



Benha University
Faculty of Science
Department of Zoology

Biochemistry 1 (303 Z)

Semester: First Term

Date: 3/1/2017

Level: Third level

Sepe: Biotechnology

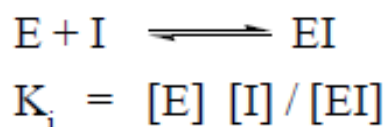
Exam time: 2:00 hours

Answer the following questions:-

Compare between:-

a) Competitive and non-competitive inhibition. (4 marks)

- **Competitive Inhibition:** Competitive inhibitors can combine reversibly with the active site of enzyme and compete with the substrate for binding with the active site. If the site is occupied by the inhibitor it is unavailable for the binding of the substrate. The competitive inhibitor always resembles the structure of the substrate. In some cases competitive inhibitors are exact structural analogues of the substrates. The combination of a competitive inhibitor (I) with enzyme (E) can be written in the same manner as combination with substrate, although the inhibitor cannot be chemically transformed to products.



K_i is equal to the dissociation constant for the enzyme – inhibitor complex EI.

The degree of inhibition depends upon the relative concentration of the substrate and the inhibitor. It also depends on the relative affinity of inhibitor towards enzyme active site. Thus, by increasing the substrate concentration we can decrease the degree of inhibition keeping inhibitor concentration at constant level.

The classic example is the inhibition of succinate dehydrogenase by malonate and other dicarboxylic acids. Succinate dehydrogenase is a



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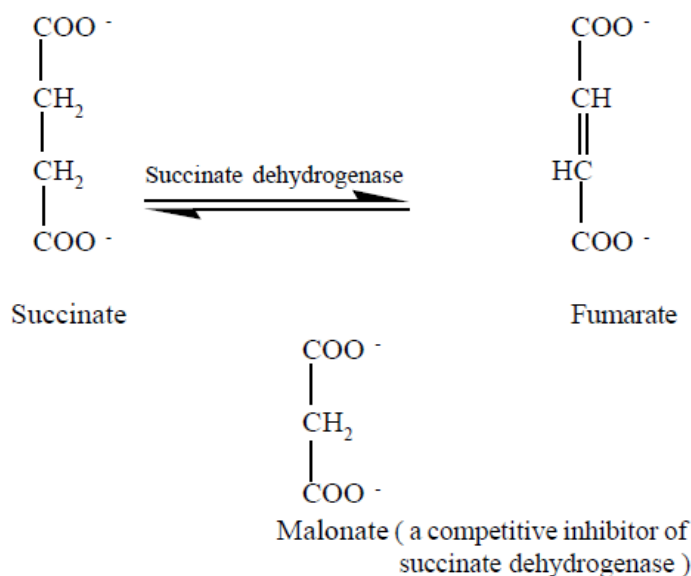
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member of the group of enzymes catalyzing the Krebs tricarboxylic acid cycle.



It catalyzes the removal of two hydrogen atoms from the two methylene carbon atoms of succinate. Succinate dehydrogenase is inhibited by malonate, which resembles succinate in having two ionized carboxyl groups.

Many micro organisms like bacteria synthesize the vitamin folic acid from para-aminobenzoic acid. Sulphanilamide and other sulfa drugs are structural analogs of para-aminobenzoic acid. So, sulfa drugs act as competitive inhibitor and occupy the active site of some bacterial enzyme catalyzing this reaction. When this reaction is affected, it blocks the folic acid biosynthesis which is essential for the



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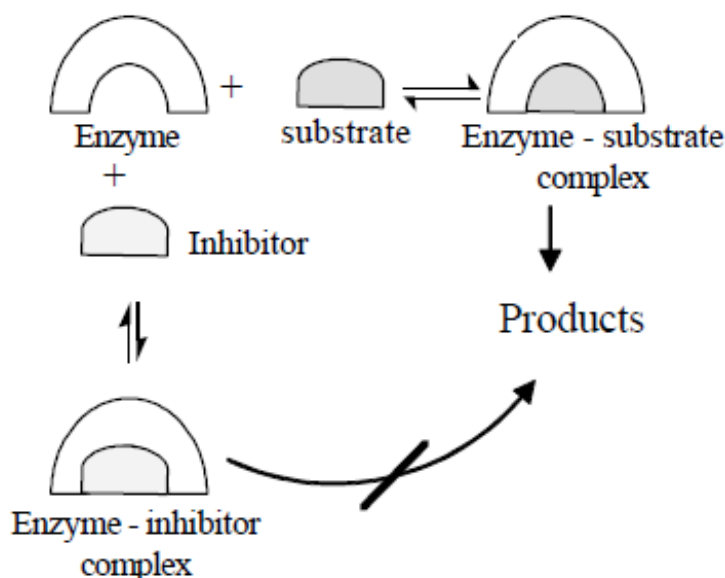
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growth of micro organisms, ultimately results in the death of the micro organisms. Thus, many sulfa drugs act as antibiotics.



- **Non-competitive Inhibition**

In this type of inhibition no competition occurs between the substrate and the inhibitor and the inhibitor has no structural resemblance with the substrate and it binds with the enzyme at a place other than the active site. Since I and S may combine at different sites, formation of both

EI and ESI complexes take place. The enzyme is inactivated when inhibitor is bound, whether the substrate is present or not. Non competitive inhibition in contrast to competitive inhibition cannot be overcome by increasing substrate concentration. For example various heavy metal ions such as Ag^{2+} , Hg^{2+} , Pb^{2+} inhibit the activity of a variety of enzymes. Urease can be inactivated by any one of these metal ions.



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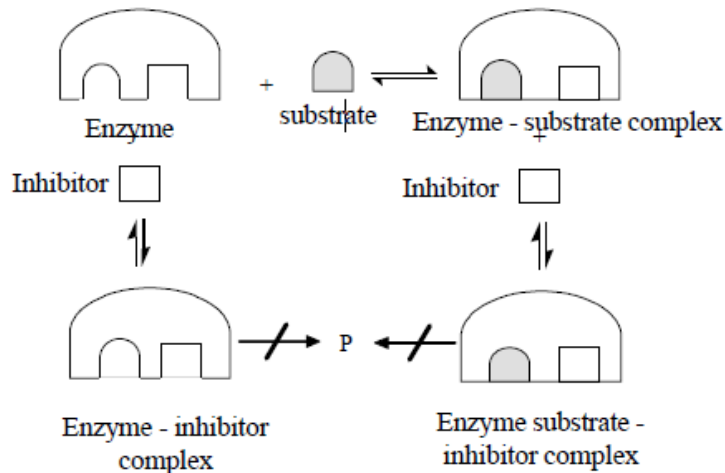
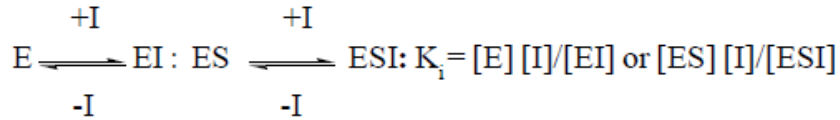
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b) Lyases and ligases. (3 marks)

Lyases (class 4) often also referred to as “synthases” catalyze reactions involving either the cleavage or formation of chemical bonds, with double bonds either arising or disappearing.

The ligases (class 6) also referred to as “synthetases” the ligation reactions catalyzed by ligases are energy-dependent and are therefore always coupled to the hydrolysis of nucleoside triphosphates.

1- Define the following:- (8 marks)

- Transamination:** The process of transfer of an amino group from an amino acid to a keto acid, resulting in the formation of a new amino acid and keto acid
- Ribozymes:** catalytically active ribonucleic acids.

2- Explain the following:- (9 marks)



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- a) **Proline differs from other amino acids** in that proline's side chain and α -amino N form a rigid, five-membered ring structure. Proline, then, has a secondary (rather than a primary) amino group. It is frequently referred to as an imino acid. The unique geometry of proline contributes to the formation of the fibrous structure of collagen, and often interrupts the β -helices found in globular proteins.
- b) **All amino acids are optically active except the glycine.** Because it's α -carbon has two hydrogen substituents and, therefore, is optically inactive.
- c) **The dipolar nature of amino acids gives them some unusual properties:**
1. Amino acids have high melting points, generally over 200 °C.
 2. Amino acids are more soluble in water than they are in ether, dichloromethane, and other common organic solvents.
 3. Amino acids are less acidic than most carboxylic acids and less basic than most amines.