

Structure of Nucleic Acids - RNA

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Structure of RNA

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bio_nucleic acid1 Nucleic acids are biological macromolecules present in all living organisms.

These biological [molecules](#) are essential for life, and include [DNA](#) (deoxyribonucleic acid) and [RNA](#) (ribonucleic acid).

These are responsible for the storage and transfer of genetic information from generation to generation.

Ribonucleic acid (RNA)

Occurrence:

RNA is present in all organisms-prokaryotes, eukaryotes, viruses and virioids. In some viruses, it is the genetic material.

Chemical composition

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bio_nucleic acid2 RNA is a polynucleotide chain with 5' phosphate and 3'-OH polarity. This polynucleotide chain is made up of repeating sequence of monomeric nucleotides arranged in a linear polynucleotide chain. Each monomeric nucleotide is made up of components.

- 1) A five carbon (pentose) sugar-ribose sugar
- 2) A phosphoric acid group
- 3) A nitrogenous base (either [purine or pyrimidine](#))

Purine bases are adenine and guanine. Pyrimidine bases are uracil and cytosine, The pyrimidine thymine is absent. The nucleotides are linked together by phosphor-diester bonds.

RNA molecule is single stranded. However, evidence indicates that there may be regions in the molecule where it folds back on itself to form helical segments held together by complementary base pairing i.e., A pairs with U by 2 hydrogen bonds and C pairs with G by 3 hydrogen bonds.

Types of RNA

There are two types of RNA namely genetic RNA and non-genetic RNA.

Genetic RNA

The RNA in some viruses carries hereditary characters from generation to generation. It is called 'genetic RNA' (genetic material). In these viruses, DNA is completely absent.

Examples: [TMV](#), poliomyelitis, Rous sarcoma virus (RSV), influenza, HIV, reovirus.

Function: It has the information in it for functions like reproduction and structural organization.

Non genetic RNA

The non genetic RNA is ribosomal RNA (rRNA) and transfer RNA (tRNA). These are involved in protein synthesis.

Ribosomal RNA (rRNA)

The major portion (80%) of the total RNA of the cell is ribosomal RNA, present in the ribosomes which are the sites of protein synthesis. The prokaryotic ribosome's contain 3 types of rRNA, i.e. 5S, 16S and 23S. The eukaryotic ribosome's contain 4 types of rRNA, i.e., 5S, 5.8S, 18S and 28S. rRNA is highly twisted or coiled containing 120 to 4500 nucleotides and the length is variable. It has a long life span.

Functions

1. rRNA maintains the structural integrity of the ribosome's.
2. Some rRNAs possess catalytic activity. They are called [ribosome's](#).
3. rRNA helps in binding ribosome to mRNA during protein synthesis or rRNA binds to mRNA during protein synthesis.

Messenger RNA (mRNA)

mRNA was discovered by Volkin in E. coli. The name mRNA was coined by Jacob and Monod. It is the largest in size among all RNA types and accounts about 5% of RNA in the cell. It is a single stranded long linear molecule without base pairing. It has an average of 900-1500 nucleotides. Most mRNAs have a very short life. mRNA contains codons (A codon is a set of three nucleotides which specify a particular amino acid). The sequence of codons on mRNA determines the sequence of amino acids in a protein molecule.

Function: It acts as a messenger to carry the genetic information from DNA to the cytoplasmic sites of protein synthesis, namely the ribosome. Hence the name messenger RNA.

Transfer RNA (tRNA)

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Robert W.Holley and colleagues in 1965 proposed “[clover leaf model](#)” to describe the two

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dimensional structure of a tRNA molecule. Holley shared the 1968 Nobel Prize in Physiology and medicine for this work.

tRNA constitutes 15% of RNA in the cell. It is the smallest nucleic acid with approximately 75-85 nucleotides. Its life span is short.

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Function: tRNAs carry amino acids from amino acid pool to the sites of protein synthesis

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and recognize the codons of the mRNA.

What is the difference between a DNA and the RNA?

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Reference Links:

- http://en.wikipedia.org/wiki/Nucleic_acid
- <http://en.wikipedia.org/wiki/RNA>
- <http://en.wikipedia.org/wiki/DNA>
- http://en.wikipedia.org/wiki/Nucleic_acid_structure
- <http://www.youtube.com/watch?v=qy8dk5iS1f0>

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