Mechanism of Enzyme Action

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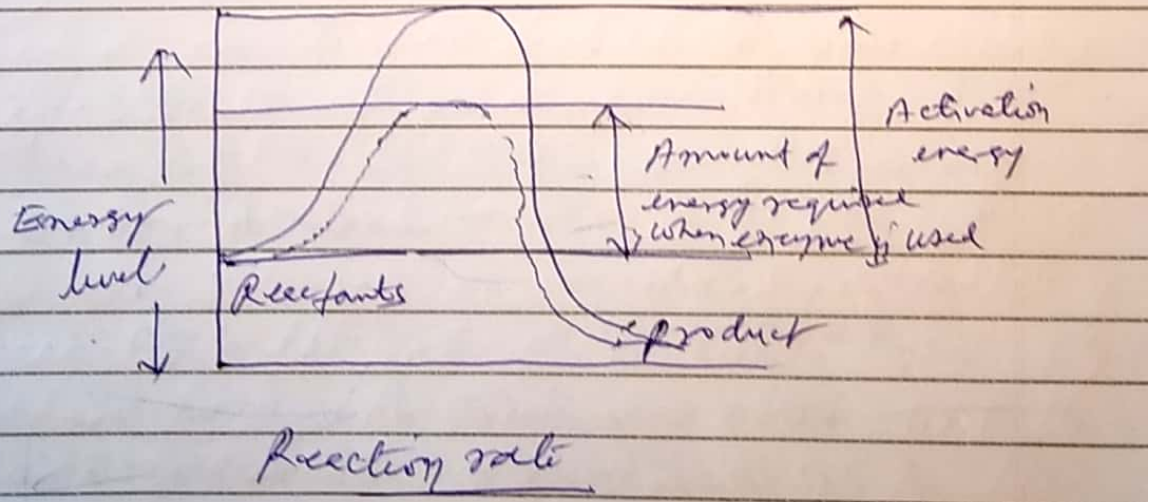
Enzymes bring about chemical reactions at the expense of minimum activation energy. The activation energy is the minimum amount of energy required for a reaction to occur.

Usually in almost all the cases two reactive substances (reactants) do not react very easily without the expense of activation energy. Because in these reactants there are some forces of ~~reaction~~ repulsion and secondally the reactive site is usually very small.

The activation energy minimises the force of repulsion by causing rapid vibrations in these reacting molecules. Due to this rapid vibration in the reacting molecules collision between them occurs frequently and this the minute reaction sites come close to each other. This way reaction takes place-



A notable example in this connexion is that a molecule of Sucrose requires 32 K.Cals activation energy for its hydrolysis. But when this hydrolysis occurs in the presence of enzymes the activation energy is considerably reduced. Only 9.4 K.Cals energy is required then.

To discuss the mechanism of enzyme action following two theories have been proposed so far-

(1) Lock and Key model theory

(11) Induced fit model theory.

(1) Lock and Key model theory

This theory was proposed by Emil and Fischer (1894). A/c to this theory every enzyme has a fixed Structure. Thus a particular substrate is catalysed during reaction by a particular enzyme. Just like every lock requires a special Key to be opened.

During reaction first enzyme makes a complex with Substrate (Enzyme Substrate Complex). In this condition the substrate is broken down into products. product also for a little while remain in contact with the enzyme. This complex is called enzyme product complex (E-P). Ultimately enzyme is released and the products are seperated.

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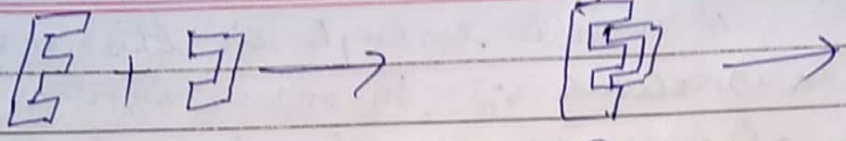
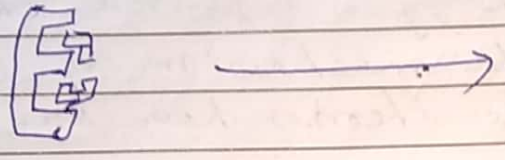
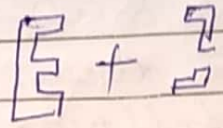


Enzyme Substrate

Enzyme Substrate Complex



Enzyme Product Complex



Enzyme Product.

Evidences -

(i) The theory provides sufficient explanation as to how a very minute amount of enzyme can bring about chemical change in large amount of substrate

(ii) The theory very clearly shows that the enzyme is never consumed in any chemical reaction.

(iii) A particular enzymes is required by a particular substrate. This explains specificity of enzyme.

(iv) When a substance similar in structure to the substrate is introduced (added) during reaction, the rate of reaction is significantly slow down. This gives an idea about the inhibition of enzyme activity by the

use of substanes similar to substrate.

II. Induced fit model theory :-

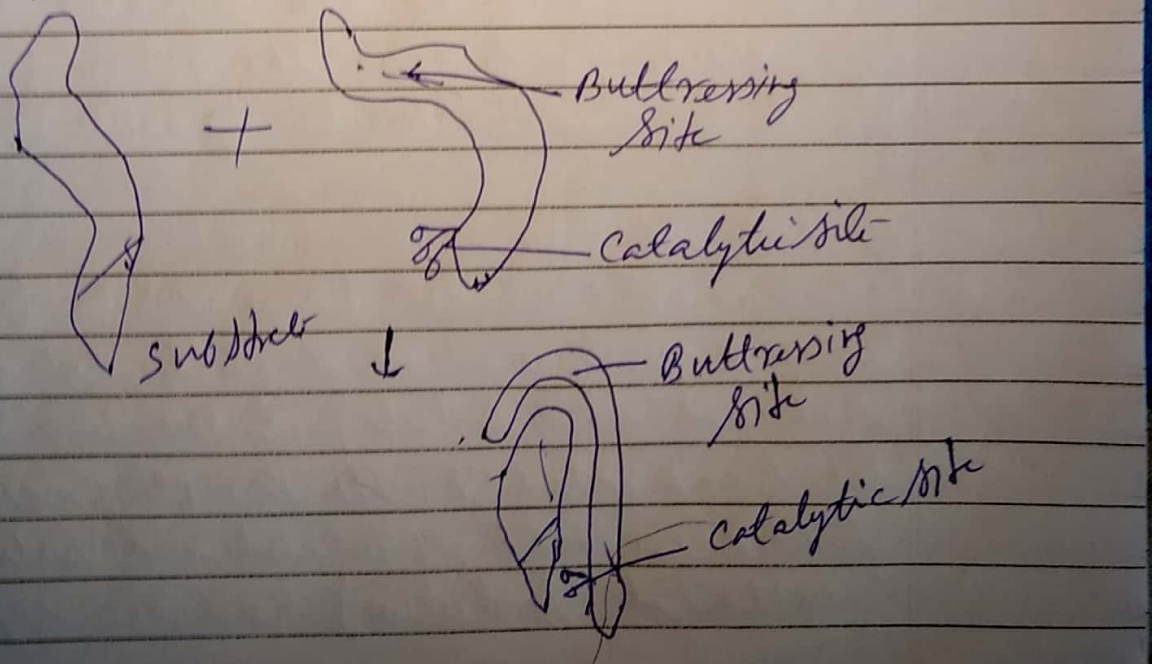
This theory was proposed by Koshland (1957). It is simply the modification of lock and key model theory. Koshland proposed that enzymes undergoes conformational (structural) changes during reaction. i.e. no rigidity in the structure of enzymes.

A/c to him every enzymes has two sites

(a) Buttressing site

(b) Catalytic site.

The buttressing site holds the substrate very firmely and catalytic comes exactly opposite to the bond from where the substrate has to break. and this way it (catalytic site) brings about chemical changes in the substrate.



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Evidences :-

(1) All evidences supporting lock and key model theory also supports this theory.

(2) X-ray diffraction and optical rotation studies on enzyme provide further evidence in support of this theory.