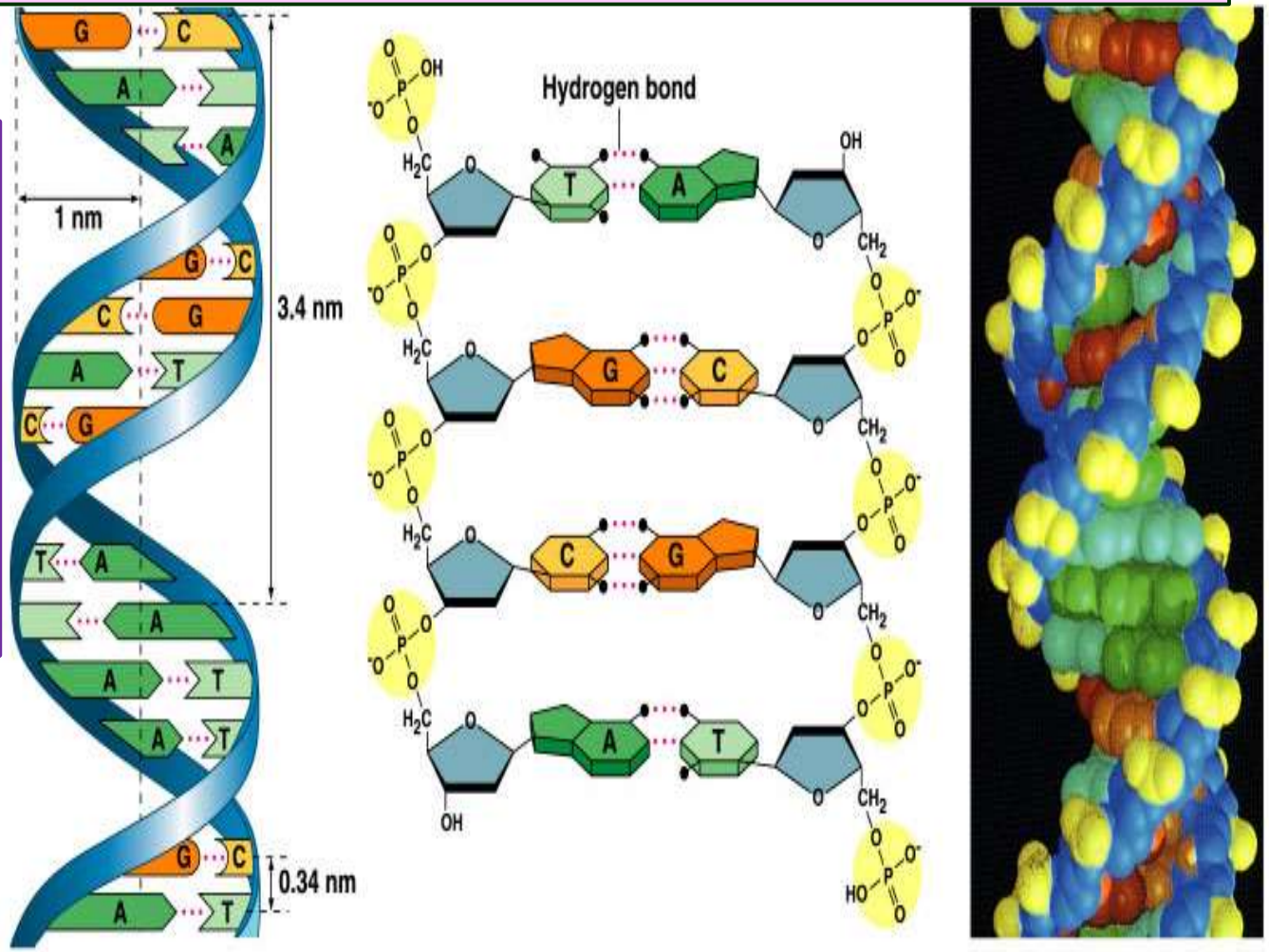
The Structure of DNA and RNA

DR. UTTAM KUMAR KANP
Assistant Professor
DEPARTMENT OF BOTANY
NARAJOLE RAJ COLLEGE



Structure of Nucleic acids

- NA structure is often divided into four different levels:

  Primary structure

  Secondary structure

  Tertiary structure

  Quaternary structure

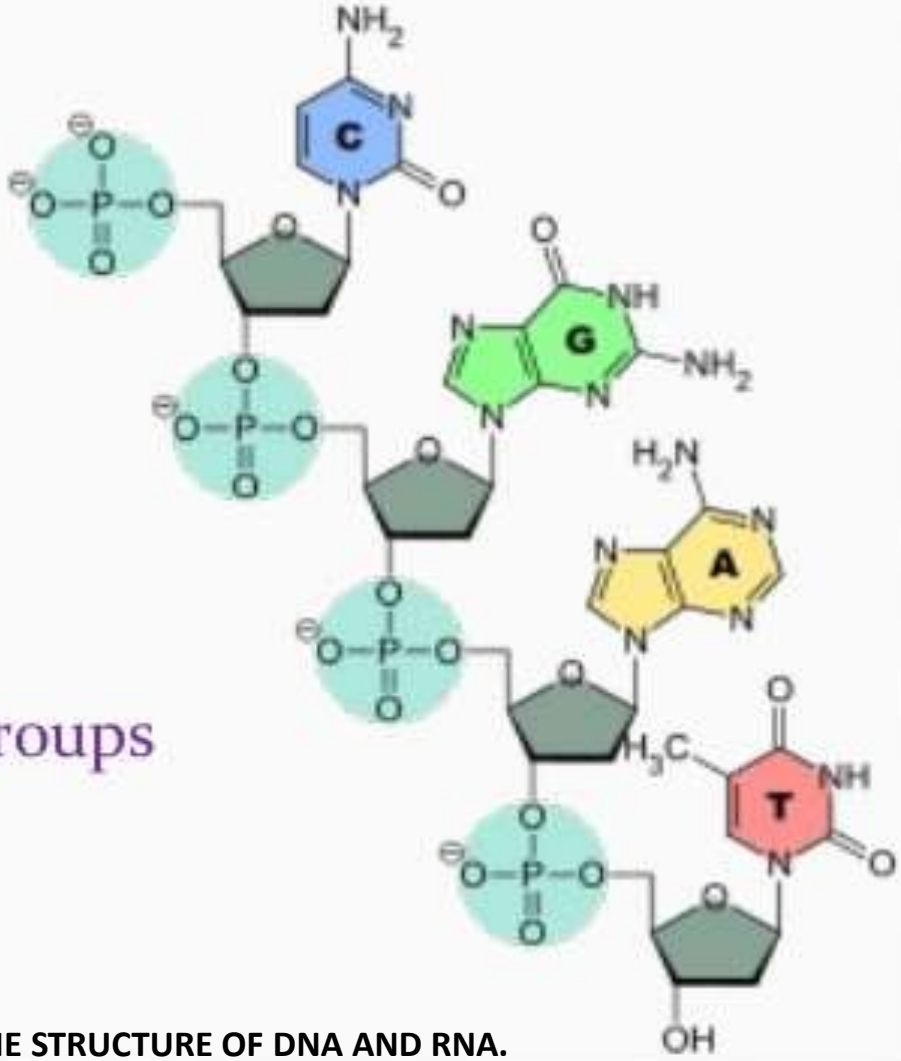
- Primary structure: consists of a linear sequence of nucleotides that are linked together by phosphodiester bond.

Nucleotides consists of 3 components:

Nitrogenous base

5-carbon sugar

One or more phosphate groups

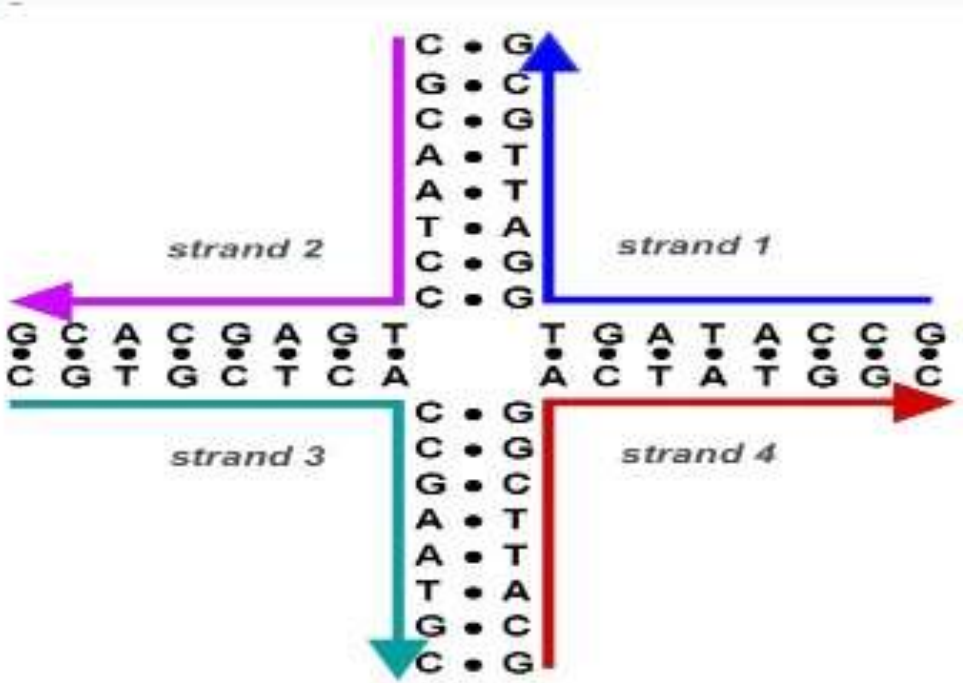


Secondary structure

This is the set of interactions between bases.

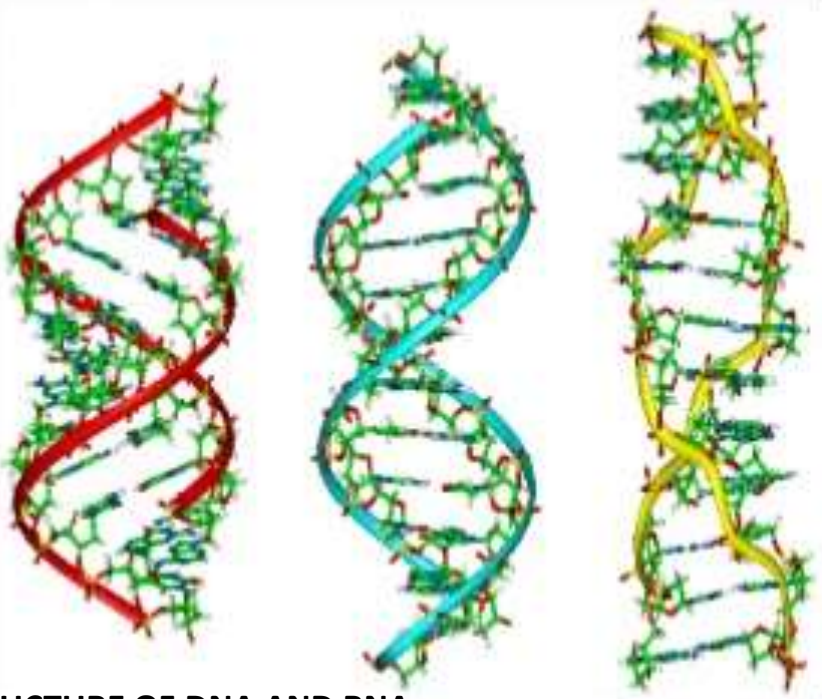
In DNA double helix, the two strands of DNA are held together by hydrogen bonds.

The nucleotides on o
strand base pairs wit
the nucleotide on the
other strand. The
secondary structure
is responsible for the
shape that the nuclei
acid assumes.



Tertiary structure

This is the locations of atoms in three-dimensional space, taking into consideration geometrical and steric constraits. A higher order than the secondary structure in which large scale folding in a linear polymer occurs and the entire chain is folded into a specific 3-dimensional shape.

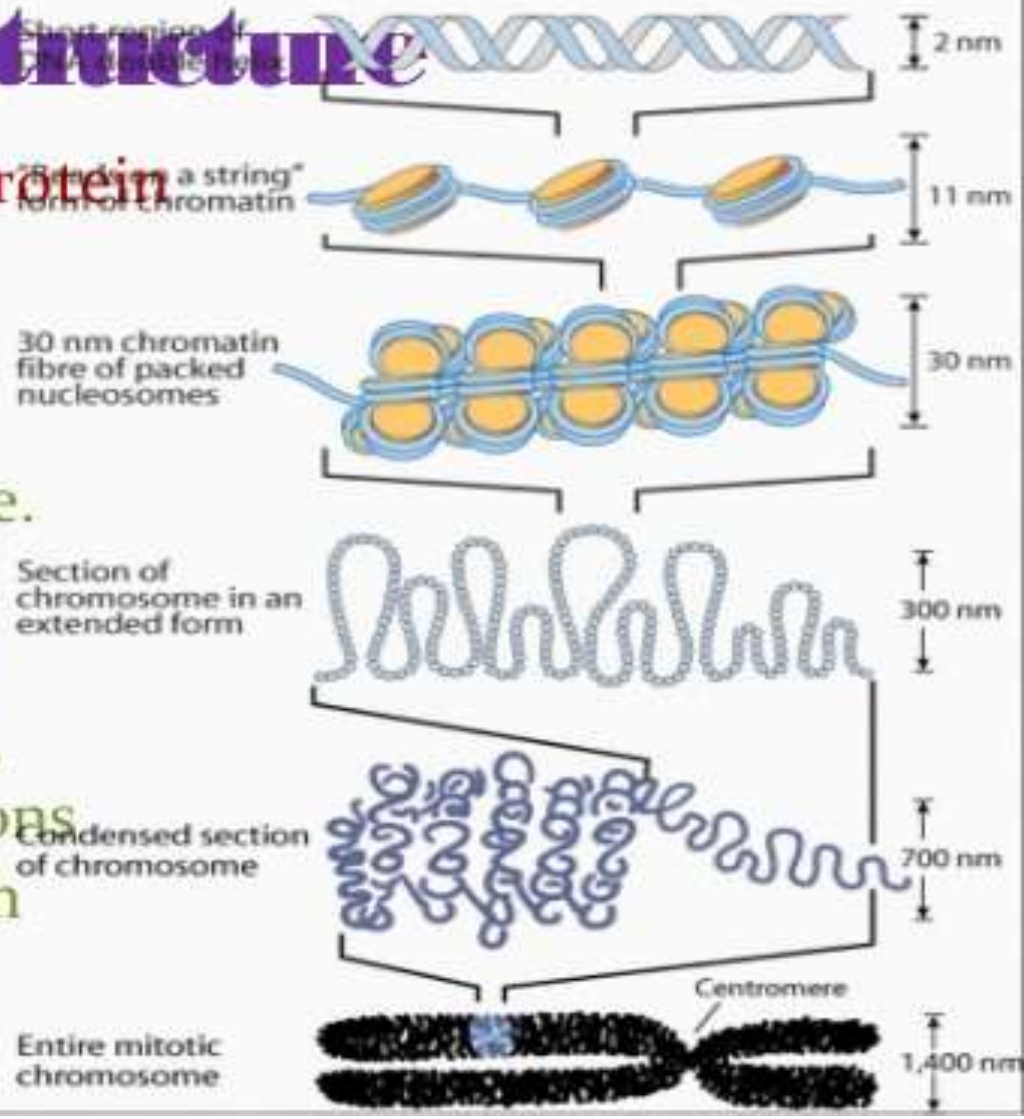


Quaternary structure

This is similar to that of protein quaternary structure.

Although some of the concepts are not exactly the same.

QS refers to a higher level of organization of nucleic acids moreover, it refers to the interactions of the nucleic acids with other molecules.



Nucleic Acids

- **Nucleic acids** are molecules that store information for cellular growth and reproduction

- There are two types of nucleic acids:
  - **deoxyribonucleic acid (DNA)** and **ribonucleic acid (RNA)**

- These are polymers consisting of long chains of monomers called nucleotides

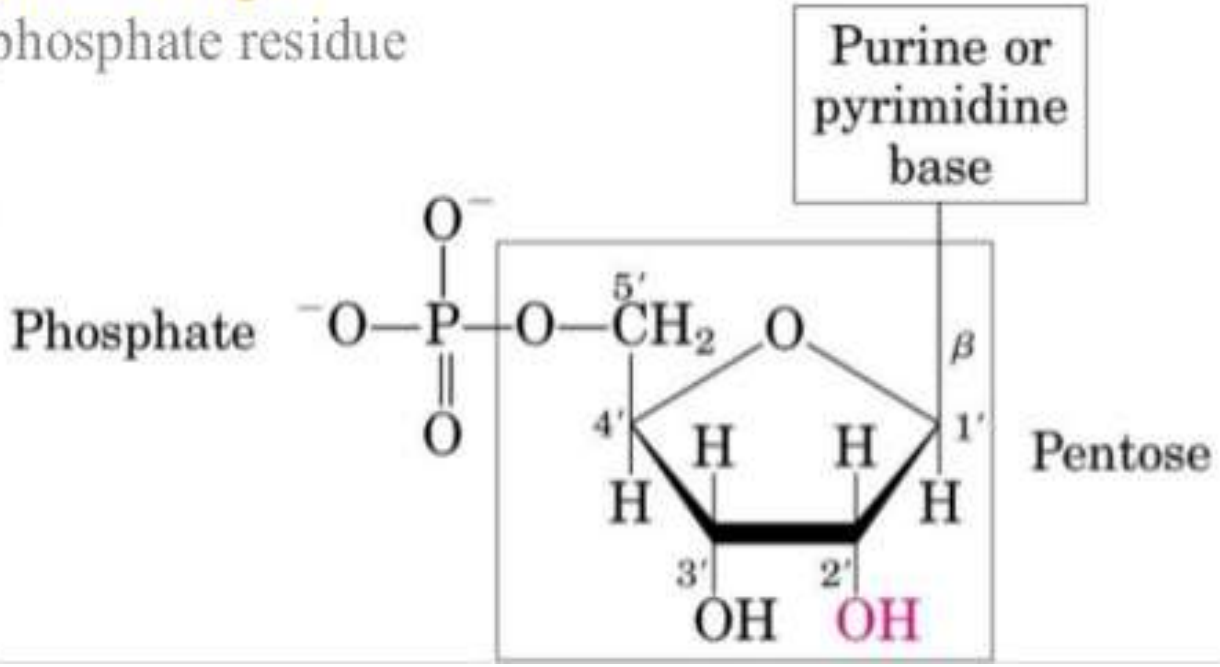
- A **nucleotide** consists of a nitrogenous base, pentose sugar and a phosphate group.

Nucleic Acids

DNA and RNA are nucleic acids, long, thread-like polymers made up of a linear array of monomers called nucleotides

All nucleotides contain three components:

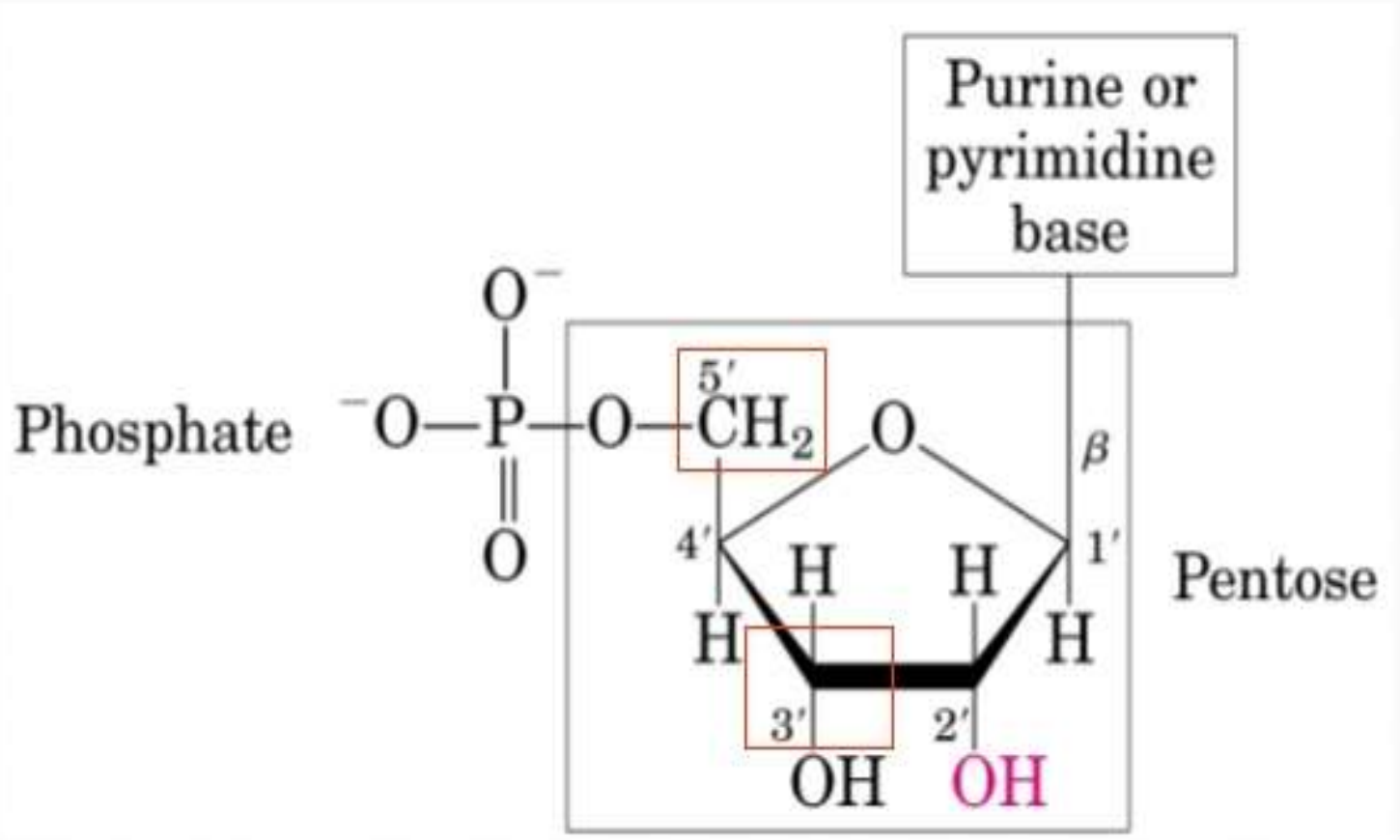
1. A nitrogen heterocyclic base
2. A pentose sugar
3. A phosphate residue



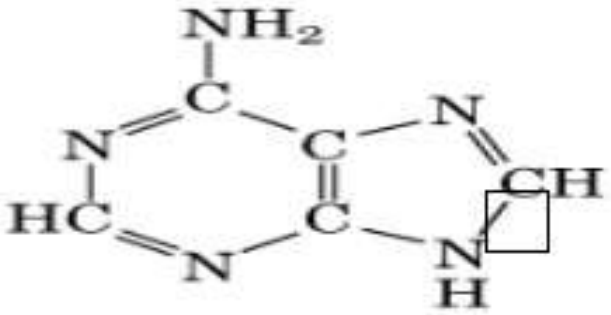
Chemical Structure of DNA vs RNA

Ribonucleotides have a 2'-OH

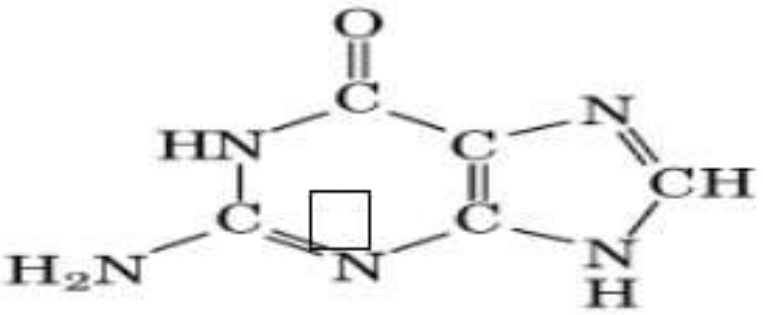
Deoxyribonucleotides have a 2'-H



Bases are classified as *Pyrimidines* or *Purines*

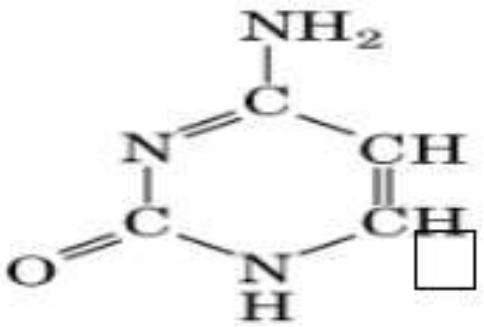


Adenine

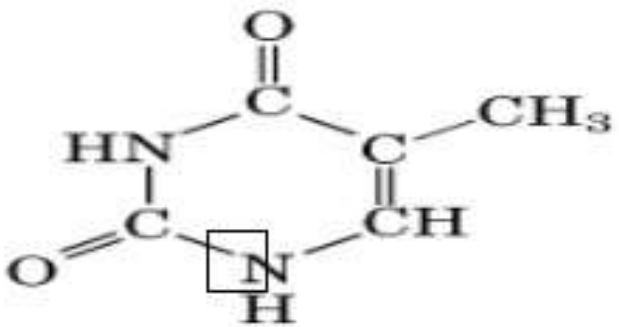


Guanine

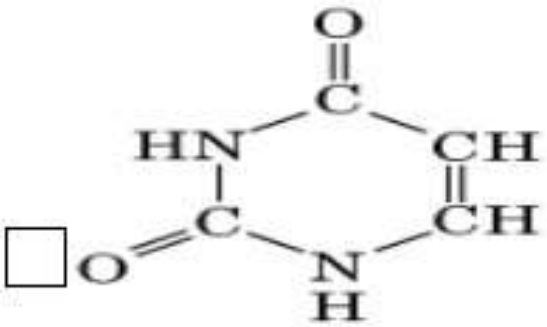
Purines



Cytosine



Thymine
(DNA)



Uracil
(RNA)

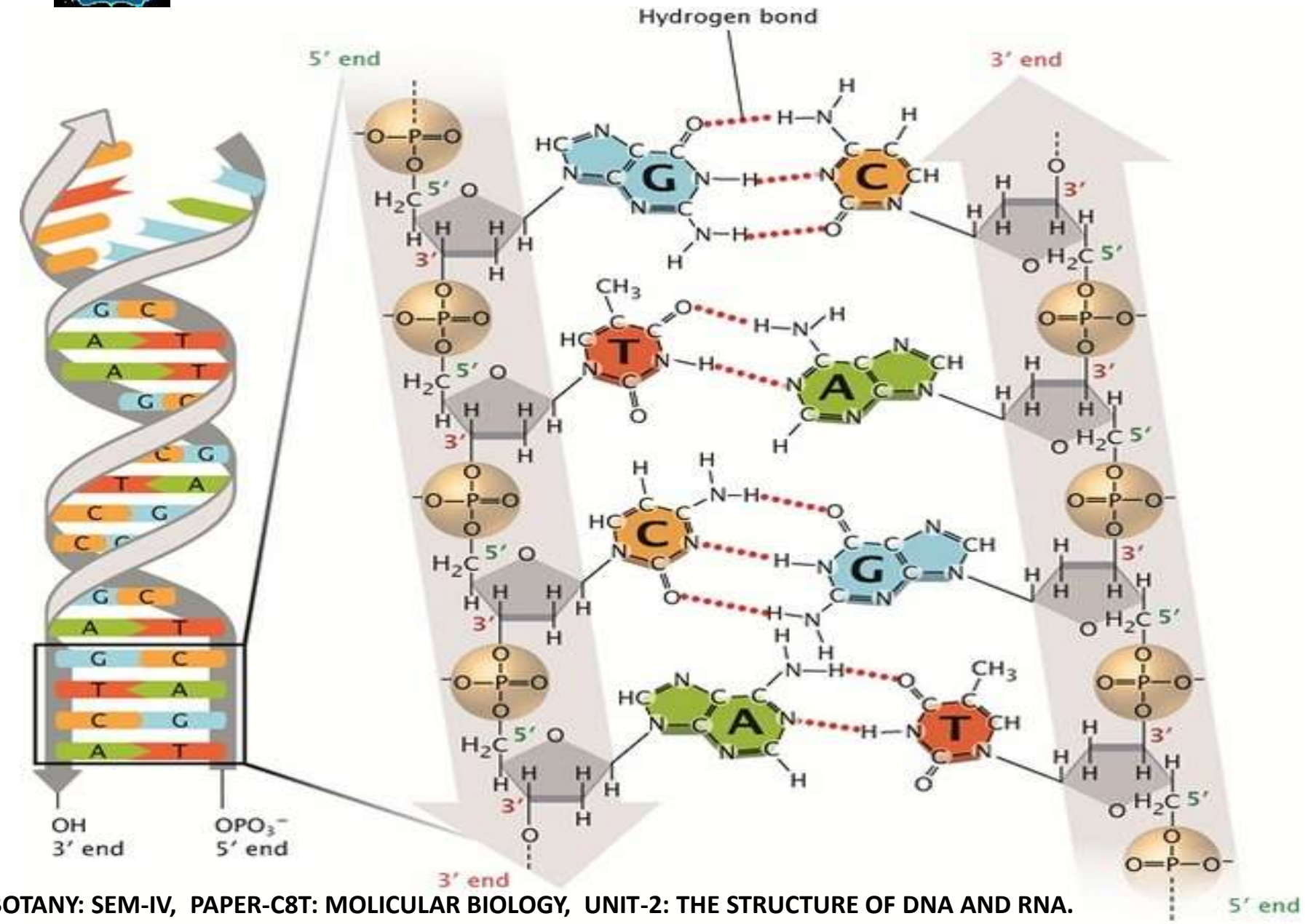
Pyrimidines

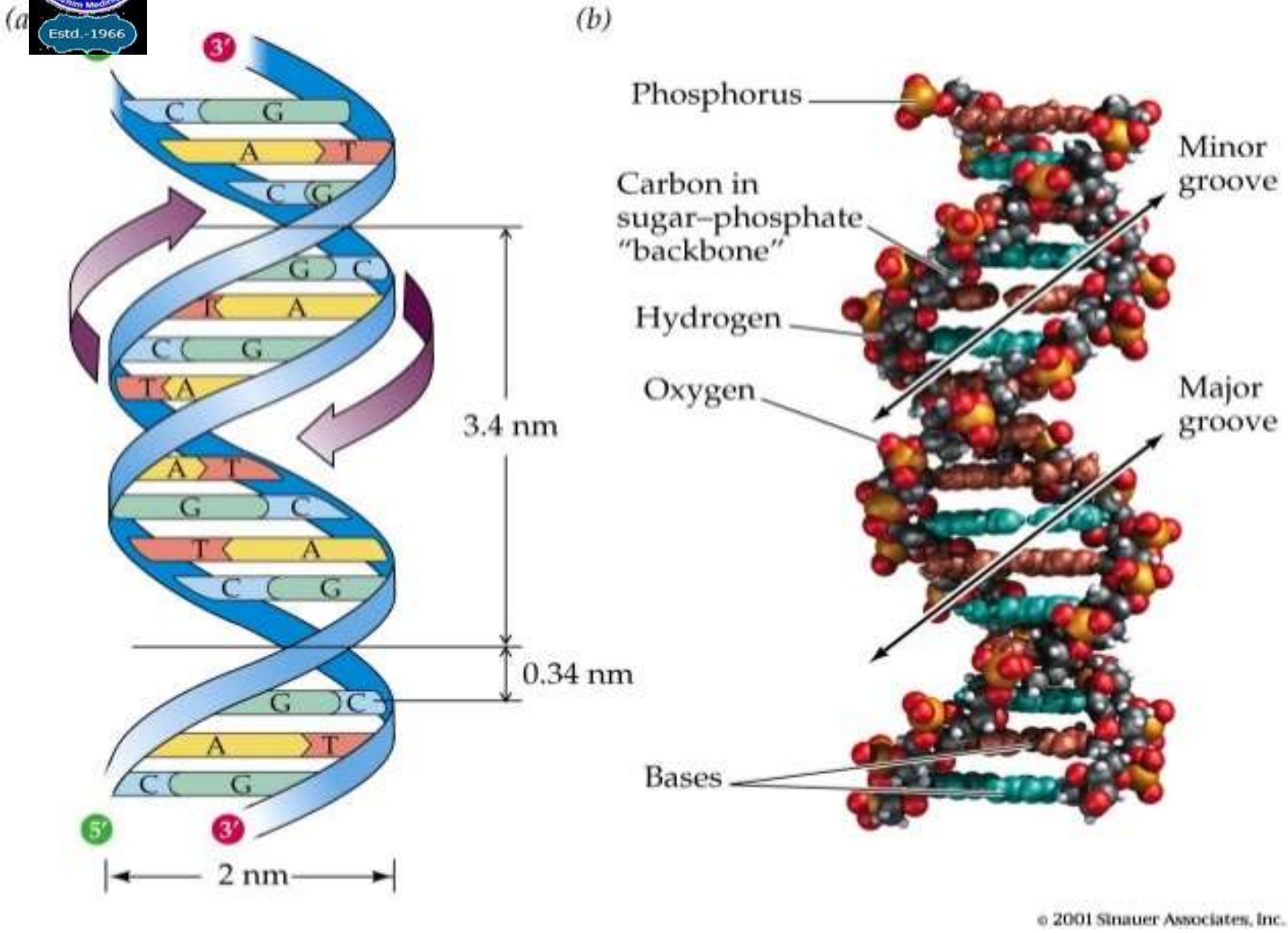
Nucleotides

Base	Nucleosides	Nucleotides
RNA		
Adenine (A)	Adenosine (A)	Adenosine 5'-monophosphate (AMP)
Guanine (G)	Guanosine (G)	Guanosine 5'-monophosphate (GMP)
Cytosine (C)	Cytidine (C)	Cytidine 5'-monophosphate (CMP)
Uracil (U)	Uridine (U)	Uridine 5'-monophosphate (UMP)
DNA		
Adenine (A)	Deoxyadenosine (A)	Deoxyadenosine 5'-monophosphate (dAMP)
Guanine (G)	Deoxyguanosine (G)	Deoxyguanosine 5'-monophosphate (dGMP)
Cytosine (C)	Deoxycytidine (C)	Deoxycytidine 5'-monophosphate (dCMP)
Thymine (T)	Deoxythymidine (T)	Deoxythymidine 5'-monophosphate (dTMP)

COMPILED AND CIRCULATED BY DR. UTTAM KUMAR KANP, ASSISTANT PROFESSOR,
DEPARTMENT OF BOTANY, NARAJOLE RAJ COLLEGE

WATSON AND CRICK MODEL (B - DNA)




(b)
3′
5′
3′
C
G
A
T
3.4 nm
0.34 nm
2 nm
Phosphorus
Minor groove
Carbon in sugar–phosphate "backbone"
Hydrogen
Oxygen
Major groove
Bases
© 2001 Sinauer Associates, Inc.

Important conclusion

NUCLEIC ACIDS

NUCLEOTIDES

NUCLEOSIDES

NITROGENOUS BASES

purines and pyrimidines

A & G C,T & U

PHOSPHORIC ACID

SUGAR

ribose and deoxyribose

THANK YOU