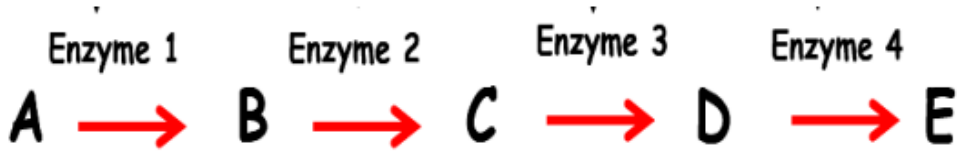
6. Metabolic Pathways

Metabolic Pathways

Integrated and **controlled** pathways of **enzyme-catalysed reactions** within a cell.

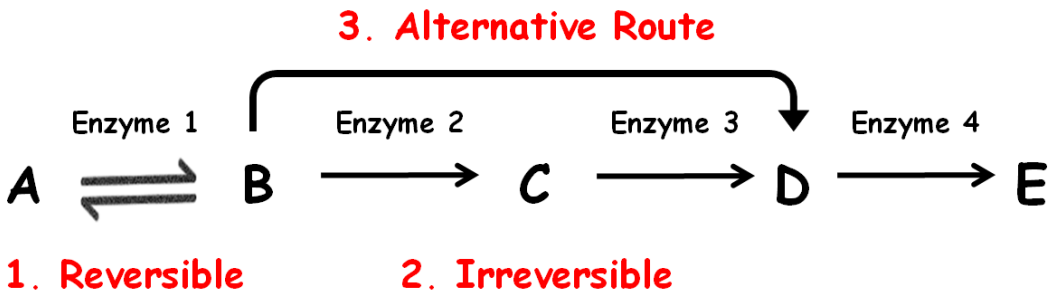
Metabolic Pathways

Each step in a metabolic pathway requires a **specific enzyme.**

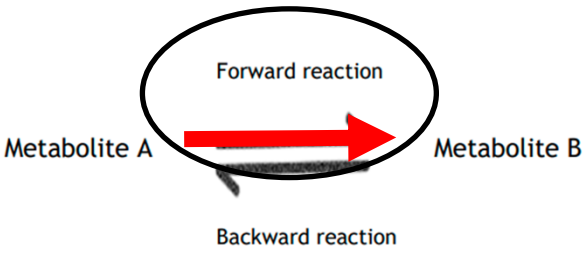


Three Steps in a metabolic Pathway

1. **Reversible** Step (2 way arrow allowing forward and backward reaction)
2. **Irreversible** Step (1 way reaction
3. **Alternative route** (skips certain steps but produces same molecule regardless)

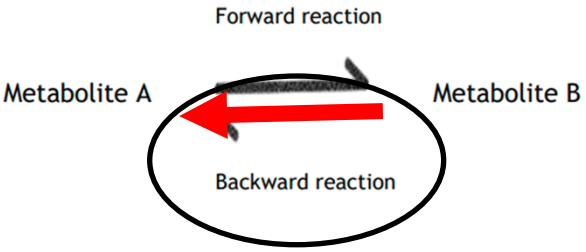


Reversible Reactions



Forward reaction favoured

1. High substrate (A) concentration
2. Low product (B) concentration



Backward reaction favoured

1. High product (B) concentration
2. Low substrate (A) concentration

6. Metabolism and Enzymes

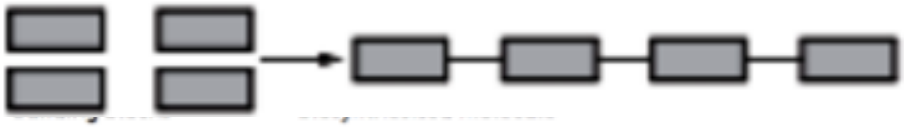
Types of Metabolic Reactions

1. Catabolic reactions **breakdown** larger molecules into smaller ones **RELEASING energy.**

   Example glycogen/starch → glucose protein → amino acids

2. Anabolic reactions involve the **BIOSYNTHESIS** of larger molecules into smaller ones **REQUIRING** energy to undertake this process.

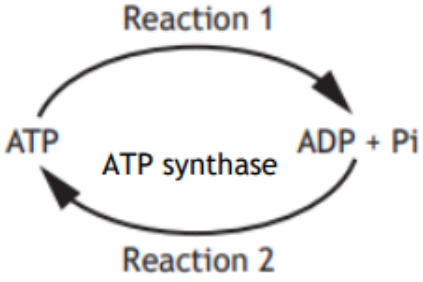
   Example glucose → starch amino acids → polypeptides (proteins)



ATP Example

Reaction 1: ATP is broken down is **catabolic** and **releases** energy.

Reaction 2: ATP is synthesized by the enzyme ATP synthase. **Anabolic** and **requires** energy.

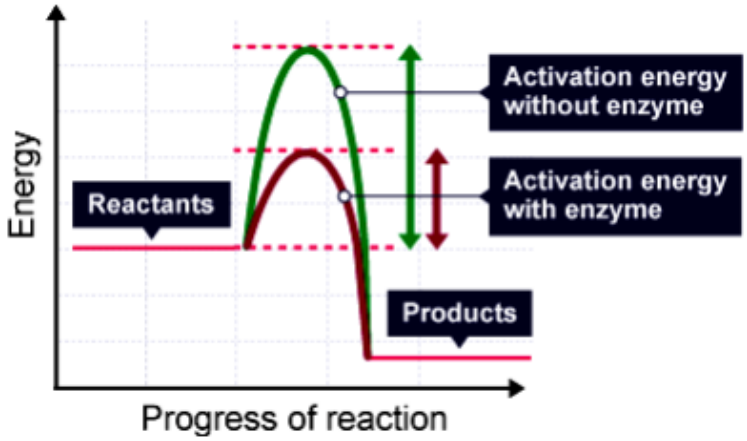


6. Enzymes

Activation Energy

The **energy** required to **BREAK chemical bonds** in the reactants to allow products to be made.

Enzymes speed up reactions as they **lower the activation energy** required to form products .



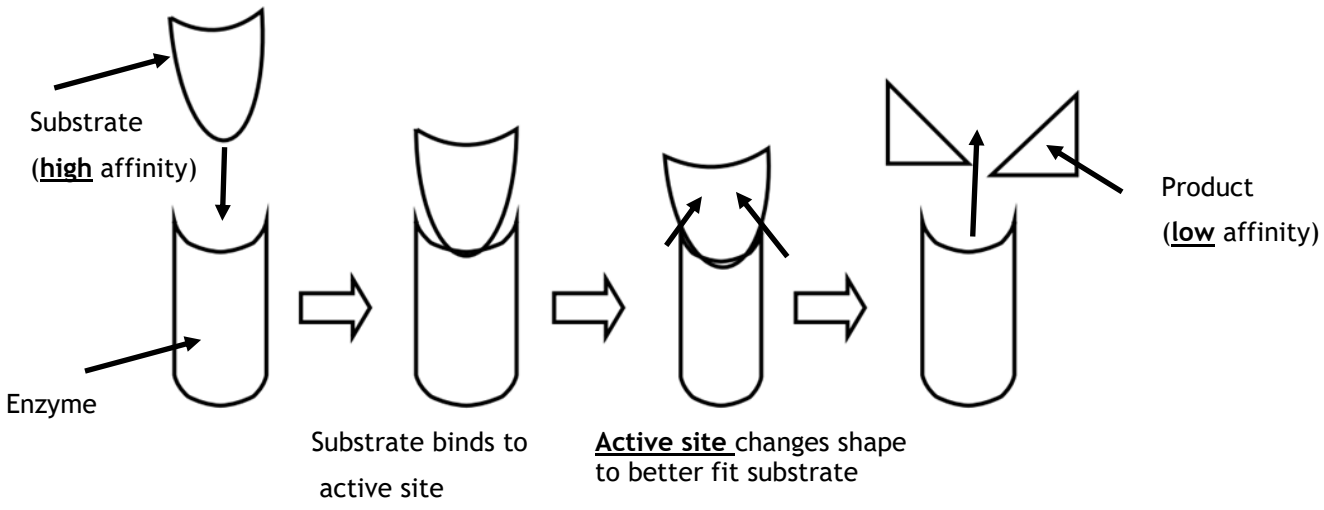
Induced Fit model

After the **substrate has bound** to the active site, the **ACTIVE site changes shape** to better fit the substrate.

Affinity for Active site

Substrate—**high affinity** for active site

Product—**low affinity** for active site



6. Inhibitors

Inhibitors

Inhibitors reduce enzyme activity.

3 types of enzyme inhibitors

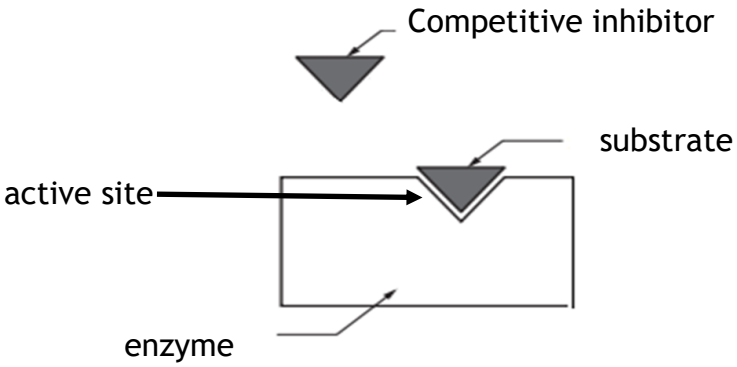
1. Competitive Inhibitors
2. Non Competitive Inhibitors
3. Feedback Inhibition

Competitive Inhibitors

Bind at the active site and prevent substrate from binding.

Competitive inhibitor molecule resembles substrate.

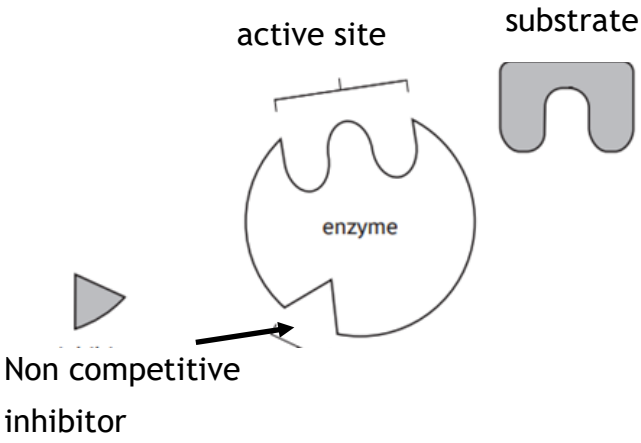
Inhibition reversed with increasing substrate concentration.



Non competitive Inhibitors

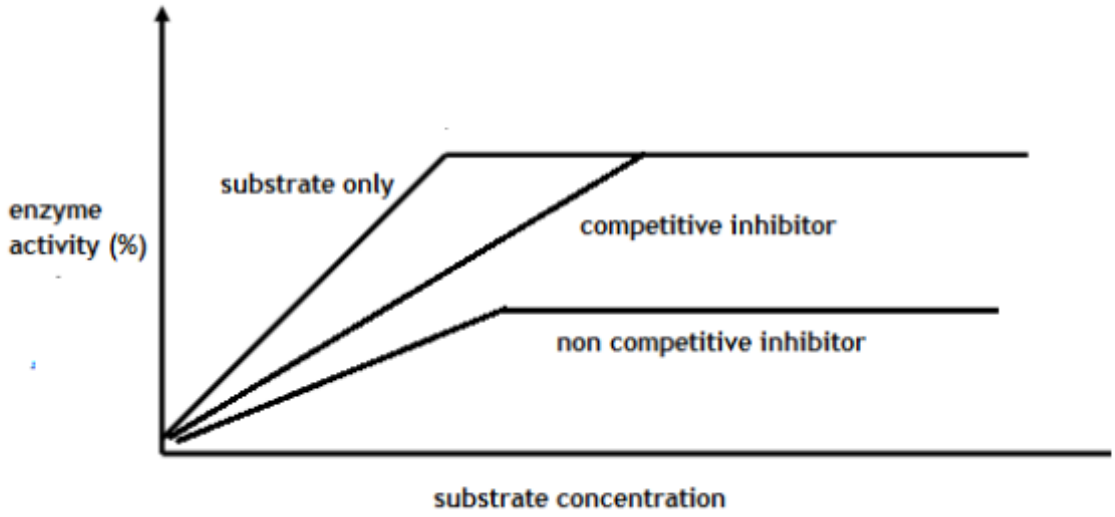
Bind AWAY from active site and **change shape** of active site preventing substrate from binding.

Irreversible inhibition: not affecting by increasing substrate concentration



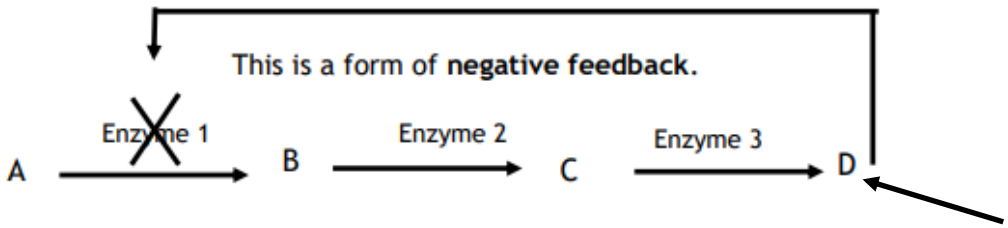
6. Inhibitors

Enzyme Inhibitor Graph



Feedback Inhibition

When the end product concentration reaches a **critical concentration** (too high), it binds to an **earlier enzyme** in the pathway, preventing its own synthesis. **Saves ATP**.



Metabolite D

Too high concentration

Blocks its own synthesis