9/12/23.

What is a Substrate.

- Substance upon which an enzyme act is called substrate.

Enzyme specificity.

- Enzyme having varying degree of specificity for substrate.
- Enzyme may recognize and catalyze:
  - → a single substrate
  - → a group of similar substrate.
  - → a particular type of bond.

(1) Absolute specificity.

- catalyze one type of reaction for single substrate.
- Urease is the only substrate for urease.
- glucose oxidase will oxidize only beta-D-glucose.

(2) Bond specificity.

- catalyze one type of reaction for a specific type of bond.
- most of the proteolytic enzyme are showing bond specificity
- Trypsin can hydrolyze peptide bonds formed by carboxyl group of arginine or lysine residues in any proteins

3. Group Specificity.

- One enzyme can catalyze the same reaction on a group of structurally similar compounds.
- Hexokinase can catalyze phosphorylation of glucose, galactose & mannose.

4. Stereospecificity.

- Human enzymes are specific for L amino acids and D carbohydrates.
- Lactate dehydrogenase, acting on pyruvate will form only L lactate, but not the D variety.

Enzyme unit.

- One standard unit or International unit of enzyme activity is the amount of enzyme that will convert one micromole of substrate per minute per litre of sample.
- abbreviation: IU/L.

Active site / active centre.

- The region of the enzyme where substrate binding and catalysis occurs is referred to as active site or active centre of enzyme.

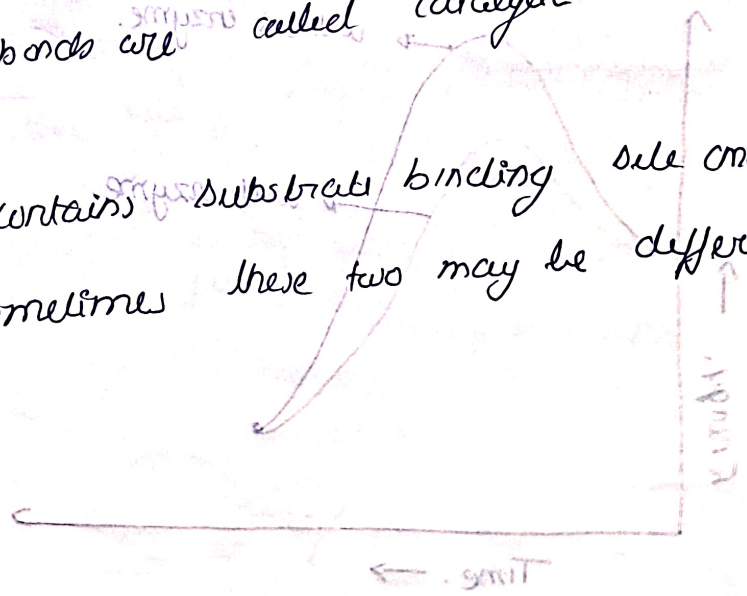
- Active site occupies only small portion of the whole enzyme.

- Substrate binds to enzyme at active site be non-covalent bonds.

- The binding of substrate to the active site depends on the alignment of specific groups or atoms at active site of

- Amino acids or groups that directly participate in making / breaking bonds are called catalytic residues or catalytic groups.

- Active site contains substrate binding site and catalytic site; sometimes these two may be different.

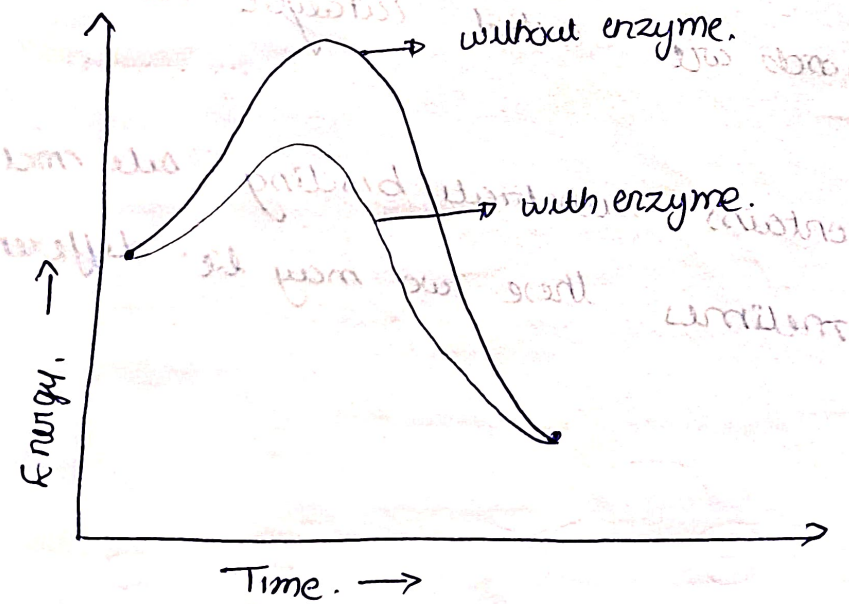


MODE OF ACTION OF ENZYMES.

→ Lowering of Activation Energy.

activation Energy - Energy required to convert all molecules of a reacting substance from the ground state to transition state.

- Enzyme reduces magnitude of activation energy & increase rate of reaction.



MICHAELIS - MENTEN THEORY.

- Enzyme Substrate Complex theory.

$E + S \rightleftharpoons E\text{-}S \text{ complex} \longrightarrow E + P$

eg: alkaline phosphatase hydrolyses phosphate esters.

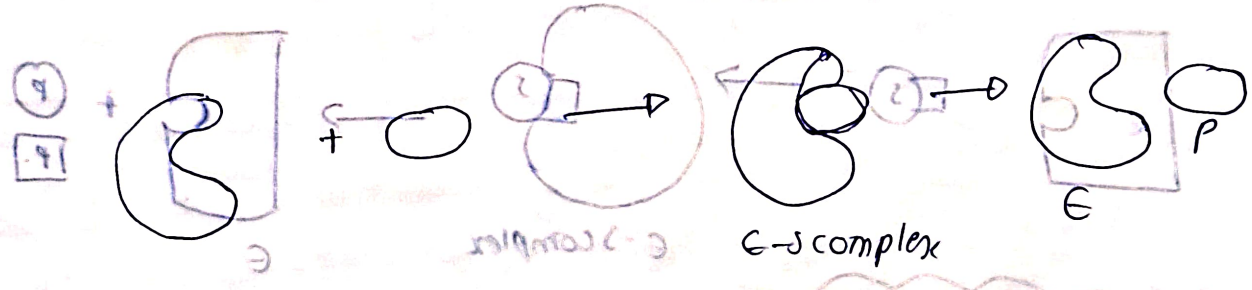
$E\text{-}Serine\text{-}OH + glucose\text{-}6\text{-}P \leftarrow E + S.$

$E\text{-}Serine\text{-}O\text{-}P + glucose \leftarrow E\text{-}S \text{ complex.}$

$E\text{-}Serine\text{-}OH + Pi \leftarrow E + P$

FISHER'S TEMPLATE THEORY. { Lock & Key model }

- 3D structure of active site of enzyme is complementary to substrate.
- Enzyme and substrate fit each other, similar to lock and key.



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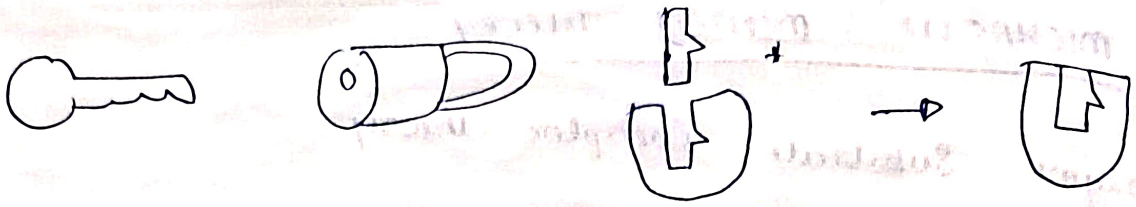
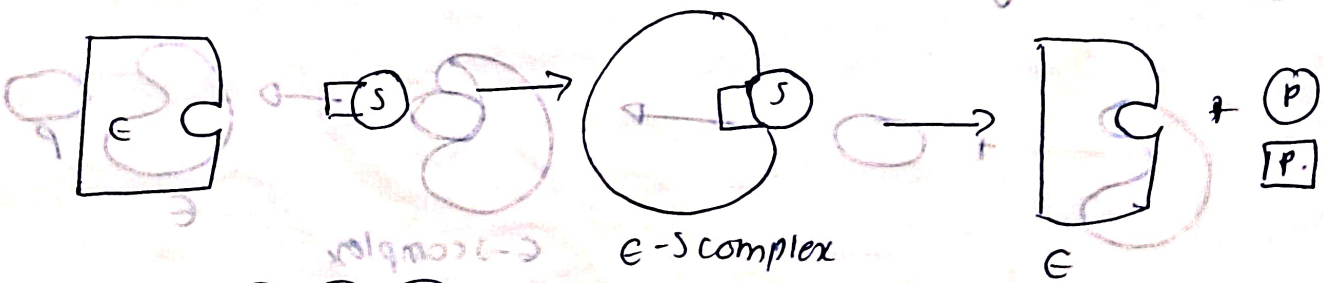


KOSHLAND'S INDUCED FIT THEORY.

- The enzyme is flexible.
- Substrate binds to specific part of enzyme.
- This leads to more 2° binding and conformational change of the active site of enzyme or.

OR

The substrate induces conformational change in the enzyme.



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Other mechanisms.

- Substrate strain theory.
- acid base catalysis
- covalent catalysis.
- Entropy effects.

Substrate Strain theory

- Binding of substrate to active site of enzyme can induce strain in the S.
- The strain induction increases the energy level of the substrate — attains transition state and easily converted to products.

Acid - Base Catalysis.

- Here the protonated form of an aminoacid at the active site act as an acid, which interact with its conjugated base (non protonated form) — product is released.
- At physiological pH, the protonated form of the AA Histidine function as an acid and its corresponding conjugate as base eg: action of Ribonuclease.