

Highlights of Lipids/Membranes

1. Membranes are composed of a lipid bilayer and other molecules, such as cholesterol. The lipid bilayer contains two main categories of molecules - glycerophospholipids and sphingolipids.
2. Glycerophospholipids contain glycerol, phosphate and one or more fatty acids. The fatty acids in the molecules of the lipid bilayer are either saturated (no double bonds) or unsaturated (contain one or more double bonds). Double bonds in biological fatty acids are almost exclusively in the *cis* configuration, resulting in a bent shape for unsaturated fatty acid.
3. Glycerophospholipids (also called phosphoglycerides by your book) are related to fats in having a glycerol backbone and two fatty acids, but they differ from fat in having a phosphate located in position #3 of the glycerol. Naming of glycerophospholipids is generally as "phosphatidyl-X" where X is the name of the molecule attached to the phosphate. Examples include phosphatidylserine, etc.
4. If there is no other molecule attached to the phosphate on the glycerophospholipids described above in #3, you have phosphatidic acid. Phosphatidic acid is an important intermediate in synthesis of phosphatidyl lipids, as well as fats.
5. Sphingolipids are molecules related to glycerophospholipids that are based on sphingosine. Sphingomyelin is a component of the myelin sheath of nerve cells. Sphingolipids containing a single sugar are called cerebrosides and sphingolipids containing a complex carbohydrate moiety are called gangliosides. Sphingolipids are prominent components of the membranes of nerves and brain tissue.
6. Steroids are lipids that are not derived from fatty acids. In animals, steroids are derived from cholesterol. Cholesterol is found in the membrane of cells and is important for membrane stability. Cholesterol is prominent in brain membranes - up to 14% of the dry weight of brain.
7. A lipid bilayer has a polar exterior facing water and a non-polar interior. As such, the membrane provides a good barrier to both polar and non-polar substances. In contrast to the lipid bilayer, fatty acids aggregate into a micelle.
8. In addition to glycerophospholipids and sphingolipids, membranes contain proteins, glycoproteins, and glycolipids. Four types of membrane proteins are integral (protein projects through both sides of the membrane), peripheral (protein projects into only one side of the membrane), anchored (protein is linked to a molecule embedded in the lipid bilayer, or associated (protein associates by hydrogen bonding with an integral membrane protein).
9. Integral membrane proteins are difficult to remove from membranes, but peripheral and associated membrane proteins are not.
10. Membranes provide a barrier between the cell and the external environment. Membranes provide a barrier to passage of many molecules, including molecules, such as sugar that the cell

could use for food.

11. Integral membrane proteins span into and/or across the plasma membrane and thus must have both hydrophilic and hydrophobic portions that interact appropriately with the same portions of the plasma membrane. By contrast, peripheral membrane proteins are found in association with membranes, such as by interacting with an integral membrane protein. Anchored membrane proteins are proteins attached to a molecule (like a fatty acid). The molecule is embedded in the lipid bilayer and thus the protein is anchored to it.

12. Bacteriorhodopsin is an integral membrane protein that uses light, chemistry, and mechanics to move protons across a membrane barrier.

13. One can assemble artificial lipid bilayers containing compounds as a means of delivering materials into cells. These artificial systems are called liposomes. Liposomes can carry substances and when the membrane of the liposome fuses with a cell membrane, the contents of the liposome are delivered into the cell. This is a useful way of getting compounds into cells that are not easily transported across the cell membrane in other ways.

14. Membrane-spanning proteins have alternating regions of non-polar membrane crossing regions interrupted by polar short sections joining the non-polar regions. Consequently, one can use a computer to examine the amino acid sequence of a protein and predict reasonably accurately if the protein is a membrane protein or not.