

# What is RNA?

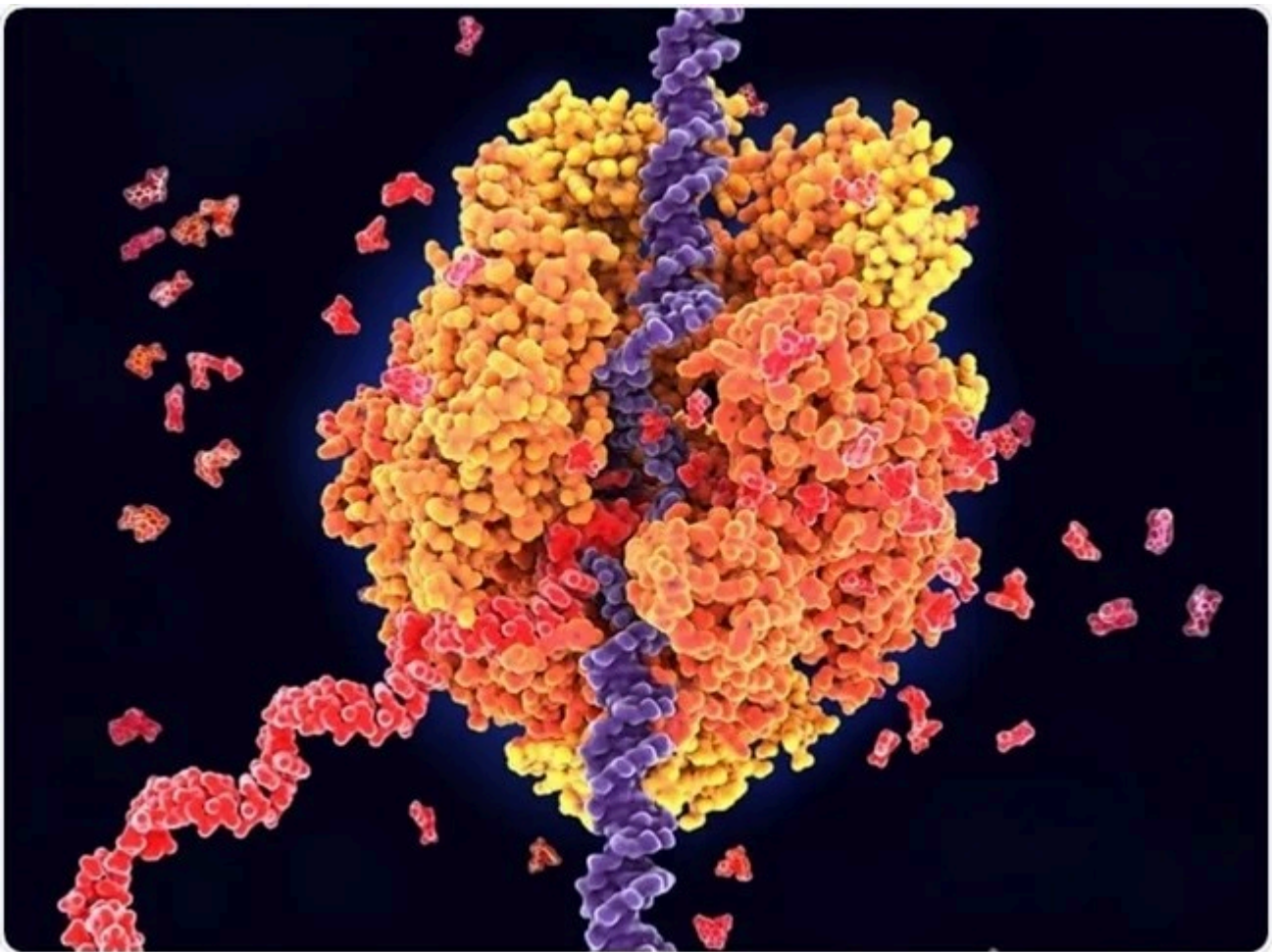


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**Ribonucleic acid (RNA) is an important biological macromolecule that is present in all biological cells.**

It is principally involved in the synthesis of proteins, carrying the messenger instructions from DNA, which itself contains the genetic instructions required for the development and maintenance of life. In some viruses, RNA, rather than DNA, carries genetic information.



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## RNA vs DNA

There are two distinct types of nucleic acid: DNA and RNA. The nucleic acid of

DNA is deoxyribose, whereas the nucleic acid of RNA is ribose. As demonstrated by their names, the deoxyribose of DNA lacks one oxygen molecule as compared to the ribose sugar of RNA. The nucleotides that comprise DNA include adenine (A), guanine (G), cytosine (C) and thymine (T), whereas RNA nucleotides include A, G, C and uracil (U).

While the structure of DNA is a double-helix in eukaryotic cells, RNA is typically single-stranded and comes in various forms. The single-stranded structure of RNA allows this molecule to fold back on itself and form various stable secondary structures as necessary.

## **Types of RNA and their roles**

The type of RNA dictates the function that this molecule will have within the cell. Aside from the coding region of messenger RNA (mRNA) molecules that will be translated into proteins, other cellular RNA elements are involved in different processes, which include transcriptional and post-transcriptional regulation of genetic material, temperature and ligand sensing, translation control and RNA turnover.

## **Transcription (DNA to mRNA)**

Since DNA cannot leave the nucleus, it is unable to generate a protein on its own. The generation of proteins from their DNA coding sequence begins with a process called transcription. During transcription, several enzymes, including helicase and topoisomerase, unwind DNA to provide access to another enzyme known as RNA polymerase. RNA polymerase travels along the unwound DNA strand to construct the mRNA molecule until it is ready to leave the nucleus.

## **Translation (mRNA to protein)**

Once mRNA exits the nucleus and enters the cytoplasm of the cell, it will find a ribosome so that the process of translation can begin. A pair of three nucleotide bases of the mRNA molecule is referred to as a codon, and each codon is specific for only one amino acid.

During translation, transfer RNA (tRNA) molecules, which are attached to a particular amino acid, will recognize a codon on the mRNA molecule and insert the appropriate amino acid at that location within the strand. For example, the codon CUC will generate the amino acid leucine, whereas the codon UGA is one type of stop codon that indicates the translation of the gene has been