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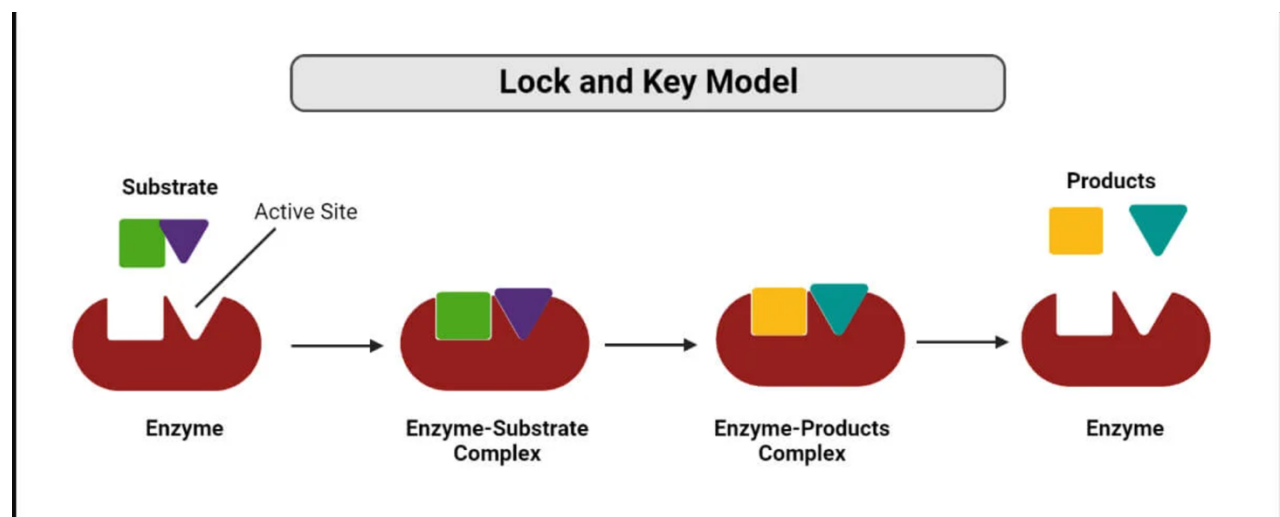
PG Semester III

Unit 1 CC XIII

Topic - Lock and Key model of Enzyme

Lock and key model - Mode of action of enzyme

The lock and key model describes one mode of action for enzymes, explaining how enzymes recognize and catalyze reactions with specific substrates due to the precise fit between the enzyme's active site and the substrate's shape.



Principle of the Lock and Key Model

- The model, proposed by Emil Fischer in 1894, treats the enzyme as a rigid "lock" and the substrate as a complementary "key".
- Only substrates with a geometry that matches the enzyme's active site can bind, forming the enzyme-substrate complex.
- Once the substrate fits into this site, the enzyme catalyzes a reaction: the substrate is converted into product(s), which then leave the active site, making the enzyme available for reuse.

Specificity and Analogy

- The lock and key analogy highlights enzyme specificity: like a key fitting a particular lock, only certain substrates fit and are processed by the enzyme, controlling which chemical reactions occur in the cell.
- This specificity is central to biological regulation, ensuring that only the correct substrate is metabolized by a given enzyme.

Limitations of the Lock and Key Model

- The model assumes the enzyme's active site is rigid and does not change shape during substrate binding.
- It does not explain how the enzyme stabilizes the transition state of the substrate or how enzymes with broad specificity (like lipases) process various substrates that are structurally similar.
- Modern research indicates that enzymes often change conformation (shape) when binding to substrates—a phenomenon described by the "induced fit model," which provides a better explanation for enzyme-substrate interactions and flexibility.

Examples

- Lactate dehydrogenase for pyruvate and lactate.
- Carbonic anhydrase for carbon dioxide and water.
- Lysozyme acting on bacterial cell wall components.