فسيولوجيا الأحياء الدقيقة
Microbial Physiology

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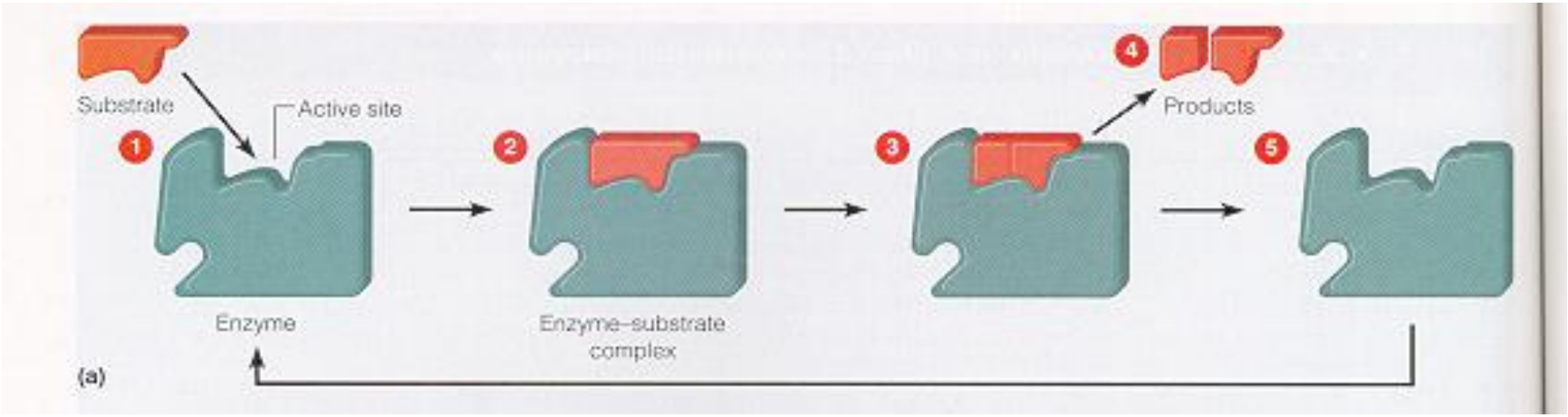
مكتب ٢ ب ٤٥

Physiological Adaptation
L 12

Enzymes - catalysts that speed up and direct chemical reactions

- A. Enzymes are substrate specific
  - Lipases — Lipids
  - Sucrases — Sucrose
  - Ureases — Urea
  - Proteases — Proteins
  - DNases — DNA

Enzyme Specificity can be explained by the Lock and Key Theory



E + S -----> ES ------> E + P

Naming of Enzymes - most are named by adding “ase” to the substrate

• Sucrose	Sucrase
• Lipids	Lipase
• DNA	DNase
• Proteins	Protease
• Removes a Hydrogen	Dehydrogenase
• Removes a phosphate	Phosphotase

Naming of Enzymes

- Grouped based on type of reaction they catalyze
  - 1. Oxido-reductases — Oxidation & Reduction
  - 2. Hydrolases — Hydrolysis
  - 3. Ligases — Synthesis

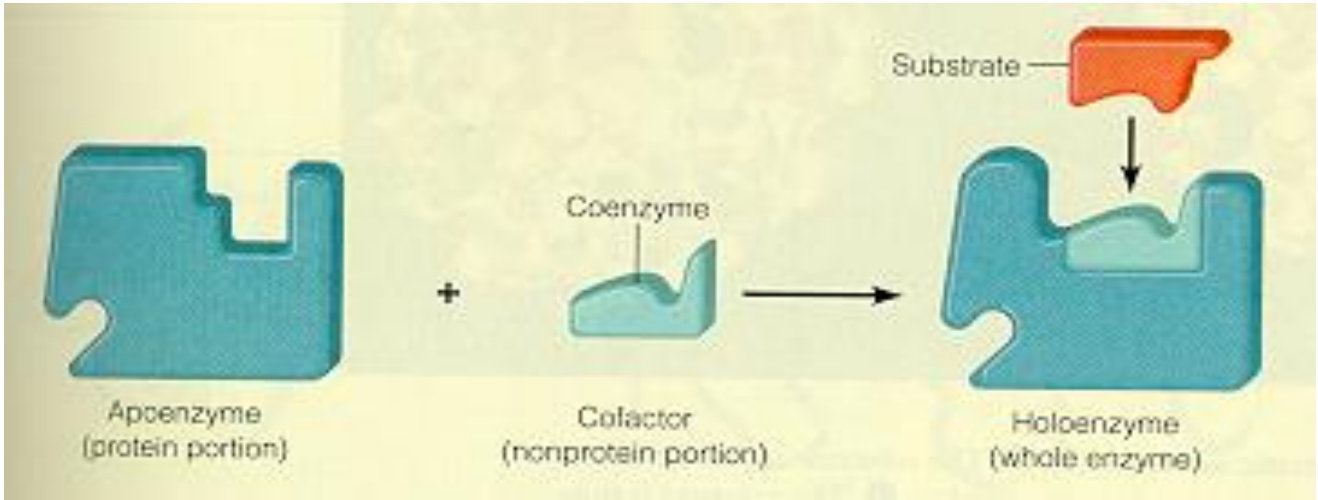
More about Enzymes

- Sometimes an enzyme needs help:
  - Protein alone = apoenzyme
  - Helper molecule: cofactor
    - Could be inorganic like a metal ion (Fe^{+2})
    - Could be organic coenzyme (like CoA, NAD "nicotinamide adenine dinucleotide").
  - Cofactors have an effect on nutrition:
    - Bacteria have certain mineral requirements.
    - Vitamins are cofactors that are needed in the "diet".

Enzyme Components - 2 Parts

1. Apoenzyme - protein portion
2. Coenzyme (cofactor) - non-protein
3. *Apoenzyme* + *cofactor* = **holoenzyme**.

Holoenzyme - whole enzyme



Enzymes can be stopped

- Conditions that disrupt the 3D shape
  - Acidic, alkaline, high salt, high temperature, etc.
  - These conditions thus affect growth of cell also.
- Inhibitory molecules affect enzymes
  - Competitive inhibitors
    - Fit in active site but are not changed; prevent normal substrate from binding, prevent reaction.
  - Non-competitive inhibitors
    - Bind permanently to active site or other site which changes molecular shape; prevents reaction.
  - Allosteric inhibitor: temporary binding, regulates.

Competitive Inhibitors -compete for the active site

- **1. Penicillin**
  - Competes for the active site on the enzyme involved in the synthesis of the pentaglycine crossbridge
- **2. Sulfanilamide** (**Sulfa Drugs**)
  - Competes for the active site on the enzyme that converts 4-Aminobenzoic acid (also known as ***p****ara*-**a**mino**b**enzoic **a**cid) PABA into Folic Acid
    - Folic Acid - required for the synthesis of DNA and RNA

QUESTIONS??