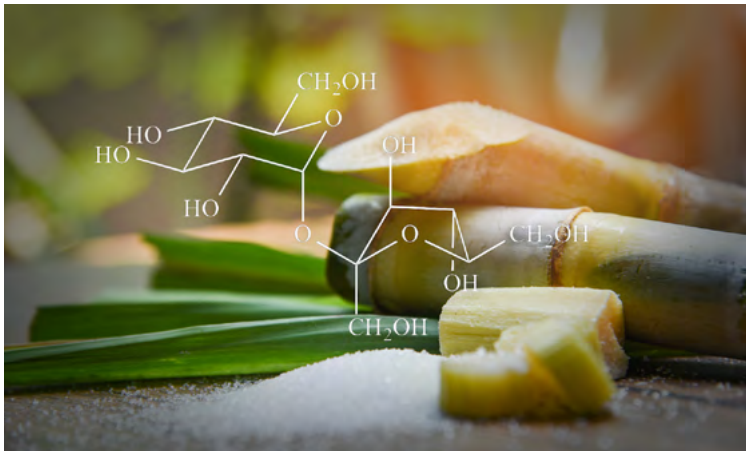
Chapter 2

The Chemistry of Life



2.6 Organic Molecules

Carbon atoms are perhaps the most versatile of all atoms especially in their ability to bond among themselves repeatedly thus forming long carbon chains. Add to this the fact that carbon atoms can also bond with atoms of other elements, and you see the possibility of an endless number of different carbon-based molecules. Each molecule has its own unique set of physical, chemical, and biological properties. The flavor of vanilla, for example, is perceived when the compound vanillin lands upon sensory cells within the nose. The flavor of chocolate is generated when a selection of compounds, such as tetramethylpyrazine, are detected by the nose, as shown in Figure 2.31.

Figure 2.31 Food and flavorings are made of organic molecules.

The study of carbon-containing compounds is known as **organic chemistry**. Because organic compounds are so closely tied to living organisms and because they have many applications—flavorings, fuels, polymers, medicines, agriculture, and more—it is important to have a basic understanding of them.

The most basic organic molecules are the hydrocarbons, which, as their name suggests, are made only of hydrogen and carbon atoms. As you'll see in the three examples of Figure 2.32, the carbon atoms bond together to form the backbone or basic structure of any organic molecule. This is because only carbon atoms are good at forming extended chains.

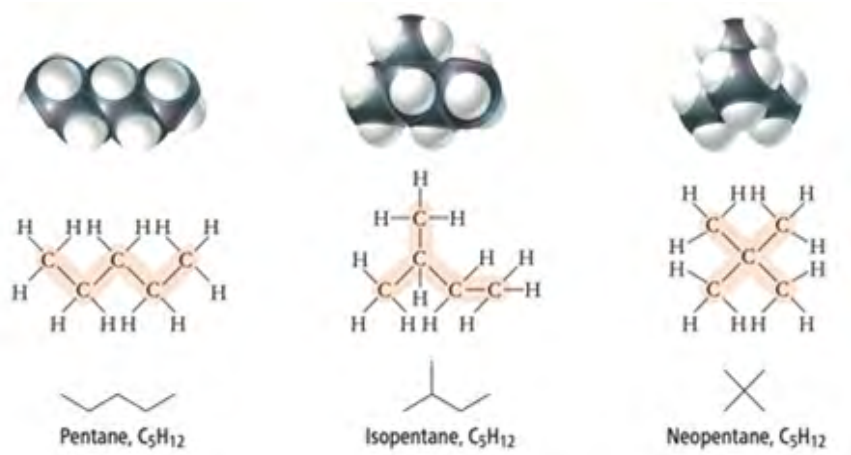


Figure 2.32

These three hydrocarbons all have the same molecular formula. We can see their different structural features by highlighting the carbon framework in two dimensions. Easy-to-draw stick structures that use lines for all carbon–carbon covalent bonds are also useful.

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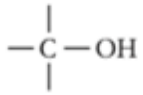
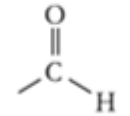
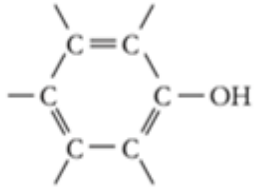
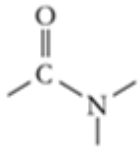
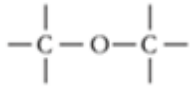
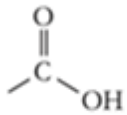
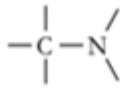
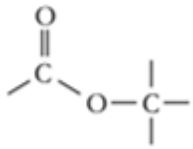
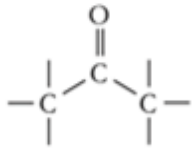
We find that atoms other than carbon, such as hydrogen, nitrogen, and oxygen, can attach themselves to chains of carbon atoms. This helps to give each organic molecule a unique character. Look back to Figure 2.32 and you'll see the vanillin organic molecule has oxygen atoms, shown in red, and the tetramethylpyrazine found in chocolate has nitrogen atoms, shown in blue.

Lastly, oxygen and nitrogen can form special groups, called *functional groups*, as shown in Table 2.1. Organic molecules can be defined by the functional groups they contain. At this point there is no need for you to memorize these functional groups. We present them here as an introduction. Look to the various biomolecules presented to you as you study biology and you will see these functional groups abound.

TABLE 2.1 Functional groups in organic molecules.

General Structure	Class	General Structure	Class
 Hydroxyl group	Alcohols	 Aldehyde group	Aldehydes
 Phenolic group	Phenols	 Amide group	Amides
 Ether group	Ethers	 Carboxyl group	Carboxylic acids
 Amine group	Amines	 Ester group	Esters
 Ketone group	Ketones		

READING CHECK

What is the significance of non-carbon atoms in an organic molecule?

CHECK YOUR ANSWER

Non-carbon atoms such as oxygen and nitrogen found within an organic molecule strongly impact the chemical and physical properties of that organic molecule.

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