Phospholipids are similar to the triglycerides with a couple of exceptions. Phosphoglycerides are esters of only two fatty acids, phosphoric acid and a trifunctional alcohol - glycerol (IUPAC name is 1,2,3-propantriol). The fatty acids are attached to the glycerol at the 1 and 2 positions on glycerol through ester bonds. There may be a variety of fatty acids, both saturated and unsaturated, in the phospholipids.

**Introduction**

The third oxygen on glycerol is bonded to phosphoric acid through a **phosphate ester** bond (oxygen-phosphorus double bond oxygen). In addition, there is usually a complex amino alcohol also attached to the phosphate through a second phosphate ester bond. The complex amino alcohols include choline, ethanolamine, and the amino acid-serine. The properties of a phospholipid are characterized by the properties of the fatty acid chain and the phosphate/amino alcohol. The long hydrocarbon chains of the fatty acids are of course non-polar. The phosphate group has a negatively charged oxygen and a positively charged nitrogen to make this group ionic. In addition there are other oxygen of the ester groups, which make on whole end of the molecule strongly ionic and polar.

Phospholipids are major components in the lipid bilayers of cell membranes. There are two common phospholipids:

- **Lecithin** contains the amino alcohol, choline.
- **Cephalins** contain the amino alcohols serine or ethanolamine

**Lecithin**

Lecithin is probably the most common phospholipid. It is found in egg yolks, wheat germ, and soybeans. Lecithin is extracted from soy beans for use as an emulsifying agent in foods. Lecithin is an emulsifier because it has both polar and non-polar properties, which enable it to cause the mixing of other fats and oils with water components. See more discussion on this property in soaps. Lecithin is also a major component in the lipid bilayers of cell membranes.

Lecithin contains the ammonium salt of choline joined to the phosphate by an ester linkage. The nitrogen has a positive charge, just as in the ammonium ion. In choline, the nitrogen has the positive charge and has four methyl groups attached.
Cephalins

Cephalins are phosphoglycerides that contain ethanolamine or the amino acid serine attached to the phosphate group through phosphate ester bonds. A variety of fatty acids make up the rest of the molecule. Cephalins are found in most cell membranes, particularly in brain tissues. They also important in the blood clotting process as they are found in blood platelets.

Note: The MEP coloration of the electrostatic potential does not show a strong red color for the phosphate-amino alcohol portion of the molecule as it should to show the strong polar property of that group.

Contributors

- Charles Ophardt, Professor Emeritus, Elmhurst College; Virtual Chembook