

Biochemistry

Carbohydrates $C_n(H_2O)_n$

Sugars:

Uses – energy (respiration). Learn to draw diagram (*right*)

Monosaccharides: 3C = triose; 5C = pentose; 6C = hexose

5-carbon: **deoxyribose** (DNA), **ribose** (RNA, ATP)

6-carbon: ($C_6H_{12}O_6$) – **α -glucose** (G); **β -glucose**; **fructose** (F)

Testing: Benedicts; Boil; Blue → Brick red;

Joined together with **glycosidic** bonds (**condensation** $-H_2O$)

Disaccharides: ($C_{12}H_{22}O_{11}$) – **maltose** (2 x G); **sucrose** (G + F) – the only non-reducing sugar

Testing: – Boil HCl, add NaOH, then **Benedicts; Boil; Blue → Brick red (as above)**

Polysaccharides: **Starch (plants only)** = $\frac{1}{3}$ **amylose** (1:4 α glucose chain);
 $\frac{2}{3}$ **amylopectin** (1:4 α and 1:6 α bonds, so **branched**)

Testing: – add I_2/KI **solution;** **yellow/orange → blue-black**

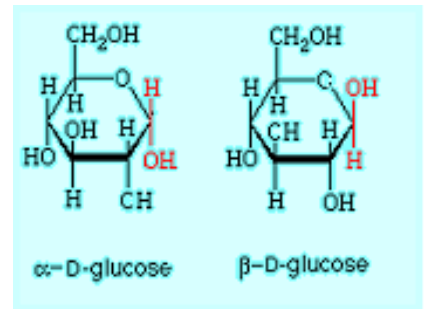
Glycogen animals, fungi, bacteria: (1:4 α and 1:6 α bonds, so **branched**)

Uses: energy store – because: **not soluble**, so no effect on water potential(ψ); not washed away

Compact, lots of energy stored, **branched**, so easily broken down

Cellulose (plants only) 1:4 β -glucose chain (X-linked by H-bonds)

Uses: plant cell wall (support) – because: strong in tension, not easily digested (roughage)



Triglycerides (Lipids) $C_nH_{2n}O_6$

Structure: **1 x glycerol** + **3 x fatty acids**, joined by **3x ester** bonds ($-3x H_2O$)

Uses – energy store, insulation, waterproofing, membranes

Contains little oxygen, so **rich in energy; hydrophobic; NOT a polymer**

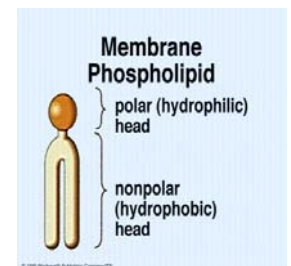
Can be **saturated** (all C-C bonds e.g. animal fats)

Or **unsaturated** (includes some C=C bonds, e.g. olive oil, cholesterol)

Phospholipids (polar) - with PO_4 – form bilayers in **fluid mosaic** membranes

Phosphate head is **hydrophilic**; 2 x fatty acid tails are **hydrophobic**

Testing: shake with warm ethanol; pour into **cold water** – forms **WHITE** emulsion



Proteins (CNON+S - in 2 amino-acids ONLY)

Proteins are polymers made of **amino-acids** (20 different e.g. **alanine**). Differ only in R-groups.

Joined by **peptide bonds** = CONH ($-H_2O$) on ribosomes (*70s Prokaryotes, 80s Eukaryotes*).

Forms **dipeptides; polypeptides**; active form = **proteins**

Primary (1°) structure = **sequence of amino-acids**;

bonds = **peptide** (covalent $-H_2O$)

Secondary (2°) structure = **folding** (α -helix, β -pleated sheet);

bonds = H-bonds (many)

Tertiary (3°) structure = **final folding to form active site**;

bonds = H and disulphide bridges

Quaternary (4°) structure – found only in haemoglobin;

bonds = weak ionic/Van der Waals forces

Denatured when H-bonds break - \downarrow pH (reversible); **temperatures $>60^\circ C$** (irreversible).

Testing: add **Biuret reagent** to **solution** of protein; **pale blue → lilac** NB **no heat!**

Uses: **enzymes; buffers pH**; movement; transport; reproduction; hormones; structural etc

General

Joining molecules = **anabolism** = condensation reactions ($-H_2O$)

Breaking molecules = **catabolism** = hydrolysis reactions ($+ H_2O$)

