NUCLEIC ACIDS:

STRUCTURE

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Friedrich Miescher in 1869

- Isolated what he called **nuclein** from the nuclei of pus cells.
- Nuclein was shown to have acidic properties, hence it became called **nucleic acid**

Two types of nucleic acid are found

- Deoxyribonucleic acid (DNA)
- Ribonucleic acid (RNA)

The distribution of nucleic acids in the eukaryotic cell

- DNA is found in the nucleus
  - with small amounts in mitochondria and chloroplasts
- RNA is found throughout the cell

NUCLEIC ACID STRUCTURE

- Nucleic acid is an important class of macromolecules found in all cells and viruses. The functions of nucleic acids have to do with the storage and expression of genetic information. Deoxyribonucleic acid (DNA) encodes the information the cell needs to make proteins. A related type of nucleic acid, called ribonucleic acid (RNA), comes in different molecular forms that participate in protein synthesis.
- Nucleic acids are **polynucleotides**
- Their building blocks are **nucleotides**

PHOSPHATE

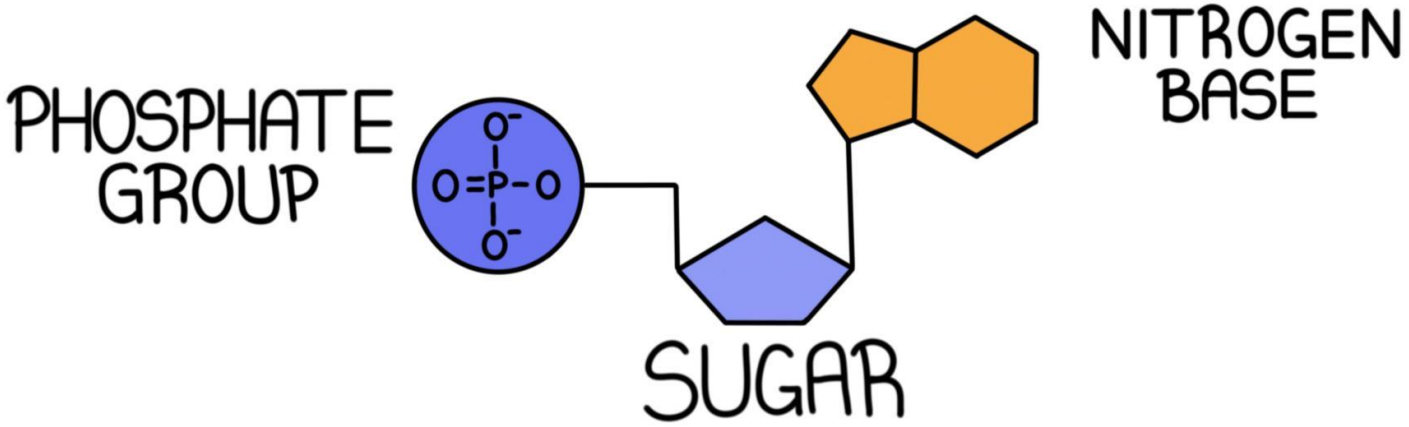
SUGAR

Ribose or
Deoxyribose

BASE

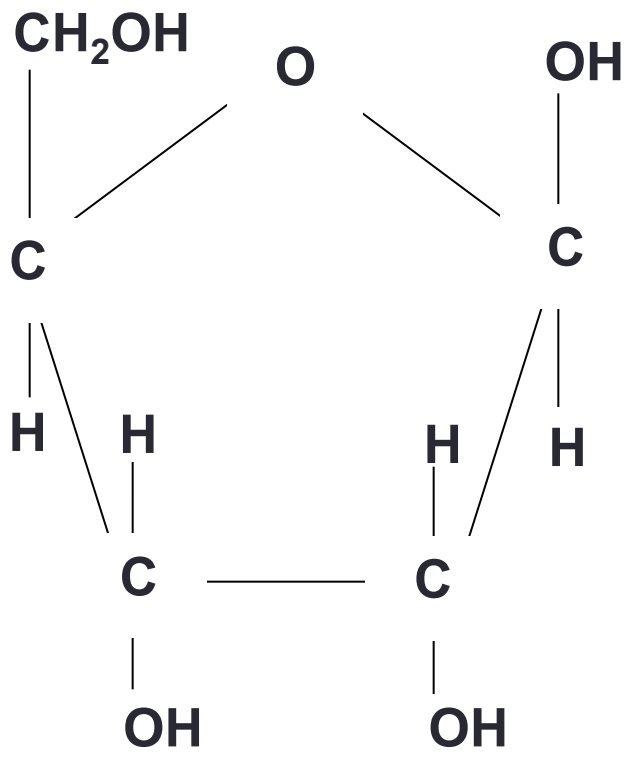
PURINES	PYRIMIDINES
Adenine (A) Guanine(G)	Cytocine (C) Thymine (T) Uracil (U)

NUCLEOTIDE

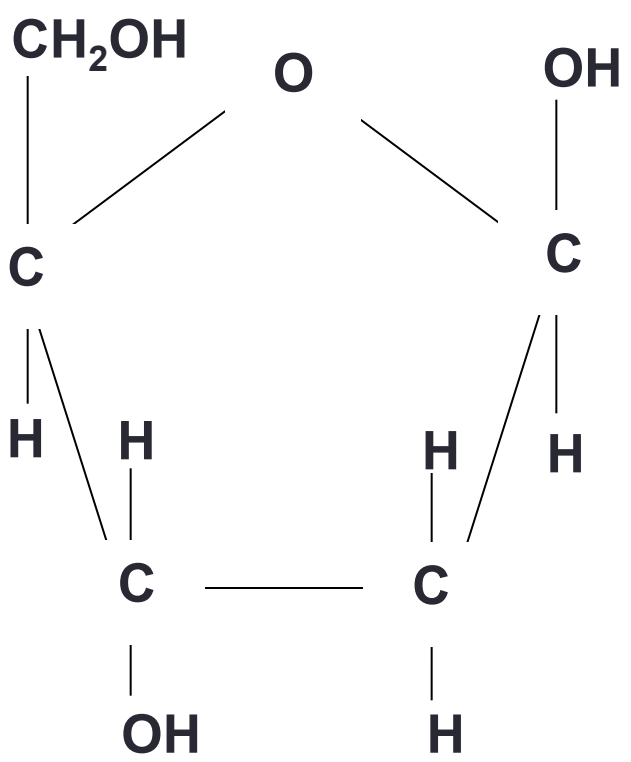


Pentose Sugar

RIBOSE

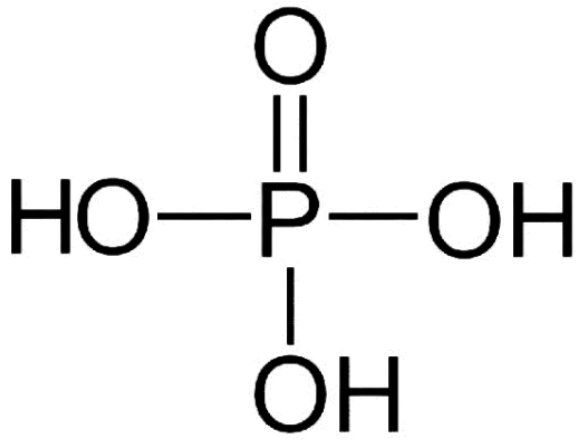


DEOXYRIBOSE

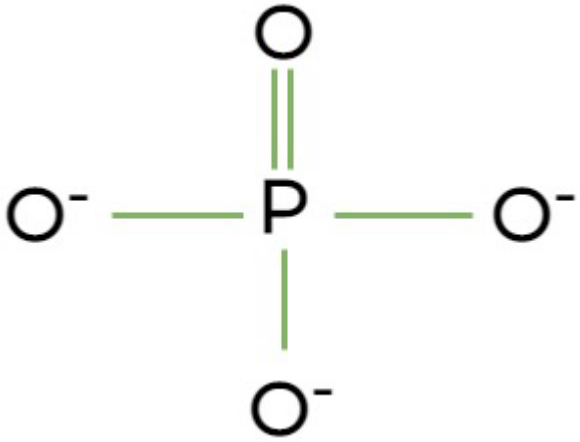


Phosphate Group

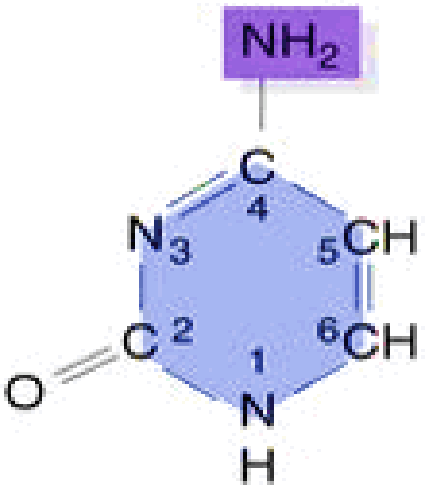
Phosphoric Acid



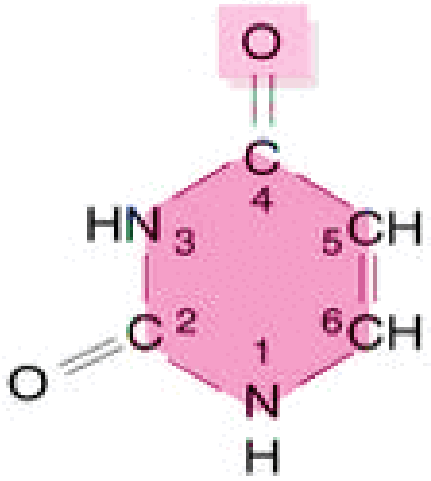
Phosphate Group



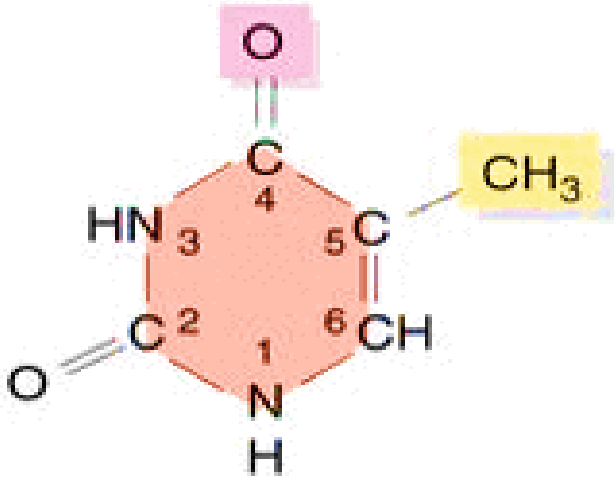
Purine and Pyrimidine Structure



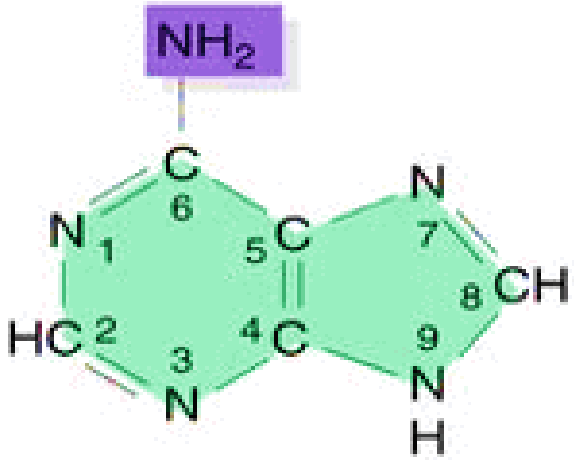
Cytosine (C)



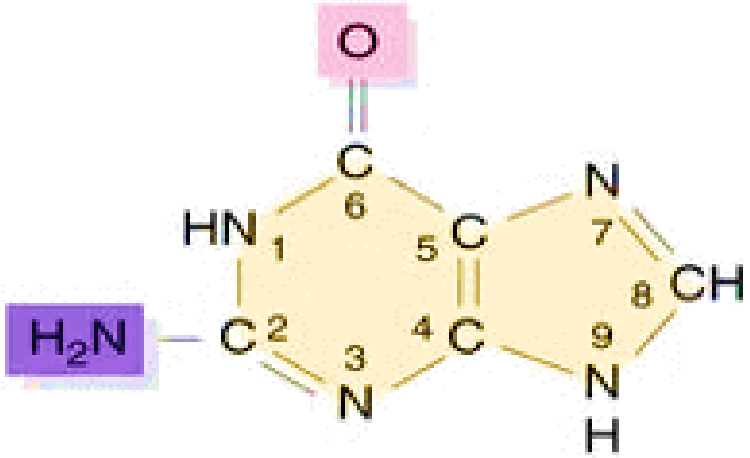
Uracil (U)
(found in RNA)



Thymine (T)
(found in DNA)



Adenine (A)

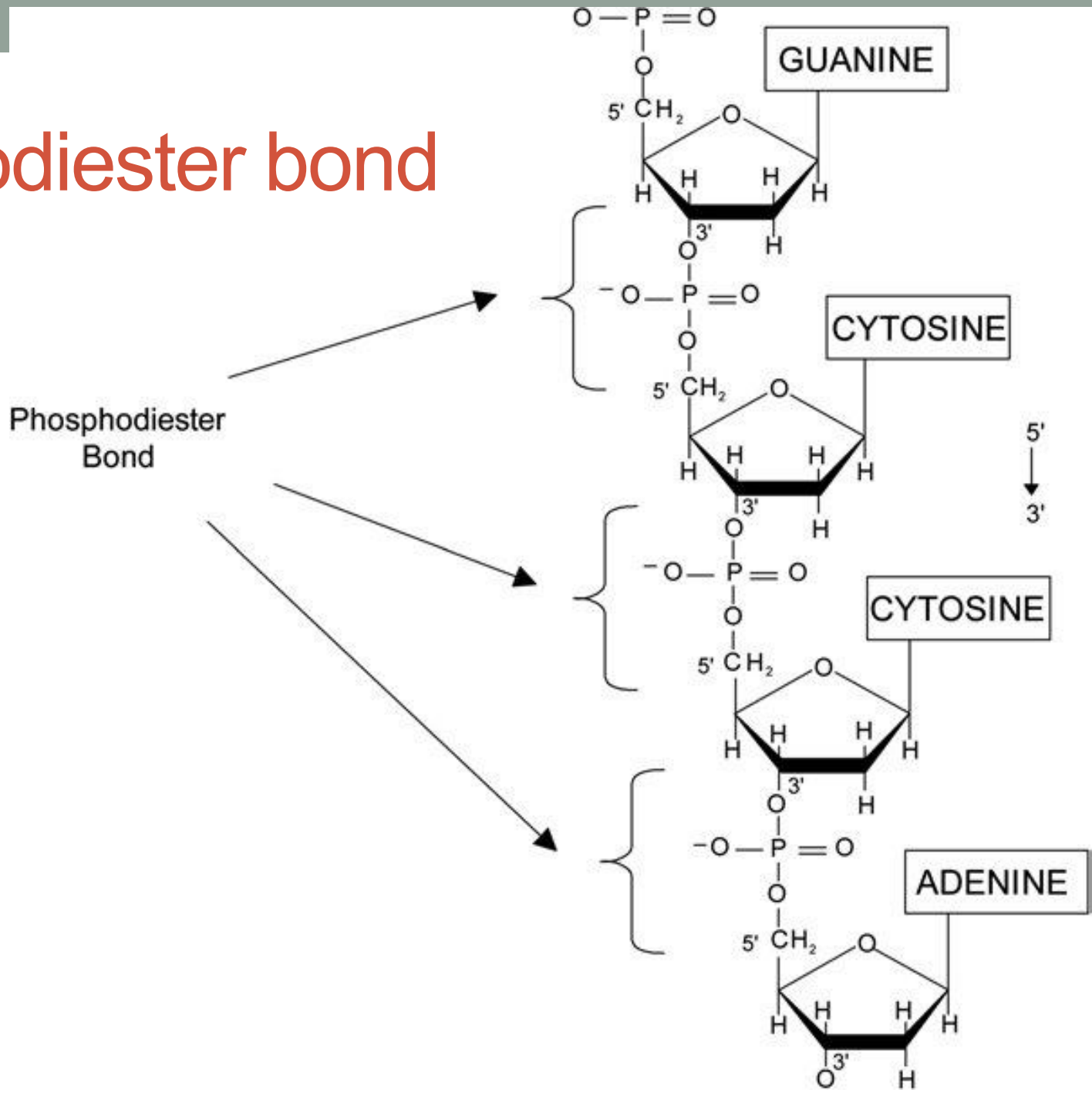


Guanine (G)

Phosphodiester bond

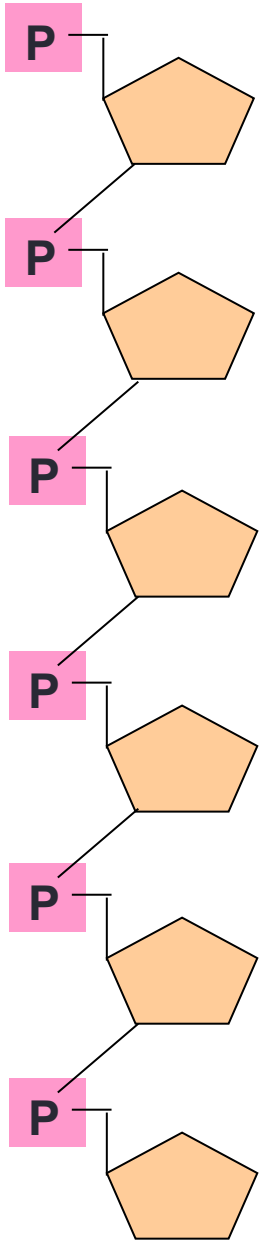
- In DNA and RNA, the *phosphodiester bond* is the *linkage* between the 3' carbon atom of one sugar molecule and the 5' carbon atom of another, deoxyribose in DNA and ribose in RNA. Strong covalent *bonds* form between the phosphate group and two 5-carbon ring carbohydrates (pentoses) over two ester *bonds.*
- ***The Bond between phosphate group of one nucleotide and hydroxyl group of another nucleotide is a dehydration synthesis releasing a molecule of water is called phosphodiester bond .***

Phosphodiester bond



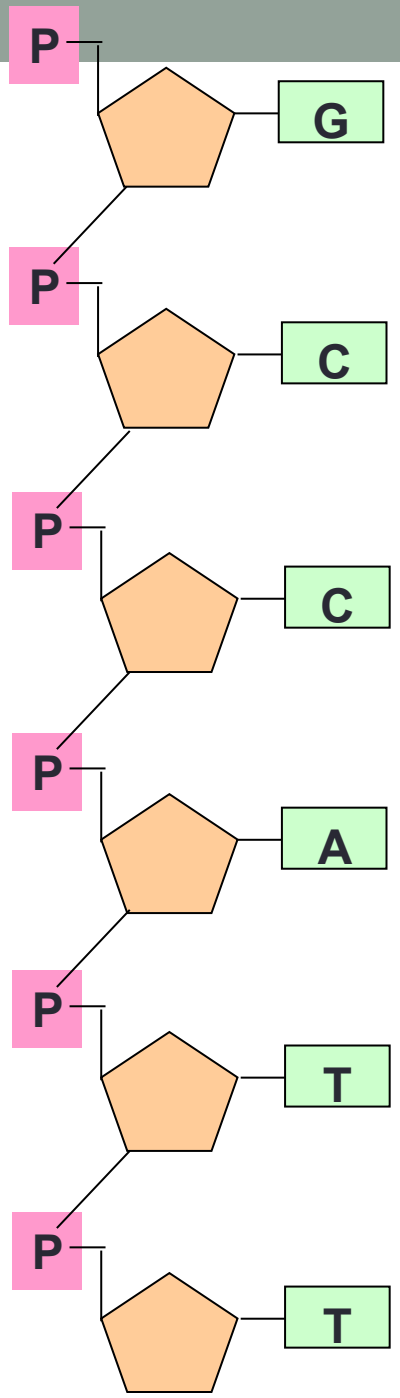
THE SUGAR-PHOSPHATE BACKBONE

- The nucleotides are all orientated in the same direction
- The phosphate group joins the 3rd Carbon of one sugar to the 5th Carbon of the next in line.

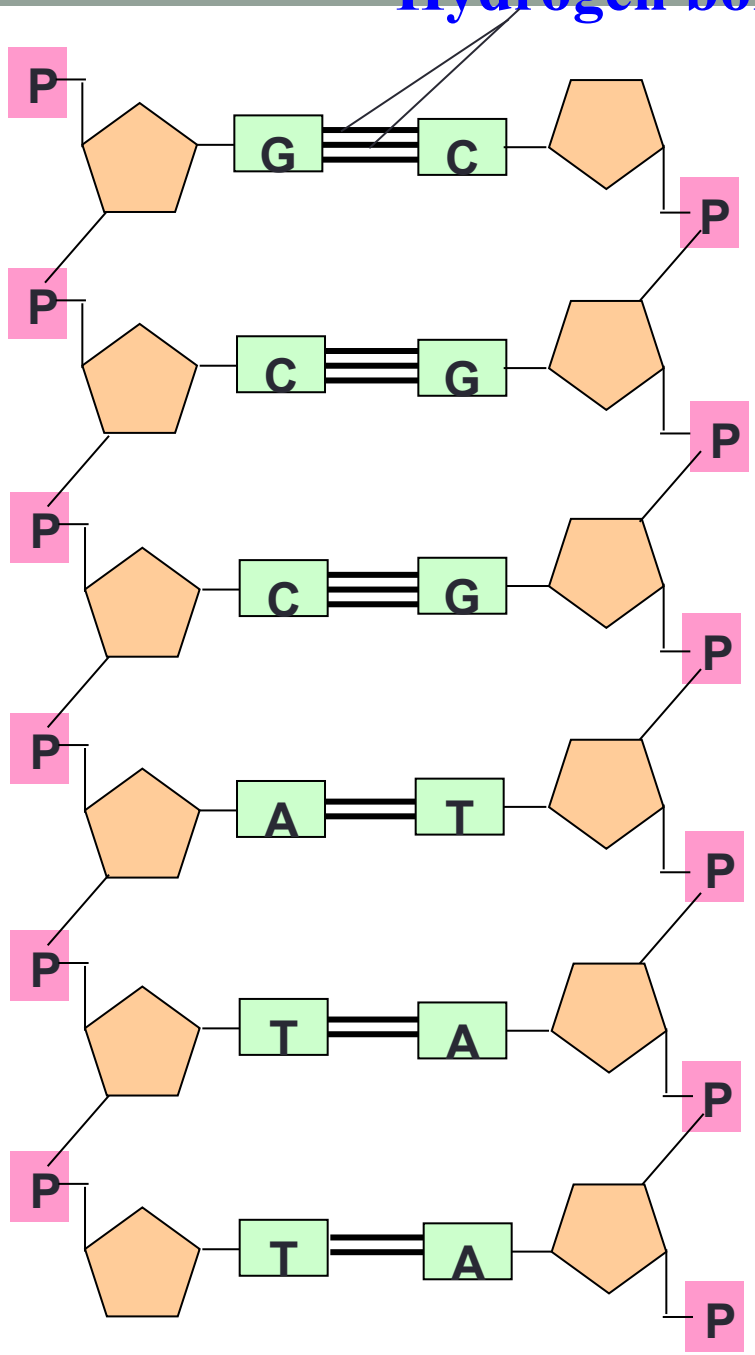


ADDING IN THE BASES

- The bases are attached to the 1st Carbon
- Their order is important
  It determines the genetic information of the molecule



DNA IS MADE OF TWO STRANDS OF POLYNUCLEOTIDE



DNA IS MADE OF TWO STRANDS OF POLYNUCLEOTIDE

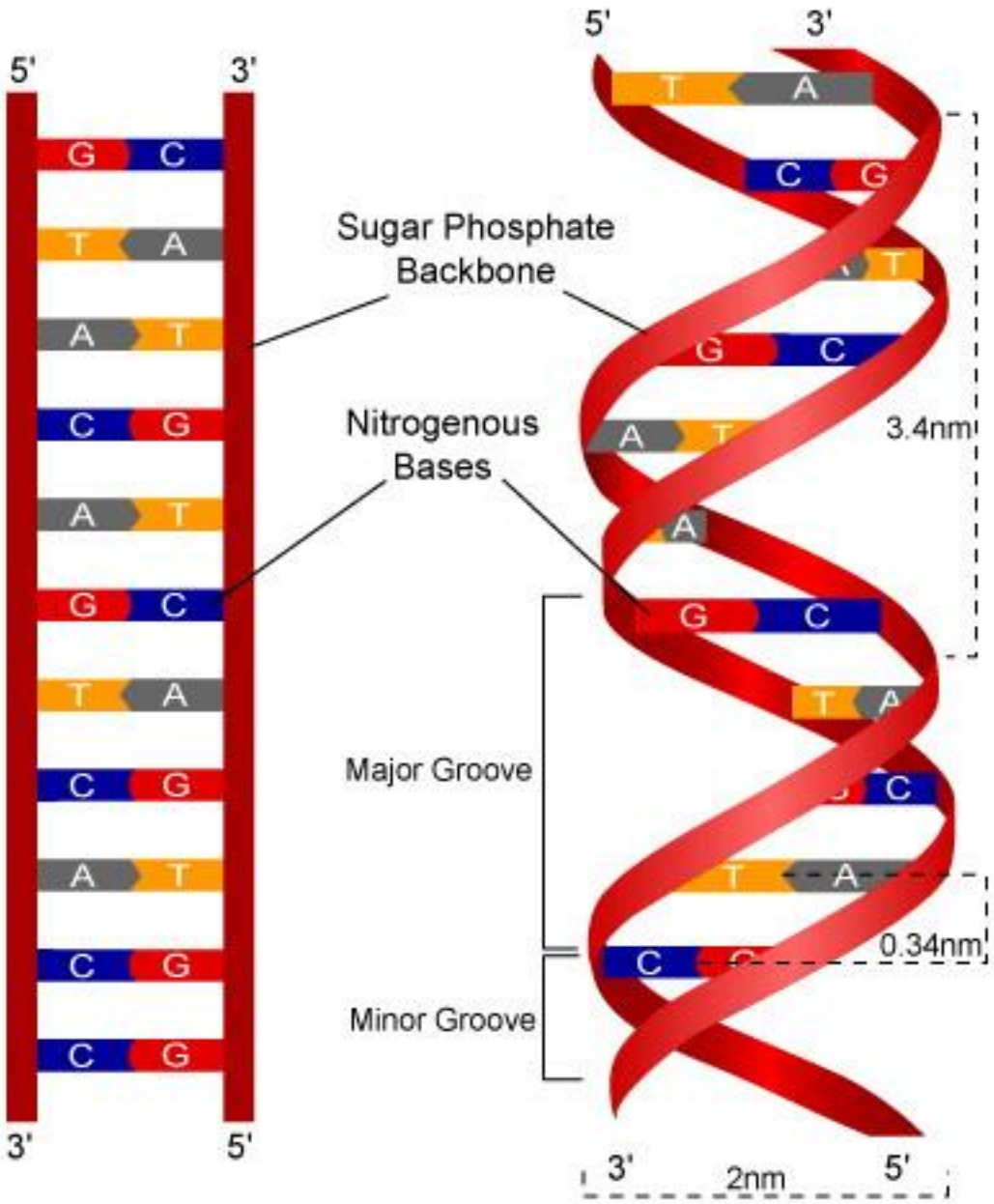
- The sister strands of the DNA molecule run in opposite directions (**antiparallel**)
- They are joined by the bases
- Each base is paired with a specific partner:

A is always paired with **T**

G is always paired with **C**

Purine with Pyrimidine

- Thus the sister strands are **complementary** but **not** identical
- The bases are joined by **hydrogen bonds**, individually weak but collectively strong.


5'
3'
G C
T A
A T
C G
A T
G C
T A
C G
A T
C G
C G
3'
5'
Sugar Phosphate Backbone
Nitrogenous Bases
Major Groove
Minor Groove
5'
3'
T A
C G
T
G C
A T
A
G C
T A
C
T A
C
3.4nm
0.34nm
3'
2nm
5'