Enzyme Catalytic Activity: Inhibition and Control

Enzyme Inhibition

Inhibitors work by binding to the enzyme and slowing or halting catalysis.

Type of Inhibitor	Where does it bind?	How does it act?	How can it be reversed?
Irreversible	Usually at the active site.	It forms a covalent bond that permanently inactivates the enzyme.	It cannot.
Reversible Competitive	Active site.	It has a structure similar to that of the substrate; therefore, it competes with the substrate to get in the active site.	Increase the concentration of the substrate to increase the probability of the substrate to get in the active site and regain activity.
Reversible Noncompetitive	A site other than the active site.	It does not resemble the substrate and it does not compete for the active site. The shape of the enzyme is distorted and the substrate cannot fit in the active site, or does not fit properly.	Decrease the concentration of the inhibitor using chemical reagents to remove it and regain activity.

Control of Enzyme Activity

The rate of a catalyzed reaction must be controlled so it can speed up when more molecules of a compound are needed and slow down when that compound is no longer needed.

- **Zymogens** or *proenzymes* are produced as an inactive form and stored in an organ; then they are transported to the part of the body where they are needed and activated by a reaction that removes a peptide section from the zymogen. (Ex. Digestive enzymes, insulin, enzymes needed for blood clotting.)

- **Allosteric enzymes** are capable of binding a regulator molecule that is different from the substrate. The regulator changes the shape of the enzyme (and the active site). The regulator may be *positive* if it speeds up the reaction or *negative* if it slows down the catalytic activity.

- In **feedback control** the end product of a sequence of reactions (reaction pathway) acts as a *negative regulator*. When the end product is present in adequate amounts, it binds to the first enzyme (E_1) and the whole process shuts down.