

Molecular biology: It is the science deals with macromolecules (DNA ,RNA and Protein) to understand the five basic behaviors patterns (growth, division, specialization, movement and interaction).

DNA (Deoxyribonucleic acid): It is the most important molecule in living cells and contains **all** the information that the cell need to live and to propagate it.

RNA (Ribonucleic acid): RNA is a ribonucleic acid that helps in the synthesis of proteins in our body. This nucleic acid is responsible for the production of new cells in the human body. It is usually obtained from the DNA molecule.

Plasmid: It is a double stranded super helix DNA, usually found in bacterial cytoplasm. Plasmid are not confined to bacteria but they have been isolated from yeast, protozoa and plants

Chromosomes: they are cellular structures made up of genes that carry hereditary information. A gene is not just a segment of DNA, a gene is a specific sequence of nucleotides that codes for a functional product, usually a protein. All the genetic information in a cell is the genome.

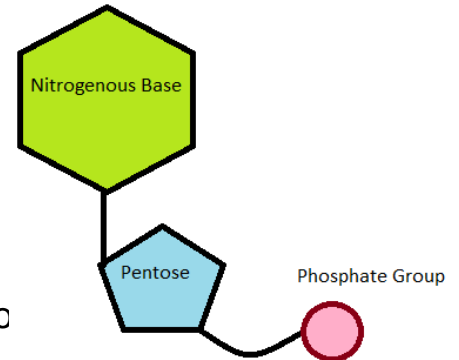
The genome of an organism can be defined as the total DNA content of the cell , and as such it contains all the genetic information required to direct the growth and development of the organism.

Basic Structure of Nucleic Acids.

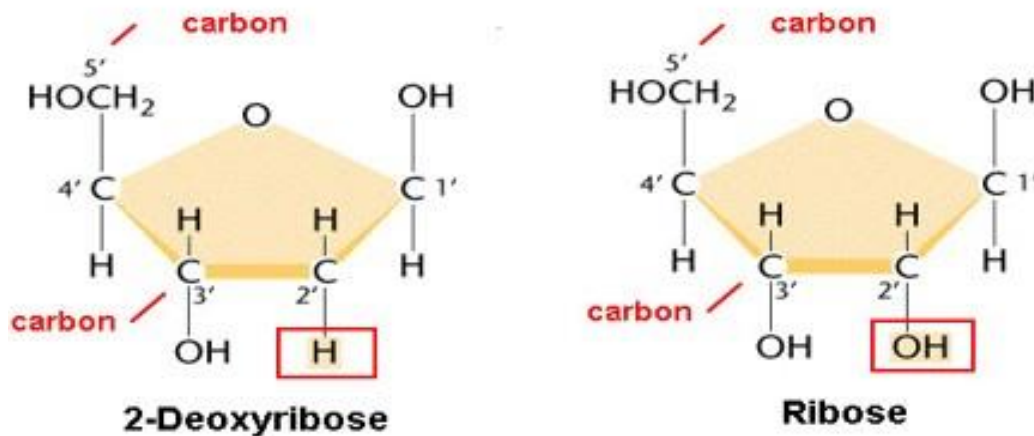
A Nucleic Acid is a polymer consisting from nucleotides (the main structural units in nucleic acid) each nucleotide has the 3 following components:

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- 1 **Ribose (five carbon sugar)**
- 2 **Nitrogen base (Purines & Pyrimidine)**
- 3 **Phosphate group**

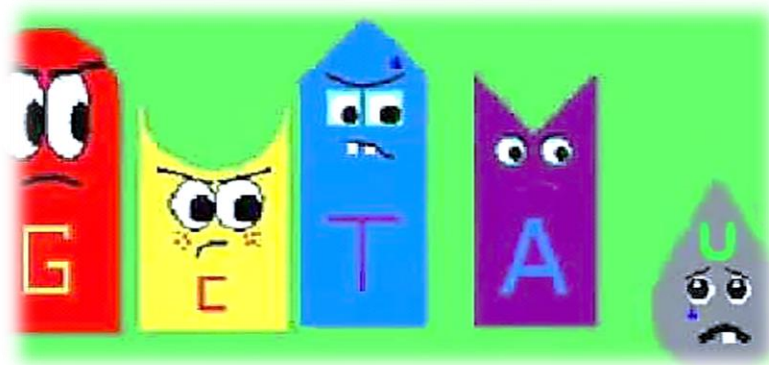
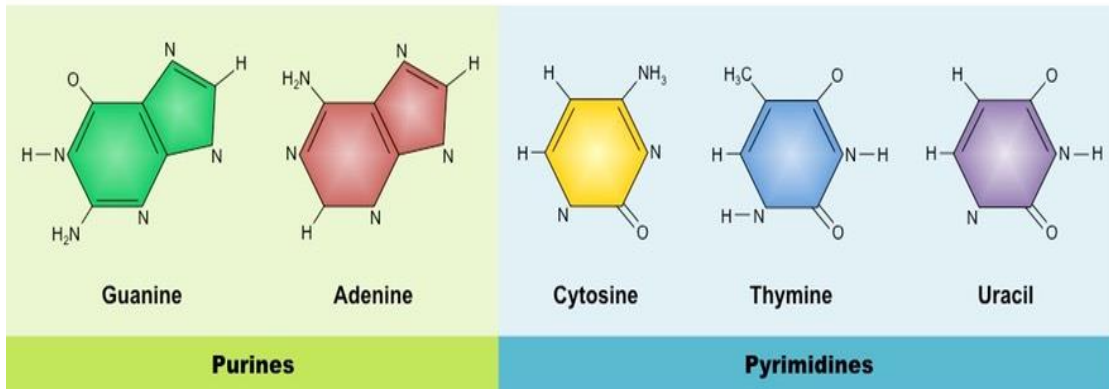


- ✚ **Ribose Sugar**, found in **RNA**, with one oxygen at carbon atom, while **Deoxyribose Sugar**, found in **DNA**, is a modified sugar, lacking one oxygen atom.

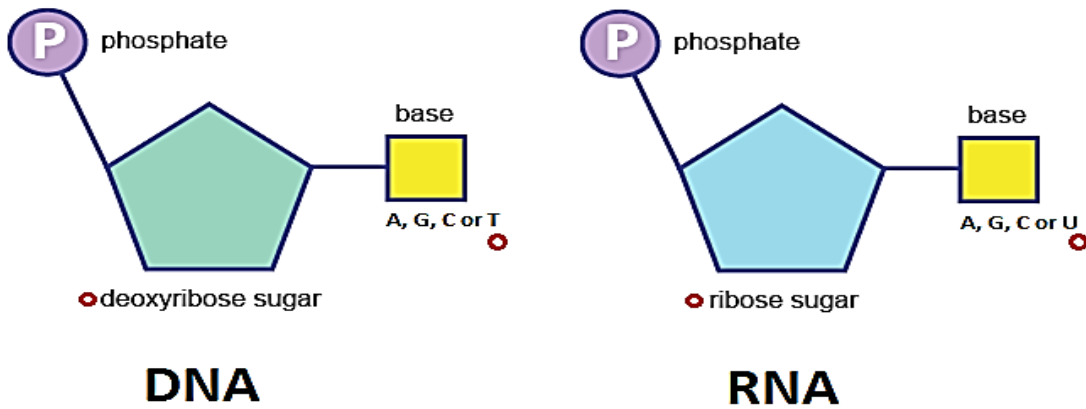


- ✚ **A nitrogenous base**: It is organic molecules that contains the element nitrogen and play an important role as building blocks of both DNA and RNA. Nitrogenous bases are classified into two groups;
 - ❖ **Pyrimidines** (which consist of one ring and contains cytosine **C**, thymine **T** and uracil **U**).

- ❖ **Purines** (which consist of two ring and contains adenine **A** and guanine **G**). Uracil is found only in RNA, while thymine is found only in DNA.



Difference between DNA & RNA Structure



Types of RNA:

✚ Messenger RNA (mRNA)

It represents a small amount of the total RNA (5%) because it will degrade once it translated.

✚ Transfer RNA (tRNA)

It represents around 10%.

✚ Ribosomal RNA (rRNA)

It represents around 85% of total RNA in the cell.

mRNA	rRNA	tRNA
Short, Unstable	Longer, Stable RNA	Short Stable RNA
Serves as intermediary between DNA and protein	catalyzes peptide bond formation between amino acids	Carries the correct amino acid to the site of protein synthesis in the ribosome

Enzymes in DNA replication:

- ❖ **Primase**: formed primer in DNA replication.
- ❖ **Topoisomerase I**: convert super coiled to relax form
- ❖ **DNA Helicase**: broken hydrogen bonds
- ❖ **DNA Gyrase**: convert relaxed form to super coiled
- ❖ **DNA Ligase**: repair, replication and recombination of DNA.

Gene Expression

Gene expression is the process by which information from a gene is used in the synthesis of a functional gene product. These products are often proteins, via two main steps Transcription and translation, but in non-protein coding genes such as transfer RNA (tRNA) or small nuclear RNA (snRNA) genes, the product is a functional RNA.

RNA Transcription

In process called (transcription). The information in DNA can be transcribed into RNA and this information, then, translated into protein (translation). When the gene expression occur the DNA is transcribed to produce a single-stranded molecule of mRNA. Then, the mRNA is translated into proteins.

Translation

The translation of genetic information from the 4-letter (A ,C ,G and T) of polynucleotides into the 20-amino acid of proteins is a complex process. The information in the sequence of a messenger RNA molecule is read out in groups of three nucleotides at a time: each triplet of nucleotides, or codon, specifies (codes for) a single amino acid in a corresponding protein.



Dr. Mohammed Abokour