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Perspective

Structure and Functions of Nucleic Acid

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DESCRIPTION

Nucleic acids are naturally occurring chemical compounds that serve as the primary information carrying molecules in cells. They play a crucial role in controlling protein synthesis. These are of 2 types, namely Deoxyribonucleic Acid (DNA) and Ribonucleic Acid (RNA). It is possible to decompose the naturally occurring chemical molecule nucleic acid to produce phosphoric acid, sugars, and a variety of organic bases (purines and pyrimidines). They are responsible to control the synthesis of proteins. Nucleic acids determine the inherited traits of every living creature.

All organisms and the majority of viruses have genetic material made up of DNA, which is the ultimate life plan. RNA is the genetic material of certain viruses, but it is also present in all living cells and is crucial to many biological activities.

Deoxyribonucleic Acid (DNA)

Deoxyribonucleic Acid (DNA) is a polymer made of two polynucleotide chains that coil around one another to form a double helix structure. It contains the genetic material which is necessary to develop, function, grow, and reproduce in all creatures. The DNA of an individual may be found in almost each and every cell.

Cellular organelles called mitochondria transform food-derived energy into a form that can be utilized by cells. The majority of DNA is found in the cell nucleus (where it is known as nuclear DNA), and small fraction of DNA is observed in mitochondria (where it is called mitochondrial DNA or mtDNA).

Adenine (A), Guanine (G), Cytosine (C), and Thymine (C) are the four chemical bases that make up the code that stores the information in DNA. More than 99 percent of the 3 billion bases that make up human DNA are the same in every person.

Ribonucleic acid (RNA)

RNA is a single-stranded polymer which has the similarities of DNA. Unlike DNA, it contains the sugar ribose. It plays various biological roles in coding, decoding, expression and regulation of genes.

In addition, phosphoric acid, pentose sugar, and a few nitrogen-containing cyclic bases make up the RNA molecule. The sugar moiety of RNA is D-ribose. RNA has the heterocyclic bases Adenine (A), Guanine (G), Cytosine (C), and Uracil (U). The RNA can occasionally fold back to form a double helix. There are three different categories of RNA molecules such as messenger RNA (mRNA), Ribosomal RNA (rRNA) which serves as the building block for protein synthesis and Transfer RNA (tRNA) which transports the amino acids.

It contains basic nitrogen compounds, sugar moiety and phosphate groups.

Nucleic acids contain purine bases, which are heterocyclic substances made up of a fused pyrimidine ring and imidazole ring. These include:

Adenine: It is a white crystalline purine base with a molecular weight of 135.15 Daltons and a melting point of 360°C to 365°C and is a building block of both RNA and DNA. In DNA, it pairs with thymine whereas in RNA pairs with uracil.

Guanine: It is a colorless, crystalline substance with a molecular weight of 151.15 Daltons which is present in DNA and RNA. Cytosine pairs with guanine in both DNA and RNA.

Pyrimidines: Two nitrogen atoms make up the six-membered ring that makes up pyrimidine bases. These include:

Cytosine: It is à white crystalline compound with a molecular weight of 111.12 Daltons and a melting point of 320-325°C, is present in both RNA and DNA.

Thymine: Thymine is found in only in DNA molecules. It has a molecular weight of 126.13 Daltons. It helps in stabilizing the nucleic acid structures.

Uracil: It is a white, crystalline pyrimidine base with a molecular weight of 112.10 Daltons and a melting point of 338°C. It is present in RNA.

In DNA and RNA, the sugar moiety present is pentose. In the nucleic acid, these are of two, namely glucose and deoxyribose. Glucose is present in RNA whereas deoxyribose is present in DNA.

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Received: 01-Jun-2022, Manuscript No. TOA-22-18457; **Editor assigned:** 03-Jun-2022, Pre QC No. TOA-22-18457 (PQ); **Reviewed:** 17-Jun-2022, QC No. TOA-22-18457; **Revised:** 27-Jun-2022, Manuscript No. TOA-22-18457 (R); **Published:** 04-Jul-2022, DOI: 10.35248/2329-8936.22.8.115

Citation: Jarosz DF (2022) Structure and Functions of Nucleic Acid. Transcriptomics. 8:115.

Phosphate is one of the basic elements of nucleic acids. It has the monovalent hydroxyl groups and one divalent oxygen atom which are joined to the pentavalent phosphorus atom. With the phosphate esterified to the 5'-carbon, the base is covalently linked (at N1 for pyrimidines and N9 for purines). By removing water-related components, the N-glycosyl bond is created (hydroxyl groups from pentose and hydrogen atoms from the base).

The transmission of inherited traits from parents to children is mediated by nucleic acids. In our body, they produce proteins. Forensic professionals can establish paternity *via* DNA fingerprinting. Furthermore, it is employed to identify criminals.

CONCLUSION

Nucleic acid plays a pivotal role in transmission of genetic information. Deoxyribonucleic acid and ribonucleic acid are the two primary constituents of nucleic acid. DNA is important in various processes of cell life. Replication, transcription and regulation of expression of many genes depend on local changes in DNA structure. RNA is a single stranded structure. It may leads to mutations also. mRNA, tRNA and rRNA are different types of RNA. RNA mainly involves in the regulation of gene expression.