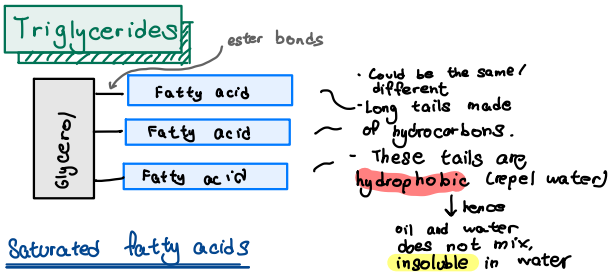
Lipids

- Lipids are made from a variety of different components, but they all contain hydrocarbons.
- There are two groups of lipids:
  - Triglycerides
  - Phospholipids

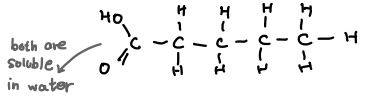
Triglycerides



There are two types of fatty acids: → bad for you
- Saturated fatty acids (as seen on food labels)
- Unsaturated fatty acids

Saturated fatty acids

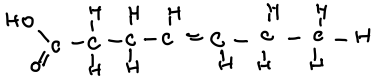
- They do not have any double bonds between their carbon atoms. (like alkanes)



(normally solid in room temperature as saturated fats can pack together tightly as tails are straight, as seen below)

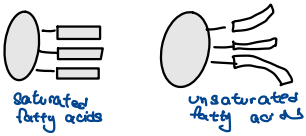
Unsaturated fatty acids

- They do have double bonds between carbon atoms, (like alkenes)

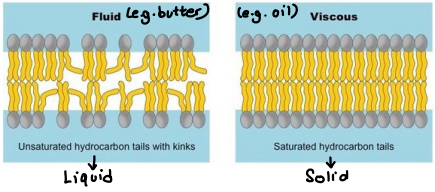


Why are unsaturated fatty acids in the form of liquids (like oil)?

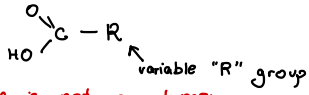
- The carbon double bonds in unsaturated hydrocarbon chains cause the fatty acid tails to bend. (kinked)



- This bend weakens the intermolecular forces so they form a liquid in room temperature.



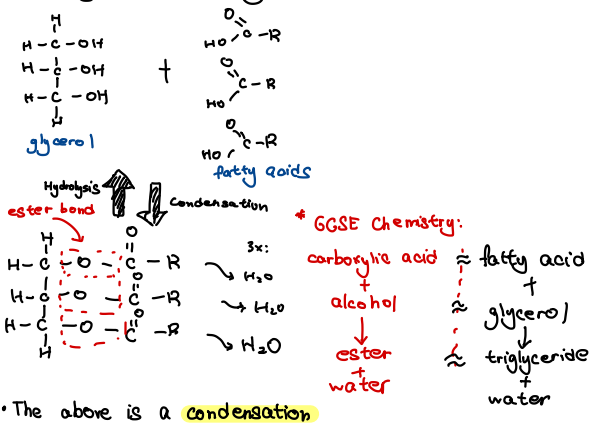
Structure of a general fatty acid:



* This is not a polymer
* Fatty acids are considered carboxylic acids since it has COOH group (GCSE Chemistry)

Triglyceride formation

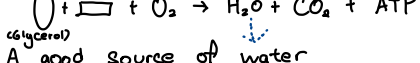
- They are formed by condensation reactions.



- The above is a condensation reaction - reverse being hydrolysis.

What are triglycerides used for?

- For energy production → they are broken down into glycerol and fatty acids which are used in respiration.

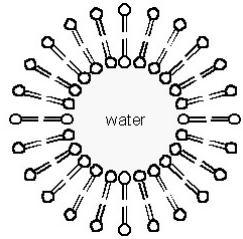


- A good source of water

Properties of Triglycerides

- Triglycerides are excellent molecules for energy storage since:
  - ↳ Long hydrocarbon tails () contain lots of chemical energy (form → ATP)
    - ↓ hence
  - ↳ Lipids contain twice as much energy (in form of ATP) per gram as carbohydrates
  - ↳ They do not affect the osmotic balance of cells in the body (water potential)
    - ∵ Triglycerides are insoluble in water
      - ↓ hence
  - ↳ Cells don't swell due to water entering the cells by osmosis.

- Triglycerides bundle together as insoluble droplets in cells
  - ∵ fatty acids are hydrophobic (they repel water)
    - ↓ hence
- The fatty acids tail face inwards, shielded from water by glycerol heads.

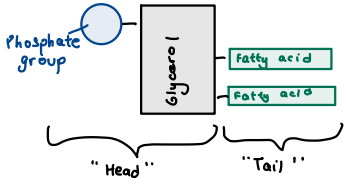


Uses of fats

- Brown fat (in babies)
- Insulation
- Protection (e.g. kidney)
- Energy store (long term)

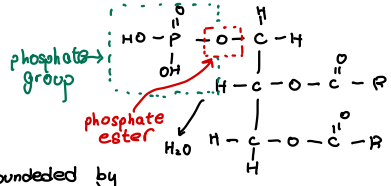
Phospholipid

- Phospholipids are found in cell membranes.



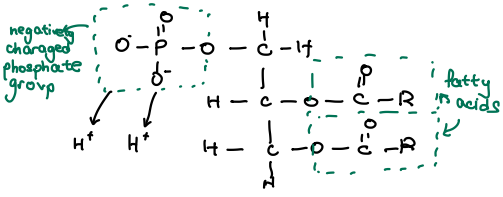
- The phosphate group is hydrophilic (attracts water)
- The fatty acid tails are hydrophobic (repels water)

Molecular Structure of Phospholipids

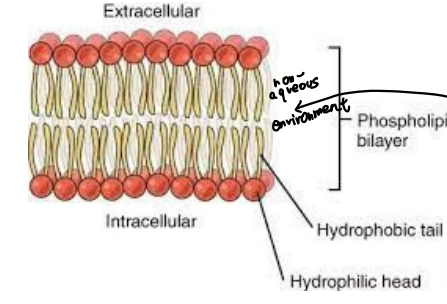


In phospholipids, one is saturated (no double bonds) and one is unsaturated (contains double bonds)

When phospholipid is surrounded by water, the hydrogen ions dissociate from the phosphoric acid:



- Since the phospholipid head is negatively charged, it is hydrophilic. (as phosphate group is charged)
  → A hydrophilic molecule is one that is attracted to water due to having a charge.
- The phospholipid tails, however, are hydrophobic.
  - ↓ hence
- Phospholipids could form a monolayer or a bilayer (phospholipid heads facing out towards the water)
- Hydrophobic tails are sheltered in the middle where there is no water
- The centre of the bilayer is hydrophobic, so water-soluble substances can't easily pass through it
  - ↓ hence
- Only non-polar molecules like O_2 / CO_2 can pass through membrane, making it partially permeable.



Complex Lipids

- Triglycerides
- Phospholipids
- Waxes

Simple Lipids

- Steroids
- Cholesterol
- Hormones
- Vitamin D
- Bile Salts

Lipid soluble, hence could go through phospholipa bilayer (cell membranes)