

Question #61105, Chemistry, Other

Describe and compare the various forms of DNA and explain the bonds that hold the (5) double helix of the DNA together.

Answer:

DNA is a molecule that carries genetic instructions, used in the growth, development, functioning and reproduction of all known living organisms and many viruses.

Three major forms of DNA are double stranded and connected by interactions between complementary base pairs. These are terms A-form, B-form, and Z-form DNA.

The main differences between those DNA forms are described in the table 1:

Table 1 – Main features of the DNA forms

Parameter	A-DNA	B-DNA	Z-DNA
Helix sense	right-handed	right-handed	left-handed
Residues per turn	11	10.5	12
Axial rise [Å]	2.55	3.4	3.7
Helix pitch(°)	28	34	45
Base pair tilt(°)	20	-6	7
Rotation per residue (°)	33	36	-30
Diameter of helix [Å]	23	20	18
Glycosidic bond configuration			
dA, dT, dC	anti	anti	anti
dG	anti	anti	syn
Sugar pucker			
dA, dT, dC	C3'-endo	C2'-endo	C2'-endo
dG	C3'-endo	C2'-endo	C3'-endo
Intrastrand phosphate-phosphate distance [Å]			
dA, dT, dC	5.9	7.0	7.0
dG	5.9	7.0	5.9

The DNA double helix is held together by two types of bonds, covalent and hydrogen. Covalent bonds occur within each linear strand and strongly bond the bases, sugars, and phosphate groups (both within each component and between components). Hydrogen bonds occur between the two strands and involve a base from one strand with a base from the second in complementary pairing. These hydrogen bonds are individually weak but collectively quite strong.