FACTORS AFFECTING
ENZYMATIC ACTIVITY

Learning objectives:

- Factors Affecting Enzymatic Activity
  - Temperature
  - Water
  - Hydrogen ion Concentration (pH)
  - Concentration of Substrate
  - Concentration of Enzyme
  - Inhibitors
  - Accumulation of End-products
  - Effect of activators
  - Effect of light and radiation

FACTORS AFFECTING ENZYMATIC ACTIVITY

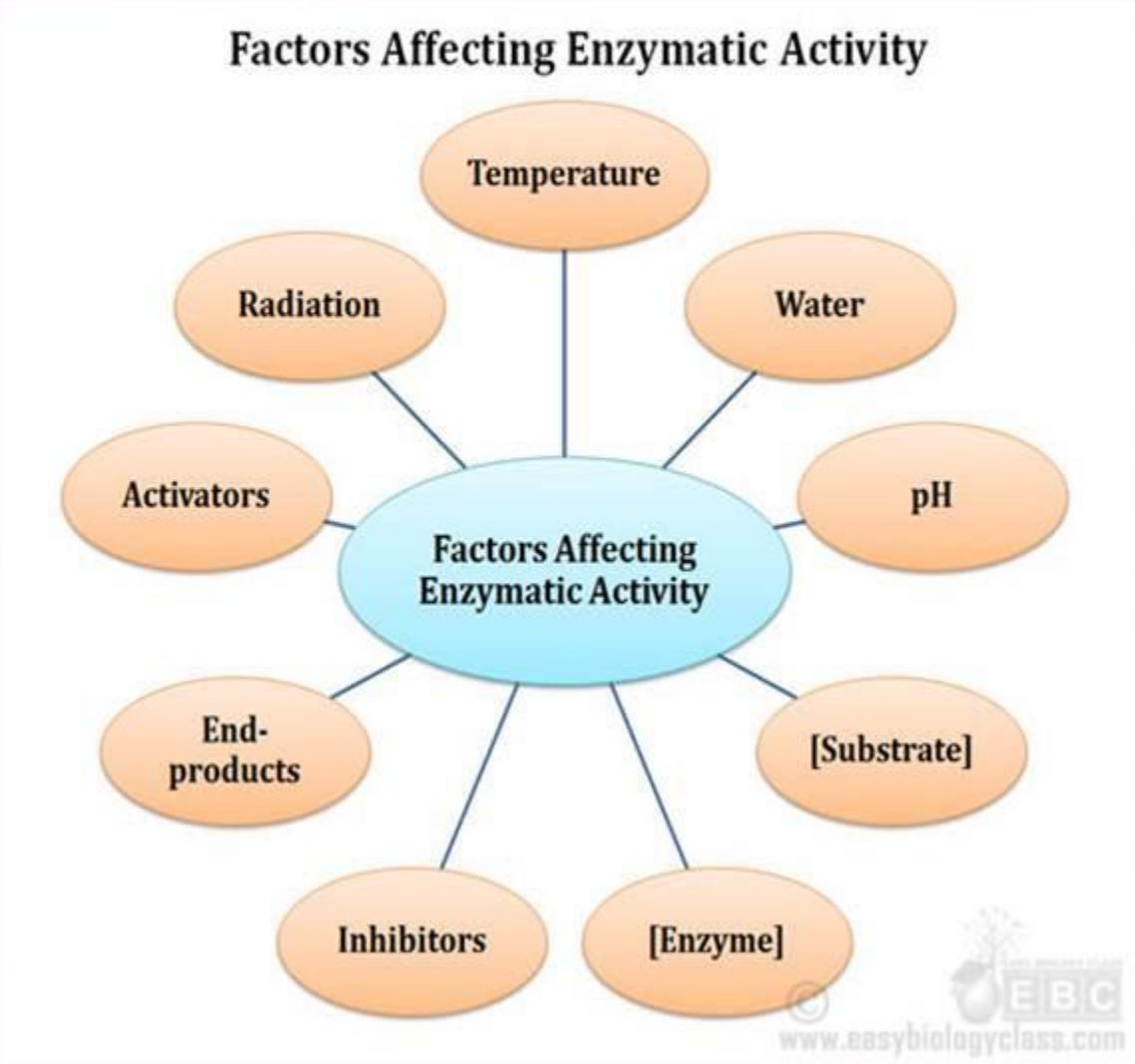
Factors Affecting Enzymatic Activity

- The catalytic activities of enzymes are affected many factors.
- They can be summarized as:

1. **Temperature**
2. **Water**
3. **Hydrogen ion Concentration (pH)**
4. **Concentration of Substrate**
5. **Concentration of Enzyme**
6. **Inhibitors**
7. **Accumulation of End-products**
8. **Effect of activators**
9. **Effect of light and radiation**

FACTORS AFFECTING ENZYMATIC ACTIVITY

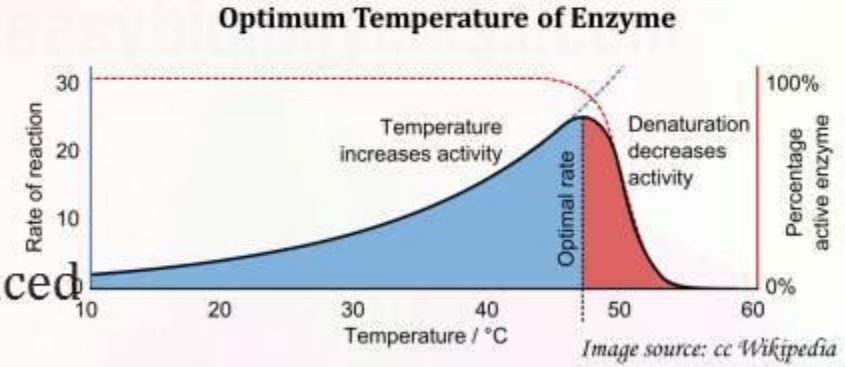
Factors Affecting Enzymatic Activity



FACTORS AFFECTING ENZYMATIC ACTIVITY

(1). Temperature

- Enzyme activity will be optimum at normal temperature
- Each enzyme will have an optimum temperature
- At very low temperature the activity will be minimal
- Increase in temperature (up to a certain limit) can increase the enzyme's catalytic activity.
- The maximum activity is at 30 to 45°C
- Beyond 45°C the enzyme activity reduced
- Beyond 60-70°C the enzymes were denatured



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(2). Water

- Enzymatic activity is suppressed in the absence of water
- In dry seeds, the enzymes are almost inactive
- Hydration of the cells are necessary for the enzymatic activity
- Water provides a medium for the enzymatic reaction to take place.
- In many cases the water is one of the reactant

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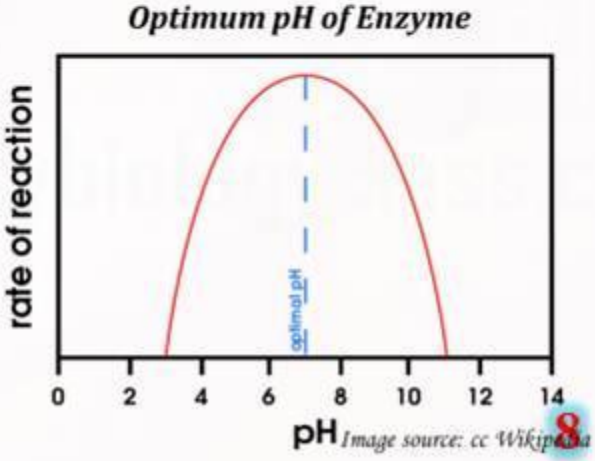
(3). Hydrogen Ion Concentration (pH)

- Enzymes are active only over a limited rage of pH
- Most of the enzymes are specific to particular pH
- Example:
  - **Trypsin** are active in alkaline medium
  - **Diastase** is active in neutral medium
  - **Pepsin** show optimum activity acidic pH



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(4). Concentration of Substrate

- Increase in substrate concentration increase the activity of enzyme until all the active sites of the enzyme molecule are saturated with the substrate.
- After this saturation point the rate of enzymatic reaction becomes steady
- Then, the addition of the substrate will not have any positive effect

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(5). Concentration of Enzyme

- Enzymes have extraordinary catalytic power.
- A small amount of enzyme is enough for large amount of substrates
- Increase in the concentration of enzyme will increase the rate of reaction (if there is enough substrates)
- Increased number of enzyme molecules will have more active sites
- At high concentration of the enzyme, the effect of inhibitors will be less

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(6). Accumulation of end products

- End product accumulation retards the enzymatic activity
- The active sites of enzymes become crowded with the products
- Thus, the substrate molecules will have comparatively lesser chances of combining with the active sites
- Inhibition by the end products is also a regulation mechanism such as Feed Back Inhibition or Allosteric Modulation

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(7). Inhibitors

- Inhibitors in the reaction can inhibit enzymatic activity
- Type of inhibition depends on the nature of the inhibitor
- Inhibitors are less effective when concentration of enzyme and substrate is higher in the medium
- Inhibitors are of different types

1. **Competitive inhibitor**
2. **Non competitive inhibitors**
3. **Uncompetitive inhibitors**

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(8). Effect of Activators

- Some enzymes require additional molecules for its optimum activity (generally known as prosthetic groups or co-factors).
- The prosthetic groups may be inorganic metal ions such as Mg2+, Cu2+, Ca2+, Na+, K+ etc. or complex organic vitamin derivatives such as NAD, FAD etc.
- In the case of allosteric enzymes, there are molecules called allosteric modulators or effectors. The binding of these modulators to a specific site in the enzyme will cause more activated or less activated forms of enzymes and thereby it can regulate the overall enzymatic reactions.

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(9). Effect of light and radiation

- Some enzymes are sensitive to light.
- Some enzymes require the presence of light for its catalytic activity.
- Example: Photolyase enzyme involved in the Photoreactivation DNA repair require light for its enzymatic activity.
- Usually, enzymatic activity is reduced under the influence of harmful radiations such as X-rays, UV rays, β and γ rays.
- Under these radiations, peroxides are formed which will cause oxidative stress.

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