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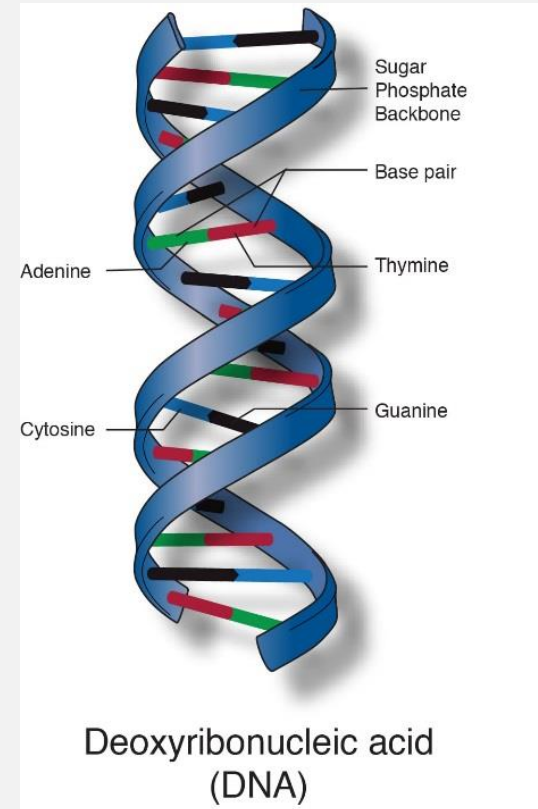
# Deoxyribonucleic acid DNA

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# Lecture objective

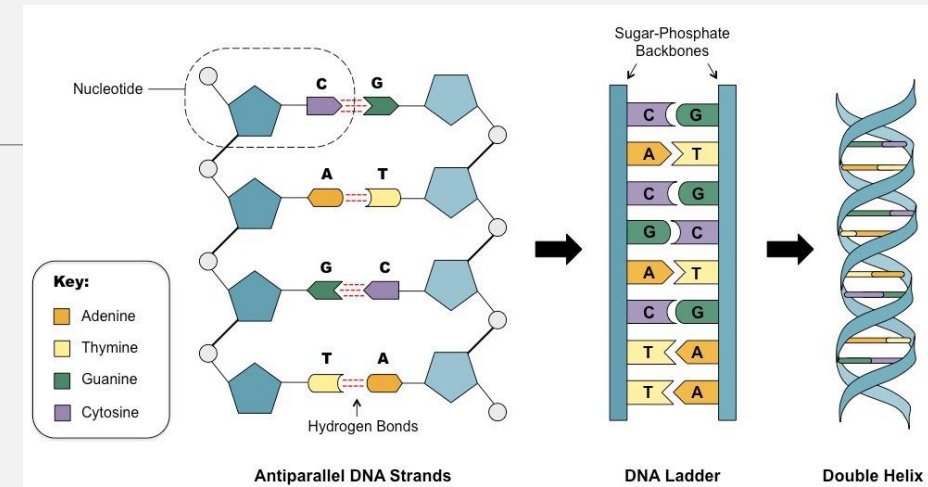
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- ❖ What is **Deoxyribonucleic acid** DNA?
- ❖ Discovering the **Structure** of DNA
- ❖ The **Components** of DNA
- ❖ The **Double Helix** and **Hydrogen Bonding**

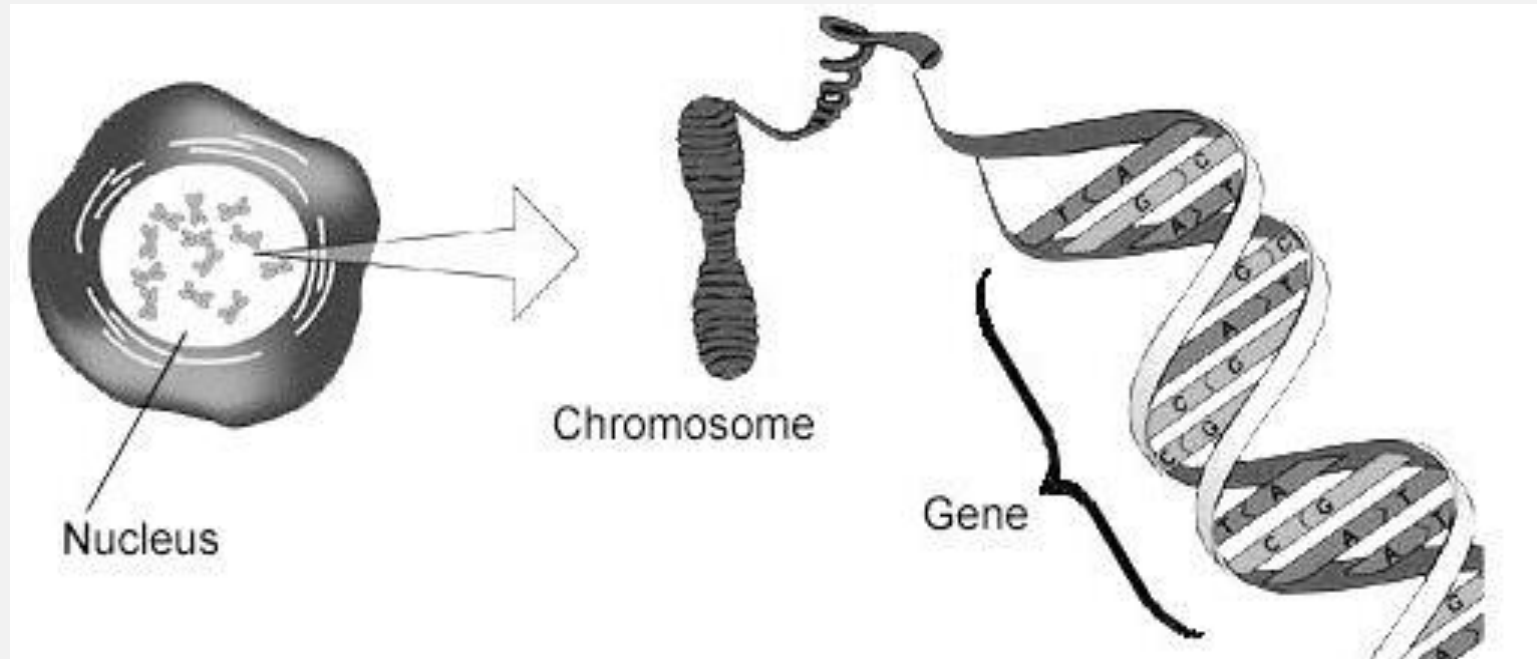


# What is DNA?

- ❖ DNA is a nucleic acid.
- ❖ DNA stands for **D**eoxyribonucleic **A**cid.
- ❖ DNA – is the genetic material inside the nucleus of eukaryotic cells.
- ❖ It contains the genetic instructions used in the development and functioning of all known living organisms and some viruses.
- ❖ DNA is a set of blueprints needed to construct other components of cells, such as proteins and RNA molecules.
- ❖ **DNA is composed of polynucleotide chain (many nucleotides).**



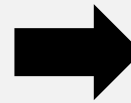
# Deoxyribonucleic Acid



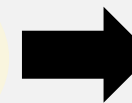
NUCLEUS



CHROMOSOMES



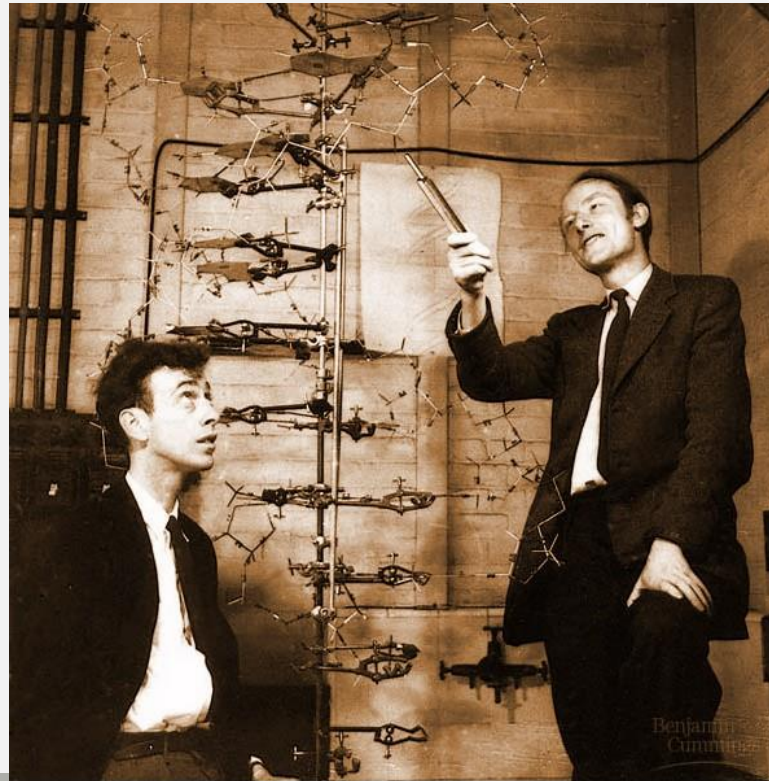
GENES



SEGMENTS  
OF DNA

# Discovering the Structure of DNA

Structure was discovered in 1953 by James Watson and Francis Crick

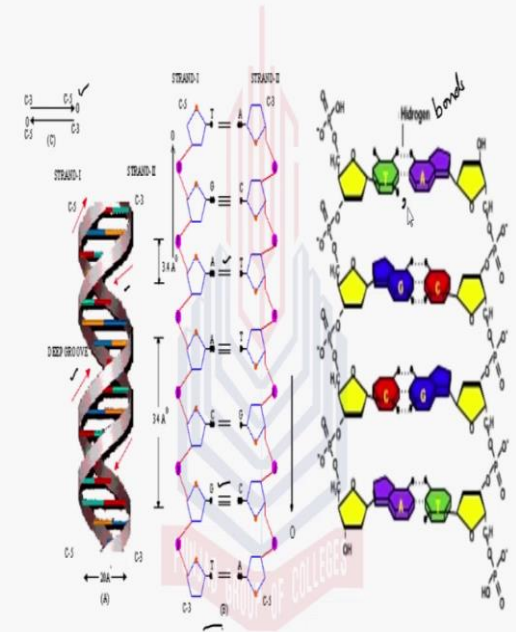


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James Watson was born in Chicago, He travelled from the United States to work with Francis Crick an English physicist at the University of Cambridge. They began working together. In 1953 they published the structure of the DNA molecule. This discovery became one of the most important scientific discoveries of the 20th century.

Watson (along with Francis Crick, Rosalind Franklin, and Maurice Wilkins) was awarded the Nobel Prize in Physiology or Medicine in 1962 for the discovery of the DNA structure. He continued his research into genetics writing several textbooks as well as the bestselling book *The Double Helix* which chronicled the famous discovery.

### ***Watson & Crick Model of DNA***



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**This is what they already knew from the work of many scientists, about the DNA molecule:**

1. DNA is made up of subunits which scientists called nucleotides.
2. Each nucleotide is made up of a sugar, a phosphate and a base.
3. There are 4 different bases in a DNA molecule: adenine (a purine) cytosine (a pyrimidine) guanine (a purine) thymine (a pyrimidine ).
4. The number of purine bases equals the number of pyrimidine bases. The number of adenine bases equals the number of thymine bases.

# What is the function of DNA?

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- ❖ Stores the genetic information that instructs the cell on which proteins to make.
- ❖ So, DNA makes PROTEINS
- ❖ Responsible for determining all organism's traits such as eye color, body structure, and enzyme production.



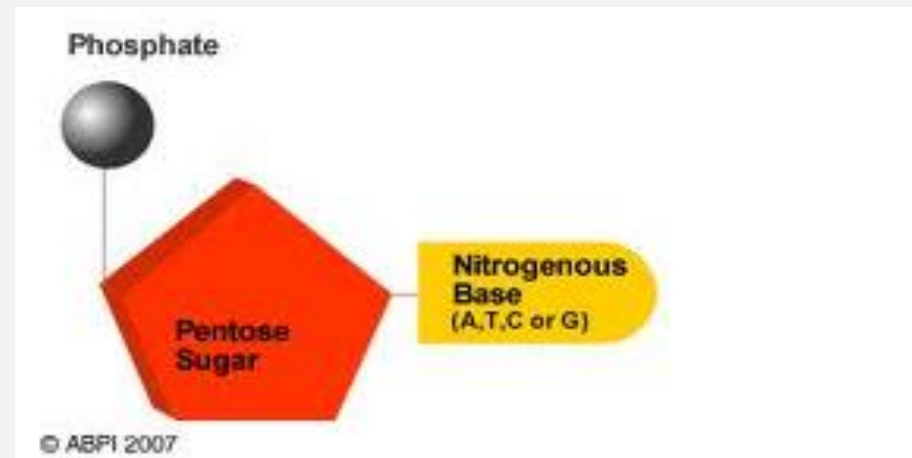
# The Components of DNA

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DNA is a long molecule made up of repeating individual units of monomers called **nucleotides**.

**Nucleotides** are made up of three parts that are held together by **covalent bonds**:

1. Phosphate Group
2. Sugar
3. Nitrogenous Base

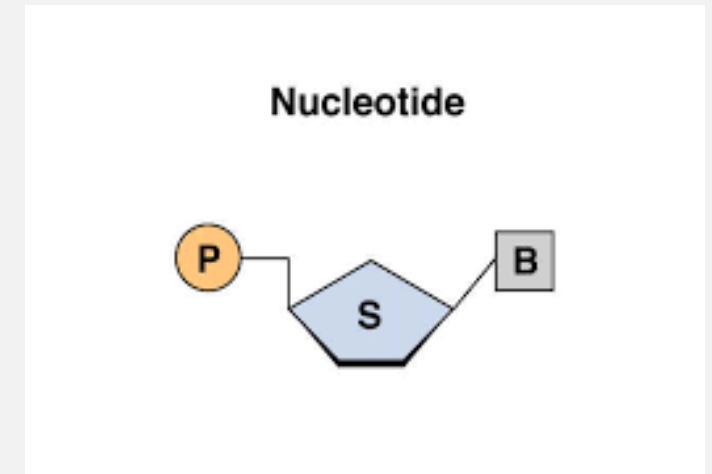


# Nucleotide

❖ **Nucleotide** –The building blocks of all nucleic acid molecule.

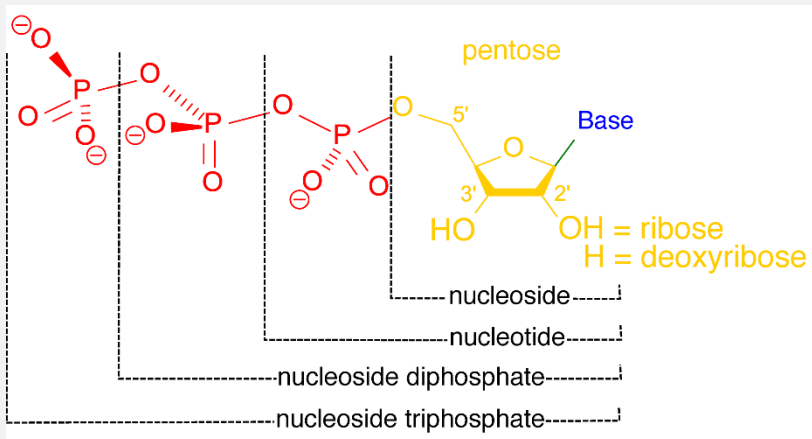
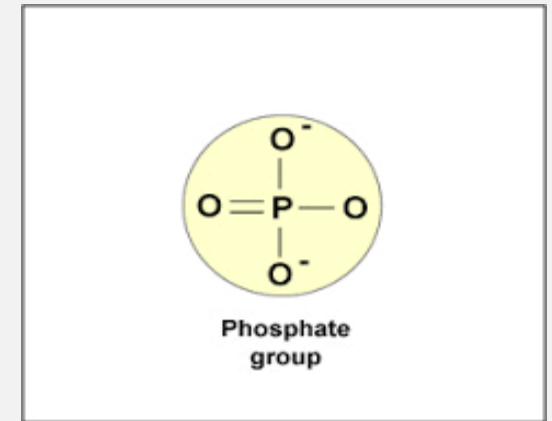
❖ Each nucleotide consists of three components:

1. a phosphate molecule.
2. a five-carbon sugar molecule (deoxyribose in the case of DNA).
3. a nitrogenous base: cytosine (C), guanine (G), adenine (A) or thymine (T).



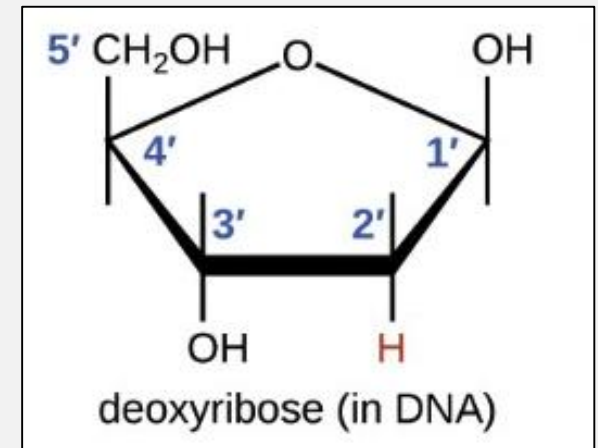
# 1-Phosphate group

❖ A nucleotide can have a monophosphate molecule, diphosphate molecule and a triphosphate molecule



## 2-Pentose sugar

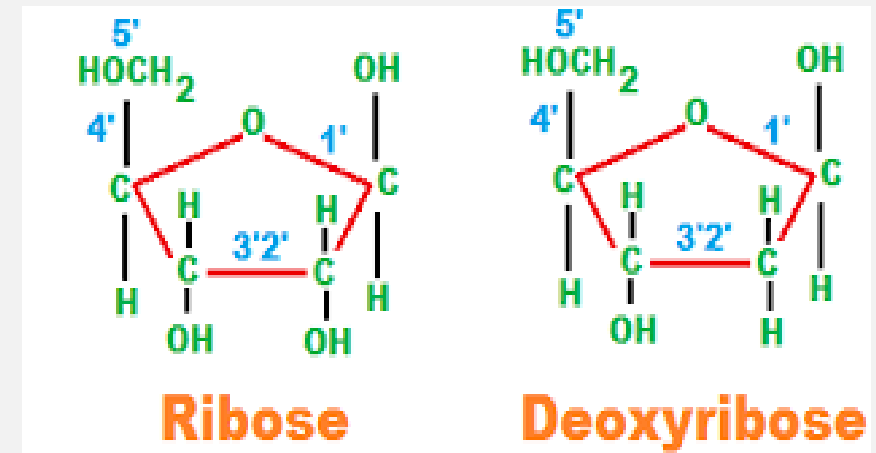
- ❖ The sugar found in the nucleotide is a **5 carbon sugar** and hence, it is known as a pentose sugar.
- ❖ The carbon atoms are numbered 1', 2', 3', 4', and 5'.



# Pentose sugar

❖ This pentose sugar is further classified into two types:

1. ribose sugar
2. deoxyribose sugar.



The ribose sugar nucleotide is known as **ribonucleotide** and is a monomer of RNA

The deoxyribose sugar nucleotide is known as **deoxyribonucleotide** and is a monomer of DNA.

## 3-Nitrogenous bases

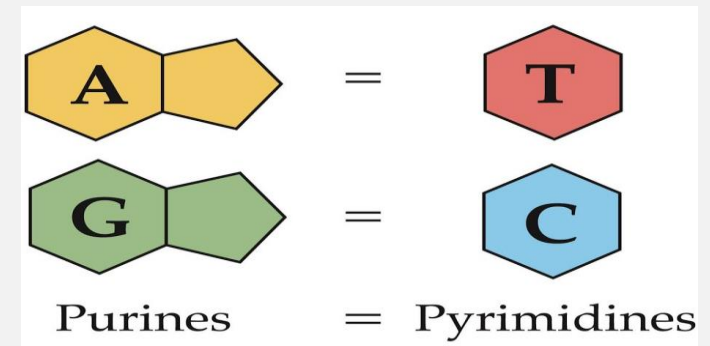
❖ The base found in the nucleotide has heterocyclic ring which is made up of **nitrogen**. Hence, it is known as **nitrogenous base**.

❖ These bases are further divided into two parts purines and pyrimidines.

**In DNA** there are

❖ **Purines:** adenine (A) and guanine (G)

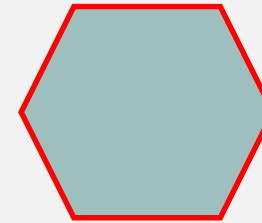
❖ **Pyrimidines:** thymine (T) and cytosine (C).



[RNA: In RNA also there are two purines: adenine (A) and guanine (G) and two pyrimidines: cytosine (C) and thymine is replaced by uracil (U)].

# Pyrimidines

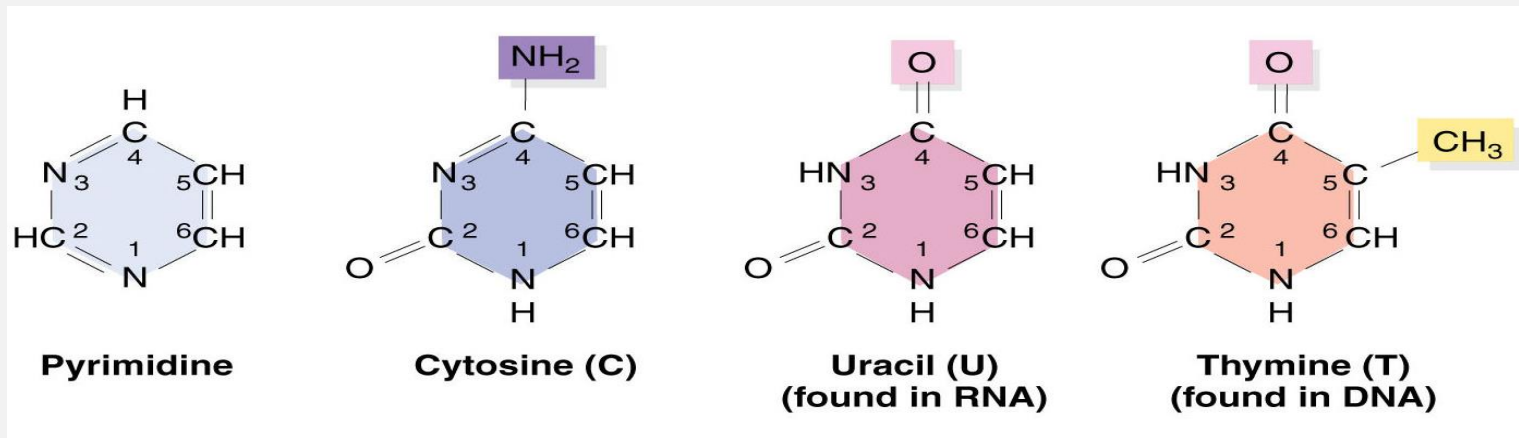
- ❖ Pyrimidine bases consist of a single six member ring.
- ❖ The ring has two nitrogen atoms and 4 carbon.



## ❖ The pyrimidine bases are:

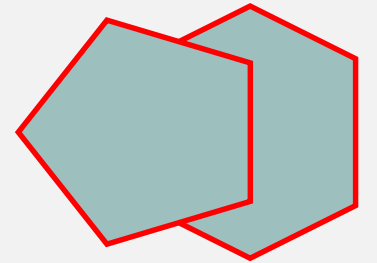
➤ Cytosine and Thymine (DNA)

➤ Uracil (RNA)



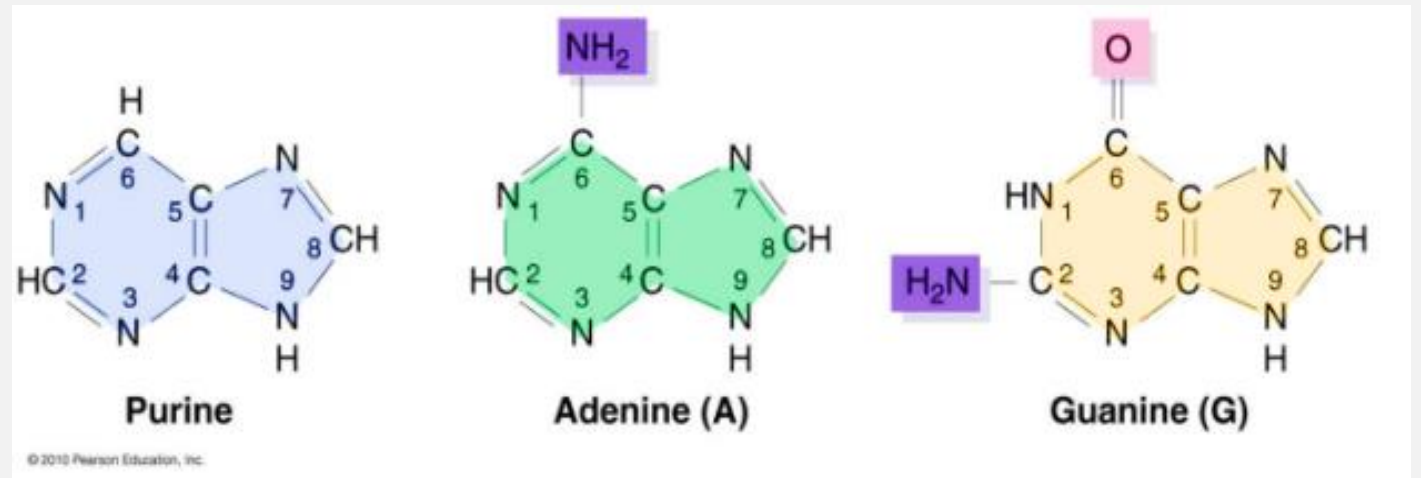
# Purines

- ❖ Purines have two rings, a six member ring, fused to a five member ring.
- ❖ The 9 atoms that make up the fused rings (5 carbon, 4 nitrogen) are numbered 1-9.



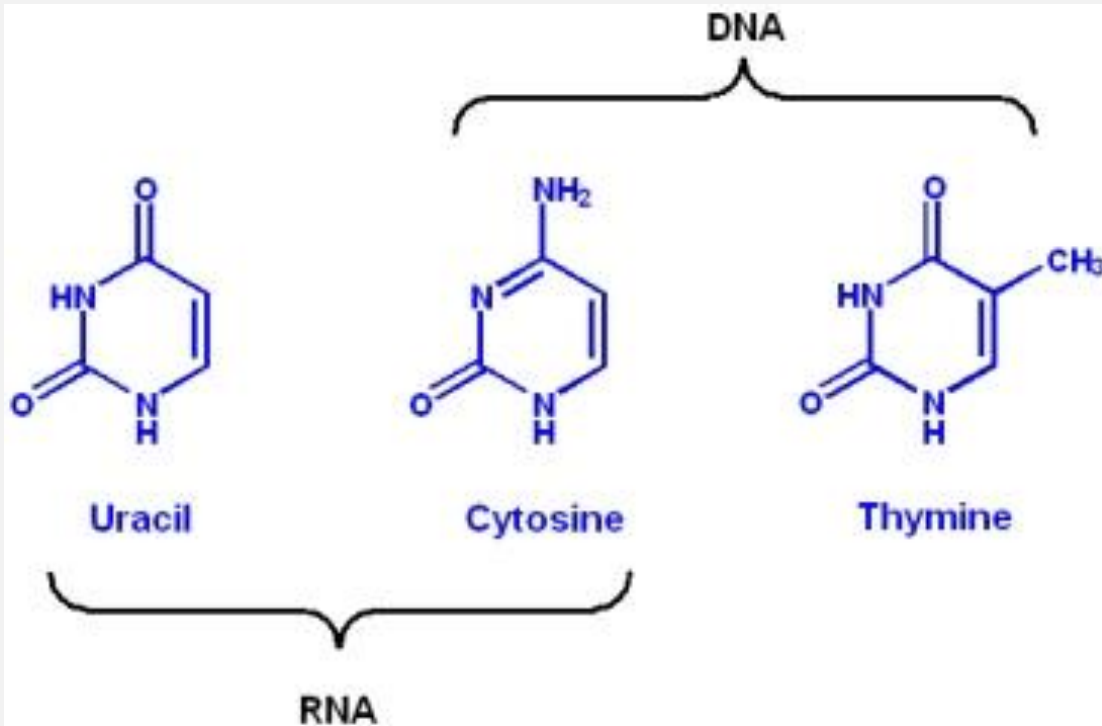
## ❖ The two purines are

- Adenine
- Guanine



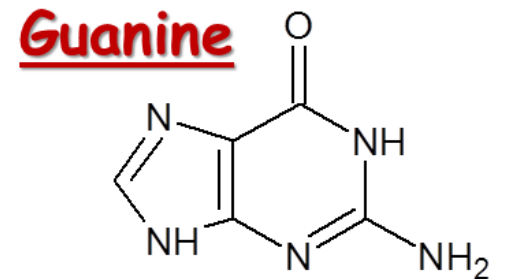
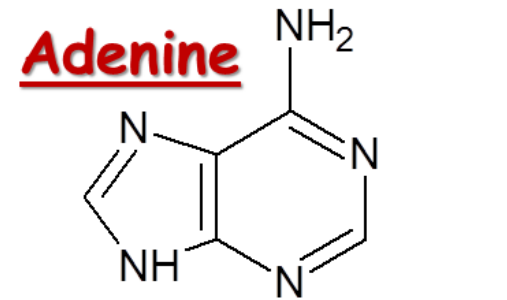


# The bases



← PYRIMIDINES

PURINES →



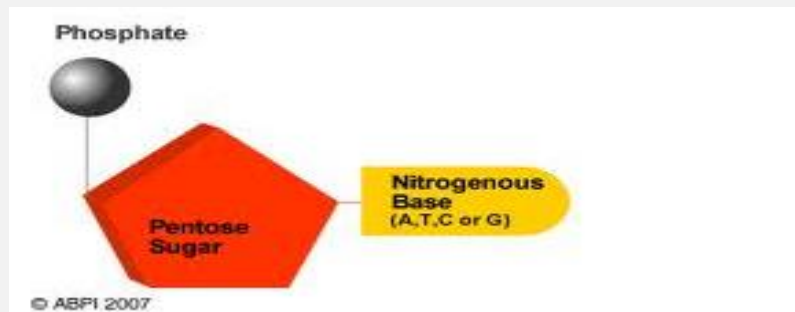
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❖ The nitrogenous base and sugar comprise a **nucleoside**

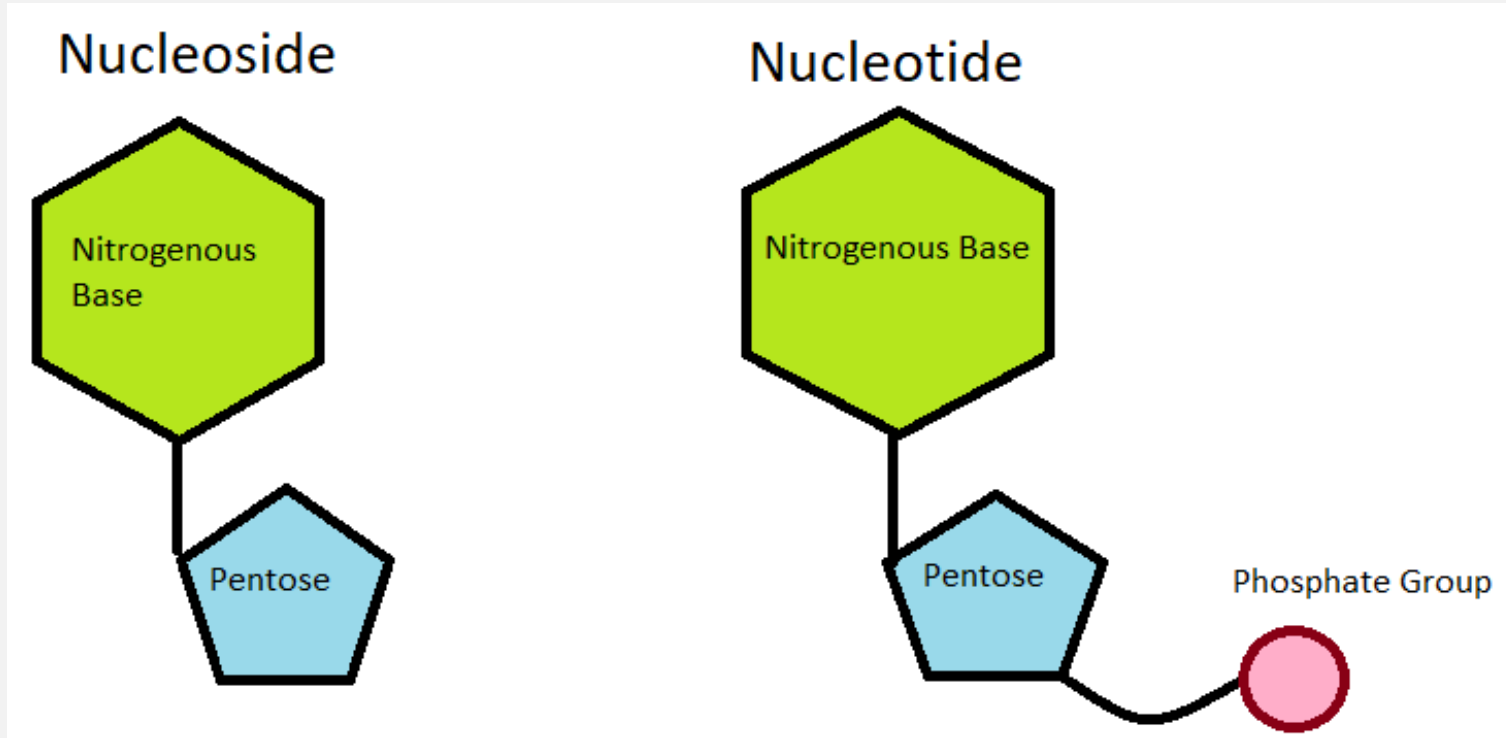
❖ A nucleoside and a phosphate group make up a **nucleotide**



Sugar + Base = **nucleoside**



Phosphate + Sugar + Base = **nucleotide**



Nucleosides differ from nucleotides in that they lack phosphate groups.

# Formation of nucleotide

In all nucleotide molecules the bonds holding the phosphate group to the sugar and the base to the sugar are both products of condensation reactions. Water is eliminated when they form. In both cases the oxygen to form the water has come from the sugar's -OH groups.

