PROPERTIES OF ENZYMES

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1. **Protein Nature:** Enzymes are proteinaceous in nature except ribozyme, ribonuclease-P as well as peptidyl transferase. Enzymatic proteins are globular in nature.

2. **Molecular Weight:** They are high molecular weight proteinaceous molecules varies from 5000 - 5000000 Da with typical values in the range 20 000 – 100000 Da. For instance, bacterial ferredoxin, urease, isocitrate dehydrogenase and pyruvate dehydrogenase depict 6000, 483000, 1000000 and 4600000.

3. **Colloidal Nature:** These enzymes are usually hydrophilic colloids.

4. **All enzymes** are more powerful and efficient compared to inorganic catalysts. For instance, urease catalyzed hydrolysis of urea is 10^{14} times faster over acid hydrolysis carried out at higher temperature of 40 ^{0}C.

5. Biocatalysts: Enzymes are produced in biological system and found to involve in catalyzing the biochemical reactions.

- Enzymes speed up the rate of chemical reactions and assist in achieving the equilibrium quite early.
- They never change the equilibria of chemical reactions.

6. Unchanged Form: Like catalysts, enzymes are neither consumed nor transformed during the biochemical reactions.

7. Complex Formation: Prior to biochemical reaction, the substrates or reactants bind with the region of active site of enzyme, thereby forming a short-lived enzyme substrate complex, where substrates undergo reaction to generate products that remain complexed with the enzyme for some time. The products are soon liberated and unchanged enzyme is freed.

8. Reversibility: The same enzyme can catalyze the enzyme in both directions. Nevertheless, the reversible reactions depict the different optima.

- For instance, fumarase transforms malic acid to fumaric acid at pH 7.8, whereas at pH 6.2, fumarase stimulates the reversible reaction from fumaric acid to malic acid.

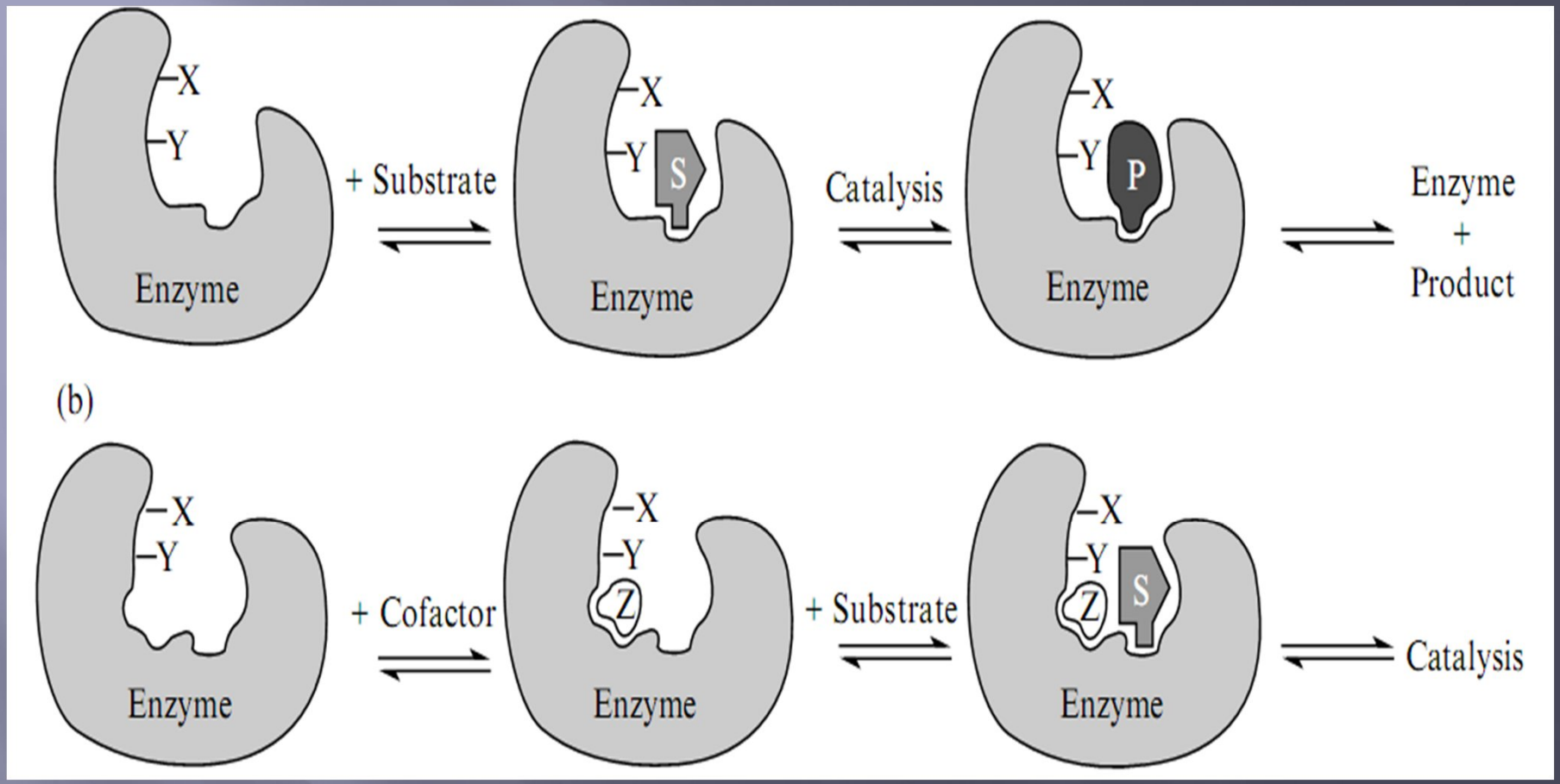

Fig. 2. Schematic figure of (a) enzyme plus substrate and (b) enzyme + substrate + cofactor (Bugg 2012).

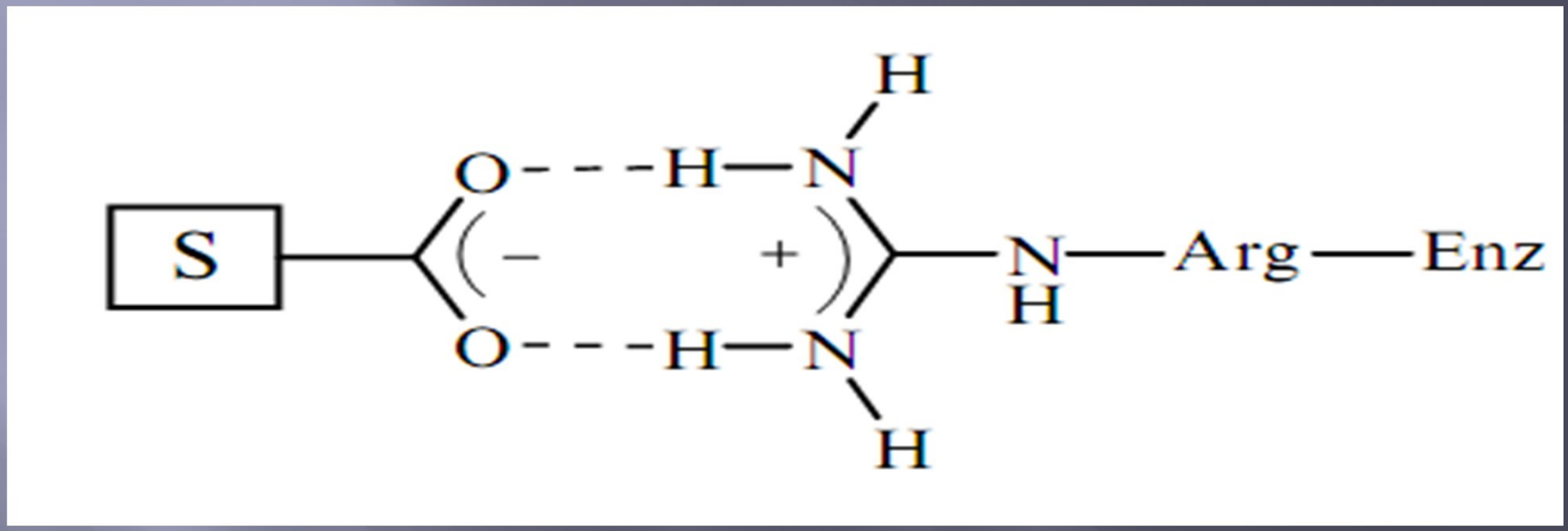

Fig . 2. Electrostatic enzyme–substrate interaction (Bugg 2012).

9. Enzyme concentration: Merely a little amount of enzyme is enough to bring about biochemical transformation as the same enzyme can be used again and again.

10. Turn-over Number (Efficiency): It is the number of substrate molecules transformed per minute per molecule of enzyme.

- The average turn-over number of common enzymes is 10^4-10^5. It is 200000 for urease, 5 million for catalase as well as 36 million for carbonic anhydrase.

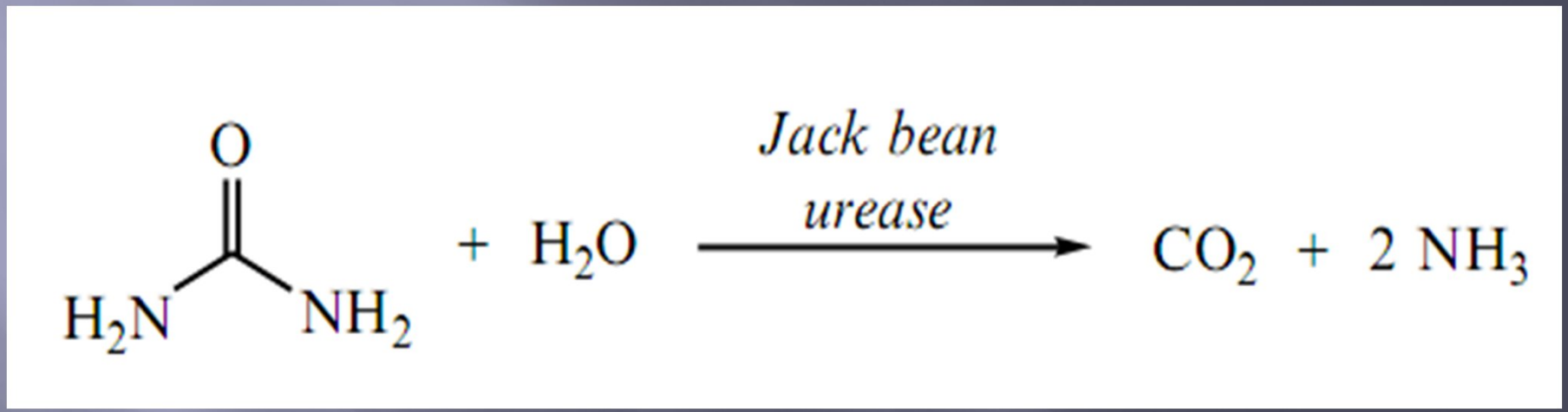

Fig. 3. Reaction catalyzed by the enzyme urease (Bugg 2012) .

11. Temperature Sensitivity: Each enzyme requires optimum temperature to act as temperature influences the enzyme catalyzed reactions.

- The majority of animal enzymes functions at optimum temperature range of 37-45 ^{0}C.
- Enzymes turn out to be inactive near freezing temperature as well as denatured above a certain temperature limit, for instance above 45 ^{0}C.
- The rate of chemical reaction increases with the increment in temperature due to enhancement towards the number of activated molecules. However, when temperature increases beyond a certain limit, the enzyme loses its catalytic activity as a result of the destruction of its tertiary structure.

12. pH Sensitivity: The activity of enzyme is significantly affected by pH value of surroundings.

- Extremely acidity or alkalinity generally causes irreversible destruction of the enzymes owing to their hydrolysis or denaturation.
- Aforementioned facts depicts that each enzyme has its optimum pH, where the maximum rapid catalytic activity take place.
- For instance, pepsin that functions in the acid medium of gastric juice has an optimum pH 2.0, while intracellular enzymes usually have a pH optimum near neutral pH.

13. Enzyme Specificity: Enzymes are specific in their actions, i.e., an enzyme catalyzes a alteration in a particular substrate with a particular linkage or a particular optical isomer. Lactose, maltose as well as sucrose are three disaccharides having the same formula $C_{12}H_{22}O_{11.}$ They are hydrolyzed by their particular enzymes, i.e., lactase (for lactose), maltase (for maltose) and sucrase (invertase for sucrose).

References

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