Enzymes

Enzymes: A type of protein that allows many chemical reactions to occur in the cell at a faster rate

Enzyme Structure

Enzymes catalyze reactions by binding to **substrates** at their active sites
↳ usually only meant for **one specific reaction**

forms an enzyme – substrate complex

There are two popularly-accepted models for enzyme–substrate binding

#1) **Lock-and-Key Hypothesis:** An enzyme is structurally rigid, contains a very specific active site that only a specific substrate can access; enzyme is lock, substrate is key

#2) **Induced Fit Hypothesis:** An enzyme is not structurally rigid. When a substrate is bound to the enzyme, the enzyme undergoes conformational change

Levinthal's Paradox: If polypeptides are able to fold into their conformations and shift every picosecond, it would take longer than the age of the universe to fold every possible way

Chapeconins: A group of proteins that help in folding

Catalysis

Catalysis → Acceleration of a reaction by a catalyst
↳ Enzymes reduce the E_a of a chemical reaction by stressing the bound substrates; excites electrons to break bonds

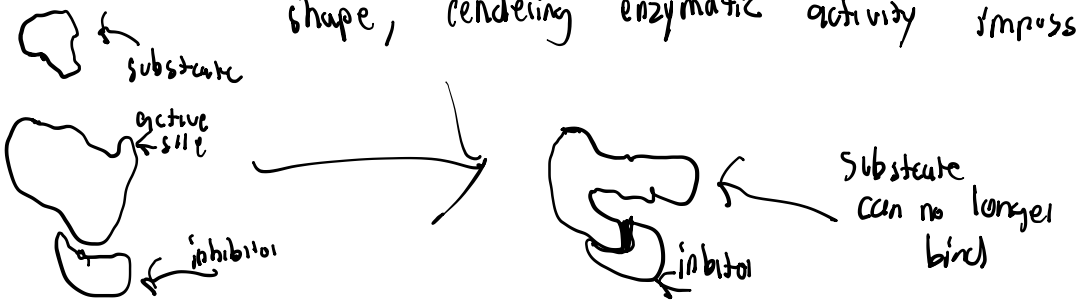
Enzyme Regulation

Enzyme activity can be regulated to speed up or slow down reactions

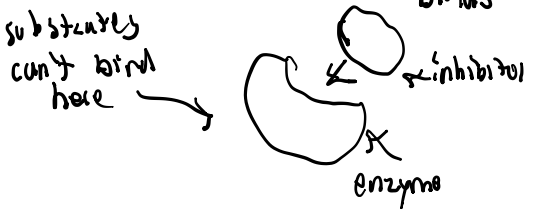
Other molecules besides substrates, called inhibitors, can stop the activity of the enzyme

Noncompetitive Inhibition: Inhibitor molecule binds to a region outside of an enzyme's active site; induces a change in shape, rendering enzymatic activity impossible

example:



Competitive Inhibition: Where a molecule which acts as an inhibitor binds to the active site of an enzyme



Inhibition can also be reversible or irreversible

reversible inhibition: binds weakly to the enzyme via IMFs
May be releasable and reversible; might induce temporary shape changes

Irreversible Inhibition: The inhibitor binds strongly to the enzyme with Covalent bonds. Prevents enzymatic activity completely

Allosteric Regulation

Allosteric Regulation includes both stimulation and inhibition of enzymatic activity
↳ uses binding of molecules to allosteric sites to regulate the activity of enzymes