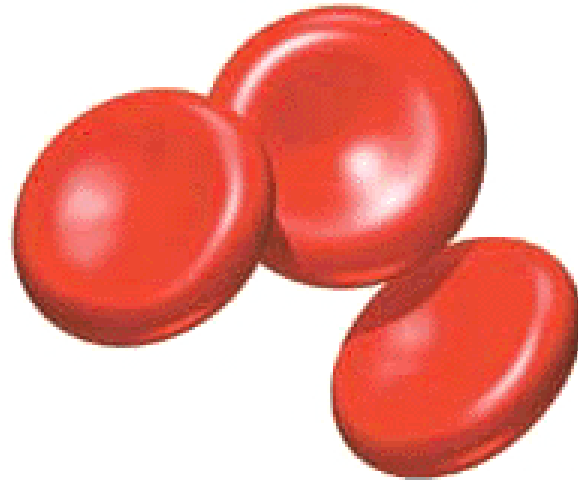


# UNIVERSAL DONOR



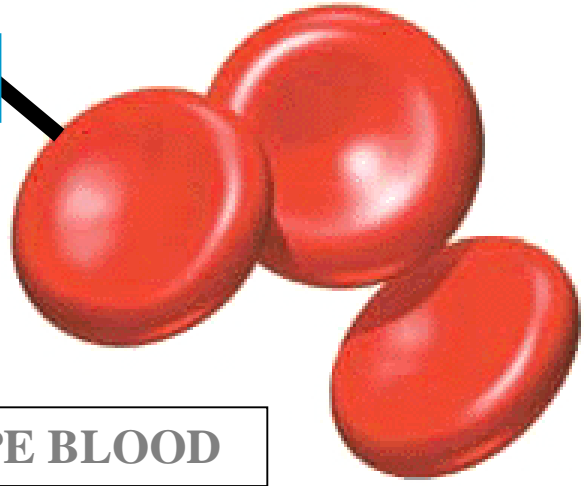
**O-TYPE BLOOD**



**BLOOD  
TRANSFUSIONS  
UNIVERSAL  
ACCEPTOR**

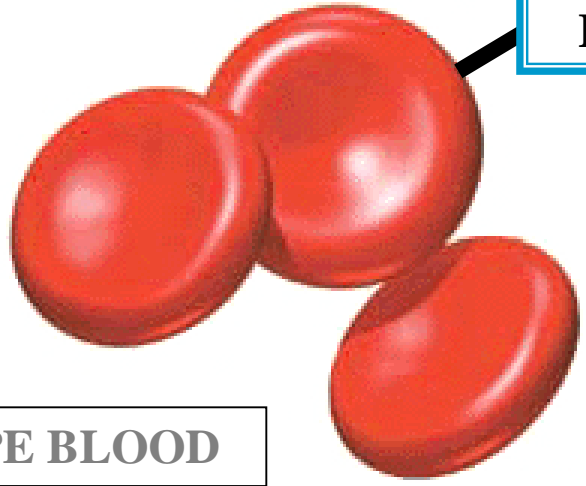
# UNIVERSAL ACCEPTOR

A



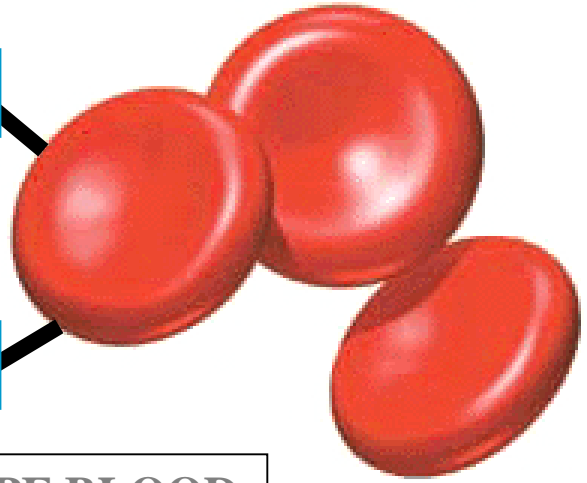
A TYPE BLOOD

B



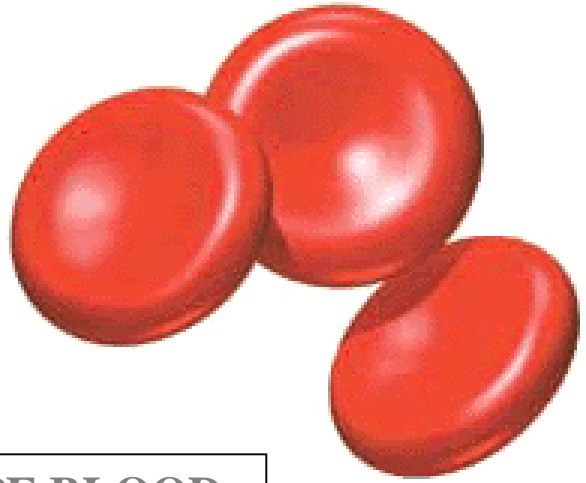
B TYPE BLOOD

A



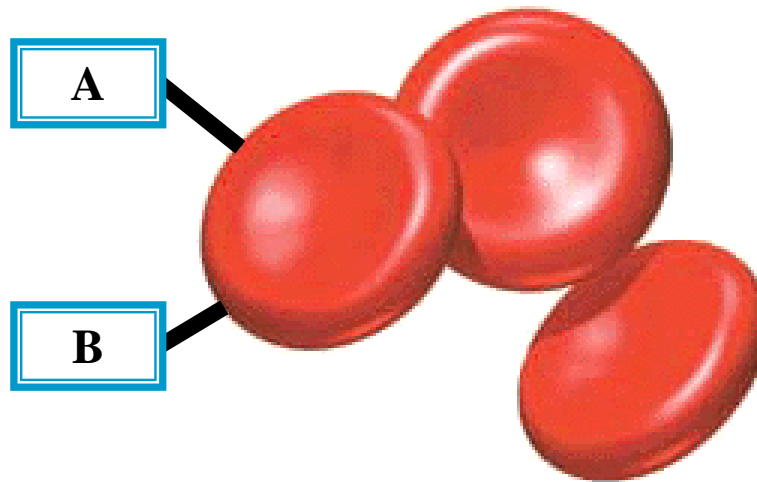
AB TYPE BLOOD

B



O TYPE BLOOD

# UNIVERSAL ACCEPTOR



**AB-TYPE BLOOD**



# CHAPTER 16

## DNA STRUCTURE & REPLICATION



# DNA STRUCTURE



**DNA**  
**STRUCTURE**  
**DISCOVERY**  
**CHRONOLOGY**



**DNA  
STRUCTURE  
DISCOVERY  
CHRONOLOGY  
1868**

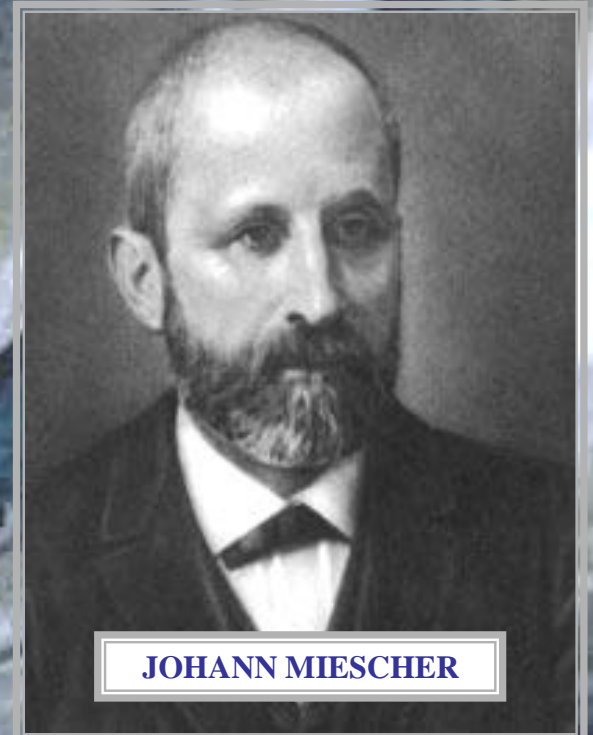


# JOHANN MIESCHER



**JOHANN MIESCHER**

# COD FISH SPERM

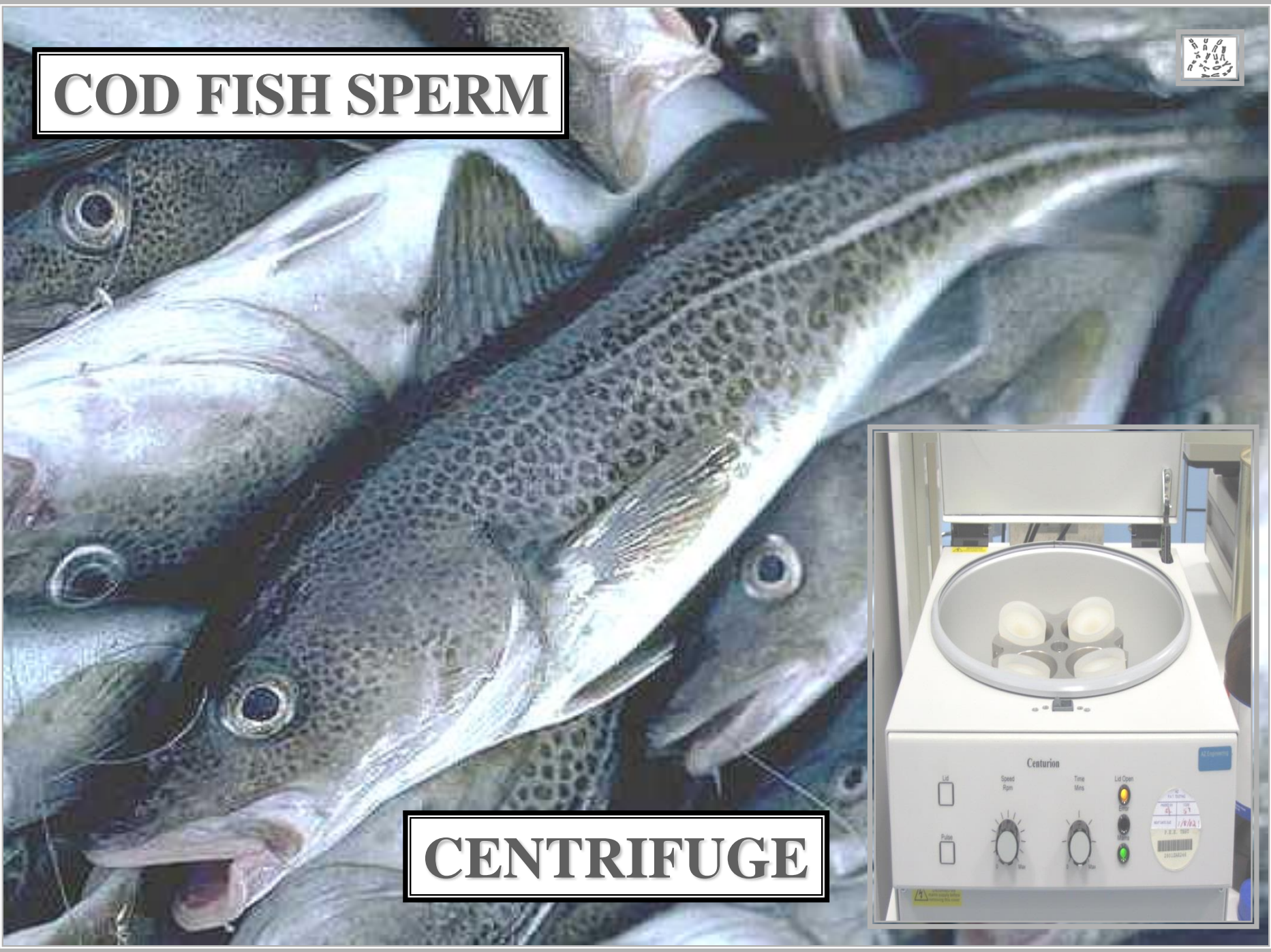


**JOHANN MIESCHER**





**COD FISH SPERM**

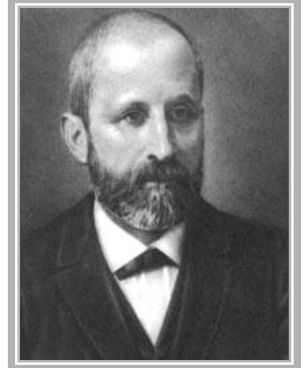


**CENTRIFUGE**



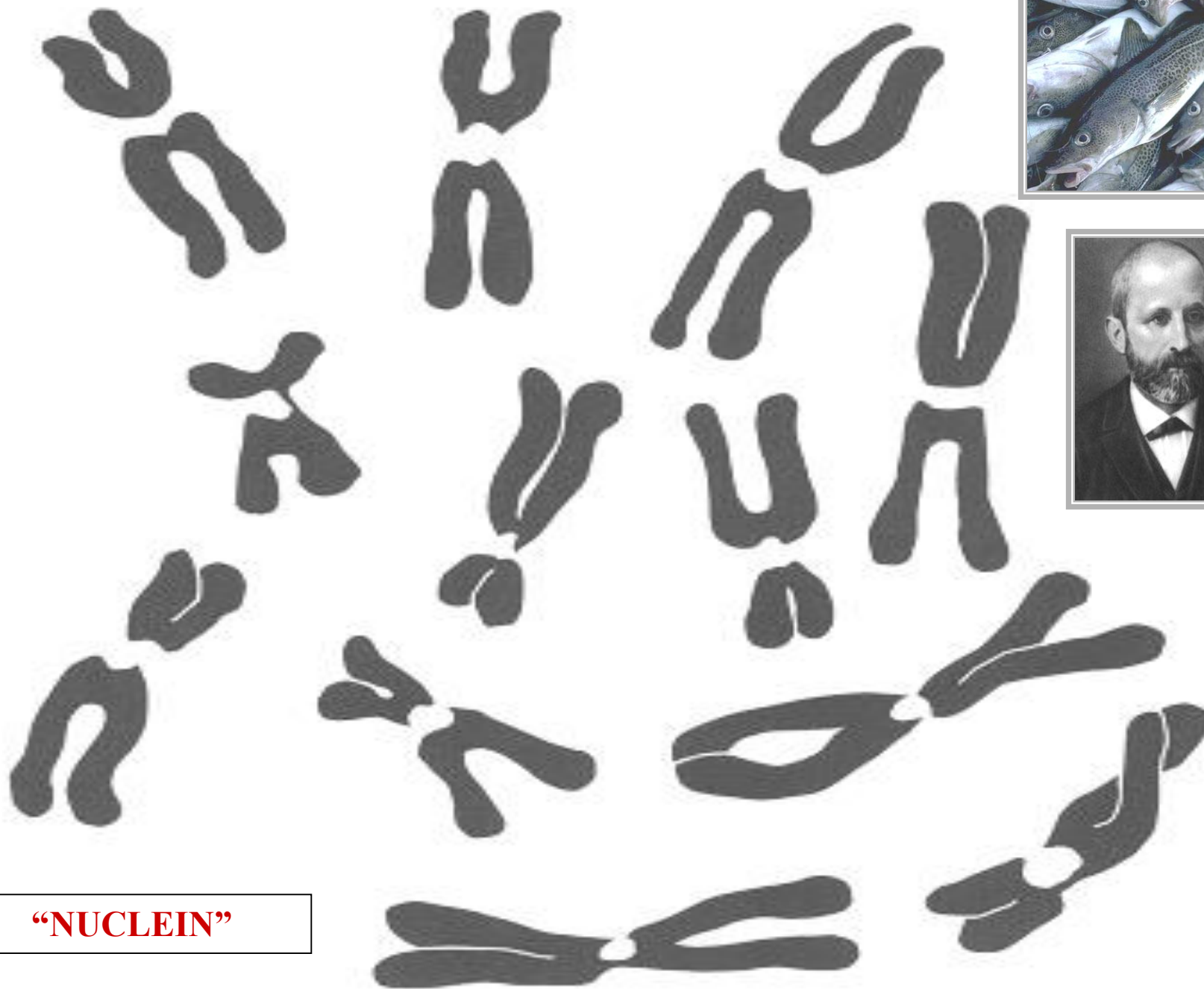
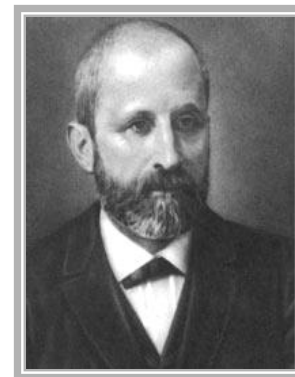


N

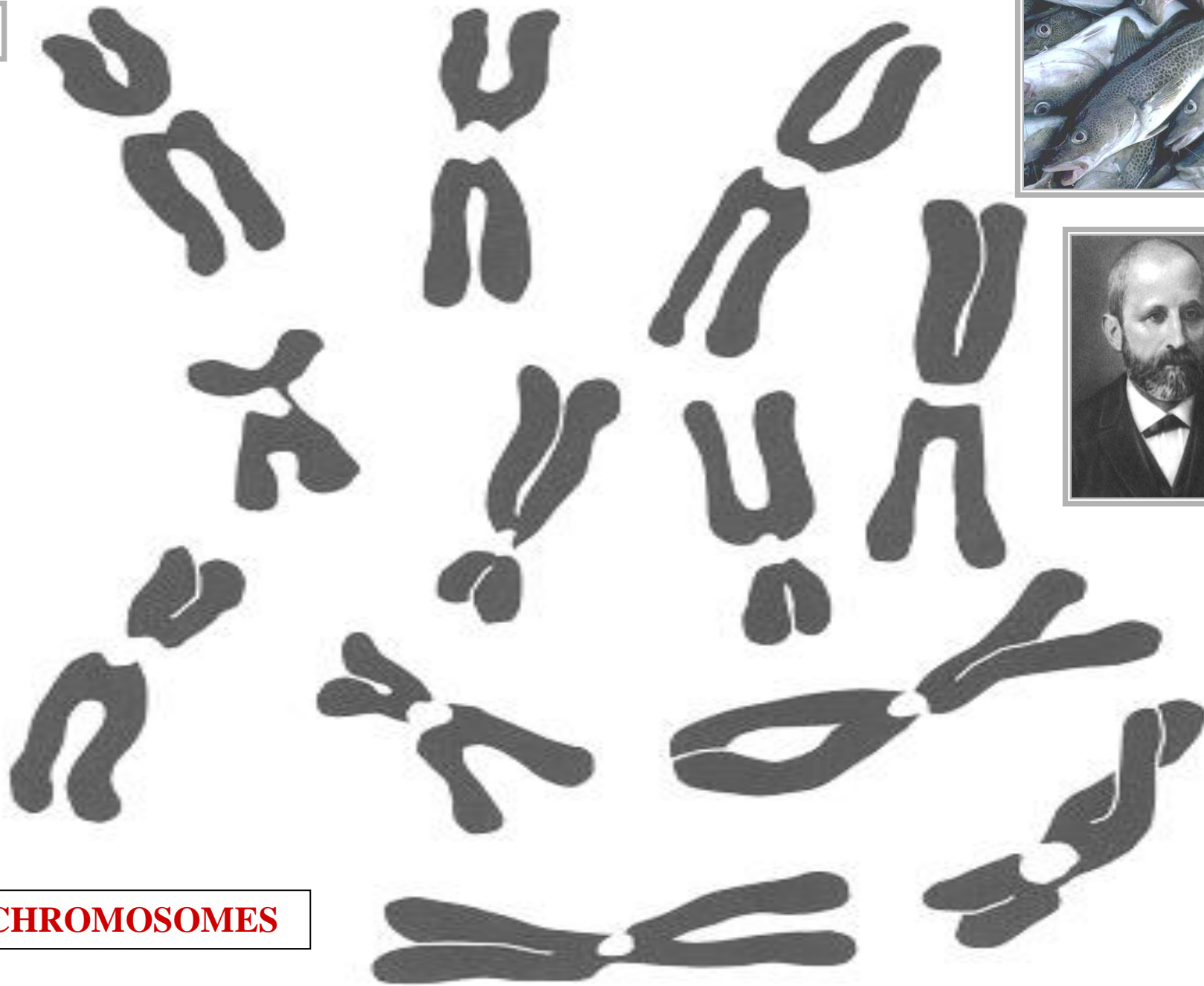
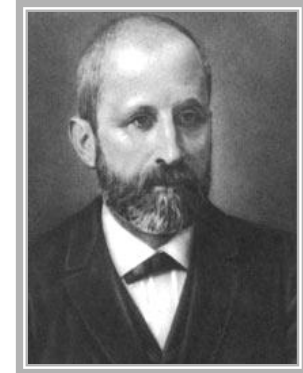


**ISOLATED  
NUCLEUS CONTENT**

C



“NUCLEIN”



**CHROMOSOMES**

# EUKARYOTE CHROMOSOME



The diagram illustrates the structure of a eukaryotic chromosome. It shows a long, thin DNA molecule (represented by a purple thread) that is tightly coiled into a series of spherical nucleosomes. Each nucleosome is composed of DNA wrapped around a core of histone proteins (represented by orange spheres). The nucleosomes are connected by linker DNA (represented by blue threads). Three arrows point from labels to the diagram: a blue arrow points to the DNA thread, and two grey arrows point to the orange histone protein cores. In the bottom right corner of the diagram, there is a small inset photograph of a fisherman in a boat, surrounded by a large catch of fish.

**DNA**

**HISTONE PROTEIN**

**HISTONE PROTEIN**

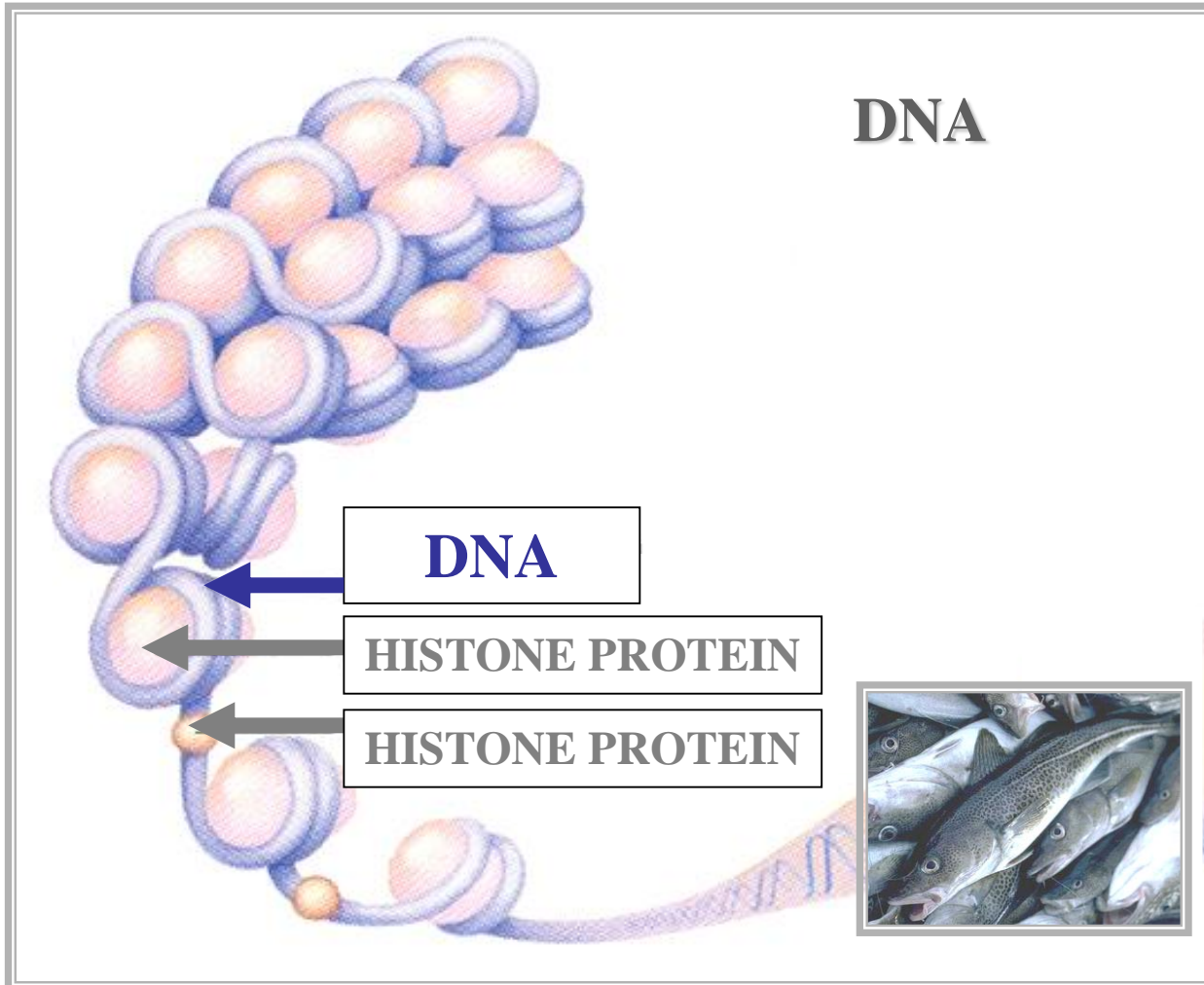


D

+

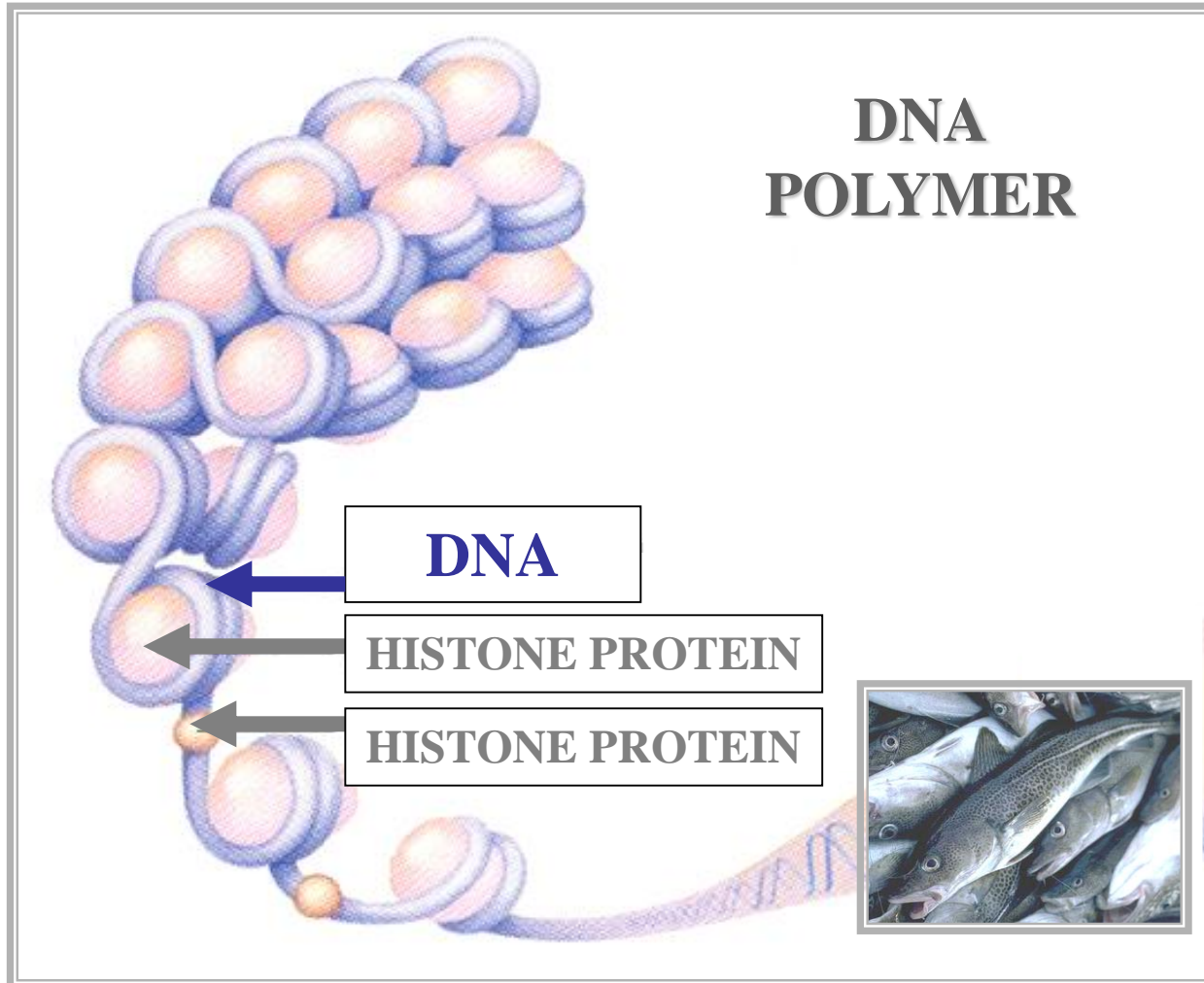
# CHROMOSOME DNA

# EUKARYOTE CHROMOSOME

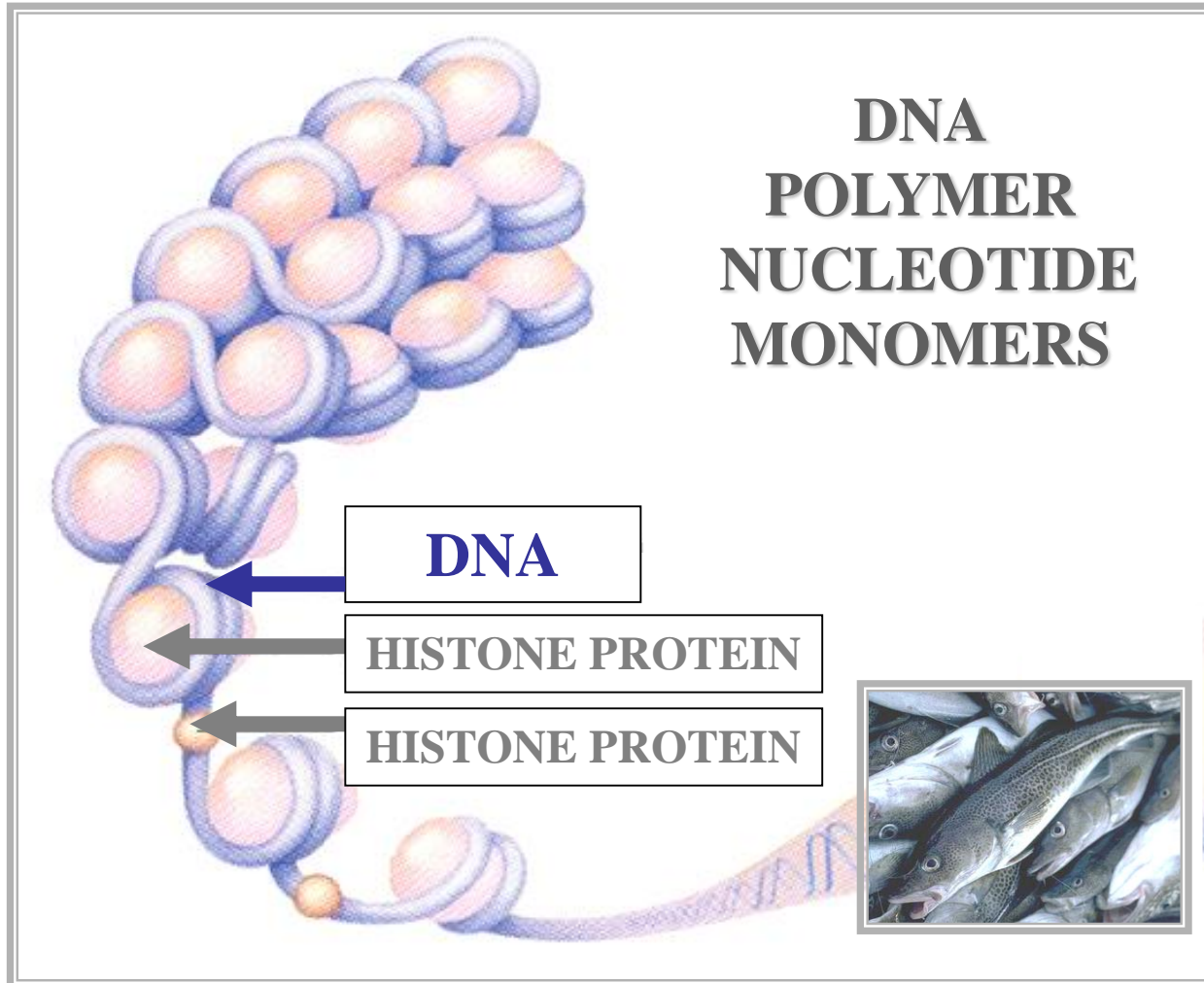




# EUKARYOTE CHROMOSOME

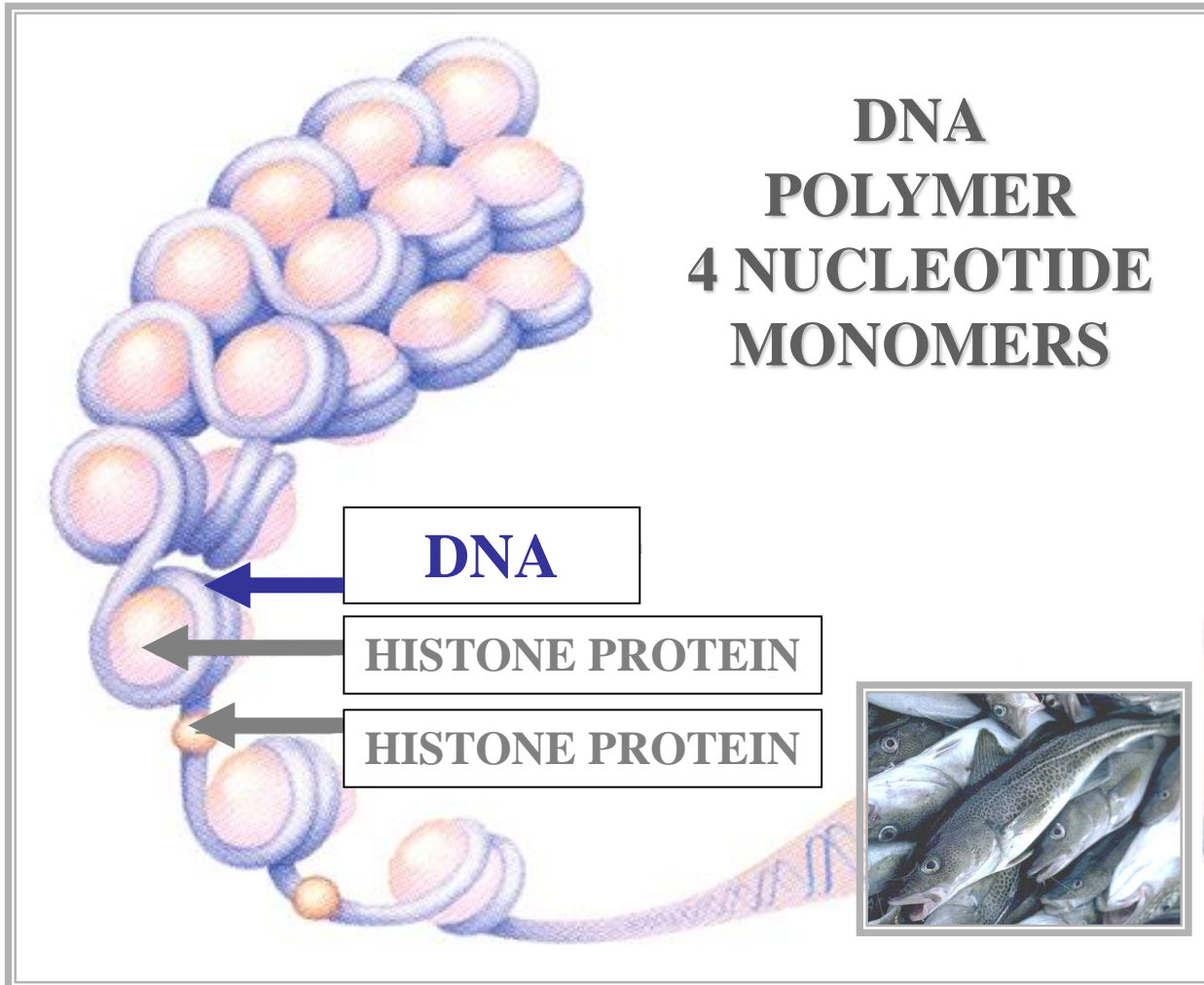


# EUKARYOTE CHROMOSOME

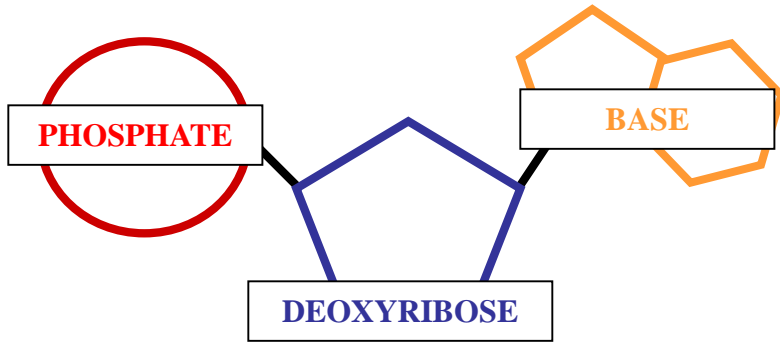




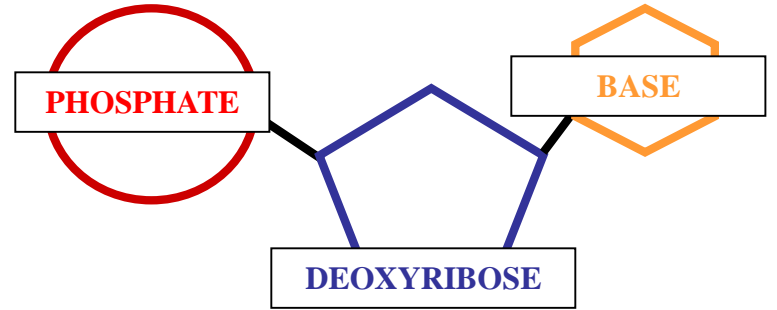
# EUKARYOTE CHROMOSOME



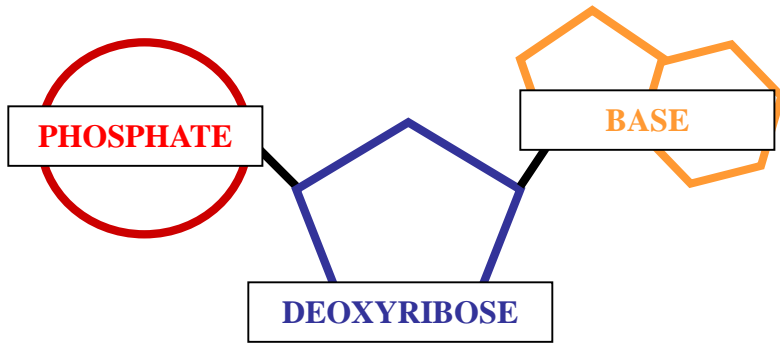
# DNA NUCLEOTIDES



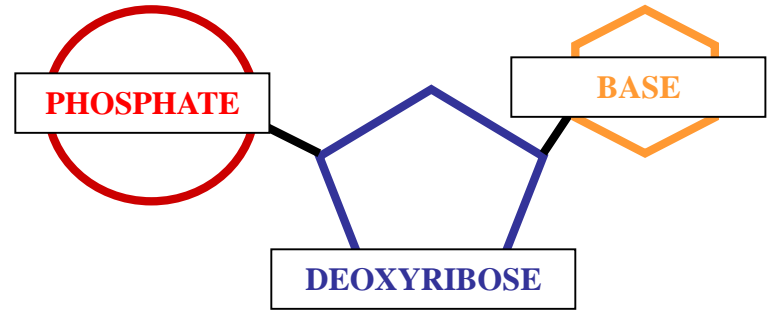
?



?

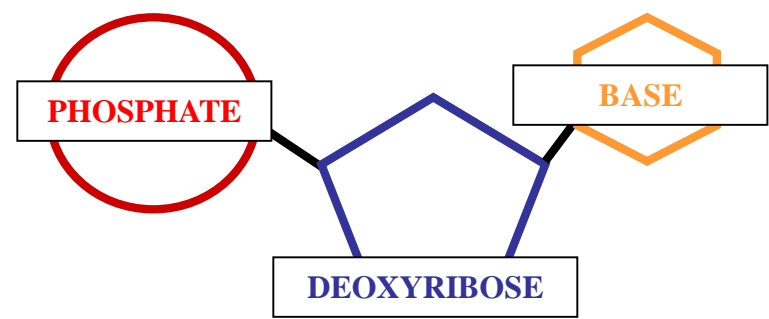
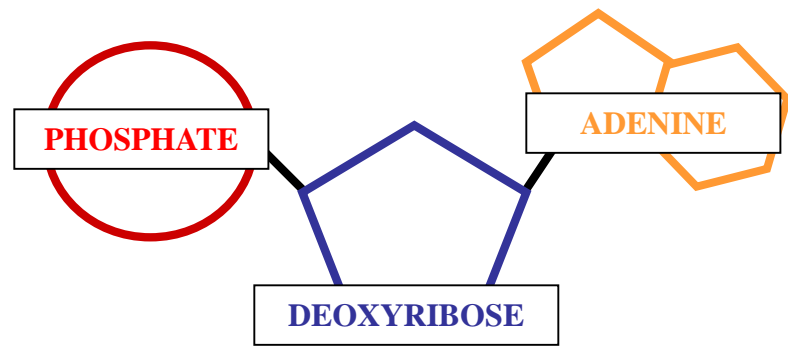


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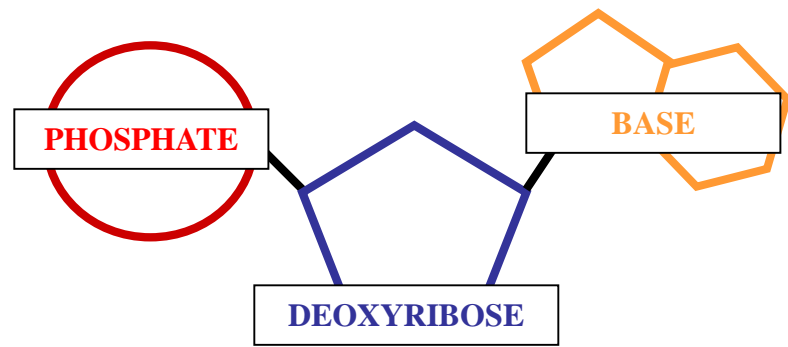
?

# DNA NUCLEOTIDES

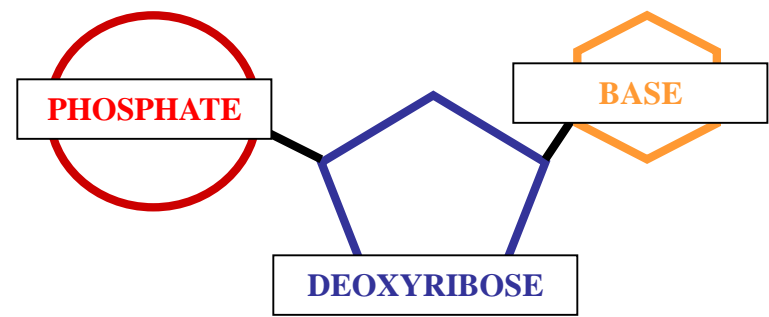


**ADENINE**

?

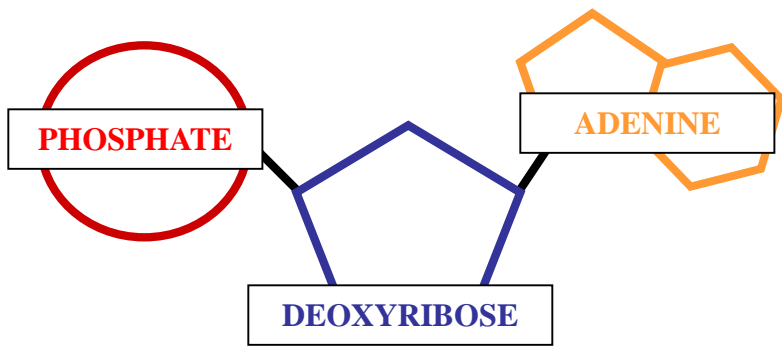


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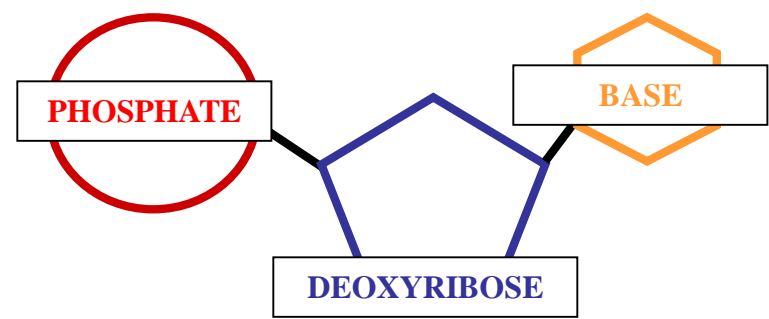


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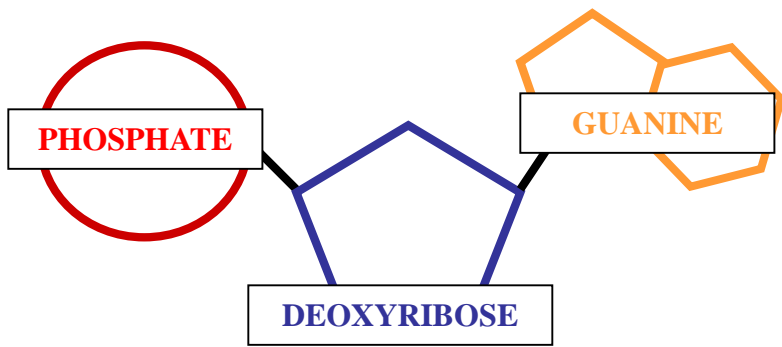
# DNA NUCLEOTIDES



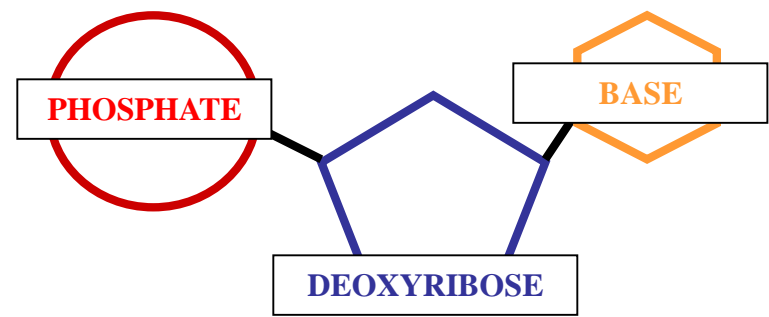
**ADENINE**



?

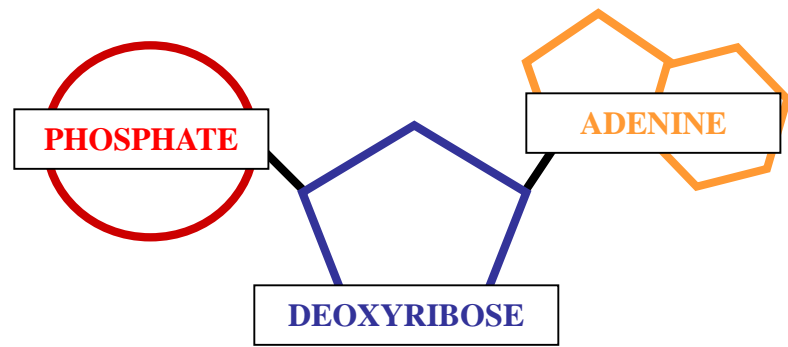


**GUANINE**

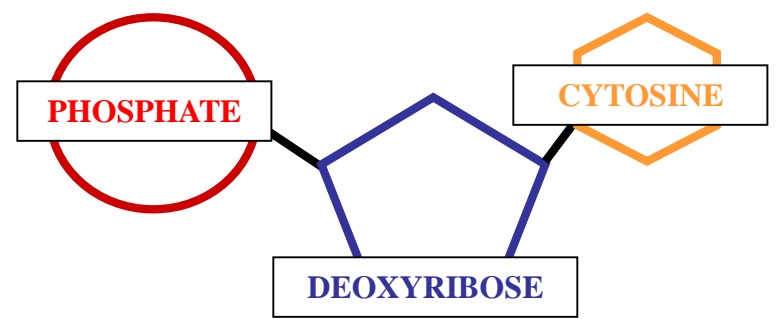


?

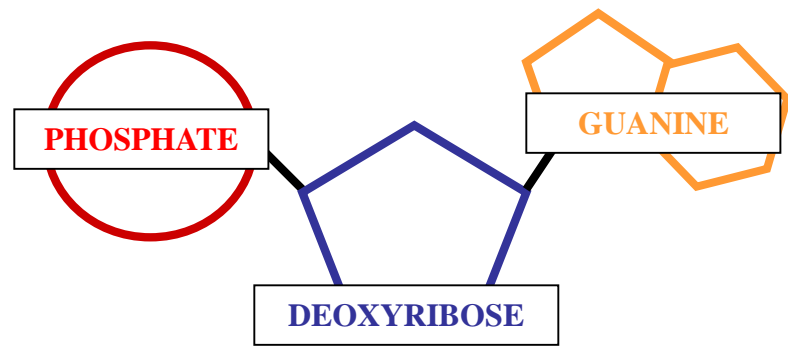
# DNA NUCLEOTIDES



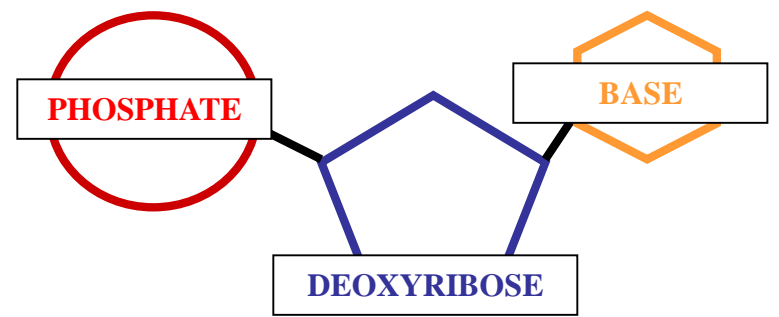
**ADENINE**



**CYTOSINE**

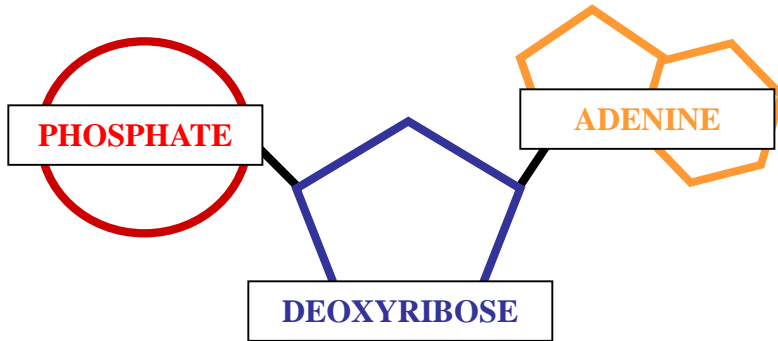


**GUANINE**

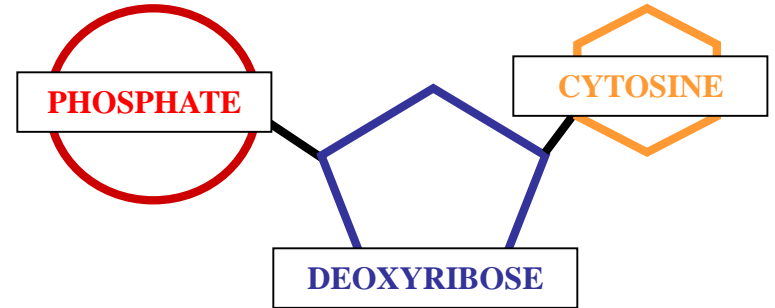


**?**

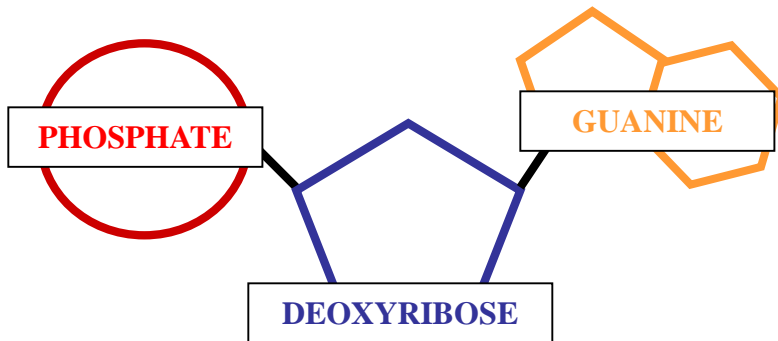
# DNA NUCLEOTIDES



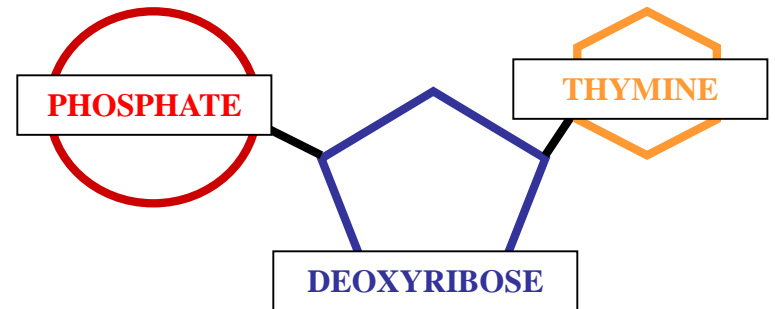
**ADENINE**



**CYTOSINE**

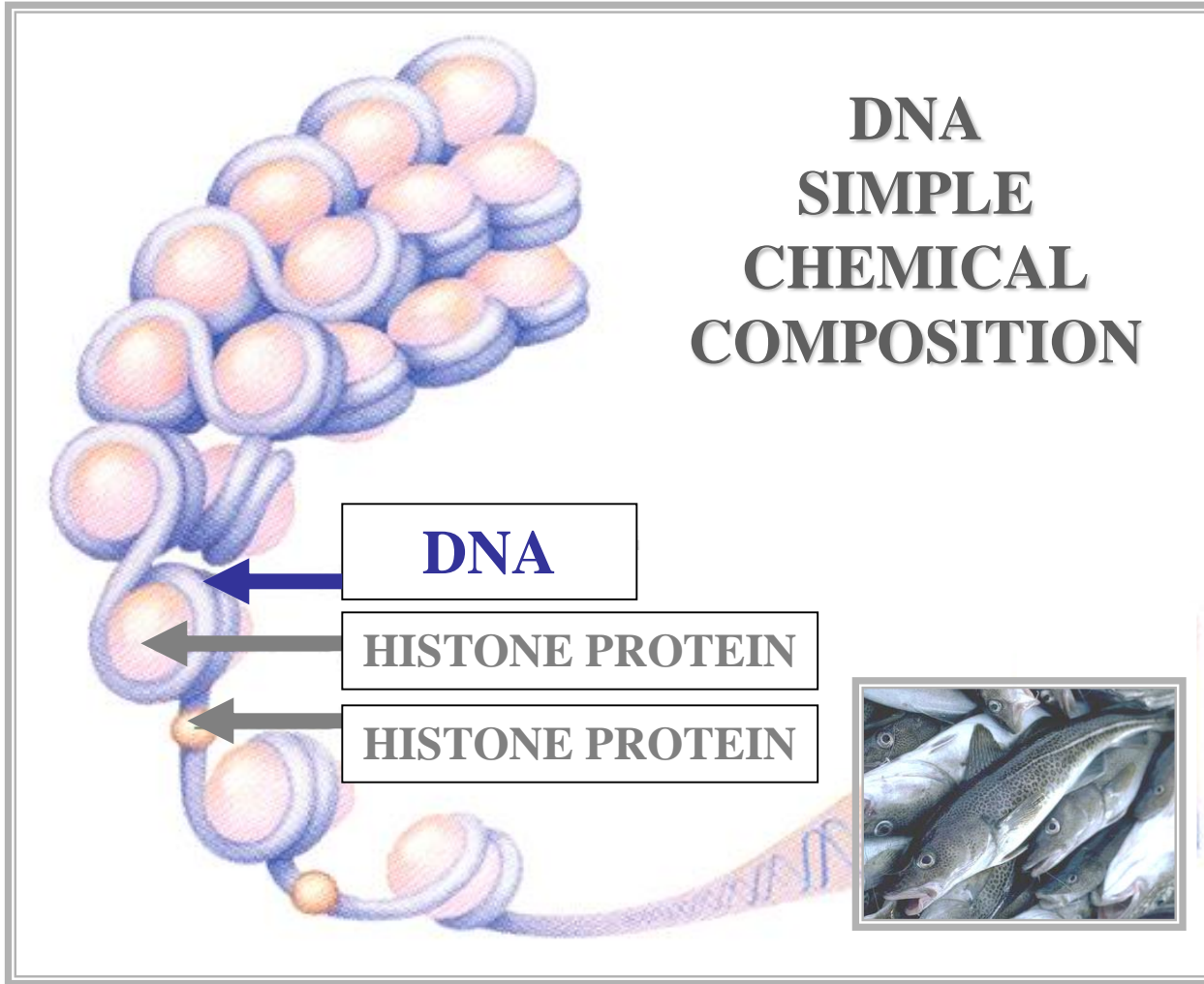


**GUANINE**



**THYMINE**

# EUKARYOTE CHROMOSOME





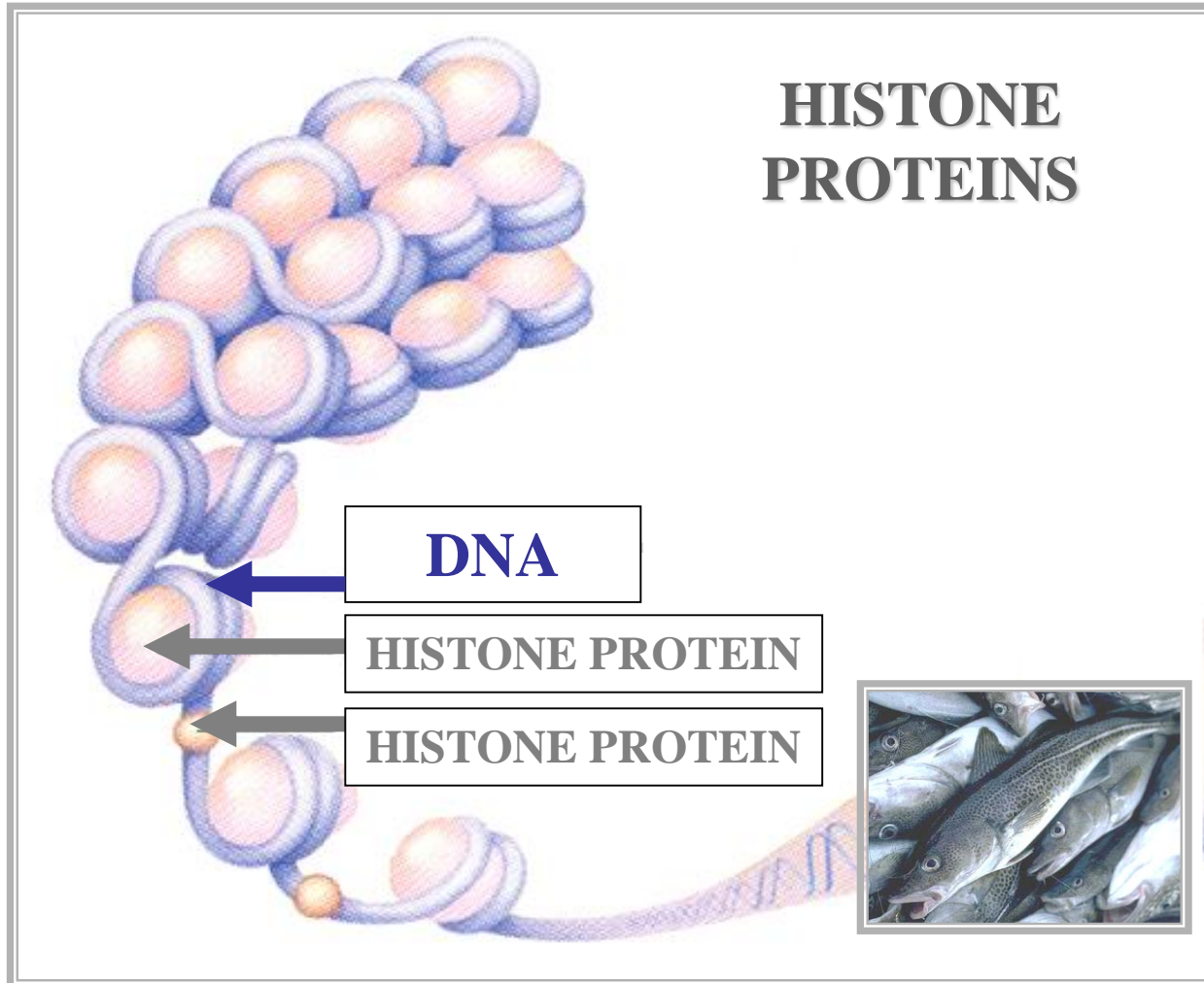
H

+

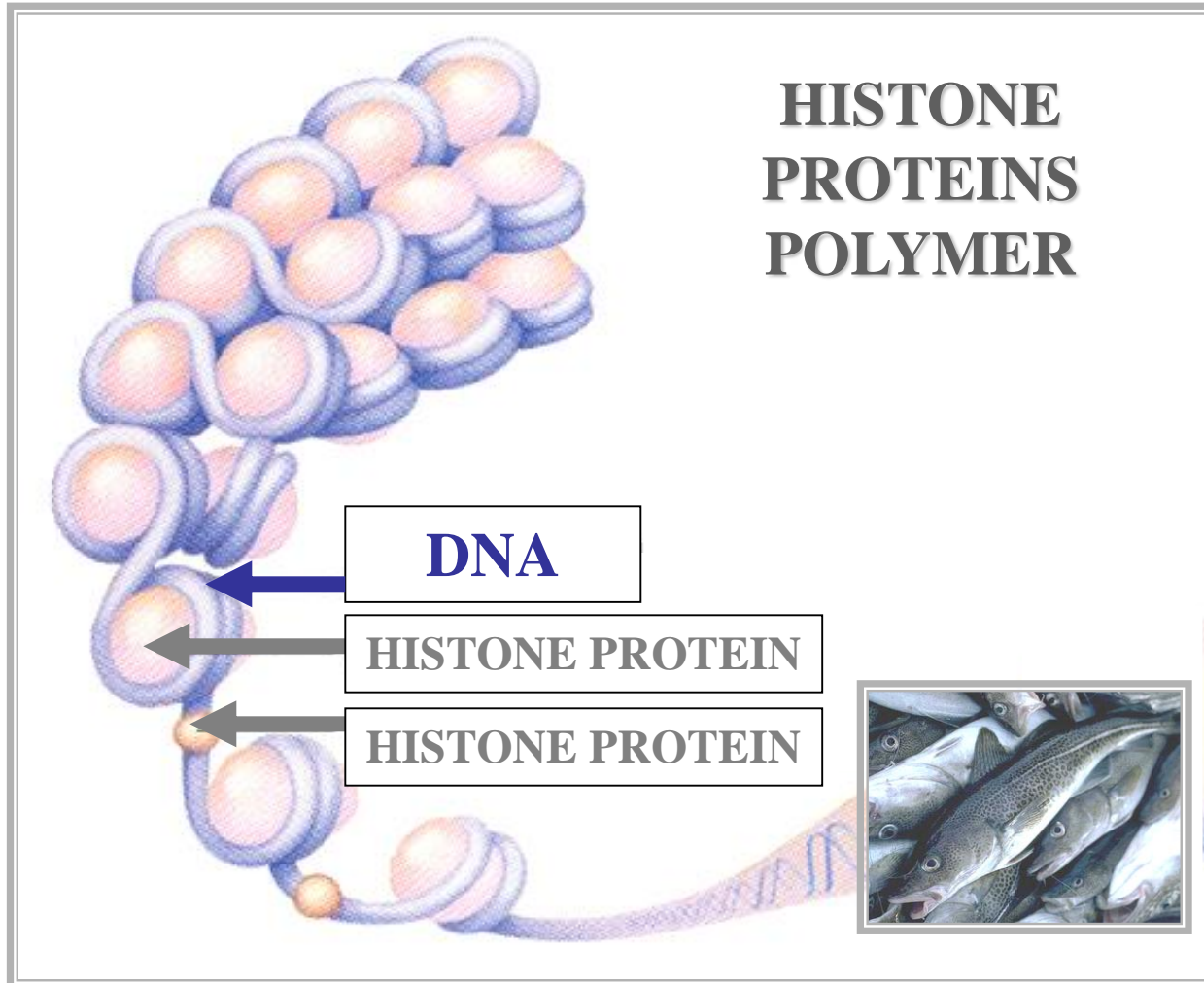
# CHROMOSOME HISTONE PROTEINS



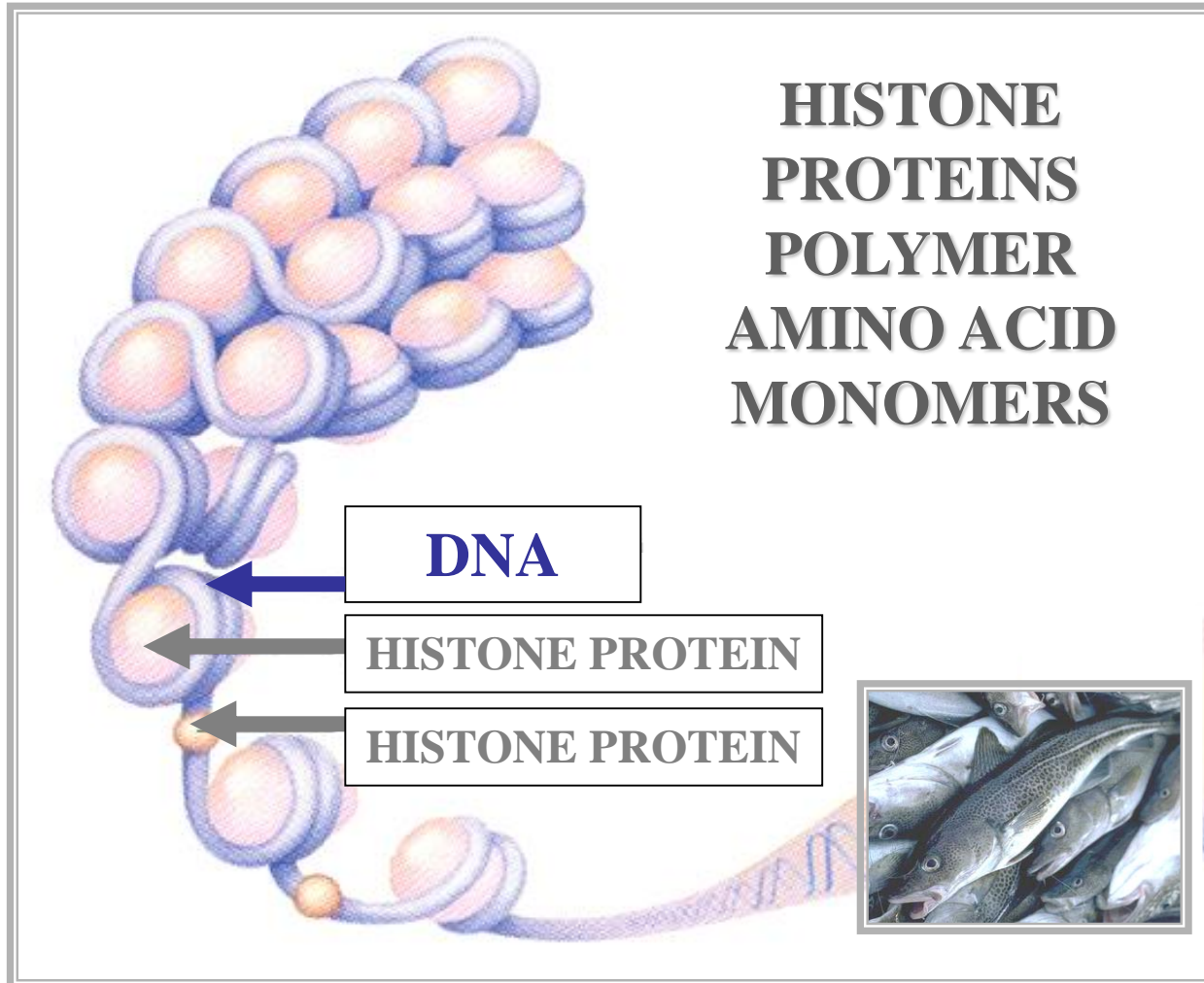
# EUKARYOTE CHROMOSOME



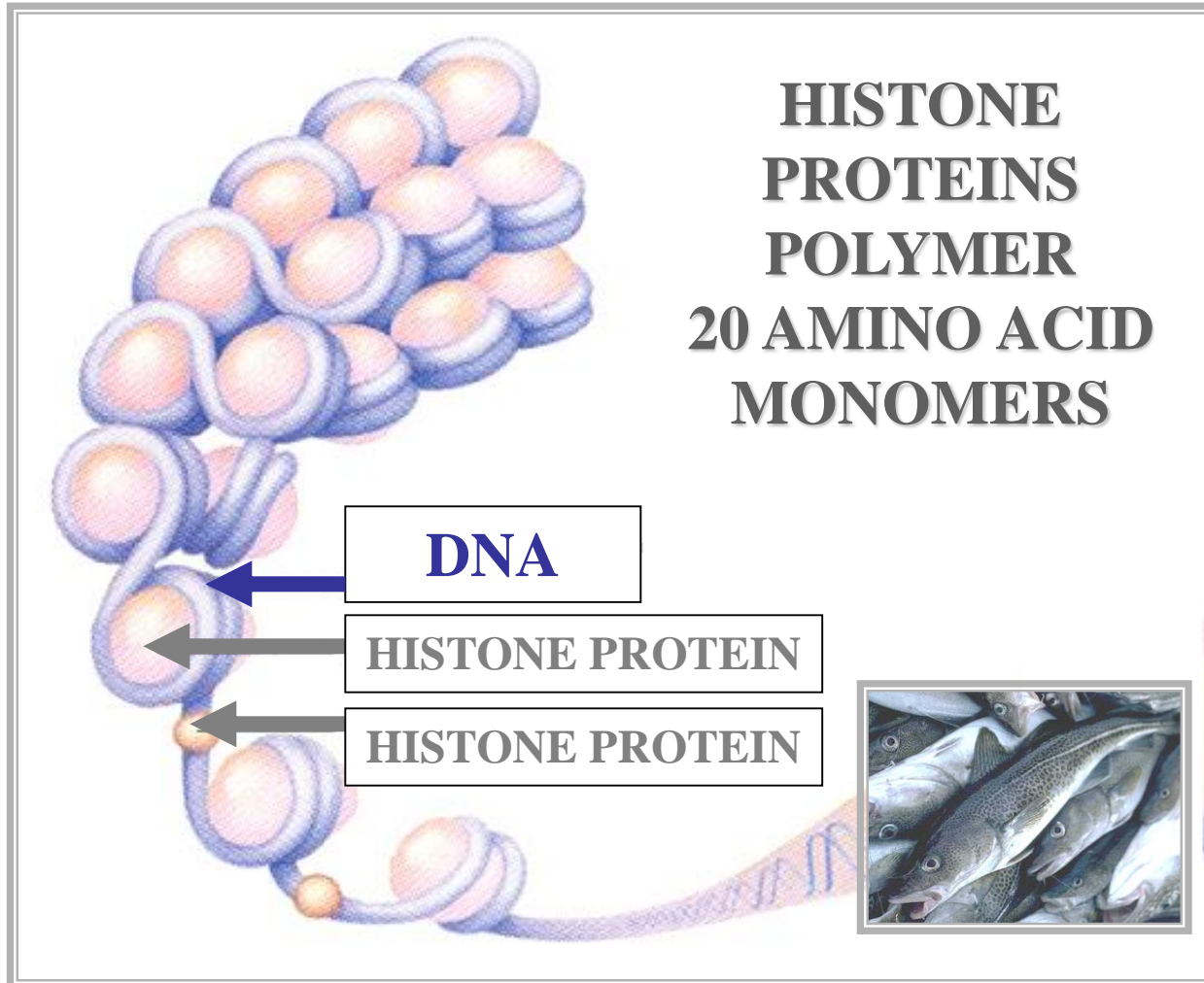
# EUKARYOTE CHROMOSOME



# EUKARYOTE CHROMOSOME



# EUKARYOTE CHROMOSOME



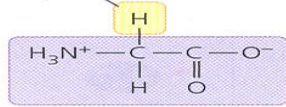


# 20 PROTEIN AMINO ACIDS

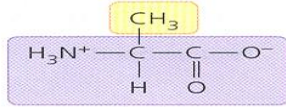


## Nonpolar side chains; hydrophobic

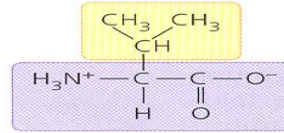
Side chain  
(R group)



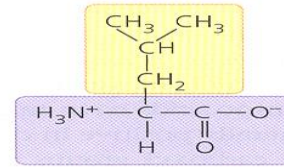
Glycine  
(Gly or G)



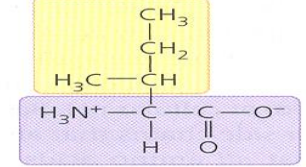
Alanine  
(Ala or A)



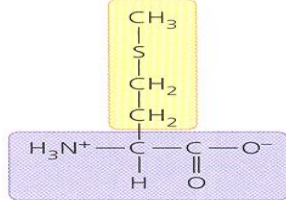
Valine  
(Val or V)



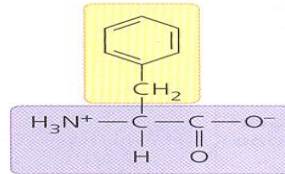
Leucine  
(Leu or L)



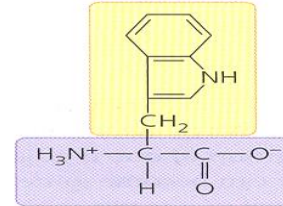
Isoleucine  
(Ile or I)



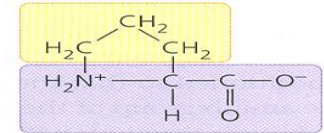
Methionine  
(Met or M)



Phenylalanine  
(Phe or F)

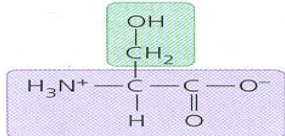


Tryptophan  
(Trp or W)

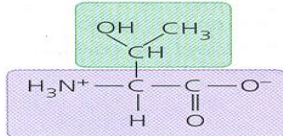


Proline  
(Pro or P)

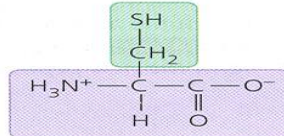
## Polar side chains; hydrophilic



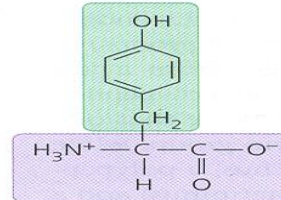
Serine  
(Ser or S)



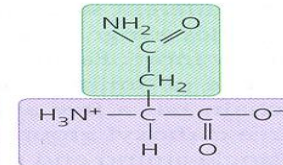
Threonine  
(Thr or T)



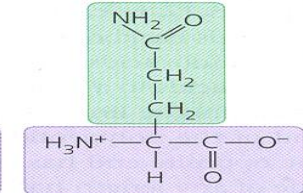
Cysteine  
(Cys or C)



Tyrosine  
(Tyr or Y)



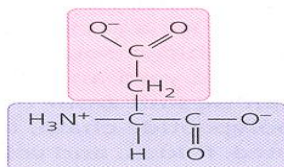
Asparagine  
(Asn or N)



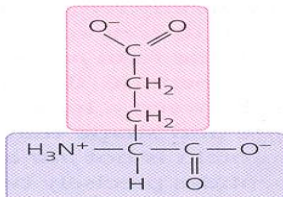
Glutamine  
(Gln or Q)

## Electrically charged side chains; hydrophilic

### Acidic (negatively charged)

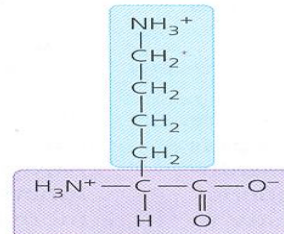


Aspartic acid  
(Asp or D)

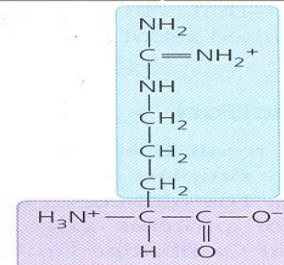


Glutamic acid  
(Glu or E)

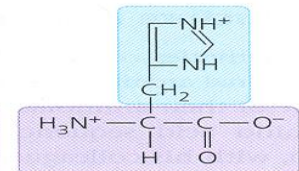
### Basic (positively charged)



Lysine  
(Lys or K)

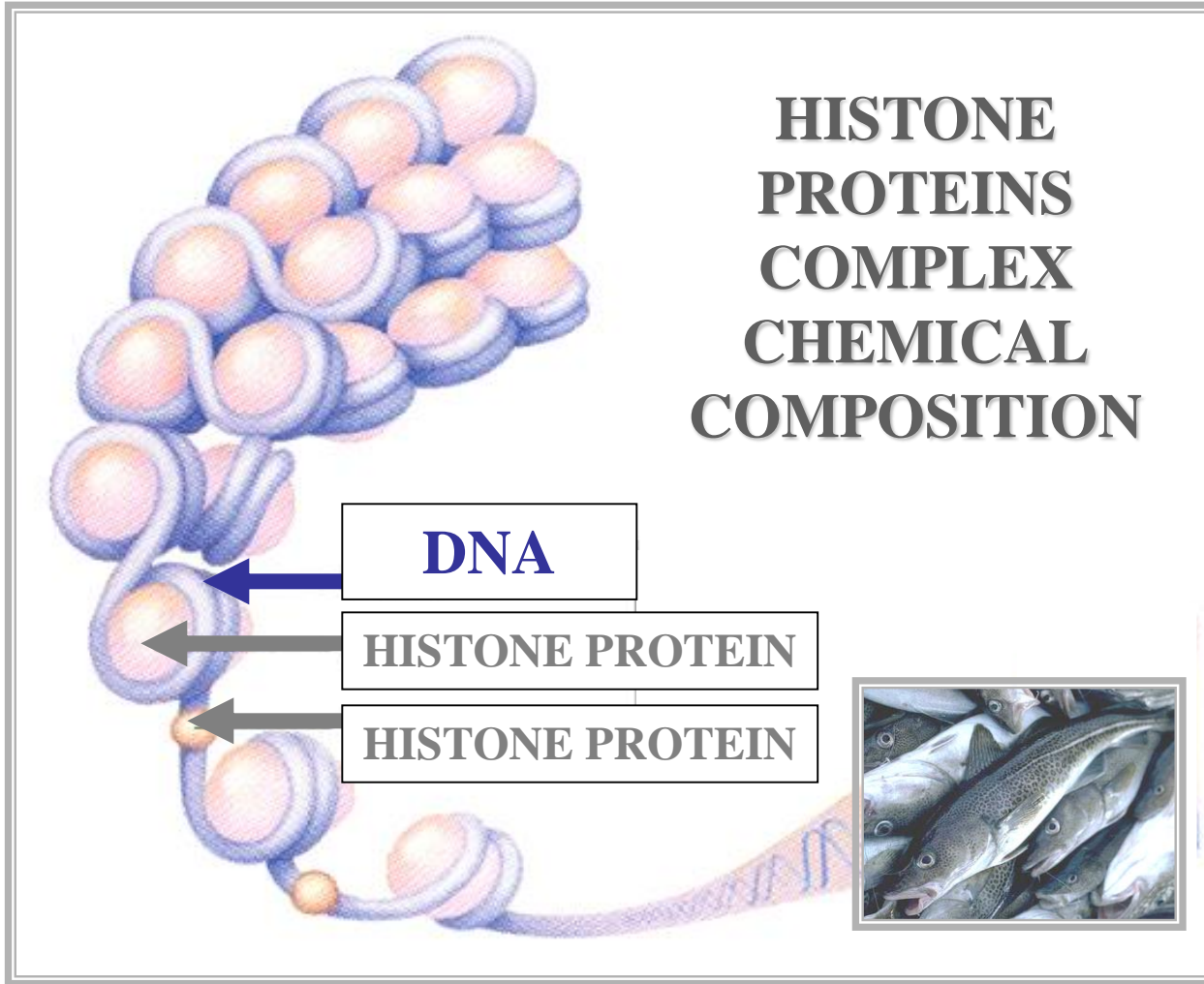


Arginine  
(Arg or R)



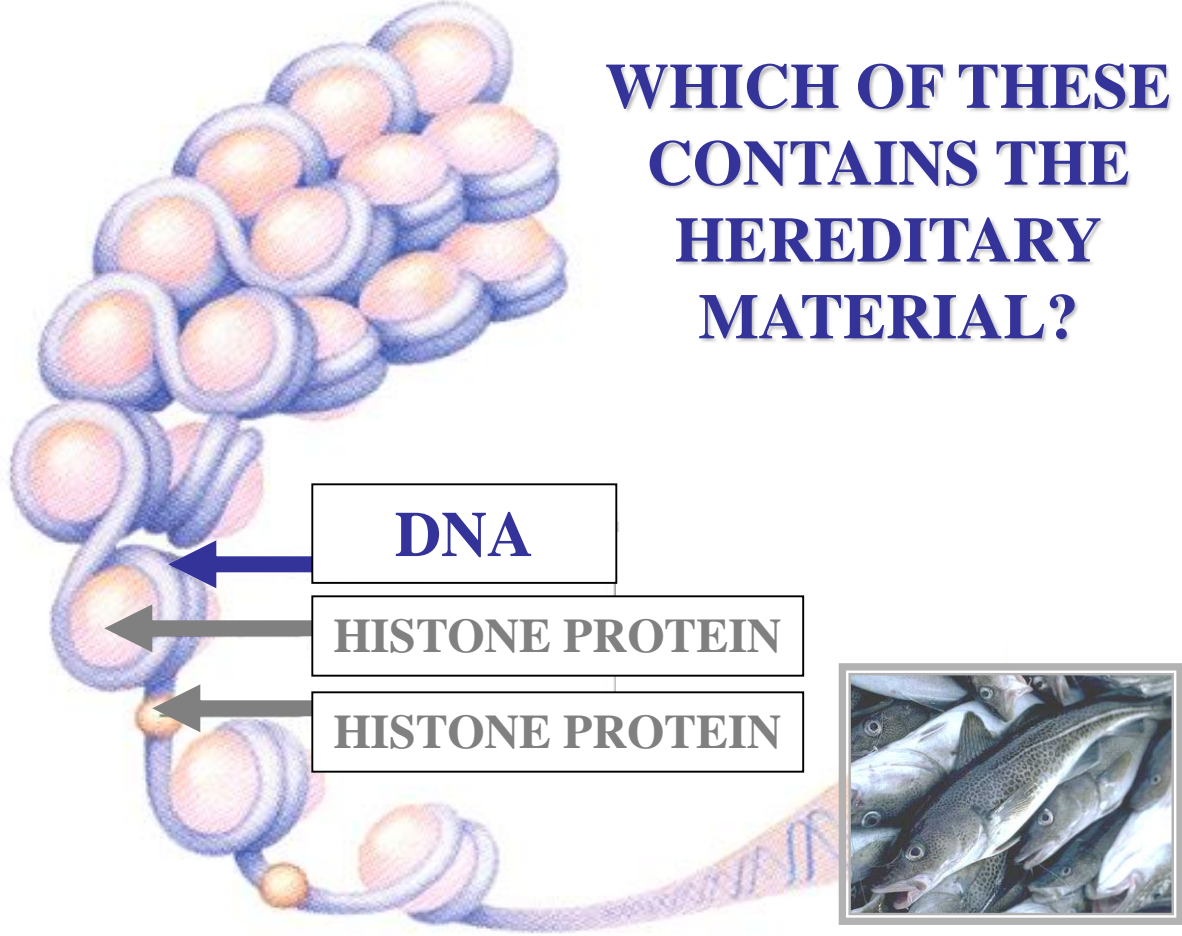
Histidine  
(His or H)

# EUKARYOTE CHROMOSOME



# EUKARYOTE CHROMOSOME

**WHICH OF THESE  
CONTAINS THE  
HEREDITARY  
MATERIAL?**



The diagram illustrates the structure of a eukaryotic chromosome. It shows a highly condensed, X-shaped structure composed of DNA and histone proteins. The DNA is represented by a blue double helix that is tightly coiled around histone proteins, which are shown as orange spheres. The resulting structure is a series of blue and orange spheres. Three arrows point from labels to the structure: a blue arrow points to the DNA, and two grey arrows point to the histone proteins. In the bottom right corner, there is a small inset image of a group of fish.

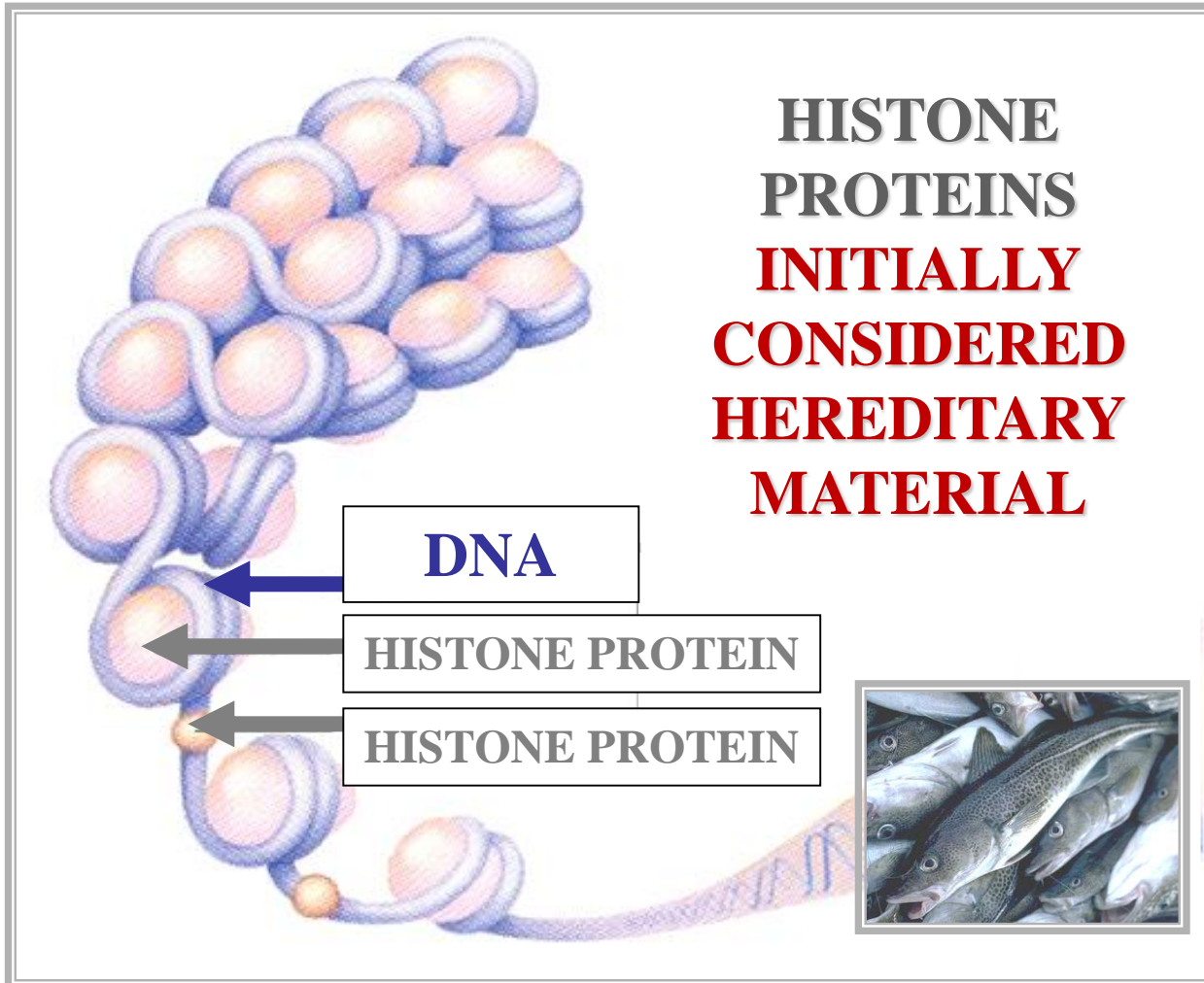
**DNA**

**HISTONE PROTEIN**

**HISTONE PROTEIN**



# EUKARYOTE CHROMOSOME



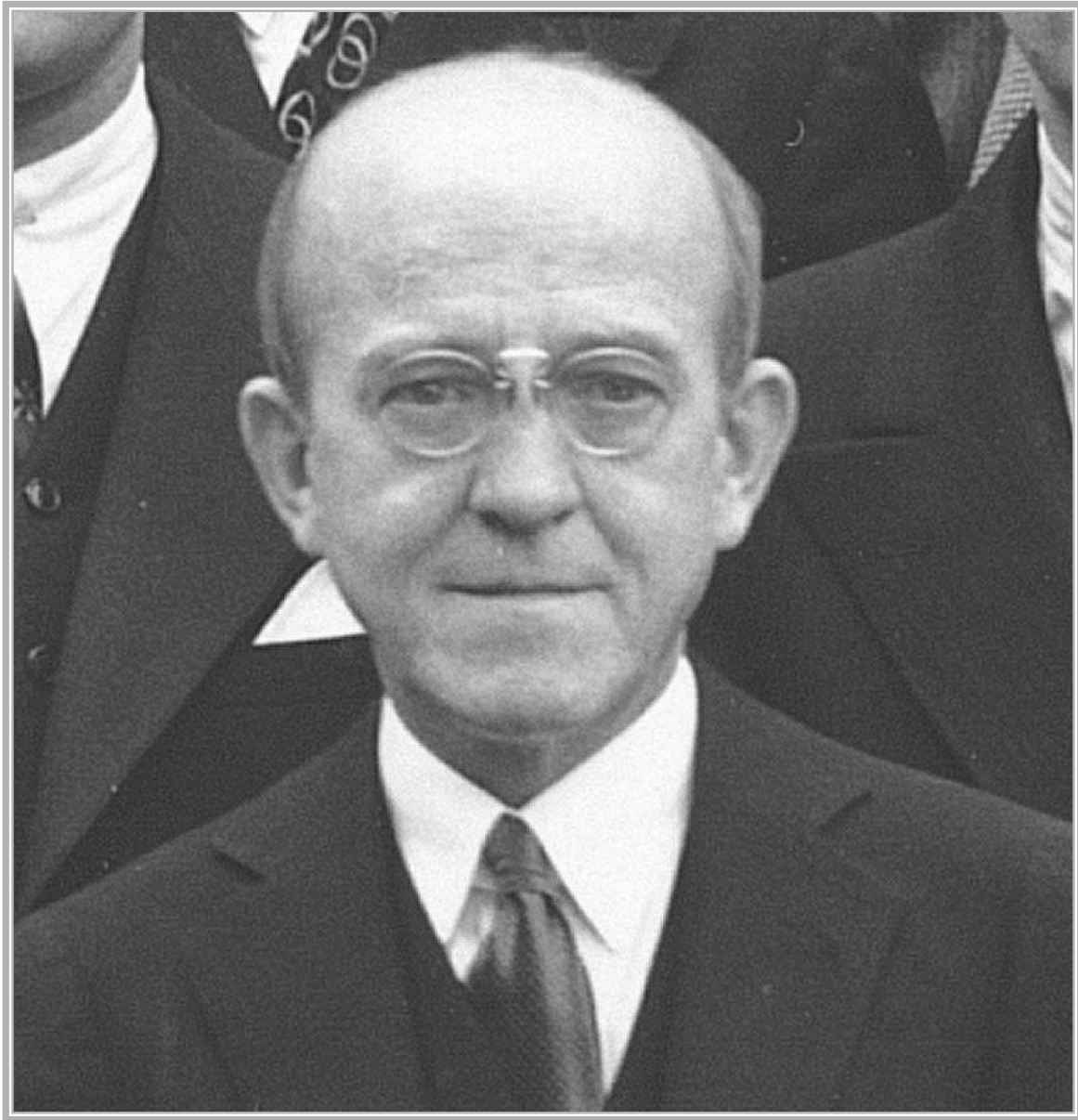




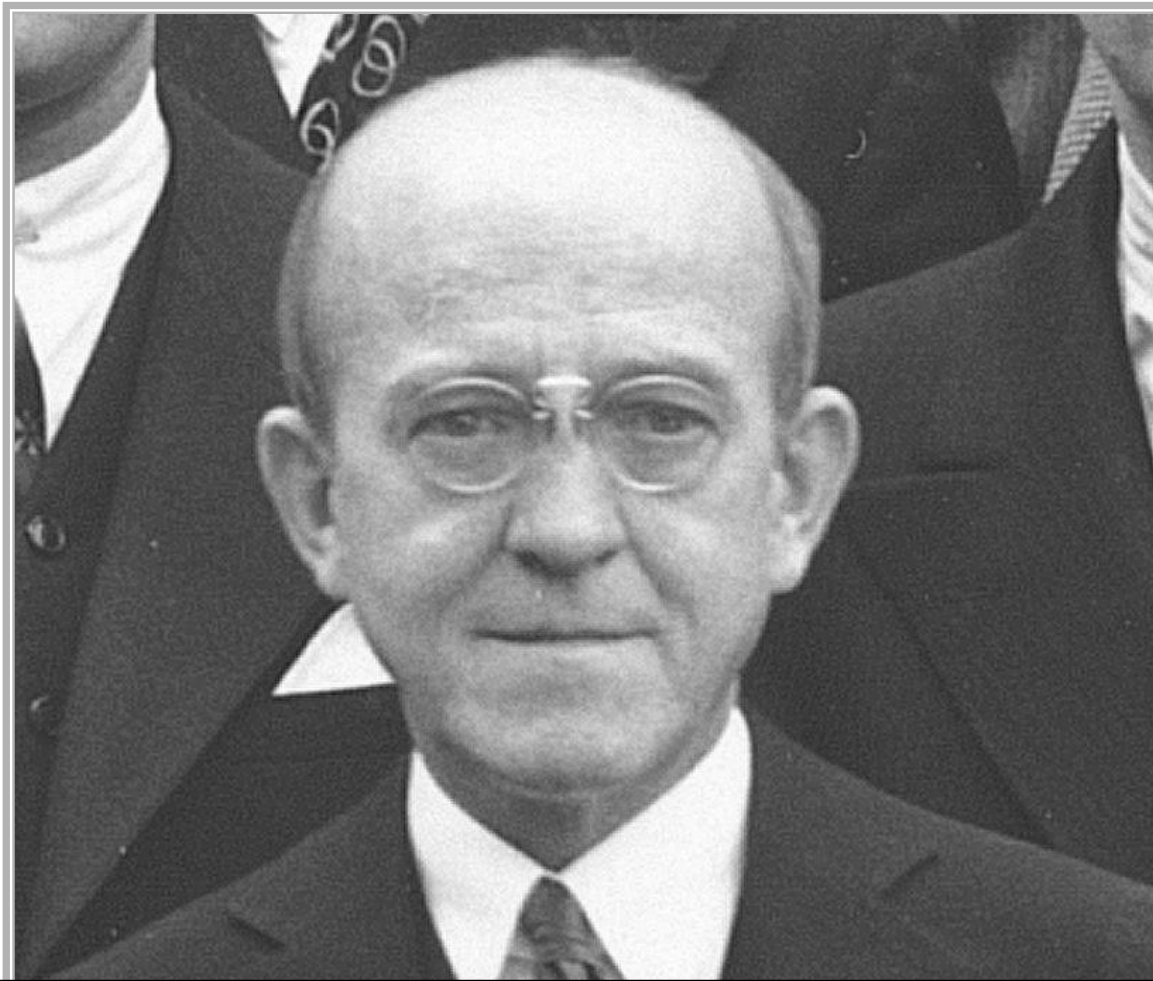
**DNA  
STRUCTURE  
DISCOVERY  
CHRONOLOGY  
1944**



# OSWALD AVERY



**OSWALD AVERY**



**EXPERIMENTS**

**ELIMINATED HISTONE PROTEINS**

**HEREDITARY MATERIAL**



**DETERMINED  
DNA HEREDITARY MATERIAL**





**HISTONE  
PROTEINS  
ELIMINATION  
INITIATED RACE  
TO DETERMINE  
DNA STRUCTURE**

**OSWALD AVERY**



# NUCLEOTIDES



# NUCLEOTIDE STRUCTURE



# NUCLEOTIDE STRUCTURAL COMPONENTS

# **NUCLEOTIDE STRUCTURAL COMPONENTS**

**SUGAR / DEOXYRIBOSE**

# **NUCLEOTIDE STRUCTURE COMPONENTS**

# **NUCLEOTIDE STRUCTURAL COMPONENTS**

**SUGAR / DEOXYRIBOSE  
PHOSPHATE**

**NUCLEOTIDE STRUCTURE  
COMPONENTS**

# NUCLEOTIDE STRUCTURAL COMPONENTS



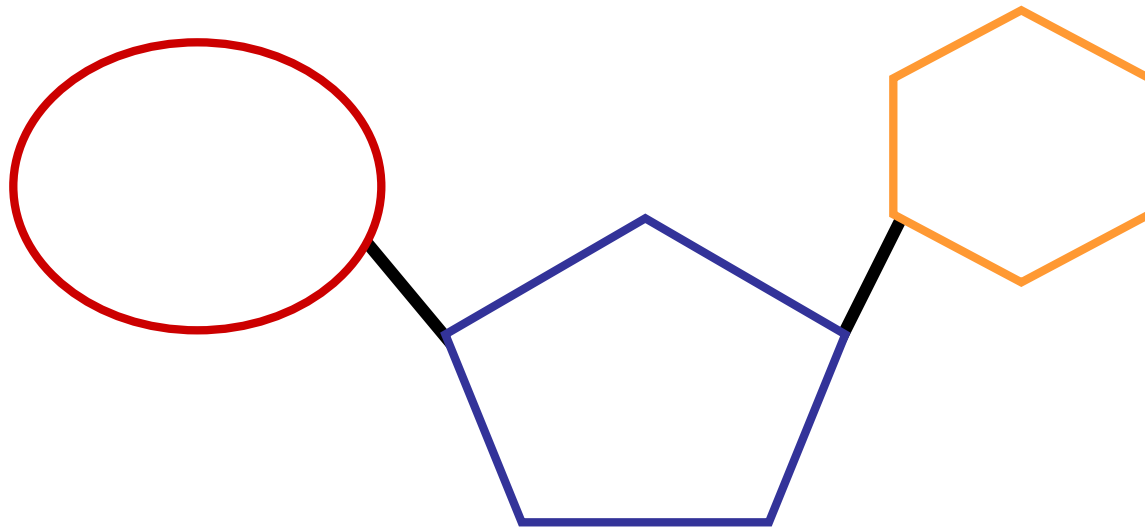
SUGAR / DEOXYRIBOSE

PHOSPHATE

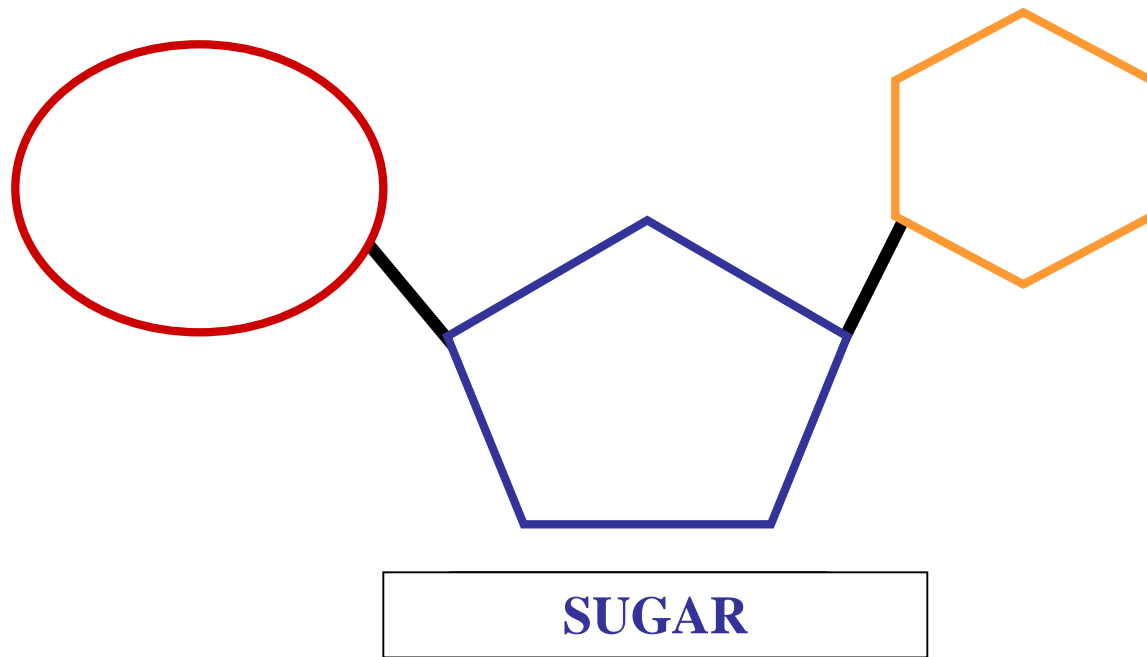
NITROGENOUS BASE

# NUCLEOTIDE STRUCTURE COMPONENTS

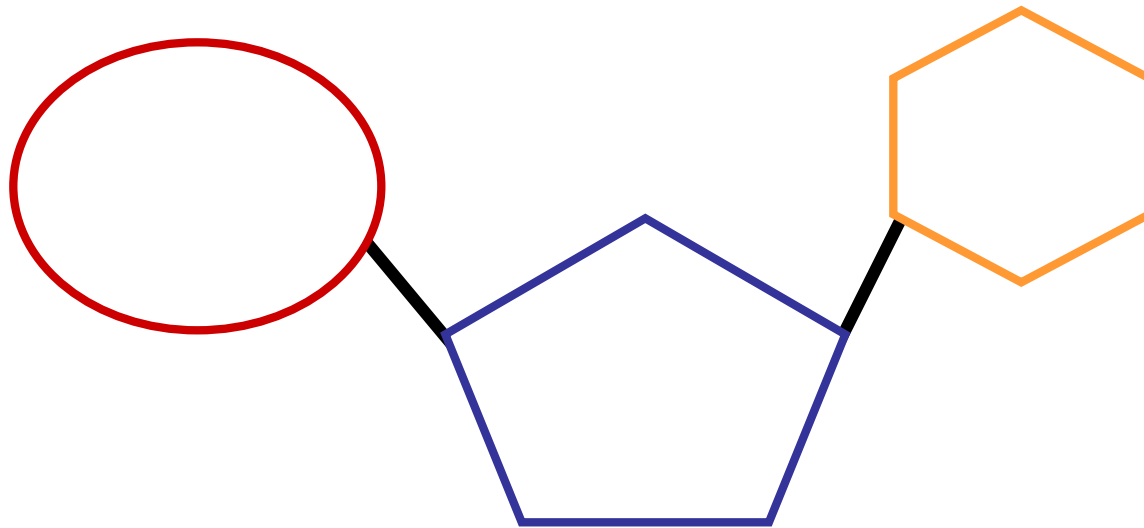
# DNA NUCLEOTIDE STRUCTURE



# DNA NUCLEOTIDE STRUCTURE

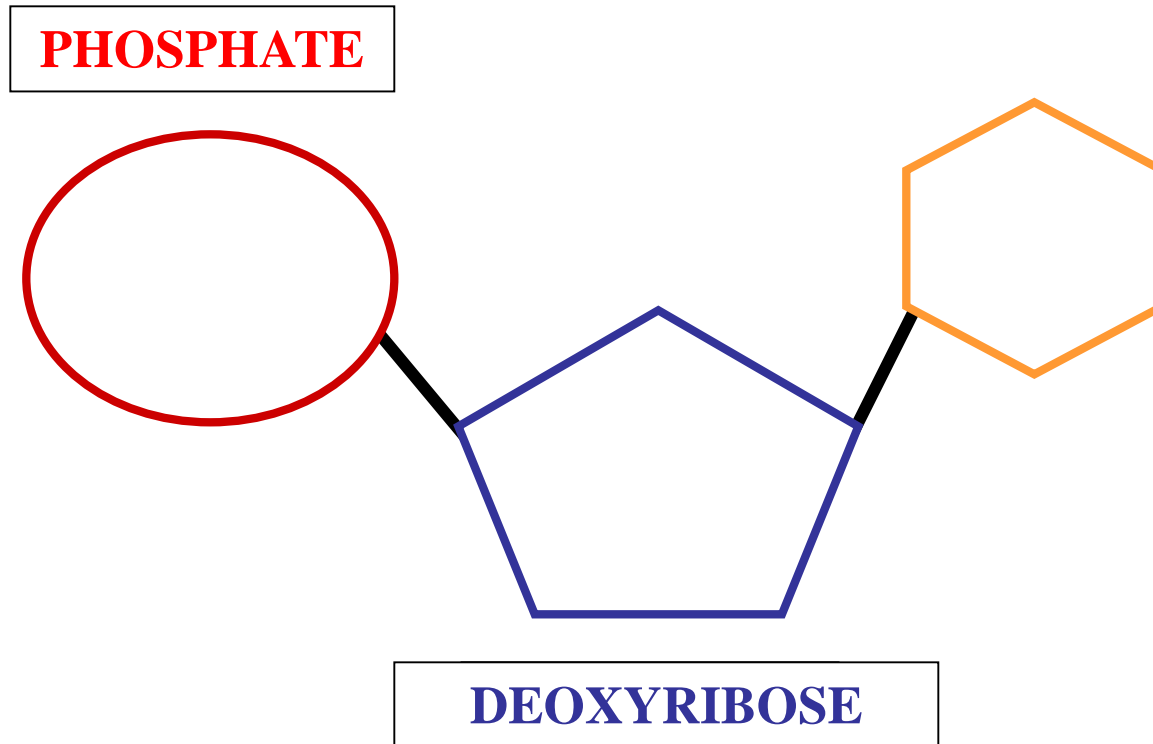


# DNA NUCLEOTIDE STRUCTURE



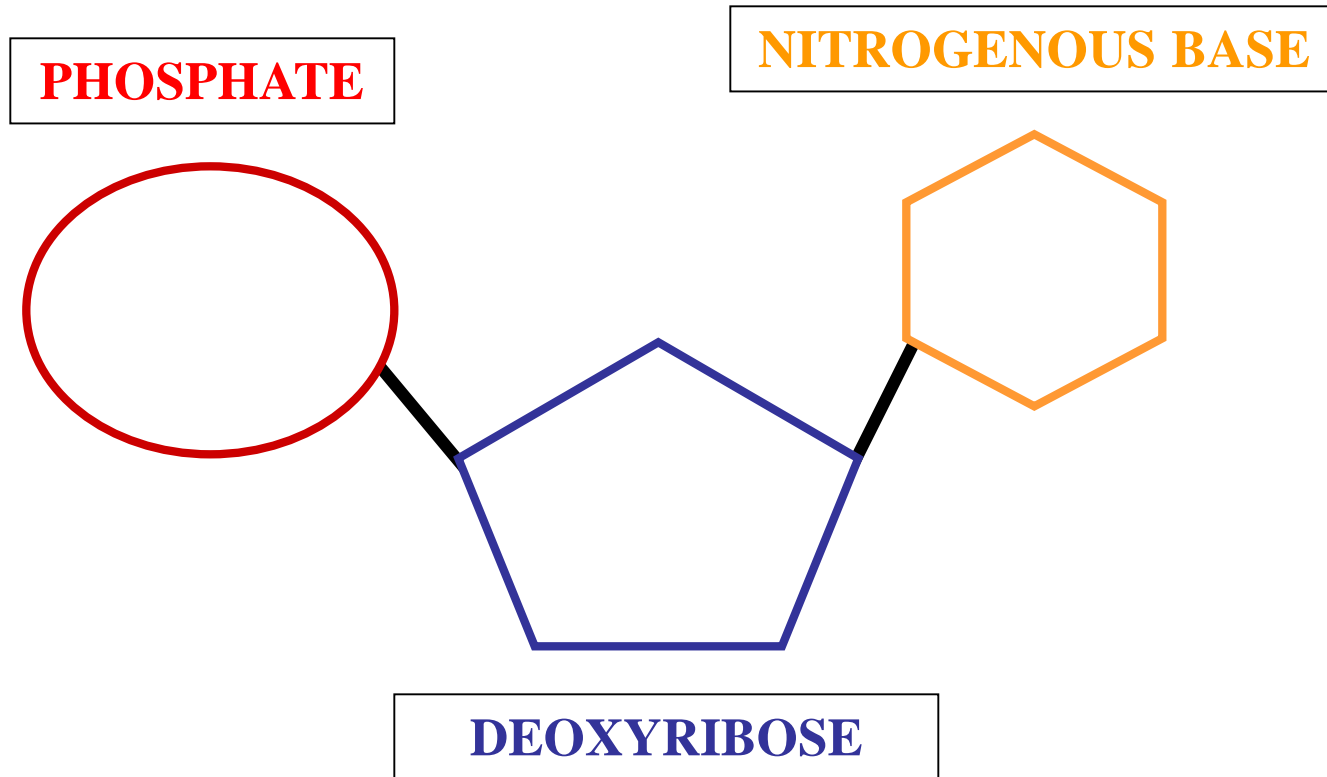
**DEOXYRIBOSE**

# DNA NUCLEOTIDE STRUCTURE

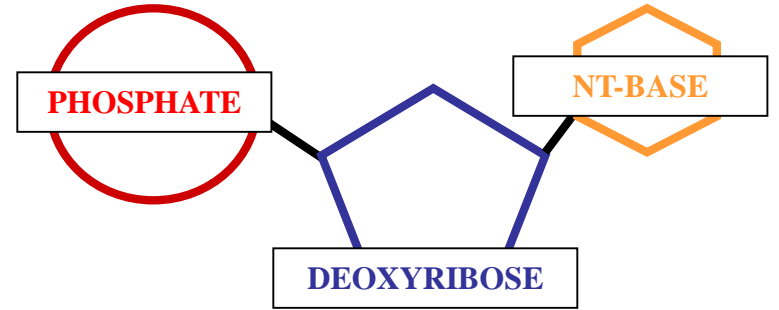
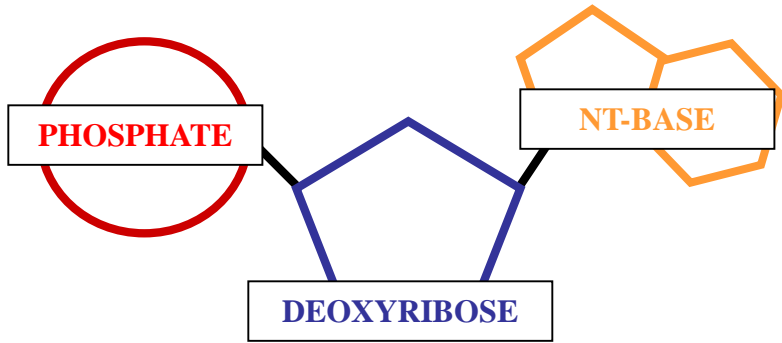




# DNA NUCLEOTIDE STRUCTURE

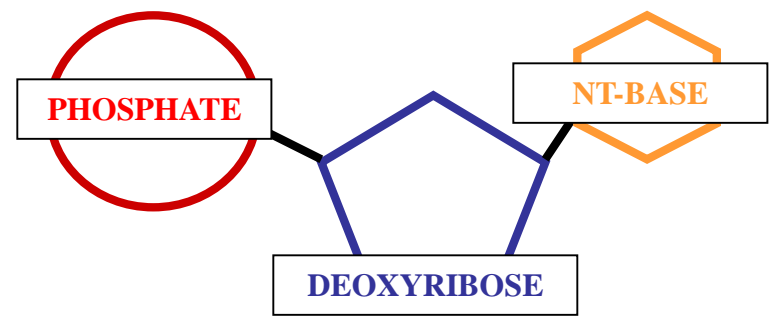
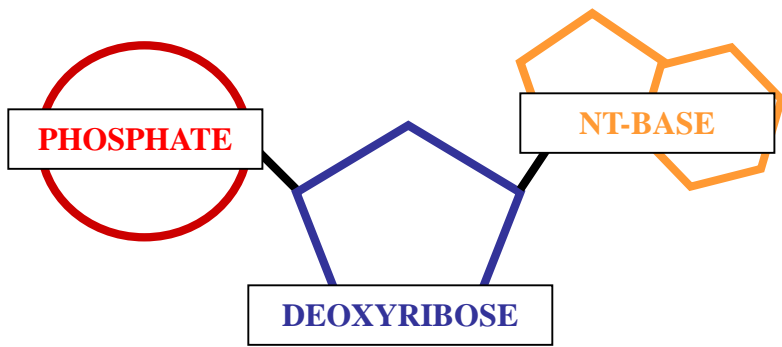


# DNA NUCLEOTIDE STRUCTURE



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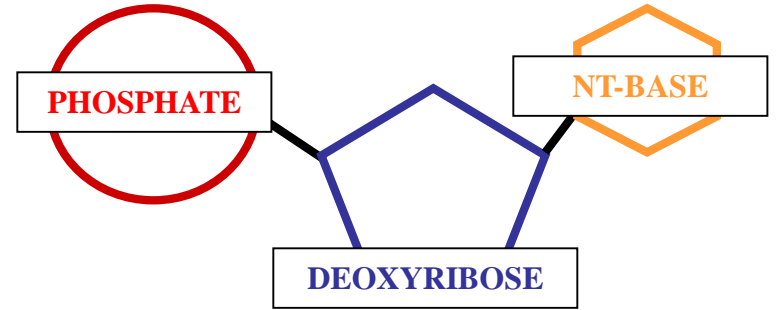
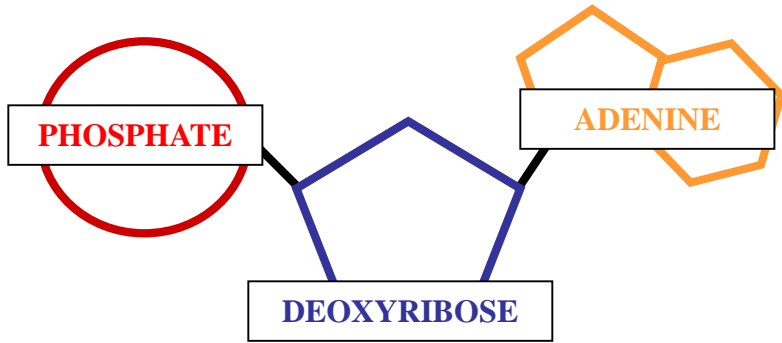
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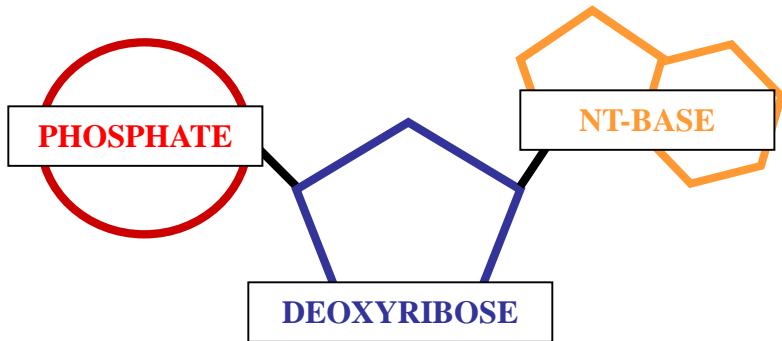
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# DNA NUCLEOTIDE STRUCTURE

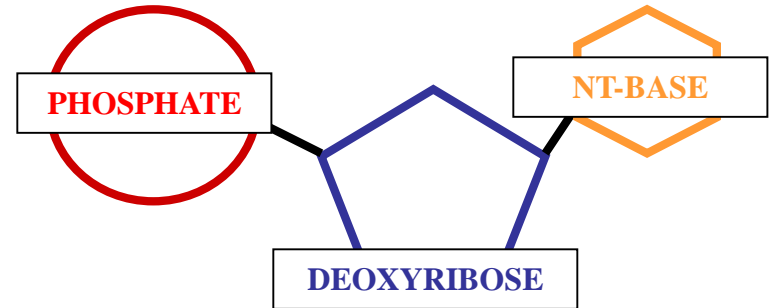


**ADENINE**

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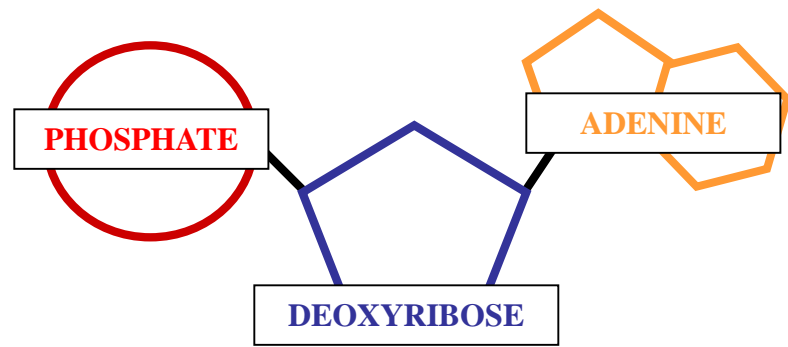


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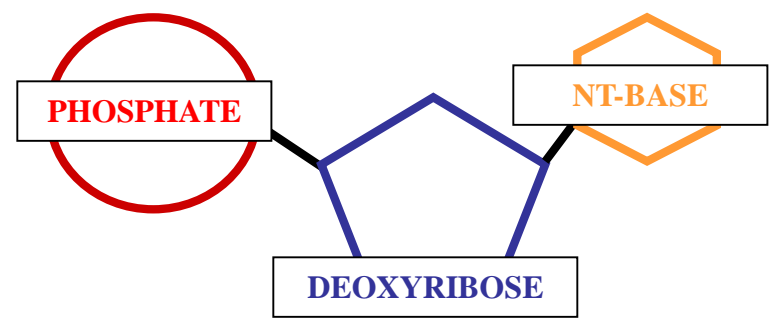


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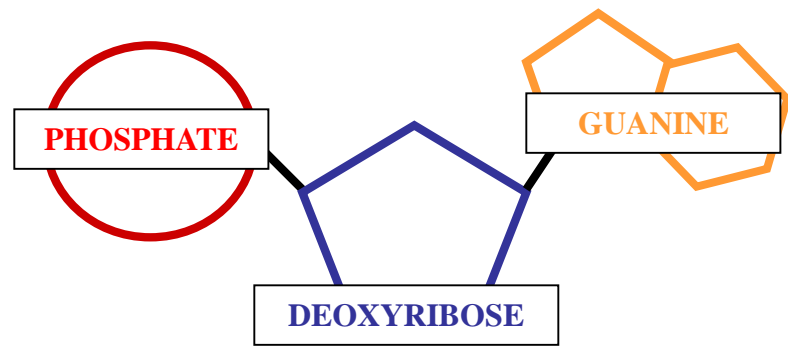
# DNA NUCLEOTIDE STRUCTURE



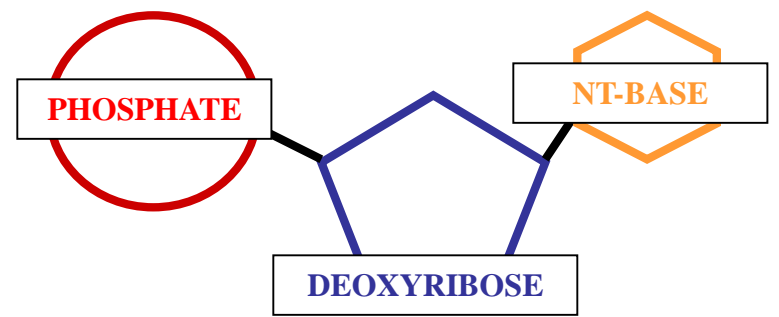
**ADENINE**



?



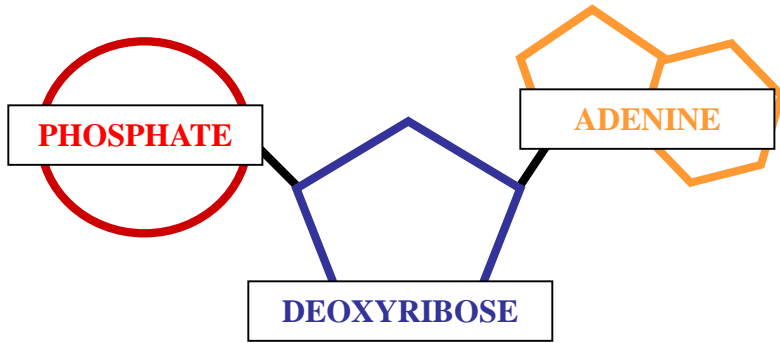
**GUANINE**



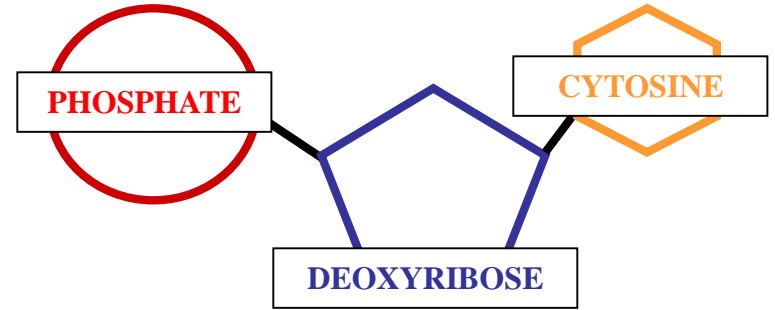
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# DNA NUCLEOTIDE STRUCTURE

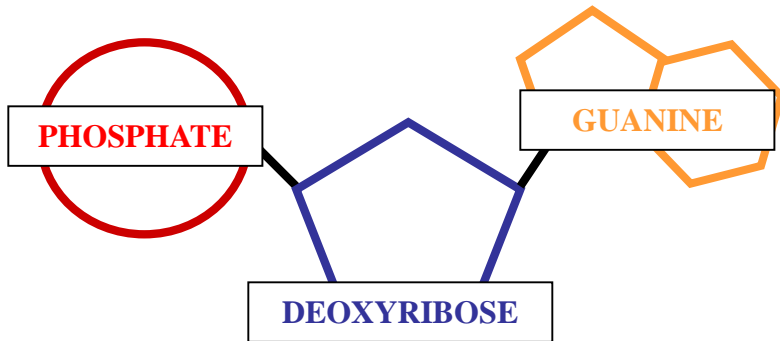
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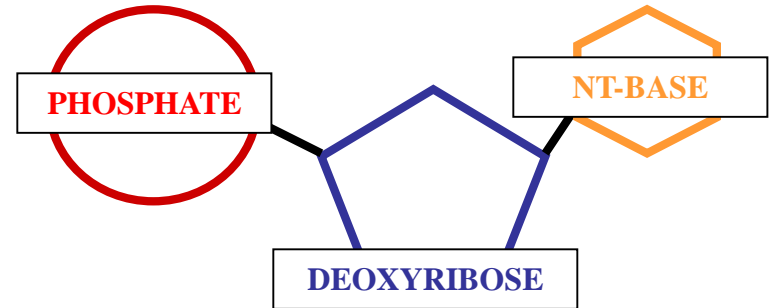
ADENINE



CYTOSINE

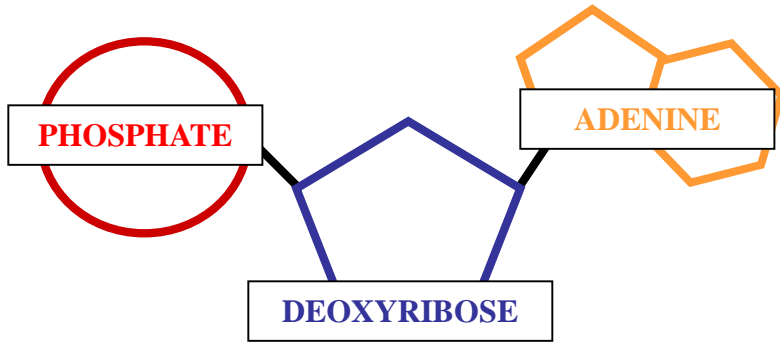


GUANINE

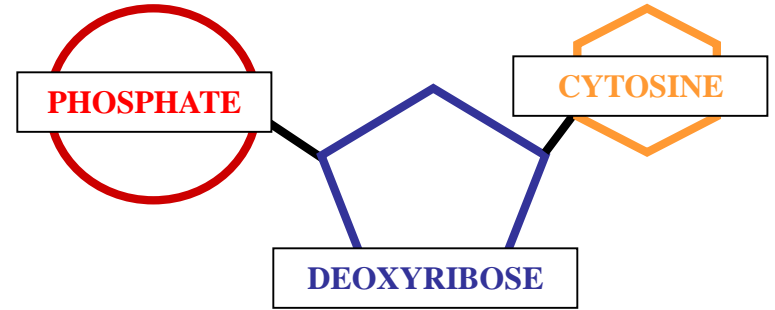


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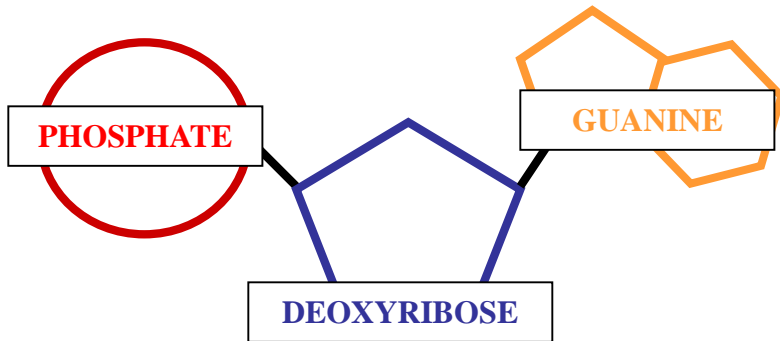
# DNA NUCLEOTIDE STRUCTURE



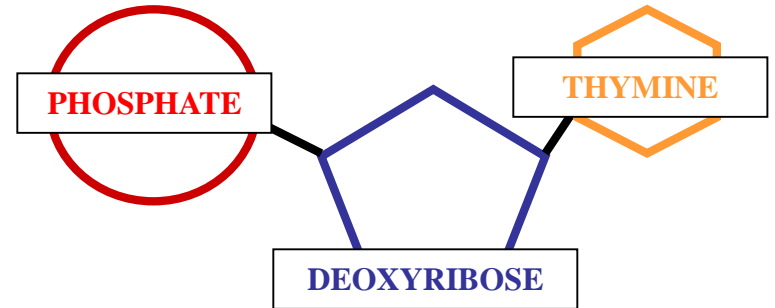
**ADENINE**



**CYTOSINE**



**GUANINE**



**THYMINE**



# NUCLEOTIDE CLASSES



**PYRIMIDINES**  
**VS**  
**PURINES**



# PYRIMIDINES

# PYRIMIDINES

# **PYRIMIDINES**

## **SMALL NUCLEOTIDE BASES**

# **PYRIMIDINES**

# **PYRIMIDINES**

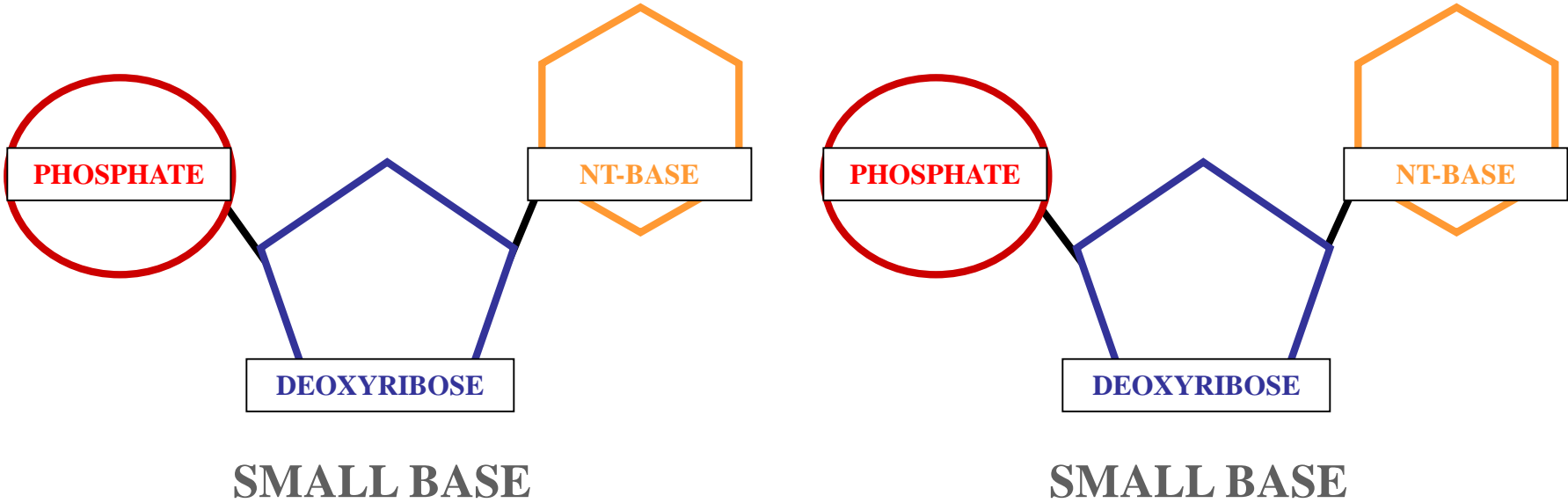
**SMALL  
NUCLEOTIDE BASES**

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**1 CARBON-RING**

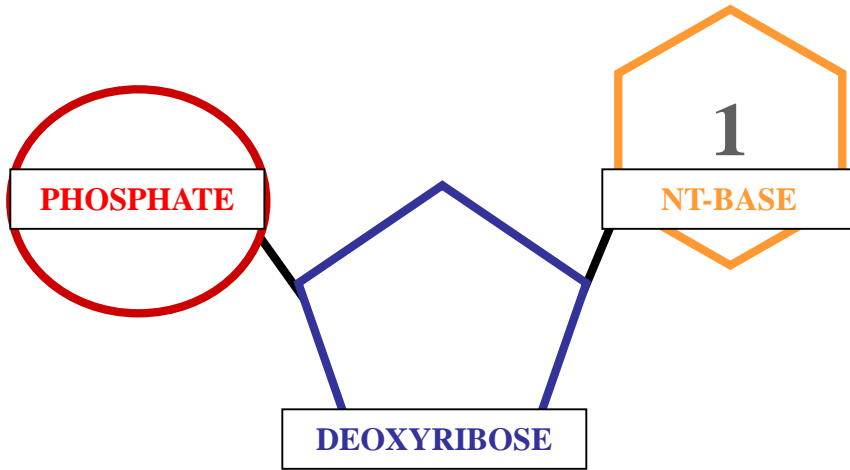
# **PYRIMIDINES**

# NUCLEOTIDE CLASSES

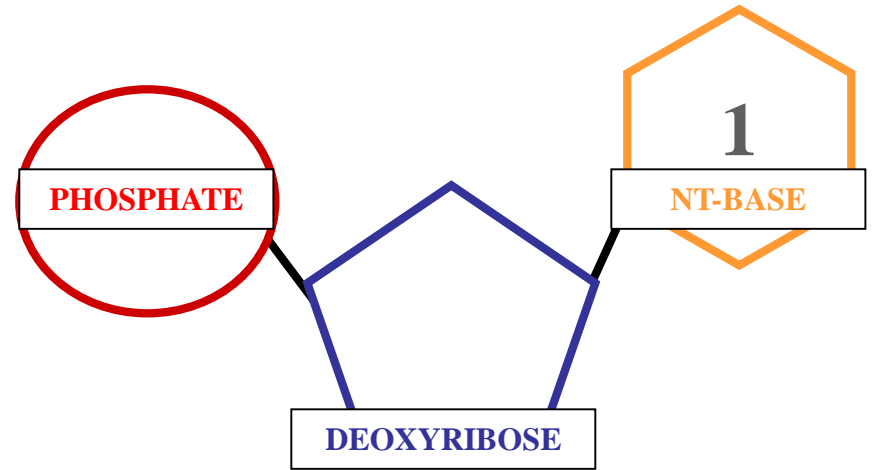


**PYRIMIDINES**

# NUCLEOTIDE CLASSES



1 CARBON RING

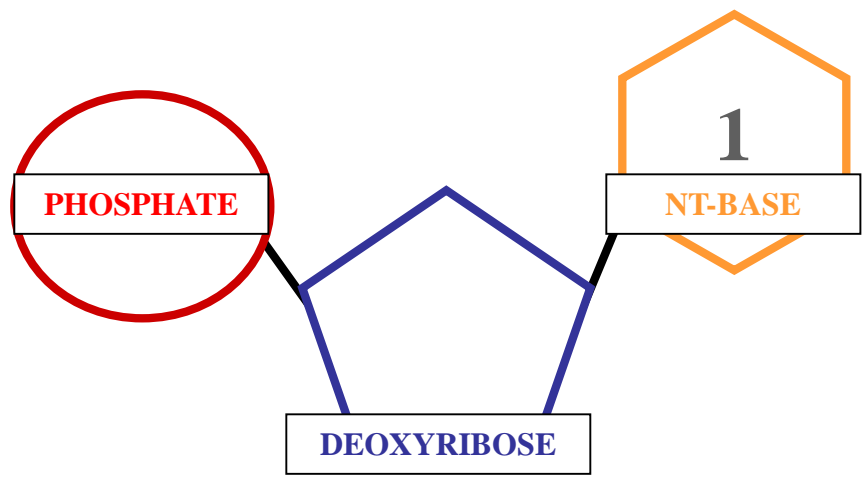


1 CARBON RING

**PYRIMIDINES**

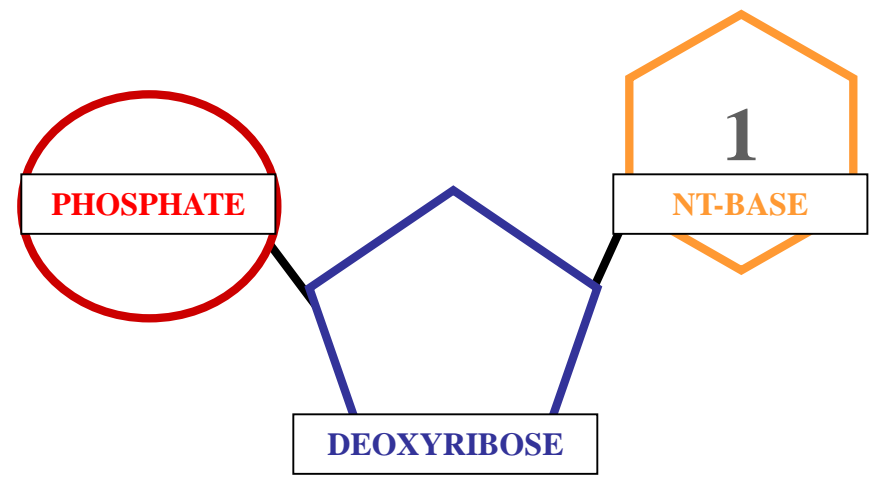


# NUCLEOTIDE CLASSES



1 CARBON RING

**CYTOSINE**



1 CARBON RING

**THYMINE**

**PYRIMIDINES**



# PURINES

# PURINES

**PURINES**

**LARGE**

**NUCLEOTIDE BASES**

**PURINES**



**PURINES**

**LARGE**

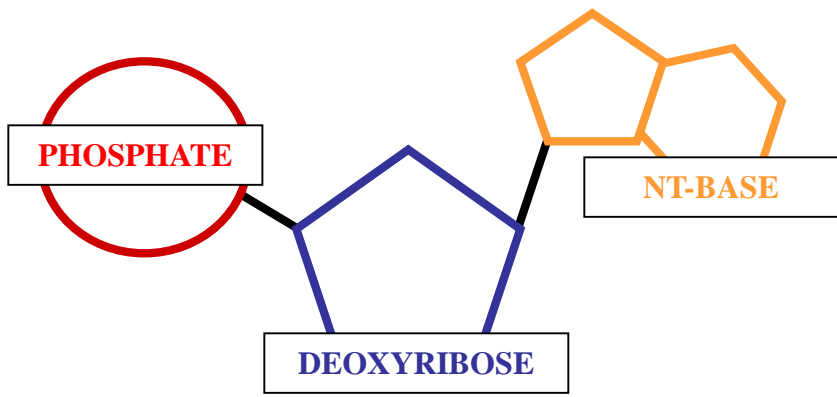
**NUCLEOTIDE BASES**

**---**

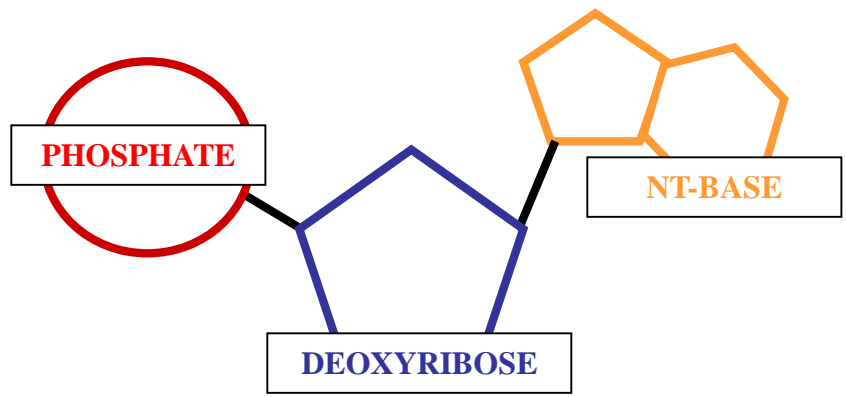
**2 CARBON-RINGS**

**PURINES**

# NUCLEOTIDE CLASSES



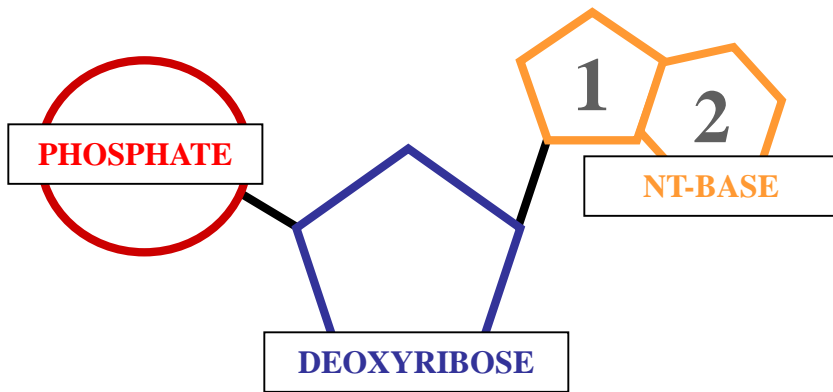
LARGE BASE



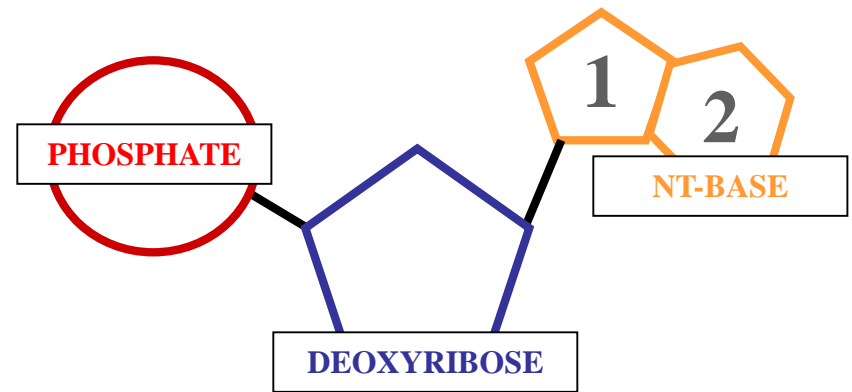
LARGE BASE

**PURINES**

# NUCLEOTIDE CLASSES



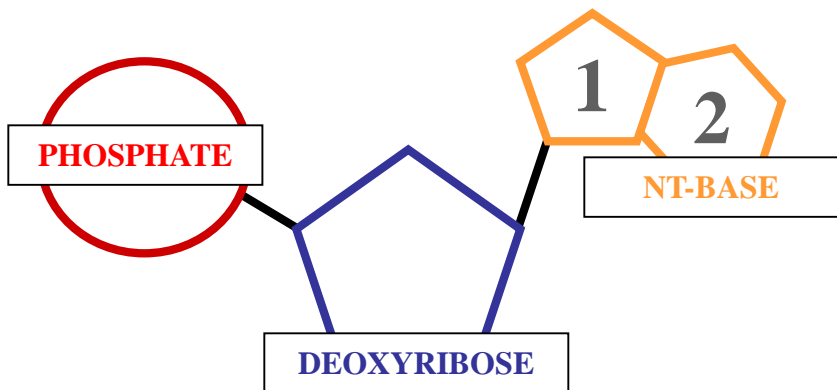
2 CARBON RINGS



2 CARBON RINGS

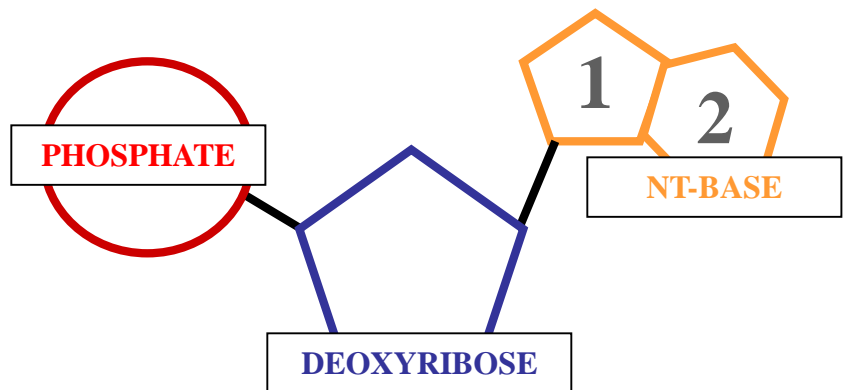
**PURINES**

# NUCLEOTIDE CLASSES



2 CARBON RINGS

**ADENINE**



2 CARBON RINGS

**GUANINE**

**PURINES**

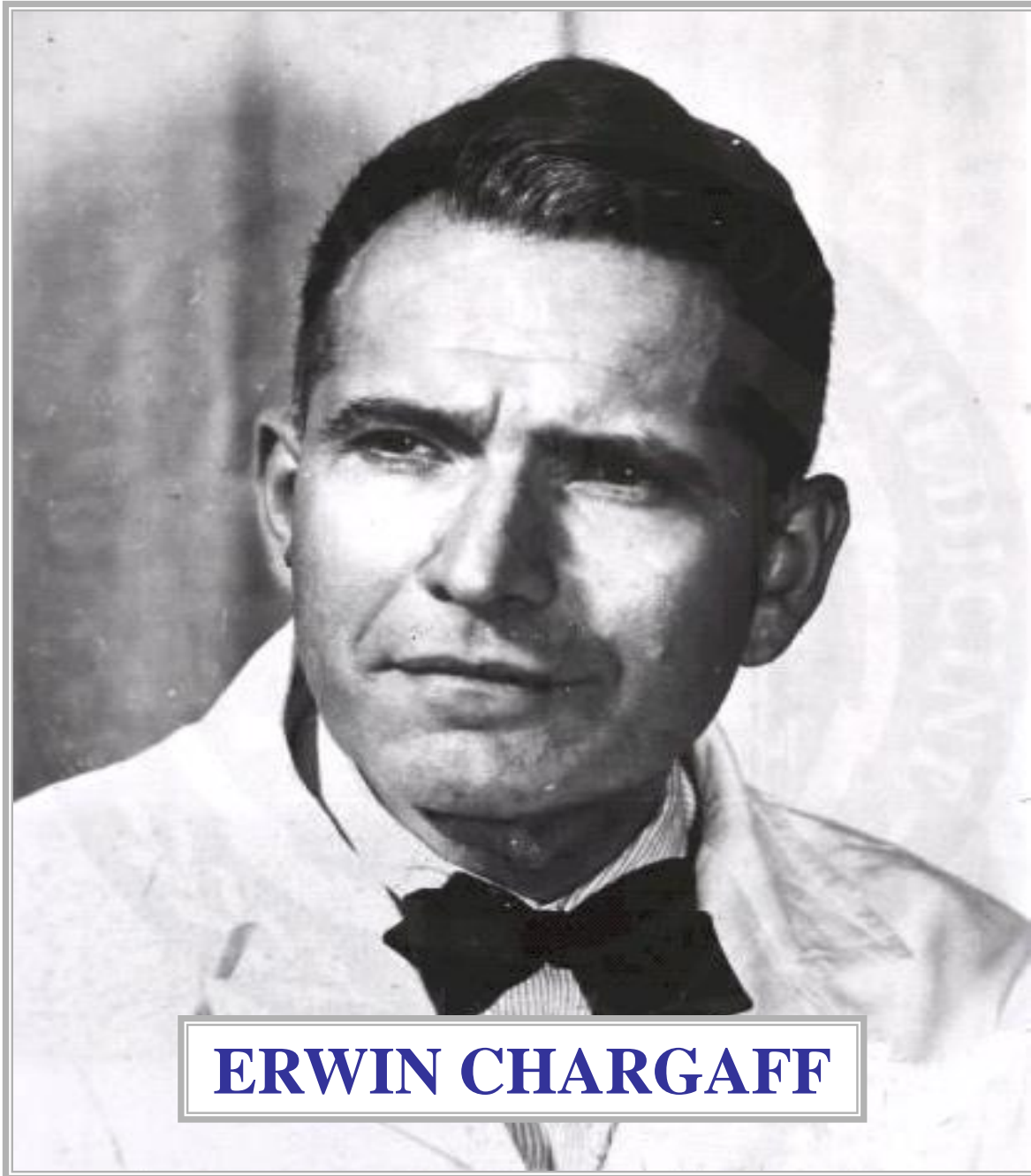


**DNA  
STRUCTURE  
DISCOVERY  
CHRONOLOGY  
1950**

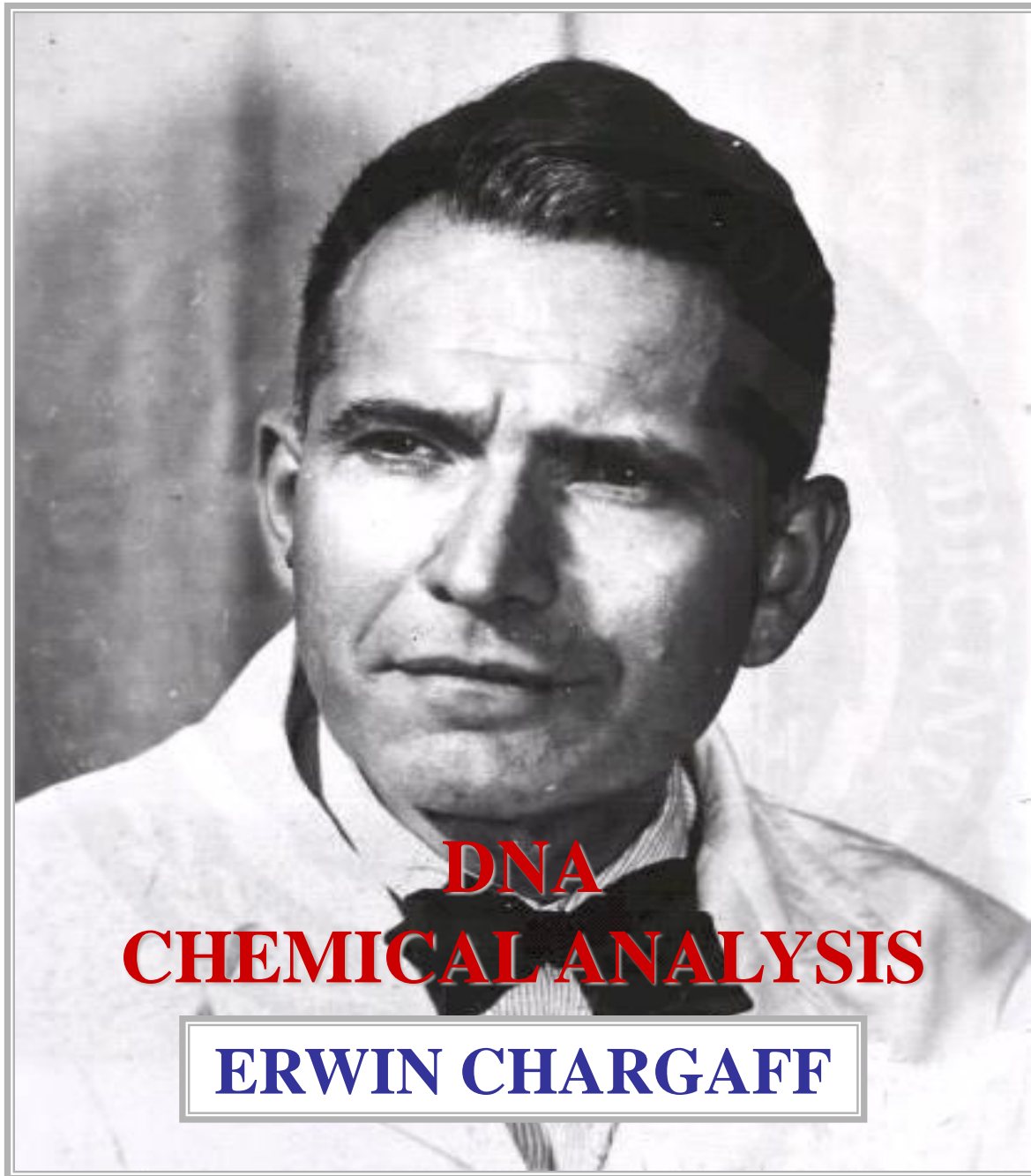




# ERWIN CHARGAFF



**ERWIN CHARGAFF**



**DNA  
CHEMICAL ANALYSIS**

**ERWIN CHARGAFF**





# FUNGUS DIVERSITY







# PLANT DIVERSITY

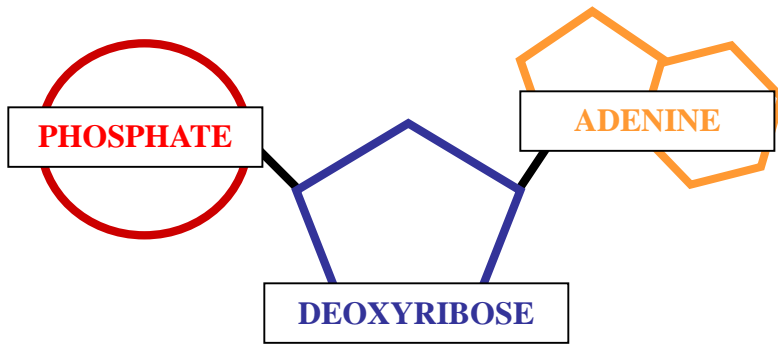






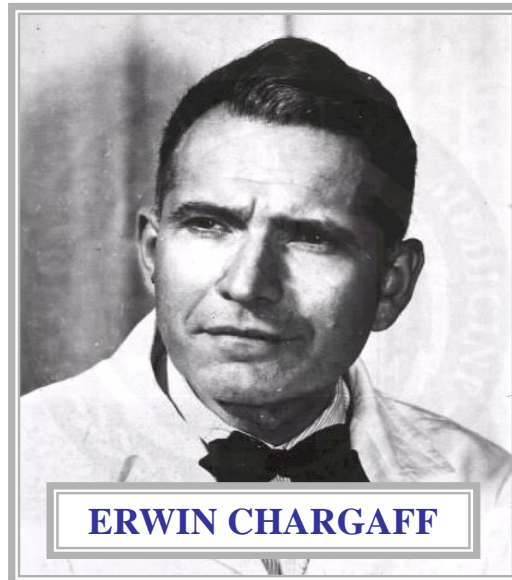
# ANIMAL DIVERSITY



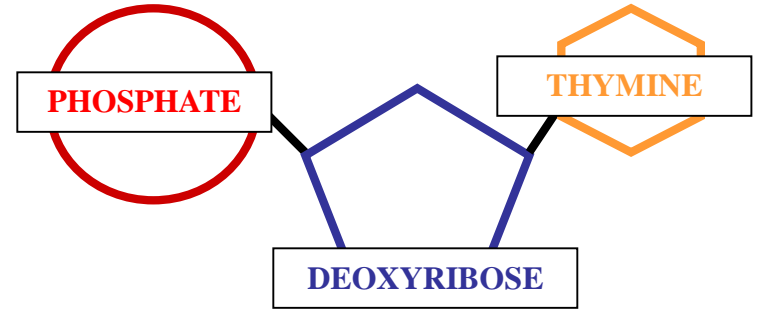
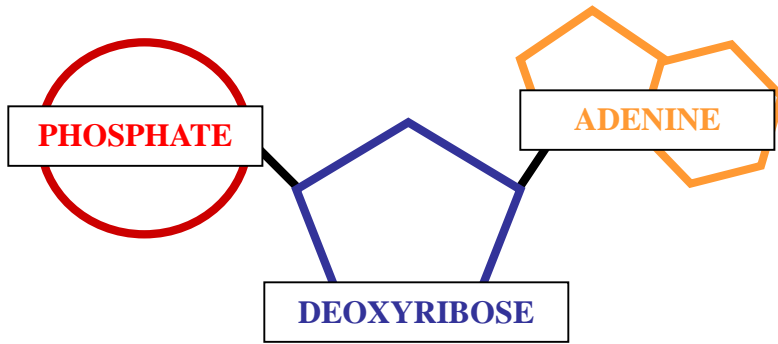


# ADENINE

**DNA  
CHEMICAL  
ANALYSIS**



**DNA  
CHEMICAL  
ANALYSIS**

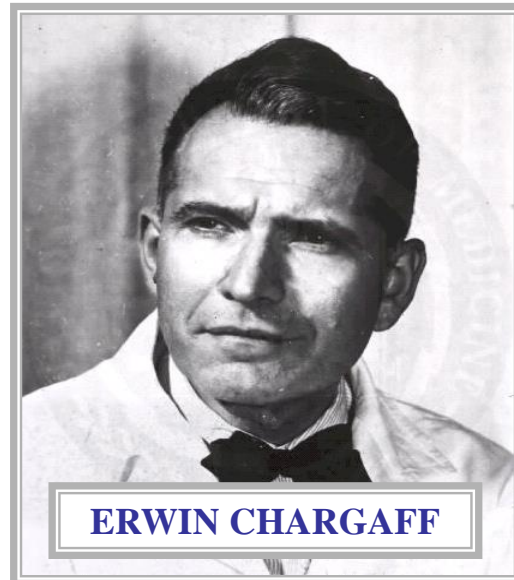


EQUAL CONTENT

ADENINE

THYMINE

DNA  
CHEMICAL  
ANALYSIS

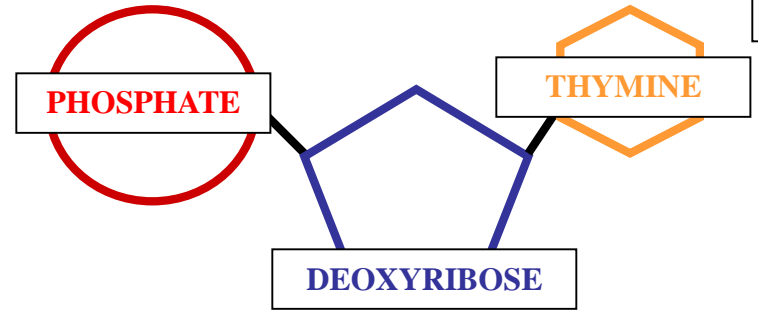
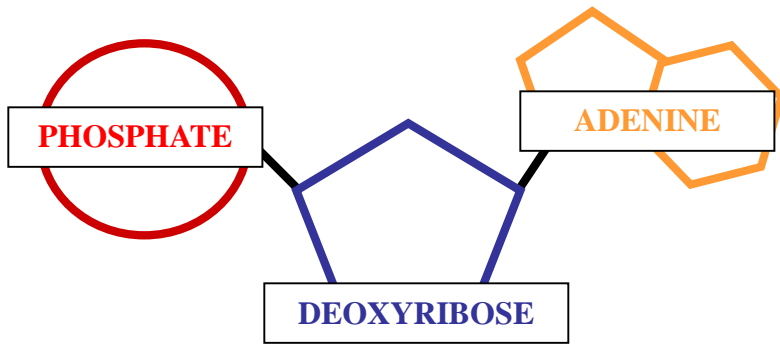


DNA  
CHEMICAL  
ANALYSIS



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G



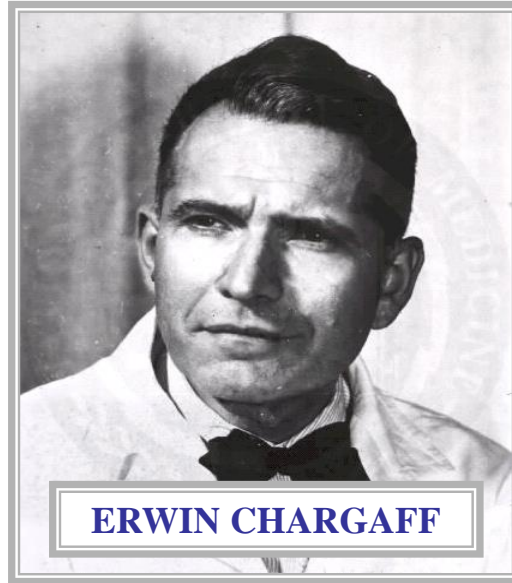
EQUAL CONTENT

ADENINE

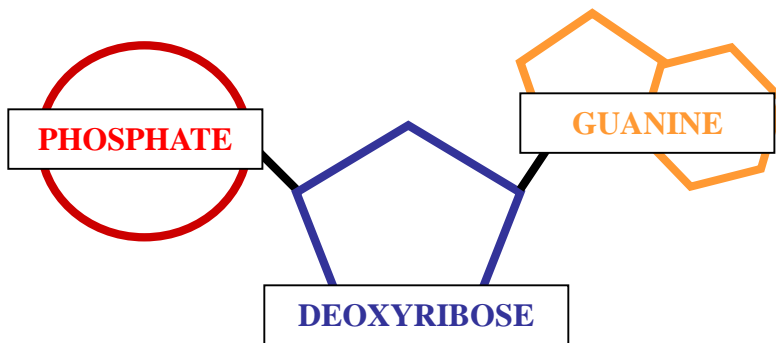
THYMINE



# DNA CHEMICAL ANALYSIS



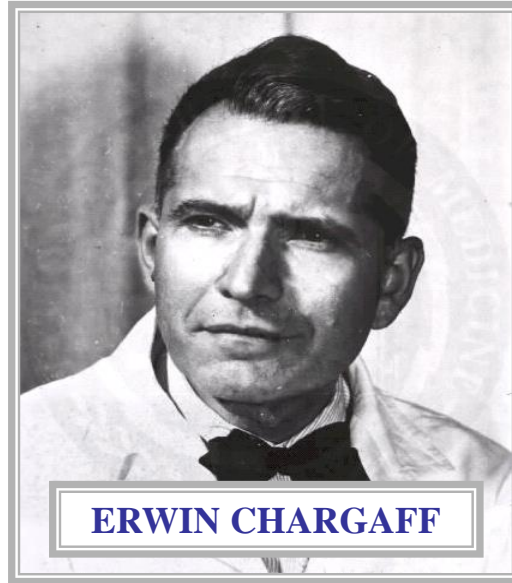
# DNA CHEMICAL ANALYSIS



# GUANINE

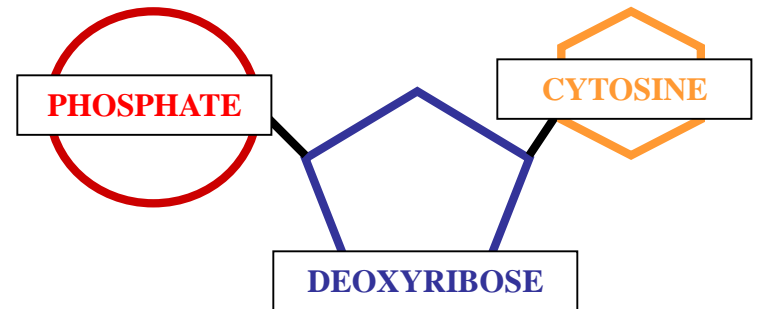
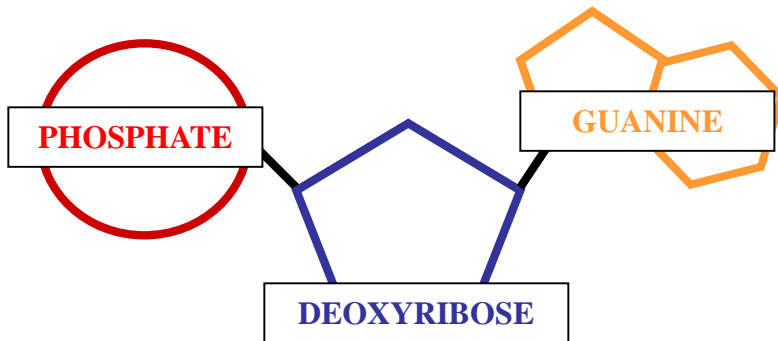


# DNA CHEMICAL ANALYSIS



ERWIN CHARGAFF

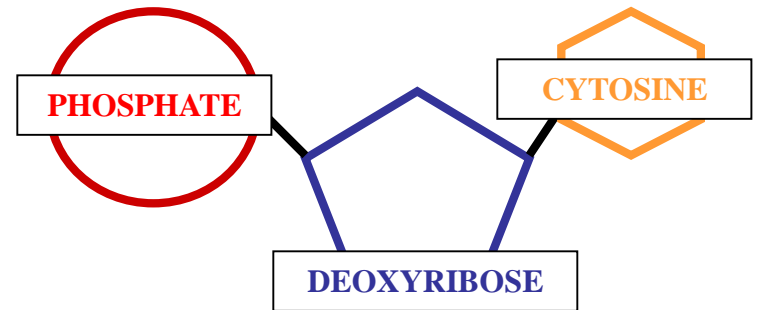
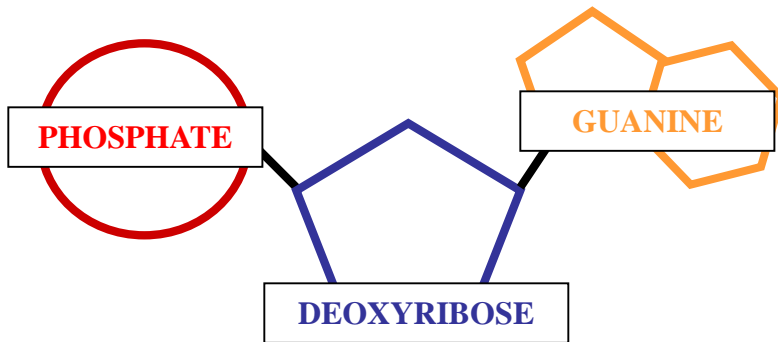
# DNA CHEMICAL ANALYSIS



EQUAL CONTENT

**GUANINE**

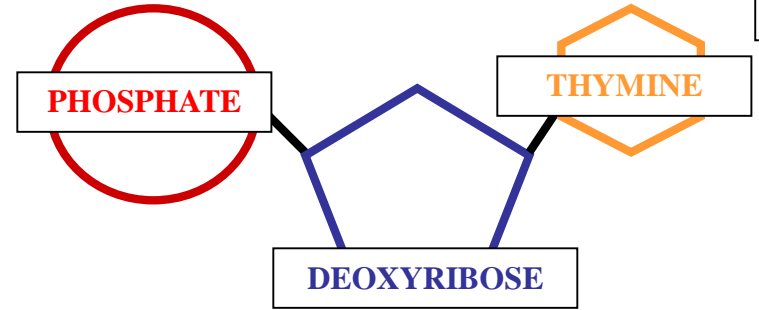
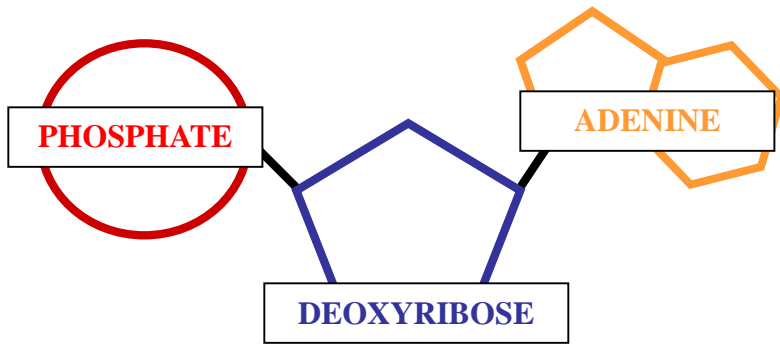
**CYTOSINE**



EQUAL CONTENT

**GUANINE**

**CYTOSINE**

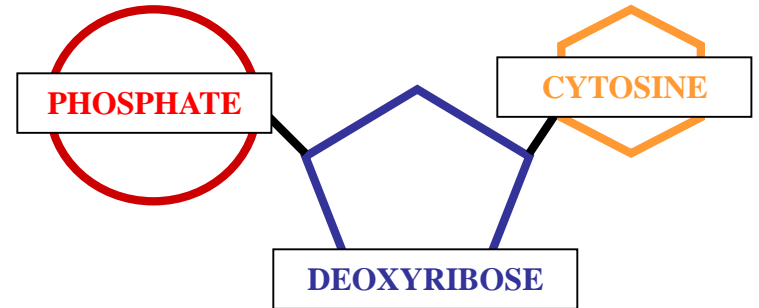
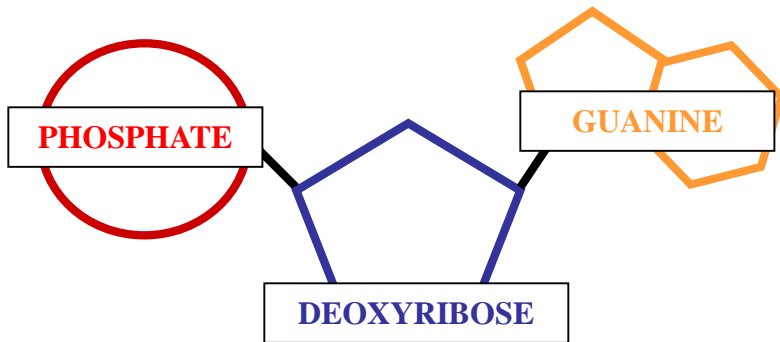


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P

EQUAL CONTENT

ADENINE

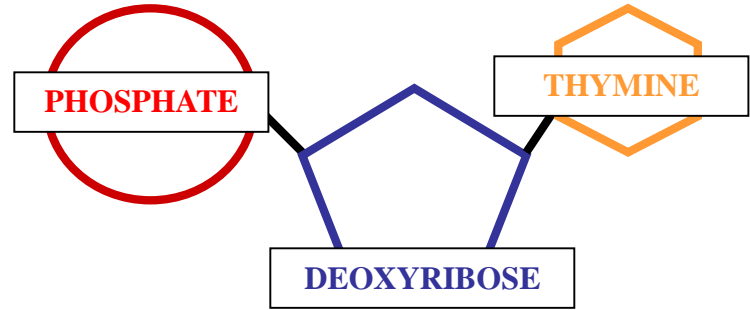
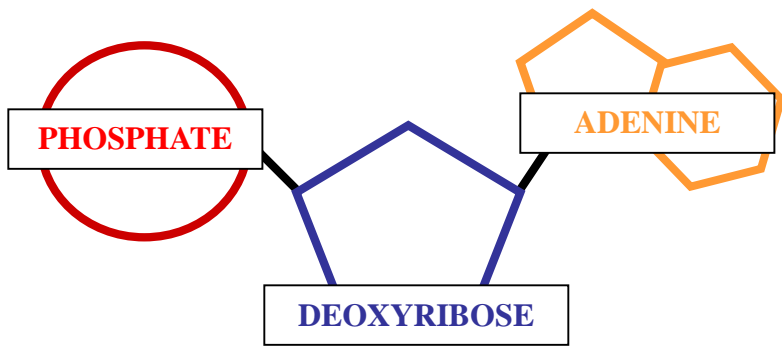
THYMINE



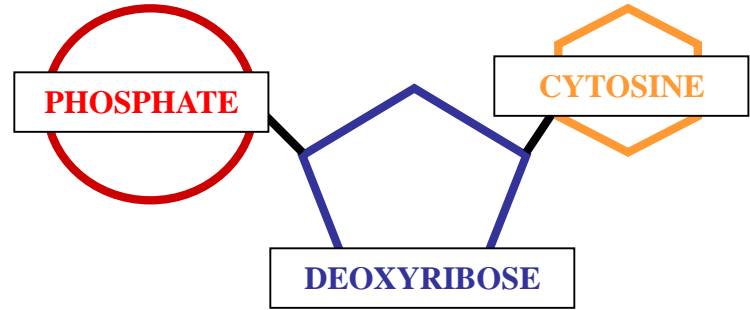
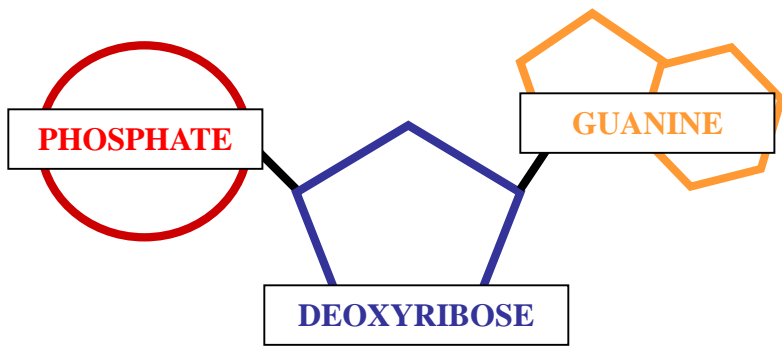
EQUAL CONTENT

GUANINE

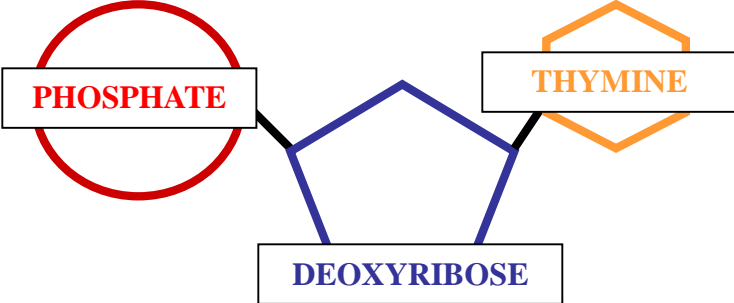
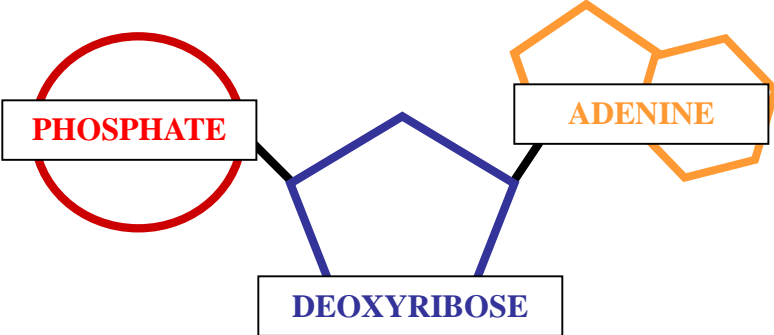
CYTOSINE



**ADENINE** EQUAL CONTENT  
**PURINE** **THYMINE**



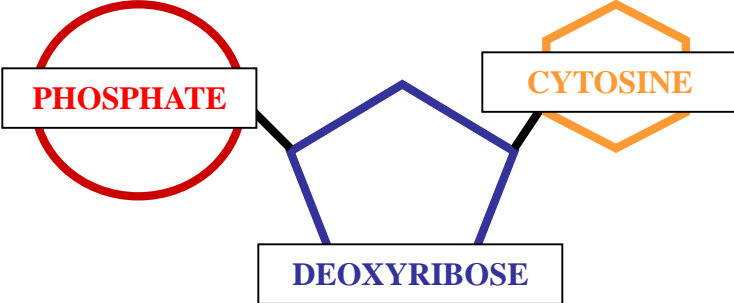
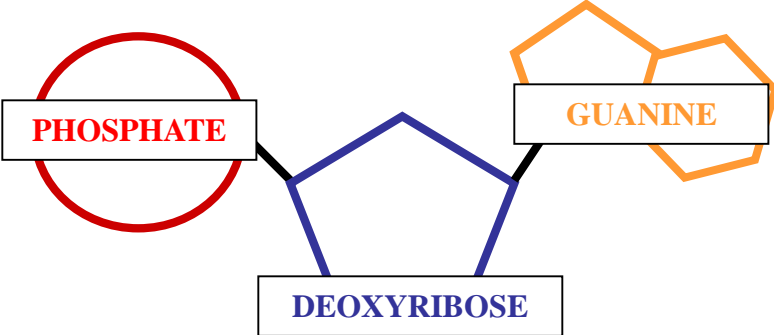
EQUAL CONTENT  
**GUANINE** **CYTOSINE**



EQUAL CONTENT

ADENINE  
PURINE

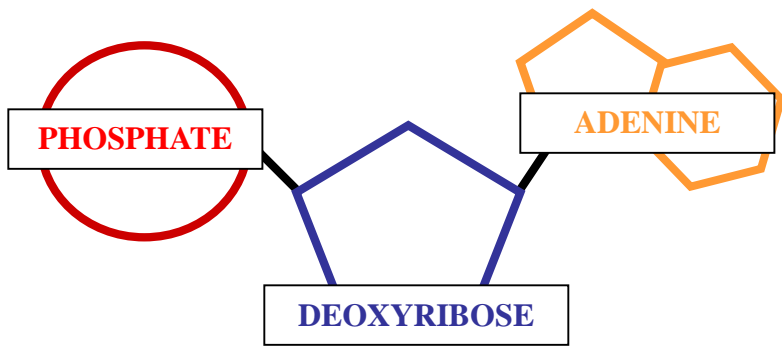
THYMINE  
PYRIMIDINE



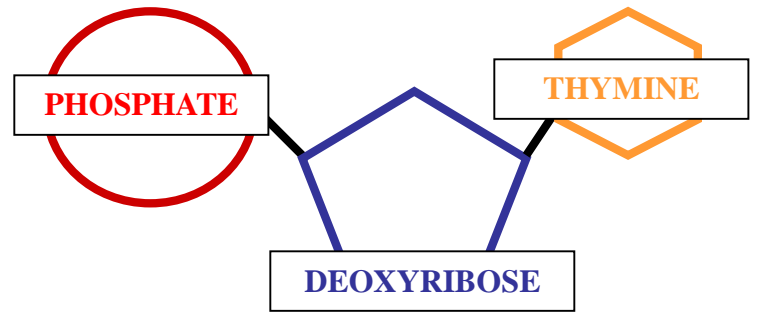
EQUAL CONTENT

GUANINE

CYTOSINE

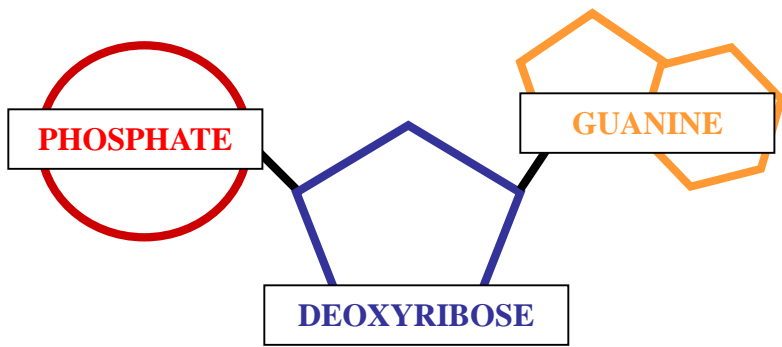


**ADENINE**  
**PURINE**

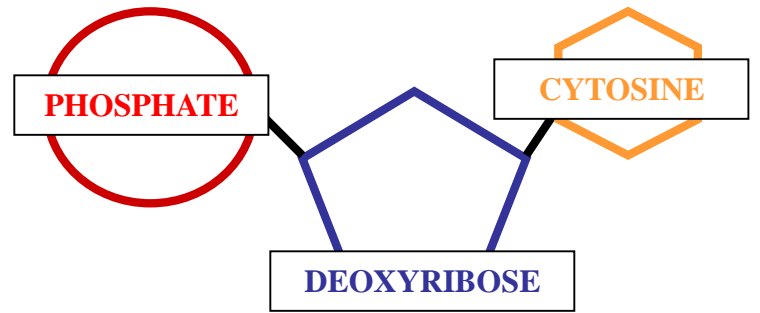


**THYMINE**  
**PYRIMIDINE**

**EQUAL CONTENT**



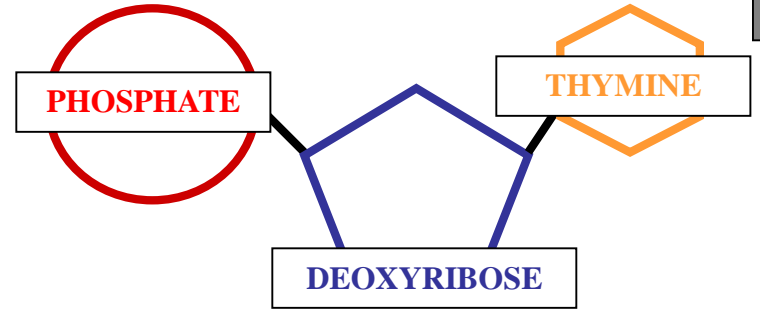
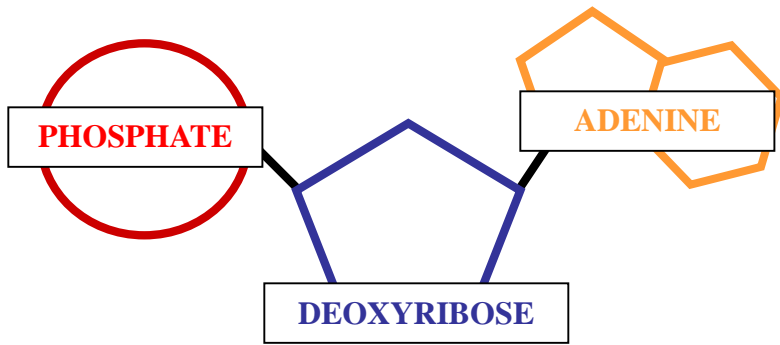
**GUANINE**  
**PURINE**



**CYTOSINE**

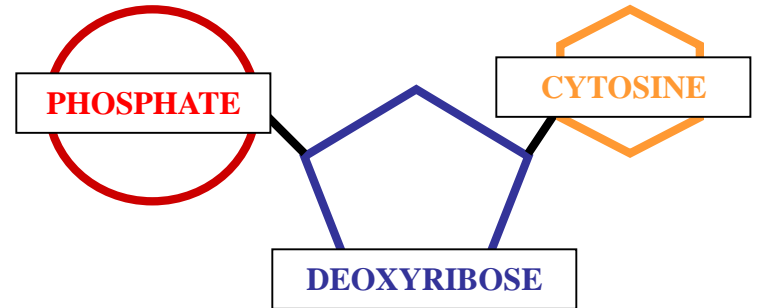
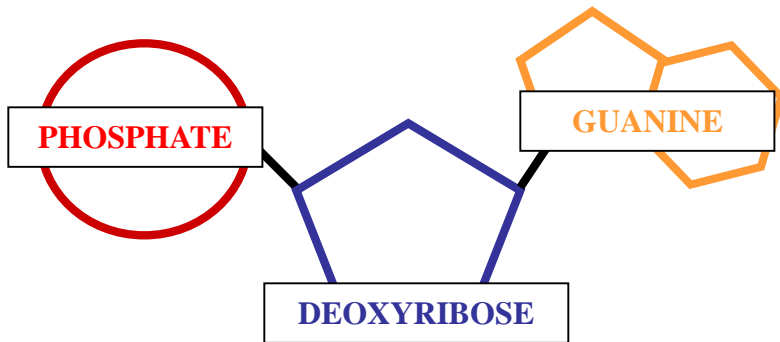
**EQUAL CONTENT**





=  
E

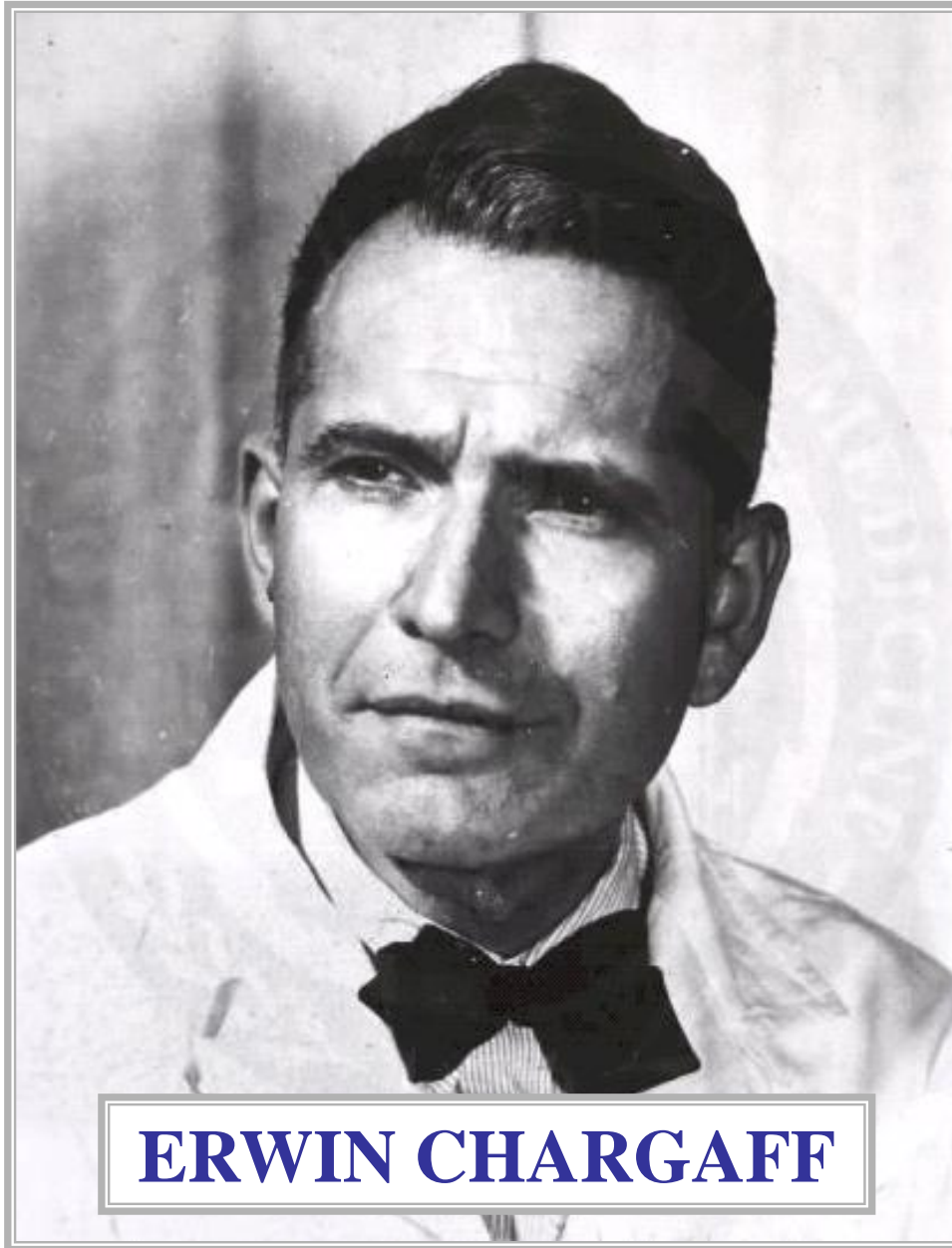
ADENINE EQUAL CONTENT THYMINE  
PURINE PYRIMIDINE



GUANINE EQUAL CONTENT CYTOSINE  
PURINE PYRIMIDINE

**DNA  
CHEMICAL  
ANALYSIS**

**DNA  
CHEMICAL  
ANALYSIS**



**ERWIN CHARGAFF**

**DNA  
CHEMICAL  
ANALYSIS**

**DNA  
CHEMICAL  
ANALYSIS**

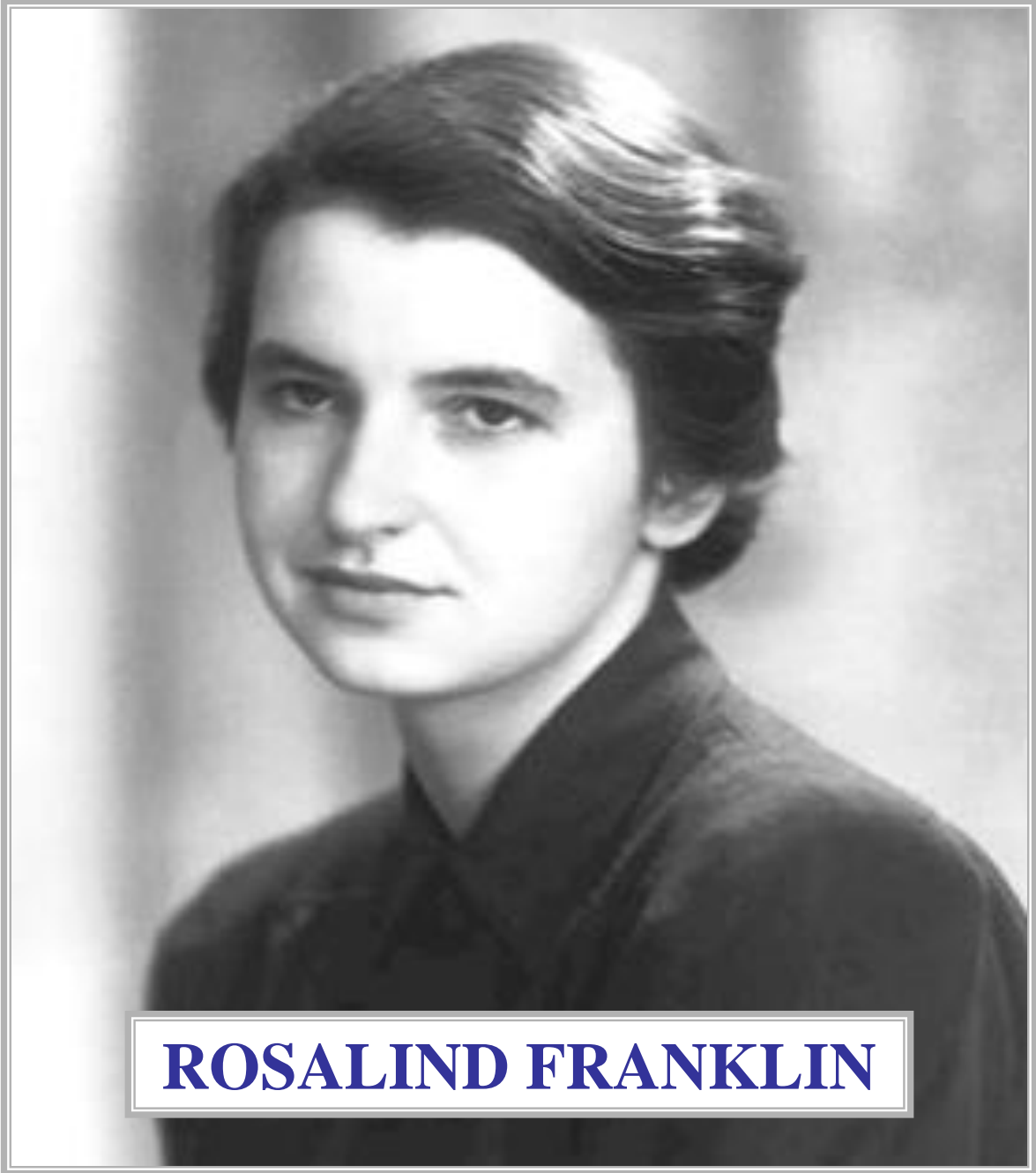
**PURINE CONTENT = PYRMIDINE CONTENT**



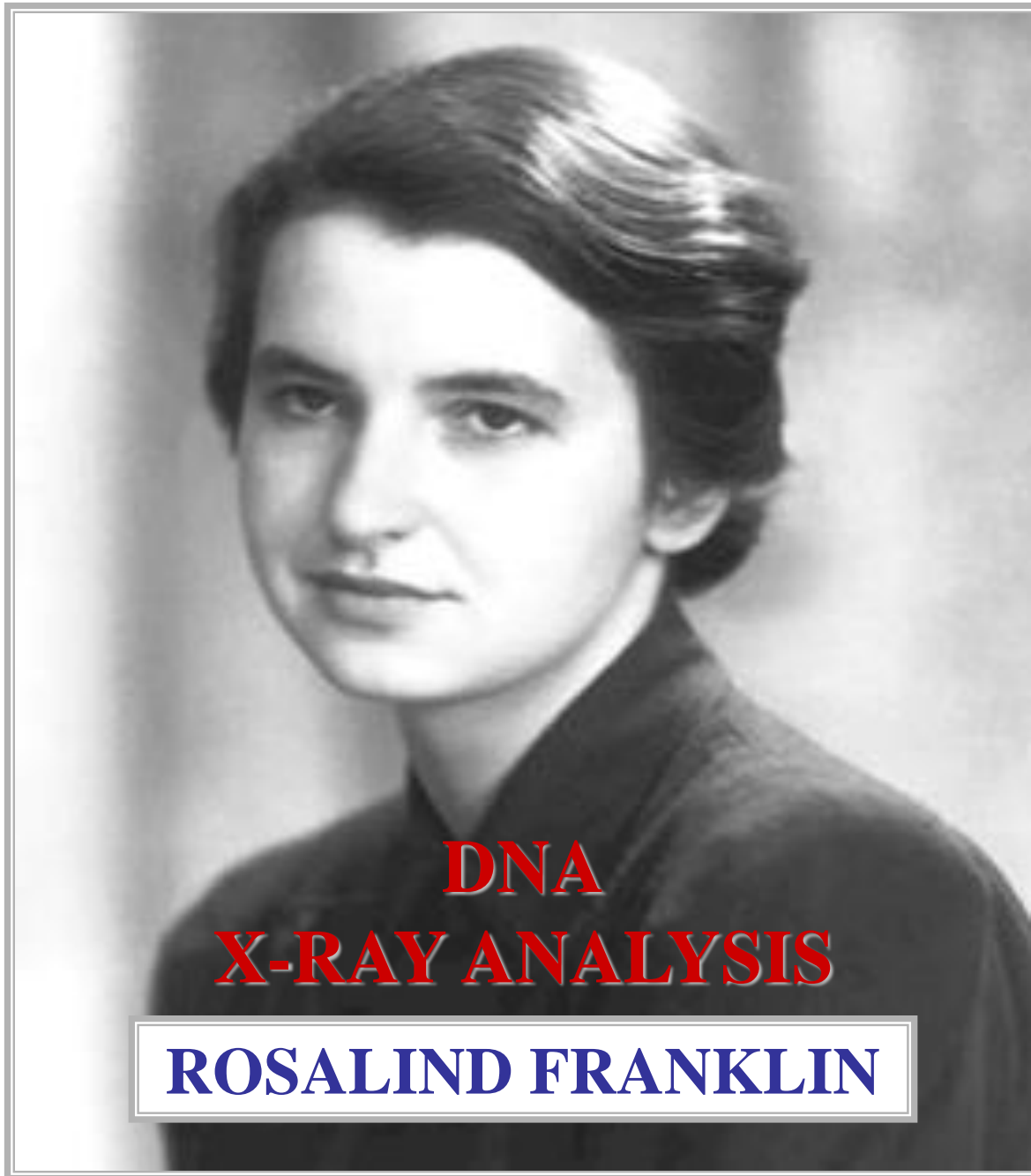
**DNA  
STRUCTURE  
DISCOVERY  
CHRONOLOGY  
1951**



# ROSALIND FRANKLIN

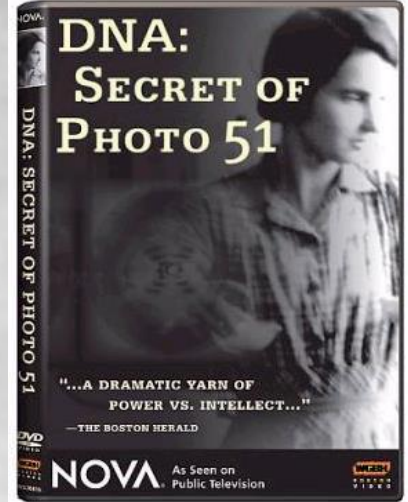
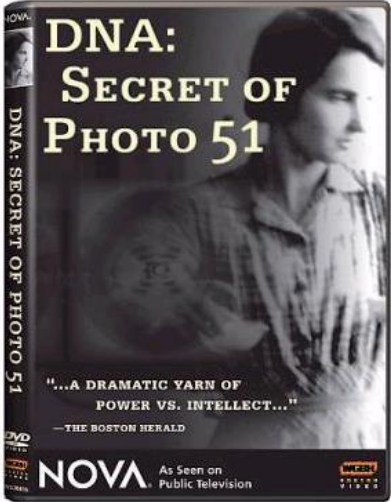
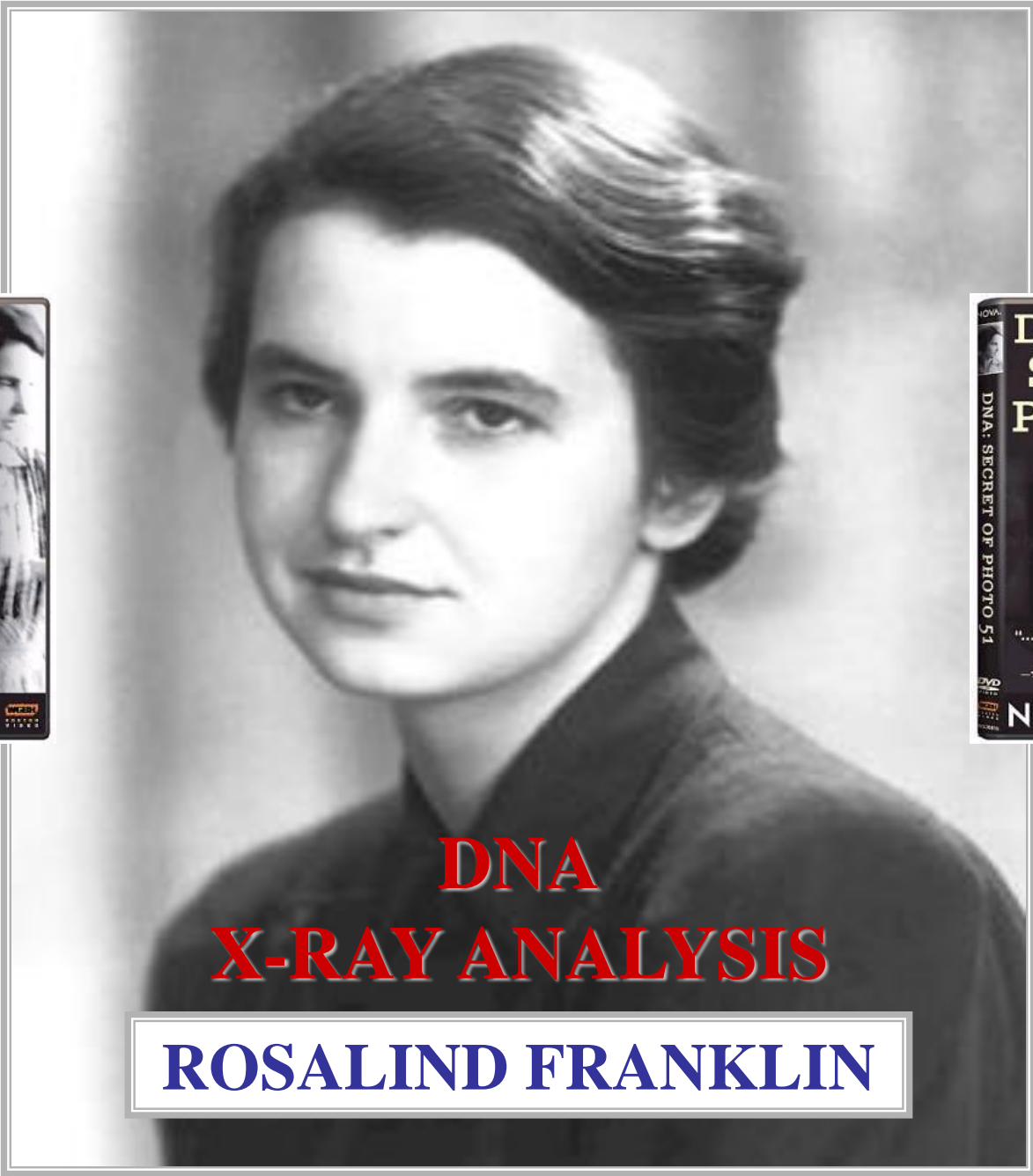


**ROSALIND FRANKLIN**



**DNA  
X-RAY ANALYSIS**

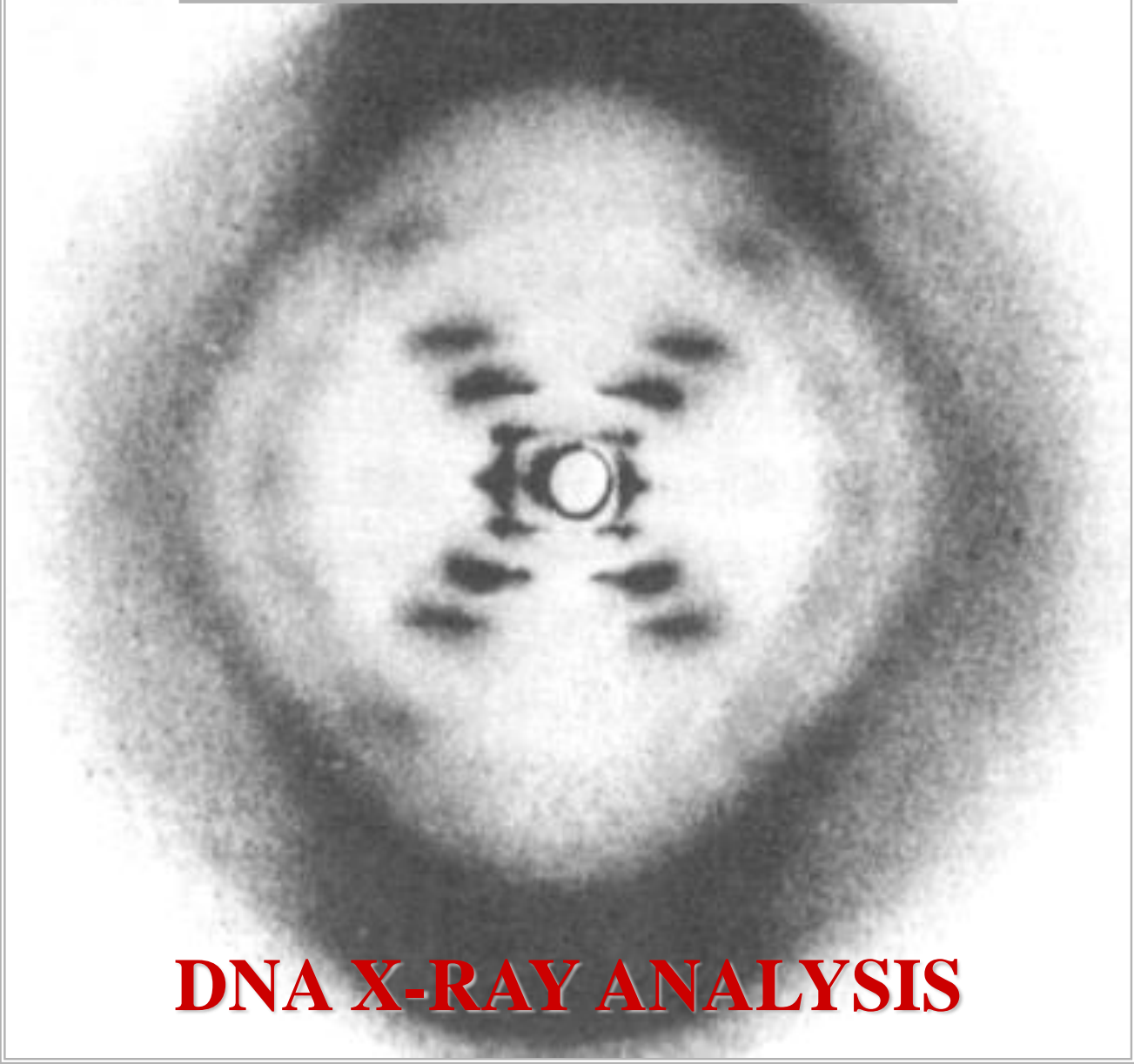
**ROSALIND FRANKLIN**



**DNA  
X-RAY ANALYSIS**

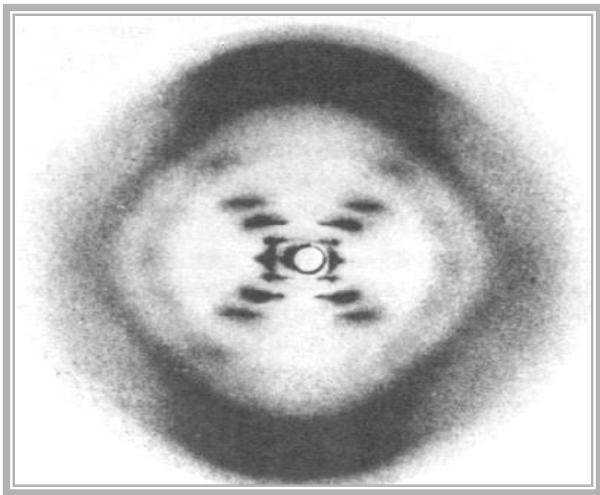
**ROSALIND FRANKLIN**

PHOTO 51

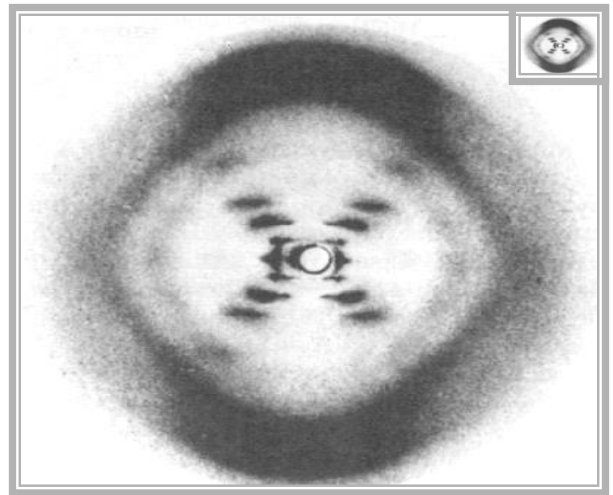


**DNA X-RAY ANALYSIS**





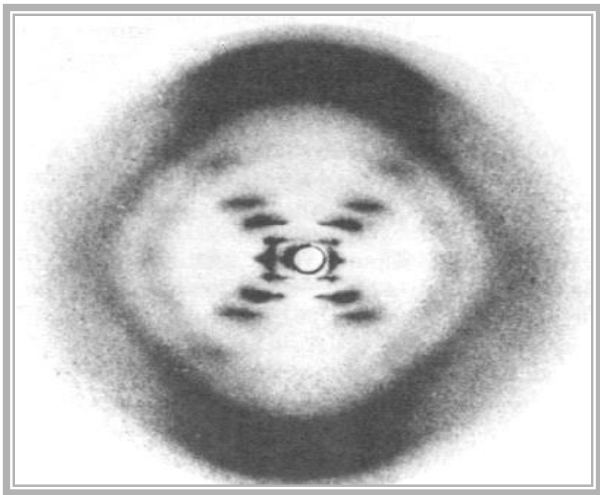
**DNA**



**HELICAL  
STRUCTURE**



**HELICAL  
STRUCTURE**



**DNA**

