

Nucleotide Encyclopedia Article

Nucleotide

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Nucleotide

A nucleotide is a single chemical unit which, when bonded with other nucleotides, forms nucleic acids. Nucleic acids such as deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) are the basis for all life on Earth.

Chemically speaking, nucleotides are composed of three types of molecular groups including a sugar structure, a phosphate group, and a cyclic base. A sugar molecule is the primary structure for all nucleotides. In general, the sugars are composed of five carbon atoms with a number of hydroxy (-OH) groups attached. The sugars differ depending on the type of nucleotide, and can be either D-ribose or 2-deoxy-D-ribose. When incorporated into a nucleotide, the sugar molecule exists in a closed ring structure.

A key part of a nucleotide is a heterocyclic base that is covalently bound to the sugar at its first carbon. These bases are either pyrimidine or purine groups, and they form the basis for the nucleic acid code. Two types of purine bases are found including adenine and guanine. In DNA, two types of pyrimidine bases are present, thymine and cytosine. In RNA, the thymine base is absent and uracil is found instead.

A phosphate group makes up the final portion of a nucleotide. This group is derived from phosphoric acid and is covalently bonded to the sugar structure on the fifth carbon. Chemical linkages between nucleotides are made possible by the presence of the phosphate group. In a nucleic acid polymer, the phosphate group from one nucleotide is bonded to the third carbon on another nucleotide. Multiple bonds are made in this way creating a sequence of bases which become an organism's genetic code.