Carbohydrates and Lipids

SECTION 1

OBJECTIVES

- Describe the structural characteristics of simple carbohydrates and complex carbohydrates.
- Explain the role of carbohydrates in living systems.
- Describe the structural characteristics of lipid molecules.
- Identify the functions of lipids in living cells.

Biochemistry is the study of the chemicals and reactions that occur in living things. Biochemical compounds are often large and complex organic molecules, but their chemistry is similar to that of the smaller organic molecules you studied in Chapter 22. Now you will study many important biochemical molecules and learn why they are needed to stay healthy. Two of the most common types of molecules that you may know about are *carbohydrates* and *lipids*. These molecules are important parts of the food that you eat and provide most of the energy that your body needs.

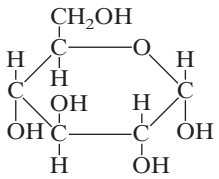
Carbohydrates

Sugars, starches, and *cellulose* belong to the large group of biochemical molecules called carbohydrates. **Carbohydrates** *are molecules that are composed of carbon, hydrogen, and oxygen atoms in a 1:2:1 ratio, and provide nutrients to the cells of living things.* They are produced by plants through a process called *photosynthesis.* Cellulose provides structure and support for plants and starch stores energy in plants. Because animals cannot make all of their own carbohydrates, they must get them from food. Carbohydrates provide nearly all of the energy that is available in most plant-derived food.

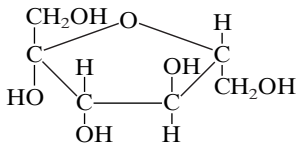
Monosaccharides

A **monosaccharide** *is a simple sugar that is the basic subunit of a carbohydrate.* A single monosaccharide molecule contains three to seven carbon atoms. Monosaccharide compounds are typically sweet-tasting, white solids at room temperature. Because they have polar, hydroxyl (−OH) groups in their molecular structures, they are very soluble in water. The most common monosaccharides are *glucose* (also called *dextrose*) and *fructose.* Although both of these monosaccharides have the formula $C_6(H_2O)_6$, their structural formulas differ. As **Figure 1** shows, glucose in a water solution forms a ring made up of five carbon atoms and one oxygen atom, and fructose in a water solution forms a ring made up of four carbon atoms and one oxygen atom. Notice that both compounds have five −OH groups in their structures.

FIGURE 1 Glucose and fructose both have 6 C, 12 H, and 6 O atoms. The arrangement of the C, H, and O atoms determines the shape and properties of each sugar.



glucose



fructose