RB2 - Enzymes and ATP – Biology Revision

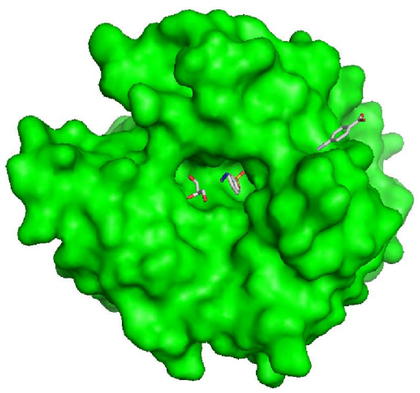
What is the monomer subunit of an enzyme?
Amino acids.

Enzymes are examples of biological catalysts. In general, how do enzymes do this?
They accept a **substrate** into a very **specific active site**. This active site then **interacts** with the substrate, using a catalytic triad which consists of different amino acids. Each amino acid has a specific role, one may act as a base, one as an acid, another a nucleophile etc. Together they can **catalyse a specific reaction**.

How do catalysts make a chemical reaction more favourable?
By providing a reaction pathway of **lower activation energy**.

How does an inhibitor stop an enzyme working as effectively?
Inhibitors **block the active site** of an enzyme, **stopping it from accepting the usual substrate**.

Inhibitor X binds to an enzyme away from its active site. Explain whether it is a competitive or non-competitive inhibitor:
A **non-competitive inhibitor**, as it is **not binding to the active site**, therefore it cannot compete with the substrate. Competitive inhibitors are ones which do bind to the active site.

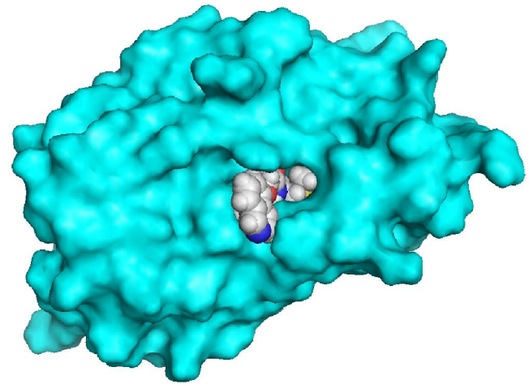


How does the induced-fit model differ from the lock and key model of enzyme action?
The induced-fit model **allows flexibility** in the structure of the **active site**. Whereas the lock and key model assumes that an active site cannot adapt around a substrate.

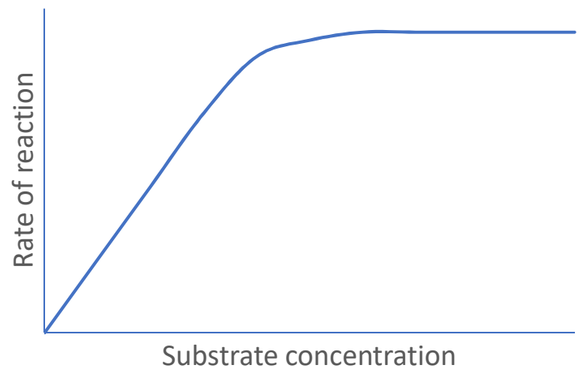
Enzymes are highly specific, meaning that that will only form an enzyme-substrate complex with certain substrates. Explain what makes each enzyme so specific to a set of substrates:
Enzymes work through utilising an **active site**. This active site is made from **amino acid residues**. Each amino acid has a very **specific structure**, and the **arrangement** of the amino acids within the active site is very **specific**, both in **bonding** and **shape**. Each enzyme has to be able to differentiate possible substrates based on their shape – do they fit in the active site – and their interactions – can they interact with the active site?

Explain how changing the concentration of H^+ ions within a system could prevent an enzyme from working effectively:
Changing the concentration of H^+ ions will **alter** the **pH** of a system. Enzymes have a **very narrow pH range** at which they work best at. By adding or removing H^+ ions, the enzyme could be **denatured**, as the bonds which hold it in its tertiary structure could be changed. Similarly, the very specific active site may be affected, and be protonated/deprotonated, this can **prevent** the desired substrate from **binding**.

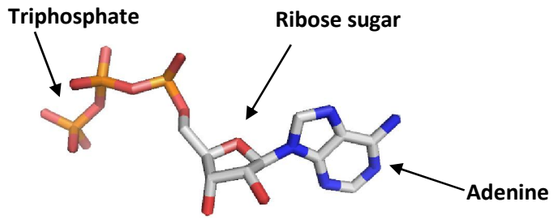
Explain why enzymes denature at high temperatures:
High temperatures will cause the enzyme to **vibrate rapidly**, and this can provide enough **energy to break the bonds which provide the overall tertiary structure.**



If the concentration of substrate was increased, but the concentration of enzyme remained constant, how would the rate of reaction change?
Increasing the concentration of substrate from zero would **initially increase the rate of reaction**, as more enzymes can catalyse the substrate when the concentration of substrate is the limiting factor. However, **once the concentration of substrate is raised high enough**, it will n**o longer be a limiting factor**. At a certain point, the **concentration of the enzyme** will become a **limiting factor**, this is the point when all of the enzymes are working at their **full capacity**, and increasing the amount of available substrate won't affect the overall rate of reaction.



Label the three constituents of ATP:



Explain why ATP is a nucleotide derivative:
Because it has a **similar structure** to a nucleotide, having a **base**, **sugar**, and **phosphate group**. However, ATP exclusively uses adenine, and has three phosphate groups instead of one.

ATP is hydrolysed by the enzyme ATP hydrolase. What are the two products of this?
ADP (adenine diphosphate) and **inorganic phosphate.**

What is the role of ATP?
To act as an **energy carrier** – transporting energy where it is needed within cells.

How does ATP hydrolase allow this to happen?
ATP hydrolase will **break down ATP at the site where energy is needed**. When ATP breaks down, a phosphate-phosphate **bond breaks**, **releasing energy** into the environment where needed.

When ATP hydrolase breaks down ATP, it often phosphorylates other compounds. When a compound is phosphorylated, does it tend to become more or less reactive?
More.

Explain how ATP is resynthesised in the body:
An enzyme called **ATPase condenses ADP** and P_i together, to form ATP.

Produced by Adam Stubbs at Newcastle University as part of a summer outreach project.