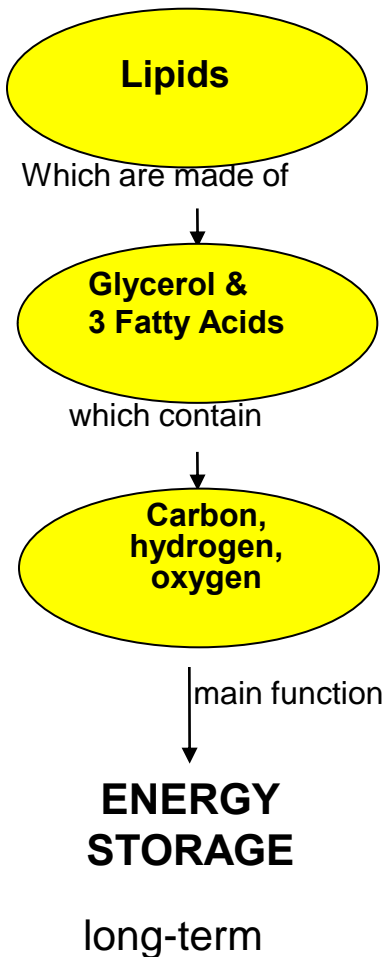


Lipids (fats)

2

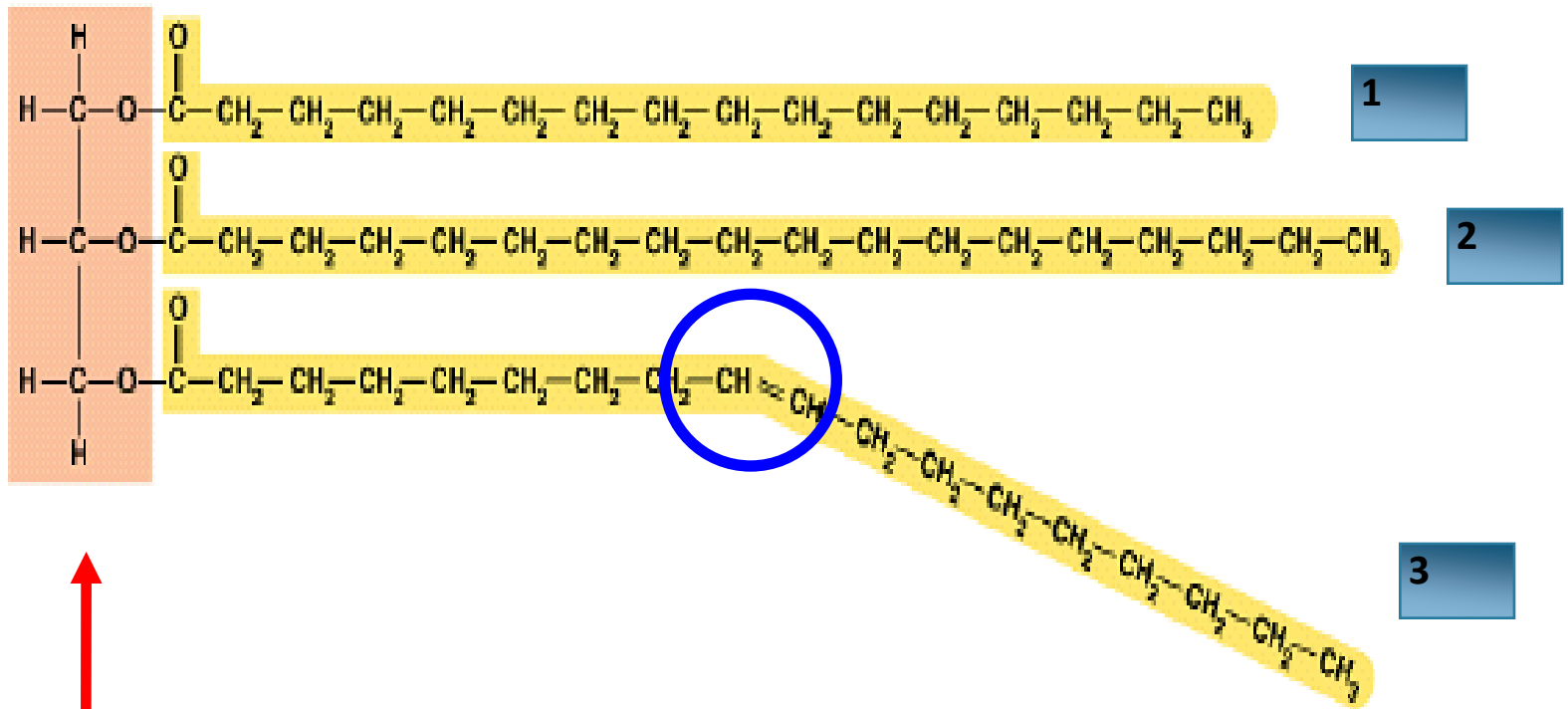
- ✓ **Main Function:** long-term energy storage
- ✓ **Other Functions:** thermal insulation, absorb fat-soluble vitamins (A, D, K, E), form cell membranes, steroids
- ✓ **Special Feature:** contain more energy per gram than any other biological molecule (9 cal/g)
- ✓ **Groupings:** Mostly C and H atoms (hydrocarbons)
- ✓ **Types:** 1. Fats and oils (triglycerides) 2. Phospholipids 3. Steroids



Plant oils (liquid @ room temp)

Animal fat (solid @ room temp)

Triglycerides

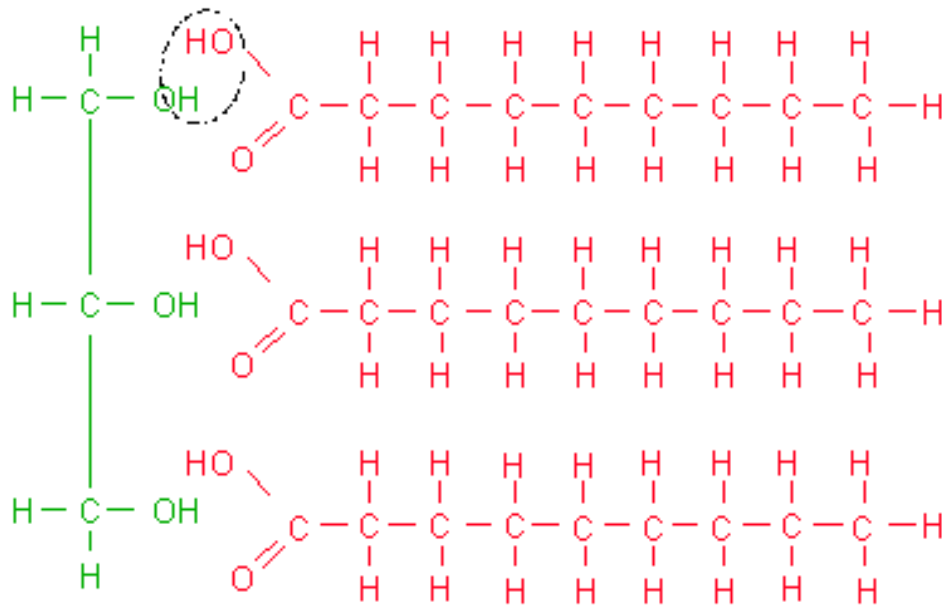


Glycerol

Fatty acids

Making and Breaking Lipids (fats)

Fats and oils are called **triglycerides** because of their structure



What functional groups are present on the glycerol and fatty acid molecules?

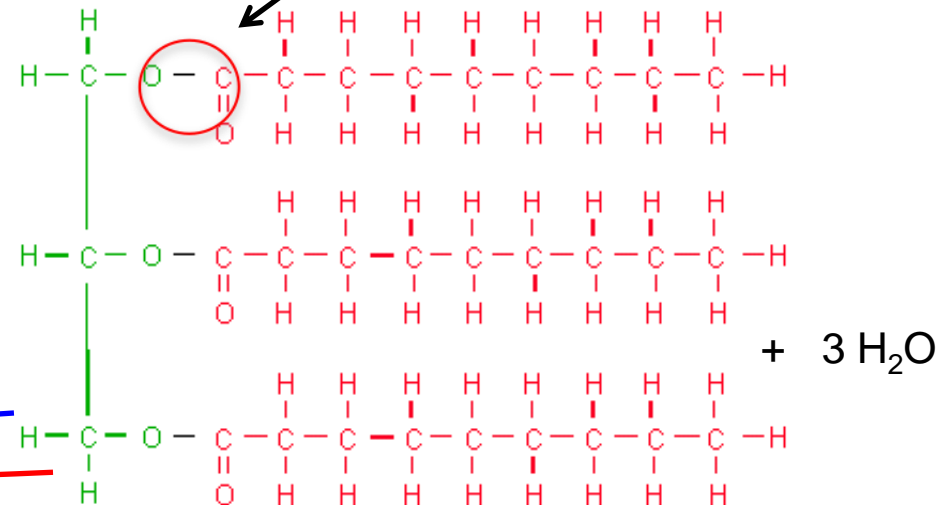
Glycerol

Fatty Acids

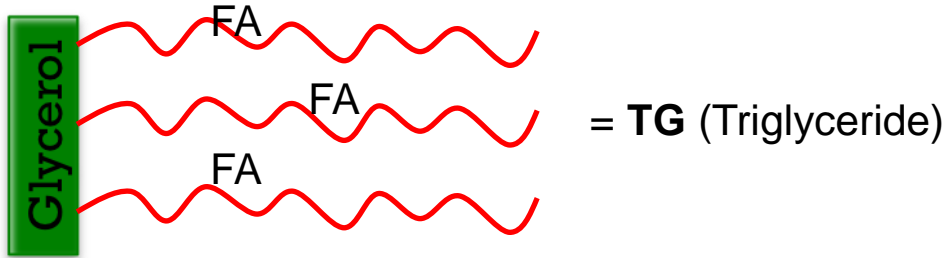
Ester linkage

Condensation
Synthesis

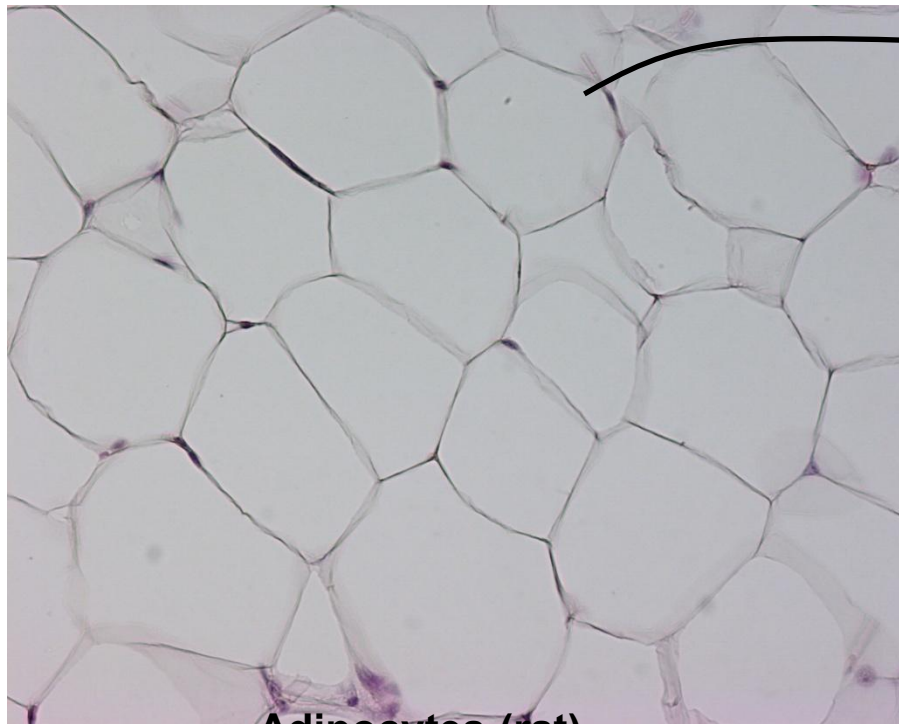
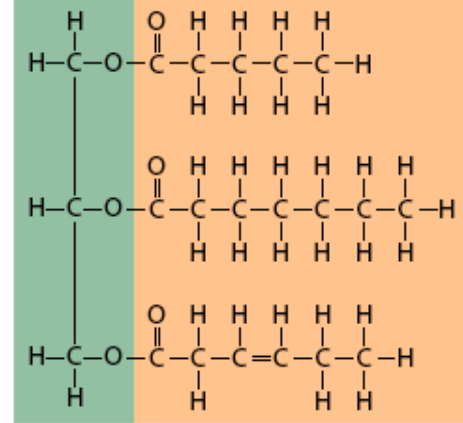
Hydrolysis



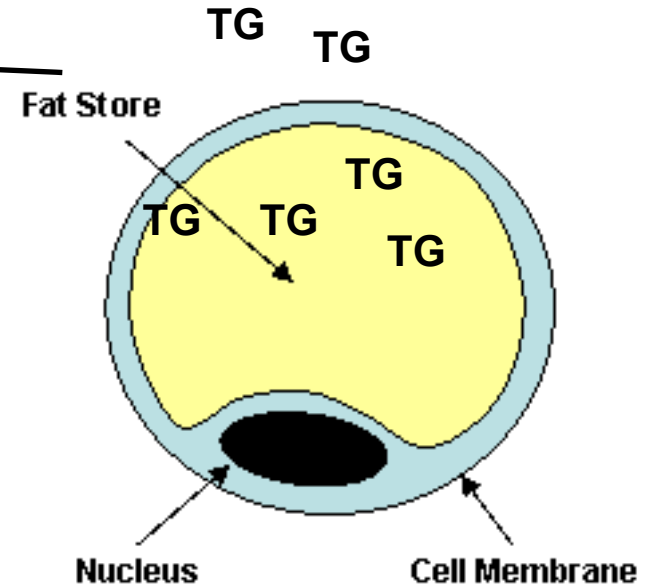
Triglycerides



Lipid droplet



Adipocytes (rat)



Types of Fatty Acids

Saturated

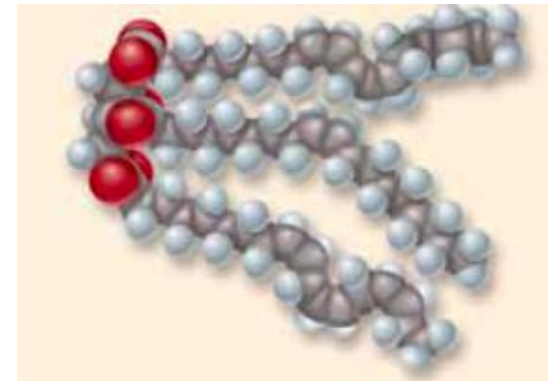
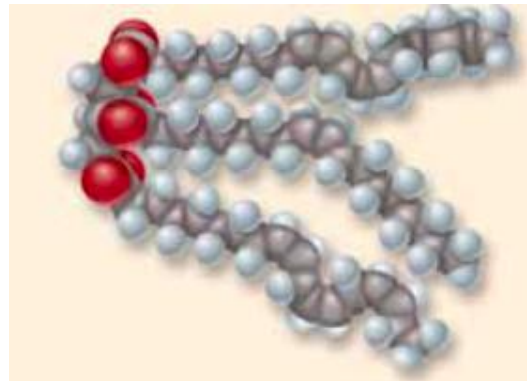
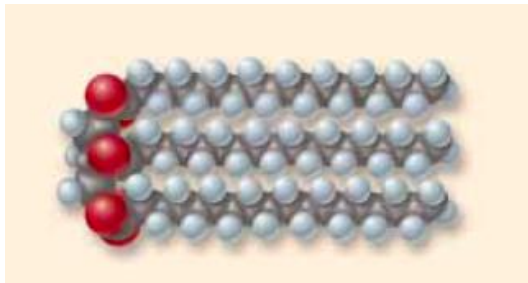
Unsaturated

Polyunsaturated

No double bonds

Has at least one double bond

Several double bonds



Types of Fatty Acids



**BEND DUE
TO DOUBLE
BOND**

Types of Fatty Acids

Saturated

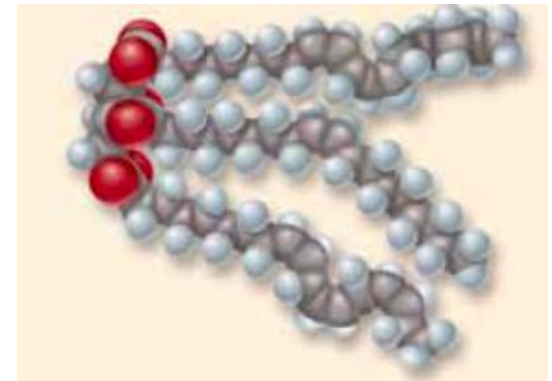
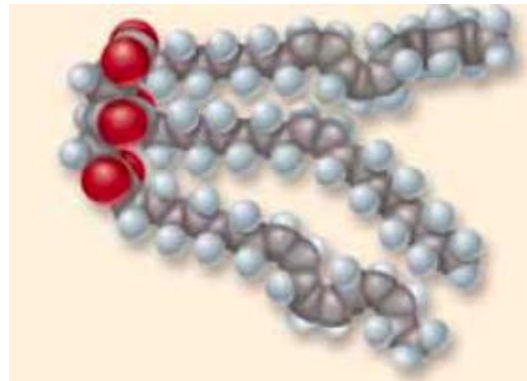
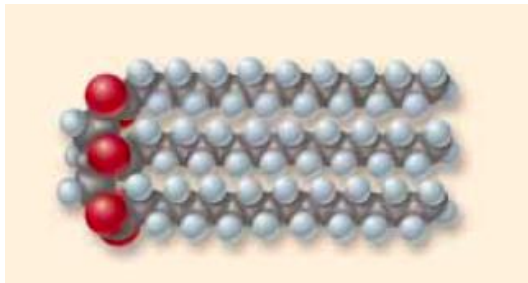
Unsaturated

Polyunsaturated

**Straight
chains**

**Kinks / bends
at the double
bonds**

**Kinks / bends
at the double
bonds**



Which is better for you?

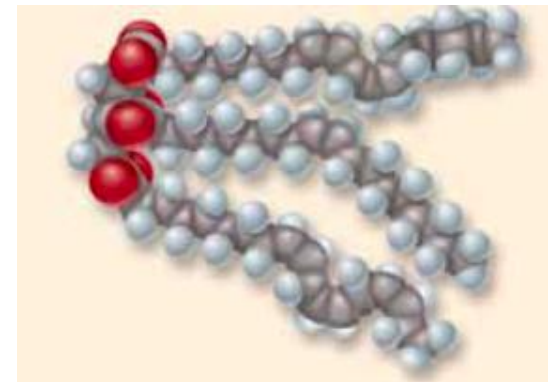
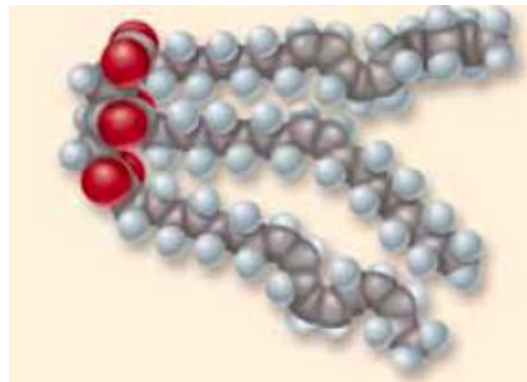
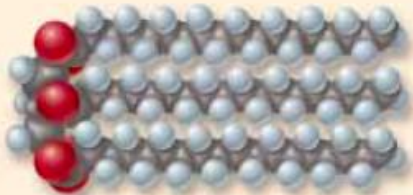
Saturated

Unsaturated

Polyunsaturated

butter,
lard

olive oil, vegetable oil,
peanut oil, canola oil



Which is better for you?

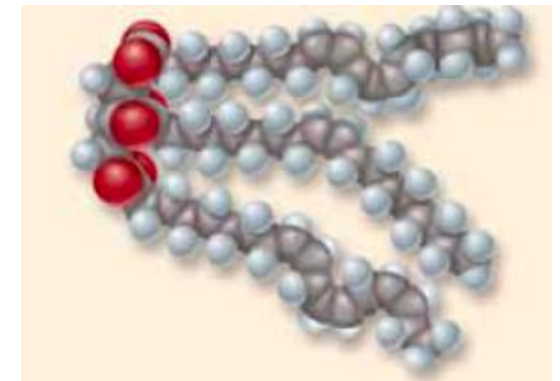
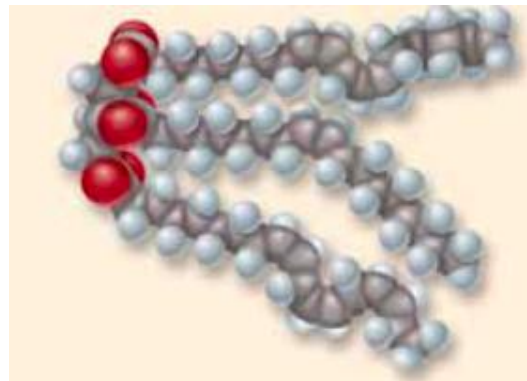
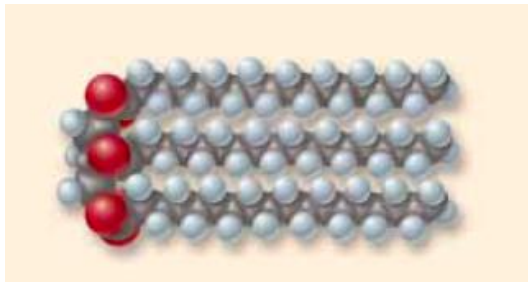
Saturated

Unsaturated

Polyunsaturated

Fatty acids
pack
closely,
solid @ RT

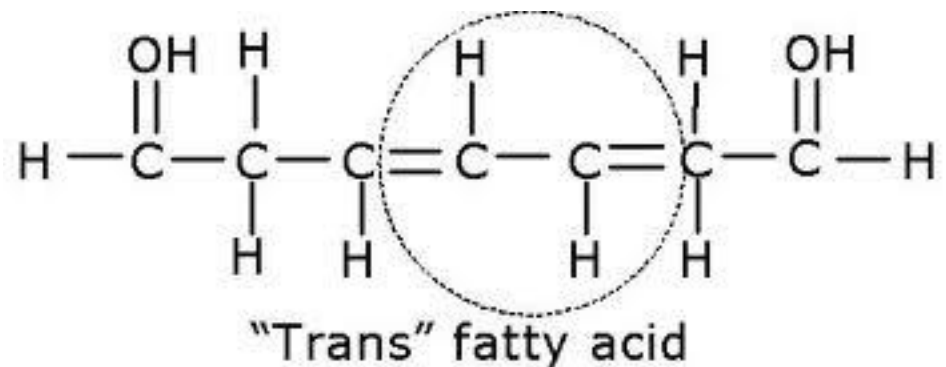
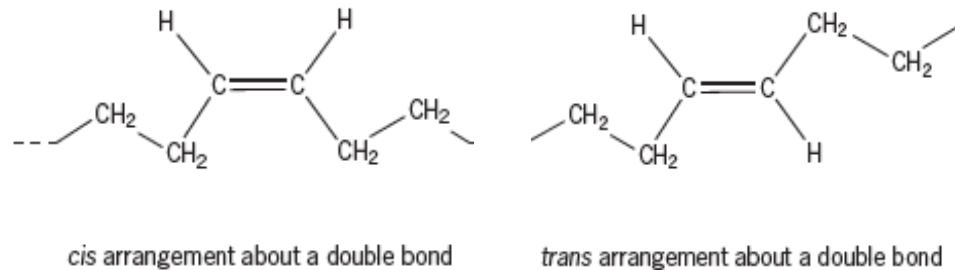
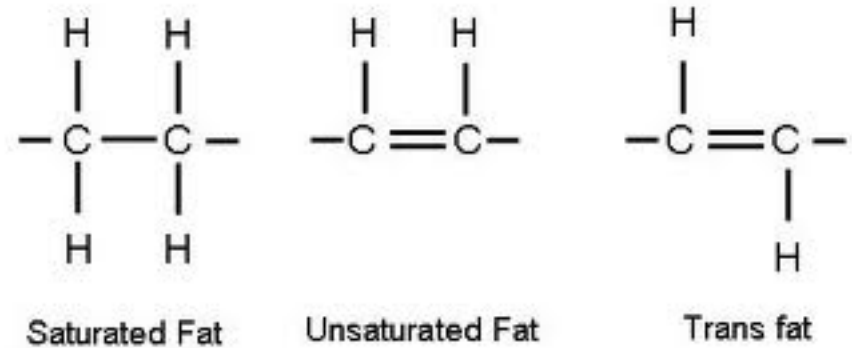
Fatty acids are not packed
closely, liquid @ RT



Types of Fatty Acids

Taking a perfectly good fat and making it bad!

Addition of hydrogen atoms to the acid, causing double bonds to become single ones.
(unsaturated becomes saturated)



Down with Trans fats!

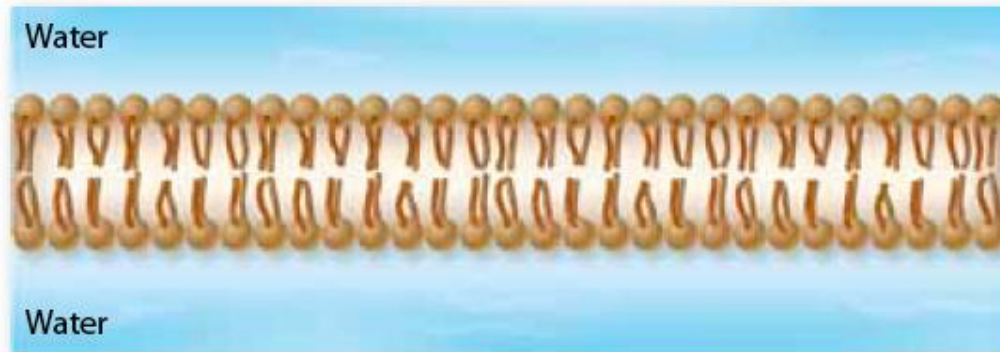
Margarine and the presence of trans fats

Margarine is the man-made equivalent of butter, the saturated fat derived from the cream from cow's milk. With butter not always being as available as consumers would like, the possibility of a mass produced vegetable-based substitute became attractive. The difference between butter and vegetable oils is the degree of saturation. Butter is made up of unsaturated triglycerides, so has a higher melting point than polyunsaturated vegetable oils. Hydrogenation, first developed in the 1890s by Paul Sabatier and further improved by the German chemist Wilhelm Normann in 1901, was found to be the way to decrease the number of double bonds in a triglyceride and consequently increase its melting point.

The process uses metal catalysts such as nickel and palladium; however, it has been shown that trans fatty acids are formed if the unsaturated fat leaves the surface of the catalyst too quickly. These trans fats were suggested as early as 1988 to be the cause of large increases in coronary artery disease and deaths from heart disease. In recent years health organizations have lobbied governments for the removal of trans fats from foods and currently many countries require that trans fats be included on the labelling of foods so that consumers can avoid them since their presence is just as bad for health as the saturated fats that they have replaced.

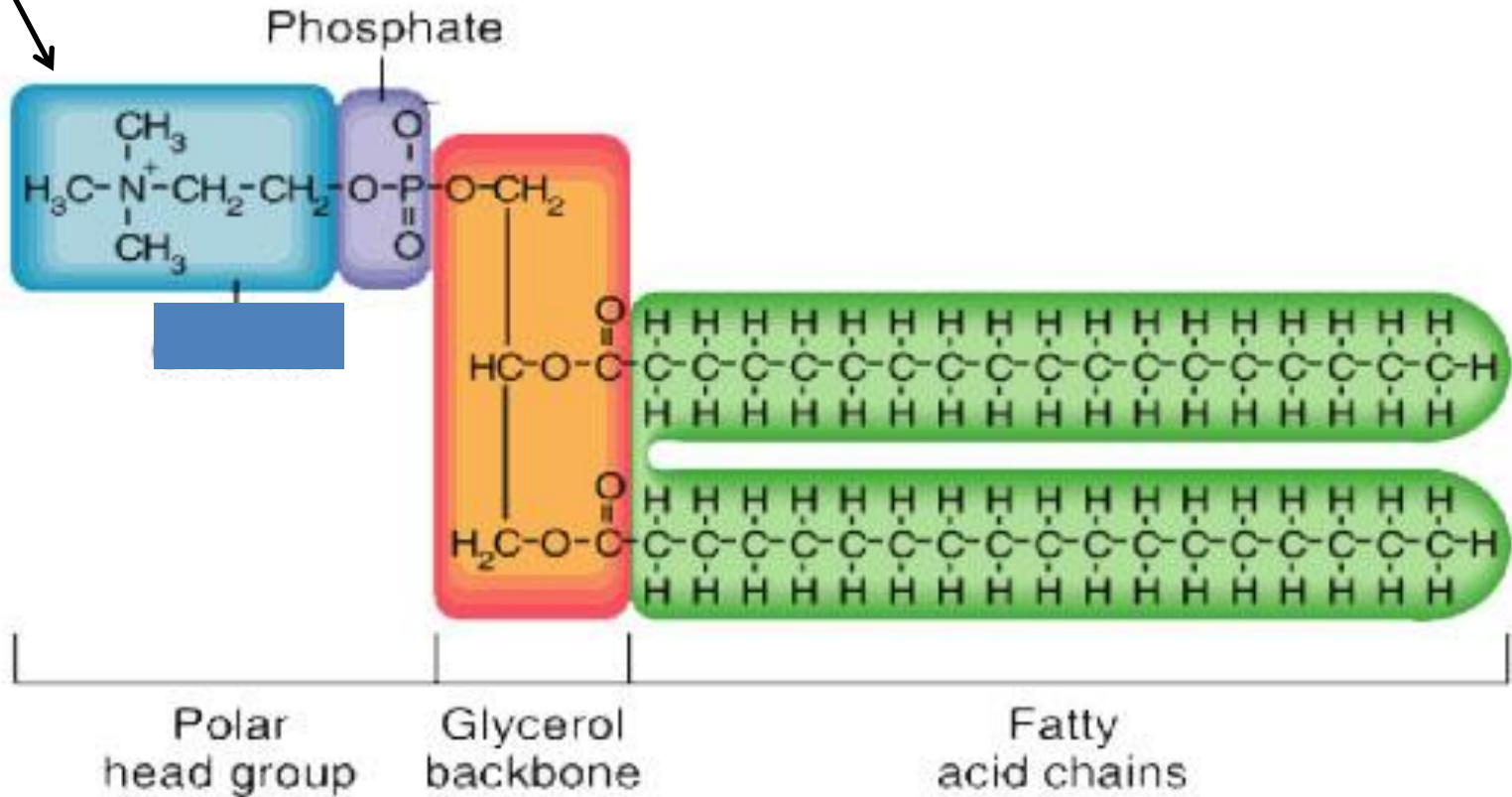
Phospholipids

- ❖ Phospholipids (along with glycolipids, cholesterol and proteins) make up an important part of the cell membrane
- ❖ Fat derivatives in which one fatty acid has been replaced by a phosphate group and one of several nitrogen-containing molecules.



Phospholipids

Nitrogen-containing group



e.g. R group called choline and is called Phosphatidylcholine

Phospholipids

The phospholipid can also be represented as:

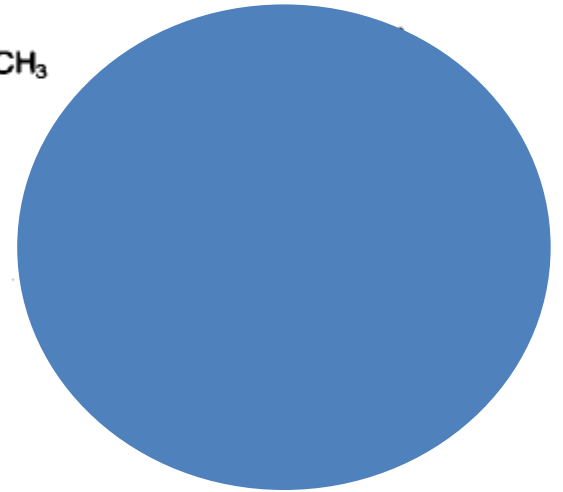
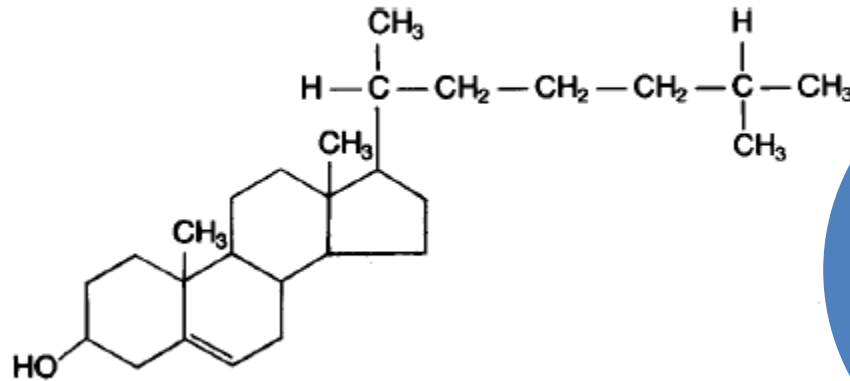


**Polar Head – hydrophilic
(water-loving)**

**Non-Polar Tails (fatty acids) –
hydrophobic (water-hating)**

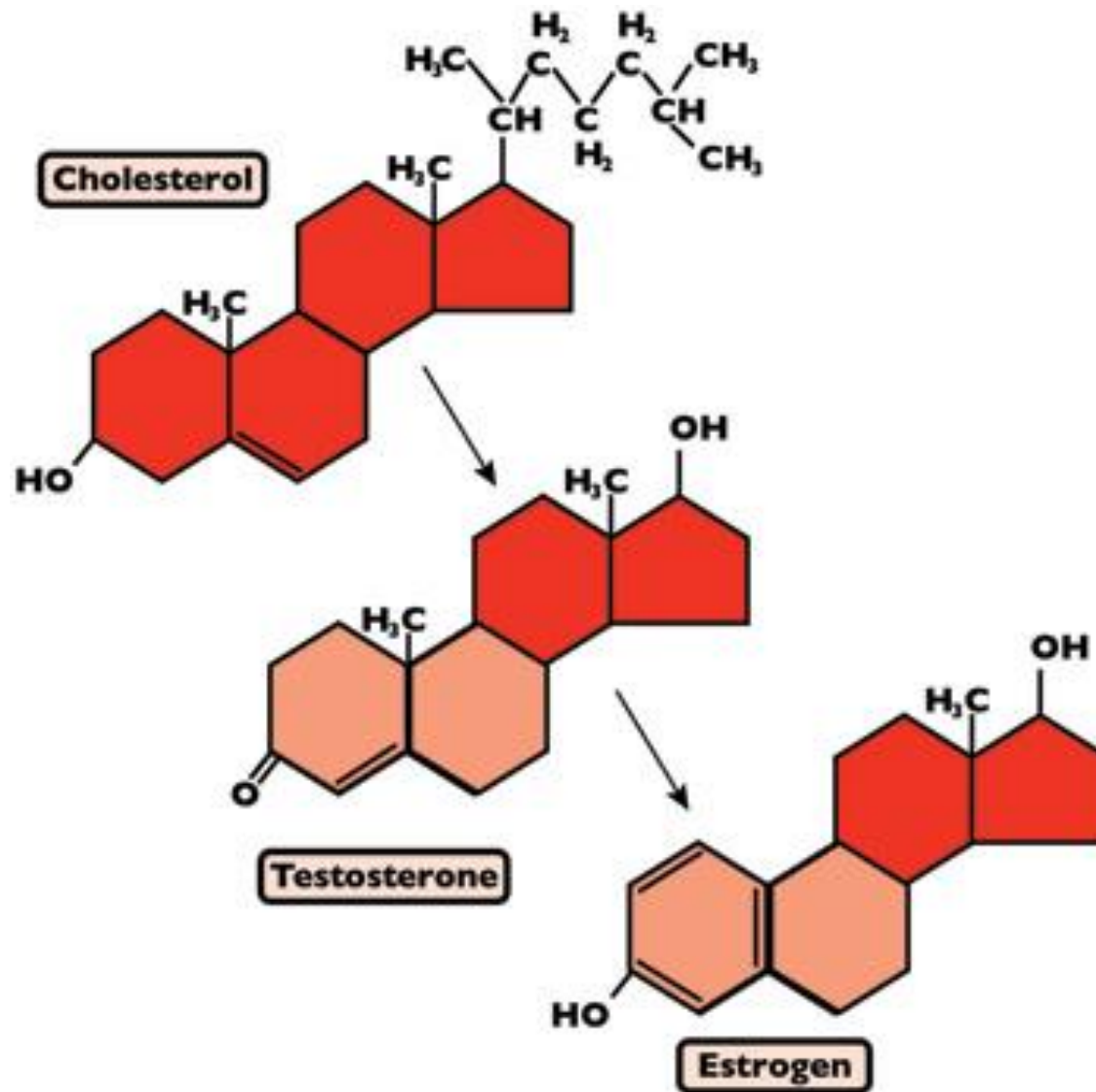
Steroids

Steroids consist of 4 fused carbon rings with an alcohol group



Cholesterol

- Precursor for other steroids
- Reacts with sunlight to form Vitamin D
- Component of animal cell membranes
 - Contributes to atherosclerosis
 - Produced in the liver



Precursor for other hormones

Cholesterol

Since cholesterol is not soluble in the blood, it must be transported by lipoproteins

Two lipoproteins are **HDL & LDL**

HDL molecules are smaller and denser, with a high amount of protein

LDL molecules contain much more cholesterol and can cause serious health effects

HDL is “good”; LDL is “bad”

