Atomic Energy Central School, Indore

Class XII Chemistry BIOMOLECULES Handout 3/3

Nucleic Acids

Nucleus of a living cell is responsible for this transmission of inherent characters, also called **heredity**. The particles in nucleus of the cell, responsible for heredity, are called chromosomes which are made up of proteins and another type of biomolecules called **nucleic acids.**

Two types of nucleic acids: deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).

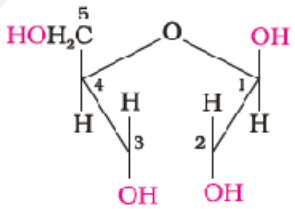
Chemical Composition of Nucleic Acids

Complete hydrolysis of DNA or RNA give a mixture of three different compounds:

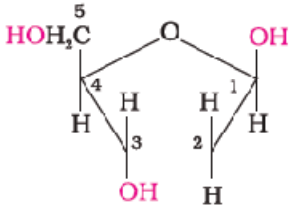
(i) A pentose sugar
(ii) Nitrogen containing heterocyclic compound(nitrogenous base)
(iii) Phosphoric acid

Sugars

DNA contains β-D-2 deoxy ribose and RNA contains β-D ribose.



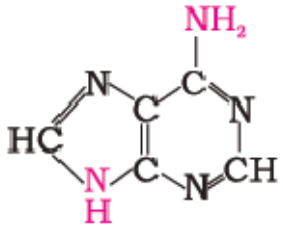
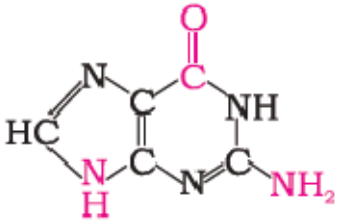
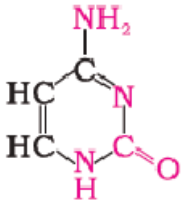
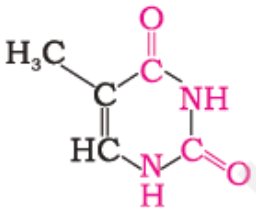
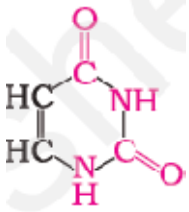
β–D–ribose



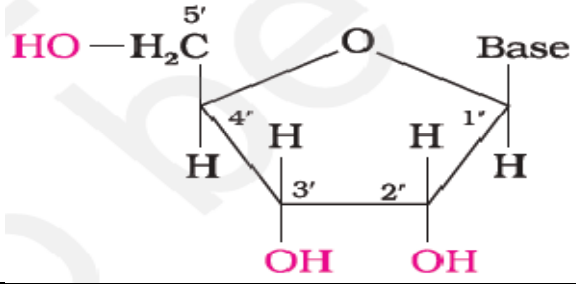
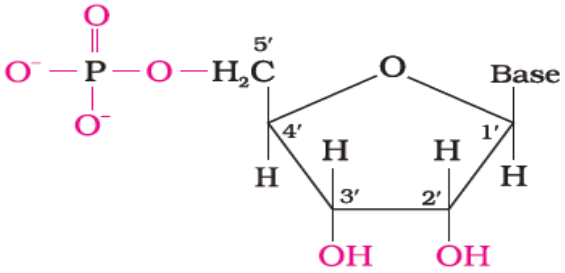
β–D–2–deoxyribose

Bases

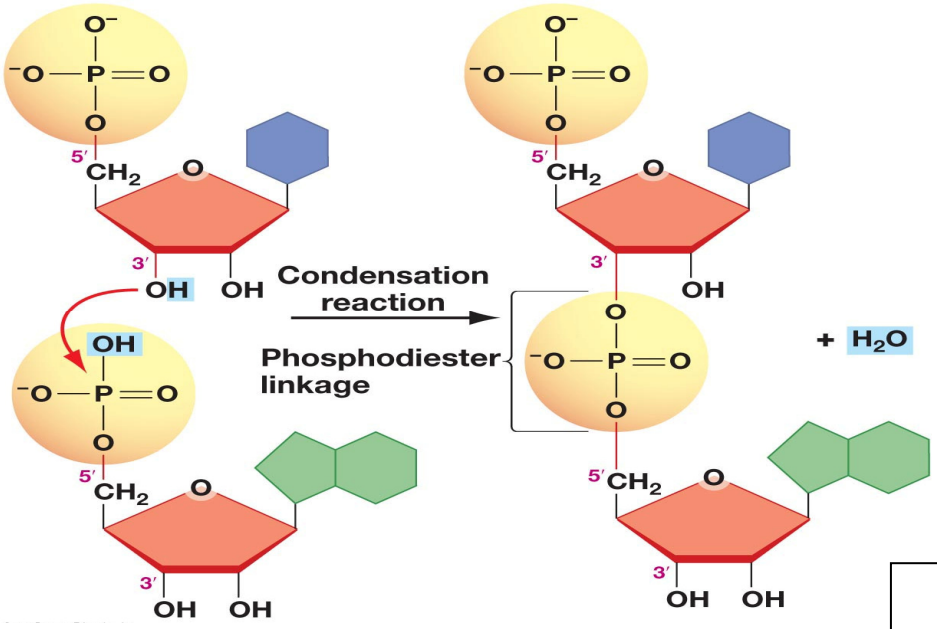
There are two different classes of nitrogenous bases.

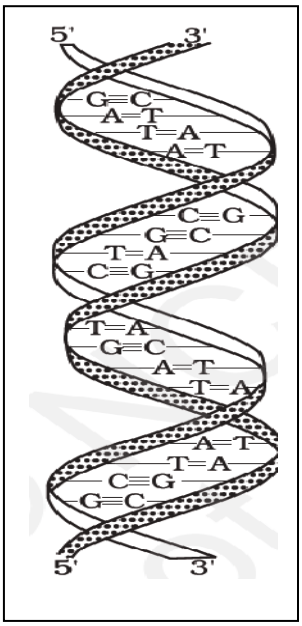
i) Purines	ii) Pyrimidines
 Adenine (A)  Guanine (G)	 Cytosine (C)  Thymine (T)  Uracil (U)

Structure of Nucleic Acids

Nucleoside	Nucleotide
A unit formed by the attachment of a base to 1′ position of sugar is known as **nucleoside**.	When nucleoside is linked to phosphoric acid at 5'-position of sugar moiety, we get a **nucleotide.** Nucleotides are joined together by phosphodiester linkage between 5' and 3' carbon atoms of the pentose sugar.
	

Formation of a dinucleotide through a Phosphdiester bond





James Watson and Francis Crick double strand helix structure for DNA→

1. Two nucleic acid chains are wound about each other and held together by hydrogen bonds between pairs of bases.
2. The two strands are complementary to each other because the hydrogen bonds are formed between specific pairs of bases.
3. Adenine forms 2 hydrogen bonds with thymine whereas cytosine forms 3 hydrogen bonds with guanine.

RNA – Ribonucleic Acid

- Single stranded helix
- Contains ribose sugar (not deoxyribose)
- Uracil replaces thymine
- 3 types of RNA
  1. mRNA (messenger RNA)
  2. rRNA (ribosomal RNA)
  3. tRNA (transfer RNA)

Biological Functions of Nucleic Acids:

1. DNA is the chemical basis of heredity and may be regarded as the reserve of genetic information. DNA is exclusively responsible for maintaining the identity of different species of organisms over millions of years.
2. Replication: A DNA molecule is capable of self duplication during cell division and identical DNA strands are transferred to daughter cells.
3. Protein synthesis: the proteins are synthesised by various RNA molecules in the cell but the message for the synthesis of a particular protein is present in DNA.

DNA Fingerprinting

It is known that every individual has unique fingerprints. These occur at the tips of the fingers and have been used for identification for a long time but these can be altered by surgery. A sequence of bases on DNA is also unique for a person and information regarding this is called DNA fingerprinting. It is same for every cell and cannot be altered by any known treatment. DNA fingerprinting is now used

(i) in forensic laboratories for identification of criminals.
(ii) to determine paternity of an individual.
(iii) to identify the dead bodies in any accident by comparing the DNA's of parents or children.
(iv) to identify racial groups to rewrite biological evolution.

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