20.7: Carbohydrates

Carbohydrates are sugars and sugar derivatives whose formulas can be written in the general form: $C_x(H_2O)_y$. (The subscripts *x* and *y* are whole numbers.) Some typical carbohydrates are sucrose (ordinary cane sugar), $C_{12}H_{22}O_{11}$; glucose (dextrose), $C_6H_{12}O_6$; fructose (fruit sugar), $C_6H_{12}O_6$; and ribose, $C_5H_{10}O_5$.Since the atom ratio H/O is 2/1 in each formula, these compounds were originally thought to be hydrates of carbon, hence their general name.

Glucose, by far the most-common simple sugar, is a primary source of energy for both animals and plants. Because they contain free glucose molecules, dextrose tablets or foods such as grapes and honey can provide a noticeable “lift” for persons tired by physical exertion. The individual glucose molecules pass rapidly into the bloodstream when such foods are eaten. Glucose is also the monomer from which the polymers cellulose and starch are built up. The structural material of plants, from the woody parts of trees to the cell walls of most algae, is cellulose. Plants store energy in starch, providing a source of glucose for all but the simplest organisms. The energy in starchy foods is not as rapidly available, however, since the polymeric structure must be broken down before glucose is released. As a consequence of the ubiquity of starch and especially cellulose, carbohydrates are by far the most plentiful organic compounds in the biosphere.

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