Chemical Reactions & Enzymes

Biology Bellringer:

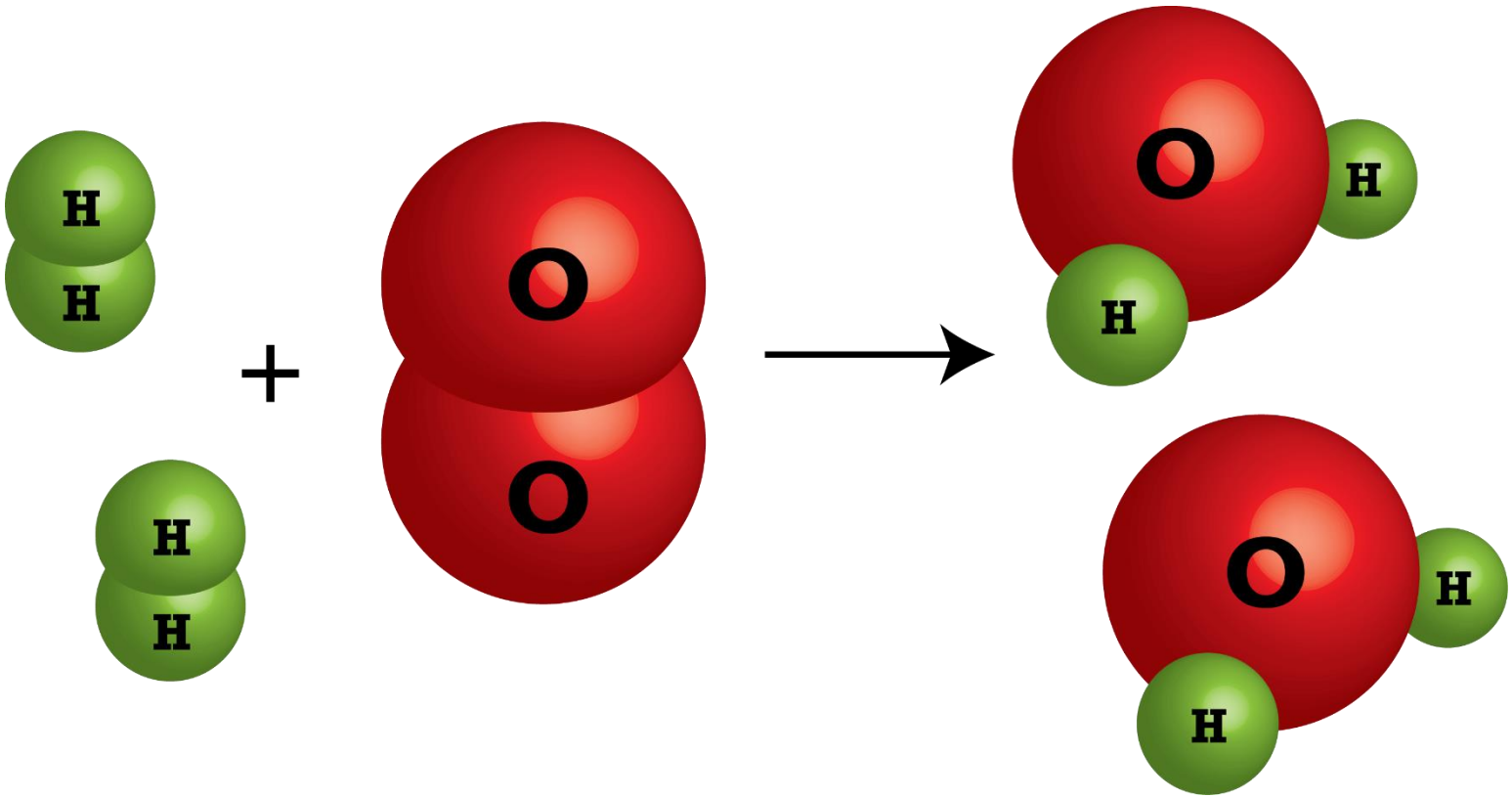
What chemical reactions are happening in your body right now?

What is the term for the chemical reactions that happen in your body?

Chemical Reactions

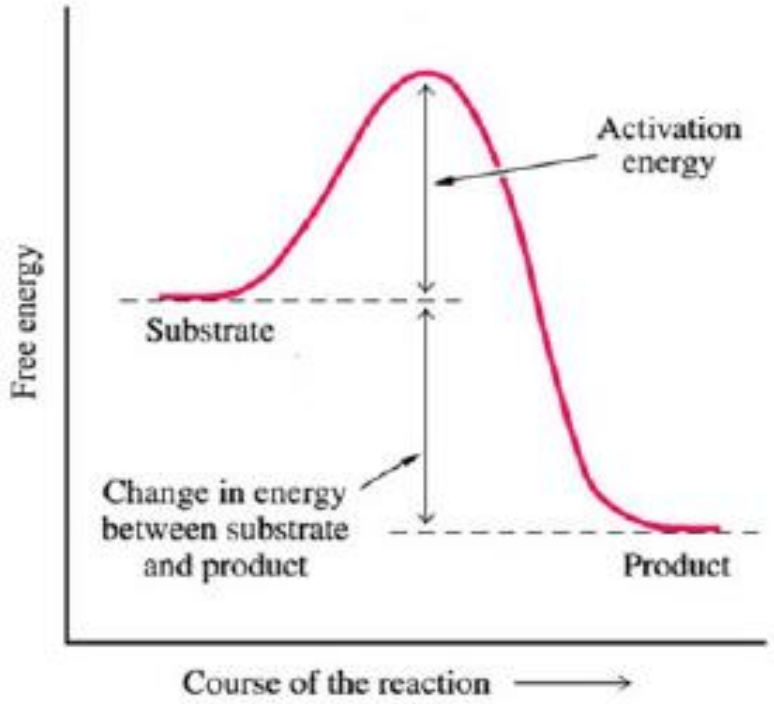
- A **chemical reaction** is a process that changes, or transforms, one set of chemicals into another by changing chemical bonds.
- Parts of a Reaction
  - **Substrates (a.k.a. Reactants)**
  - **Products**
- Reactants enter a chemical reaction and are turned into products

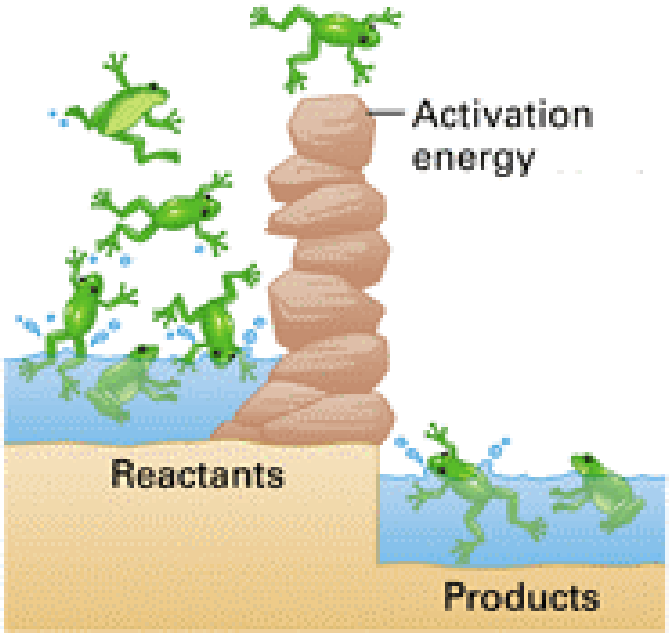
A chemical reaction:



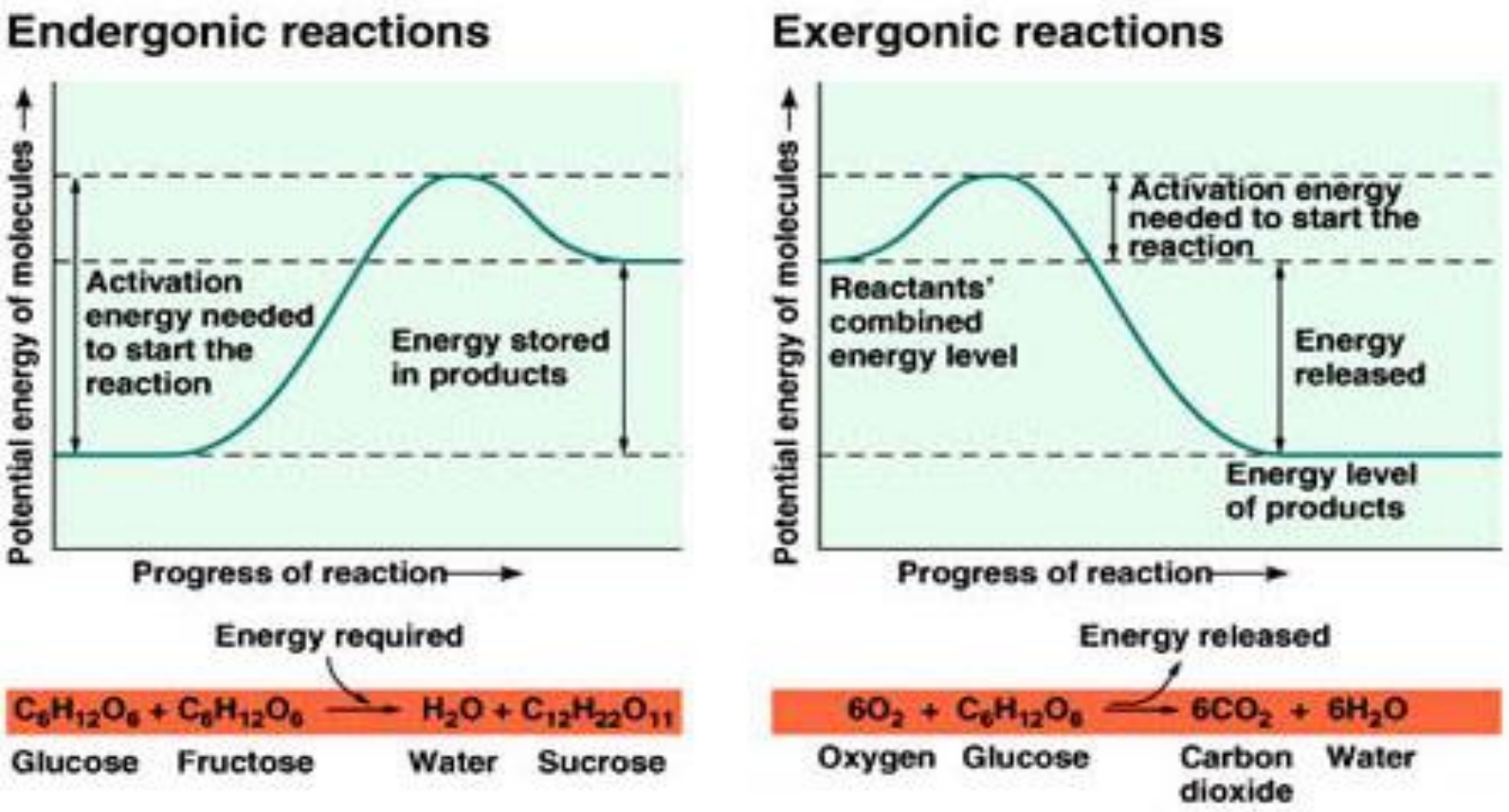
Energy

- **Activation energy** is the amount of energy needed in order for a chemical reaction to take place





Types of Chemical Reactions

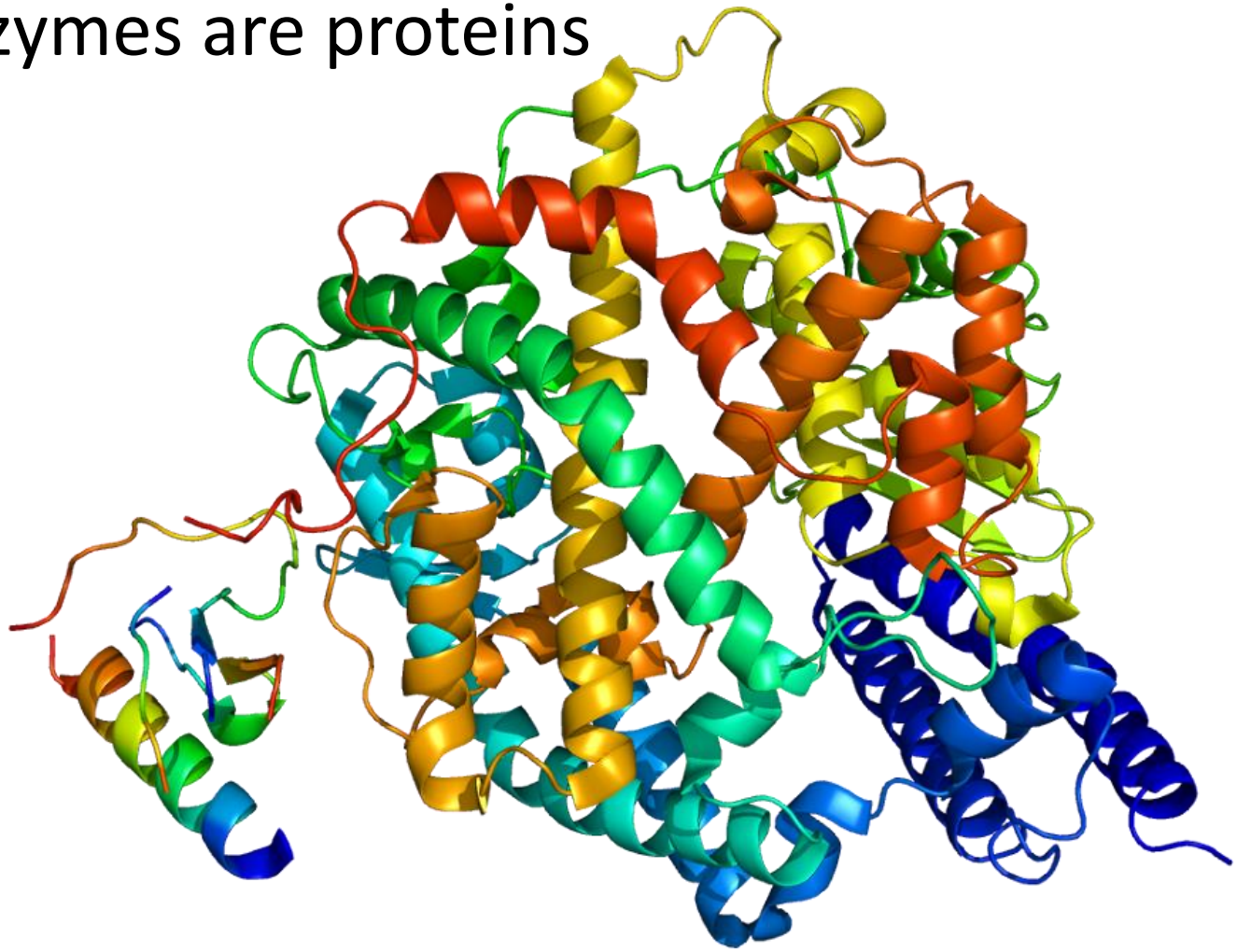


Rate of Chemical Reactions

- Things that affect the rate of chemical reactions include:
  - **Catalysts**
  - Inhibitors
  - **Temperature**
  - **pH**
  - Concentration (of substrates, catalysts, or inhibitors)

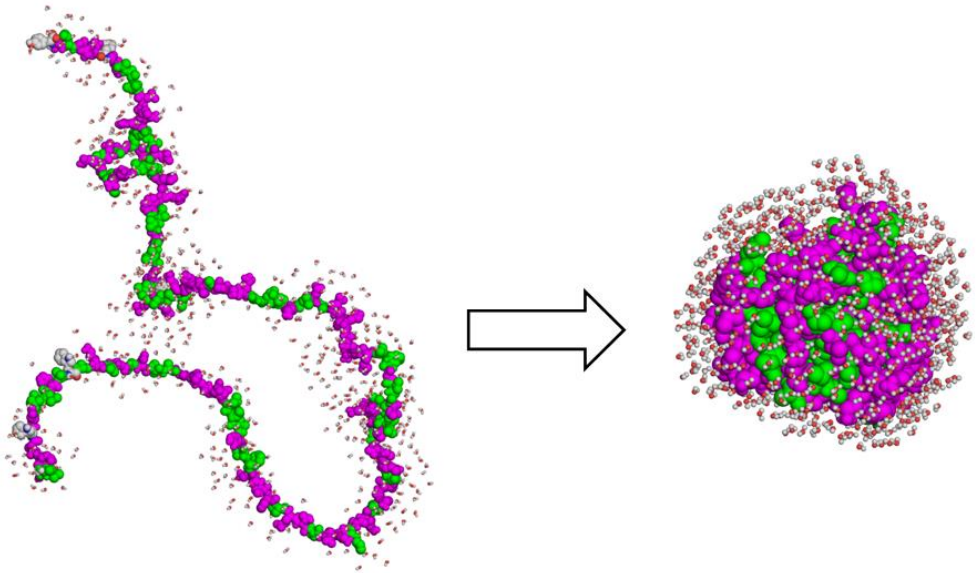
Enzyme Structure

- Most enzymes are proteins



Protein Structure

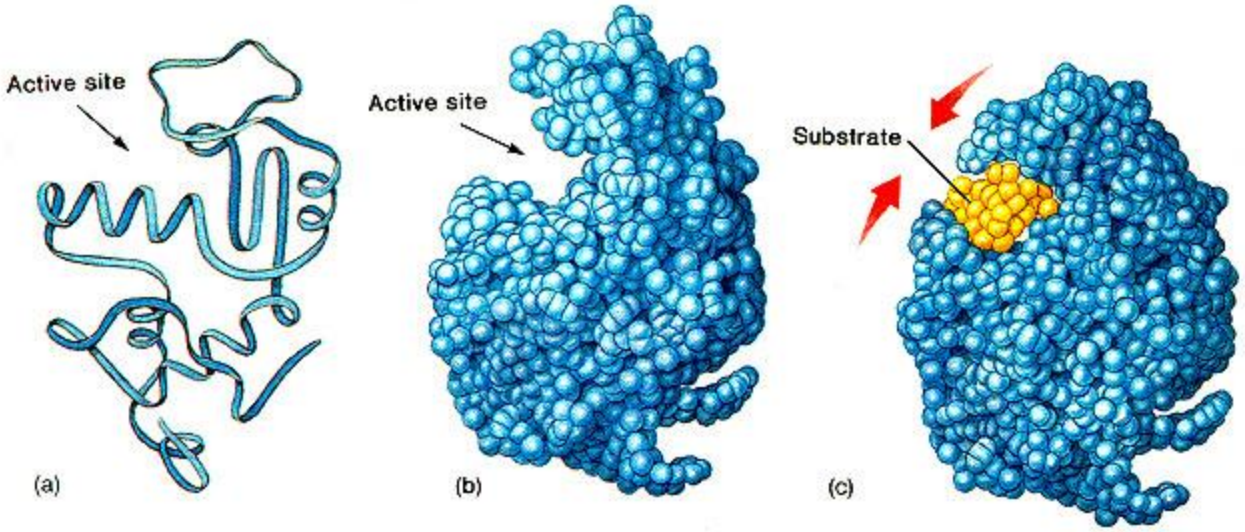
- The order of amino acids determines the shape of the protein.

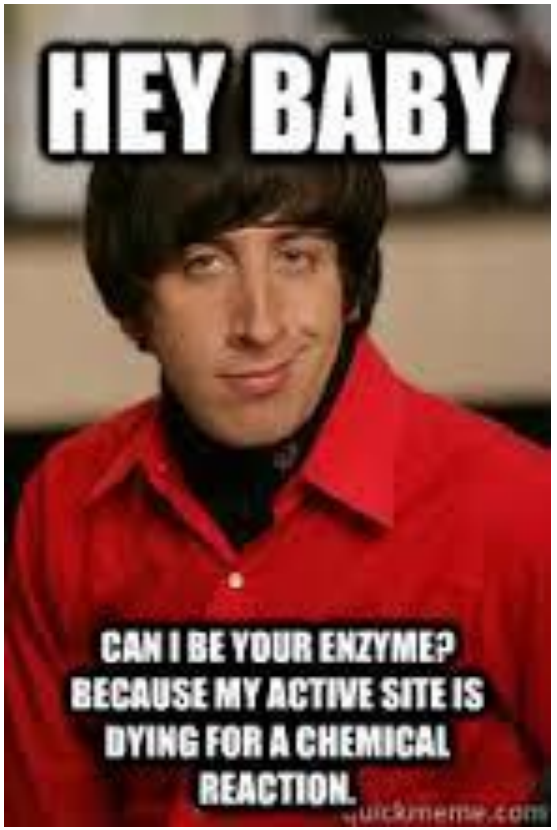


Unfolded

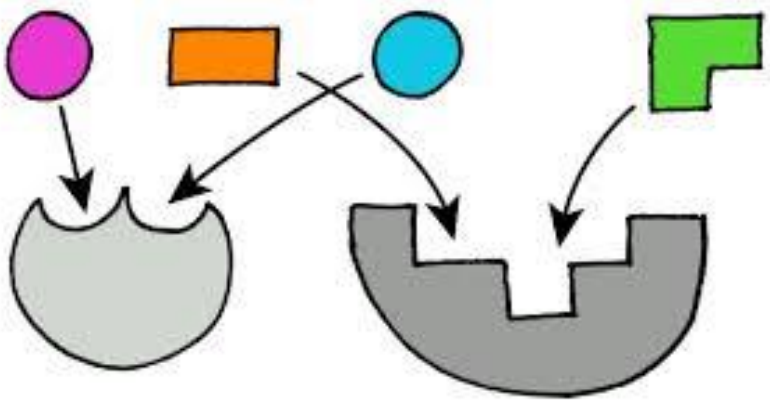
Folded

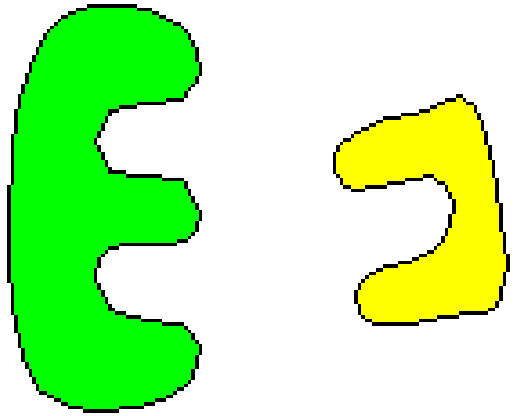
- Enzyme Shape
  - The shape of an enzyme determines which substrates it can interact with. Substrates fit into an enzymes active site much like a key fits into a lock.
    - An enzyme's **active site** is the place where the substrate binds to the enzyme





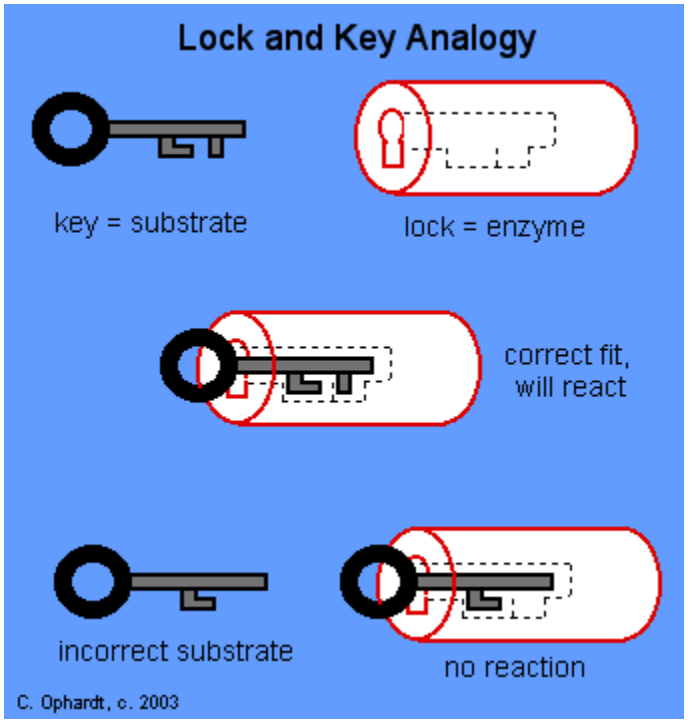
- Enzyme Shape, continued
  - Enzymes are substrate-specific, i.e. they will only work on one type of substrate
  - Enzymes are not used up during a chemical reaction; therefore, they can be used again and again

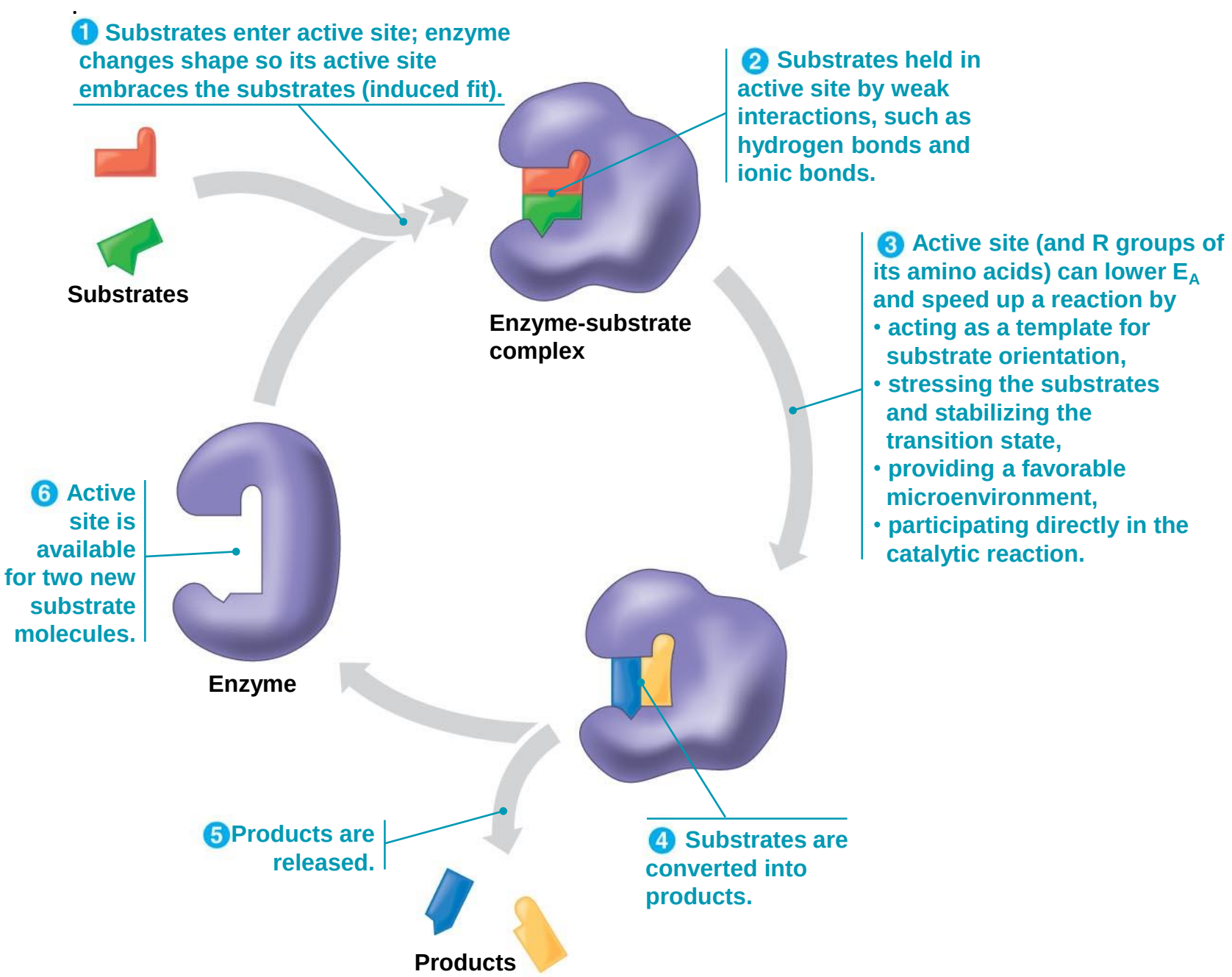




Lock & Key Analogy

- Lock—enzyme
- Keyhole—active site
- Key—substrate (a.k.a. reactant)

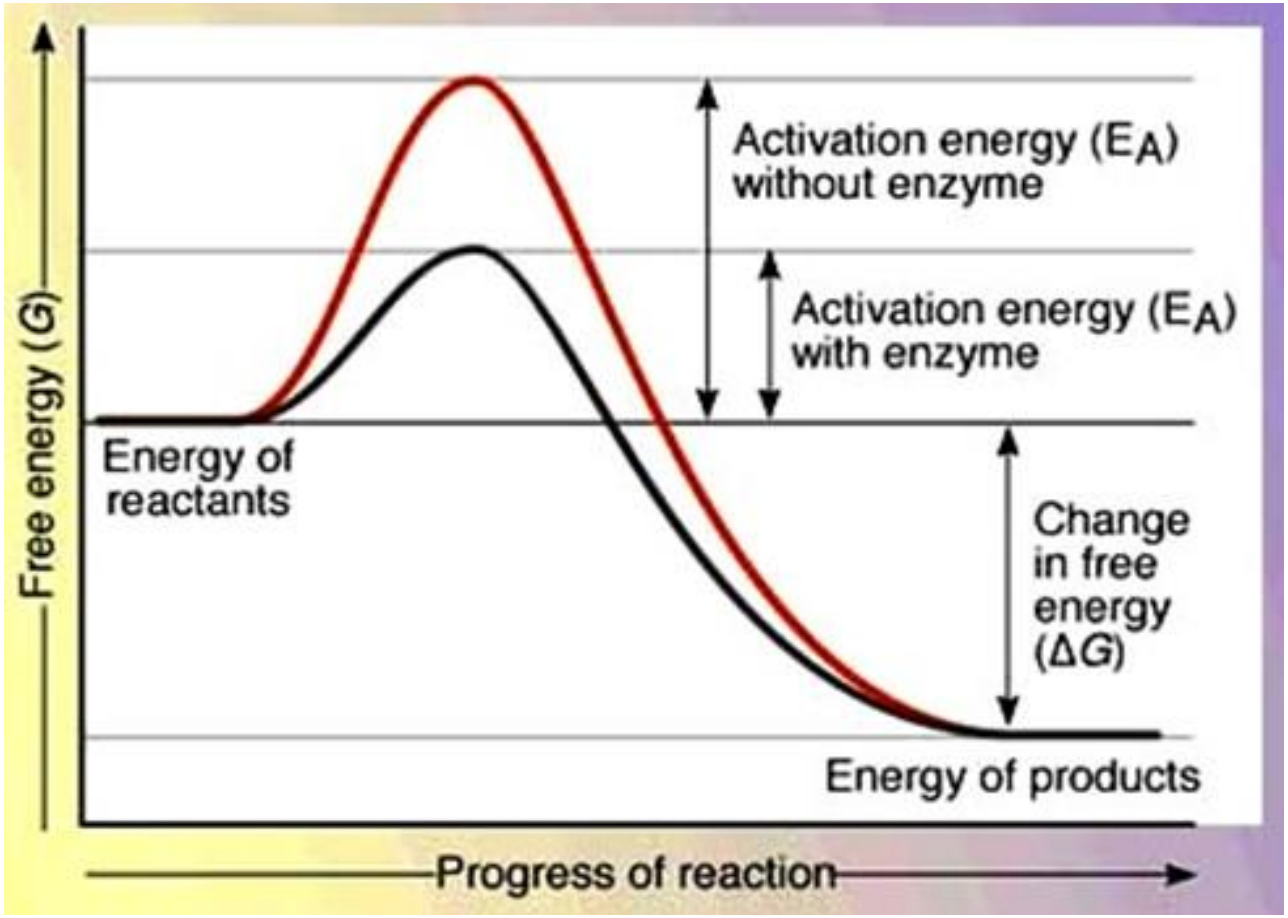




Enzyme Function

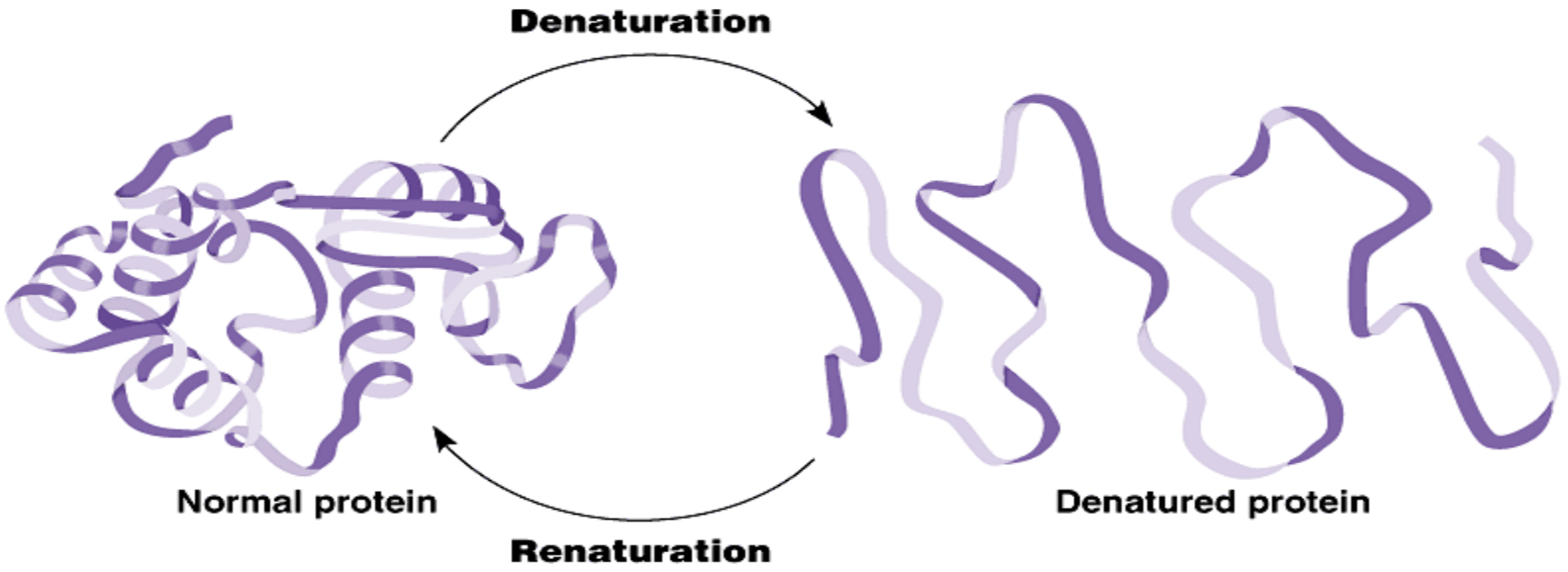
- **Enzymes** are proteins that function as biological **catalysts**
  - A **catalyst** is something that speeds up the rate of chemical reactions
- Enzymes catalyze biochemical reactions by lowering the activation energy required for the reaction to occur

A reaction with and without an enzyme



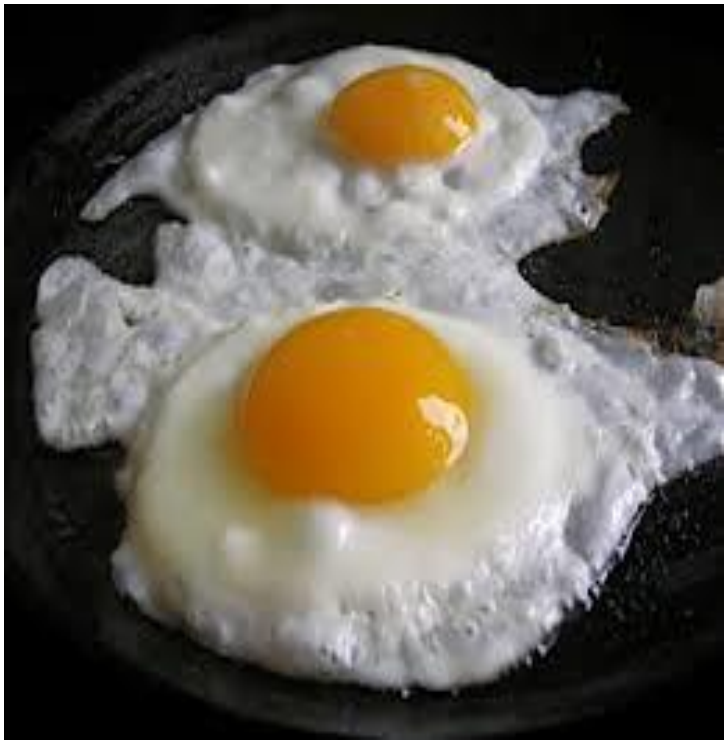
Enzyme Structure & Function

- An enzyme's function depends on its shape. If an enzyme's shape is changed, it is said to be **denatured**. A denatured enzyme will function poorly, or not at all.



Two Ways to Denature a Protein

Expose to high **temperature**



Expose to sub-optimal **pH** (too acidic or too basic)

Optimal Performance

- Enzymes (proteins in general) have an optimal temperature and pH. In other words, the temperature and/or the pH cannot be too high or too low or the enzyme's performance will be affected.
- Different enzymes have different optimal pH/temp.