Semester-III

Biochemistry Notes

NUCLEIC ACID

by

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Nucleic Acids

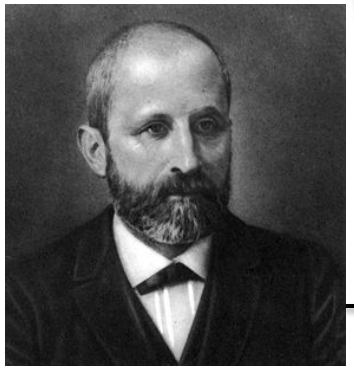
"Molecules of heredity"---allow organisms to transfer genetic information from one generation to the next

Nucleic acids →
- First discovered within the Nucleus
- Presence of Phosphate group
- Chloroplasts & Mitochondria

Polysaccharides

Proteins

Biological Polymers



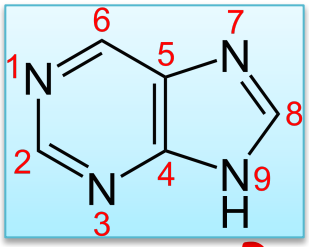
F. Meischer (1969)

Isolated DNA (NUCLEUS) — PUS cells — "NUCLEIN"

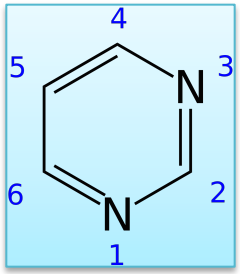
Structural Features of Nucleic Acids

Types:
RNA: ribonucleic acid
DNA: deoxyribonucleic acid

The monomeric units for nucleic acids are Nucleotides:
Sugar+ Nitrogenous base+ Phosphate

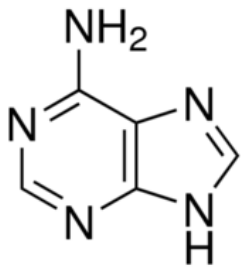


Nitrogenous base

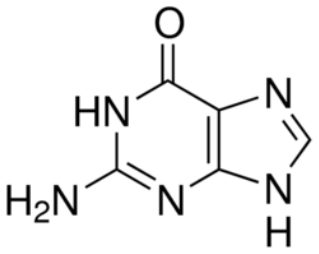


Purines

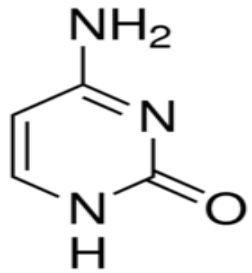
Pyrimidines



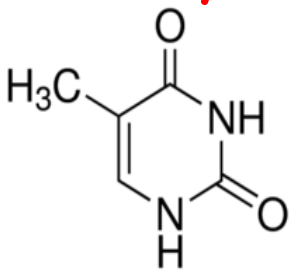
Adenine (A)



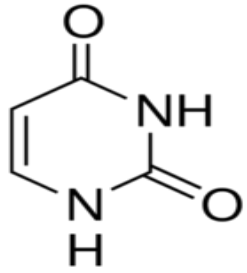
Guanine (G)



Cytosine (C)



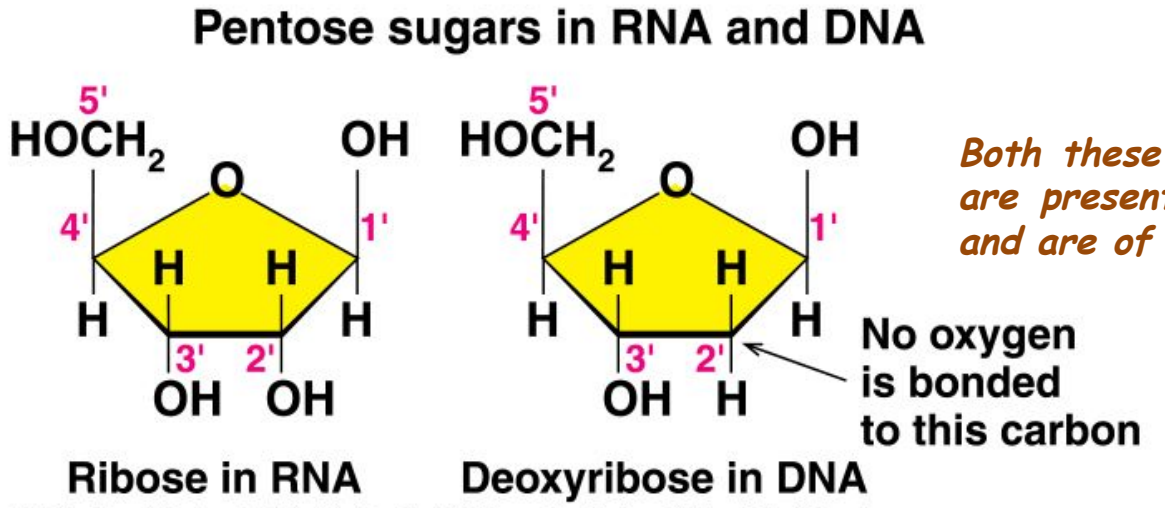
Thymine (T)



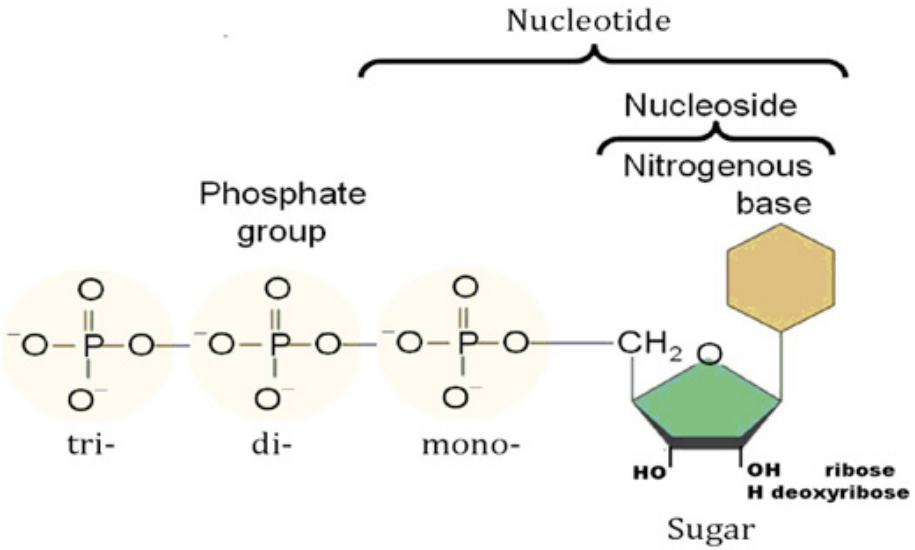
Uracil (U)

DNA: A, T, G, C
RNA: A, U, G, C

Structural Features of Nucleic Acids



Both these sugars in nucleic acids are present in the furanose form and are of β configuration.

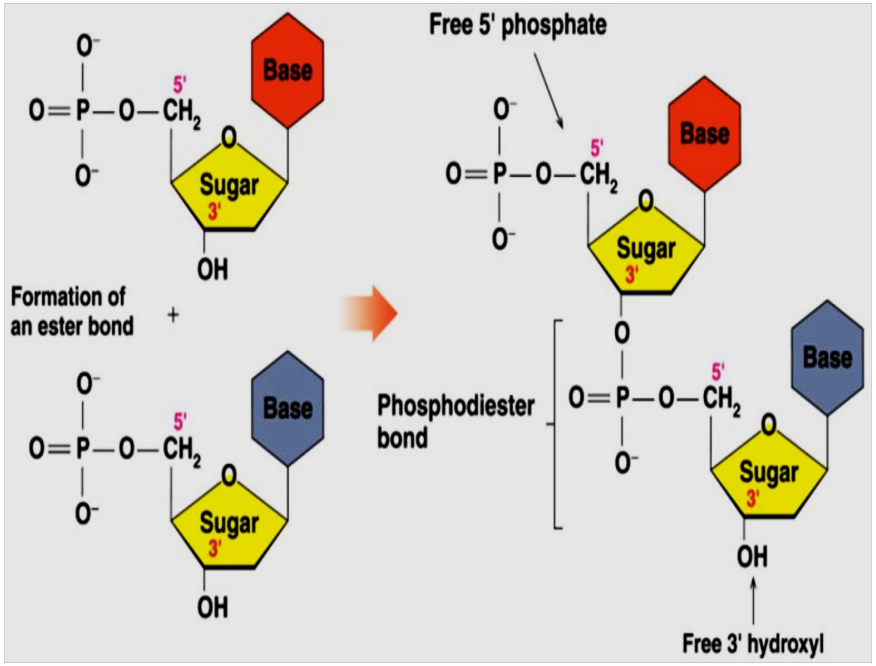


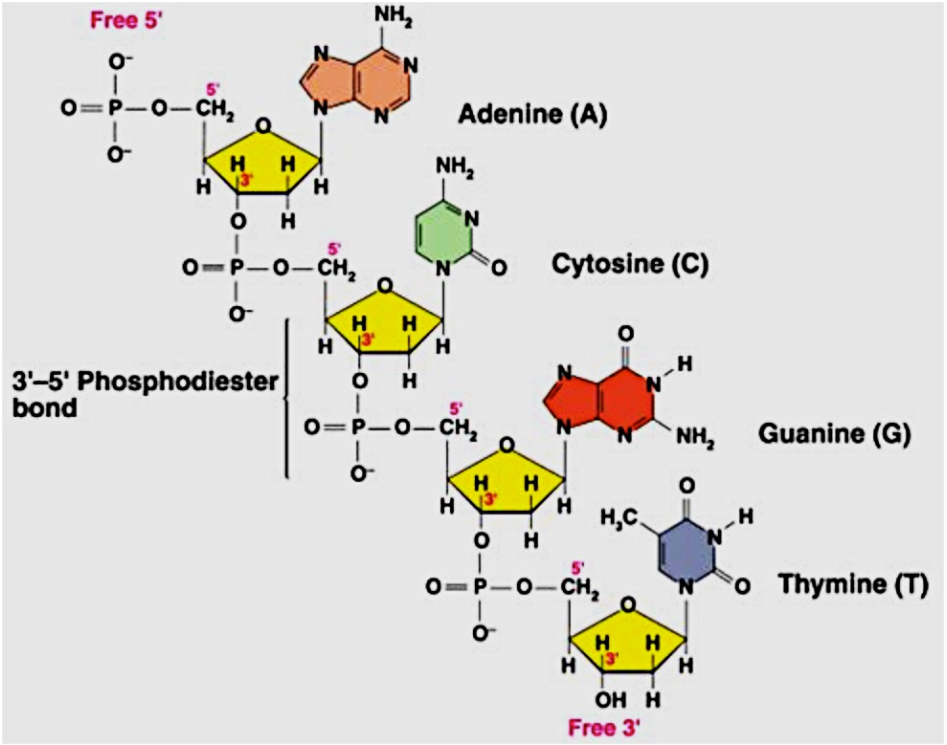
Nucleosides:
Pentose sugar + Nitrogenous base

Nucleotides:
Pentose sugar + Nitrogenous base + Phosphate

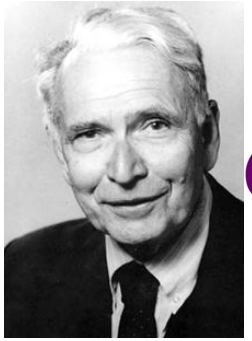
Primary Structure of Nucleic Acids

- Nucleotides are joined together by phosphodiester linkage between 5′ and 3′ carbon atoms of the pentose sugar to form a typical dinucleotide
- Information regarding the sequence of nucleotides in the chain of a nucleic acid is called its primary structure.





Secondary Structure: DNA Double Helix



Erwin Chargaff (1940)

A=T; C=G

(A/T)=(C/G)=1

Nobel Prize (1962)

Crick Watson Wilkins

Rosalind Franklin

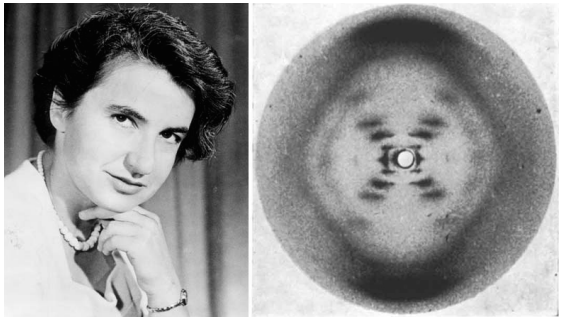
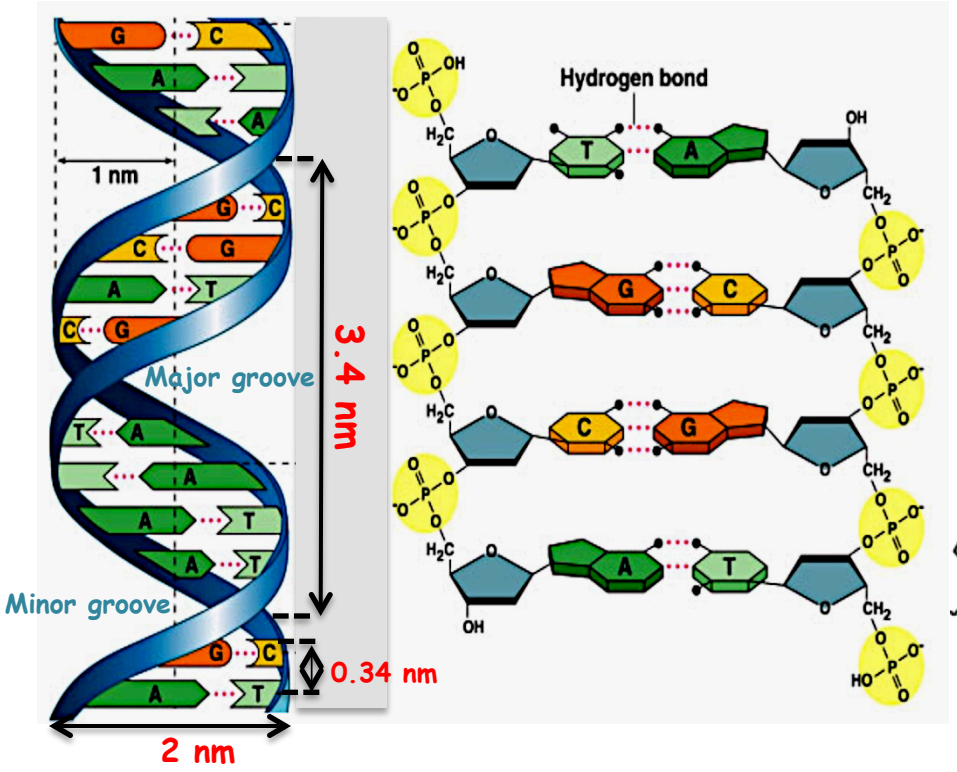
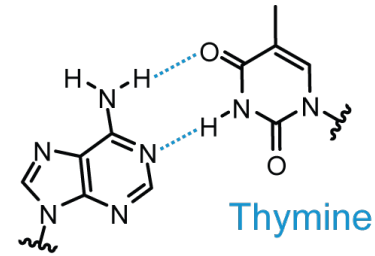
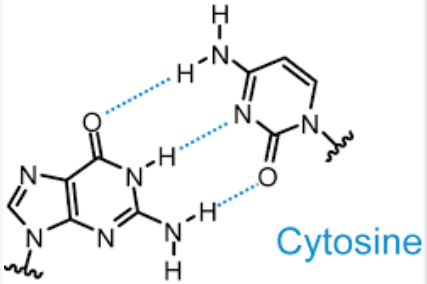


Photo 51, showing x-ray diffraction pattern of DNA





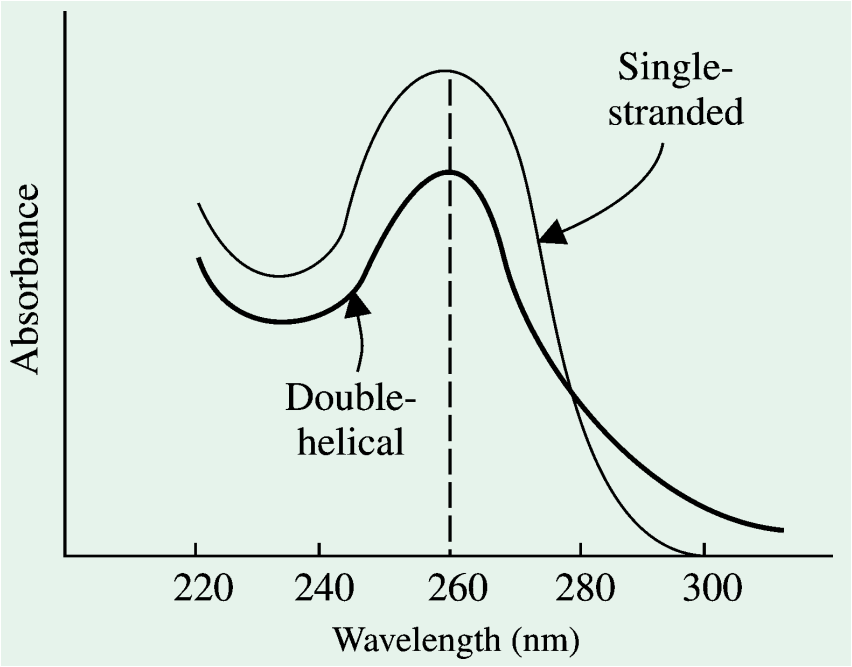


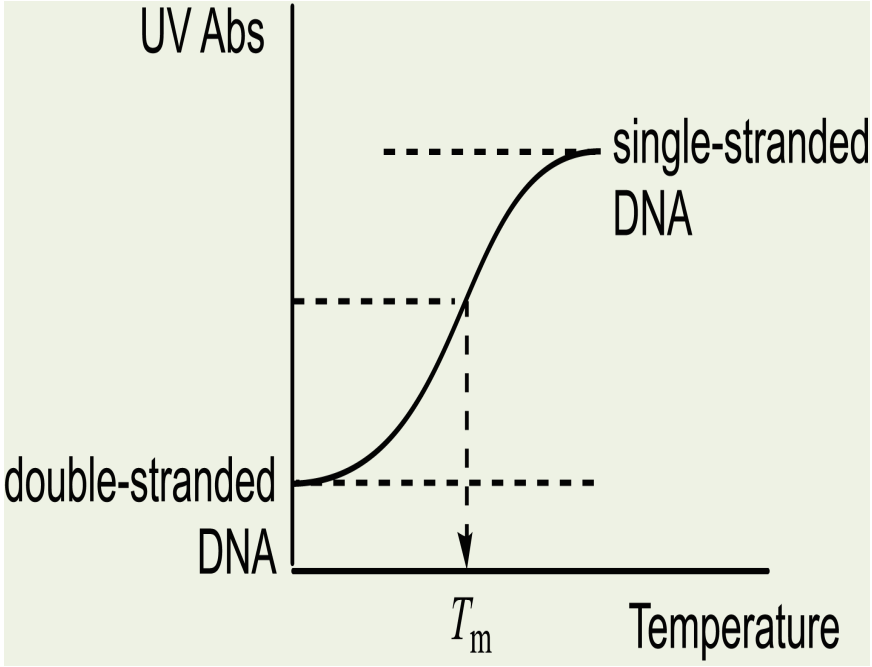
Types of DNA

A-DNA: 11 bp/turn
B-DNA: 10 bp/turn
C-DNA: 9 bp/turn
Z-DNA: 12 bp/turn

A, B, C----Right handed
Z…..Left handed

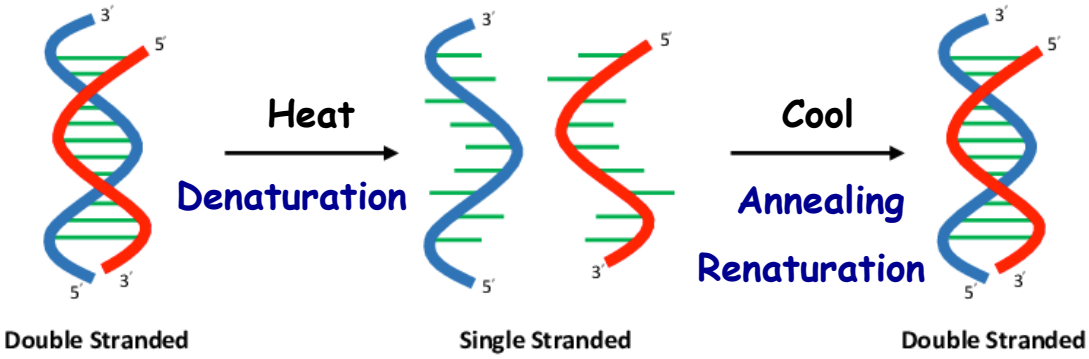
Properties of DNA





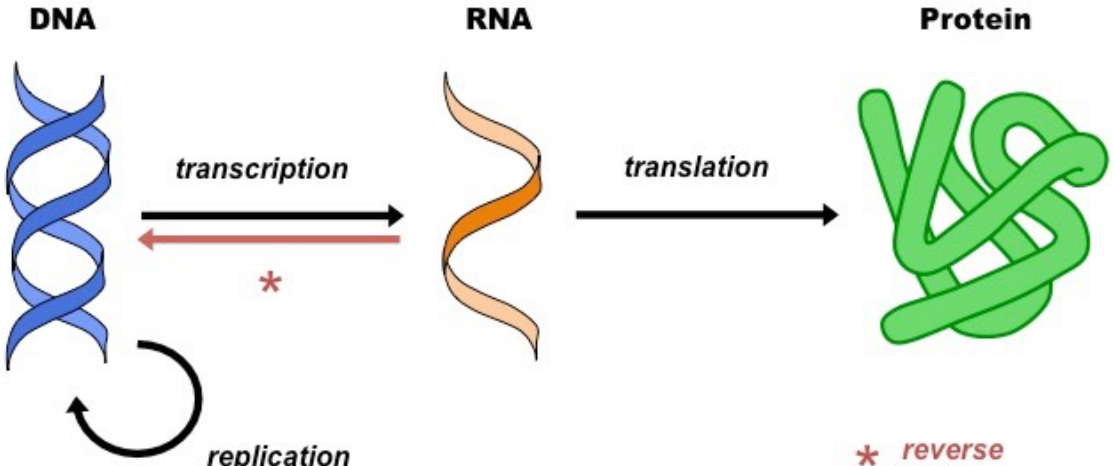
Denaturation:

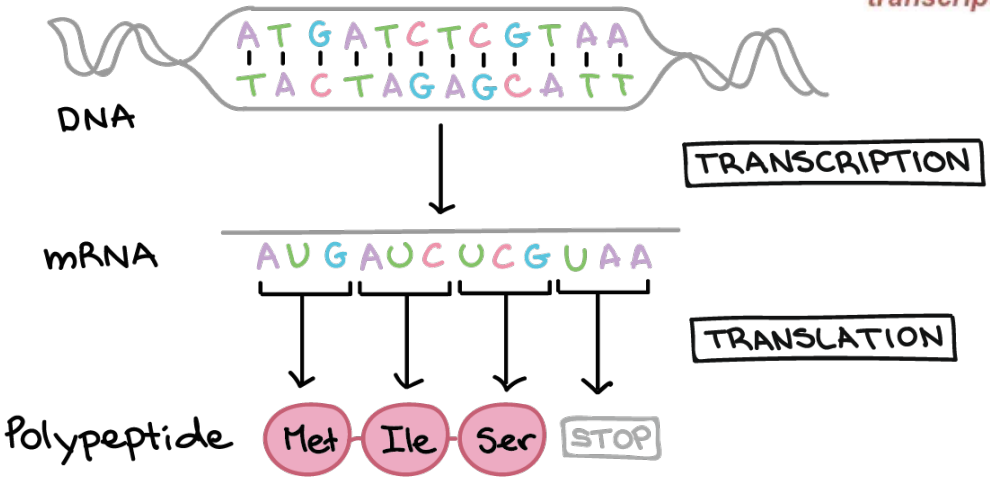
- **Increase in absorption of ultraviolet ligt: Hyperchromic effect**
- **Low pH (1-3) and High pH (>12)**
- **Melting Temperature (T_m)**



Central Dogma

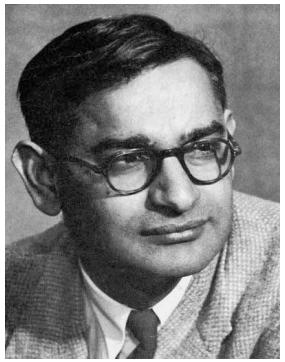
- Proposed by Francis Crick (1958)
- Instructions in DNA are converted into a functional product





Interpretation of the genetic code and its function in protein synthesis

Nobel Prize in Physiology and Medicine (1968)



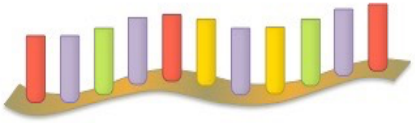
Har Gobind Khorana

Types of RNA

- Single stranded
- Uracil instead of Thymine
- Ribose sugar

- **mRNA:** Messenger RNA (Information molecule)

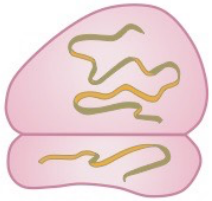
  Carries the message of the DNA into the cytoplasm of the cells



Messenger RNA (mRNA)

- **tRNA:** Tranfer RNA

  Carries amino acids to the site of the protein synthesis

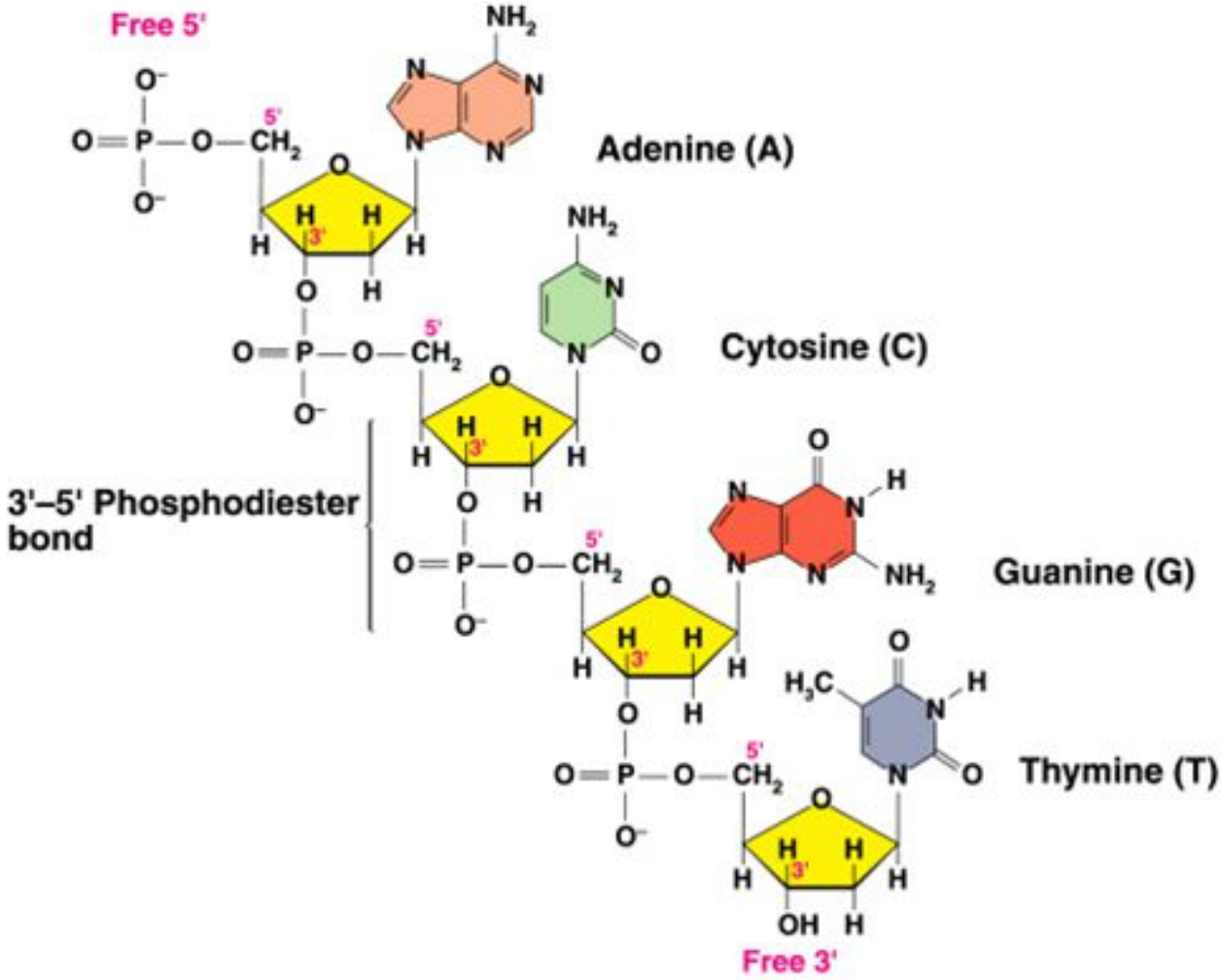


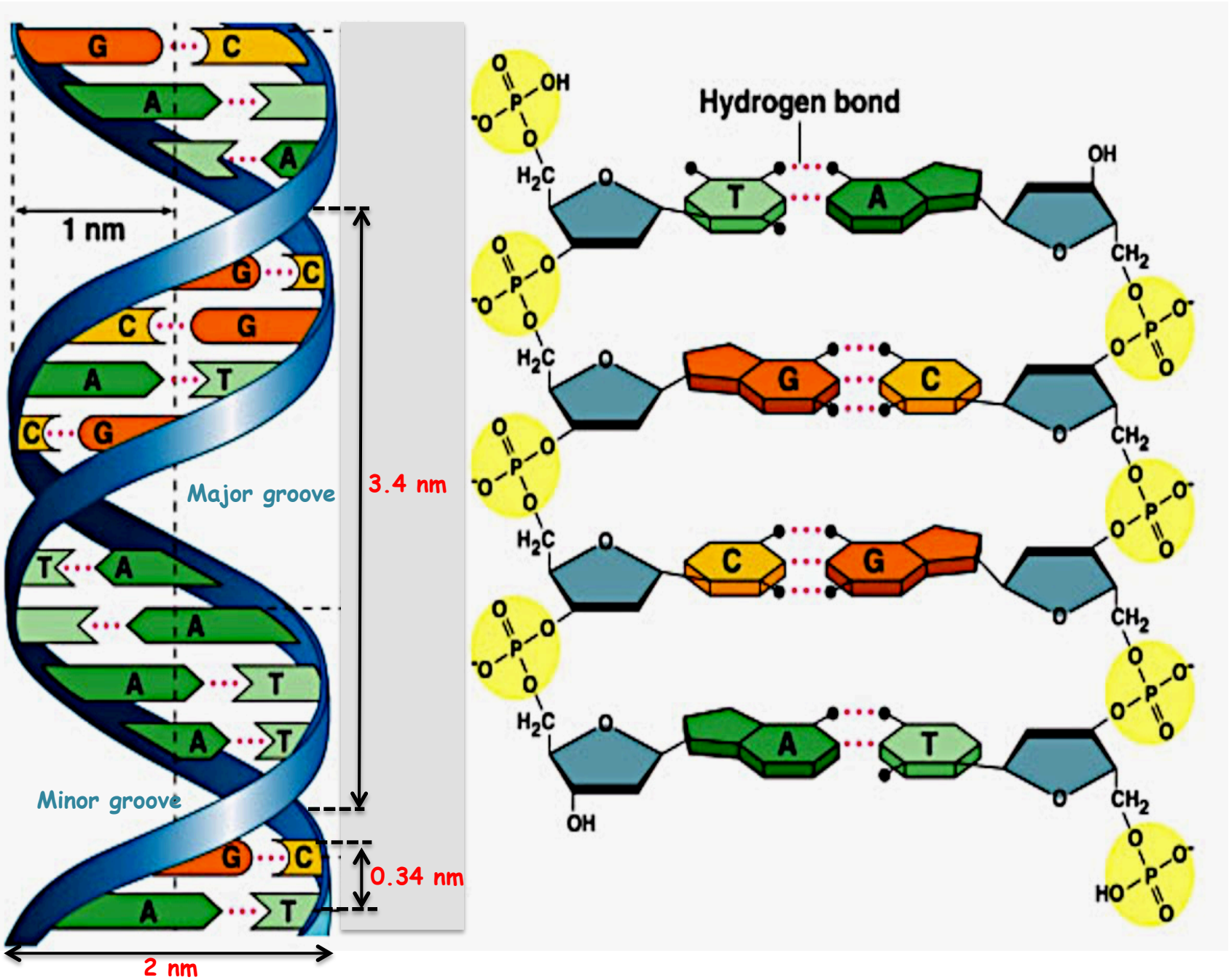
Ribosomal RNA (rRNA)

- **rRNA:** Ribosomal RNA

  Facilitates binding of of mRNA to ribosome

Transfer RNA (tRNA)


Free 5'
Adenine (A)
Cytosine (C)
3'–5' Phosphodiester bond
Guanine (G)
Thymine (T)
Free 3'


1 nm
Major groove
3.4 nm
Minor groove
0.34 nm
2 nm
Hydrogen bond