Biomembranes and Cell Architecture

The lipid membrane has been established as the universal basis for cell-membrane structure. The spontaneous self assembly of these lipid molecules under normal body conditions make them suitable for formation of membranes.
Some important facts:

1. Lipids, by mas consist of 50% of the cell membrane; the rest is made of proteins.
2. Lipid molecules in cell membranes are **amphipathic**.
3. Phospholipids are the most abundant membrane lipids, they have a roughly cylindrical shape, with a polar head and two non polar tails. Four major phospholipids predominate in the plasma membrane of many mammalian cells: phosphatidylcholine, phosphatidylethanolamine, phosphatidylserine, and sphingomyelin.
4. Cell membranes have a self sealing property, small tears are eliminated by rearrangement of lipids, while the larger tears are repaired by fusion of intracellular vesicles.

Fluidity of Plasma membrane

Individual lipid molecules are able to diffuse freely within lipid bilayers. This is termed fluidity. Fluidity can be studied in the form of:

- liposomes - spherical vesicles made of lipid bilayers
- black membranes - planar bilayers formed acrosss a hole in a partition between two aqeuous compartments.

The movement of lipids can be of two types -

- rotation about the long axis, which is very fast
- flipping movement, which is much rarer and slower

Factors controlling membrane fluidity:

1. Kink in the unsaturated hydrocarbon tail - creates space
2. Cholesterol content - The cholesterol molecules enhance the permeability-barrier properties of the lipid bilayer. They orient themselves in the bilayer with their hydroxyl groups close to the polar head groups of the phospholipid molecules. In this position, their rigid, platelike steroid rings interact with—and partly immobilize—those regions of the hydrocarbon chains closest to the polar head groups . By decreasing the mobility of the first few CH_2 groups of the hydrocarbon chains of the phospholipid molecules, cholesterol makes the lipid bilayer less deformable in this region and thereby decreases the permeability of the bilayer to small water-soluble molecules. Although cholesterol tends to make lipid bilayers less fluid, at the high concentrations found in most eucaryotic plasma membranes, it also prevents the hydrocarbon chains from coming together and crystallizing. In this way, it inhibits possible phase transitions.

Curvature of the membrane depends on the shape of the phospholipid.