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Other Structures

Deoxyribonucleic acid (DNA) acts as a biochemical storage system for storing hereditary information. DNA is a biopolymer consisting of chains (strands) of molecules called nucleotides. Genomic DNA typically consists of two paired DNA strands bound in an anti-parallel orientation, where each complementary pair of nucleotides is connected by two or three hydrogen bonds. The pairing of complementary nucleotides is governed by a very simple rule (adenines pair with thymines, guanines pair with cytosines), which also provides the basis for DNA's replication and transcription mechanisms. Each nucleotide consists of a phosphate group, a sugar group, and a nitrogenous base. The geometry of the phosphate group is relatively simple (tetrahedral shape), although the deoxyribose sugar has five torsion angles that enable alternative conformations (pucker).

DNA is typically found in one of three biologically active helical structures: A-form, B-form, and Z-form, with B-form being the most common. Although the precise details and measurements of these forms differ slightly, they all involve two helical strands of DNA bound in an anti-parallel orientation. However, when involved with various different biological activities, DNA can assume a variety of different shapes and orientations.

Vast amounts of DNA are stored in every single cell using a tight packing mechanism. Helical DNA is wrapped around histone proteins to form a nucleosome. Nucleosomes can be packed tightly together into coiled fibers, which are stacked even more tightly with scaffolding proteins.

A variety of chemical processes, termed epigenetic mechanisms, can alter the chemical state of particular nucleotides or histones by adding or removing chemical markers, such as methyl or acetyl groups. These relatively minor changes can have significant effects on gene and chromatin regulation.