2.3. CARBOHYDRATES AND LIPIDS

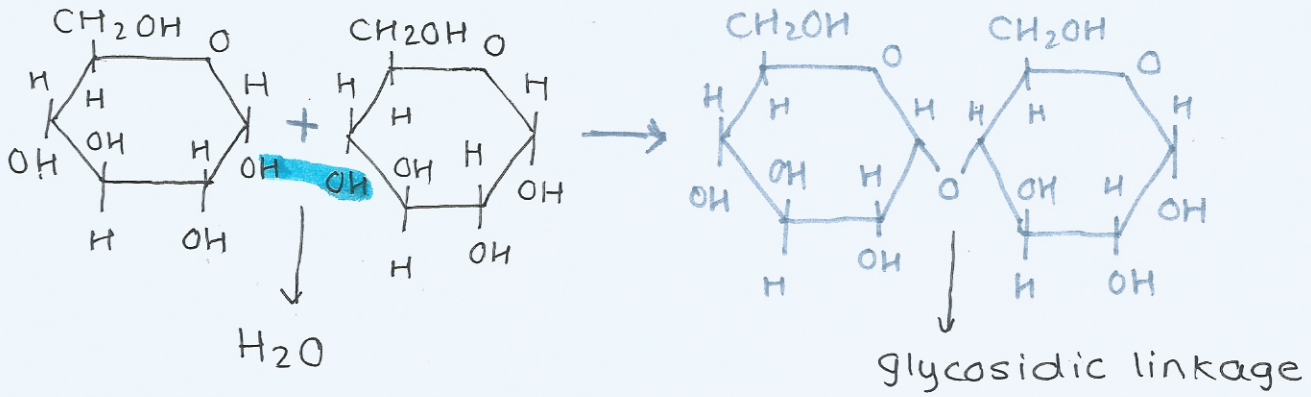
Carbohydrates:

→ They are made up of carbon, Hydrogen and oxygen.

→ carbohydrates are composed of monosaccharides.
↓
single sugar units.

→ monosaccharides link together to form disaccharides (2 monosaccharides) or polysaccharides (multiple monosaccharides).

They get linked together via condensation reaction and form a GLYCOSIDIC LINKAGE.



Monosaccharides:

- sweet in taste
- immidiate energy source

examples: glucose, fructose and galactose

Disaccharides:

- small enough to be soluble in water
- transportation

examples: lactose, maltose and sucrose.

Polysaccharides:

- energy storage
- cell structure
- cell recognition

examples: cellulose, glycogen and starch.

POLYSACCHARIDES

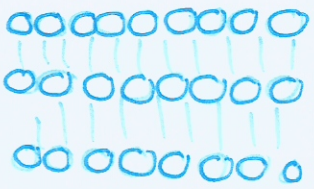
carbohydrate polymers comprised of many monosaccharide monomers.

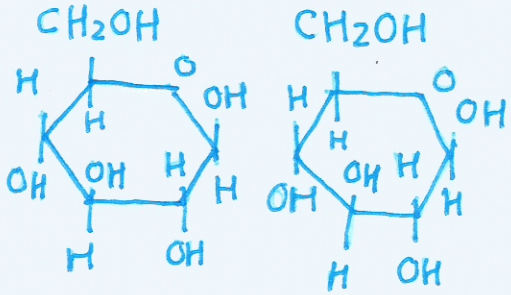
1. CELLULOSE

→ found in cell wall of plants

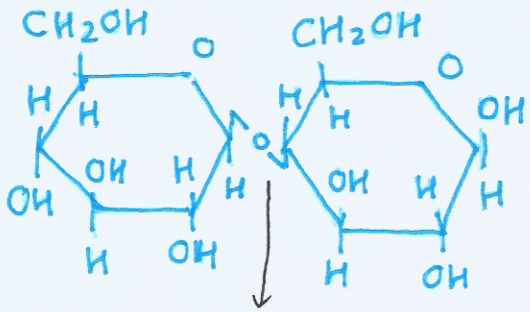
→ linear molecule composed of β glucose

→ indigestible by most animals





β glucose monomers



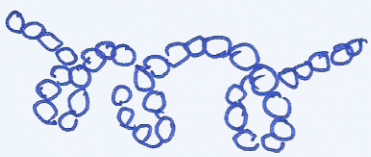
cellulose

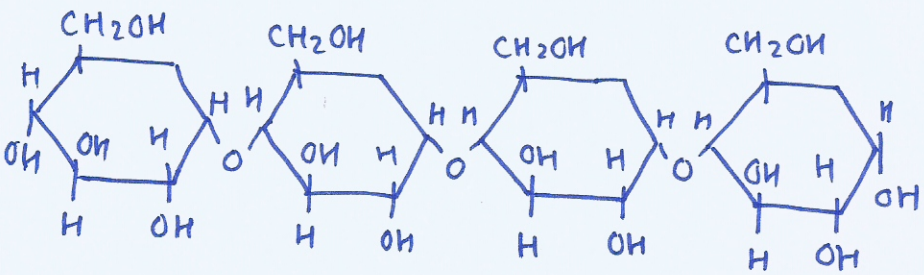
2. STARCH

→ energy storage in plants

→ composed of α-glucose

→ hard to digest and less soluble





AMYLOSE

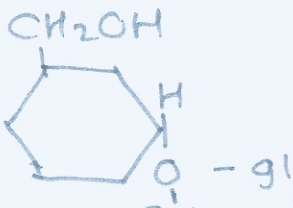
α glucose molecules

3. GLYCOGEN

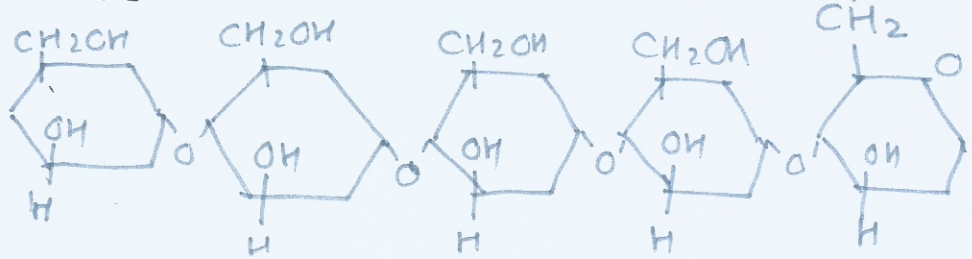
→ energy storage in animals

→ found in liver in humans

→ α glucose



O - glycosidic linkage



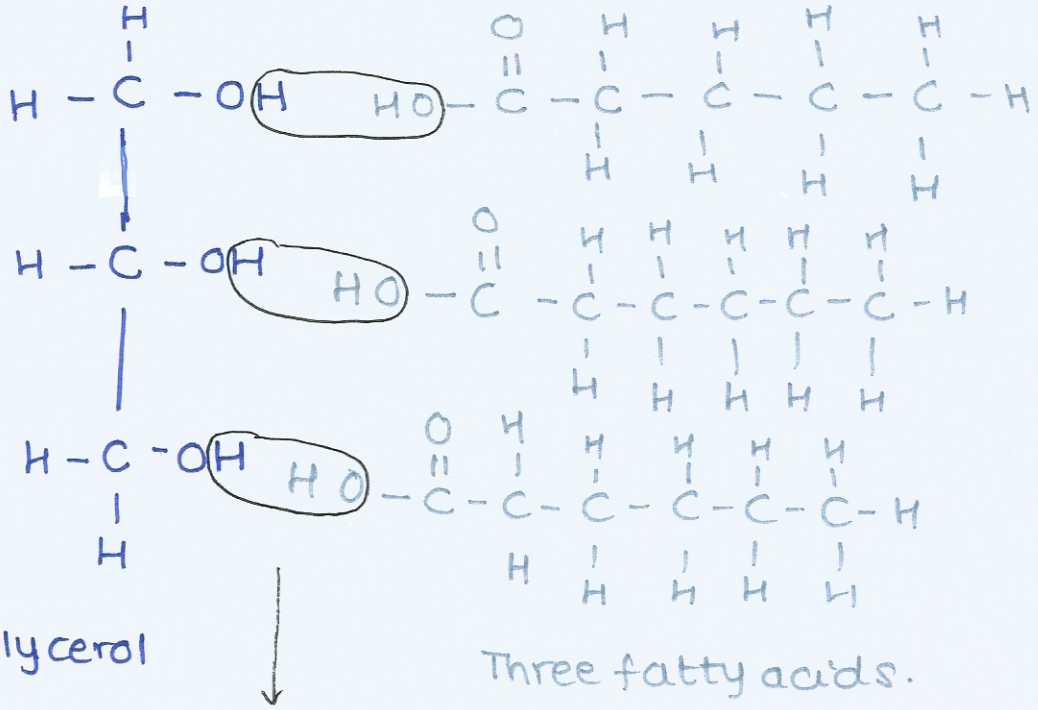
(branches out) (1-6)

LIPIDS

- used as energy stores
- do not conduct heat ∴ heat insulators

- Triglycerides are the largest class of lipids.
- They are formed when condensation reaction occurs between one glycerol and three fatty acids.

Formation of a triglyceride:

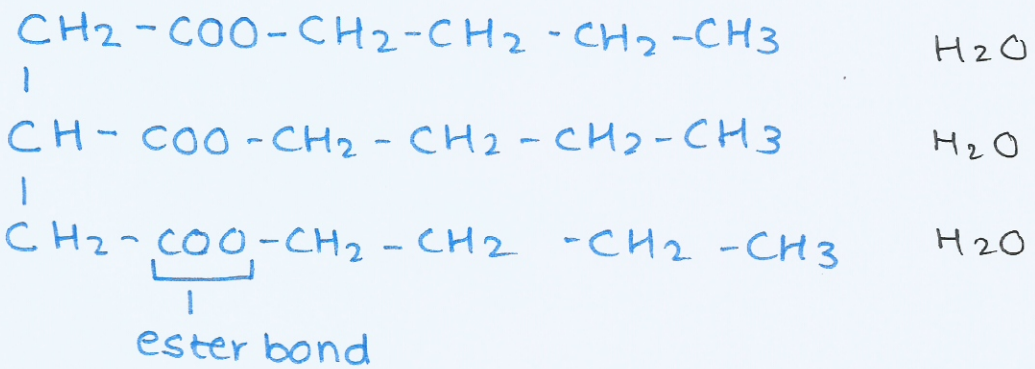


glycerol

Three fatty acids.

3 water molecules (condensation reaction)

Triglyceride + 3 H_2O molecules



- The hydroxyl groups (OH) of glycerol combine with hydroxyl groups of the fatty acids to form an ester bond.
- As a result of condensation reaction, 3 molecules of water are formed.

ENERGY STORAGE IN LIPIDS V/S CARBOHYDRATES

Storage

Lipids have long term energy storage

Carbohydrates have short term energy storage.

Osmolality

Lipids have less effect on osmotic pressure.

carbs have more effect on osmotic pressure.

Digestion

Lipids aren't easy to digest → can only be used for aerobic respiration.

carbs are easy to digest → used for aerobic & anaerobic respiration.

ATP Yield

Lipids - (~4000KJ per 100g) stores more ATP.

Carbs - (~1760KJ per 100g) stores less ATP.

Solubility

Lipids are not soluble in water (hydrophobic).

carbs are soluble in water as monomers / dimers

- Fats are liquid at body temperature (37°c) but solid at room temperature (20°c).
- Oils are liquid at both - body temperature and room temperature.

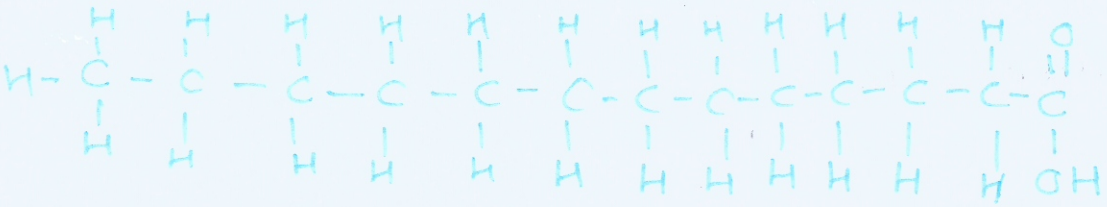
FATTY ACIDS

- They are hydrocarbon chains with a carboxyl group (COOH) attatched at the end.

- Fatty acids are either Saturated or Unsaturated depending on if they have any double bonds between 2 carbon atoms or not.

Saturated Fatty Acids: BAD FATS

A fatty acid where there are no double bonds between 2 carbon atoms.



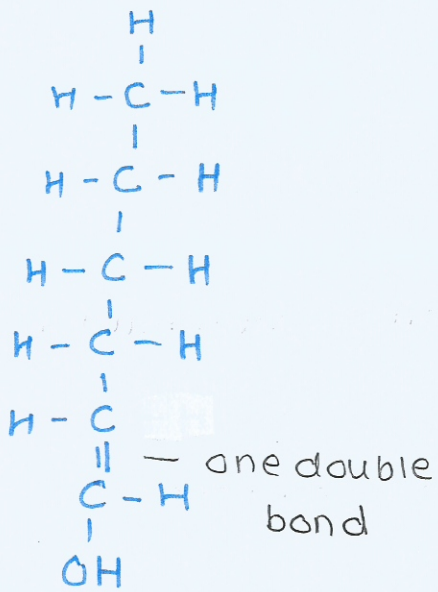
(single bonds)

Unsaturated Fatty Acids:

A fatty acid that has one or more double bonds between 2 carbon atoms.

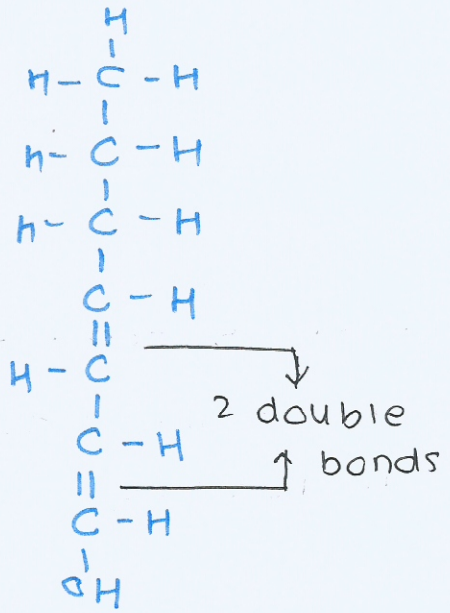
monounsaturated

→ only one double bond



Polyunsaturated

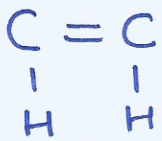
→ more than 2 double bonds.



Unsaturated Fatty Acids

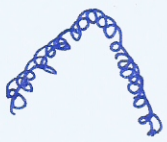
CIS-FATTY ACIDS

- When the hydrogen atoms are on the same side of the double bonded carbon atoms.



GOOD FATS

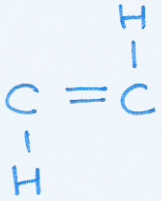
- Cis-fatty acids have a bend in the hydrocarbon chain at the double bond.



- low melting point
- liquid at room temp.

TRANS-FATTY ACIDS

- When the hydrogen atoms are on the opposite sides of the double bonded carbon atoms.



BAD FATS

- Trans-fatty acids do not have a bend in the hydrocarbon chain at the double bond.

- High melting point
- Solid at room temp.

HEALTH RISKS OF LIPIDS

(refer to bioninja for more content)

Coronary Heart Disease (CHD)

↳ The coronary arteries become partially blocked by fatty acid deposits. It leads to blood clot formation & heart attacks.

There is a positive correlation between amounts of trans-fats consumed and the rates of CHD.