



B11: Analyze the role of enzymes in biochemical reactions

ENZYMES

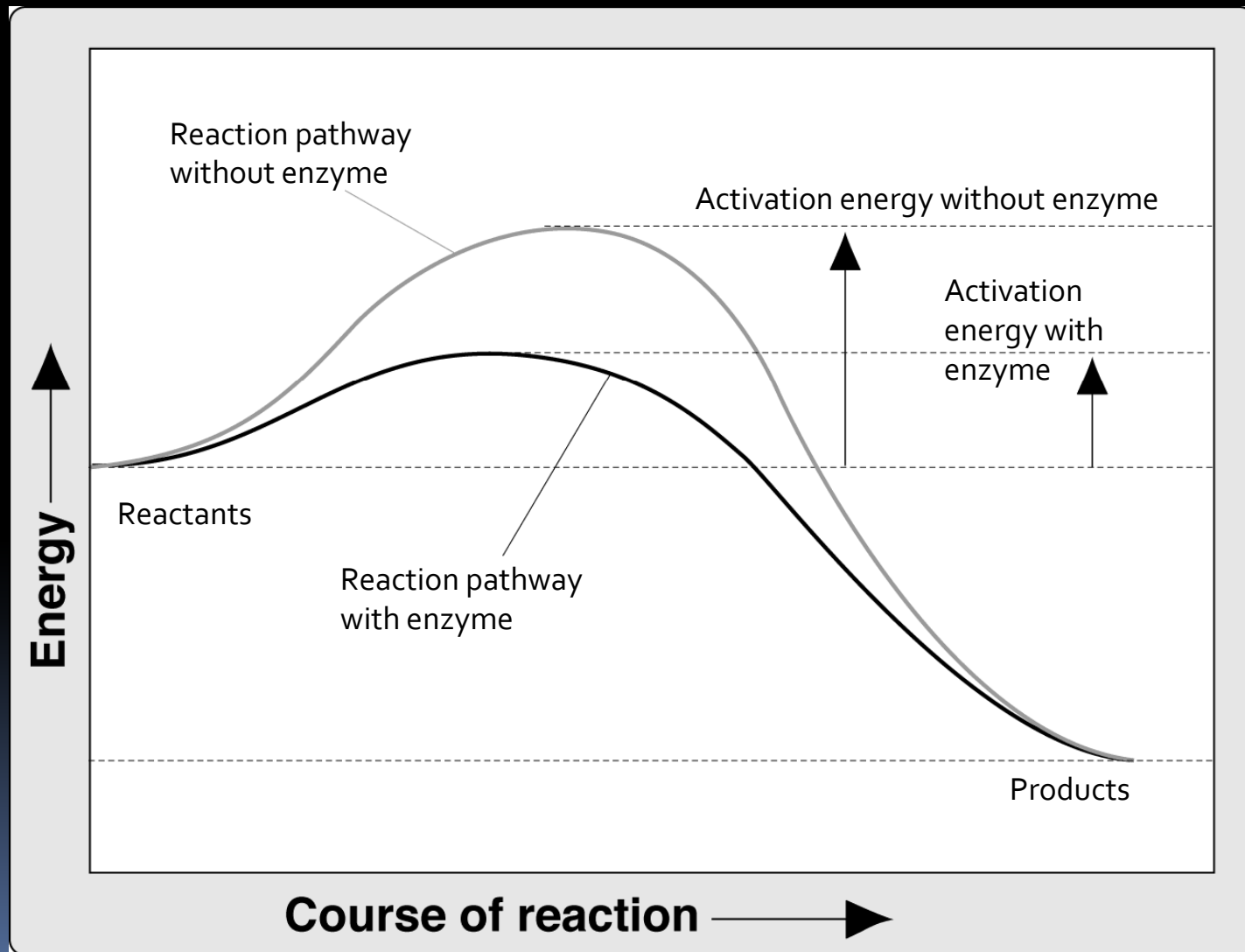
Terminology:

- 1. **Metabolism**: a term used to describe the total activity in the cells of the body
- 2. **Catalyst**: a substance that speeds up the rate of a chemical reaction
- 3. **Enzyme**: a protein that catalyzes reactions within biological organisms

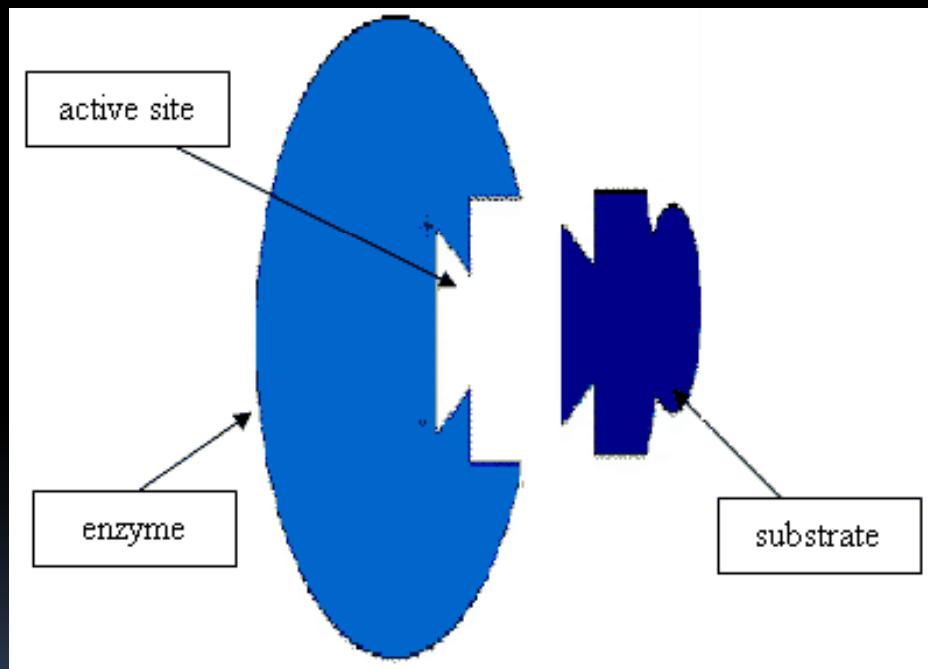
Terminology p.2

- 4. **substrate**: the molecules that react with enzymes are called substrates
- 5. **coenzyme**: non-protein organic molecules that help enzymes to catalyze reactions
- 6. **activation energy**: the amount of energy required for a reaction to proceed

Enzymes & Activation Energy



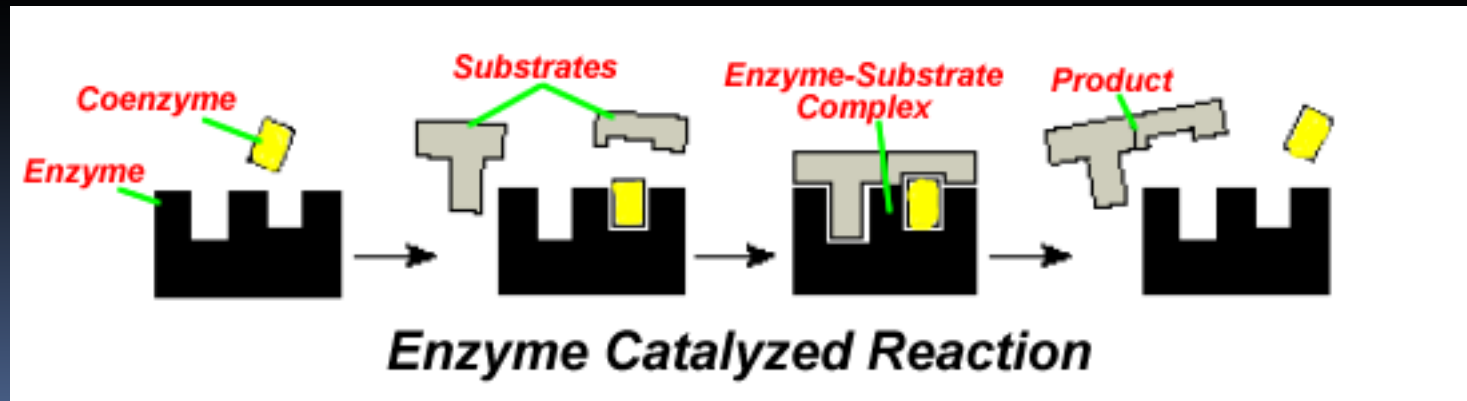
Enzyme Structure



- Enzymes are large tertiary protein molecules
- Each enzyme has an active site with a unique shape
- The active site is where the substrate will attach

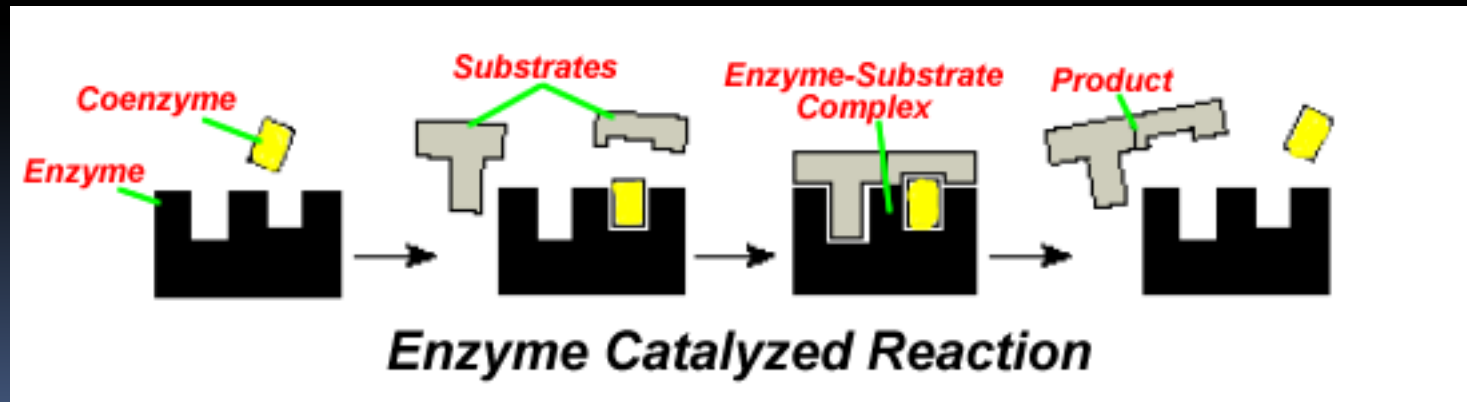
Lock & Key / Induced Fit Model

- Substrates are the reactants
- The substrate(s) fit into the active site of the enzyme like a **KEY** fits into a **LOCK**
- Only one specific substrate is acted upon by any single enzyme
- The enzyme is not changed by the reaction



Lock & Key / Induced Fit

- 'Induced fit' refers to the idea that when the enzyme-substrate complex is formed it forces the substrate into a different shape (perhaps by bending the molecule) which leads to the reaction.





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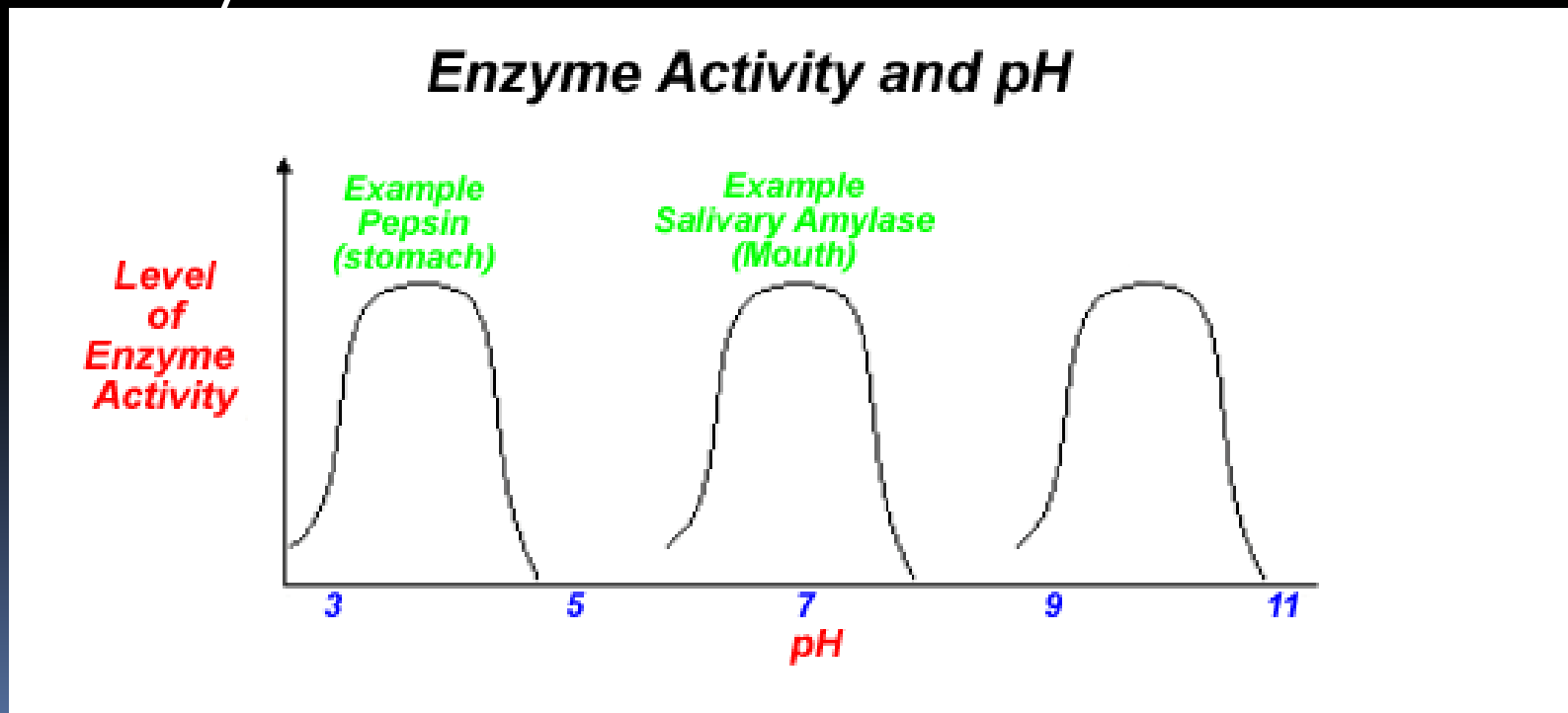
Enzymatic Reactions

Cofactors & Coenzymes

- **Cofactors** are non-protein molecules or ions required for proper enzyme function
- **Coenzymes** are organic cofactors
- **Vitamins** are often part of a coenzyme
- Lack of a particular vitamin in the diet can lead to a shortage of a particular coenzyme and therefore a lack of certain enzymatic reactions

pH & Enzyme Activity

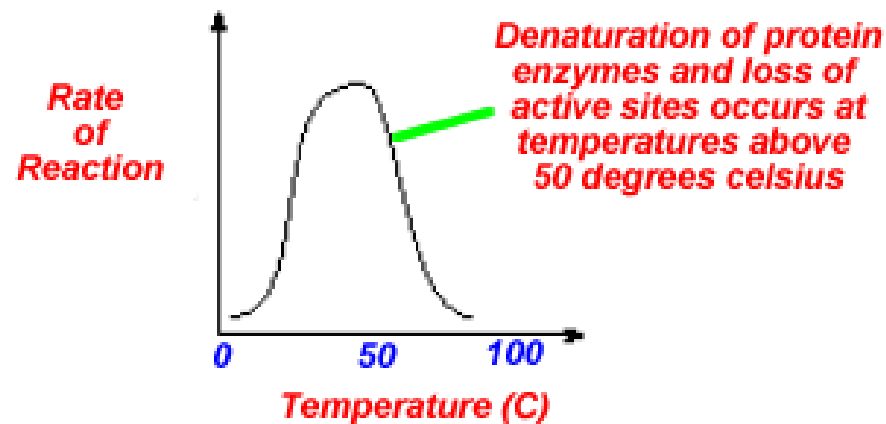
- Each enzyme has an optimal pH (a pH where it functions best)
- Large changes in this pH can denature the enzyme



Temperature & Enzyme Activity

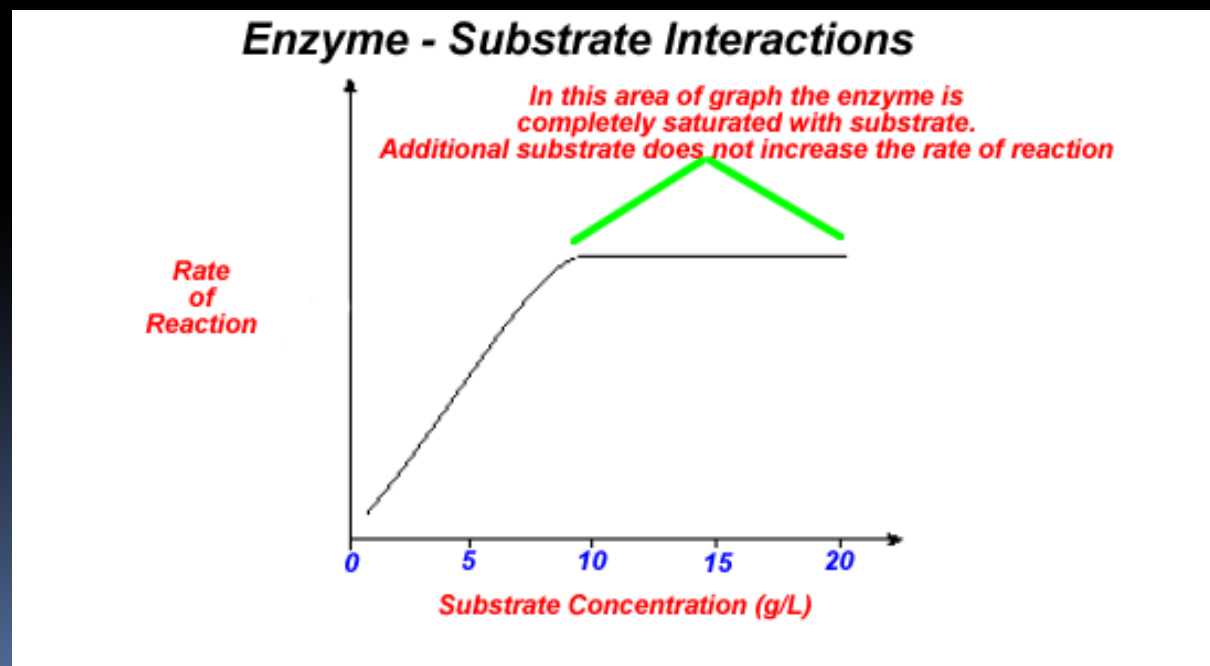
- Each enzyme has an optimal temperature
- In humans this is generally about 37°C

Enzyme Activity and Temperature



Substrate Concentration

- The amount of substrate can limit the reaction rate
- As substrate concentration increases reaction rate will increase until all enzymes are 'full'



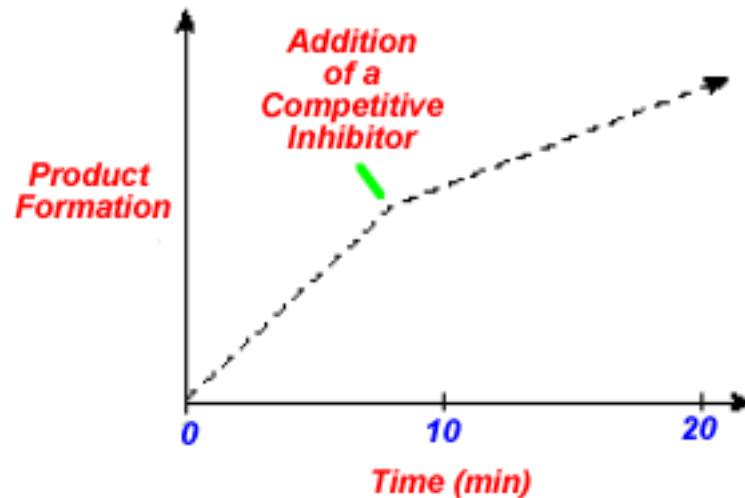
Enzyme Concentration

- In a reaction where there is an excess amount of substrate the reaction rate can be increased by adding more enzyme

Competitive Inhibitors

- A competitive inhibitor competes with the substrate to bond with the active site
- As long as a competitive inhibitor is attached to the active site the enzyme will not function

Enzyme Activity and Competitive Inhibitors



Heavy Metals & Enzyme Activity

- Heavy metals such as lead and mercury can interfere with the bonds between R-groups in the enzyme
- This causes the active site to denature (change shape)
- The denatured enzyme will no longer function
- These heavy metals are called non-competitive inhibitors.

Thyroxin

- Controls a person's metabolic rate
- This hormone is produced by the thyroid gland (located in the neck)
- Thyroxin does not have a specific target organ like many hormones
- Stimulates all cells in the body to burn more glucose and oxygen to make more ATP available for the cells to use
- The overall effect is an increase in metabolism by all cells.

