Exploring Nucleic Acid Structures
Nucleic Acid Building Blocks: Nucleotides

Base
Sugar
Phosphate
Chemistry

- **Bases**
  - Purines and Pyrimidines
  - Bases in DNA (dA, dT, dG, dC)
  - Bases in RNA (A, U, G, C)

- **Sugars**
  - DNA has deoxy ribose sugar
  - RNA has ribose sugar

- **Phosphate**
Tautomeric structures

- Keto vs inol
- Different hydrogen bonding patterns
Watson Crick Base Pairs

Geometry of A:T and G:C base pairs are isosteric.
Diversity of hydrogen bonding

- **homo purine**
  - symmetric
    - I
    - II
    - III
    - IV
  - asymmetric
    - V
    - VI
    - VII

- **hetero pyrimidine**
  - symmetric only
    - XVII
    - XVIII

- **purine - pyrimidine**
  - symmetric
    - XIX
    - XX
  - asymmetric
    - reversed Watson - Crick
      - XXI
      - XXII
    - Hoogsteen
      - XXIII
      - XXIV
    - reversed Hoogsteen
      - XXV
      - XXVI
      - XXVII
      - XXVIII
Backbone conformation
Anti vs. syn

Anti conformation

Syn conformation
Change in sugar conformation affects the backbone
Ribose ring is never flat
A DNA

A DNA vs B DNA

A-DNA

B-DNA
Z DNA

- Left handed
- Very deep minor groove
- Major groove on outside

G pairing in quadruplex

Side view 1L1H

Top view 1L1H

Close-up of G-pairing
RNA

- Double and single stranded
- Double helix has A-form structure
- Single stranded forms globular structure
tRNA: Secondary and Tertiary Structures