

## Lipids

The characteristic of all lipids is their insolubility in water. Lipids are hydrophobic. Hydrophobic literally means the fear of water. Hydrophobic molecules repel water. Lipids can dissolve in other organic hydrophobic compounds. Fats, oils, waxes and steroids are examples of lipids.

Lipids have several functions. Phospholipids and cholesterol are the primary components of biological membranes. Lipids also function as energy reserve molecules, cell signaling molecules (hormones), in thermal insulation and protection (padding organs).

There are two major groups of lipids, the glycerides and the steroids. Steroid structures are composed of multiple rings (4 ring backbone). Many of the steroids differ only by functional groups attached to the rings. Estrogen and testosterone differ by only 2 functional groups. The glycerides are the most common lipids found in living organisms. They are composed of a backbone of glycerol to which up to 3 other moieties are attached. A triglyceride or neutral fat has 3 fatty acids attached to glycerol. A diglyceride has 2 fatty acids attached to glycerol. A phospholipid has a phosphate group and 2 fatty acids attached to glycerol. Triglycerides yield more energy than an equal amount of carbohydrate or protein. They are the predominant form of long term energy storage as adipose tissue in animals.

The fatty acids found in lipids range in length from 12 and 20 carbon atoms. If there are only single bonds between the carbon atoms in the fatty acids, the fatty acid is called saturated, i.e., the carbons have made 4 bonds to other atoms, they have saturated their bonding capacity. The geometry of the singly bonded carbon backbone allows the fatty acids to pack together tightly producing substances that are solids at room temperature, like butter or lard. If a single double bond exists in the fatty acid, it is called monounsaturated. If two or more double bonds occur in the fatty acid, it is called polyunsaturated. Double bonds in the fatty acid chains cause kinks in the structure. Because of these kinks the fatty acids do not pack tightly together and produce a more fluid compound. Unsaturated fats include vegetable oil and olive oil.

Waxes are also lipids. Unlike the triglycerides, waxes are a combination of an alcohol (like glycerol) and a single fatty acid (12-32 carbons). Waxes are insoluble in water. Waxes protect plant surfaces like leaves and the skin surface in the ear canal.