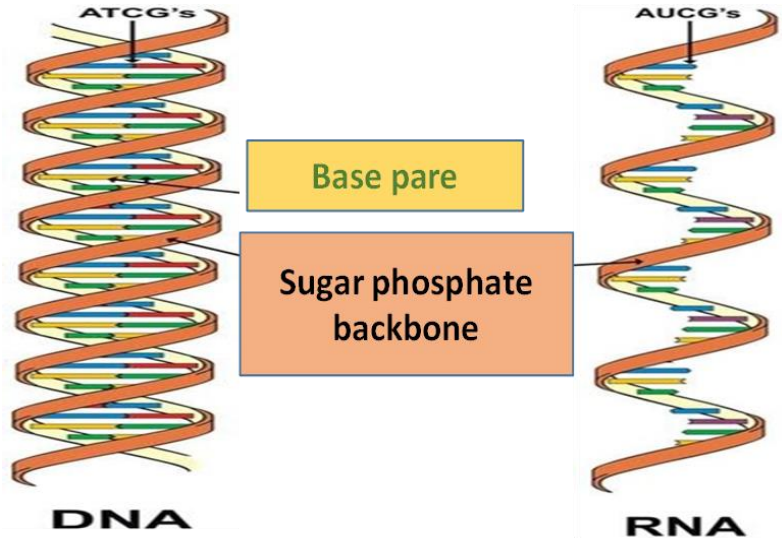
Nucleic acids

Nucleic acids are required for the storage and expression of genetic information. There are two chemically distinct types of nucleic acids: deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).



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Functions of Nucleic Acids:

1. Transmission of hereditary Characters (DNA)
2. Synthesis of Proteins (RNA)

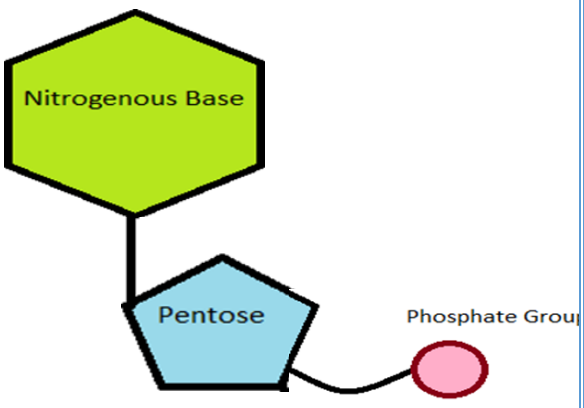
Nucleic acids structure

Nucleotides are the building blocks of all nucleic acids. Nucleotides have a distinctive structure composed of three components bound together

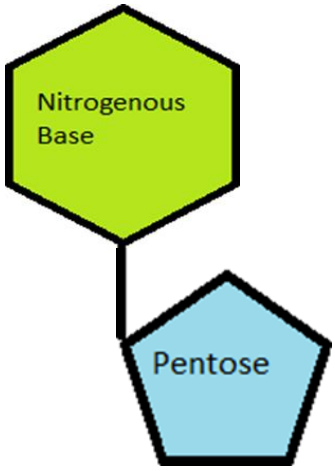
- a nitrogen-containing "base" - either a pyrimidine (one ring) or purine (two rings)
- a 5-carbon sugar - ribose or deoxyribose
- a phosphate group

Nucleotide Vs. Nucleoside

Nitrogenous base + Sugar + Phosphate= Nucleotide



Nitrogenous base + Sugar = Nucleoside



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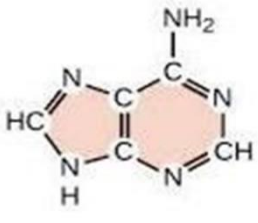
Types of nitrogen base in nucleic acids

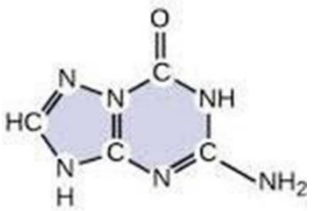
A nitrogenous base is an organic molecule with a nitrogen atom. The main biological function of a nitrogenous base is to bond nucleic acids together. There are two kinds of nitrogen-containing bases - purines and pyrimidines.

Purines consist of a six-membered and a five-membered nitrogen-containing ring, fused together. **Pyrimidines** have only a six-membered nitrogen-containing ring

1. Purines

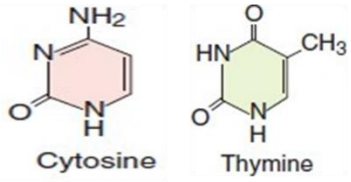


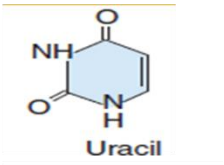
adenine



guanine

2. Pyrimidines

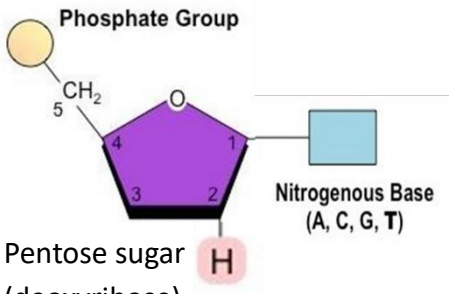




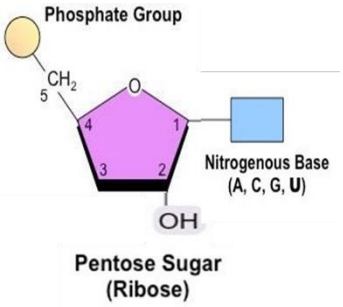
DNA **RNA**

Instead of thymine

Type of sugar and nitrogen bases in DNA & RNA



DNA Nucleotide



RNA Nucleotide

Biomedical importance of nucleotide:-

1. Storage and transfer of energy (ATP & GTP)
2. Precursors of nucleic acid DNA & RNA
3. Storage & transfer of genetic information (DNA & RNA)
4. Components of important co-enzyme (NAD, FAD, co-enzyme A)
5. Metabolic regulator such as cAMP

Nucleic acids

DNA

- DNA is a polymer of deoxyribonucleoside monophosphates (dNMP) covalently linked by (3-5)-phosphodiester bonds. With the exception of a few viruses that contain single-stranded DNA (ssDNA), DNA exists as a double-stranded molecule (dsDNA), in which the two strands wind around each other, forming a double helix.
- Is found in the nucleus with small amounts in mitochondria and chloroplast.

RNA

- RNA like DNA, is a long, unbranched macromolecule
- RNA is found throughout the cell.
- Single strand, consisting of nucleotide joined by 3 ⟶ 5 phosphodiester bond.

Types of RNA and their functions

Messenger RNA	Transfers genetics information from gene to ribosomes to synthesize protein.
Transfer RNA	Transfer amino acids to mRNA for protein synthesis.
Ribosomal RNA	Provides structural framework for ribosomes

DNA	RNA
It usually occurs inside nucleus and some cell organelles.	Found in the cytoplasm.
Is the genetic material.	Is not the genetic material except in certain viruses.
It is double stranded with the exception of some viruses	Is single stranded with the exception of some viruses.(double stranded in Reovirus).
Is of only two types:- intra nuclear and extra nuclear.	There are three types of RNA:- mRNA, tRNA , rRNA
It contains deoxyribose sugar.	It contains ribose sugar
Nitrogen base in DNA includes – adenine , cytosine , guanine and thymine	Thymine is replaced by uracil in RNA , the other three are similar – adenine , cytosine and guanine.
It is long lived	Some RNA are very short lived while others have somewhat longer life.
Its quantity is fixed for cell	The quantity of RNA of a cell is variable.