Nucleotides are fundamental building blocks of nucleic acids, which include DNA (deoxyribonucleic acid) and RNA (ribonucleic acid). Here are some important notes about nucleotides:

Definition:

Nucleotides are organic molecules that serve as the monomers, or building blocks, of nucleic acids.

Each nucleotide consists of three main components: a nitrogenous base, a pentose sugar, and a phosphate group.

Components of Nucleotides:

Nitrogenous Base: There are two types of nitrogenous bases: purines (adenine and guanine) and pyrimidines (cytosine, thymine in DNA, and uracil in RNA).

Pentose Sugar: The pentose sugar in DNA is deoxyribose, while in RNA, it is ribose.

Phosphate Group: Nucleotides contain one or more phosphate groups.

Formation of Nucleic Acids:

Nucleotides link together through phosphodiester bonds to form polynucleotide chains.

The sugar-phosphate backbone of the nucleic acid chain is formed by the alternating arrangement of sugar and phosphate groups.

Types of Nucleotides:

In DNA, the four types of nucleotides are composed of adenine (A), thymine (T), cytosine (C), and guanine (G).

In RNA, thymine is replaced by uracil (U), so the four types of nucleotides are adenine (A), uracil (U), cytosine (C), and guanine (G).

Role in Genetic Information:

Nucleotides encode genetic information in the sequence of their bases.

The order of nucleotides in DNA and RNA determines the genetic code, which directs the synthesis of proteins and carries genetic instructions.

ATP (Adenosine Triphosphate):

ATP is a nucleotide that plays a crucial role in cellular energy transfer.

It consists of the nitrogenous base adenine, the sugar ribose, and three phosphate groups.

ATP stores and releases energy during cellular processes like metabolism.

cAMP (Cyclic Adenosine Monophosphate):

cAMP is a derivative of ATP and functions as a second messenger in cellular signaling.

It is involved in the regulation of various cellular processes, including metabolism and gene expression.

Nucleotide Coenzymes:

Nucleotides also serve as coenzymes in various metabolic reactions.

Examples include NAD+ (nicotinamide adenine dinucleotide) and FAD (flavin adenine dinucleotide), which play roles in redox reactions.

Hydrogen Bonding in DNA:

The complementary base pairing in DNA involves hydrogen bonds: adenine pairs with thymine, and guanine pairs with cytosine.

This base-pairing specificity is crucial for the accurate replication and transmission of genetic information.