2.1.3 Enzymes

How Activation Energy is lowered
If two substrates need joining, the enzyme holds them close together, preventing repulsion so bonding is made easy. If they need to be broken down, the enzyme puts strain on the bonds in the molecule.

(a) **Globular** proteins with a **specific tertiary structure**, which **catalyse metabolic reactions** in living organisms (b) Enzyme action may be **intracellular** or **extracellular**

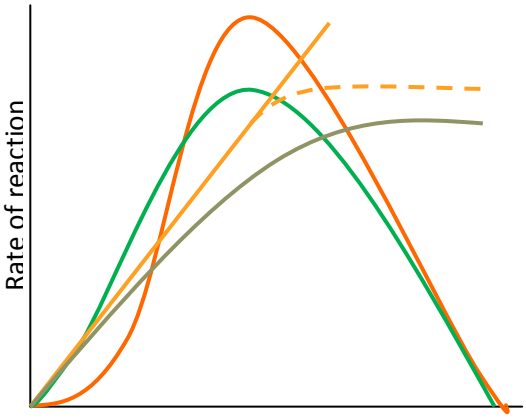
The lock and key hypothesis (Induced Fit: the active site changes shape slightly to fit the substrate molecule)

The enzyme has a **specific** shape determined by its **tertiary** structure. Its **active site** is **complementary** to the shape of the **substrate**

The substrate binds to the active site to form an **enzyme-substrate complex.**

The **enzyme-product complex.** Enzymes speed up a reaction by lowering the **activation energy** (energy required to start a reaction)

Enzyme activity



Temperature: more heat, more KE, more energetic collisions, more reactions….Until optimum temperature. Too much heat→molecules within enzyme vibrate more, bonds break, active site changes shape: DENATURATION ☹

pH: Above and below optimum pH, H^+ and OH^- ions in acids and alkalis breaks ionic and hydrogen bonds that hold enzyme's tertiary structure. Active site changes shape: DENATURATION ☹

Enzyme concentration: more enzymes, increased likelihood of collisions. If substrate is limited, more enzymes eventually has no further effect (there are more than enough enzymes in the solution)

Substrate Concentration: more substrates, more collisions until saturation point. Enzyme concentration becomes a limiting factor and the reaction levels off.

Experiments

e.g. measuring rate of oxygen production in breakdown of hydrogen peroxide with the enzyme catalase/presence of starch using iodine *(please have a look at examples in more detail)*

Competitive Inhibition
Molecule competes with substrate molecule for active site but no reaction takes place

Non-competitive Inhibition
Molecule binds to enzyme away from active site which changes enzyme shape so substrate can't bind.

If the bonds between the enzyme and inhibitor are **strong, covalent**/ **weak hydrogen or ionic,** inhibition is **irreversible**/ **reversible**

Cofactors bind to an enzyme and activate it…
Inorganic; non-protein molecules that help catalysis indirectly
Organic (*coenzymes*); participate directly and are changed.
A prosthetic group; helps enzyme form correct 3D shape

Metabolic poisons
Cyanide: non-competitive inhibitor of cytochrome c oxidase (respiration enzyme)

Medicinal Drugs
Reverse transcriptase inhibitors are antiviral drugs that treat HIV by inhibiting reverse transcriptase which catalyses replication of viral DNA