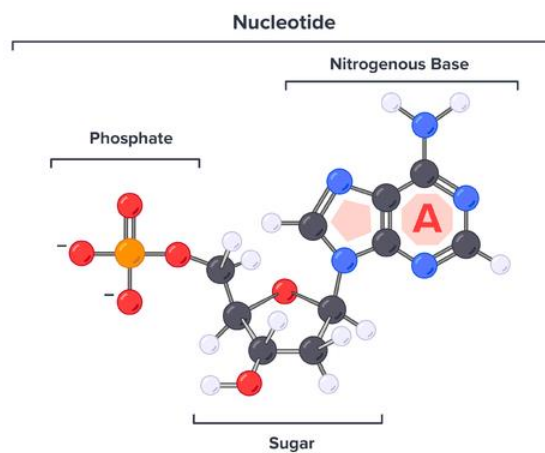




## Molecular Biology

### 2nd stage

## Nucleic Acid



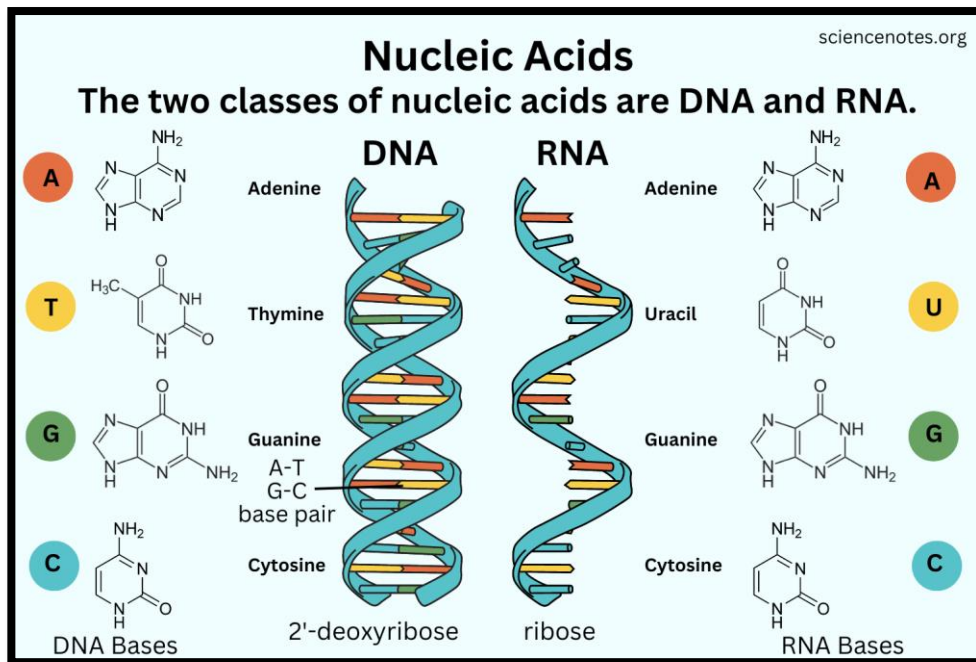
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## Nucleic Acid Definition

Nucleic acids are essential large biological molecules for all forms of life. The nucleic acids include the DNA and the RNA. They are the hereditary determinants of living organisms. They are present in most living cells either in Free State or bound to proteins as nucleoproteins. The nucleic acids are biopolymers with mononucleotides and their repeating units. The monomers are known as nucleotides, they are made up of three units: a sugar, an amine and a phosphate group.



## basic structure Nucleic acids :

1- **Composition:** Nucleic acids are long chainlike molecules composed of smaller units called nucleotides.

### 2 - Nucleotide Components:

- **Nitrogen-Containing Base:** Each nucleotide consists of a nitrogen-containing aromatic base (such as adenine, guanine, cytosine, thymine, or uracil).
- **Pentose Sugar:** The base is attached to a pentose (five-carbon) sugar.
- **Phosphate Group:** The sugar is further linked to a phosphate group, which imparts acidity to the molecule.

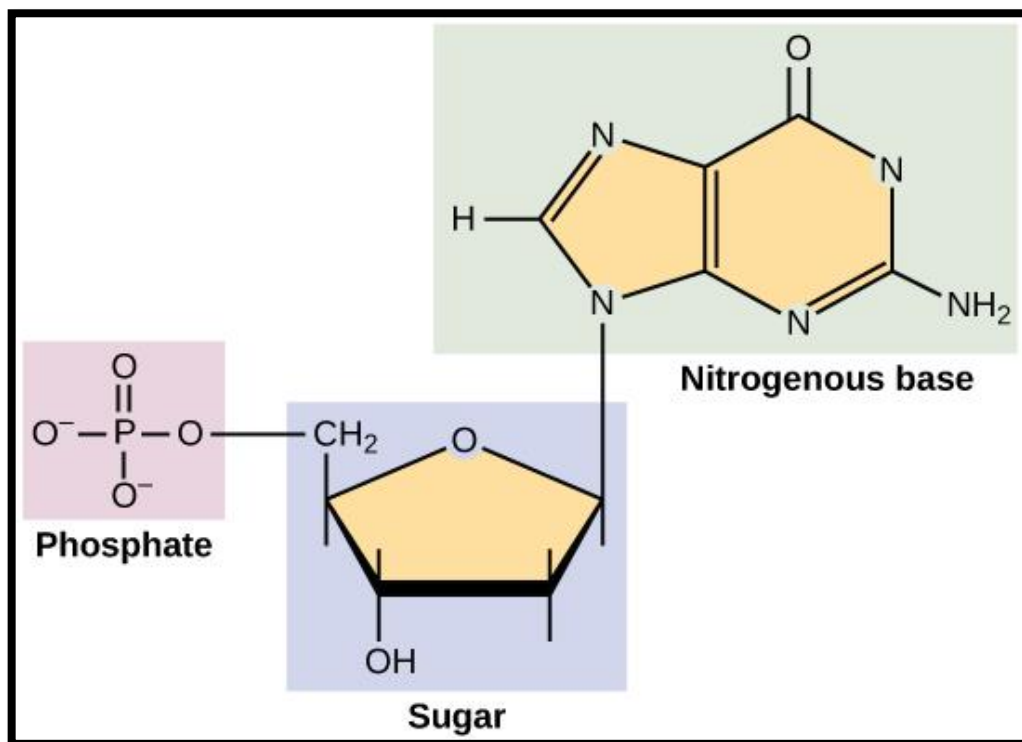
### 3- Types of Nucleic Acids:

- **DNA (Deoxyribonucleic Acid):** DNA serves as the master blueprint for life. It constitutes the genetic material in all free-living organisms and most viruses.
- **RNA (Ribonucleic Acid):** RNA is the genetic material of certain viruses and is also found in all living cells. It plays a crucial role in processes like protein synthesis.

### 4 Base Pairs:

- All nucleic acids contain the bases adenine (A), cytosine, and guanine (G).
- Thymine (T) is found only in DNA, while uracil (U) is present in RNA.

In summary, nucleic acids are the information-carrying molecules of the cell, determining the inherited characteristics of every living organism



**structure Nucleic acids**

## Properties of nucleic acids :

- 1- Nucleic acids (DNA and RNA) are long polymers made of repeating units of nucleotides.
- 2- Nucleotide units are made of phosphate-sugar-nitrogenous base units.
- 3- The nitrogenous bases found in DNA are adenine, guanine, cytosine and thymine.
- 4- Adenine and guanine are purine bases while cytosine and thymine are pyrimidines.
- 5- In RNA, the thymine bases are replaced by uracil which is also a pyrimidine.
- 6- The nucleotides are linked with phosphodiester bonds.
- 7- They are linked by a phosphate group on the 5th position of sugar residue becomes linked to 3' hydroxyl group of the proceeding sugar molecule.
- 8- Any one of the five heterocyclic bases can be combined with either  $\beta$ -ribose or  $\beta$ -deoxyribose to form nucleoside.
- 9- The double stranded model of the DNA was worked out by Watson and Crick in 1953.
- 10- The double helix model consists of two strands wound around a central axis with the bases stacked inside.
- 11- The order of the strand is in opposite directions, i.e., from 5' to 3' direction in one and 3'to 5' direction in the other.
- 12- The bases stacked in the center of the helix as they interact with each other through weak hydrogen bonds.
- 13- Hydrogen bonds are weaker than covalent bonds, they are continually forming and disassociating.
- 14- In the double stranded nucleic acids, the adenine form hydrogen bonds only with thymine (or uracil) molecule. While cytidine will only form hydrogen bonds with guanine.
- 15- Hence, in a given strand of DNA, the amount of adenine is always equal to the amount of thymine, and the amount of cytidine always equals the amount of guanine, in a given species.
- 16- The per cent of the G-T and the A-T is variable from species to species.
- 17- The base pairs form a flat plain in the helix, the adenine forming two hydrogen bonds with thymine, and the cytidine forming three bonds with guanine.
- 18- The double stranded DNA can be denatured by alkaline conditions or heat.

## Basic equipments in molecular biology lab

### 1 . Refrigerator:

The device is used for the storage of the stock solutions, chemicals, kits and PCR products that should be maintained at certain temperatures.



### 2- Deep Freezer:

It is used to store mammalian cell stock cultures. It is a device used to store materials which should be kept at low temperatures (cells, tissues, enzymes, proteins, etc.).



### 3- Magnetic Stirrer:

is a device which provides mixing and keeping the chemical solutions and mixtures at a certain time and temperature by the help of a magnetic bar.



### 4-Vortex mixer (shaker):

Use to mix liquids, reagents, and samples with diluent in tubes.



### 5-Autoclave:

The main purpose of this device is to sterilize materials and media under pressure and steam.



## 6- Centrifuge:

This device is mainly used in cell culture, nucleic acid isolation and in microbiology to separate two liquids in emulsion form or suspended solids in liquids by the help of the ce



## 7- Thermal Cycler :

This device is used for the amplification of a specific region of any DNA sample with polymerase chain reaction in a test tube.



## 8- Electrophoresis System:

This device is used for profiling DNA fragments according to their sizes after polymerase chain reaction (PCR).



**9- Gel Documentation System:**

This device is used to display DNA fragments after electrophoretic run. Gel documentation System widely used in molecular biology laboratories for imaging and documentation of nucleic acids and protein polyacrylamide or agarose gels typically stained with ethidium bromide or SYBR green .

**10- Biosafety cabinet :**

which are the primary means of containment developed for working safely with infectious microorganisms .

