Enzymes

Enzymes are organic catalysts which are usually globular proteins. They are effective in small amounts and can be used over and over again. The way enzymes work means that they can't cause reactions to occur only speed them up.

Structure and Function

Enzymes are 3D complex globular proteins and although the enzyme itself is usually larger than the substrate only a small part of the enzyme actually comes into play. The active site of the enzyme is where it comes into contact with the substrate and it is only a few of the amino acids which make it up out of the total.

Enzymes are usually named after what they effect, with 'ase' on the end, e.g. lipids - lipase

There are two types of enzymes:

- Intracellular - made and used within cells for reactions like metabolism.
- Extracellular - produced by cells but work outside the cell in reactions like during digestion.

Factors that affect the rate of reaction of enzymes

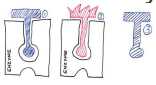
- Temperature - Enzymes have their optimum temperature and anything significantly above or below will begin to denature and slow the rate of reaction.
- pH - As well as temperature, enzymes also have an optimum pH in which they work fastest. For most enzymes it's around 7-8 pH.
- Substrate Concentration - The more substrate complex that is available for the enzyme the faster the rate of reaction until a point when it levels out.
- Enzyme Concentration - As the enzyme concentration increases the rate of reaction increases because there are more enzyme molecules, this increases the collision rate.

Enzyme Inhibition

Competitive Inhibition

Competitive inhibitors compete with the substrate for the active sites of the enzyme molecules. The inhibitor will have the same binding site configuration as the substrate thus meaning the enzyme will accept it.

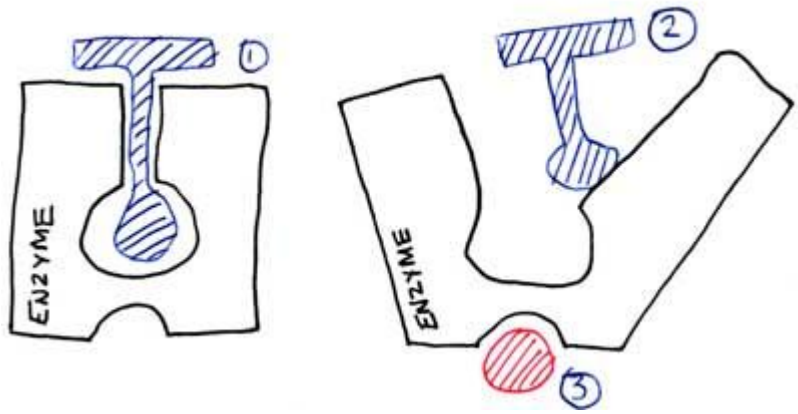
An example of competitive inhibition could be malonic acid which competes with succinate for active sites of succinic dehydrogenase, an important enzyme in the Krebs cycle.



1. This shows on the diagram where the substrate has occupied the active site of the enzyme.
2. The red substrate is a competitive inhibitor which is occupying the active site.
3. Because the inhibitor is in the active site of the enzyme there aren't any free for any other substrate.

Non-Competitive Inhibition

Non-competitive inhibitors don't attach to the active site of the enzyme but somewhere else on the enzyme. They alter the shape of the enzyme molecule in such a way that the active site changes its shape, making the active site no longer able to accommodate the substrate.
An example of non-competitive inhibition could be cyanide (or potassium cyanide - KCN) which combines dehydrogenase with the cytochrome enzymes responsible for the transfer of hydrogen atoms during cellular respiration.



1. This shows the substrate in the active site of the enzyme.
2. Because the non-competitive inhibitor has attached to the enzyme, it has changed shape which means the substrate can't attach to the binding site.
3. The non-competitive inhibitor attaches to the enzyme but not at the active site.

Immobilised Enzymes

Immobilised enzymes are enzymes which are attached to an inert and insoluble material. This inert material allows them to be held in place throughout the reaction. They can also be used again and again because they are attached to the inert material. They are used widely in industry because they are extremely efficient.