

Module 9 / Differences between DNA and RNA

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Describe the structural differences between the A-helix and B-helix.

Define which helix type describes DNA and RNA.

The tertiary structure of B-DNA has been described with a number of specific characteristics. These characteristics describe what is referred to as the B-helix. It is the most common structural form of double stranded DNA. RNA and hybrids of DNA with RNA have altered characteristics resulting from the substitution of a ribose for a deoxyribose in the backbone structure. The general characteristics found in the B-DNA are still present; however, slight differences in the specific characteristics result in dramatic changes in the overall structure of the helix.

The following table compares some of the finer characteristics of the B-helix and A-helix. In general, the A-helix is broader than the B-helix, there are slightly more base pairs per turn in the A-helix, and most significantly, the tilt of the bases relative to the axis of the helix is much greater in the A-Helix.

	A-helix	B-helix
Shape	Broader than B	
Screw Sense	Right	Right
Base pairs/Turn	11	10.4
Pitch/turn	25	35
Tilt of Bases	19	1
Major Groove	Narrow/Very Deep	Wide/Quite Deep
Minor Groove	Very Broad/Shallow	Narrow/Deep

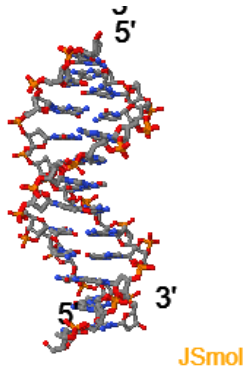
The following 3D representations illustrate the result of these differences in comparing similar views of the B-helix of DNA with the A-helix in duplex RNA. When exploring these structures you should focus on the following aspects of the structures, noting similarities and differences:

1. The location of phosphate, ribose, and bases with respect to the interior and exterior of the helix
2. The location of the major and minor grooves. The grooves are water and ion filled channels on the side of the double helix. Proteins usually interact with the edges of the bases in the major groove.
3. The tilt of the bases with respect to the axis of the helix.
4. How the bases overlap with each other. As a result of the greater tilt in the bases relative to the helix axis, the bases of the A-helix slide past each other and do not exactly stack on top of each other as they do in the B-helix.

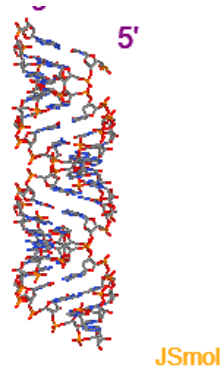
Nucleic Acid Structure

Instructions: The structure of DNA is shown on the left, and double stranded RNA on the right. Use the buttons to highlight common features of both of these nucleic acids as you answer the questions below.

DNA Structure (B-helix)

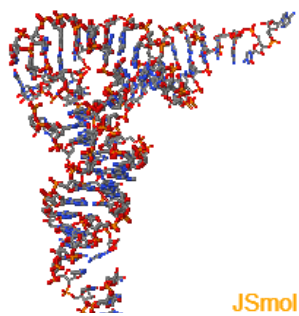


RNA Structure (A-helix)



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Structure of a Nucleic Acid



Use the above Jmols to answer this question.

In both DNA and RNA the phosphate groups are on the outside of the structure.

True

False



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