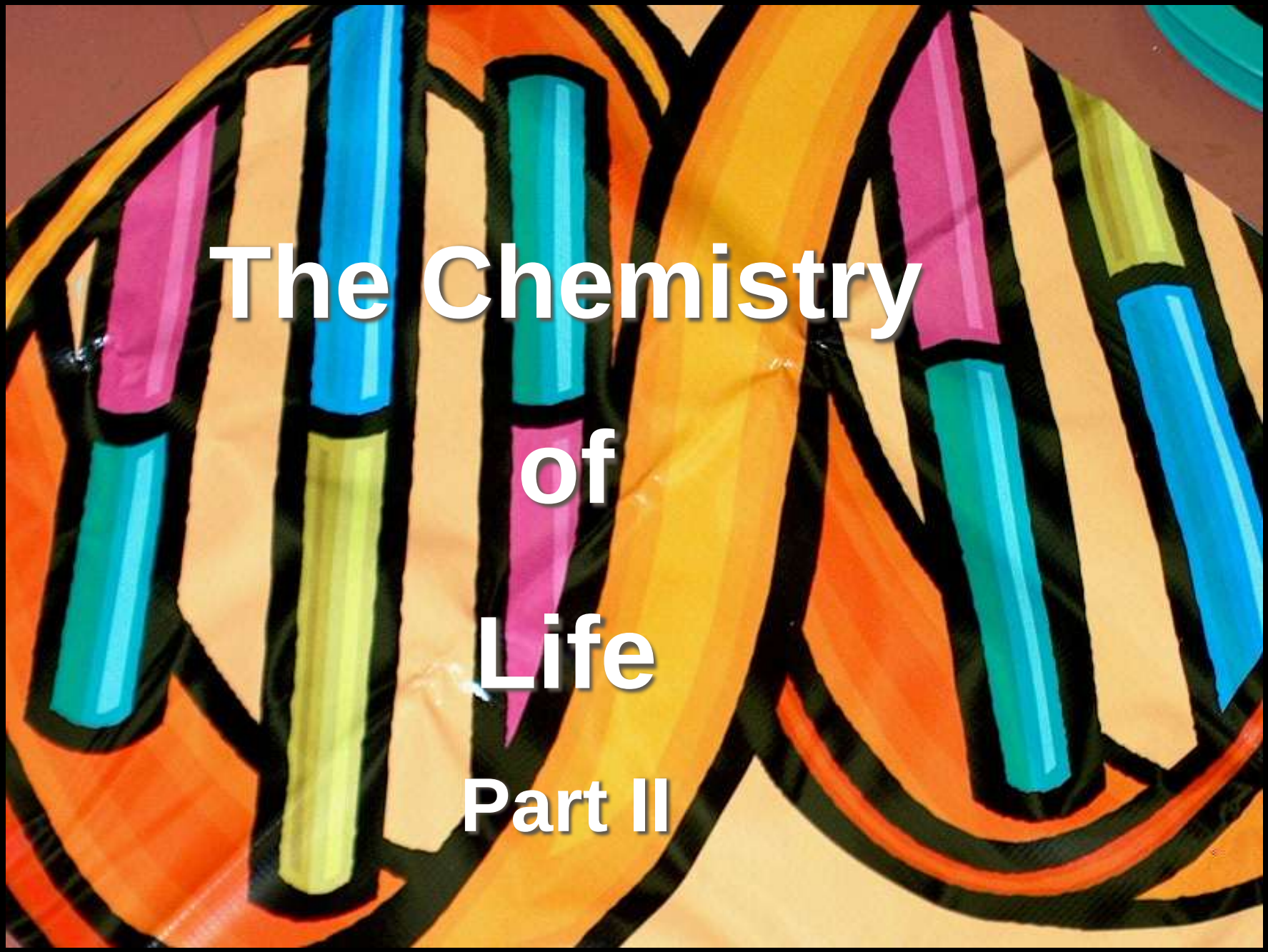
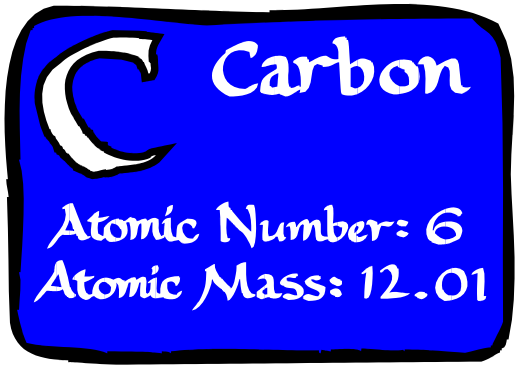
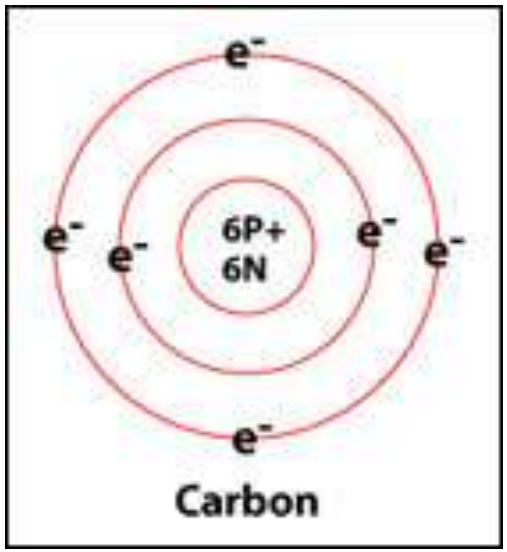

The Chemistry
of
Life
Part II

Biological Molecules

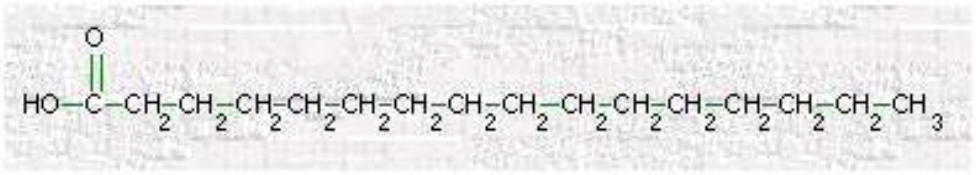
- *Carbon* is the most important element to living things
- Why is the carbon backbone present in all of the biological molecules?



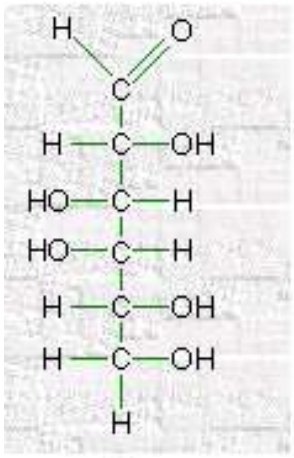


Carbon

- Has 4 electrons in its outer energy level
- Can form covalent bonds with up to 4 other atoms
- Can form chains or rings with single, double, or triple bonds



a



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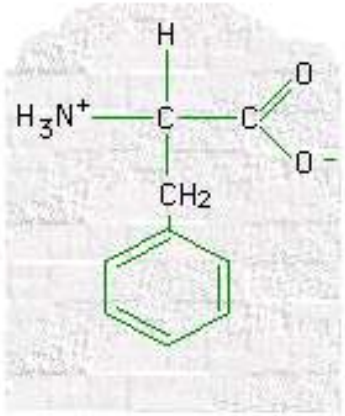

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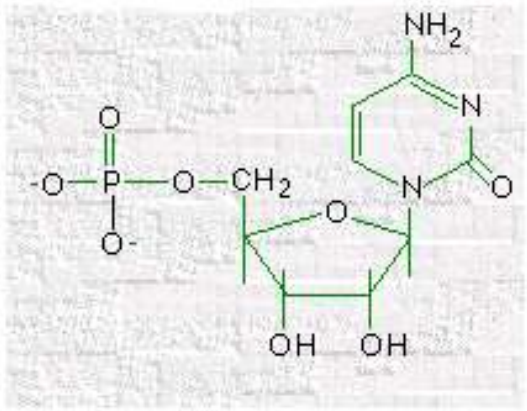
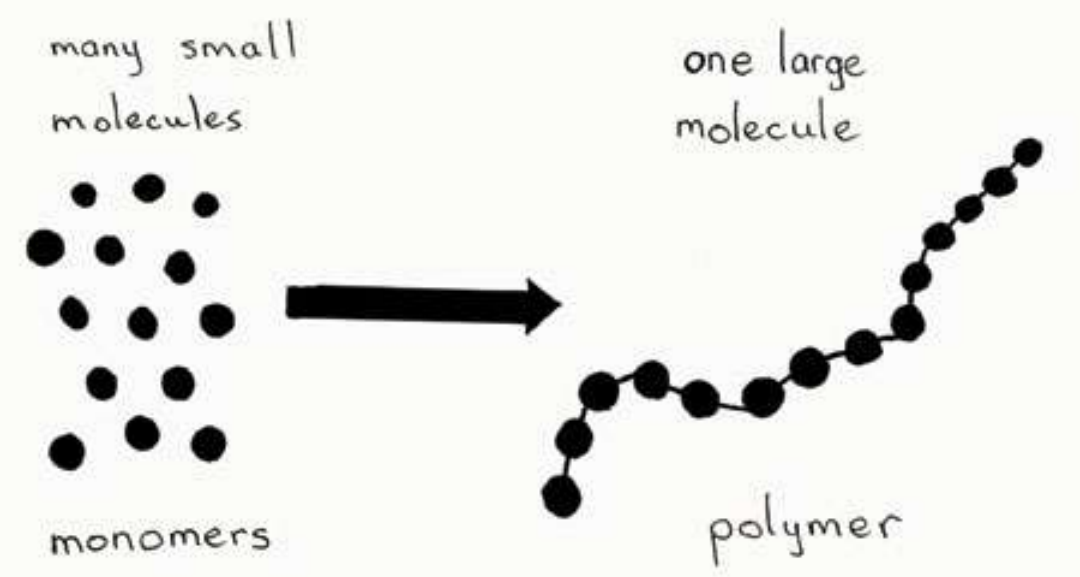


d

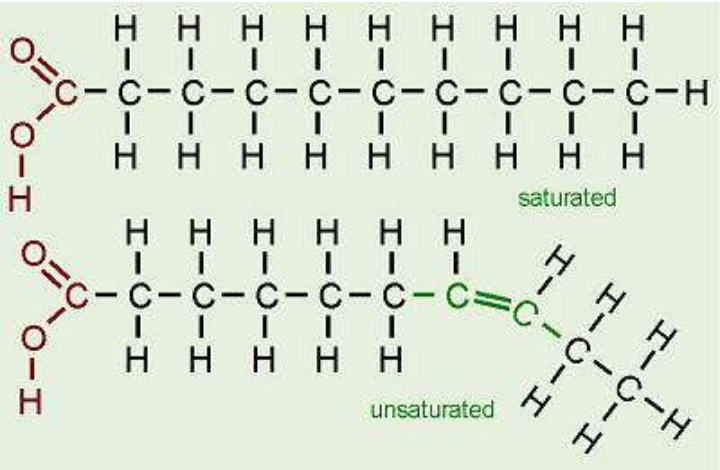
Monomers and Polymers

- Monomers are small molecules that can be linked together
- By forming covalent bonds between the monomers, larger molecules-called Polymers- are formed.

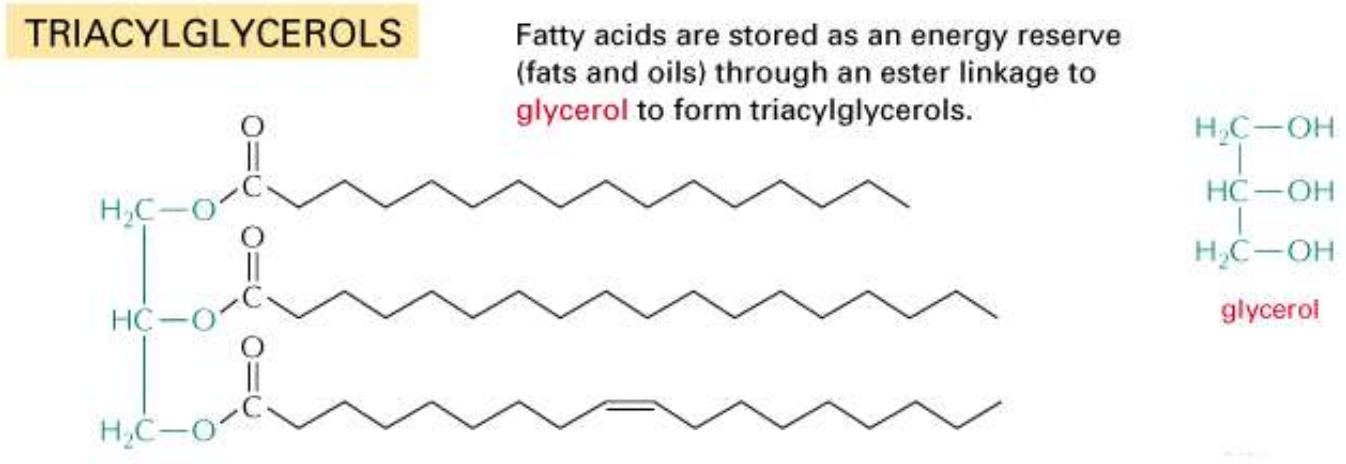


4 Types of Monomers

1. Fatty Acids

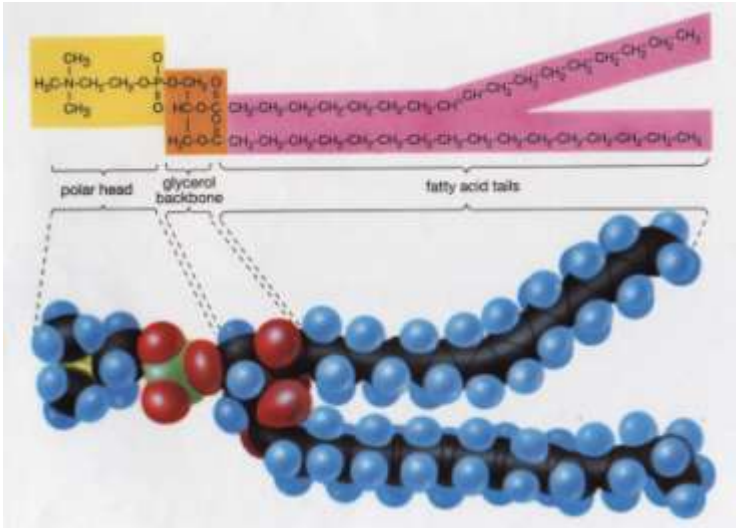


- Long chains of Carbon, Hydrogen, with a few Oxygen atoms.
- Can be linked together with covalent bonds to form Lipids
  - Do not dissolve easily in water



Examples of Lipids

- Oil made by plants for energy storage
- Fat made by animals for energy storage, protection and insulation.
- Phospholipids found in the membranes of all cells



4 Types of Monomers (cont.)

2. Sugars- monosaccharides
   - Short chains or rings
   - Carbon, Hydrogen and Oxygen in the ratio of $(CH_2O)_n$ Ex. Glucose $C_6H_{12}O_6$

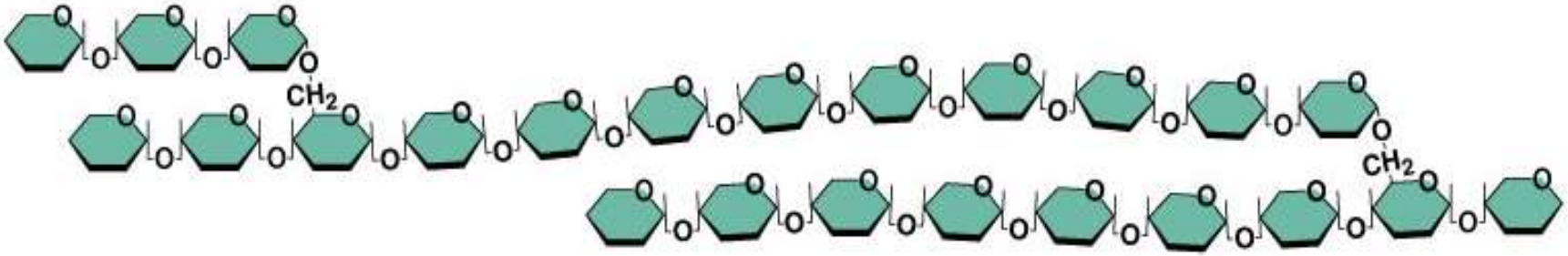
(a) Simple sugar (monosaccharide)

(b) Double sugar (disaccharide)

   - Can be linked together with covalent bonds to form a Disaccharide (2 sugars) or Polysaccharide (many sugars) aka Carbohydrate

Examples of Carbohydrates

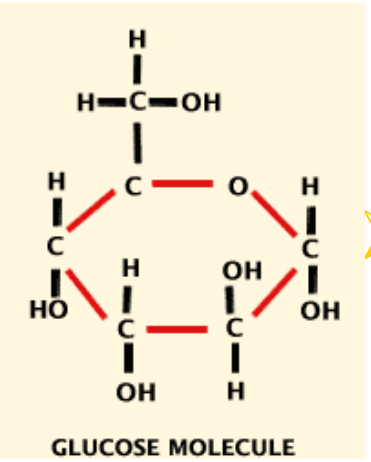
- Starch in plants for energy storage
- Glycogen in animal muscle and liver for energy storage
- Cellulose provides support for plant cell walls

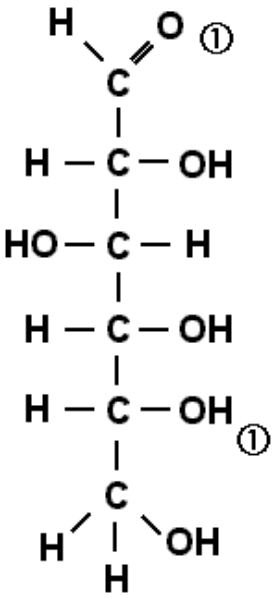


(c) Starch (polysaccharide)

Examples of Carbohydrates

- Chitin for support and protection in the exoskeleton of insects and crustaceans
- Small sugars such as glucose, sucrose, fructose and lactose for energy storage

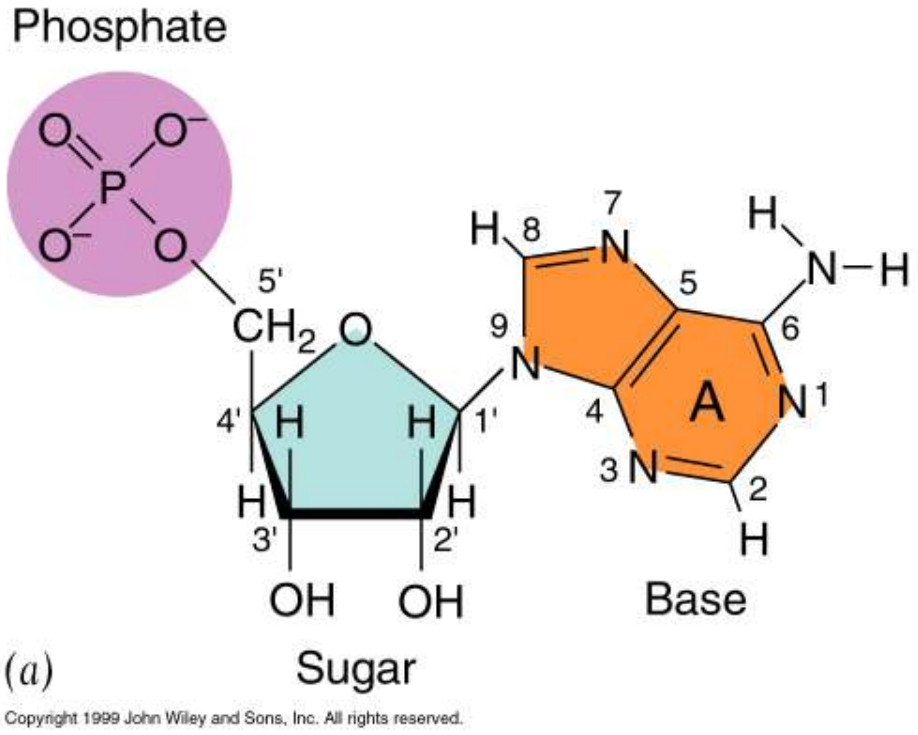




4 Types of Monomers (cont.)

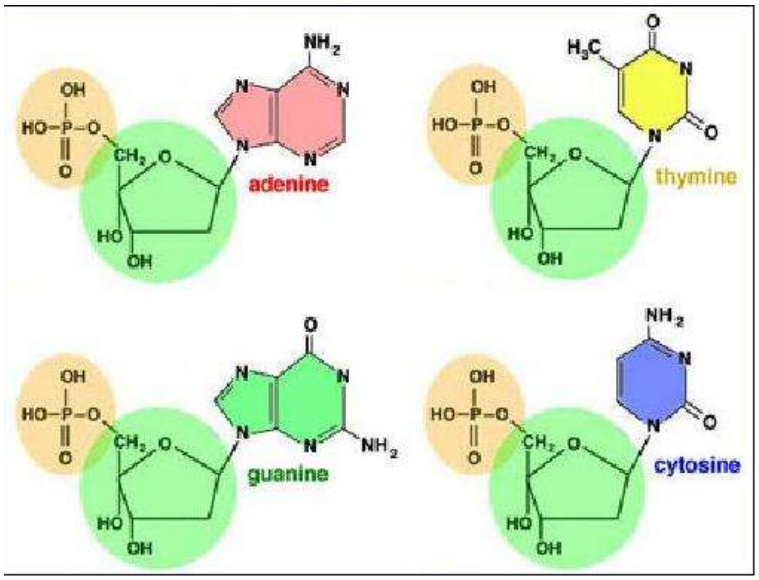
3. Nucleotides

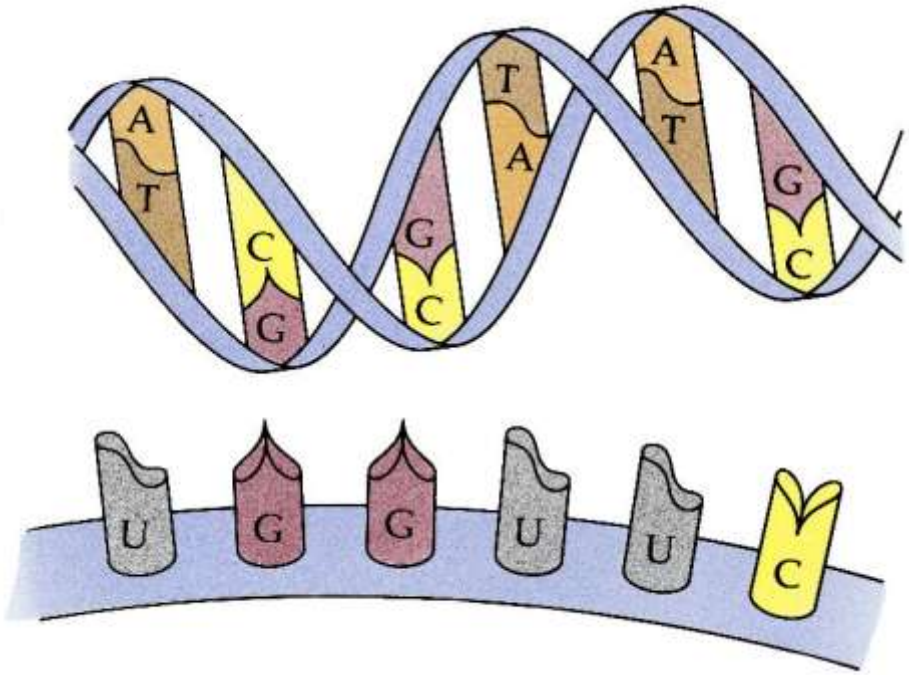
- 3 parts
  - A phosphate group
  - A sugar
  - Nitrogen containing base- 1 or 2 rings
- Can be linked together with covalent bonds to form nucleic acids



Examples of Nucleic Acids

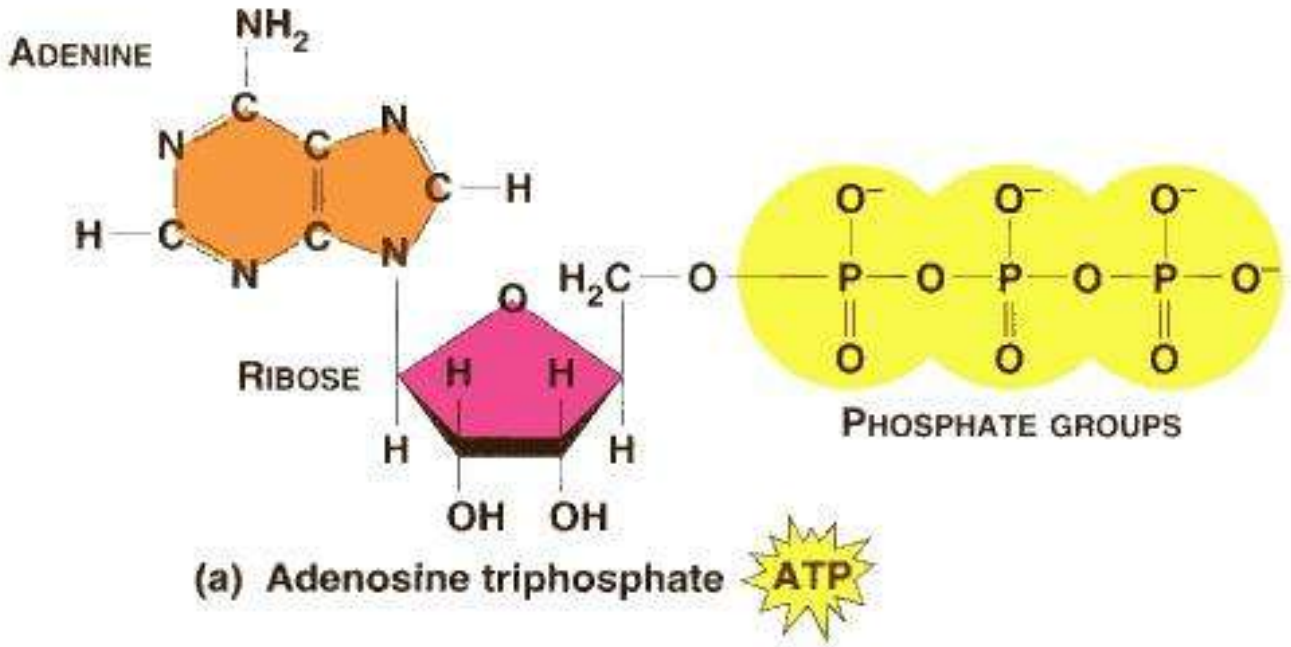
- DNA, deoxyribonucleic acid- for inheritance of traits
- RNA, ribonucleic acid- used in making proteins





ATP

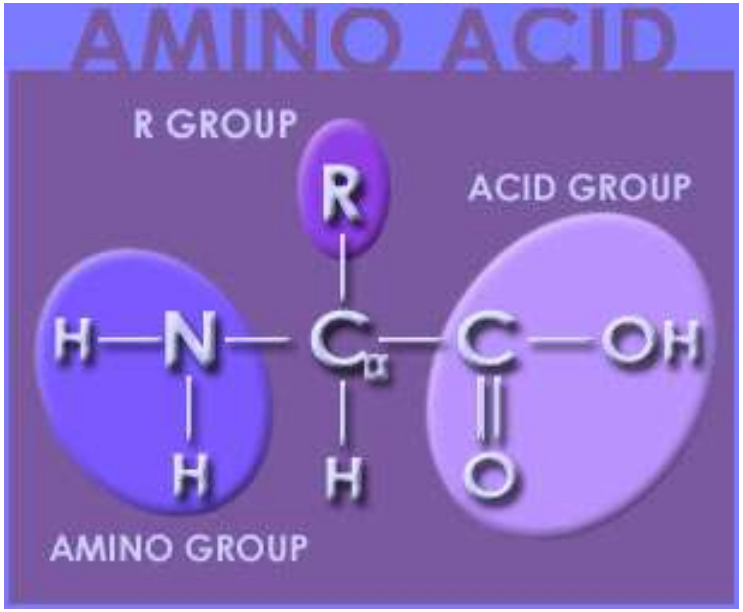
- Adenosine triphosphate
- Nucleotide
- Energy source for all cells



4 Types of Monomers (cont.)

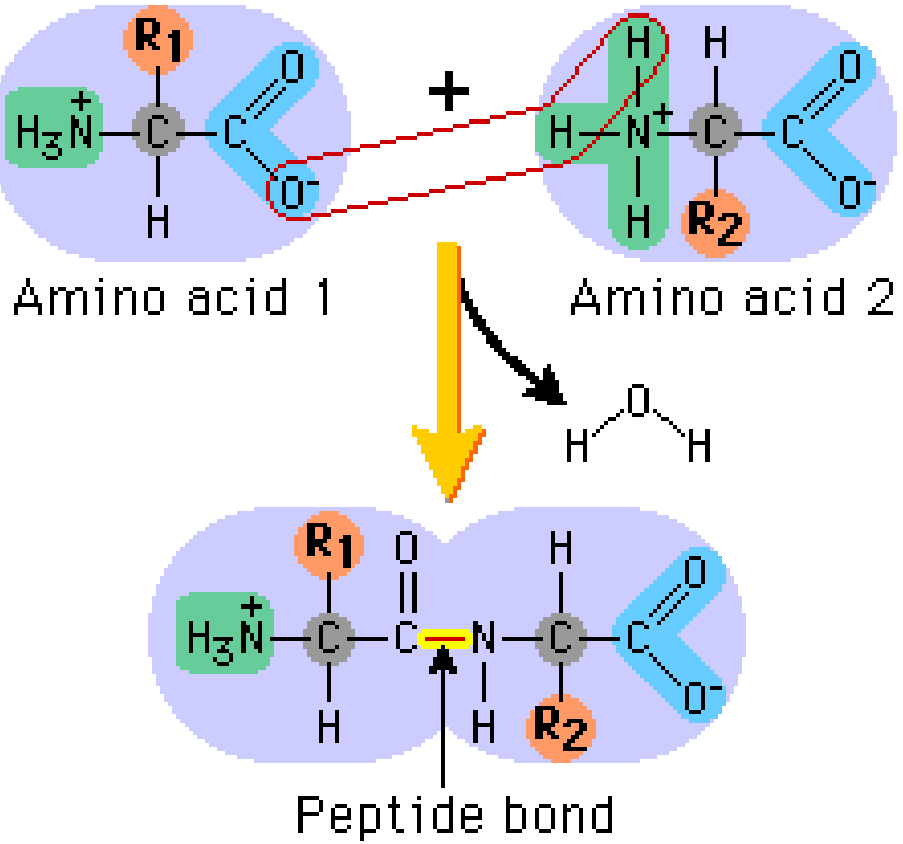
4. Amino Acids

- N-C-C backbone
- 3 parts
  - Amino end (NH_3^+)
  - Acid end (COO^-)
  - R group that varies- one of 20 different groups of atoms



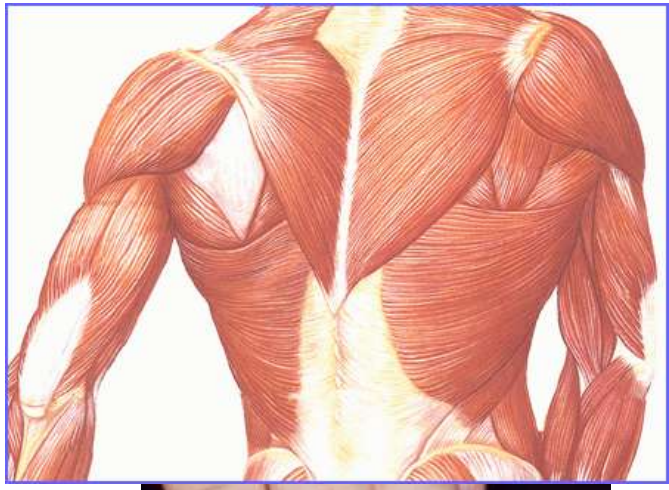
4. Amino Acids (cont.)

- can be linked together by a special covalent bond called a peptide bond
- Form Polypeptides, aka Proteins



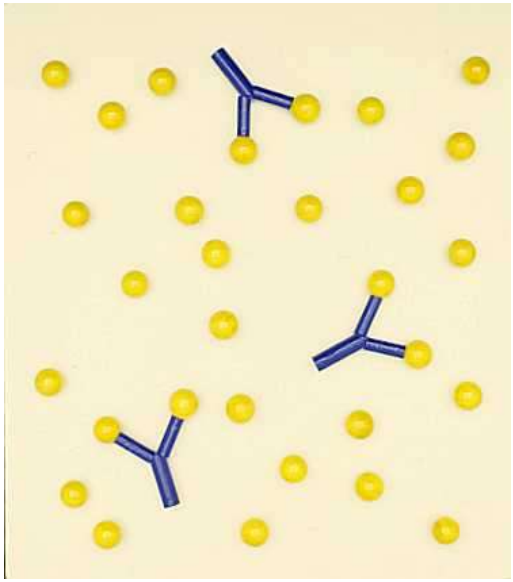
Examples of Proteins

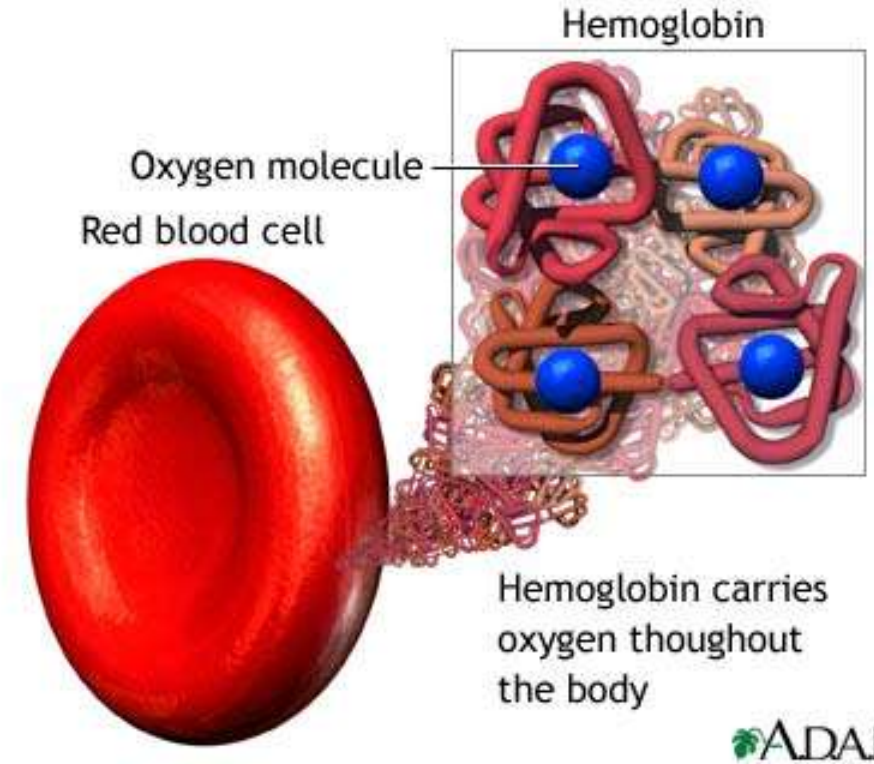
- Muscle for movement
- Hormones, like insulin for communication
- Hair and nails for protection

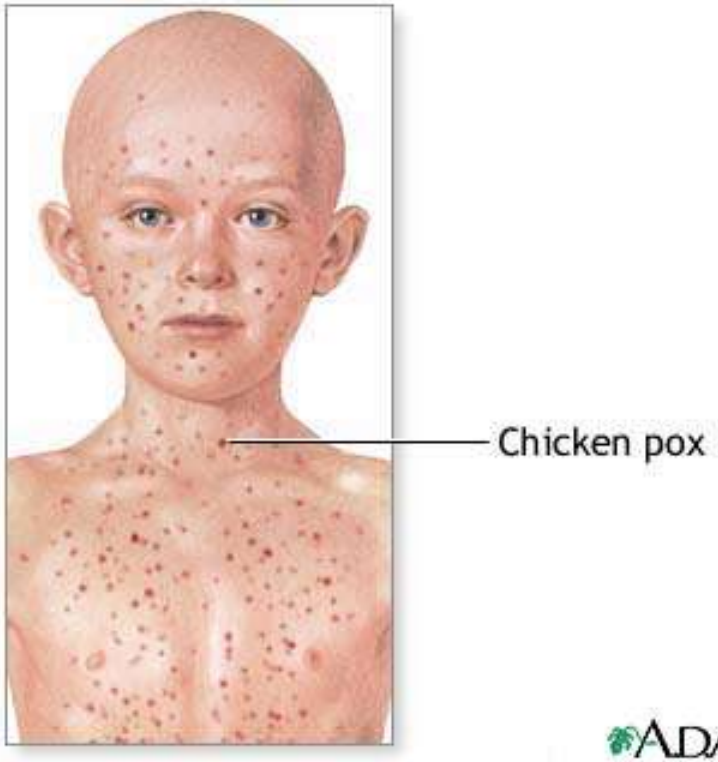


Examples of Proteins

- Antibodies for protection from disease
- Hemoglobin for transporting oxygen in the blood

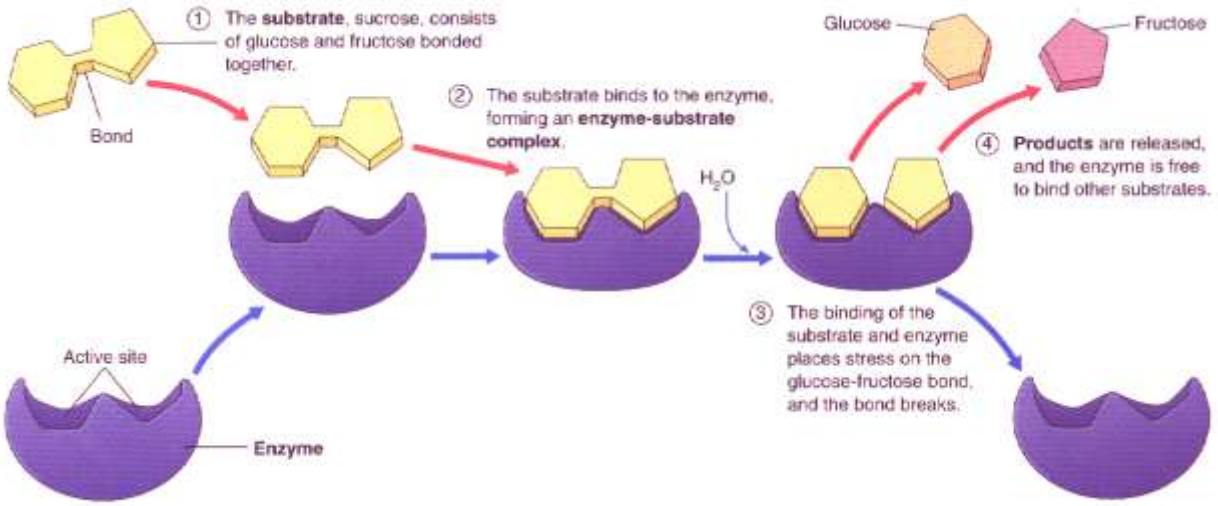






Enzymes

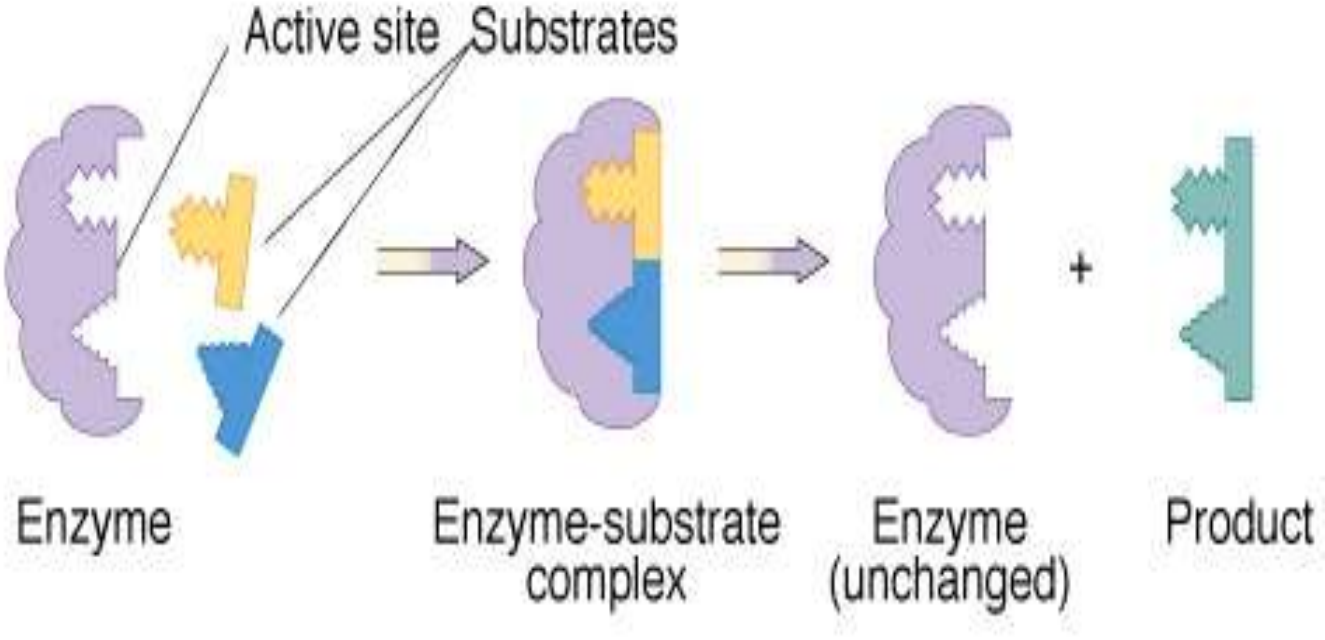
- The most important proteins in living things
- End in –ase Ex: sucrase, lipase
- Speed up chemical reactions
- Specific- speed up only 1 type of reaction



Enzyme Action

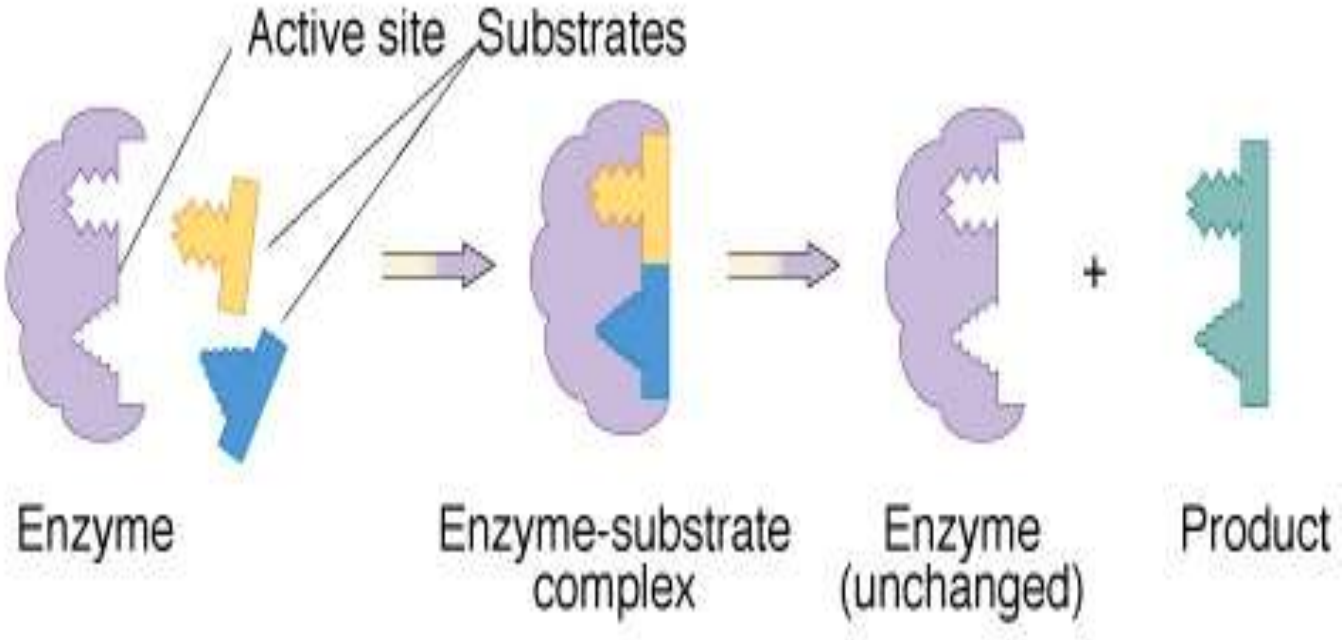
enzyme animation

1. Substrate- (what you start with) binds with the active site
2. Enzyme-substrate complex is formed
3. Bonds are formed or broken



Enzyme Action (cont.)

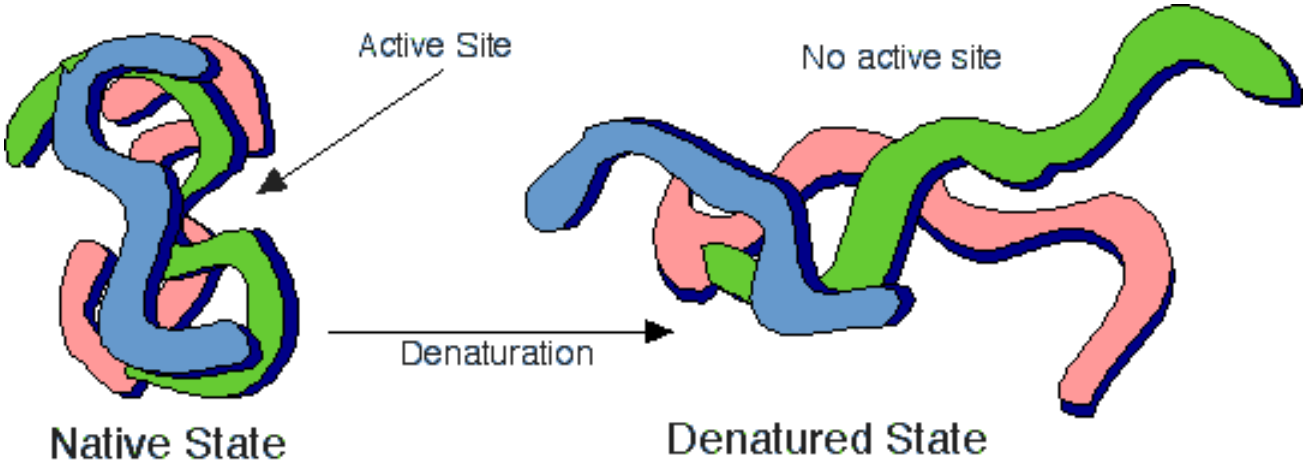
4. Product- (what you end with) is released
5. Enzyme is not changed or used up and can be used over and over.



Enzymes

enzyme review

- Work best under specific conditions of pH and temperature
  - If pH or temperature is too high or too low enzyme loses its 3-D shape and can not work: Denatured



How do enzymes speed up reactions?

Catalysts: a substance that speeds up chemical reactions in cells!!!

- Reduce the "start up energy" (**ACTIVATION ENERGY)** by:
  - Bringing two substrates together at **ACTIVE SITE**