



RAMA  
UNIVERSITY

[www.ramauniversity.ac.in](http://www.ramauniversity.ac.in)

FACULTY OF ENGINEERING & TECHNOLOGY  
DEPARTMENT OF BIOTECHNOLOGY

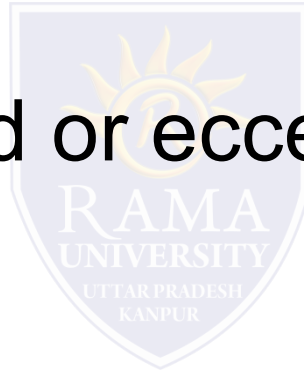
# Variations in DNA

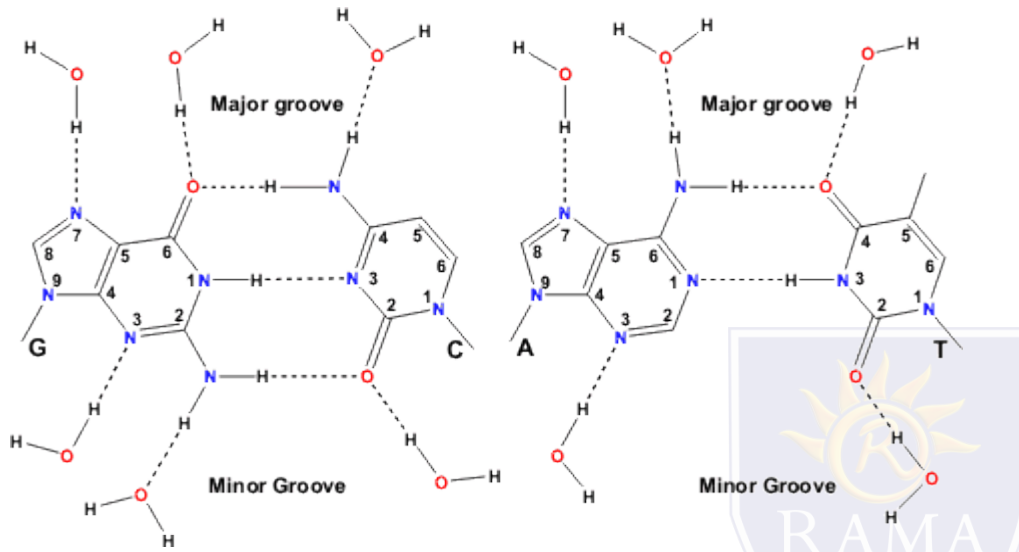
- Most of the DNA is in the classic Watson-Crick model simply called as B-DNA or B-form DNA.
  - In certain condition, different forms of DNAs are found to be appeared like A-DNA, Z-DNA, C- DNA, D-DNA, E-DNA.
  - This deviation in forms are based on their structural diversity.
-

## DIFFERENT FORMS OF DNA

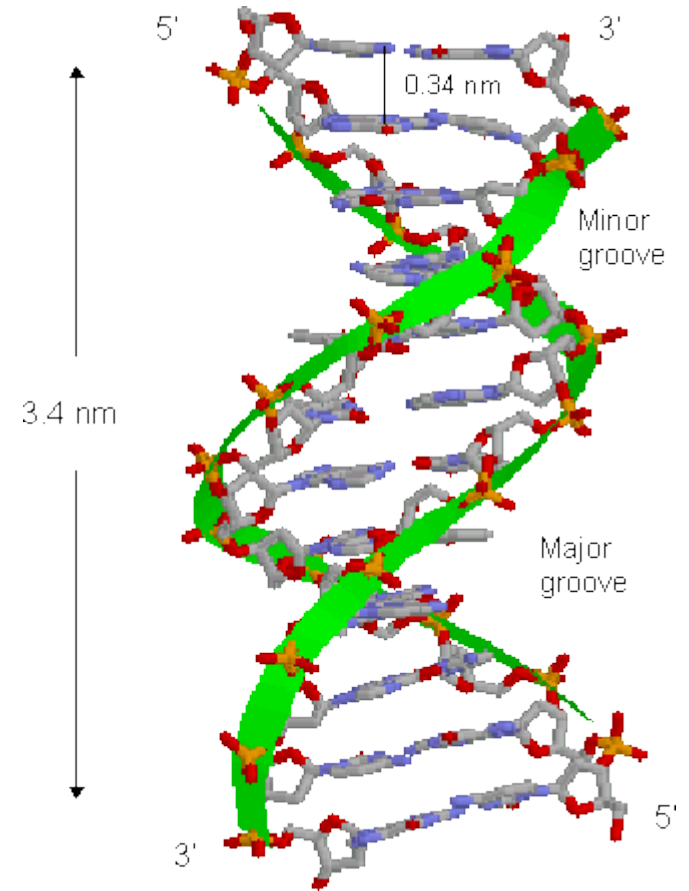
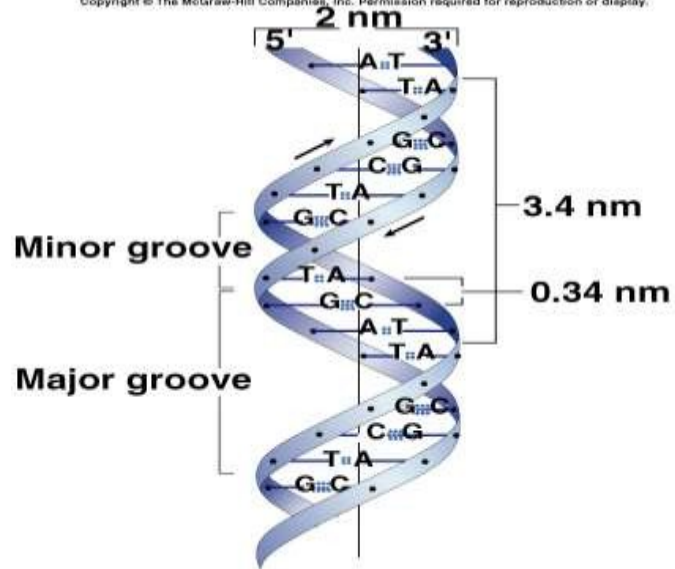
- X-ray analysis of DNA crystals at atomic resolution have revealed that DNA exhibits much more structural diversity than formly envisaged. Such variations are:
  - **B-DNA**: Most common ,originally deduced from X-ray diffraction of sodium salt of DNA fibres at 92% relative humidity.
  - **A-DNA**: Originally identified by X-ray diffraction of analysis of DNA fibres at 75% relative humidity .
  - **Z-DNA**: Left handed double helical structure winds to the left in a zig- zag pattern .
  - **C-DNA**: Formed at 66% relative humidity and in presence of  $\text{Li}^+$  and  $\text{Mg}^{2+}$  ions.

- D-DNA: Rare variant with 8 base pairs per helical turn, form in structure devoid of guanine.
- E-DNA: Extended or eccentric DNA.



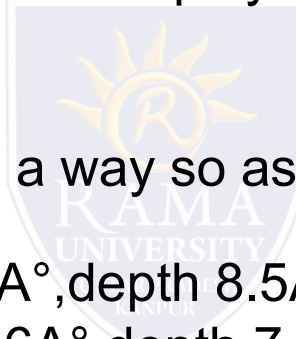


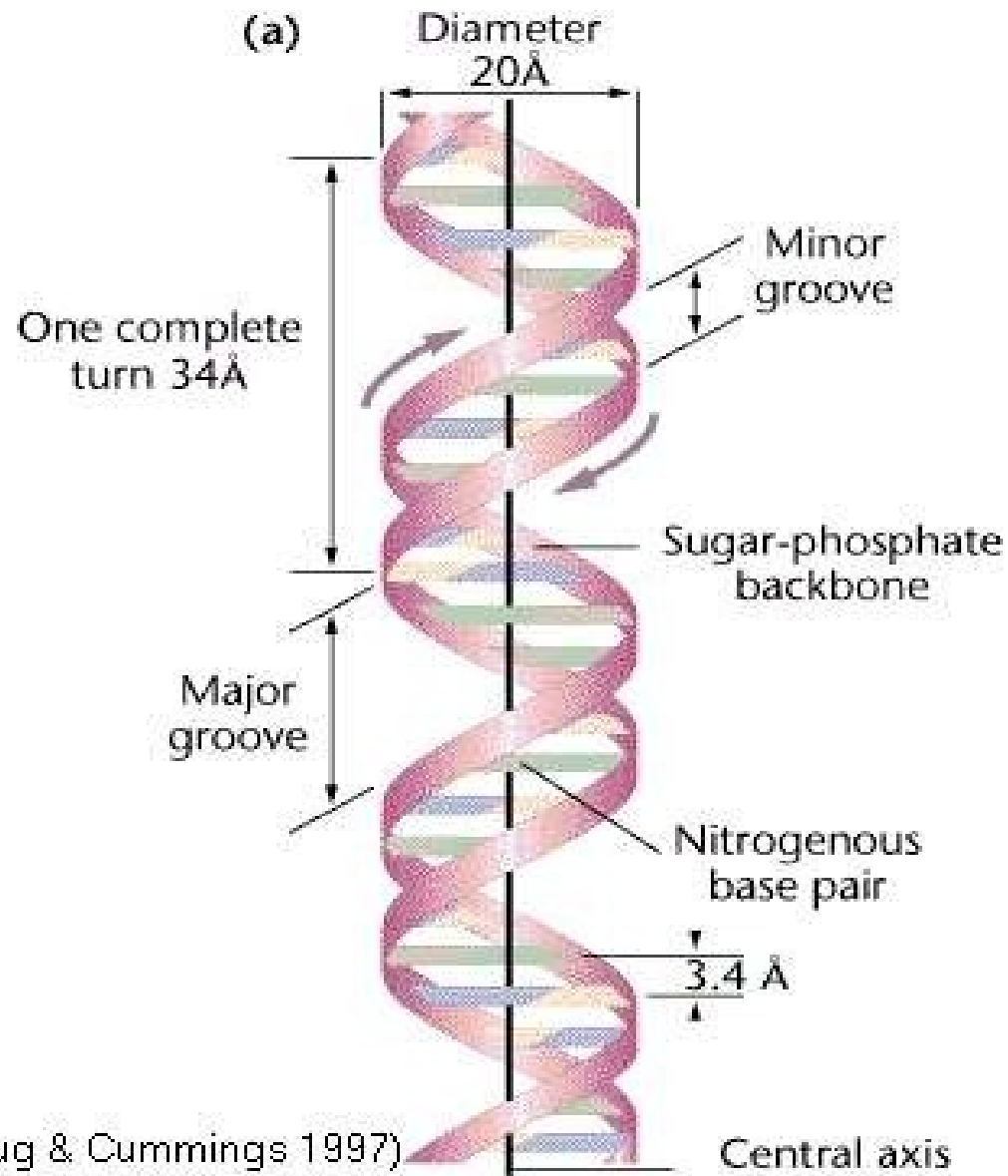
Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



## B-DNA

- Described by James D. Watson & Francis crick.
- Commonly found in DNA.
- DNA molecule consists of 2 helical polynucleotide chains coiled around common axis.
- 2 helices are wound in such a way so as to produce 2 interchain spacing or groove –
  - Major/wide groove(width  $12\text{\AA}$ ,depth  $8.5\text{\AA}$ )
  - Minor /narrow groove(width  $6\text{\AA}$ ,depth  $7.5\text{\AA}$ )
- These grooves provide surface with which proteins,chemicals,drugs can interact.





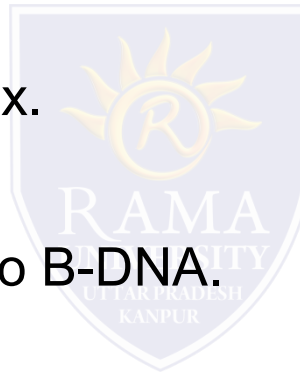
(Klug & Cummings 1997)

- 2 helical wind along the molecules.
- 2 chains run in opposite direction ,they are antiparallel ,the plane of bases are perpendicular to helix axis.
- Right handed twisting .
- Uniform diameter( $20\text{\AA}$ )
- Complementary base pairing.
- Base pair per turn is 10.4.
- Rise per base pair is  $3.4\text{\AA}$ .

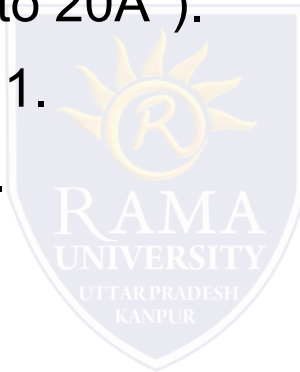


## A-DNA

- A-DNA is one of the possible double helical structure which DNA can adopt along with other two biologically active helix structure (B-DNA, Z-DNA).
- Right handed double helix.
- Short and fat compared to B-DNA.
- Occur only in dehydrated sample of DNA, Such those used in crystallographic experiments.

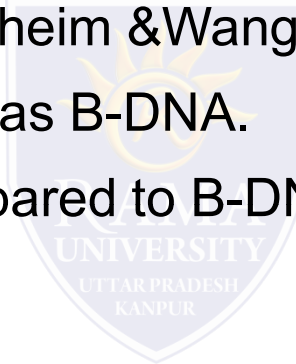


- A-DNA was originally identified by X-ray diffraction analysis of DNA fibres at 75% relative humidity.
- The grooves are not as deep in B-DNA.
- The bases are more tilted (to  $20^\circ$ ).
- The base pairs per turn is 11.
- Rise per base pair is  $2.3\text{\AA}$ .



## Z-DNA

- One of the many possible DNA double helix structure.
- Left handed double helix structure winds to left in zig-zag manner.(DNA backbone were in zig-zag manner)so they are termed as Z-DNA.
- Discovered by Rich, Nordheim &Wang in 1984.
- It has antiparallel strands as B-DNA.
- It is long and thin as compared to B-DNA.



	A	B	Z
HELIX	RIGHT HANDED	RIGHT HANDED	LEFT HANDED
WIDTH	WIDEST	INTERMEDIATE	NARROWEST
PLANE OF BASE	PERPENDICULAR TO HELIX AXIS	PERPENDICULAR TO HELIX AXIS	PERPENDICULAR TO HELIX AXIS
CENTRAL AXIS	6A° HOLES ALONG HELIX AXIS	TINY CENTRAL	NO INTERNAL SPACE
MAJOR AXIS	NARROW & DEEP	WIDE & DEEP	NO MAJOR GROOVE
	WIDE AND	NARROW & DEEP	NARROW & DEEP