

Enzymes

Enzyme Biological molecules (**proteins**) that act as **catalysts** and **help complex reactions**.

are specific to their substrates and each enzyme has its own optimum pH

Substrate Material upon which an enzyme acts.

Enzyme inhibition important in normal metabolism for control of pathways.

Reversible inhibitor

competitive (Raises K_m only) Same size and shape with the substrate inhibition

noncompetitive (Lowers V_{max} only) inhibitor doesn't mind whether there is a substrate or not. but when the inhibitor binds, it switches off catalysis.

uncompetitive (Lowers V_{max} and K_m) the inhibitor can ONLY be on the surface of the enzyme if the substrate is there.

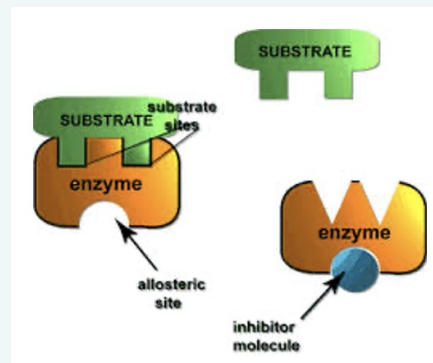
Irreversible inhibitor acts by reacting with the enzyme protein, usually at the active site(substrate site), to permanently block activity.

V_{max} is the maximum rate of an enzyme catalysed reaction i.e. when the enzyme is saturated by the substrate.

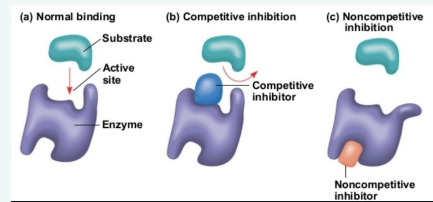
K_m is measure of how easily the enzyme can be saturated by the substrate.

K_m and V_{max} are constant for a given temperature and pH and are used to characterise enzymes. They can be used to identify types of inhibitors i.e. competitive, non-competitive and uncompetitive.

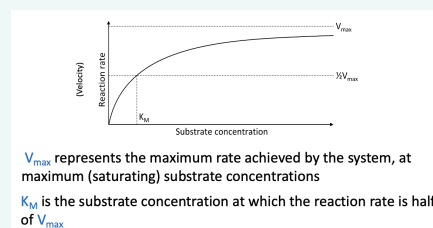
Allosteric site



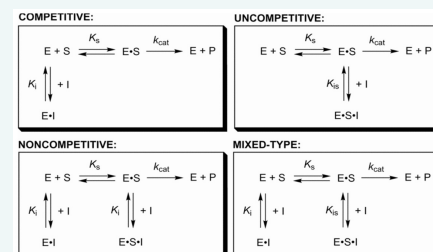
Normal binding



Enzyme kinetics



Reversible inhibition



Enzyme in human digestion

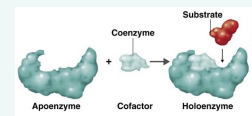
Three main types of enzymes in human digestion:

Amylases break down carbohydrates
 Example: salivary amylase
 Substrate: starch Product: maltose
 Source: mouth (salivary glands)
 Optimum pH: 7-7.8

Proteases break down polypeptides
 Example: pepsin
 Substrate: polypeptides Product: amino acids
 Source: stomach
 Optimum pH: 2

Lipases break down fats and lipids
 Example: pancreatic lipase
 Substrate: triglycerides Product: fatty acids & glycerol
 Source: pancreas, delivered into small intestine
 Optimum pH: 7.2 - 7.5

with co-enzyme



CoFactor

In the case of **metal ion cofactors**

Stabilise the structure, not directly involved in the chemistry

Ca^{++} with some proteinases

part of substrate Mg^{++} -ATP with some kinases

part of active site Zn^{++} in alcohol dehydrogenase

Organic cofactors

coenzymes they do come on and off like other substrates (NAD^+)

prosthetic groups a cofactor that forms a permanent part of the enzyme's active site.

Doesn't come on and off in a catalytic cycle (FAD , PLP)

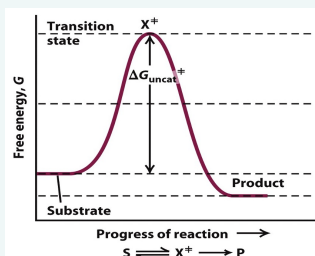
NAD^+ is both a coenzyme and a substrate

Why use coenzyme in one case and not in the other case?

Metabolic point: NAD is one of a range of cofactor substances that is present in small concentration

They turn over and over again to process a large amount of substances

Pathway is to process large amount with tiny amount of coenzyme



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