

Chapter 6 Chemistry of Living Systems (Life Sciences)**Molecules in Living Organisms**

- 6. c.** *Students know* that living organisms have many different kinds of molecules, including small ones, such as water and salt, and very large ones, such as carbohydrates, fats, proteins, and DNA.

Four groups of organic molecules required by living organisms are carbohydrates, proteins, lipids, and nucleic acids. Many of the molecules in these groups are very large, complex polymers.

A **carbohydrate** is an energy-rich organic compound made of the elements carbon, hydrogen, and oxygen. All living organisms use carbohydrates for energy. Sugars are the simplest carbohydrates. Starches are more complex carbohydrates. A **complex carbohydrate** is a polymer made of simple carbohydrates bonded to one another. Plants store energy in the form of the complex carbohydrate **starch**. **Cellulose** is a complex carbohydrate found in plant structures that strengthens stems and roots.

A **protein** is an organic polymer made up of smaller molecules called amino acids. There are 20 kinds of amino acids found in living things. Each **amino acid** has a carboxyl group ($-\text{COOH}$) and an amino group ($-\text{NH}_2$). Amino acids differ from each other by their side group, which helps determine the shape and function of a protein. Living organisms use proteins to build and repair body parts and to regulate life processes.

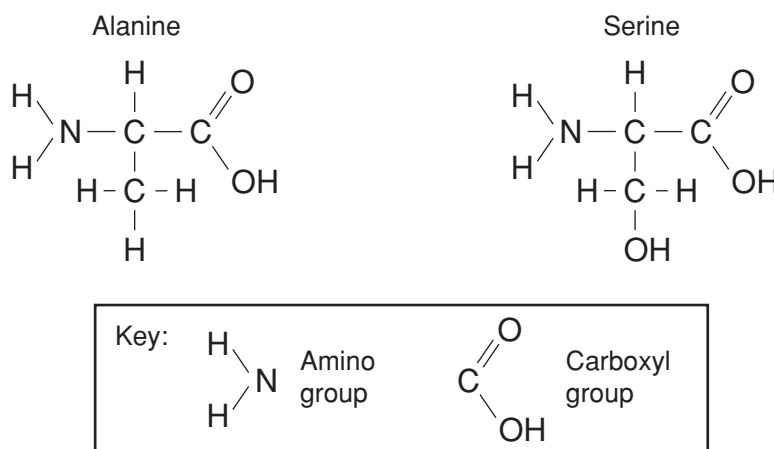


Figure 6-4 Amino acids Alanine and serine are two of the 20 amino acids found in living things.

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Lipids are energy-rich compounds made of carbon, oxygen, and hydrogen. Fats, oils, and waxes are lipids. Living organisms use lipids for energy. Gram for gram, lipids release twice as much energy as carbohydrates. Each fat or oil is made up of three fatty acids and one alcohol.

Nucleic acids are very large organic molecules made up of carbon, oxygen, hydrogen, nitrogen, and phosphorus. There are two types of nucleic acids: **DNA** and **RNA**. The building blocks of nucleic acids are called **nucleotides**. Living things differ from one another because of their DNA. The sequence of nucleotides in DNA determines a related sequence in RNA. The sequence of RNA nucleotides determines the sequence of amino acids in proteins made by a living cell. When a living organism reproduces, it passes its DNA and the information it carries to the next generation.

Not all of the molecules in living organisms are organic compounds. Smaller molecules that living organisms need to survive include water, vitamins, minerals, and salts. Most of the chemical reactions that occur in living organisms take place in water. Vitamins and minerals serve as helper molecules in many life processes. Salts are required for many functions, such as contracting muscle, transmitting nerve impulses, and balancing blood pH.

Standard 6. c. Check

9 Which of the following is an example of a complex carbohydrate?

- A starch
- B cholesterol
- C RNA
- D amino acid

10 The building blocks of proteins are

- A lipids.
- B simple sugars.
- C nucleotides.
- D amino acids.

11 Which organic molecules does your body use to build and repair body parts and to regulate cell activities?

- A carbohydrates
- B proteins
- C lipids
- D nucleic acids

12 The building blocks of nucleic acids are

- A nucleotides.
- B amino acids.
- C simple sugars.
- D fatty acids.