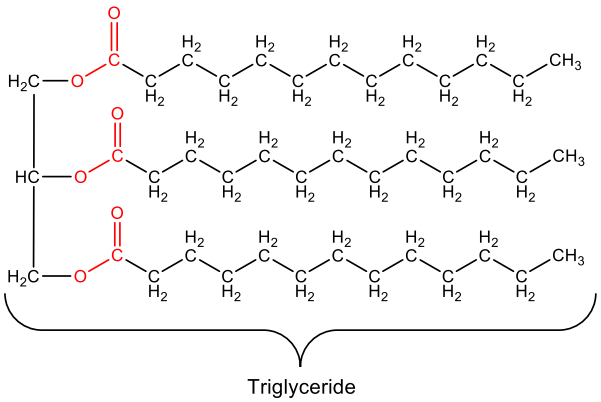
Structure and Properties

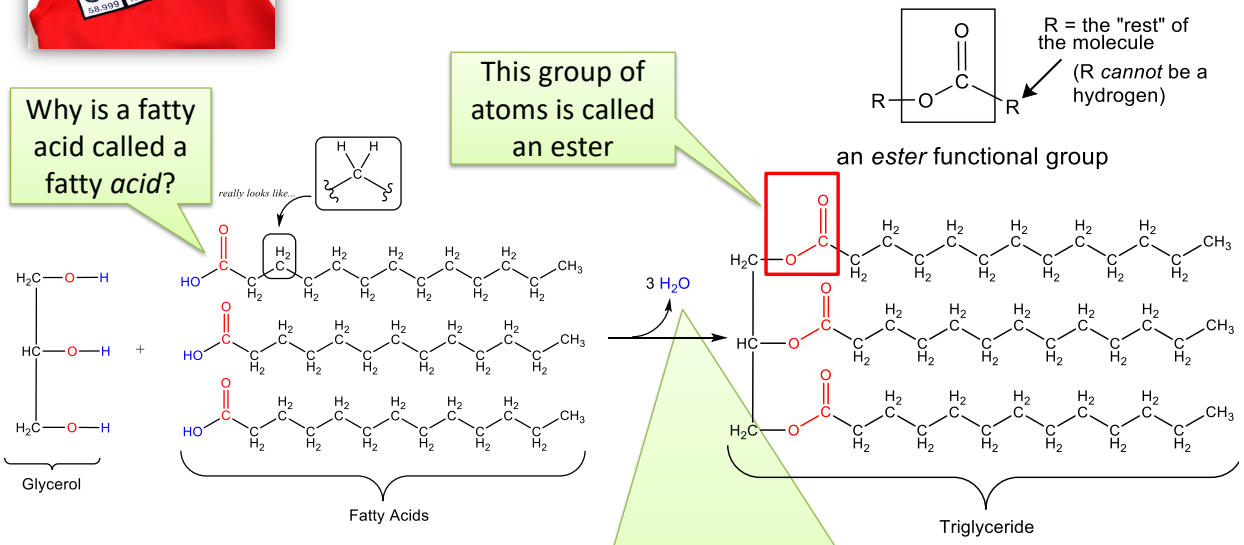
FATS: STRUCTURE AND SOLUBILITY

Fats are Lipids



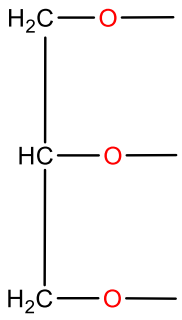
- When chemists think of *fats* they think of a large class of molecules called *lipids*.
  - The word *lipids* comes from the greek "*lipos*" for fat.
- Natural fats and oils are made mostly of molecules called triglycerides.
- Fats are solid triglycerides, while oils are liquid triglycerides.

A triglyceride is made from the combination of fatty acids and glycerol



When fatty acids and glycerol combine, bonds are broken and formed in a chemical reaction to produce a triglyceride and 3 molecules of water. In that process, a new group of atoms is formed called an *ester*.

Using the glycerol backbone below, draw the structure of a generic monoglyceride below



How many water molecules are produced when a monoglyceride is made?

Table. The comopositition of mono-, di- and triglycerides

Monoglyceride = Glycerol + One fatty acid
Diglyceride = Glycerol + Two fatty acids
Triglyceride = Glycerol + Three fatty acids

Lipids are *insoluble in water*

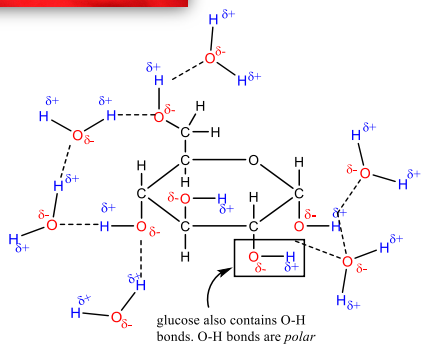
By definition, *lipids* are insoluble in water, so that means triglycerides are *insoluble* in water.

To be *soluble* means that two molecules will dissolve in one another to form a homogeneous mixture.

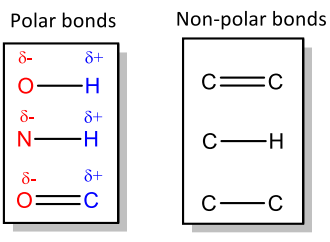
When compounds are *insoluble*, the combination forms a *heterogenous mixture*.

- When a lipid (e.g. oil) is mixed with water, you will see boundaries form between the two *phases* – literally, the two cannot mix.

Like dissolves like



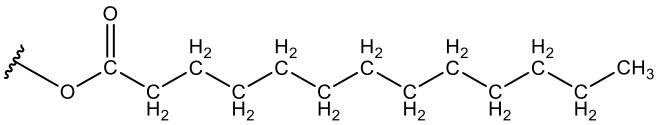
Like Dissolves Like: i.e. sugar dissolving in water, lemon juice dissolving in water, vinegar dissolving in water



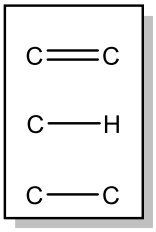
- Polar compounds:
  - are soluble in water; non-polar molecules are not.
  - can mix with or *dissolve in* water to form ***homogeneous mixtures***.
  - are ***hydrophilic***

hydro = water, *phileo* = love

Like dissolves like



Typical Non-polar bonds



Non-polar compounds

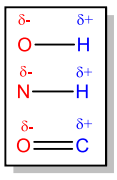
- are soluble in oil/fat
- can mix with or *dissolve in* oils/fats to form homogenous mixtures
- are ***hydrophobic***

hydro = water, *phobos* = fear

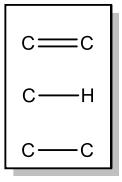
A triglyceride has some *polar* and some *non-polar* bonds – and yet the molecule as a whole is very hydrophobic (i.e. water hating).

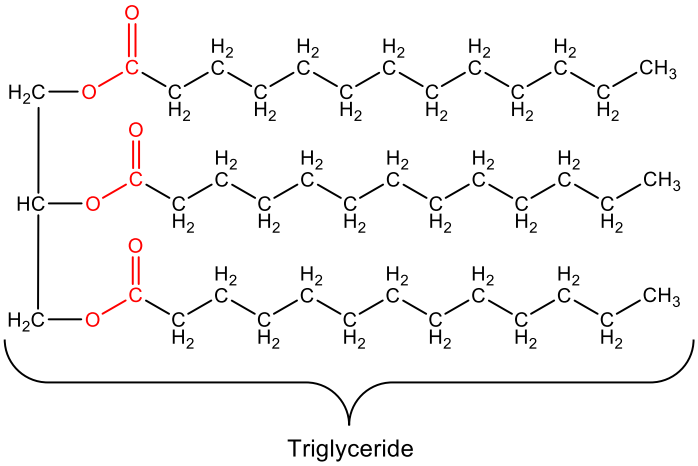
- Why is the *non-polar* carbon chain unable to interact with water?

Polar bonds



Non-polar bonds





Triglyceride