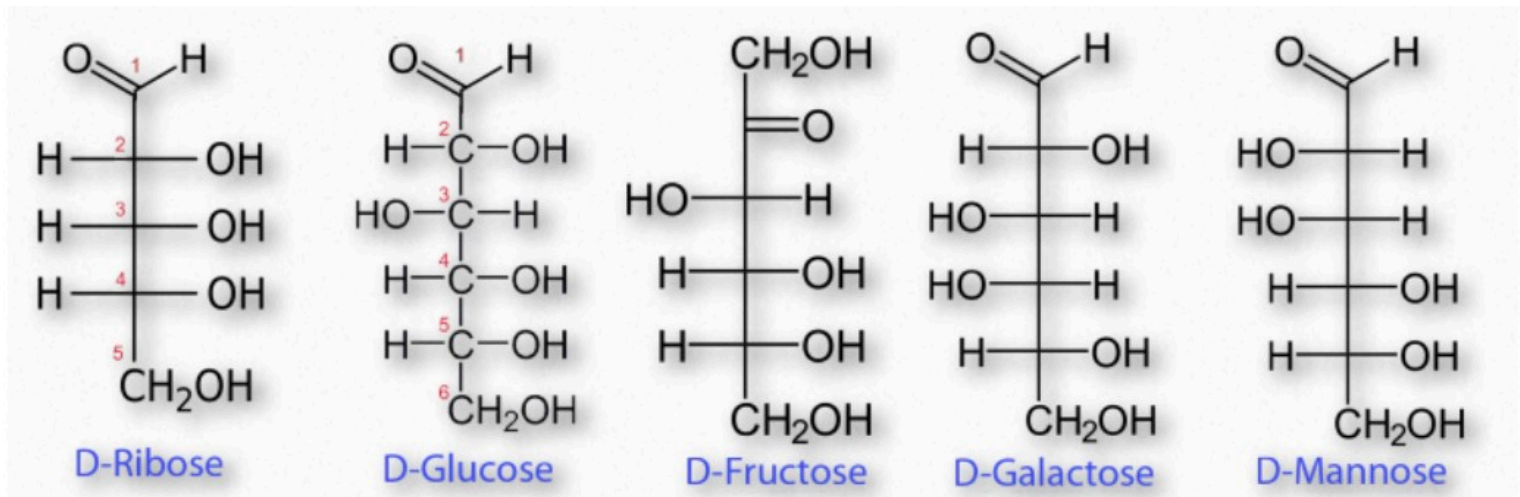


Carbohydrates are a third major group of biomolecules. This diverse group is commonly described as sugars, or saccharides, from the Greek word for sugar. The simplest carbohydrates are called monosaccharides, or simple sugars. An example is glucose. Monosaccharides can be joined to make larger molecules. Disaccharides contain two monosaccharides. Sucrose is a disaccharide, containing both fructose and glucose. Polysaccharides are chains of many sugar subunits. Examples include glycogen and cellulose, both of which are polymers of glucose (but with different configurations).

Carbohydrates are literally “hydrates of carbon.” This designation derives from the generalized formula of simple monosaccharides, which can be written in the form of $C_x(H_2O)_x$, where x is a digit typically between 3 and 8. Not all sugars have this formula, however. Deoxyribose, the sugar found in every nucleotide in a DNA molecule lacks one oxygen and thus has the formula $C_5H_{10}O_4$.

Carbohydrates are important in cells as energy sources (glucose, glycogen, amylose), as markers of cellular identity (oligosaccharides on the surface of cells of multicellular organisms), as structural components (cellulose in plants), and as constituents of nucleotides (ribose in RNA, deoxyribose in DNA).


The building blocks of carbohydrates are simple sugars and it is here we begin our description.



Monosaccharides

The most common monosaccharides include glucose, fructose, galactose, ribose, and mannose. Of these sugars, all but one (fructose) exists as an aldehyde. Fructose and other less well known sugars are ketones. Figure 2.148 shows the structure of these sugars. Some discussion of nomenclature is appropriate.

By convention, the letters 'ose' at the end of a biochemical name flags a molecule as a sugar. Thus, there are glucose, galactose, sucrose, and many other '-oses'. Other descriptive nomenclature involves use of a prefix that tells how many carbons the sugar contains. For example, glucose, which contains six carbons, is described as a hexose. The following list shows the prefixes for numbers of carbons in a sugar:



- Tri- = 3

- Tetr- = 4

- Pent- = 5

- Hex- = 6

- Hept- = 7

- Oct- = 8

Other prefixes identify whether the sugar contains an aldehyde group (aldo-) or a ketone (keto-) group. Prefixes may be combined. Glucose, which is a 6-carbon sugar with an aldehyde group, can be described as an aldohexose. The list that follows gives the common sugars and their descriptors.

- Ribose = aldo-pentose

- Glucose = aldo-hexose

- Galactose = aldo-hexose

- Mannose = aldo-hexose

- Fructose = keto-hexose