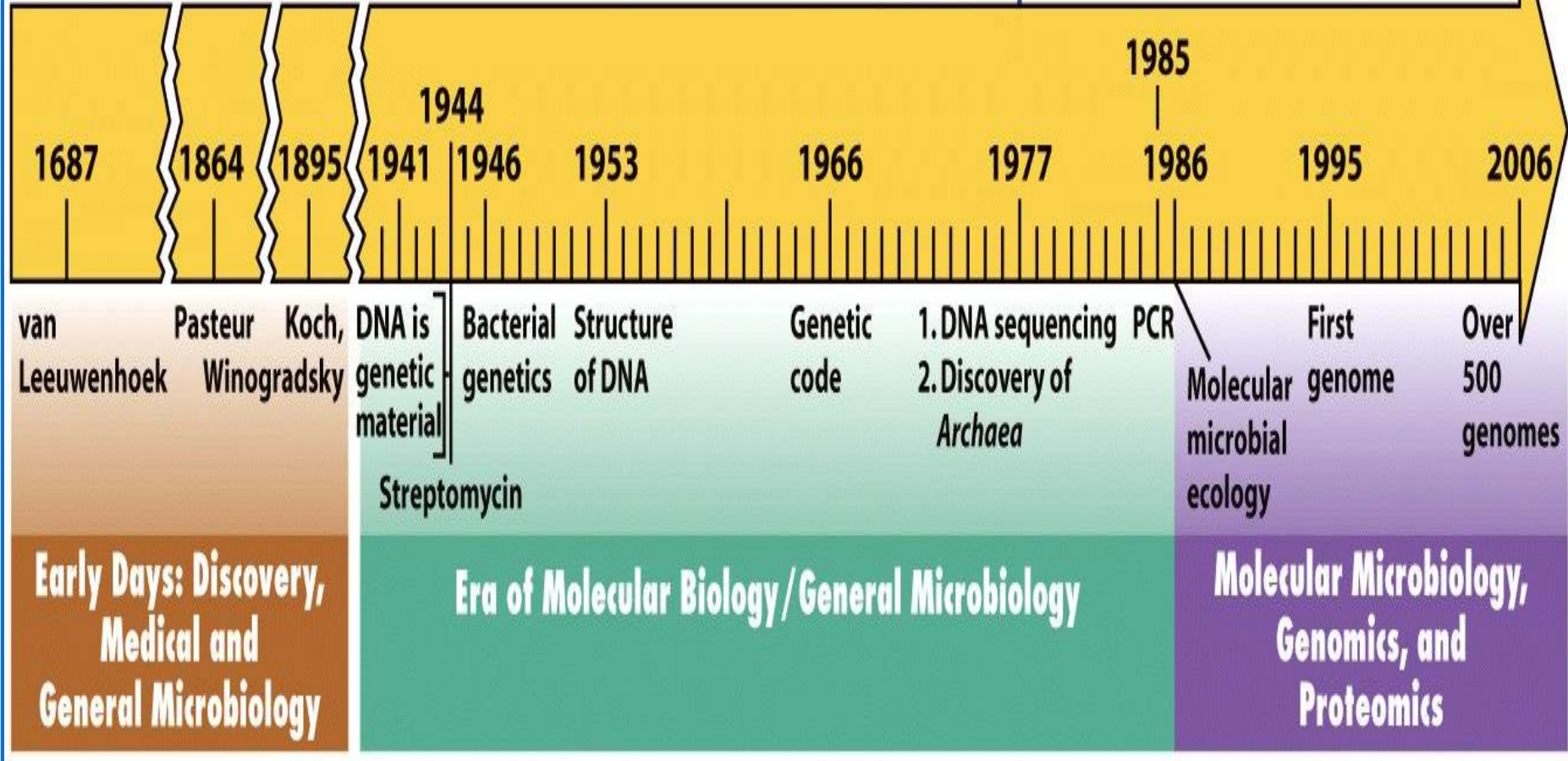
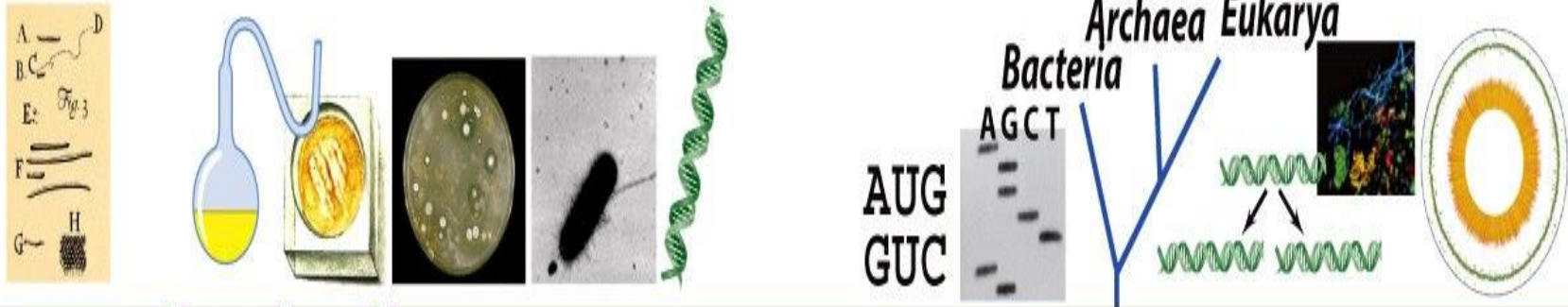


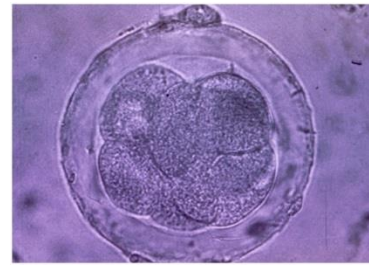
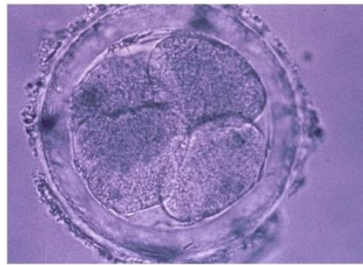
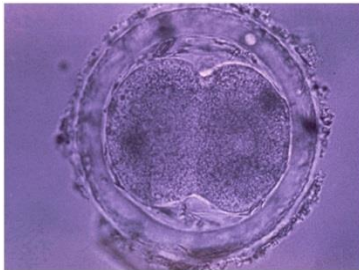
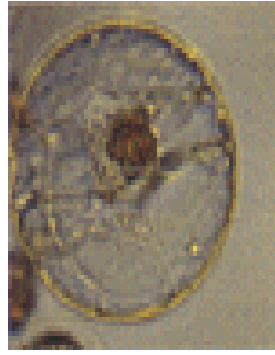
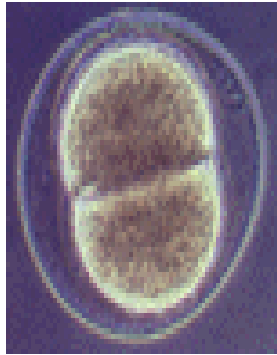
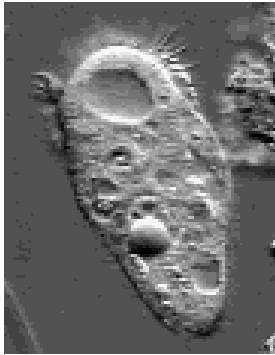
# وراثة الأحياء الدقيقة Microbial Genetics

أساسيات في علم الوراثة  
Fundamentals of Genetics  
Lecture 2

# Historical Events of Genetics



# What is Life made of?



# What is Life made of?

- All living things are made of Cells.
- **Fundamental working units** of every living system.
- Every organism is composed of one of two basic different types of cells:
  - **Prokaryotic** cells or
  - **Eukaryotic** cells.
- A cell is a smallest structural unit of an organism that is capable of independent functioning
- All cells have some common features.

# The Cell

- Living cells are constructed from a small number of different types of molecules.
- Most biomolecules contain carbon and many contain nitrogen.
- Three levels of organization:
  - The simplest level- **individual elements** (carbon, nitrogen, or oxygen).
  - The basic elements “**building blocks**”- amino acids.
  - **Macromolecules**- nucleic acids, proteins, lipids, and carbohydrates

# The Composition of Living Systems

**Elements, ions, and trace minerals that make up living systems**

<b>Elements</b>	<b>Ions</b>	<b>Trace minerals</b>
Oxygen	Sodium	Manganese
Carbon	Potassium	Iron
Nitrogen	Magnesium	Cobalt
Hydrogen	Calcium	Copper
Phosphorus	Chloride	Zinc
Sulfur		Aluminum
		Iodine
		Nickel
		Chromium
		Selenium
		Boron
		Vanadium
		Molybdenum
		Silicon
		Tin
		Fluorine

I

Elements

II

Phosphate  
Pyrimidines  
Purines  
Ribose  
Deoxyribose

Amino acids

Fatty acids  
Glycerol  
Other components

Sugars

III

Nucleic acids

Proteins

Lipids

Carbohydrates  
or  
Polysaccharides

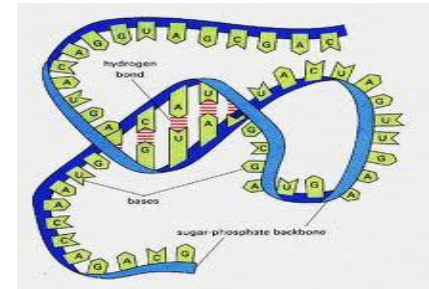


# Components involve in Genetics

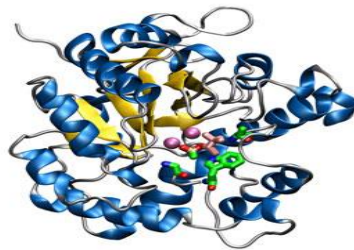
**DNA**



**RNA**

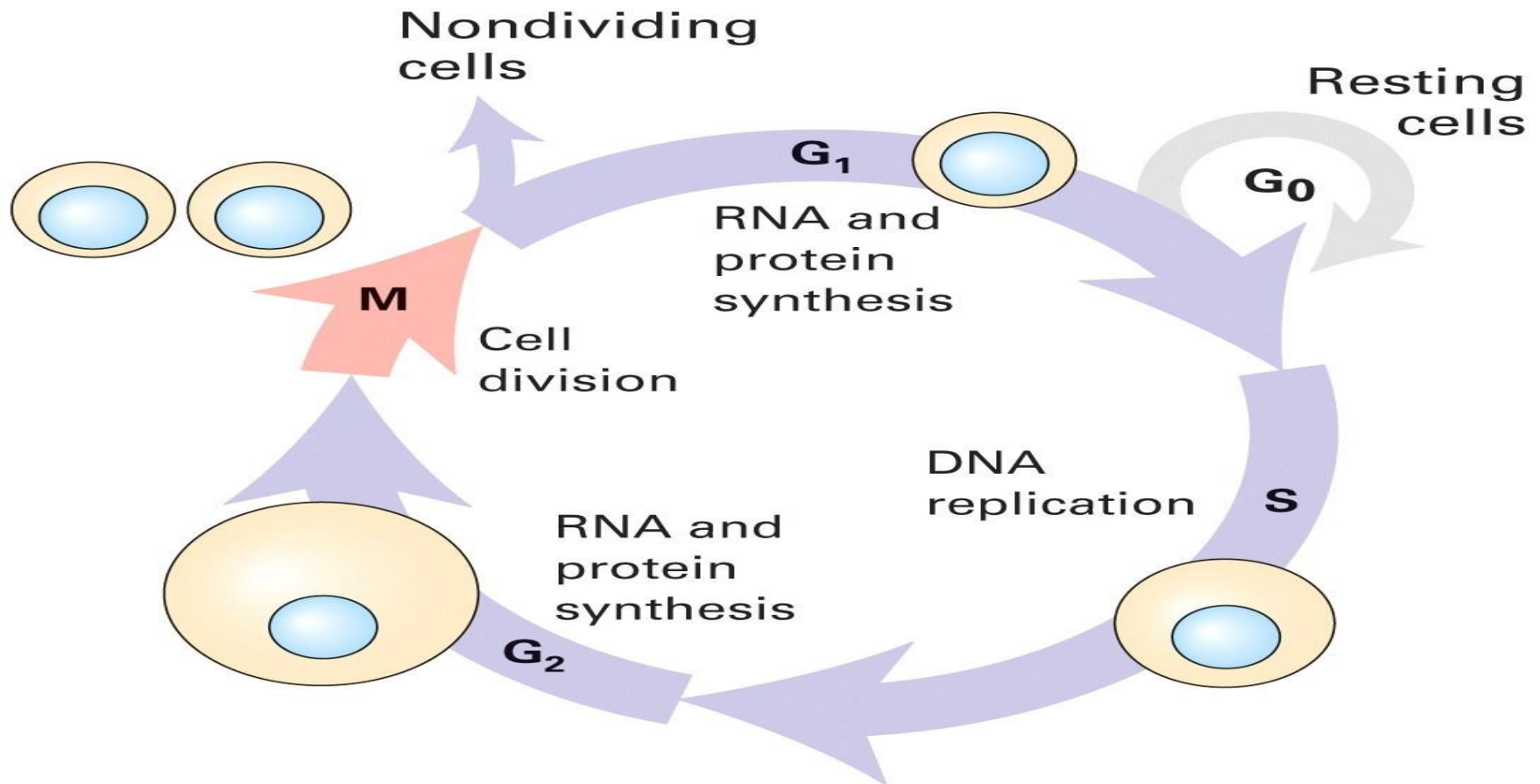


**Protein**





# All Cells have common Cycles



- Born, eat, replicate, and die.

# Prokaryotes and Eukaryotes

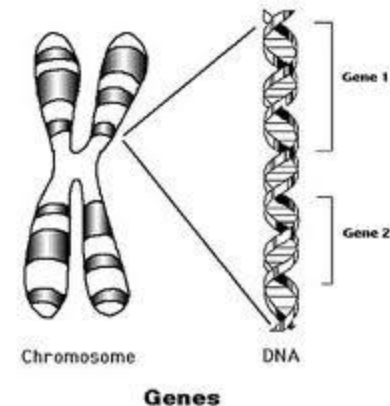
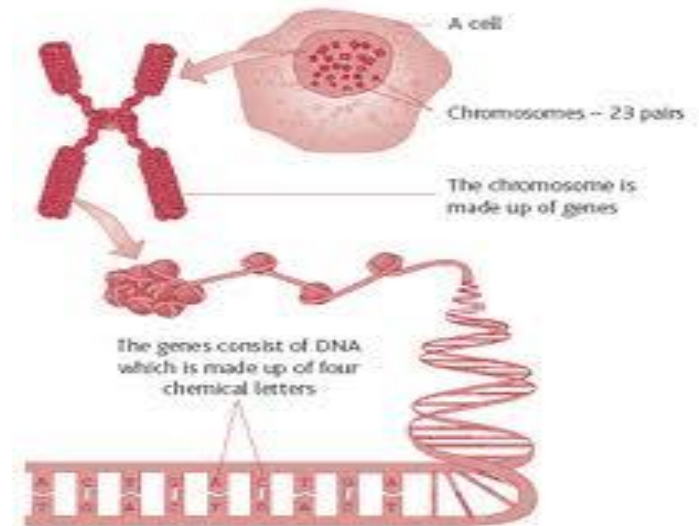
Prokaryotes	Eukaryotes
Single cell	Single or multi cell
No nucleus	Nucleus
No organelles	Organelles
One piece of circular DNA	Chromosomes
No mRNA post transcriptional modification	Exons/Introns splicing

# Overview of organizations of life

- **Nucleus = library**
- **Chromosomes = bookshelves**
- **Genes = books**
- Almost every cell in an organism contains the same libraries and the same sets of books.
- Books represent all the information (DNA) that every cell in the body needs so it can grow and carry out its various functions.

# Gene : Unit of heredity

- The DNA segments that carries genetic information are called genes.
- It is normally a stretch of DNA that codes for a type of protein or for an RNA chain that has a function in the organism.
- Genes hold the information to build and maintain an organism's cells and pass genetic traits to offspring.

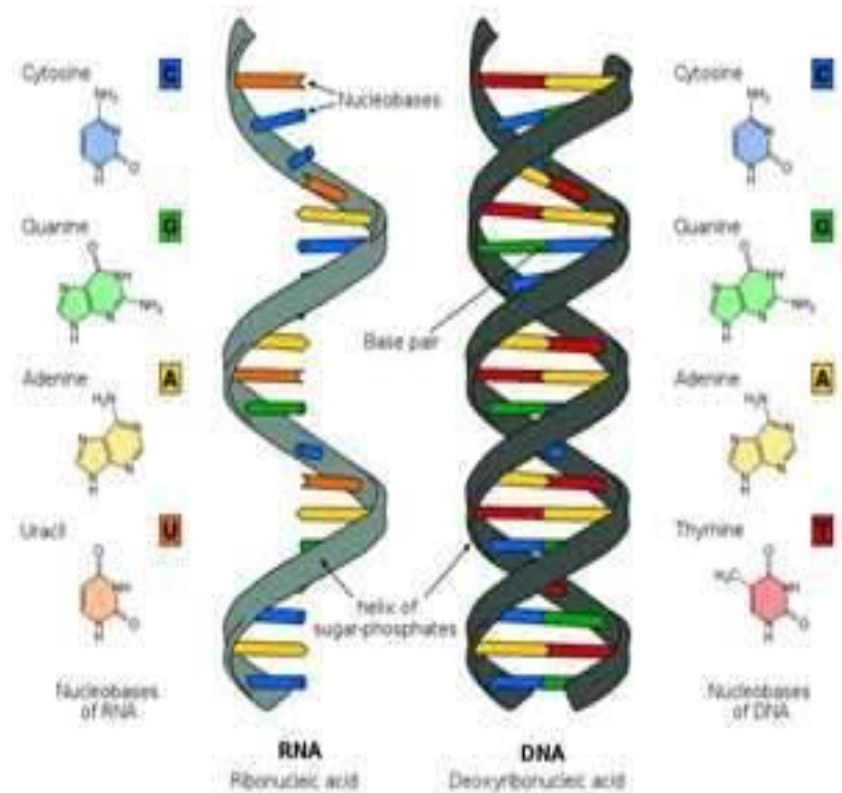


# Genetic Materials **المادة الوراثية**

- Nucleic Acids
  - Composed of chains of nucleotides.
  - Nucleic acid molecules are usually composed of 4 different nucleotides.
  - A nucleic acid molecule may contain several thousands or millions of nucleotides.
  - Each nucleic acid molecule has its own order, or “sequence,” of nucleotides.
  - The correct sequence of nucleotides is essential for the nucleic acid’s function.

# General Structure of Nucleic Acid

- **DNA** and **RNA** are long chain polymers of small chemical compound called **nucleotides**.



# Nucleotides

**Nucleotides; ring shaped structures composed of:**

- **Nitrogenous base;** these bases are classified based on their chemical structures into two groups:
  - ❖ Purine; double ringed structure (fused five- and six-membered heterocyclic compounds).
  - ❖ Pyrimidine; single ring structures (six-membered rings).
- **Pentose sugars:**
  - ❖ Ribose (found in RNA).
  - ❖ Deoxyribose (found in DNA).
- **Phosphate group.**

# **Sugar + Base = nucleoside**

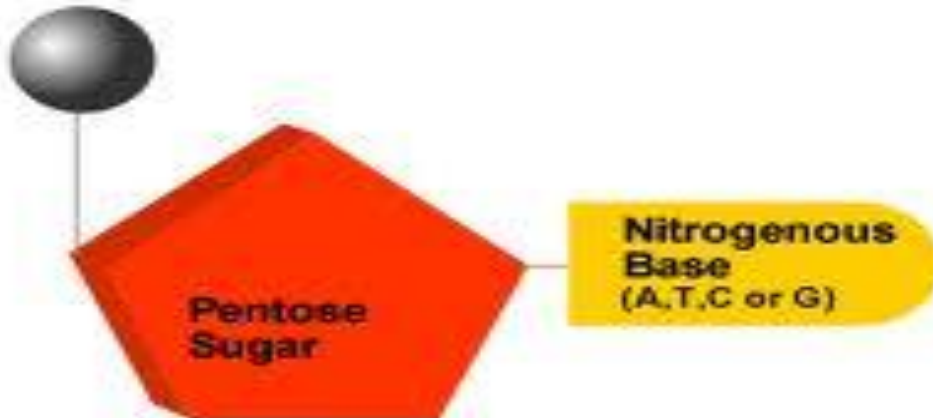


nucleoside

# **Phosphate + sugar + Base = nucleotide**

**A nucleotide**

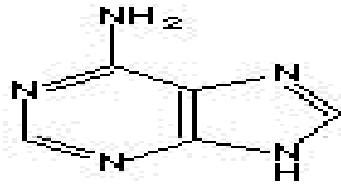
**Phosphate**



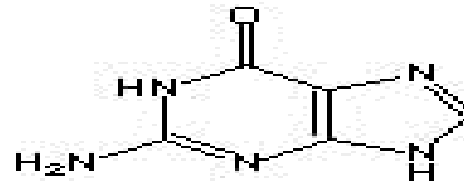


# Bases

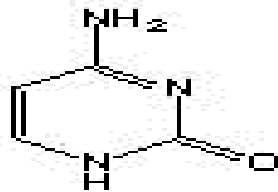
- Types:- Adenine (A) and Guanine (G) – **Purines**



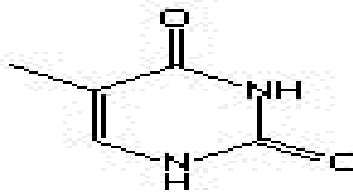
Adenine



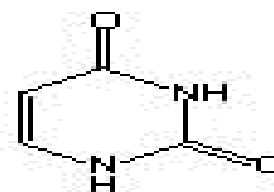
Guanine



Cytosine



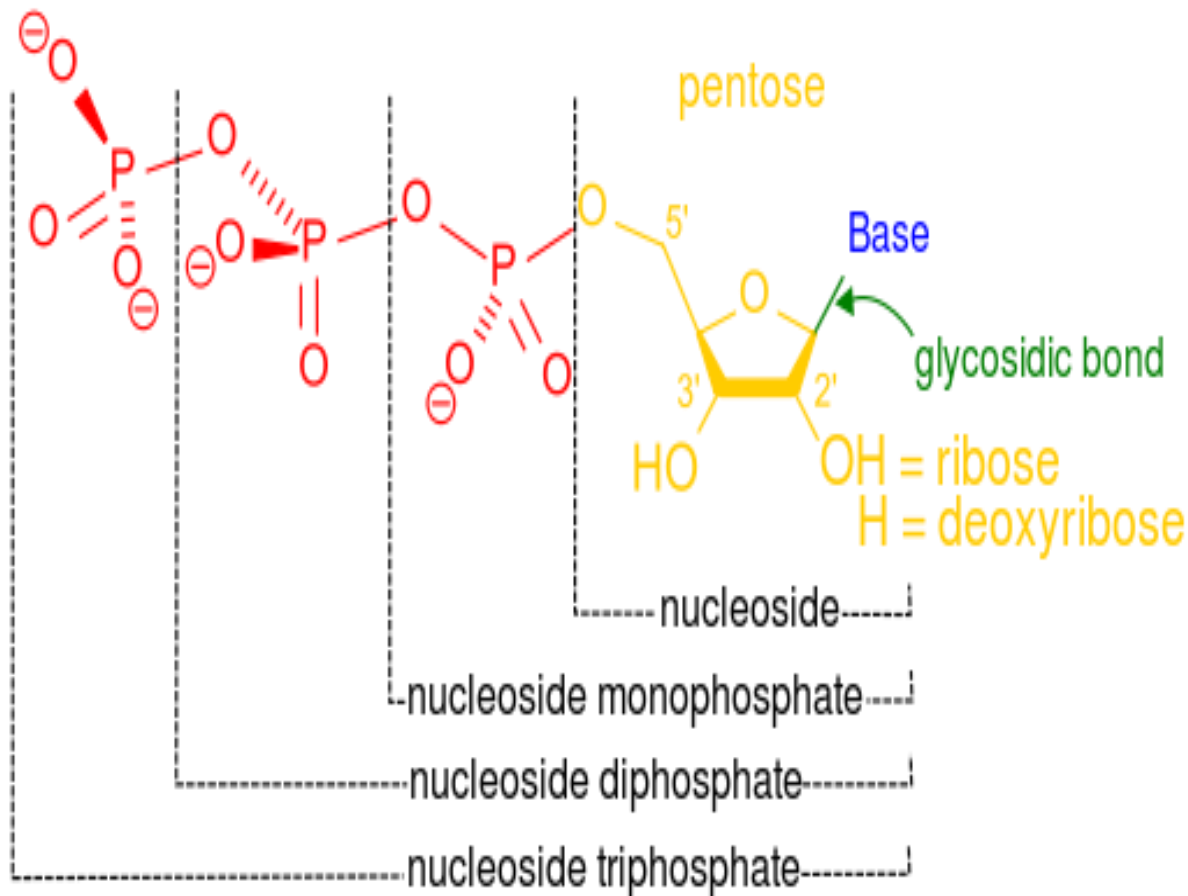
Thymine



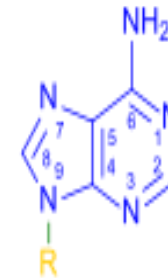
Uracil

- Cytosine (C) & Thymine (T) -Pyrimidines.**
- A fifth pyrimidine base, called **Uracil (U)**, usually takes the place of thymine in **RNA** and differs from thymine by lacking a methyl group on its ring.
- PAIRING :     $\text{A}=\text{T}$     and     $\text{A}=\text{U}$   
                   $\text{G}\equiv\text{C}$

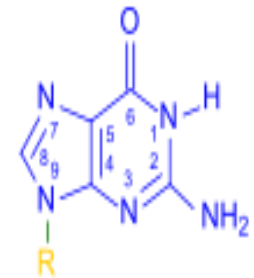
# المادة الوراثية Genetic Material



## Purines

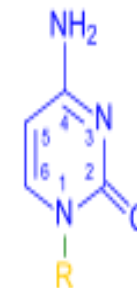


Adenine

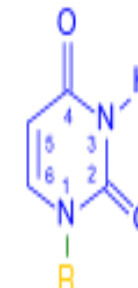


Guanine

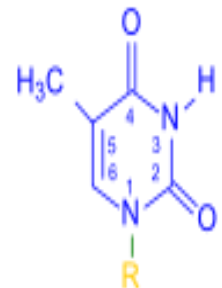
## Pyrimidines



Cytosine



Uracil



Thymine

# Genetic Materials **المادة الوراثية**

- DNA: Deoxyribonucleic acid
  - Pentose sugar: 2'-deoxyribose
  - Nitrogenous bases:
    - Adenine and guanine (purines)
    - Cytosine and thymine (pyrimidines)
  - Structure is typically a double-stranded helix
  - Nucleotide sequences of the strands are complementary to each other, A pairing with T and C pairing with G.

# Genetic Materials **المادة الوراثية**

- RNA: Ribonucleic acid
  - Pentose sugar: Ribose
  - Nitrogenous bases:  
Adenine and guanine (purines)  
Cytosine and uracil (pyrimidines)
  - Structure is typically single-stranded.
  - An RNA strand can also form a double-stranded structure with a DNA strand; in this case, the U on the RNA will base-pair with the A on the DNA.

# Genetic Materials **المادة الوراثية**

- The RNA in the cell has at least four different functions:
  - **Messenger RNA (mRNA).**
  - **Transfer RNA (tRNA).**
  - **Ribosomal RNA (rRNA).**
  - **Some small, stable RNAs.**

# Genetic Materials    المادة الوراثية

- Overall function:
  - The nucleotide sequence of a nucleic acid molecule encodes the amino acid sequence of a protein.
  - Genome: The entire nucleotide sequence of an organism; transmitted to offspring during reproduction.
  - DNA molecules serve as the genome for the proteins of all cellular organisms, both eukaryotic and prokaryotic. DNA also serves as the genome for certain viral groups.
  - RNA molecules serve as an intermediate in gene expression in eukaryotic and prokaryotic organisms, as well as some viruses. RNA serves as the genome for certain viral groups.

# Genetic Materials    المادة الوراثية

- Important Processes in Genetics:
  - **DNA Replication:** The sequence of a nucleotides in a DNA molecule serves as a template to copy itself, so two identical copies of the DNA helix are formed.
  - **Transcription:** The sequence of nucleotides in a DNA molecule serves as a template for the synthesis of an RNA molecule; typically, only a small segment of the DNA is copied. This is the first step in gene expression.
  - **Translation:** The sequence of nucleotides in an RNA molecule serves to direct the assembly of amino acids into a protein chain on a ribosome. This is the second step in gene expression.

# QUESTIONS??

