# Proteins, Polysacharydes, Lipids and Nucleic Acid - Overview

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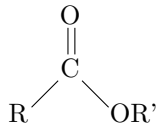
27/10/2016

## 1 Lipids

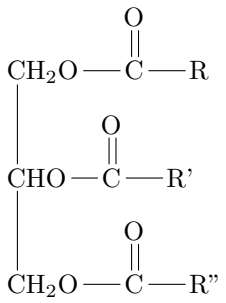
We call **lipids** natural organic molecules with little solubility in water, isolated from cells and tissues by extraction with non-polar solvents. Examples of lipids are: fats, oils, waxes, hormones and most of non-protein cell membrane elements. *Note that lipids definition is based on physical property, solubility and not structure !*
Lipids can be divided into two basic classes.

**Fats and waxes** are lipids that contain ester bonds and cant be subjected to hydrolysis.

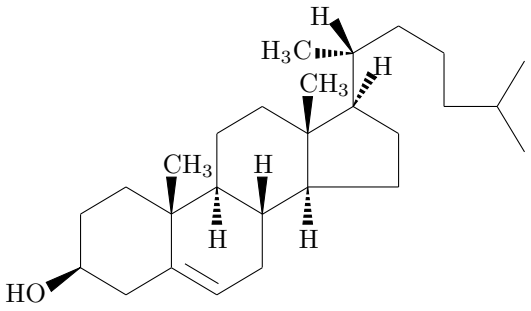


Ester bond

The general structure of animal fat is as follows:



**Steroids** They have no ester bonds and can't be subjected to hydrolysis, as an example consider cholesterol:




Their structure is based on four cyclic system, three six membered rings (in chair like conformation) and one five membered ring. In humans most of steroids play role of hormones, regulatory signals (examples: testosterone, estron).

## 1.1 Waxes, fats and oils

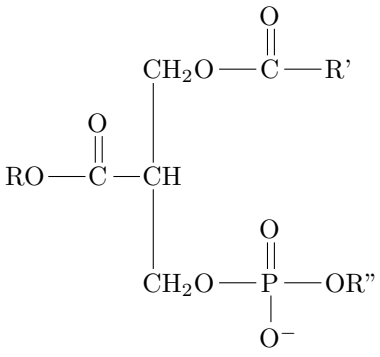
**Waxes** are mixtures of long chained fatty acid esters and long chained alcohols. For example heksadekanin triakontylu, main ingredient of bee wax, consist of alcohol $C_{30}$ and fatty acid $C_{16}$ ester. Protector layers on fruits and vegetables have very similar structure.

**Fats and oils** are most common lipids. They are quite different when it comes to physical properties, like melting point, but they share very similar structure. In a chemical sense they are triacylogricerols, triesters of glycerin with tree long chained carboxylic acids. Those acids doesn't have to be the same. Composition of those fatty acids is very important, as they have big impact on melting points. Generally the more unsaturated fatty acids in a fat the lower is melting point temperature. This results from differences in structure, saturated acids have very regular structure and can be easily packed into crystal network.

## 1.2 Phospholipids

Phospholipids are esters of phosphoric acid, $H_3PO_4$. There can be distinguished two main types of phospholipids: *glicerophospholipids and sfingomielins.*

**Glicerophospholipids** are closely related to fats and oils, in a structural sense. They are build out of glycerin skeleton connected through ester bonds with two molecules of fatty acids and one phosphate acid. Commonly phosphate group is also connected through another ester bond with aminoalkohol like choline $[(CH_3)_3NCH_2CH_2OH]^+$ or etylamine $H_2NCH_2CH_2OH$. The most important glycerolophospholipids are lecytines and cefalines.



Where R": $CH_2CH_2N(CH_3)_3$ for lecytyne,
$CH_2CH_2NH_3$ for cefaline

Glicerolophospholipides are main component of cell membranes ( 40%). Glicerolophospholipides have long non polar tails connected with polar head (phosphate group), thank to this they can aggregate into bi layer membrane, which is effective barrier against water, ions and other polar molecules outside and inside the cell.

**Sfingomielins** are other group of phospholipids. This are compounds with sfingozine or dihidroksyamin skeleton. They are ingredients of animal and plats cell membranes. They are most abundant in brain and nerve tissue.

### 1.3 Others

It should be noted that there are many more subgroups of lipis. One example are terpenoids - found in ether oils.

## 2 Nucleic Acids