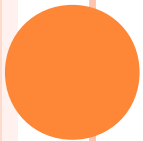


LIPIDS



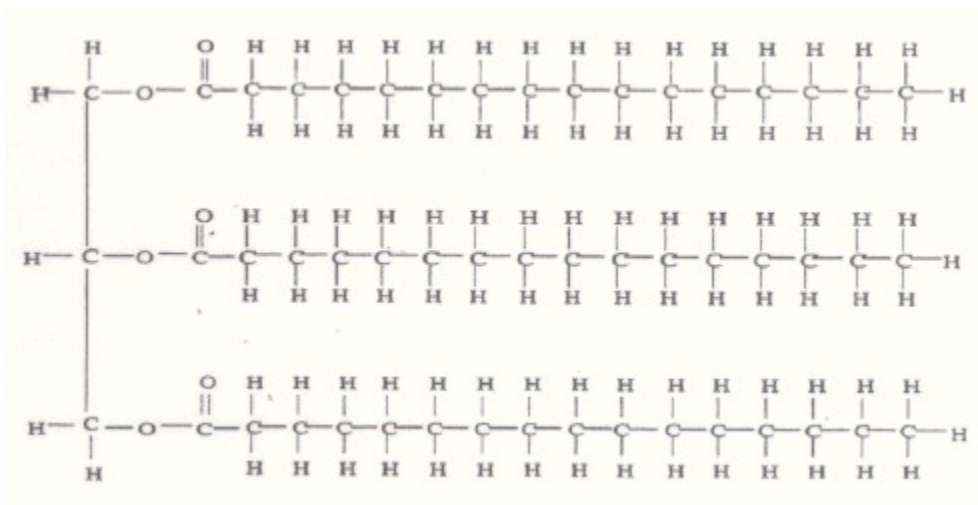
LIPIDS

- **Definition:** Lipids are organic molecules with long hydrocarbon chains that are soluble in non-polar solvents.
- They have different uses:
 - a) Energy storage.
 - b) Insulating and protecting vital organs.
 - c) Forming cell membranes.
 - d) Acting as hormones (in some cases).
- The most important types of lipids are:
 - a) Triglycerides
 - b) Phospholipids
 - c) Steroids



FATS & OILS

- Fats and oils are both triesters (triglycerides). They are formed by the condensation reaction between propane-1,2,3-triol and long chain carboxylic acids.



General formula of a fat or oil



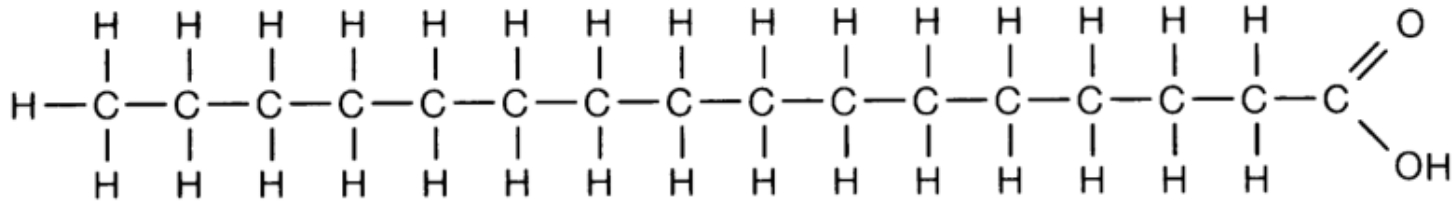
- Fats → Solid triglycerides
i.e. butter, lard.
- Oils → Liquid in room temperature
i.e. olive oil, linseed oil.

The main chemical difference between oils and fat is that fats contain saturated carboxylic groups (no double bonds). Oils contain at least one double bond and are said to be unsaturated.

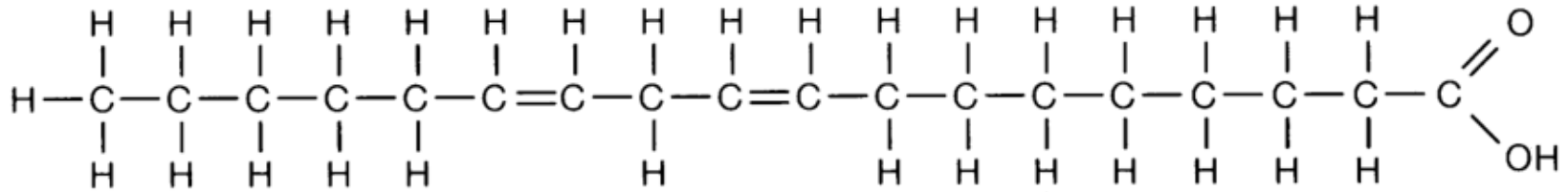
note: most oils contain many double bonds and are named polyunsaturated.



Palmitic acid – saturated



Linoleic acid – unsaturated

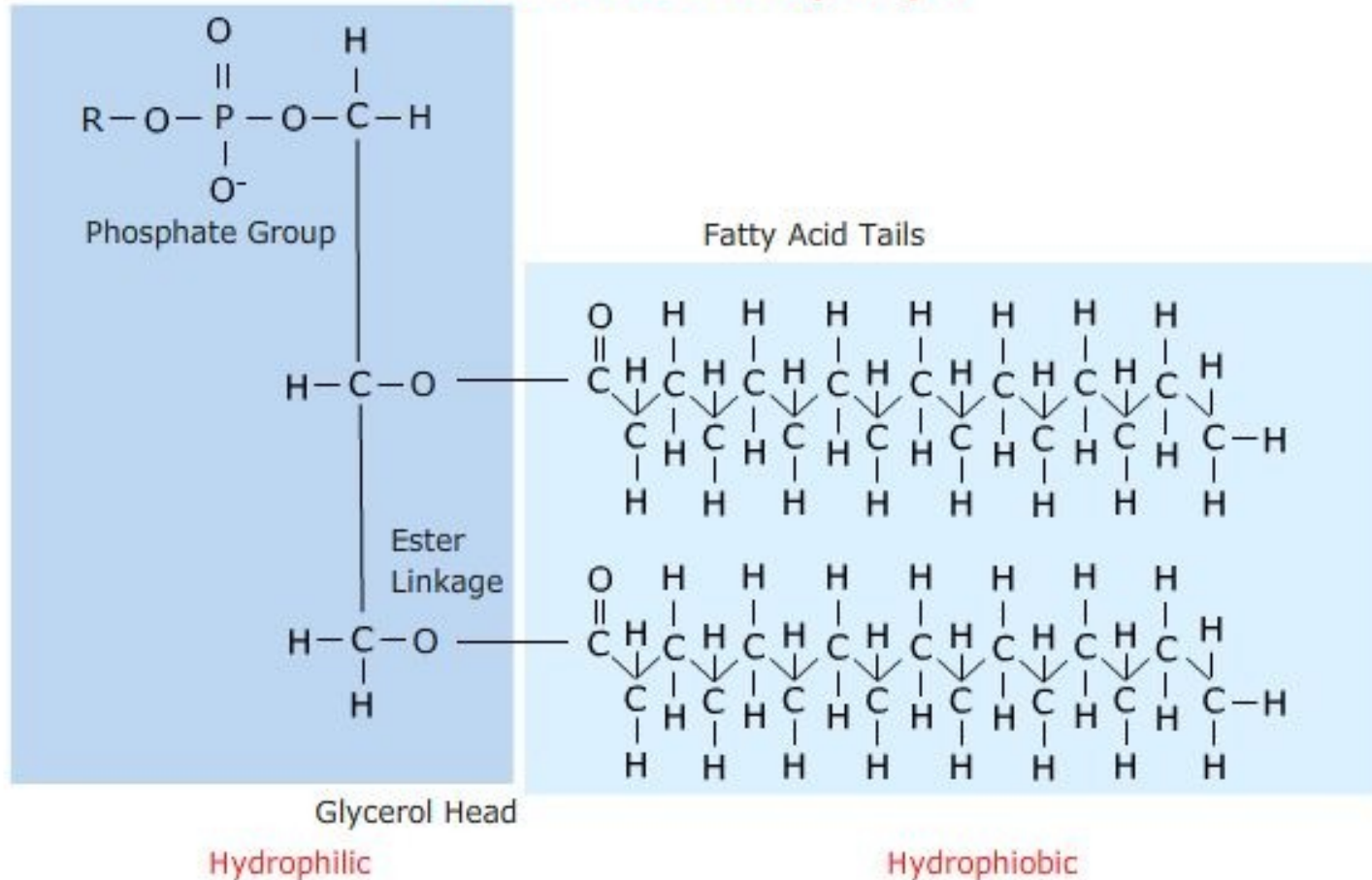


PHOSPHOLIPIDS

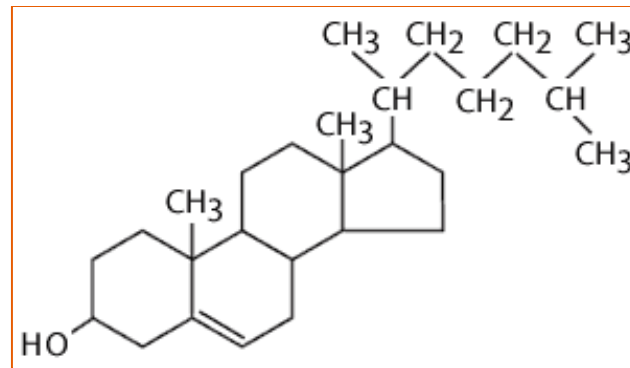
- Phospholipids form the integral part of all the cell membranes.
- They are made by four components.
- A back bone such as propane-1,2,3-triol (glycerol) is linked by esterification to two fatty acids and a phosphate group. The phosphate group it is condensed to a nitrogen containing alcohol.



Structure of a Phospholipid



CHOLESTEROL



Cholesterol is transported around the body by lipoproteins



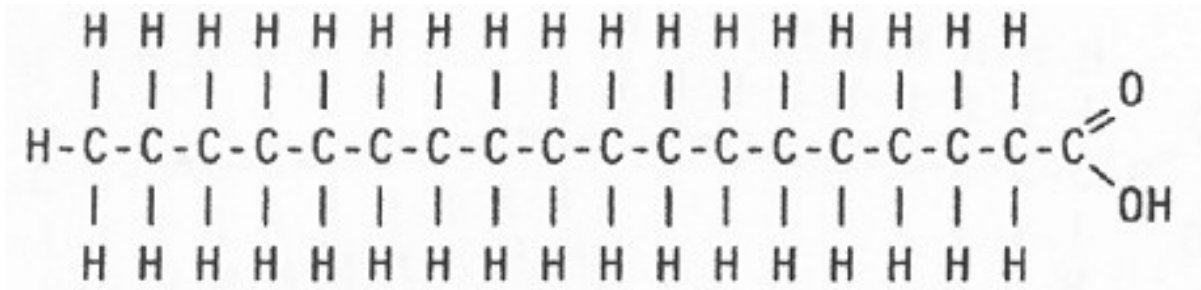
LIPOPROTEINS

- Low density proteins (LDL): are in order of 18-25nm. They transport cholesterol to the arteries where it can line the walls of the arteries leading to cardiovascular. The major cause of the this low density are unsaturated fats.
- High density proteins (HDL): are smaller in the order of 8-11 nm. They can remove the cholesterol from the arteries and transported back to the liver.



FATTY ACIDS

- The more unsaturated the fatty acid the lower its melting point.



Stearic Acid: A typical saturated fatty acid

c18:0



ESSENTIAL FATTY ACIDS

- Essential fatty acids are fatty acids that the body cannot synthesize.
- Two essential fatty acids are:
 - a) ω -6 linoleic acid
 - b) ω -3 linoleic acid

Green leaves are good source of ω -3 linoleic acids and seeds and vegetables are a good source of ω -6 linoleic acids



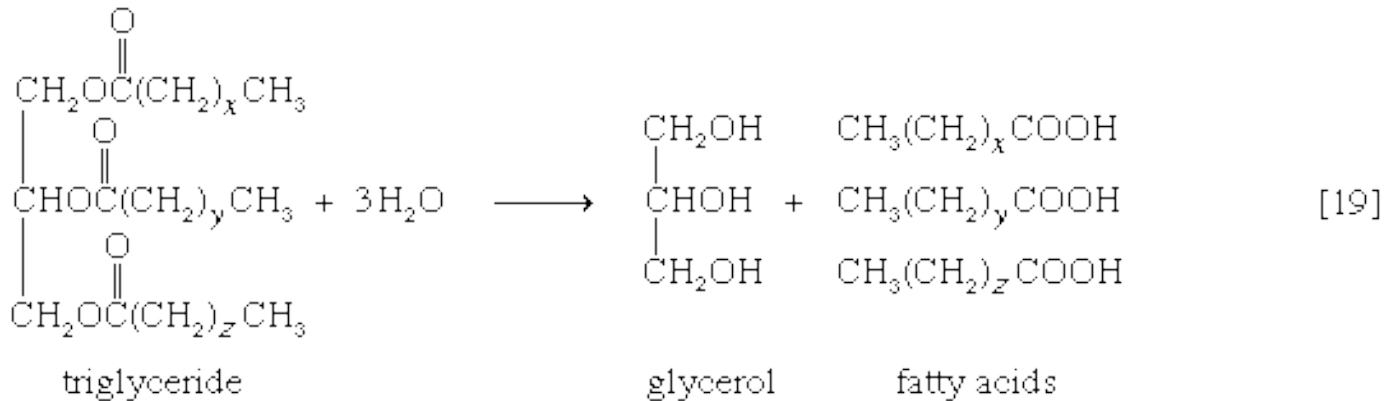
TRANS FATTY ACIDS

- When fatty acids are formed by partially hydrogenating other polyunsaturated fatty acids then the trans isomer may be formed. Trans -fatty acids are found in fried food. They increase the formation of LDL and thus the risk of heart diseases.



HYDROLYSIS OF FAT

- Oil & Fats → are hydrolyzed by enzymes and form glycerol and fatty acids.



- Fats are broken down by a series of redox reaction producing energy, ultimately carbon dioxide and water.



DETERMINING THE NUMBER OF C=C BONDS IN AN UNSATURATED FAT

- Unsaturated fats can undergo addition reaction.
- So, in order to determine the number of C=C bonds we add iodine.
- This can be succeed because one mole of iodine will react quantitatively with one mole of double bonds.
- Iodine is colored.
- When the iodine is added to the unsaturated fat the purple color will disappear as the reaction takes place.



THE ROLES OF THE LIPIDS IN THE BODY

- Energy storage.
- Insulation and protection of organs.
- Steroid hormones.
- Cell membranes.

