

# Lab 2: Enzymes

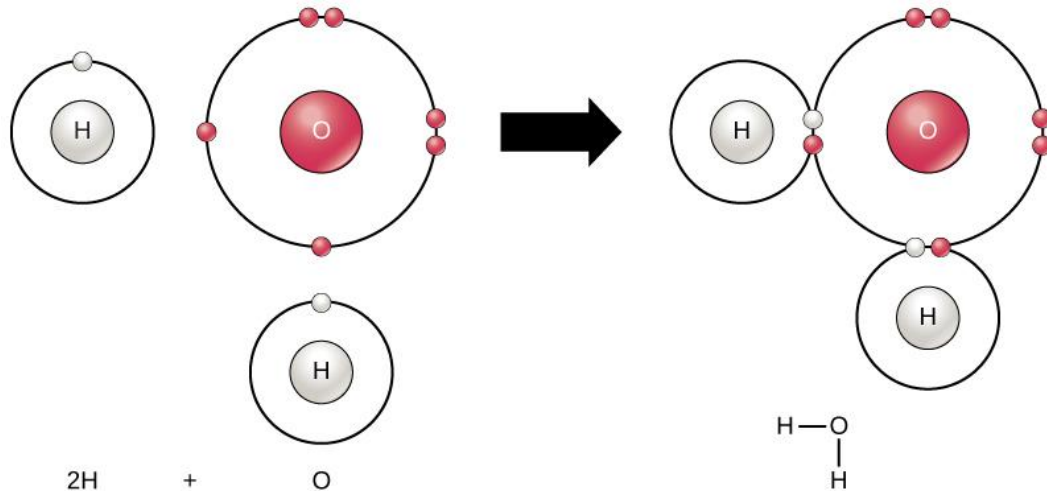
4-6-16

# Announcements

- Pre-lab 2 due now
- Quiz 1 is today (after this)
  - Topics:
    - Biology and living organisms
    - Scientific method
    - Macromolecules

# What is a chemical reaction?

- A chemical reaction is a process that forms or breaks the chemical bonds that hold atoms together
  - Chemical reactions allow elements to fill their outermost shell by sharing

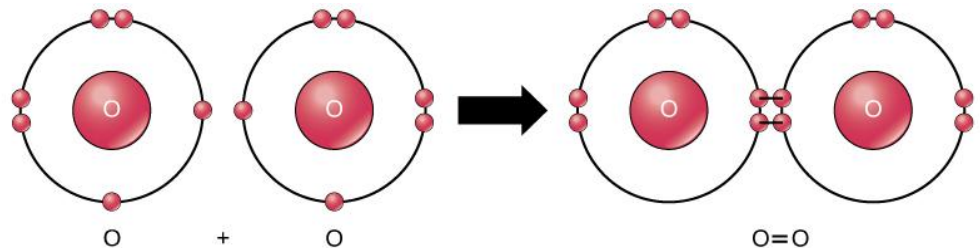
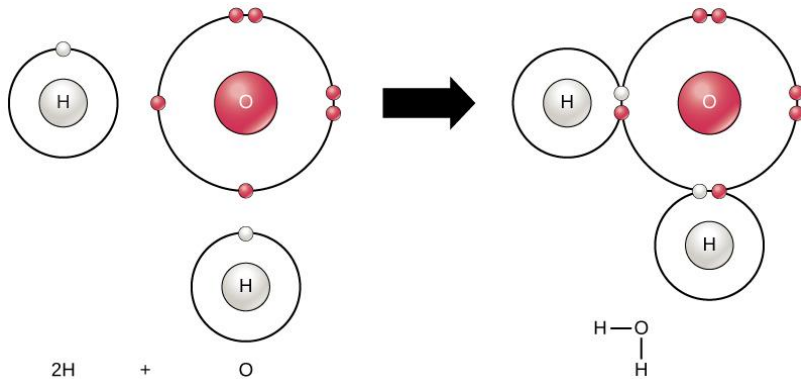


# What is a chemical reaction?

- A chemical reaction is a process that forms or breaks the chemical bonds that hold atoms together
  - Chemical reactions convert one set of chemical substances, **the reactants**, into another set, **the products**

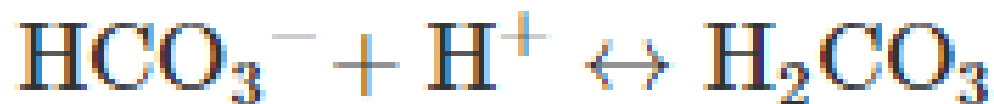
# Reactions can be reversible or irreversible

- When the reactions can proceed in one direction until the reactants are all used up are called **irreversible reactions**



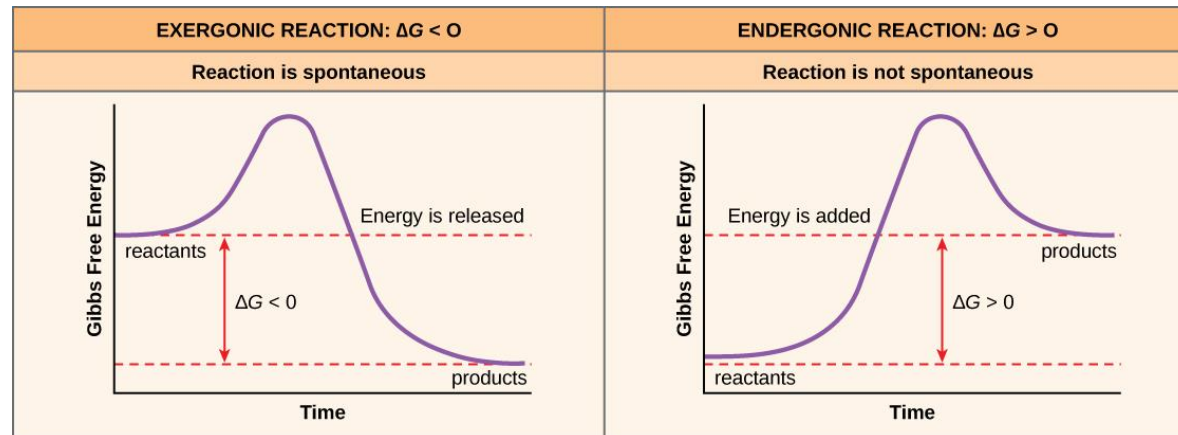
# Reactions can be reversible or irreversible

- When the concentration of product goes beyond a certain threshold, some of these products will be converted back into reactants
- This back and forth continues until an **equilibrium** is reached



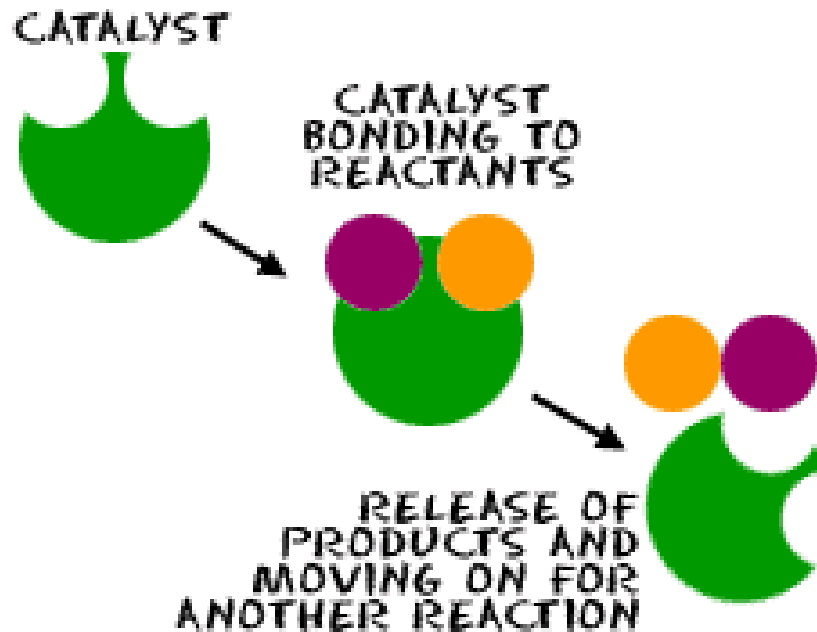
# Types of chemical reactions

- All chemical reactions either release energy (break a bond) or require a net input of energy (create a bond)
  - **Exergonic:** release energy (aka spontaneous reactions)
  - **Endergonic:** require energy



# What are catalysts?

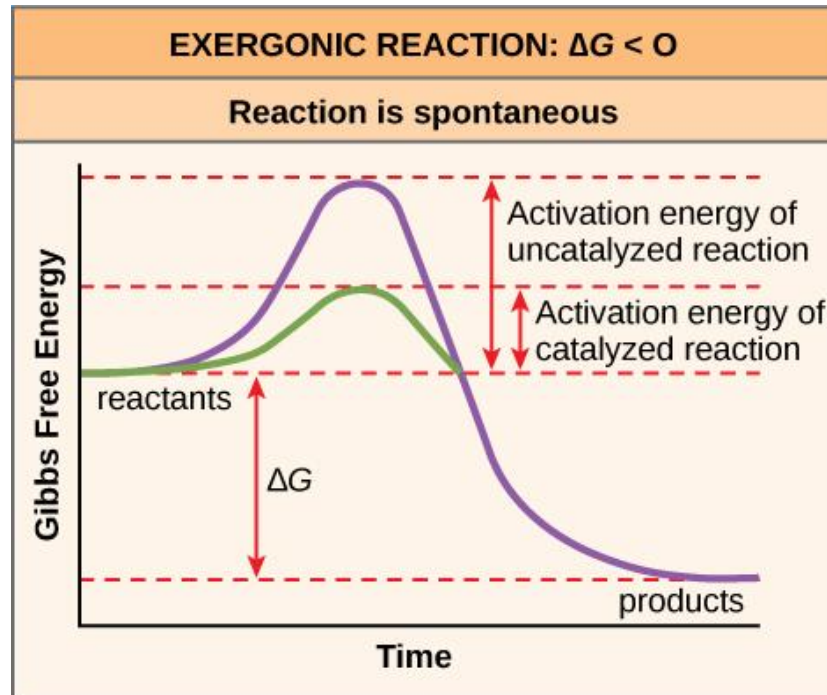
- Catalysts are molecules that speed up the rate of reaction w/out being used up or permanently altered





# What do catalysts do?

- Catalysts speed up the reaction by lowering up the activation energy required for the reaction to begin

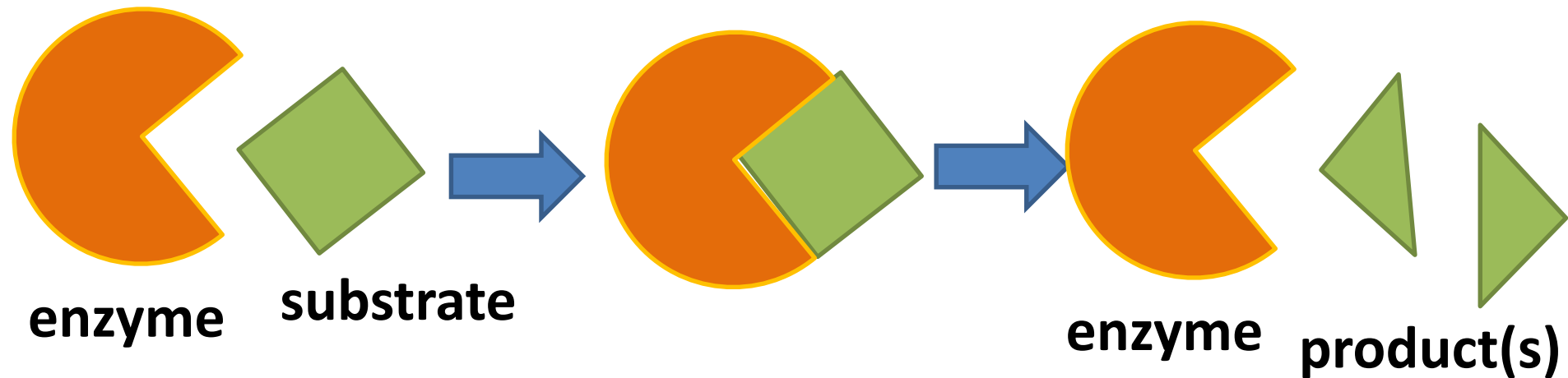


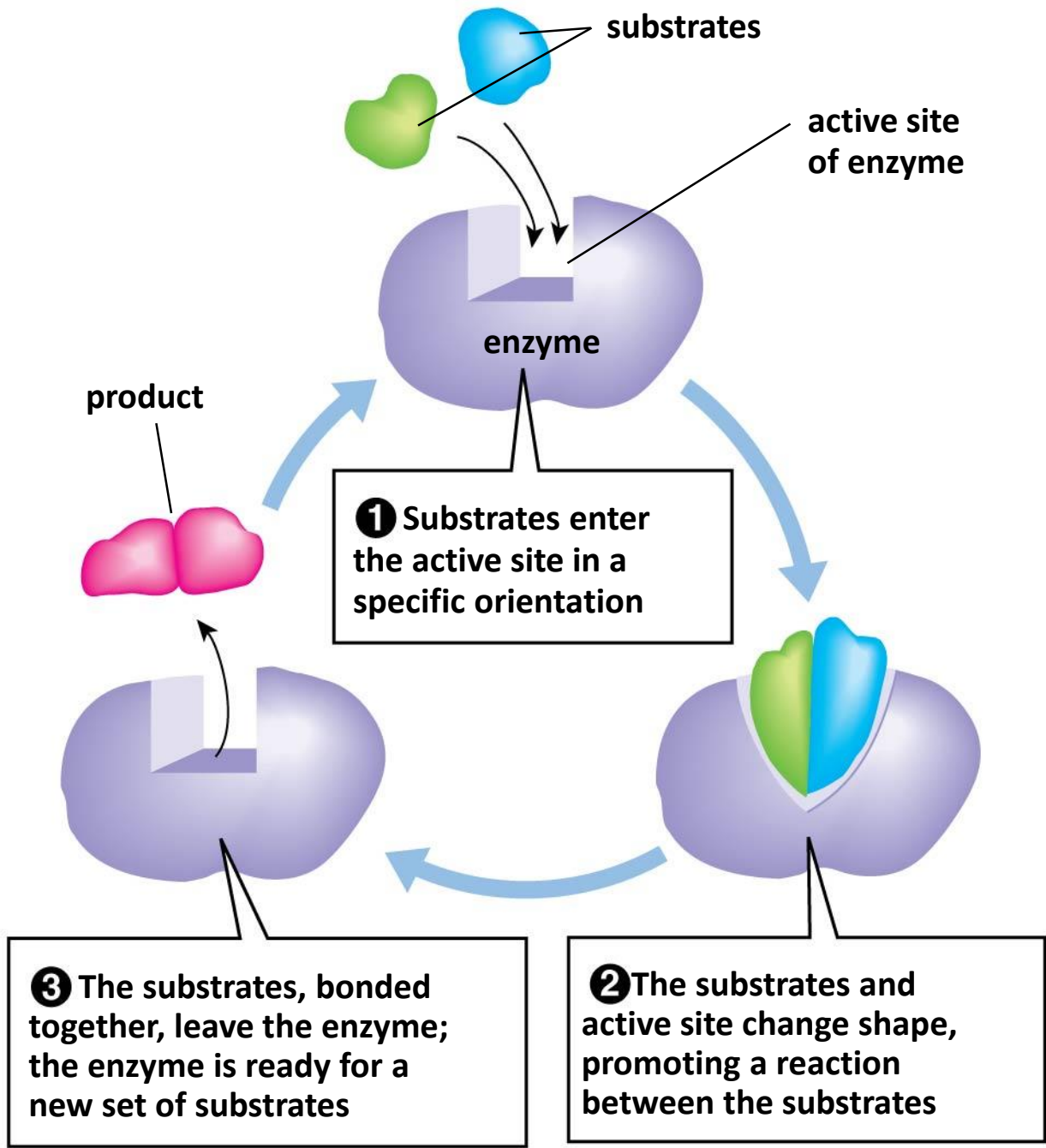
# Activation energy

- A small amount of energy needed for exergonic reactions to occur ( $E_A$ )
- Bonds that will break and release energy need to get into the correct state
- This contorted state is called the **transition state**
  - High-energy
  - Unstable

# What are enzymes?

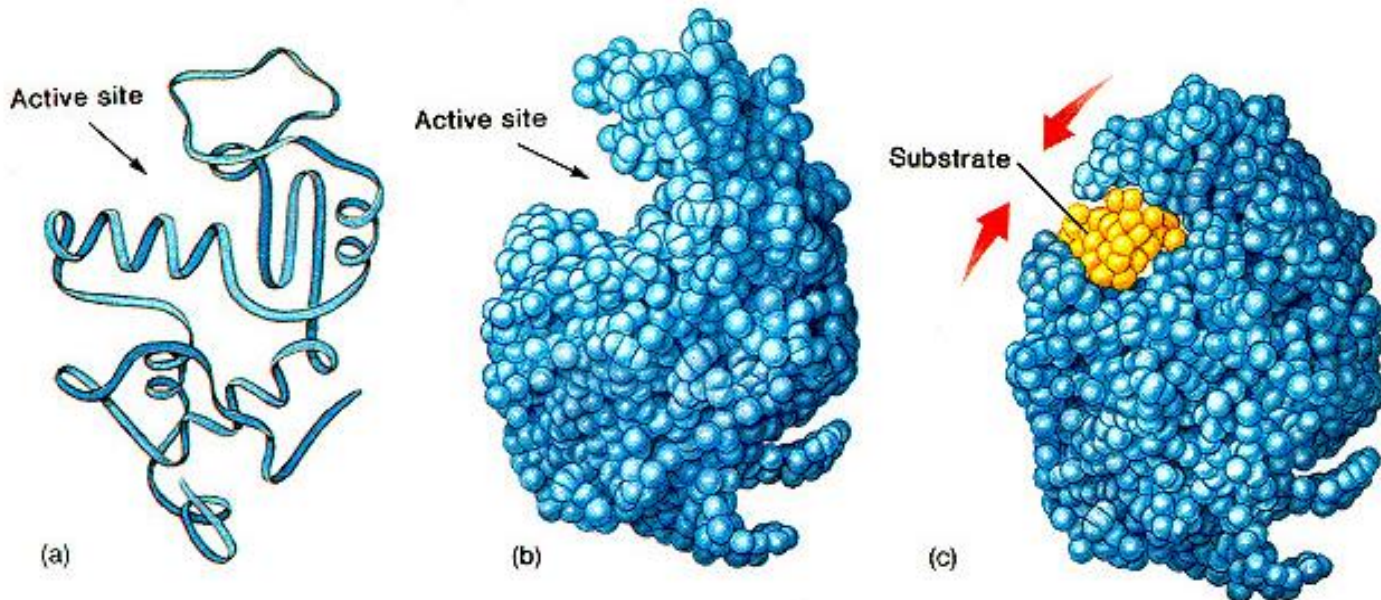
- Biological catalysts
- Mainly proteins
- They speed up only exergonic reactions
- The majority catalyze one single reaction
  - Leaving similar substrates unchanged





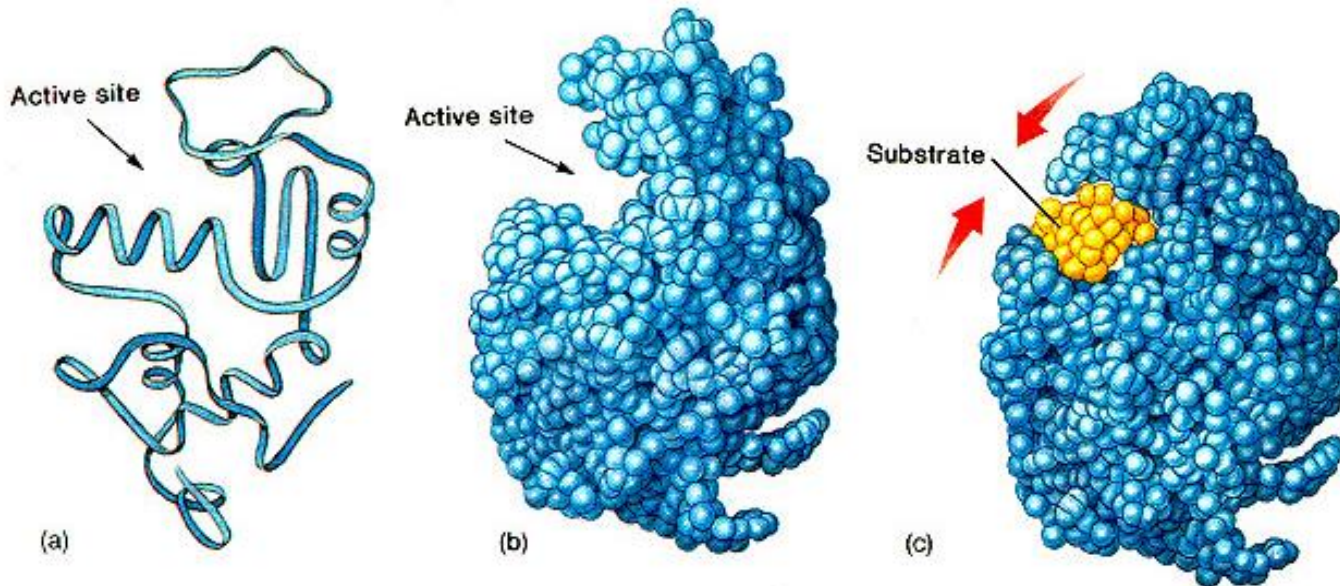
# Enzyme structures allow them to catalyze specific reactions

- Each enzyme has a pocket called an **active site** into which one or more reactant molecules, called **substrates**, can enter



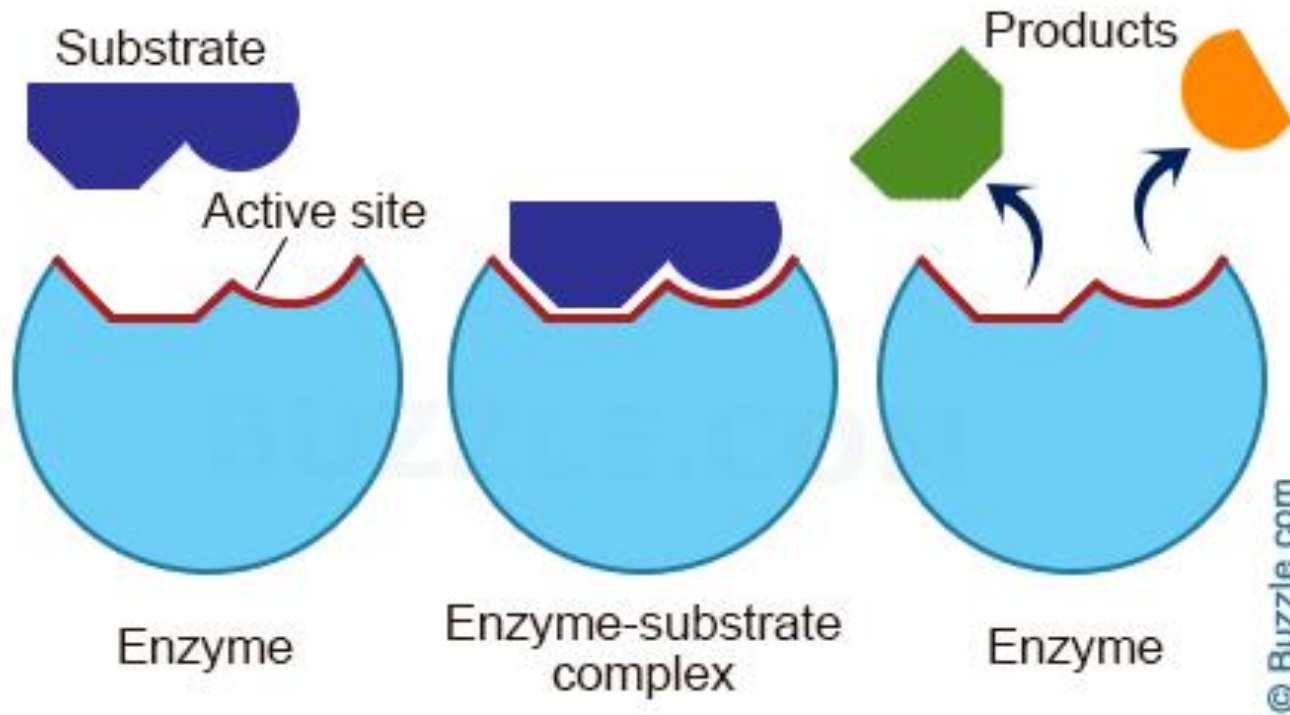
# Enzyme structures allow them to catalyze specific reactions

- The amino acid sequence + folding of the protein chains → **distinctive shape** and distribution of **electrical charge**



# Enzyme structures allow them to catalyze specific reactions

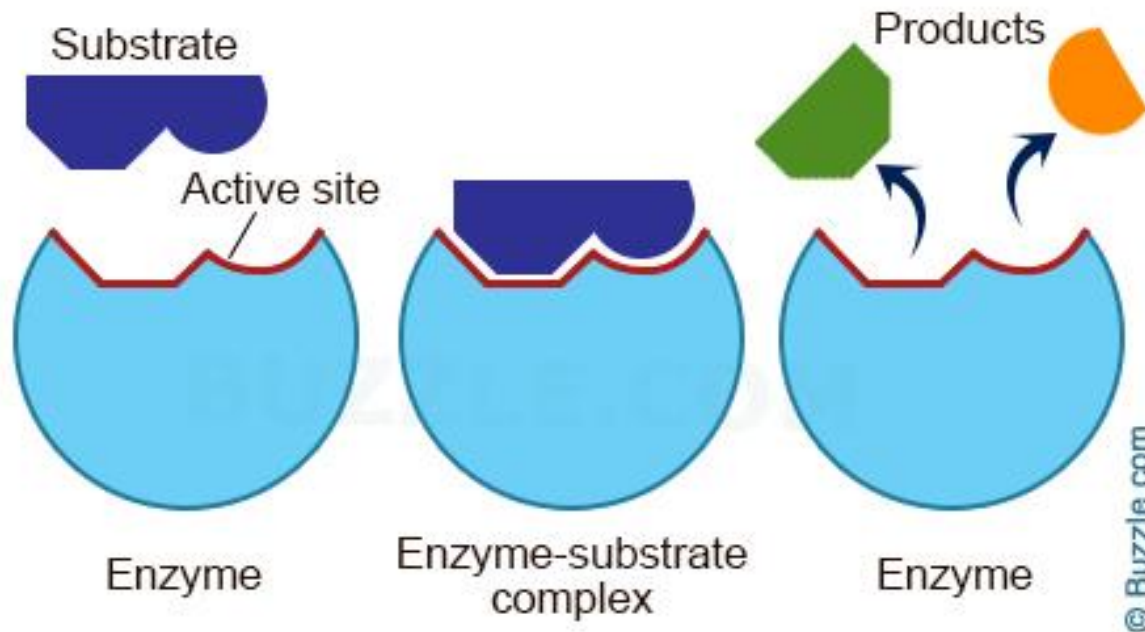
- The distinctive shape of the active site is both **complementary** and **specific** to the **substrate**





# Enzyme structures allow them to catalyze specific reactions

- In summary, active site amino acids bind to the substrate and distort bonds to facilitate a reaction





# Enzymes are proteins, so...

- What is it called when a protein loses its shape and hence its function?
- What can cause that?

# Enzymes are affected by the environment

- High temperatures
- Changes in pH
- Concentration

# Learning Goals For Today:

- From lab packet:
  - Look at some of the roles enzyme play in biological systems
  - Explore conditions that may limit enzyme activity
  - See the effects of enzyme activity on polymers
  - Think through the concepts of enzyme specificity

# Lab today:

- Part 1: Lactase
  - Observing the activity of a human enzyme
- Part 2: Catalase
  - To explore the real impacts of environmental change on enzyme activity

# Lactose Intolerance

