18.11: Nucleic Acids

Cancer treatment is a complex and challenging effort. Cancer cells grow without the usual controls that act on normal cells. One approach to treating cancer is to alter the structure of the DNA in order to slow down or stop the growth of the abnormal cells. Compounds that structurally resemble the normal building blocks of DNA have been shown to be very effective in stopping some forms of cancer from spreading throughout the body.

Nucleic Acids

The Swiss biochemist Friedrich Miescher first discovered nitrogen-containing compounds in the nuclei of cells in 1869. The term nucleic acid was used to describe these molecules because of their discovery within the cell nucleus, and because of the presence of phosphate groups and their relationship to phosphoric acid. A **nucleic acid** is a large biopolymer consisting of many nucleotides. The two primary nucleic acids which are found in cells are deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). DNA is the carrier of genetic information and is ultimately responsible for how cells produce proteins in order to carry out all the functions necessary for life. RNA is a related molecule that is involved in the mechanism by which the information stored in DNA is eventually converted into protein molecules.

The basic components of nucleic acids are nucleotides. A **nucleotide** is a molecule that contains a five-carbon sugar, a phosphate group, and a nitrogen-containing base. The five-carbon sugar is either ribose, in the case of RNA, or deoxyribose, in the case of DNA. The only difference between the two molecule is the presence of a hydroxyl group attached to one member of the carbon ring in RNA. In DNA, that same carbon atom is attached only to a hydrogen atom (see figure below). Note that in drawing the structure of organic molecules, the single hydrogen atoms are not shown in the structure, but are understood to be attached at each carbon point unless another molecule is shown.

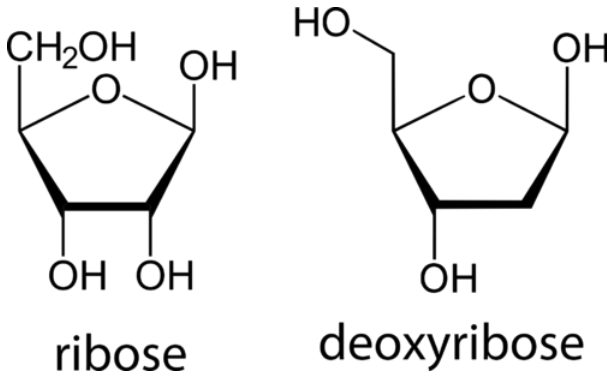

Figure 18.11.1: The sugars ribose and deoxyribose are components of RNA and DNA respectively.

The nucleotides form the backbone of RNA and DNA. Each nucleotide consists of a base, a pentose (either ribose or deoxyribose) and phosphate groups (see figure below). Three of the bases in RNA and DNA are identical (adenine, cytosine, and guanine). Thymine is found in DNA, while uracil is found in RNA.

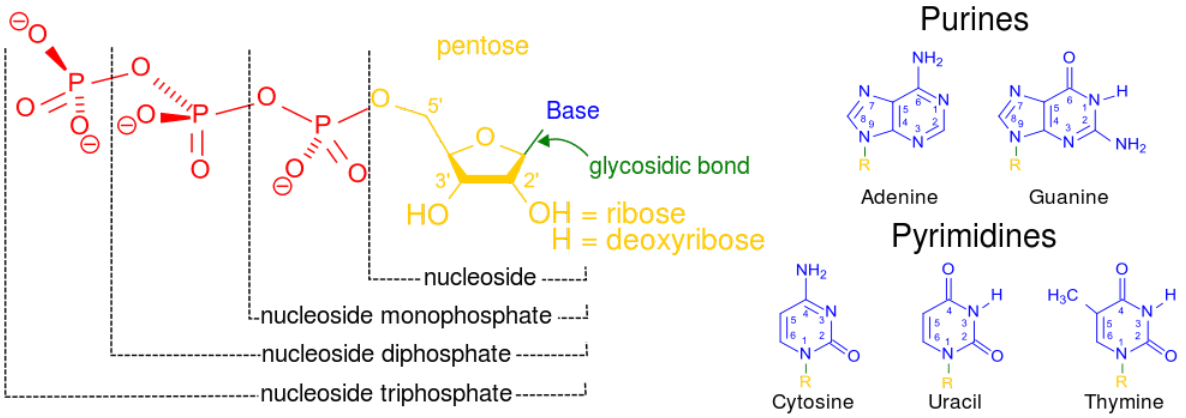

Figure 18.11.2: Nucleotides.

Summary

- A nucleic acid is a large biopolymer consisting of many nucleotides.
- The two primary nucleic acids which are found in cells are deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
- A nucleotide is a molecule that contains a five-carbon sugar, a phosphate group, and a nitrogenous base.
