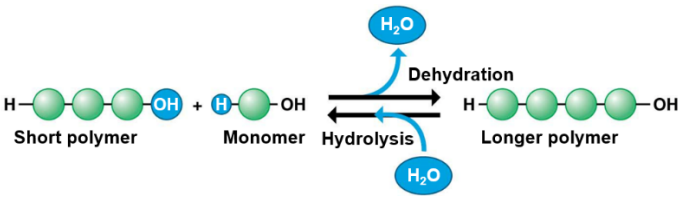
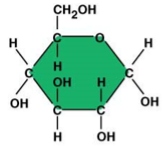
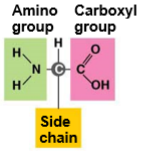
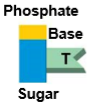
Review

Chapter 3. The molecule of life

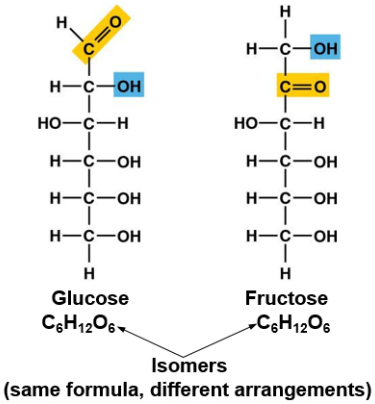
- **Functional group:** in an organic compound, the groups of atoms directly involved in chemical reactions.
- **Polymers:** large molecules made by stringing together many smaller molecules (monomers).
- **Reactions:** Dehydration reaction, hydrolysis



- **Large molecules:** carbohydrates, lipids, proteins, nucleic acids

Large Biological Molecules	Functions	Components	Examples
Carbohydrates	Dietary energy; storage; plant structure	 Monosaccharide	Monosaccharides: glucose, fructose; disaccharides: lactose, sucrose; polysaccharides: starch, cellulose
Lipids	Long-term energy storage (fats); hormones (steroids)	 Fatty acid Glycerol Components of a triglyceride	Fats (triglycerides); steroids (testosterone, estrogen)
Proteins	Enzymes, structure, storage, contraction, transport, etc.	 Amino group Carboxyl group Side chain Amino acid	Lactase (an enzyme); hemoglobin (a transport protein)
Nucleic acids	Information storage	 Phosphate Base T Sugar Nucleotide	DNA, RNA

- **Carbohydrates:** a class of molecules that includes sugars and polymers of sugars.
  1) Monosaccharides: the monomers of carbohydrates that can't be broken down into smaller sugars. Provide cells with energy and building materials.
  - ✧ **Isomers:** molecules that have the same molecular formula but different structure.



2) Disaccharide: double sugar, is constructed from two monosaccharides by a dehydration reaction.

3) Polysaccharides: long chains of sugar—polymers of monosaccharides.

- ✧ Starch in plants and glycogen in animals are storage polysaccharides;
- ✧ The cellulose of plant cell walls, which is indigestible by animals, is structural polysaccharide.

- **Lipids:** hydrophobic. fats and steroids

1) Fats: the major form of long-term energy storage in animals.

- ✧ Most animal fats are saturated, meaning that their fatty acids have the maximum number of hydrogens;
- ✧ Plant oils contain mostly unsaturated fats, having fewer hydrogens in the fatty acids because of double bonding in the carbon skeletons.
- ✧ Trans fats are a type of unsaturated fat that is bad for health.

2) steroids: including cholesterol and the sex hormones.

- **Protein:** a polymer of amino acid monomers.

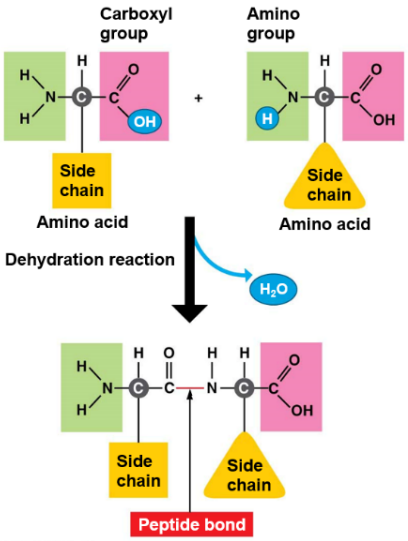
1) Amino acid: consists of a central carbon atom bonded to four covalent partners. Three of those attachments are common to all 20 amino acids:

- ✧ a carboxyl group (-COOH),
- ✧ an amino group (-NH2),
- ✧ a hydrogen atom.

The variable component of amino acids is called the side chain (or R group, for radical group); it's attached to the fourth bond of the central carbon.

2) Peptide bond: the bond that joins adjacent amino acids.

3) Polypeptide: the long chain of amino acids.



4) Shape: the shape of a protein determined its function.

- **Nucleic acids:** macromolecules that store information and provide the instructions for building proteins.

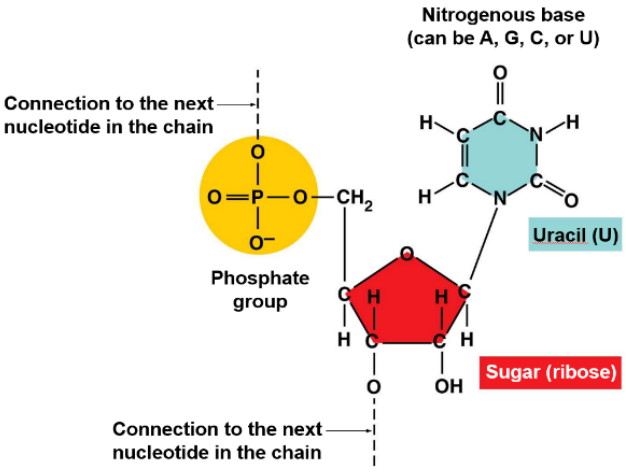
  1) DNA: deoxyribonucleic acid. Takes the form of a double helix.

  2) RNA: ribonucleic acid.

  3) Gene: a unit of inheritance encoded in a specific stretch of DNA that programs the amino acid sequence of a polypeptide.

  4) Nucleotides: monomers.

  - ✧ At the center of each nucleotide is a five-carbon sugar, deoxyribose in DNA and ribose in RNA;
  - ✧ Attached to the sugar is a negatively charged phosphate group containing a phosphorous atom bonded to oxygen atoms;
  - ✧ Attached to the sugar is nitrogen-containing base made of one or two rings.
  - ✧ The sugar and phosphate are the same in all nucleotides; only the base varies. Each DNA nucleotide has one of four possible nitrogenous bases: adenine (A), guanine (G), cytosine (C), thymine (T).



5) Sugar-phosphate backbone: a repeating pattern of sugar-phosphate-sugar-phosphate, with the bases (A,T,C,G) hanging off the backbone like appendages.