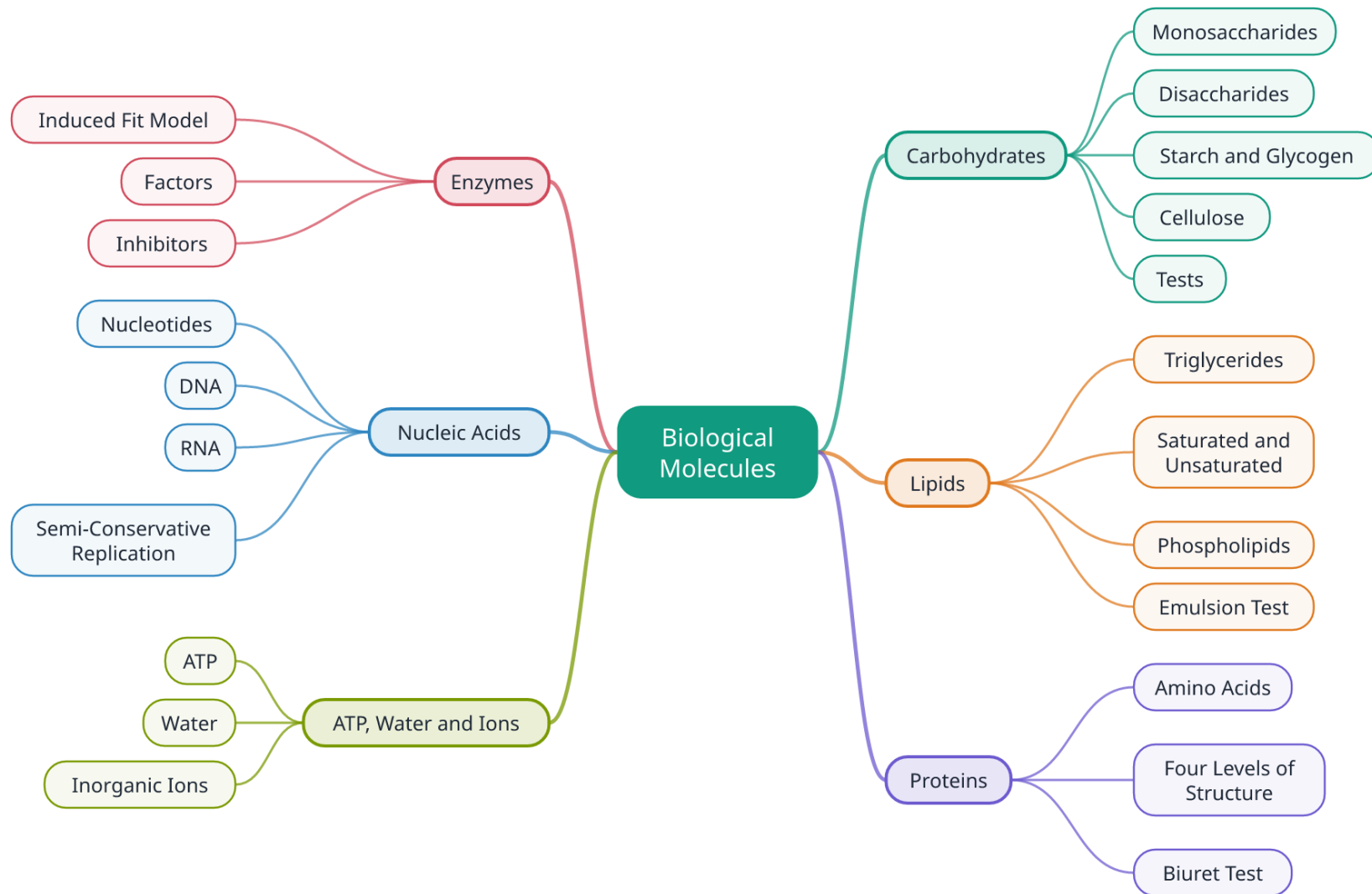


Biological Molecules Mind Map (A Level Biology)

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Biological Molecules mind map explained

Carbohydrates

Made of carbon, hydrogen and oxygen. Monosaccharides join by condensation reactions to form glycosidic bonds; hydrolysis breaks them.

Monosaccharides

Single sugars: glucose (alpha and beta forms), galactose and fructose.

Disaccharides

- Maltose: glucose + glucose
- Sucrose: glucose + fructose
- Lactose: glucose + galactose

Starch and Glycogen

Energy stores made of alpha-glucose. Starch (plants) is amylose, a coiled unbranched chain, plus amylopectin, which is branched. Glycogen (animals) is more highly branched, so it is broken down quickly. Both are compact and insoluble.

Cellulose

Made of beta-glucose in straight, unbranched chains. Hydrogen bonds link parallel chains into microfibrils, giving plant cell walls their strength.

Tests

- Reducing sugars: heat with Benedict's reagent; blue turns green, yellow, orange or brick red
- Non-reducing sugars: boil with acid, neutralise, then test with Benedict's
- Starch: iodine turns blue-black

Lipids

Include triglycerides and phospholipids. Insoluble in water.

Triglycerides

One glycerol and three fatty acids joined by ester bonds in condensation reactions. A good energy store, insoluble, and a source of metabolic water.

Saturated and Unsaturated

Saturated fatty acids have no carbon-carbon double bonds; unsaturated ones have at least one, which puts a kink in the chain.

Phospholipids

One fatty acid is replaced by a phosphate group, giving a hydrophilic head and hydrophobic tails. They form the bilayer of cell membranes.

Emulsion Test

Shake the sample with ethanol, then add water: a milky white emulsion shows a lipid is present.

Proteins

Polymers of amino acids joined by peptide bonds in condensation reactions.

Amino Acids

Each has an amine group, a carboxyl group and a variable R group. There are 20 that are common to all organisms.

Four Levels of Structure

- Primary: the sequence of amino acids
- Secondary: alpha-helix and beta-pleated sheet, held by hydrogen bonds
- Tertiary: the 3D folding, held by hydrogen, ionic and disulfide bonds

- Quaternary: more than one polypeptide chain

Biuret Test

Add biuret reagent: blue turns purple if protein is present.

Enzymes

Proteins that act as biological catalysts by lowering the activation energy of reactions.

Induced Fit Model

The active site changes shape slightly as the substrate binds, putting strain on bonds and lowering the activation energy.

Factors

Temperature, pH, substrate concentration and enzyme concentration all affect the rate. High temperatures and extreme pH denature the enzyme by changing the shape of the active site.

Inhibitors

Competitive inhibitors have a similar shape to the substrate and block the active site. Non-competitive inhibitors bind elsewhere and change the active site's shape.

Nucleic Acids

DNA and RNA are polymers of nucleotides, joined by phosphodiester bonds.

Nucleotides

Each has a pentose sugar, a phosphate group and a nitrogen-containing base.

DNA

Deoxyribose sugar; bases adenine, thymine, cytosine and guanine. Two antiparallel strands in a double helix, with complementary base pairs (A with T, C with G) held by hydrogen bonds.

RNA

Ribose sugar, uracil instead of thymine, and usually a single, shorter strand.

Semi-Conservative Replication

DNA helicase unzips the strands; free nucleotides pair with each template; DNA polymerase joins them. Each new molecule keeps one original strand. Meselson and Stahl's experiment provided the evidence.

ATP, Water and Ions

Small molecules with vital roles.

ATP

Adenine, ribose and three phosphate groups. ATP hydrolase breaks it into ADP and phosphate, releasing energy in small, manageable amounts. ATP synthase makes it again during respiration and photosynthesis.

Water

A polar molecule that forms hydrogen bonds. It is a good solvent and a metabolite, has a high specific heat capacity and a high latent heat of vaporisation, and shows strong cohesion.

Inorganic Ions

Hydrogen ions set pH, iron ions are part of haemoglobin, sodium ions are needed for co-transport, and phosphate ions are part of DNA and ATP.

How to revise with this mind map

1. Draw the structures. Sketch alpha and beta-glucose, a triglyceride, a phospholipid, an amino acid and a nucleotide from memory, then check them. Questions often give a diagram to interpret.
2. Link structure to function every time: why glycogen's branches help animals, why cellulose's straight chains make strong cell walls, why phospholipids form a bilayer.

3. Know condensation and hydrolysis for every polymer, and the bond each one forms: glycosidic, ester, peptide or phosphodiester.
4. Learn the tests as methods, with the positive result for each: Benedict's, the non-reducing sugar test, iodine, the emulsion test and biuret.
5. Make it yours. Build your own biological molecules map in Mindmapi from your notes, and ask the AI about any branch you are unsure of. The answer is saved into that branch's notes for next time.