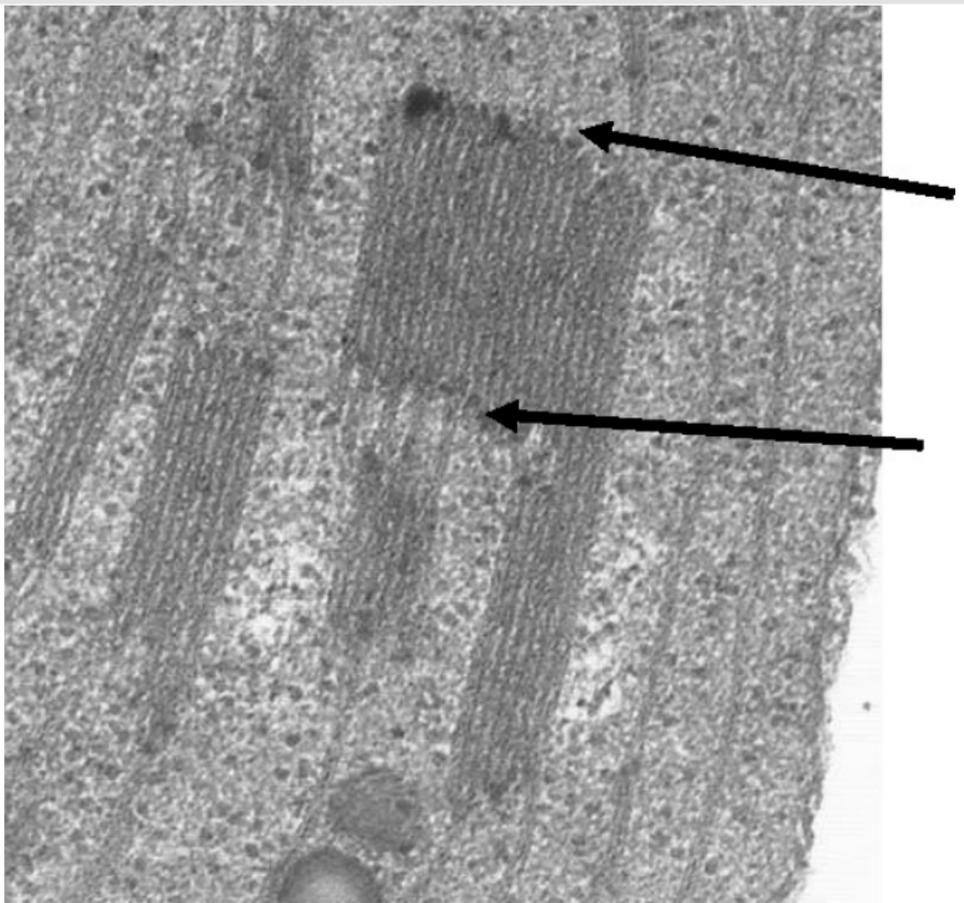


FIGURE 4.10 ■ As an example of a typical lipid, the figure shows a phospholipid (phosphatidylcholine, PC, often called lecithin). Its amphiphilic character is seen by the hydrophobic hydrocarbon acyl chains (tails) and the hydrophilic polar head group connected by the backbone, in this case glycerol.

Lipids self-assemble...



....and make complex membranes:



Controlling the amount of unsaturation

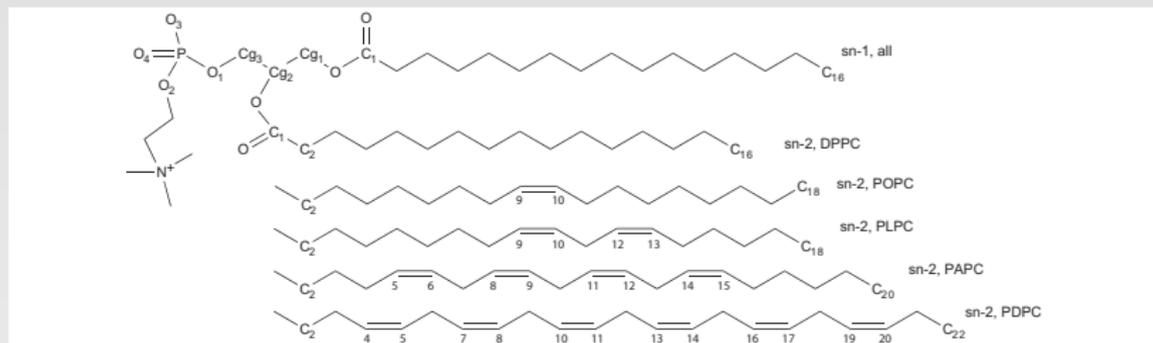


FIGURE 4.5 ■ Phosphatidylcholine with some of the most common fatty acyl chains. DPPC stands for dipalmitoyl-PC; POPC for palmitoyloleoyl-PC; PLPC for palmitoylinoleoyl-PC; PAPC for palmitoylarachidonyl-PC; and PDPC for palmitoyldocosahexaenoyl-PC.

Lipid phase diagrams

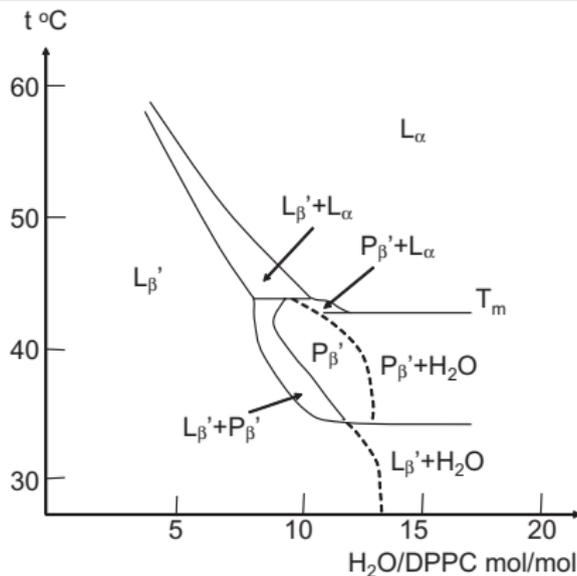
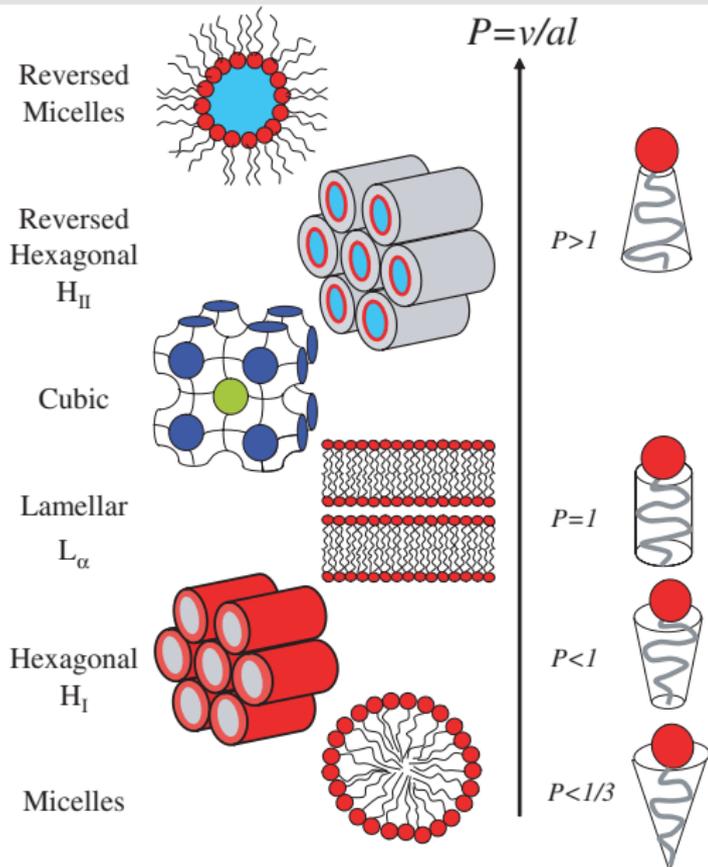
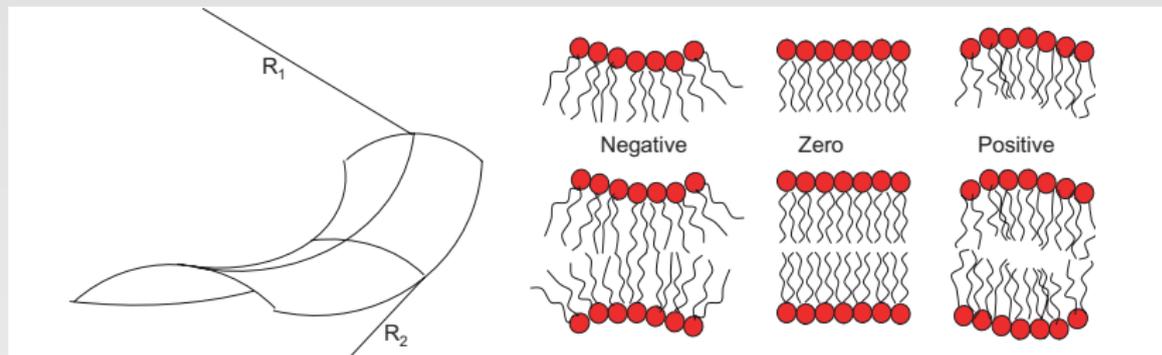


FIGURE 4.7 ■ A partial phase diagram of DPPC and water. At low temperature the gel, $L_{\beta'}$, phase is formed and at high temperature and relatively high water content, a lamellar liquid crystalline, L_{α} , phase is stable. In the middle of the phase diagram the ripple $P_{\beta'}$ phase is stable in a narrow region of temperature and water content. (Adapted with permission from Ulmius J, Wennerström H, Lindblom G, Arvidson G. (1977) Deuteron NMR studies of phase equilibria in a lecithin-water system. *Biochemistry* **16**: 5742–5745. Copyright (1997) American Chemical Society.)

Types of structures



Lamellar (membrane) phases have curvature



Lipid packing and lateral pressure

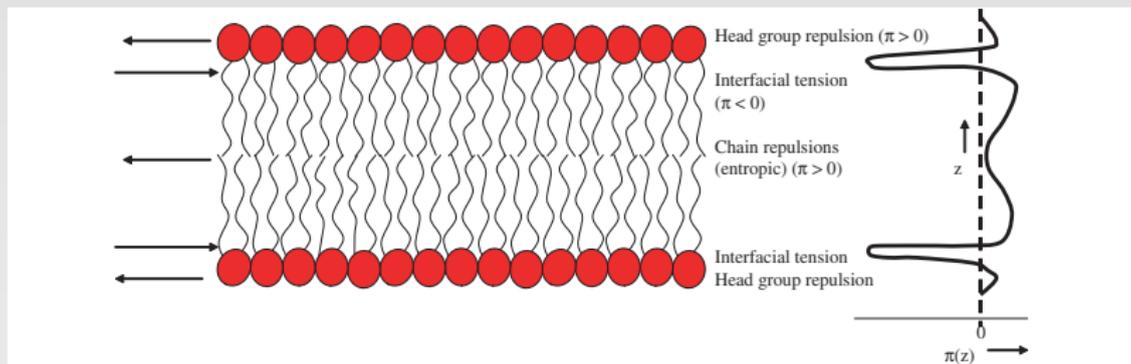
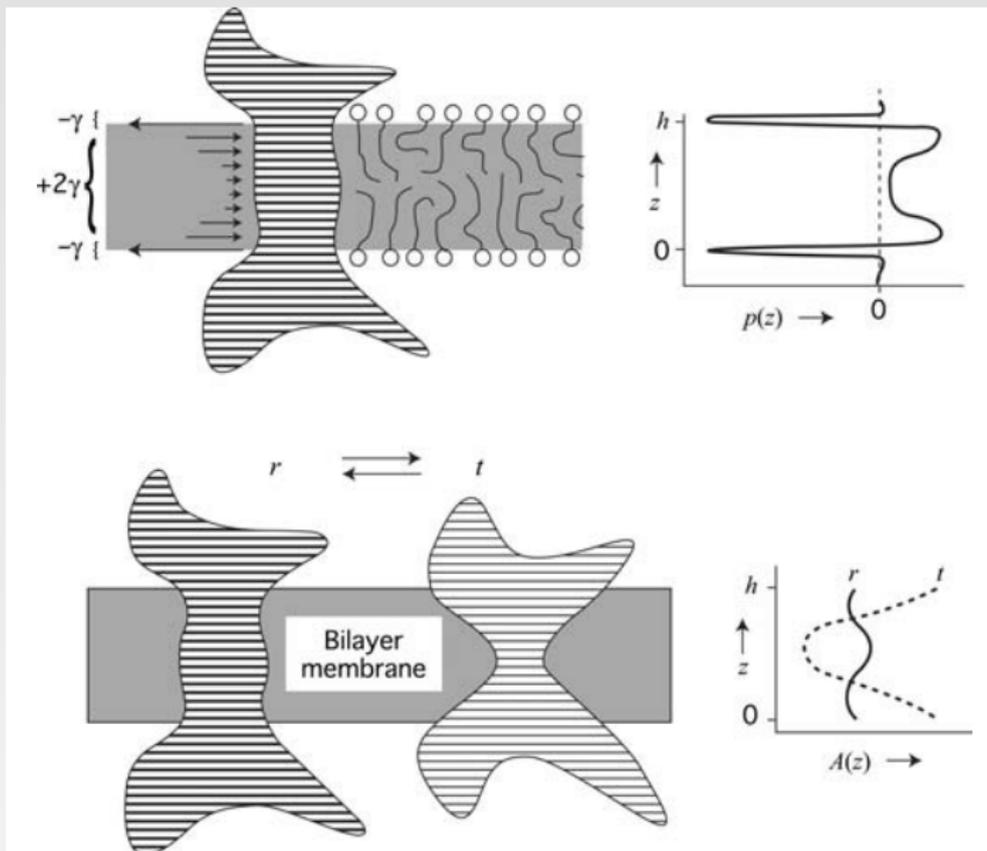
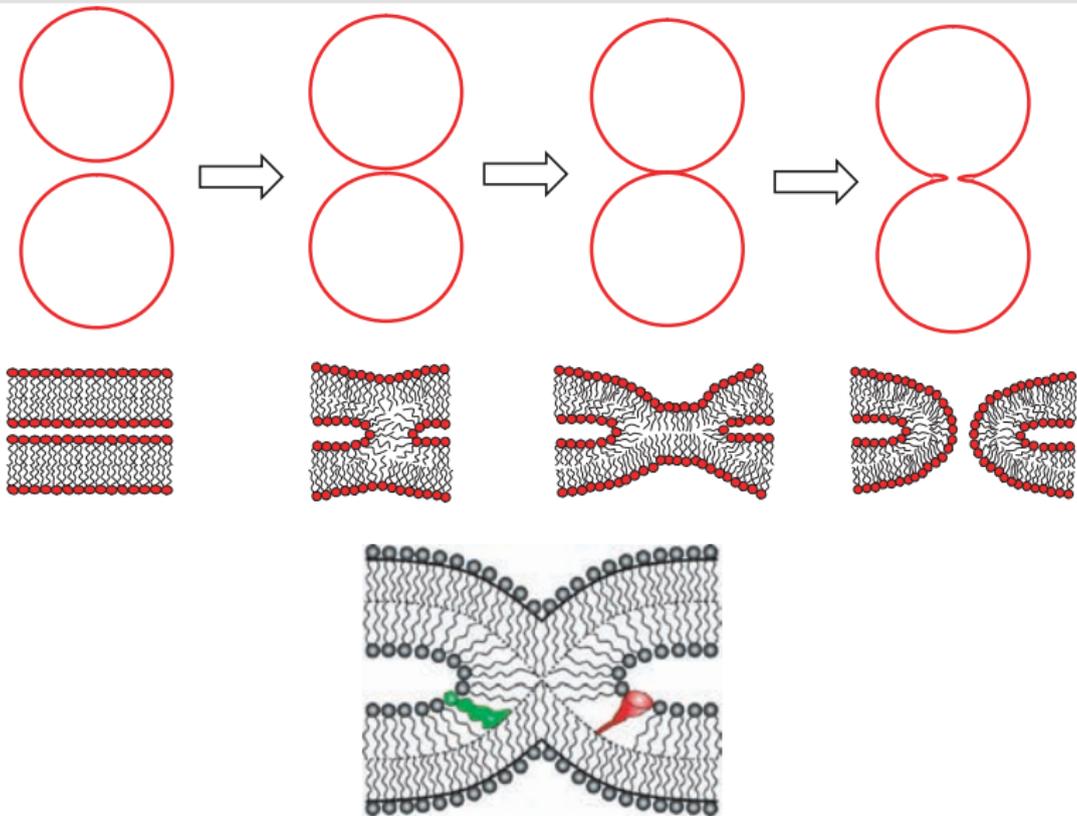


FIGURE 4.17 ■ Illustration of the lateral pressure, $p(z)$, profile in a lipid bilayer. A coordinate system, z , along the normal to lipid bilayer, showing the pressure distribution across the bilayer is schematically indicated to the right. The lateral pressure in the middle of the bilayer can be very high. However, the total pressure over the bilayer is zero. (Courtesy of Ole Mouritsen.)

Pressure and conformation



Membrane fusion



Lipid domains and rafts

