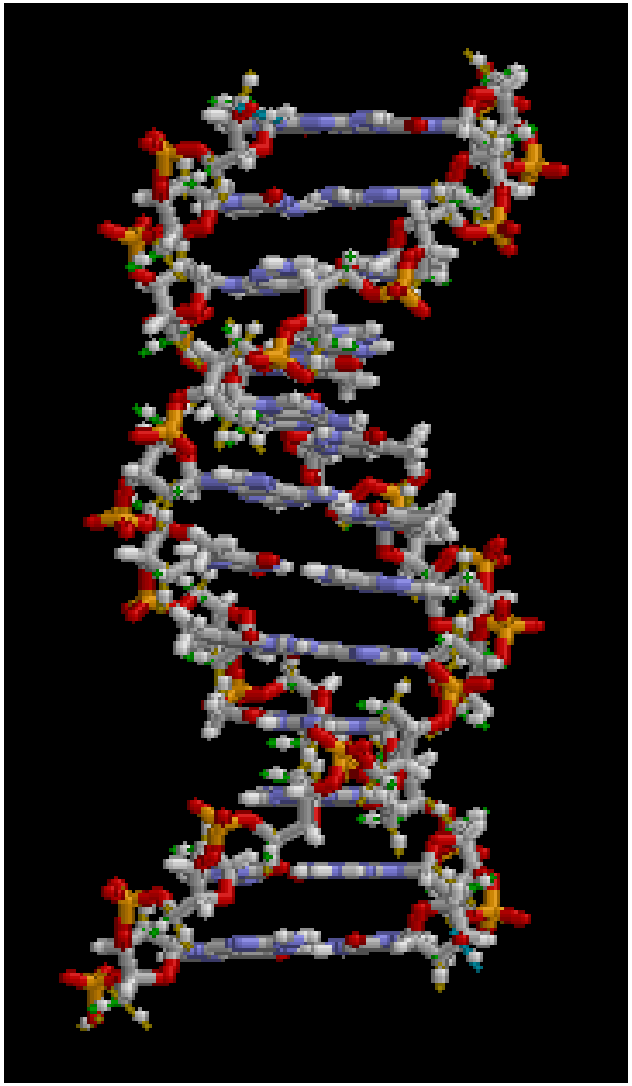
DNA, the molecule

**Deoxyribonucleic acid**



Major Groove 2.2 nm

Minor Groove 1.2 nm

0.3 nm per base

http://en.wikipedia.org/wiki/DNA

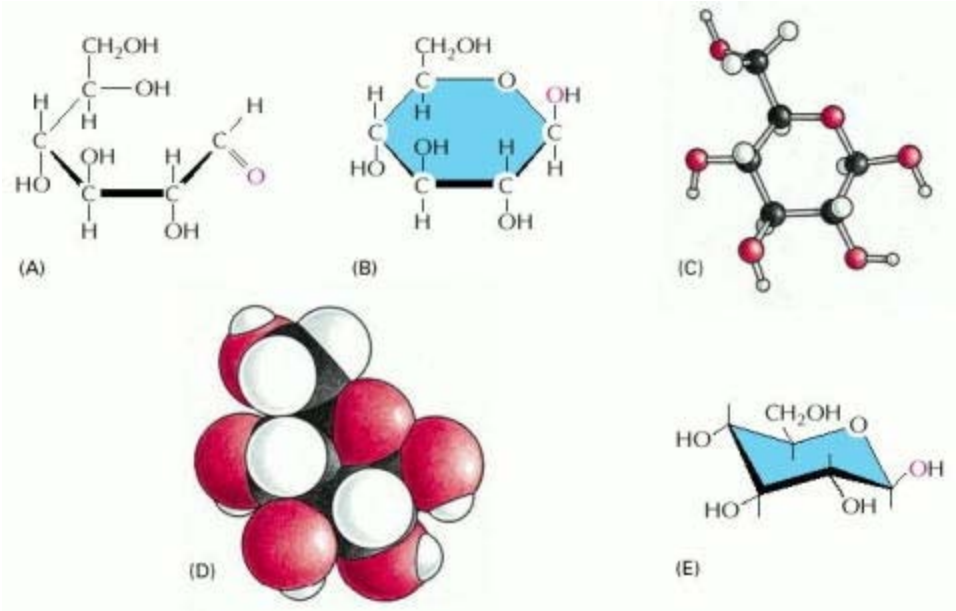
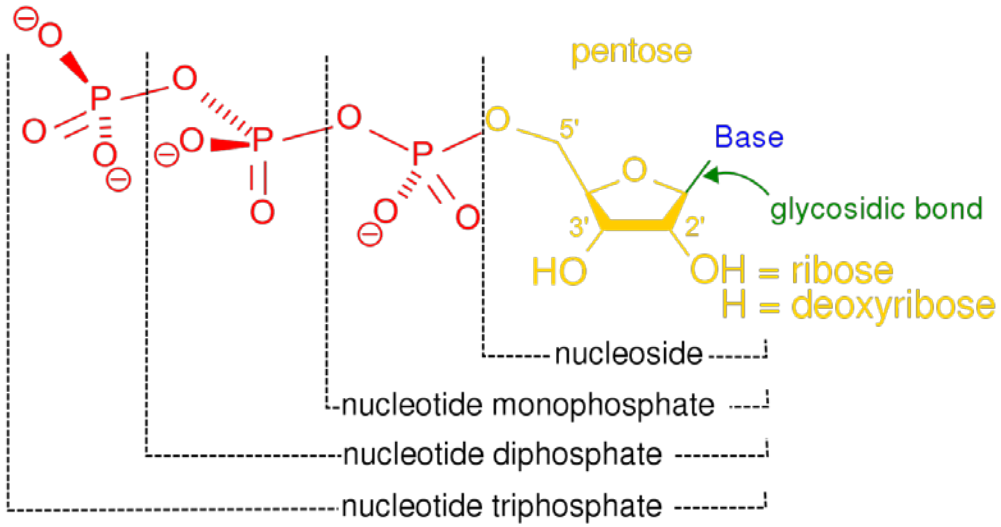
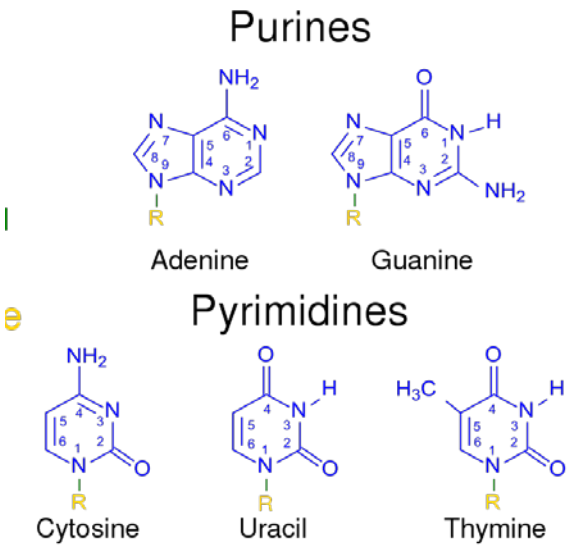



Figure 2-18

**The structure of glucose, a simple sugar**

As illustrated previously for water (see Figure 2-12), any molecule can be represented in several ways. In the structural formulas shown in (A), (B) and (E), the atoms are shown as chemical symbols linked together by lines representing the covalent bonds. The *thickened lines* here are used to indicate the plane of the sugar ring, in an attempt to emphasize that the -H and -OH groups are not in the same plane as the ring. (A) The open-chain form of this sugar, which is in equilibrium with the more stable cyclic or ring form in (B). (C) A ball-and-stick model in which the three-dimensional arrangement of the atoms in space is shown. (D) A space-filling model, which, as well as depicting the three-dimensional arrangement of the atoms, also uses the van der Waals radii to represent the surface contours of the molecule. (E) The chair form is an alternative way to draw the cyclic molecule that reflects the geometry more accurately than the structural formula in (B). The atoms in (C) and (D) are drawn according to the conventional color coding for atoms. For example, these colors are H, *white*; C, *black*; O, *red*; N, *blue* (see also Figure 2-8).




| Nitrogenous base | Nucleoside | Deoxynucleoside |
|---|---|---|
| Adenine | Adenosine<br>A | Deoxyadenosine<br>dA |
| Guanine | Guanosine<br>G | Deoxyguanosine<br>dG |
| Thymine | 5-Methyluridine<br>$m^5U$ | Thymidine<br>dT |
| Uracil | Uridine<br>U | Deoxyuridine<br>dU |
| Cytosine | Cytidine<br>C | Deoxycytidine<br>dC |

The structure elements of the nucleosides and the phosphate group bearing nucleotides

http://en.wikipedia.org/wiki/Nucleoside

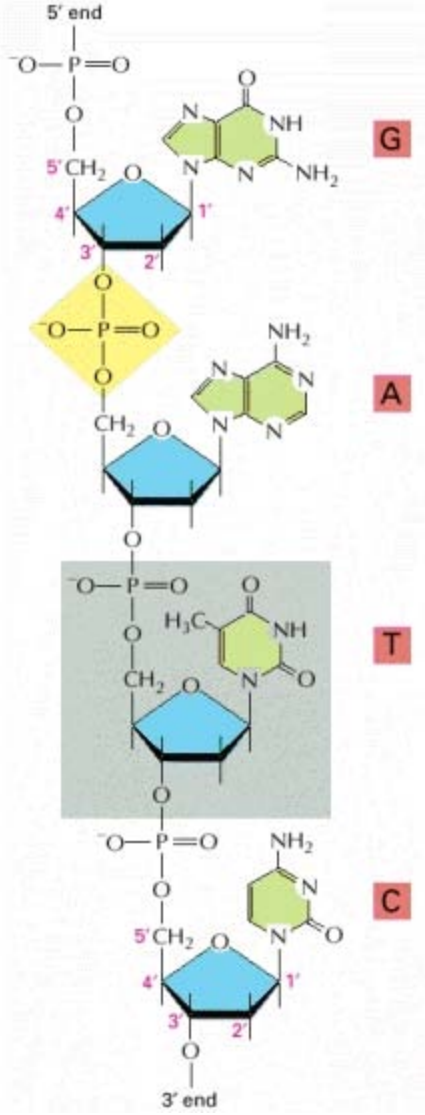



Figure 2-28

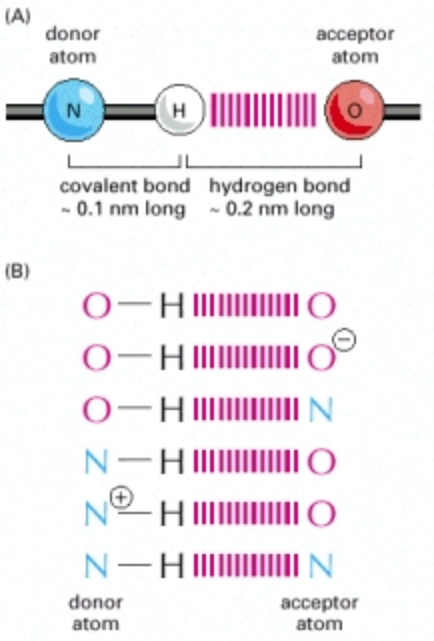
**A small part of one chain of a deoxyribonucleic acid (DNA) molecule**

Four nucleotides are shown. One of the phosphodiester bonds that links adjacent nucleotide residues is highlighted in *yellow,* and one of the nucleotides is shaded in *gray.* Nucleotides are linked together by a phosphodiester linkage between specific carbon atoms of the ribose, known as the 5′ and 3′ atoms. For this reason, one end of a polynucleotide chain, the 5′ end, will have a free phosphate group and the other, the 3′ end, a free hydroxyl group. The linear sequence of nucleotides in a polynucleotide chain is commonly abbreviated by a one-letter code, and the sequence is always read from the 5′ end. In the example illustrated the sequence is G-A-T-C.

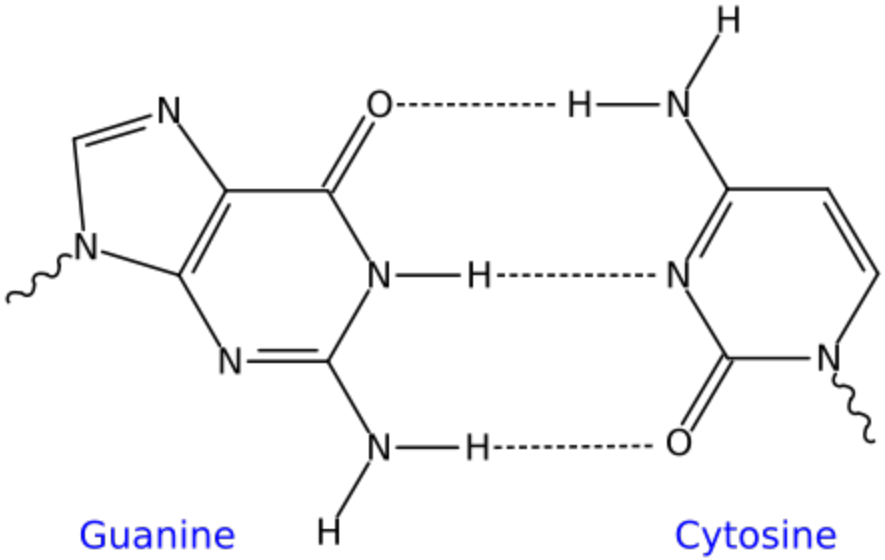
| **Nucleoside** | Adenosine | Guanosine | Thymidine | Cytidine | Uridine |
|---|---|---|---|---|---|
| | A | G | T | C | U |

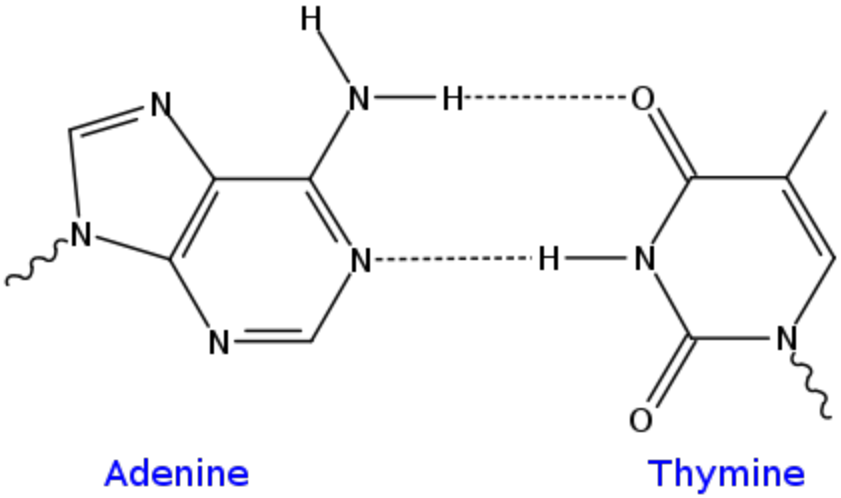
| BOND TYPE | LENGTH (nm) | STRENGTH (kcal/mol) IN VACUUM | IN WATER |
|---|---|---|---|
| Covalent | 0.15 | 90 | 90 |
| Ionic | 0.25 | 80 | 3 |
| Hydrogen | 0.30 | 4 | 1 |
| van der Waals attraction (per atom) | 0.35 | 0.1 | 0.1 |

1 kcal/mol ~ 1.7 $k_B T$ (T = 25 C)




(A) Ball- and-stick model of a typical hydrogen bond. The distance between the hydrogen and the oxygen atom here is less than the sum of their van der Waals radii, indicating a partial sharing of electrons. (B) The most common hydrogen bonds in cells.



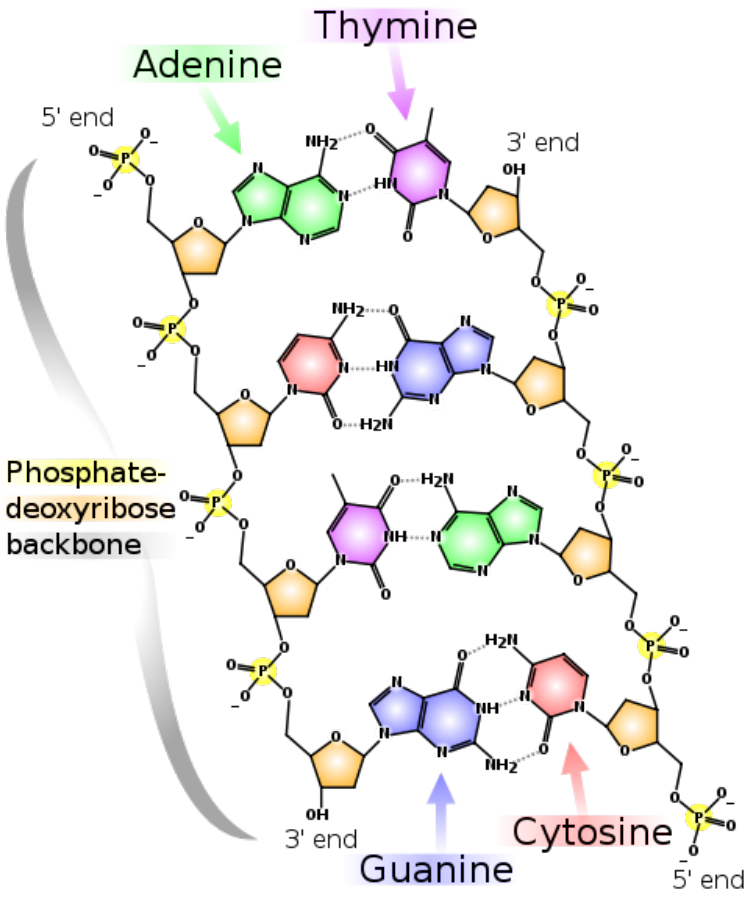



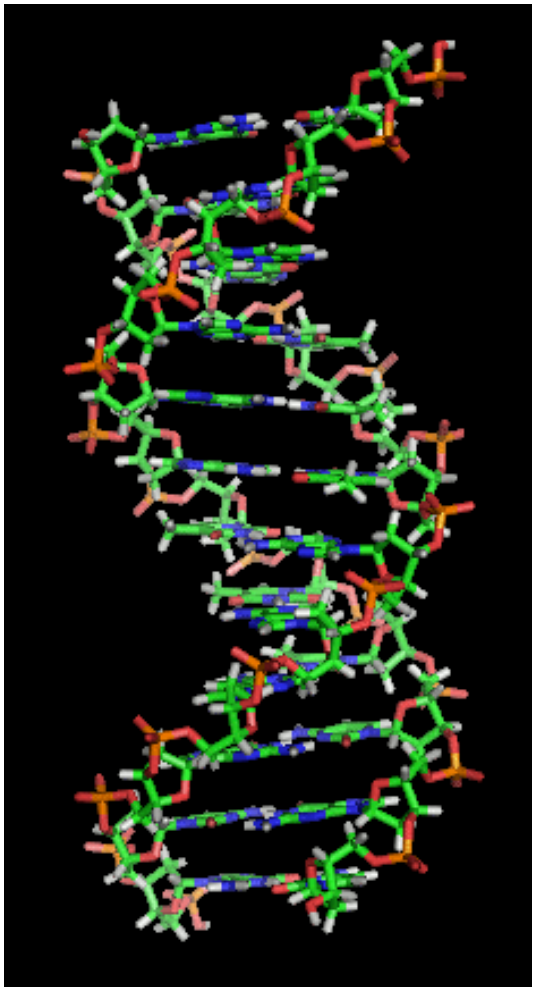

**hydrogen bond**

Noncovalent bond in which an electropositive hydrogen atom is partially shared by two electronegative atoms

Names are the ‘nucleobase’, not ‘nucleoside’

http://en.wikipedia.org/wiki/DNA



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