

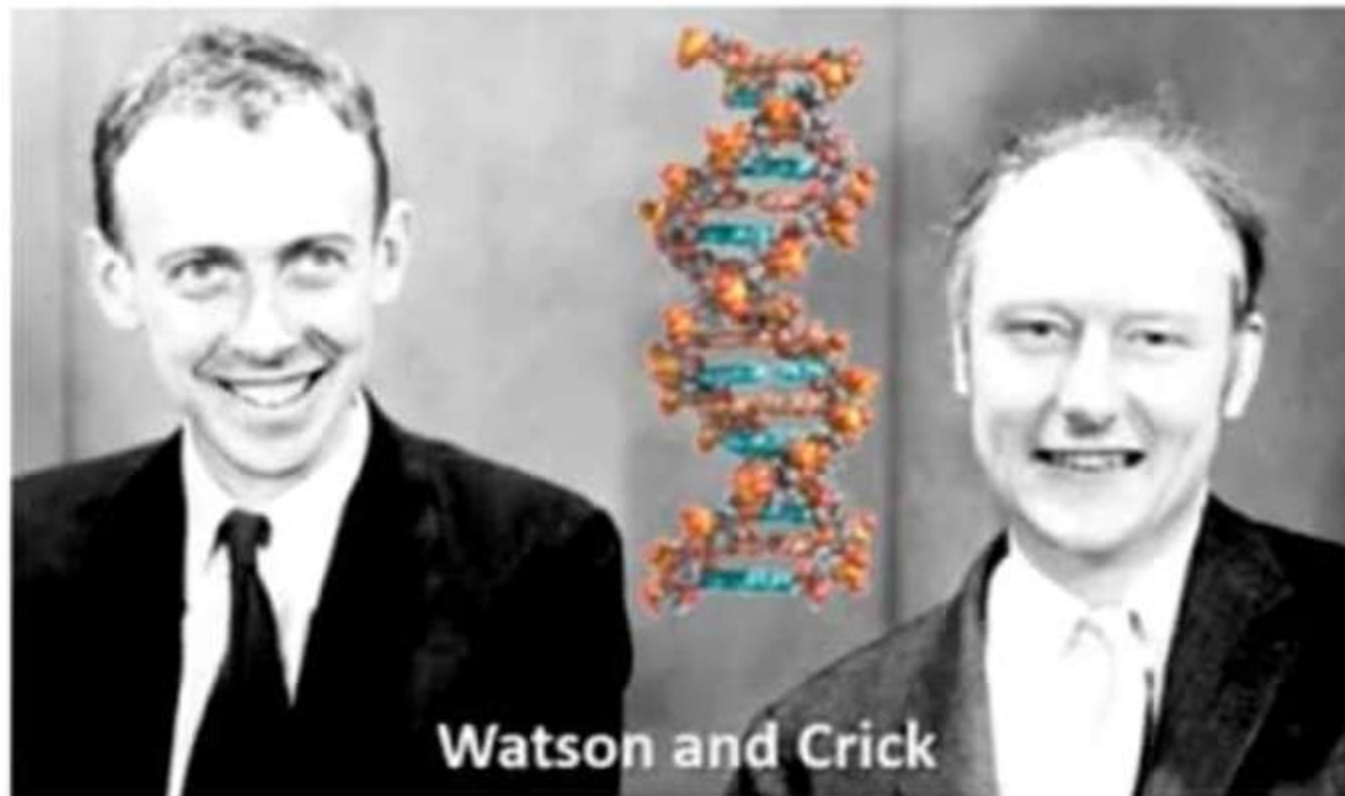
# THE DNA



- **Friedrich Meischer (1869):** Identified DNA and named it as 'Nuclein'.
- **James Watson & Francis Crick** proposed **double helix model** of DNA.
- It was based on X-ray diffraction data produced by **Maurice Wilkins & Rosalind Franklin**.



F. Meischer



Watson and Crick



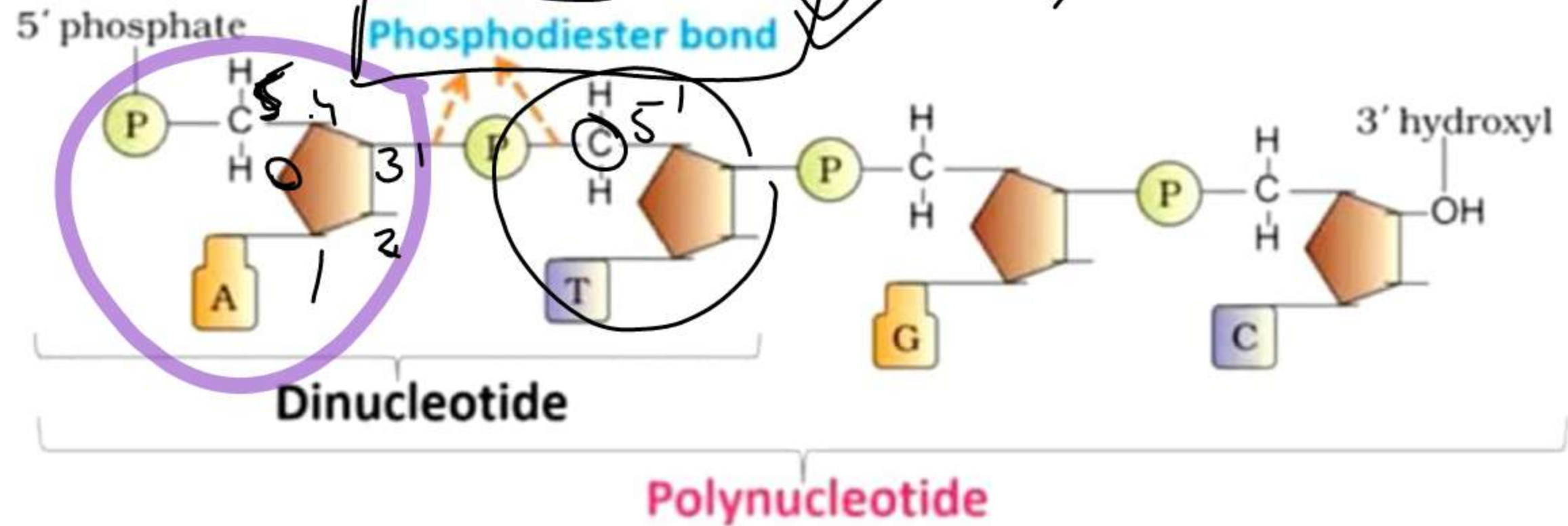
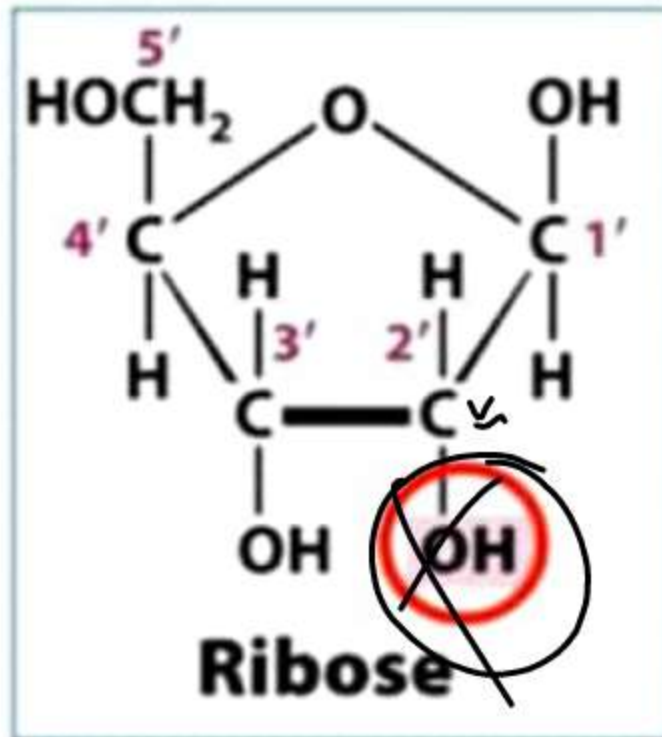
Maurice Wilkins & Rosalind Franklin

# THE DNA

## STRUCTURE OF POLYNUCLEOTIDE CHAIN

2' ⇒ 2 prime


- In **RNA**, each nucleotide has an additional -OH group at 2'-position of **ribose (2'-OH)**.
- 2 nucleotides are linked through **3'-5' phosphodiester bond** to form **dinucleotide**.
- When more nucleotides are linked, it forms **polynucleotide**.



# THE DNA

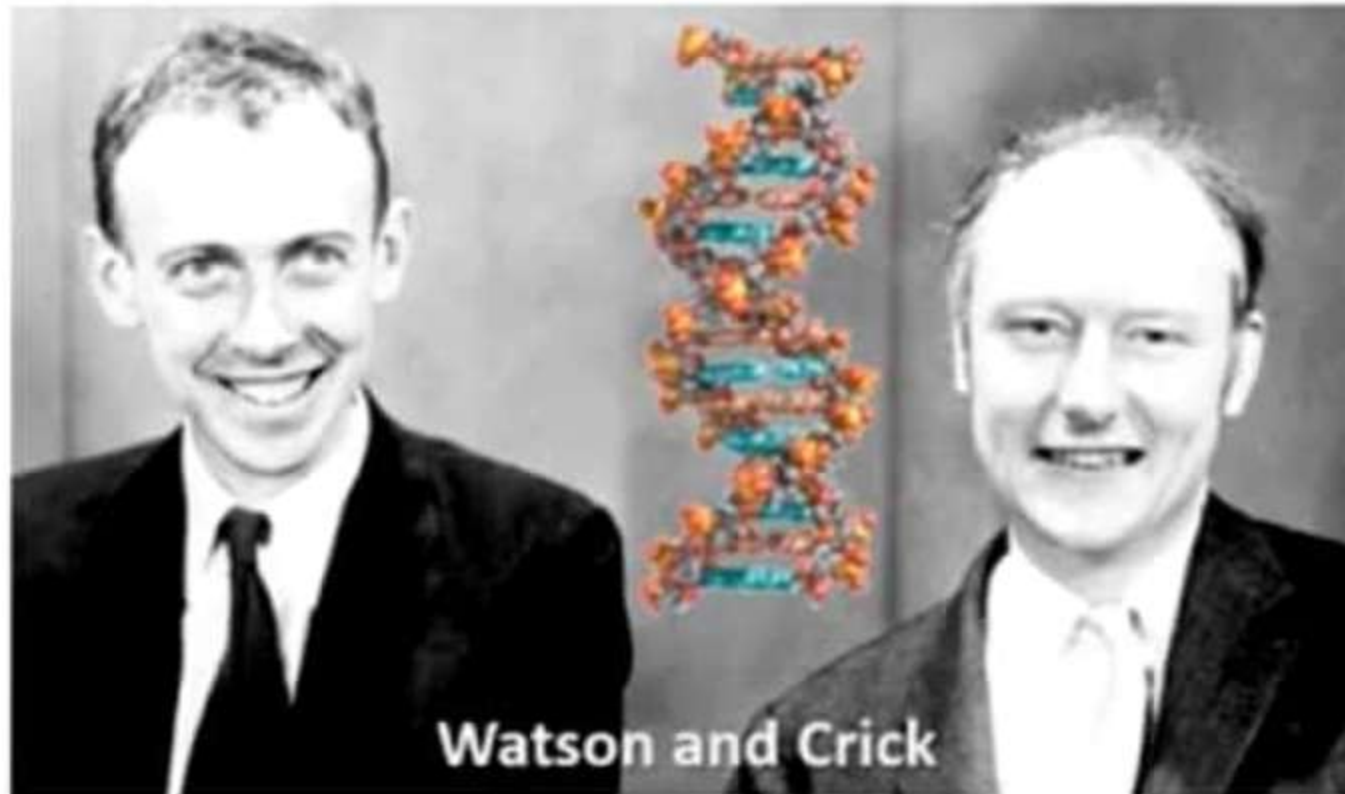


## CONTRIBUTION :-

1. • **Friedrich Meischer (1869):** Identified DNA and named it as **Nuclein'**. 
2. • **James Watson & Francis Crick** proposed **double helix model of DNA.**
3. • It was based on X-ray diffraction data produced by **Maurice Wilkins & Rosalind Franklin.**



F. Meischer



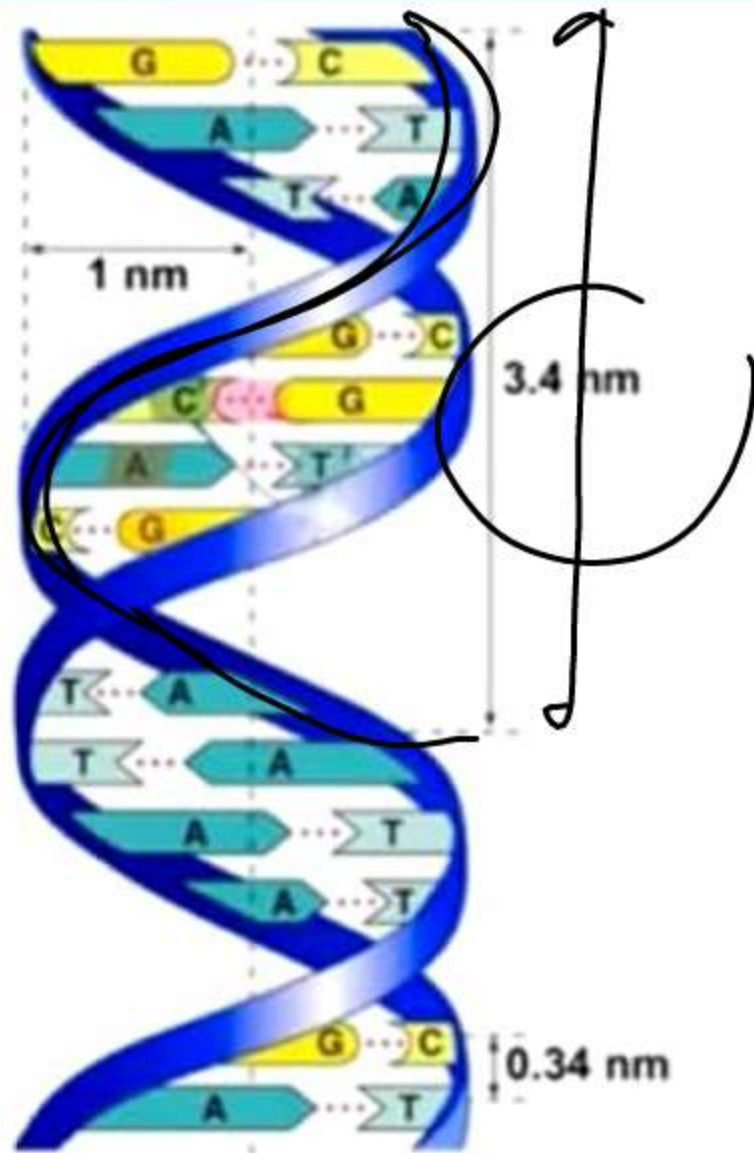
Watson and Crick



Maurice Wilkins & Rosalind Franklin

# THE DNA

## STRUCTURE OF DNA



→ Double-Helix str.  
→ Right-handed double Helix str.

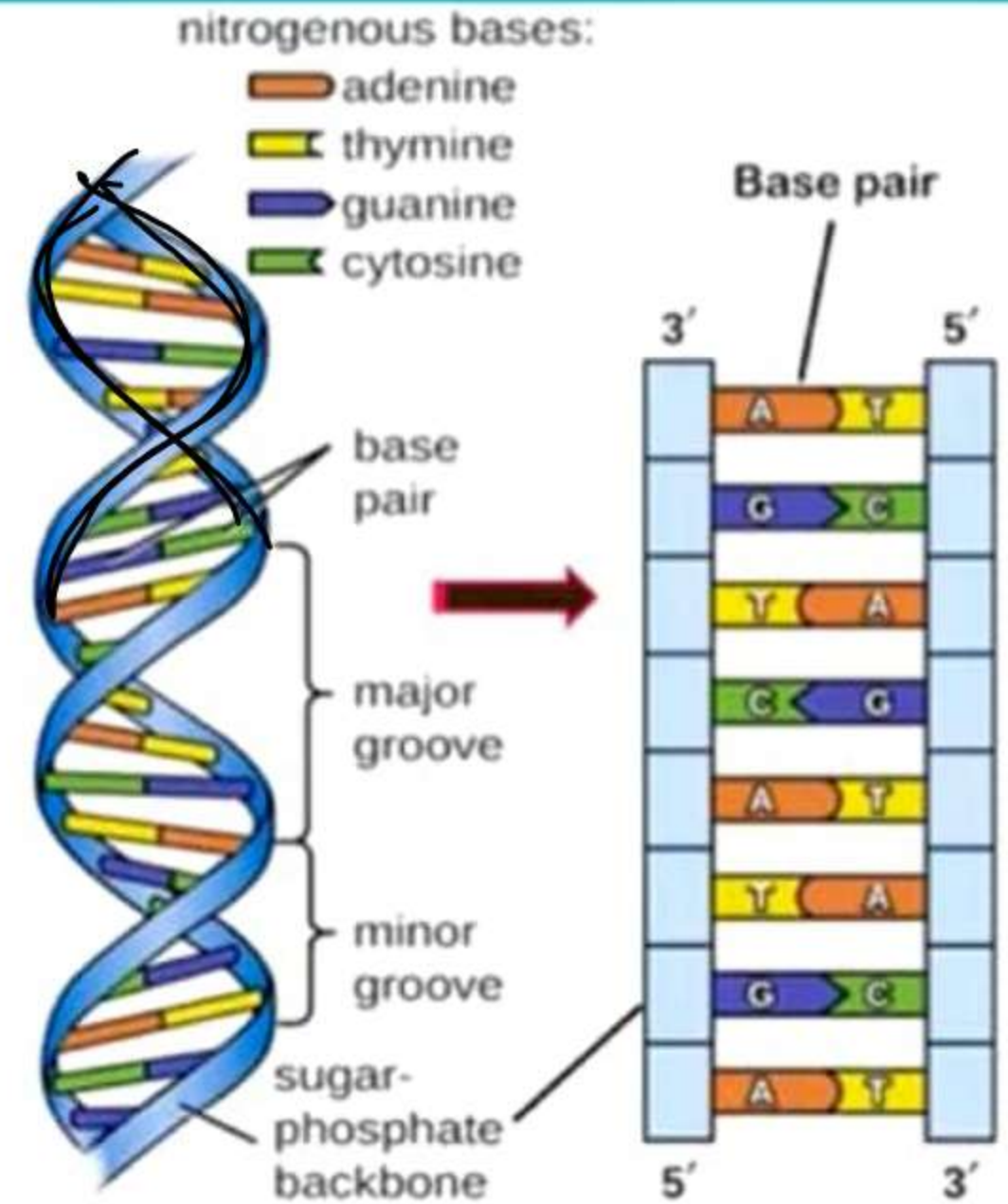


- DNA is made of **2 polynucleotide chains** coiled in a right-handed fashion.
- Pitch of the helix = 3.4 nm (34 Å) ✓ (1 nm = 10<sup>-9</sup> m)
- Number of base pairs in each turn = 10
- Distance b/w adjacent base pairs = **0.34 nm (3.4 Å)**

# THE DNA

## STRUCTURE OF DNA

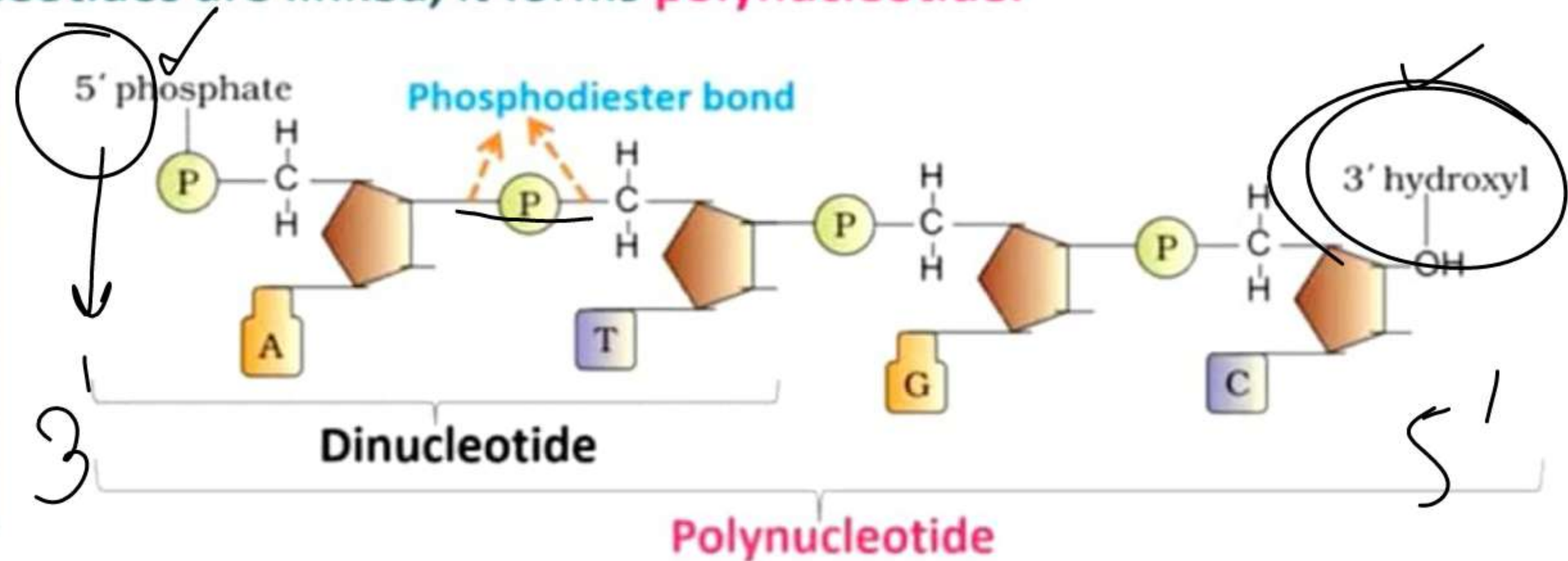
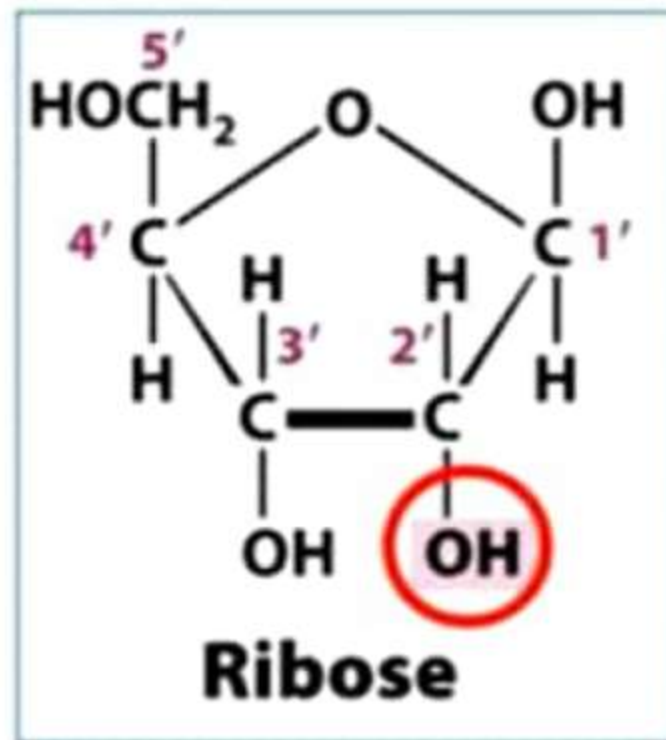
- Backbone of DNA is formed of **sugar & phosphates**.
- The bases project **inside**.
- The 2 chains have **anti-parallel polarity**, i.e. one chain has the polarity **5' → 3'** and the other has **3' → 5'**.



# THE DNA

## STRUCTURE OF POLYNUCLEOTIDE CHAIN

- In **RNA**, each nucleotide has an additional  $-OH$  group at 2'-position of **ribose (2'-OH)**.
- 2 nucleotides are linked through **3'-5' phosphodiester bond** to form **dinucleotide**.
- When more nucleotides are linked, it forms **polynucleotide**.



# THE DNA

## STRUCTURE OF DNA

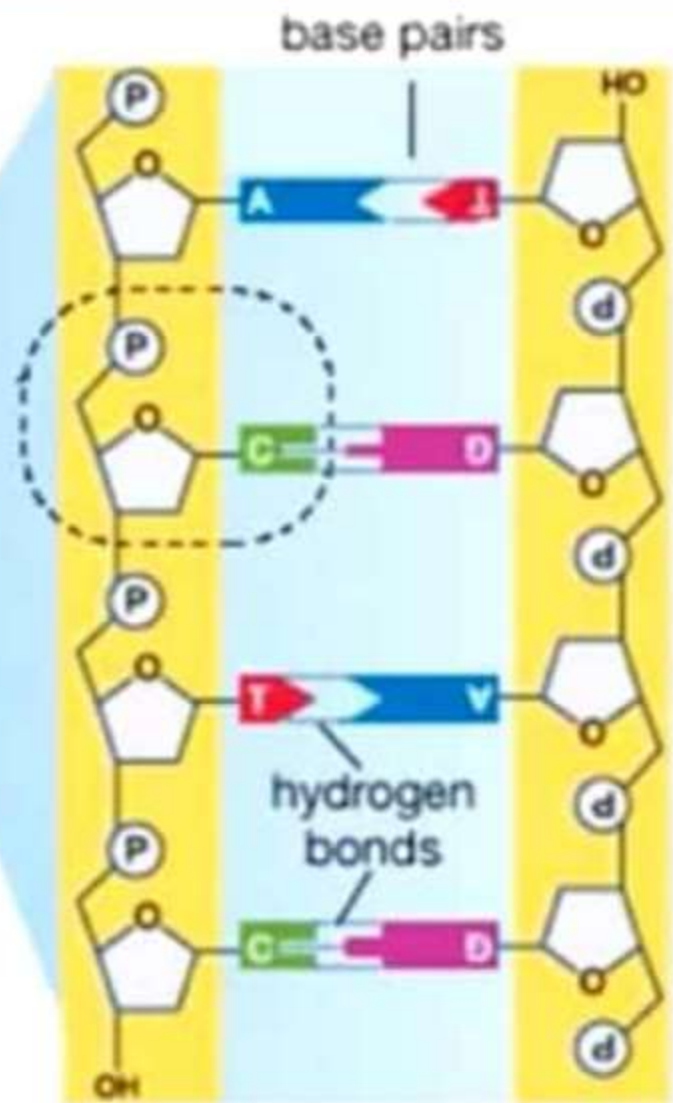
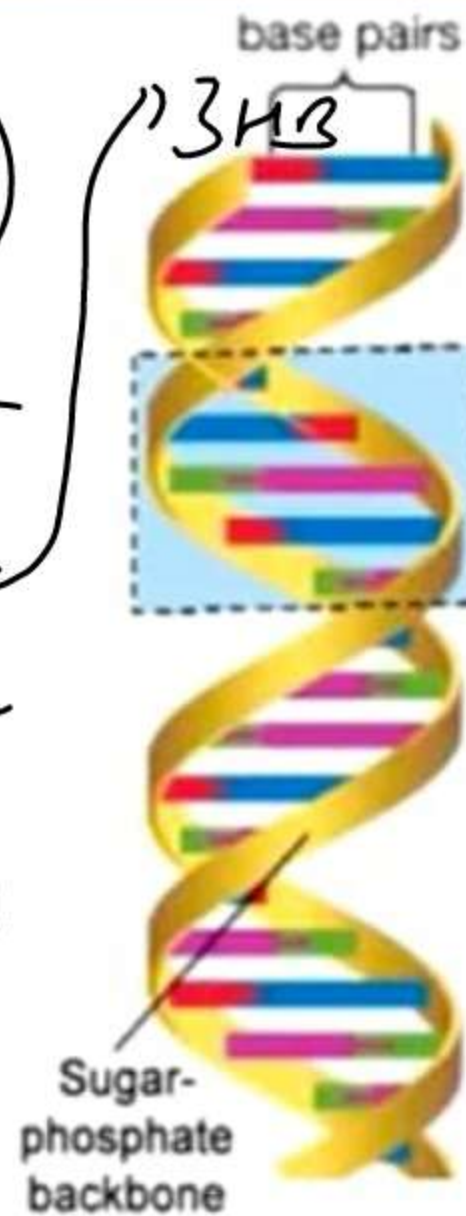
- The bases in 2 strands are paired through **H-bonds** forming **base pairs (bp)**.
- A=T** (2 hydrogen bonds)  
**C≡G** (3 hydrogen bonds)
- Purine** comes opposite to a **pyrimidine**. This generates uniform distance between the 2 strands.

2 H.B

A=T

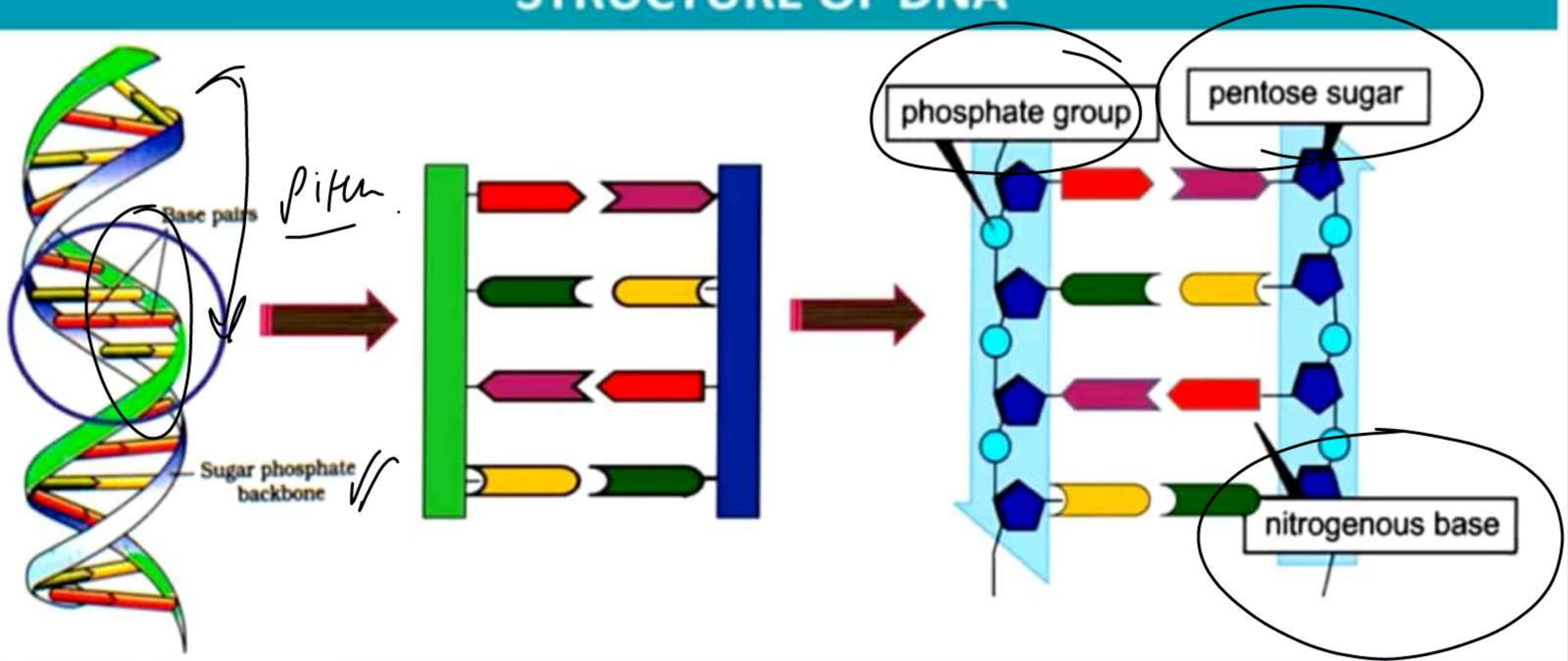
C≡G

○



# THE DNA

## STRUCTURE OF DNA





# THE DNA

## ERWIN CHARGAFF'S RULE



In DNA, the proportion of **A is equal to T** and the proportion of **G is equal to C**.

Therefore,

~~30~~  $30 = 30$

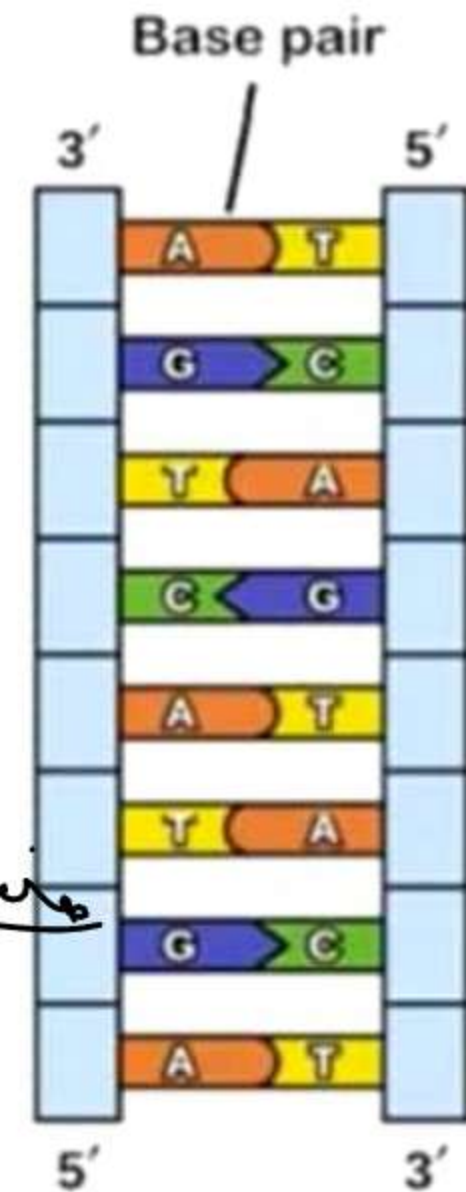
$$[A] + [G] = [T] + [C]$$

10 20      10 20

OR

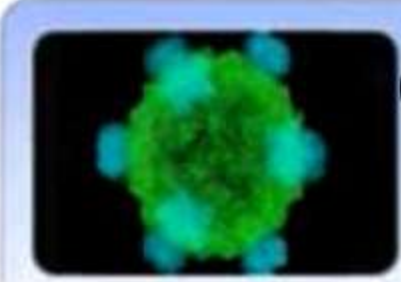
Purine      Pyrimidine

$$[A] + [G] / [T] + [C] = 1$$



# THE DNA

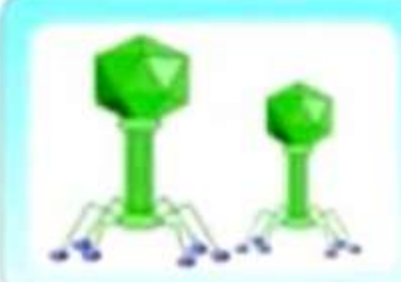
$\phi = f_i = \text{electric flux}$



$\Phi$  174 (a bacteriophage) has 5386 nucleotides.

infect *E. coli*

ss DNA



Bacteriophage lambda has 48502 base pairs (bp).

$\lambda$ -phage

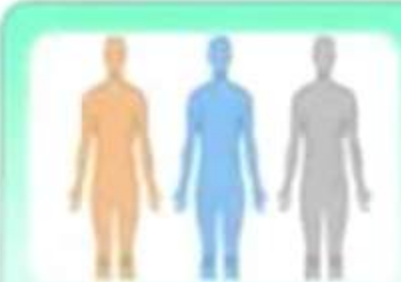
linear DNA



*E. coli* has  $4.6 \times 10^6$  bp.

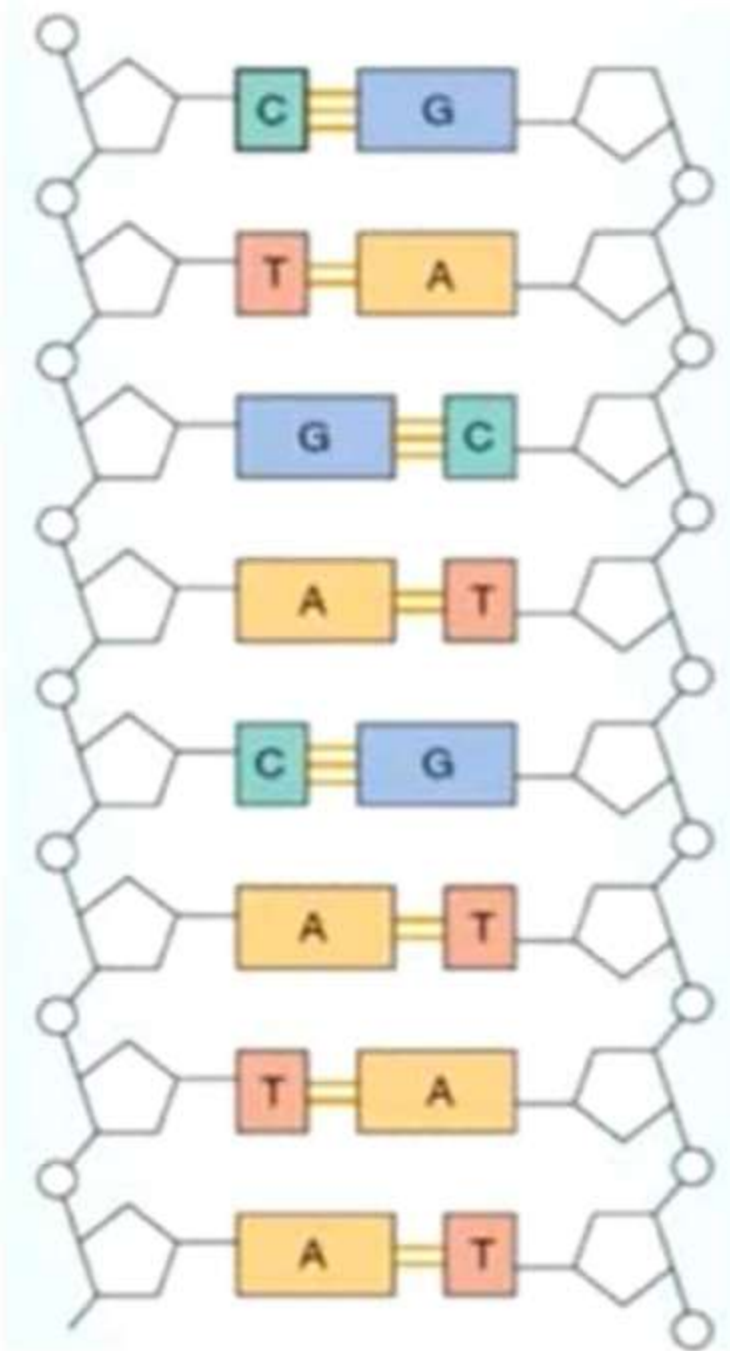
$4.6 \times 10^6$

ds-linear



Haploid content of human DNA is  $3.3 \times 10^9$  bp.

$46 \text{ chr.} \times 2n \xrightarrow{\text{Morgan's}} n \rightarrow 23 \text{ chr.}$



# ~~DI/NUCLEOTIDE~~

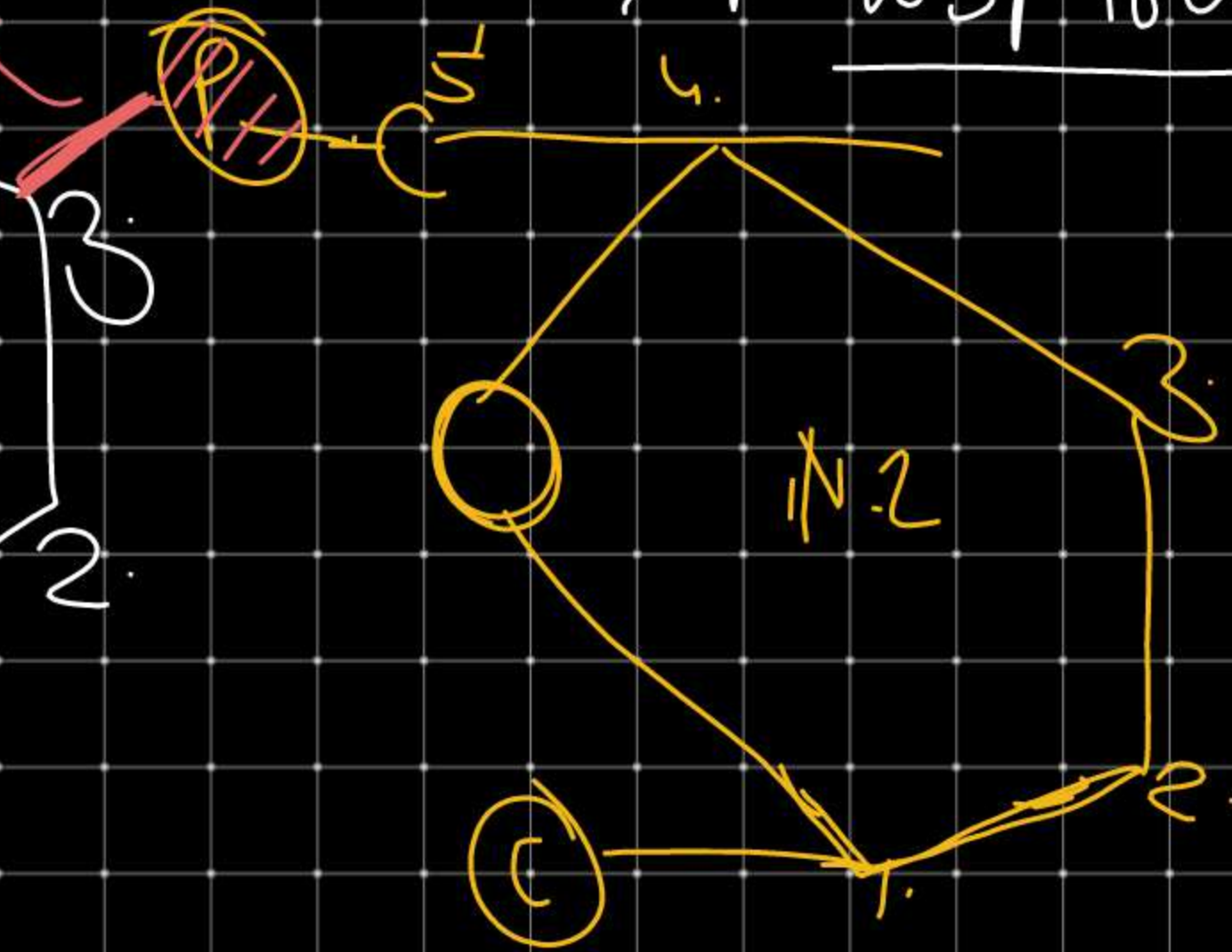
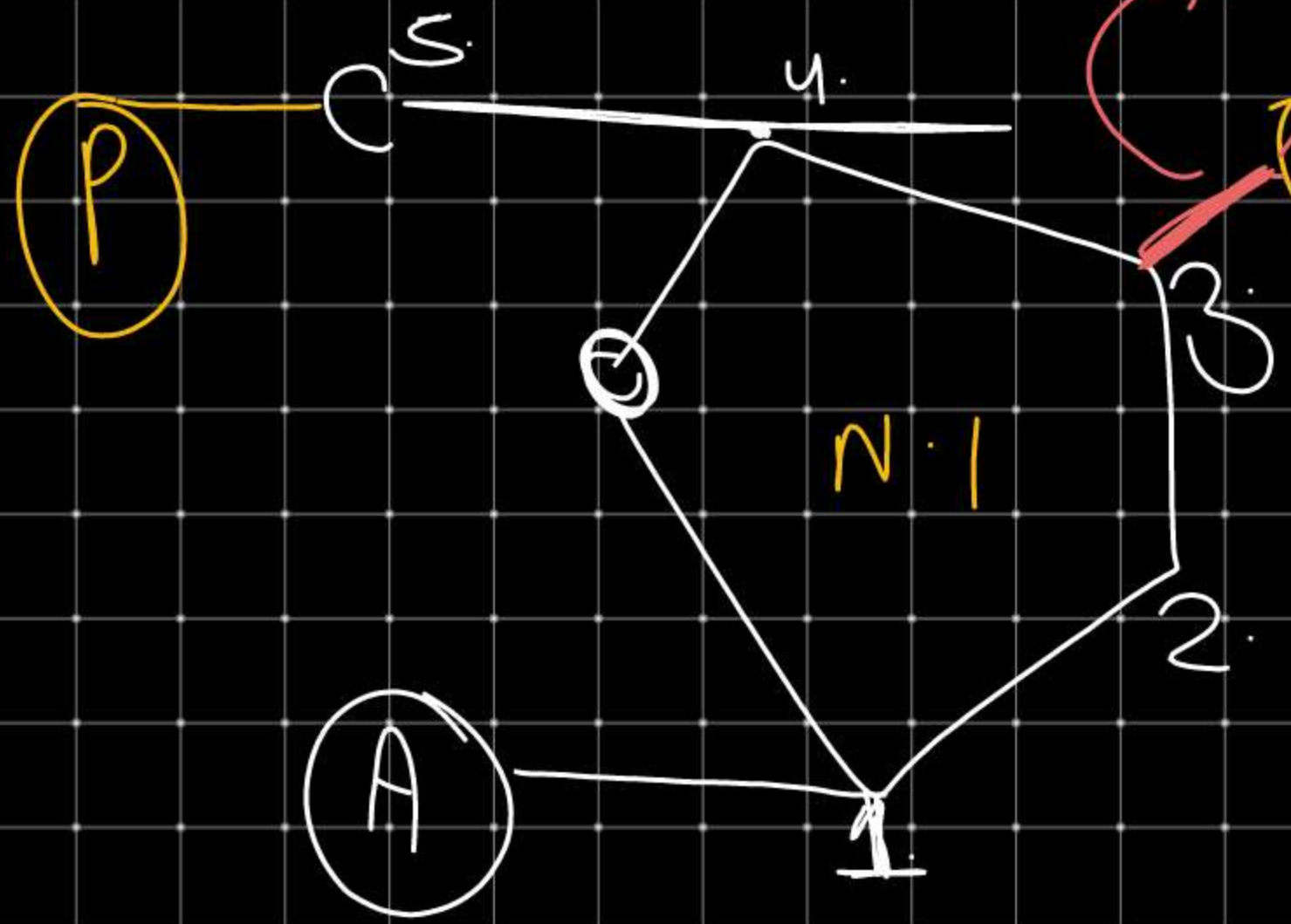
3' - 5'

Nucleotide

Nucleotide

Phosphodiester Bond

Phosphodiester Bond



3.4 nm  $\rightarrow$  10

1 bp  $\rightarrow$  0.34 nm

3.4 nm  
(Pitch)



Base Pair

10

base pair

0.34 nm



diploid  
set of  
chromosome

46 chromosome ( $2 \times 23$ )  
 $\Rightarrow 2 \times n$

meiosis

23 chromosome ( $n$  set of chr.  
Haploid)

Q: E. coli DNA  $\Rightarrow$  1.36 mm. ✓

BP  $\Rightarrow$

$$\begin{array}{r} 1.36 \times 10^3 \text{ m} \\ \hline 0.34 \times 10^9 \text{ bp} \end{array}$$

$$\Rightarrow 4 \times 10^6 \text{ bp}$$

~~A~~ 3 <sup>types</sup> DNA

