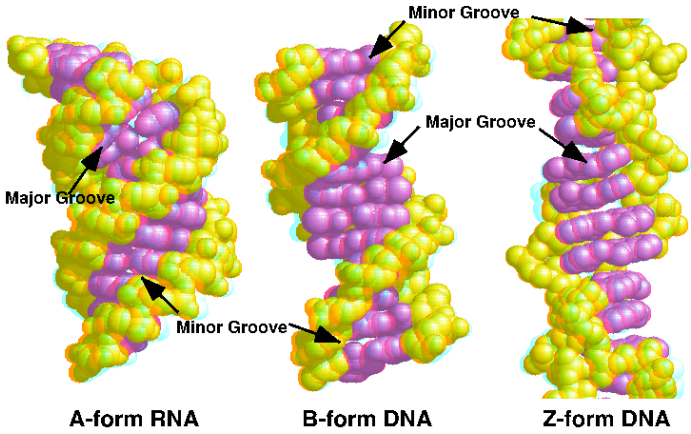


A-form

- Most RNA and RNA-DNA duplex in this form
- Shorter, wider helix than B.
- Deep, narrow major groove not easily accessible to proteins
- Wide, shallow minor groove accessible to proteins, but lower information content than major groove.
- Favored conformation at low water concentrations
- Base pairs tilted to helix axis and displaced from axis
- Sugar pucker C3'-endo (in RNA 2'-OH inhibits C2'-endo conformation)

B-form

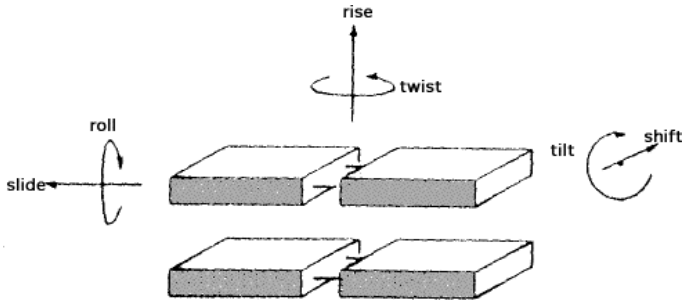
- Most common DNA conformation in vivo
- Narrower, more elongated helix than A.
- Wide major groove easily accessible to proteins
- Narrow minor groove
- Favored conformation at high water concentrations (hydration of minor groove seems to favor B-form)
- Base pairs nearly perpendicular to helix axis
- Sugar pucker C2'-endo

Z-form

- Helix has left-handed sense
- Can be formed in vivo, given proper sequence and superhelical tension, but function remains obscure.
- Narrower, more elongated helix than A or B.
- Major "groove" not really groove
- Narrow minor groove
- Conformation favored by high salt concentrations, some base substitutions, but requires alternating purine-pyrimidine sequence.
- N2-amino of G H-bonds to 5' PO: explains slow exchange of proton, need for G purine.
- Base pairs nearly perpendicular to helix axis
- GpC repeat, not single base-pair
  - P-P distances: vary for GpC and CpG
  - GpC stack: good base overlap
  - CpG: less overlap.
- Zigzag backbone due to C sugar conformation compensating for G glycosidic bond conformation
- Conformations:
  - C; anti, C2'-endo
  - G; syn, C3'-endo

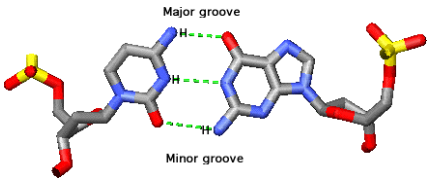
The geometry of the DNA forms can be used to describe the differences seen.

	A	B	Z
Helix sense	Right handed	Right-handed	Left handed
Repeating unit	1 bp	1bp	2 bp
Rotation/bp	33.6°	35.9°	60°/2
Mean bp/turn	10.7	10.0	12
Inclination of bp to axis	+19°	-1.2°	-9°
Rise/bp along axis	2.3Å	3.32Å	3.8Å
Pitch/turn of helix	24.6Å	33.2Å	45.6Å
Mean propeller twist	+18°	+16°	0°
Glycosyl angle	anti	anti	C: anti, G: syn
Sugar pucker	C3'-endo	C2'-endo	C: C2'-endo, G: C3'-endo
Diameter	26Å	20Å	18Å

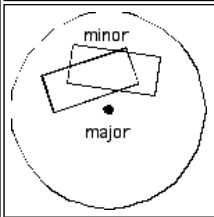
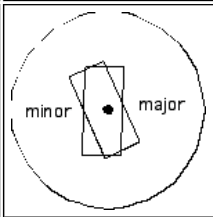
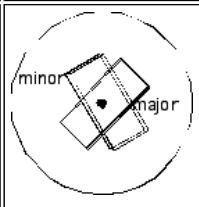


Grooves and stacking of bases:

Major and minor groove definition:



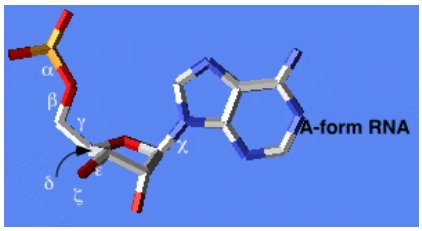
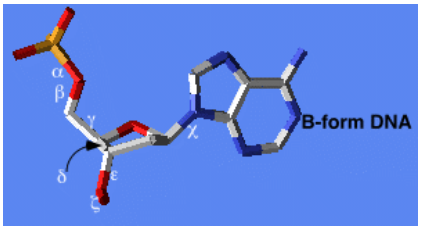
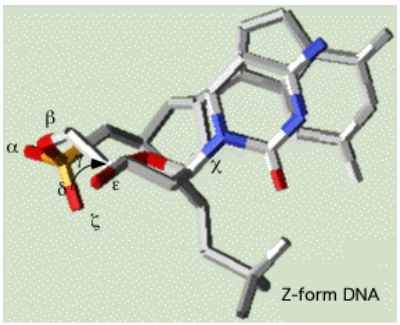
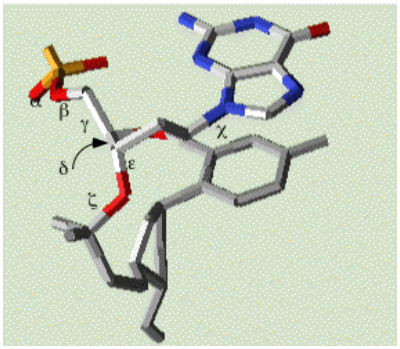
Sugars are on minor groove side of the base pair

A	B	Z
		
RNA and low humidity DNA Bp displaced from axis-> deep major	Hydrated DNA Bp on axis, both major and minor grooves available	High salt DNA (Pu-p-Py polymers) bp stick out into major groove.

groove		

Sugar pucker:

Differences --> differences in forms of helices

A	B	Z
		 
C3'-endo (favored in RNA due to steric problems with 2'OH)	C2'-endo	C: C2'-endo G: C3'-endo
Glycosyl (c) *anti*	Glycosyl (c) *anti*	C: Glycosyl (c) *anti* G: Glycosyl (c) *syn*