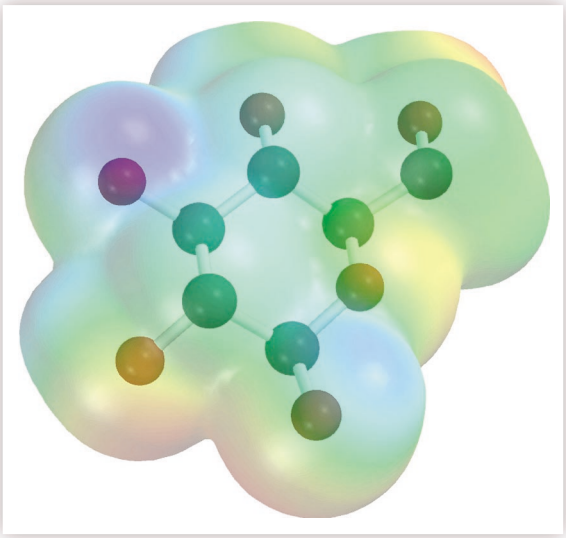
CHAPTER OUTLINE



CHAPTER 15
CARBOHYDRATES

The major classes of organic compounds common to living systems are lipids, proteins, nucleic acids, and carbohydrates. Carbohydrates are very familiar to us—we call many of them "sugars." They make up a substantial portion of the food we eat and provide most of the energy that keeps the human engine running. Carbohydrates are structural components of the walls of plant cells and the wood of trees. Genetic information is stored and transferred by way of nucleic acids, specialized derivatives of carbohydrates, which we'll examine in more detail in Chapter 18.

Historically, carbohydrates were once considered to be "hydrates of carbon" because their molecular formulas in many (but not all) cases correspond to $C_n(H_2O)_m$. It is more realistic to define a carbohydrate as a polyhydroxy aldehyde or polyhydroxy ketone, a point of view closer to structural reality and more suggestive of chemical reactivity.

15.1 CLASSIFICATION OF CARBOHYDRATES

"Sugar" is a combination of the Sanskrit words *su* (sweet) and *gar* (sand). Thus, its literal meaning is "sweet sand."

The Latin word for "sugar" is *saccharum,* and the derived term "saccharide" is the basis of a system of carbohydrate classification. A **monosaccharide** is a simple carbohydrate, one that on attempted hydrolysis is not cleaved to smaller carbohydrates. Glucose ($C_6H_{12}O_6$), for example, is a monosaccharide. A **disaccharide** is cleaved on hydrolysis to two monosaccharides, which may be the same or different. Sucrose—common table sugar—is a disaccharide that yields one molecule of glucose and one of fructose on hydrolysis.

$$\text{Sucrose } (C_{12}H_{22}O_{11}) + H_2O \longrightarrow \text{glucose } (C_6H_{12}O_6) + \text{fructose } (C_6H_{12}O_6)$$