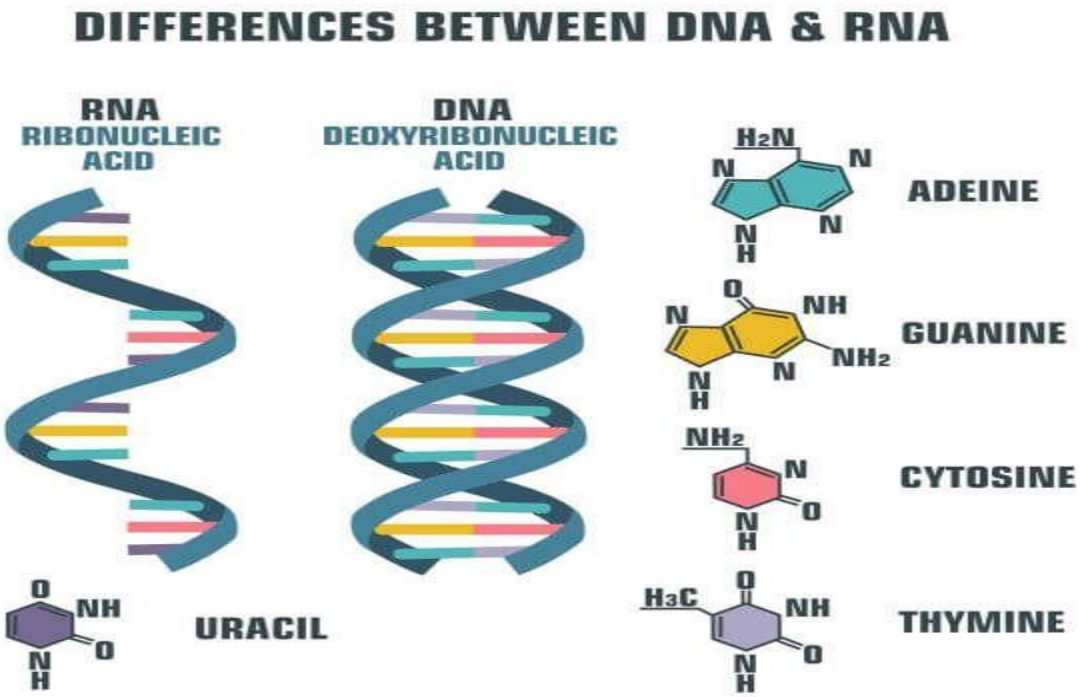
DNA and RNA

DNA and RNA are both types of ***nucleic acids,*** large molecules that are made up of monomers called nucleotides. Nucleic acids are used to store genetic information, which the cell uses to make proteins. Although DNA and RNA share many similarities, there are several key structural and functional differences between these two molecules.



DNA vs. RNA

What Are Nucleic Acids?

DNA and RNA are both types of ***nucleic acids,*** which are large molecules found in all living cells and viruses.

Nucleic acids are the information-carrying molecules of the cell. They store all the genetic material of an organism, which is passed on to offspring (inherited) when the organism reproduces. They also play important roles in essential cellular processes, such as cell division and protein synthesis.

What is DNA?

DNA stands for ***deoxyribonucleic acid.*** It is the ***information molecule*** and stores all the genetic material of a cell. It also contains instructions for the synthesis of other molecules, like ***proteins.***

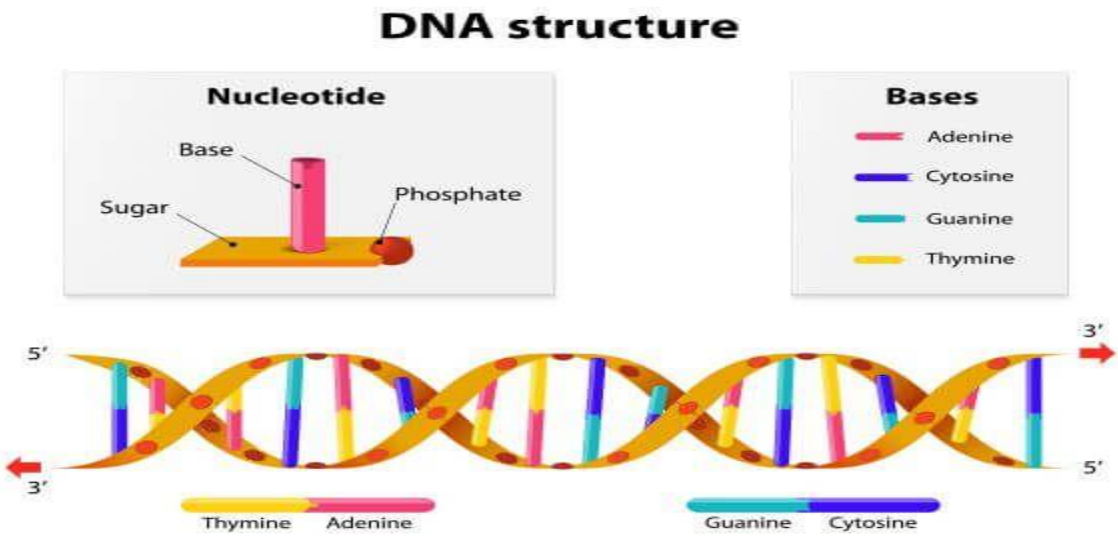
DNA is a ***polymer*** and is made of many smaller molecules (AKA ***monomers***) called ***nucleotides.*** Each nucleotide contains a phosphate group, a 5-carbon sugar, and a nitrogenous base. The four types of nitrogenous bases in DNA molecules are:

- Adenine
- Thymine
- Guanine
- Cytosine

The type of nitrogenous base determines the type of nucleotide. The four types of nucleotide are:

- A nucleotide (containing ***adenine***)
- T nucleotide (containing ***thymine***)
- G nucleotide (containing ***guanine***)

- C nucleotide (containing ***cytosine***)

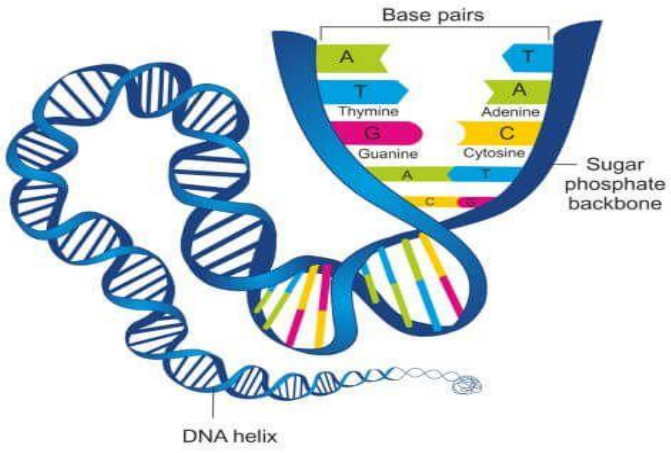


DNA nucleotides

The sequence of nucleotides in a DNA molecule determines the instructions contained in that stretch of DNA. Nucleotides are joined together by ***phosphodiester bonds,*** which form between the 3′ carbon atom of one nucleotide and the 5′ carbon atom of another.

A string of nucleotides all joined together makes a ***DNA strand.*** Each DNA molecule contains two strands, which are twisted around one another to form a structure called the ***double helix.*** The nucleotides that make up each DNA strand are joined together by ***hydrogen bonds.*** These bonds form between specific nitrogenous bases, known as ***base pairs.*** The base pairs in DNA molecules are:

- Adenine (A) – Thymine (T)
- Cytosine (C) – Guanine (G)



Base pairs in DNA

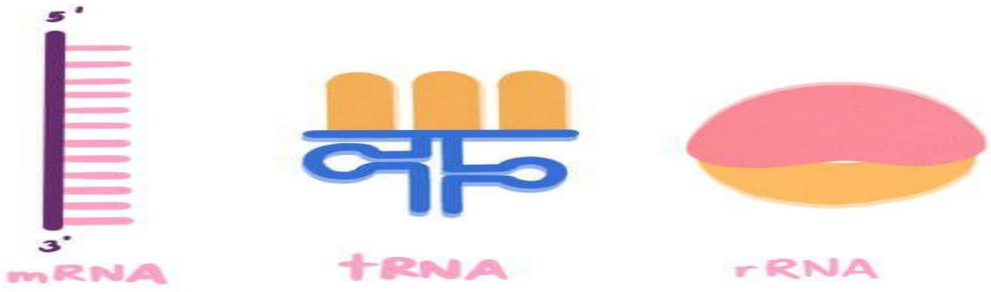
What is RNA?

RNA stands for ***ribonucleic acid.*** Its function is to carry out the instructions encoded in DNA. There are three types of RNA, each with a different function. These are:

Messenger RNA (mRNA) – mRNA carries information for protein synthesis from the DNA molecules in the nucleus to the ***ribosomes***

Ribosomal RNA (rRNA) – rRNA is a structural component of ***ribosomes*** (the organelles that perform protein synthesis)

Transfer RNA (tRNA) – tRNA transfers amino acids to the ribosome. These amino acids are used to assemble a new ***polypeptide chain***



Different types of RNA

RNA is made up of ***ribonucleotides,*** each containing a phosphate group, a 5-carbon sugar, and a nucleotide base. The four types of nitrogenous base found in RNA molecules are:

- Adenine
- Uracil
- Guanine
- Cytosine

Therefore, the four types of RNA nucleotide are:

- A nucleotide (containing ***adenine***)
- U nucleotide (containing ***uracil***)
- G nucleotide (containing ***guanine***)
- C nucleotide (containing ***cytosine***)

Like in DNA molecules, these ribonucleotides are joined together by ***phosphodiester bonds*** that form between the 3′ carbon of one sugar and the 5′ carbon of another. Unlike DNA, RNA is a single-stranded molecule; however, it can still form double-stranded structures.

The ***base pairs*** in RNA molecules are:

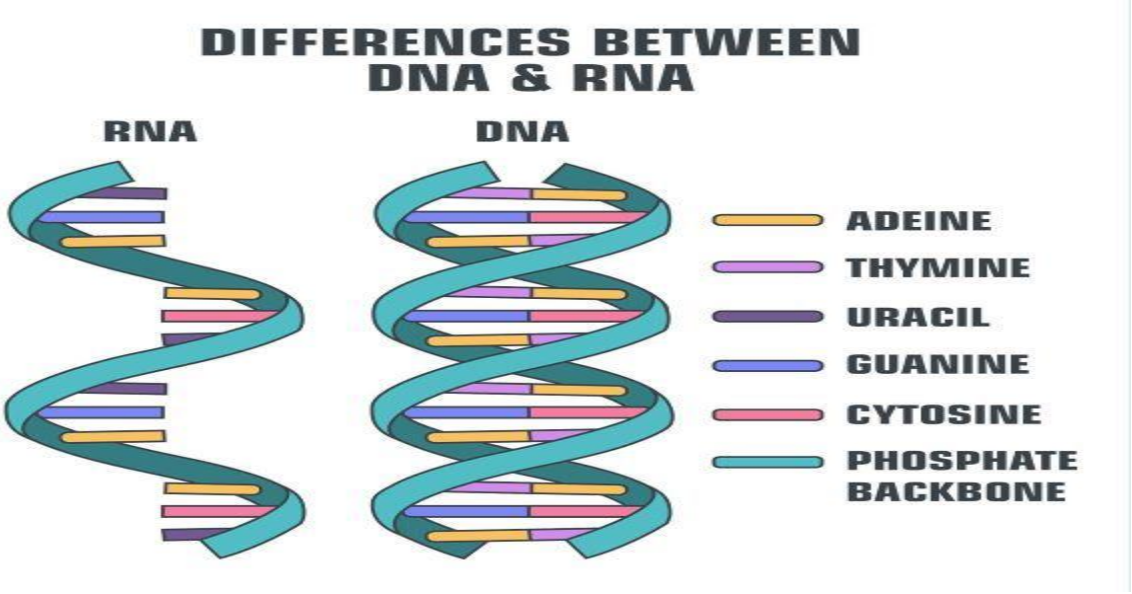
- Adenine (A) – Uracil (U)
- Cytosine (C) – Guanine (G)

DNA vs. RNA

DNA	RNA
Stores genetic information for the cell	Uses the information stored in DNA to make proteins
Contains the 5-carbon sugar deoxyribose	Contains the 5-carbon sugar ribose
Double-stranded	Single-stranded
Contains thymine	Contains uracil
Self-replicating	Synthesised by transcription

Similarities Between DNA and RNA Molecules

DNA and RNA are both types of nucleic acid, and there are several similarities between the two.



DNA vs. RNA

Nucleotides and Ribonucleotides

The nucleotides of DNA and the ribonucleotides that make up RNA are very similar in structure. Both contain a phosphate group, a 5-carbon sugar, and a nitrogenous base.

Phosphodiester Bonds

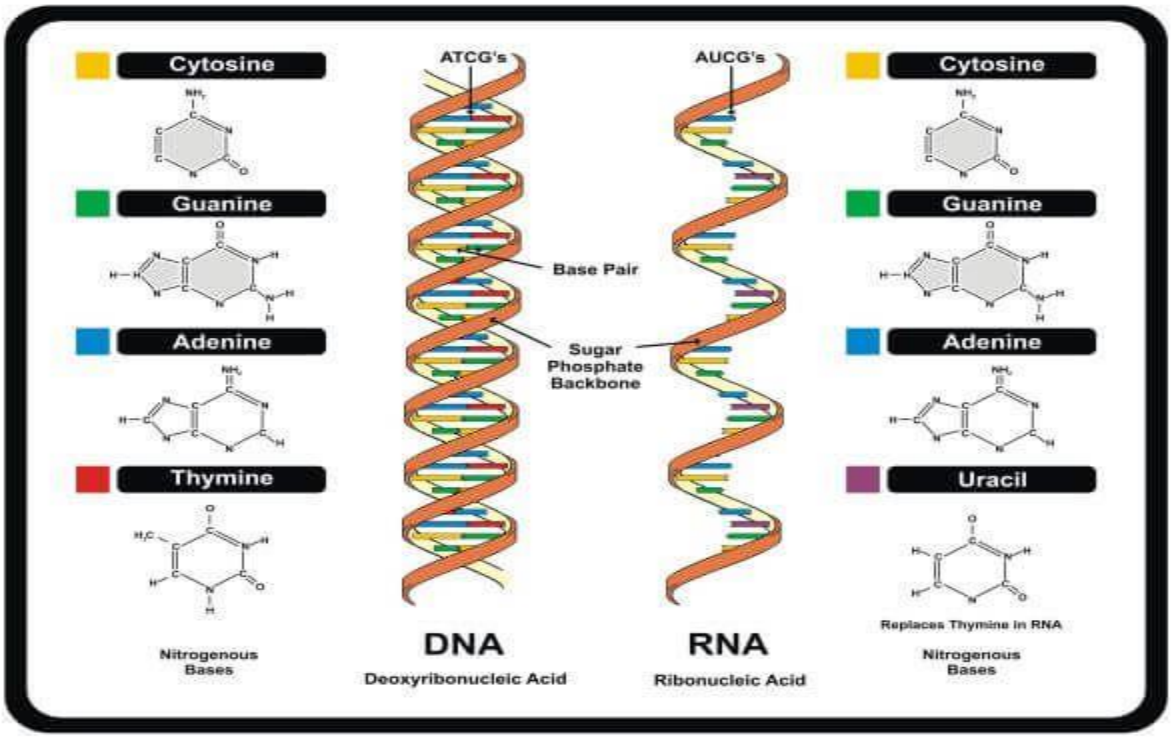
In both DNA and RNA molecules, monomers are joined together by ***phosphodiester bonds*** that form between the 3′ carbon of one molecule and the 5′ carbon of the next.

Number of Nitrogenous Bases

DNA and RNA molecules both contain four nitrogenous bases. Three of these (adenine, cytosine, and guanine) are found in both types of nucleic acid.

Sugar-Phosphate Backbone

Both DNA and RNA molecules are made up of a ***sugar-phosphate backbone*** with nucleotide bases sticking out.



DNA vs. RNA structure

Differences between DNA and RNA Molecules

There are also several differences between DNA and RNA molecules. These are:

Type of Sugar

The 5-carbon sugar found in DNA is ***deoxyribose,*** whereas RNA contains the sugar ***ribose.***

Nitrogenous Bases

DNA contains the bases cytosine, guanine, adenine, and ***thymine,*** whereas RNA contains cytosine, guanine, adenine, and ***uracil.***

Base Pairing

Base pairing is slightly different in DNA and RNA molecules. The base pairs in DNA molecules are:

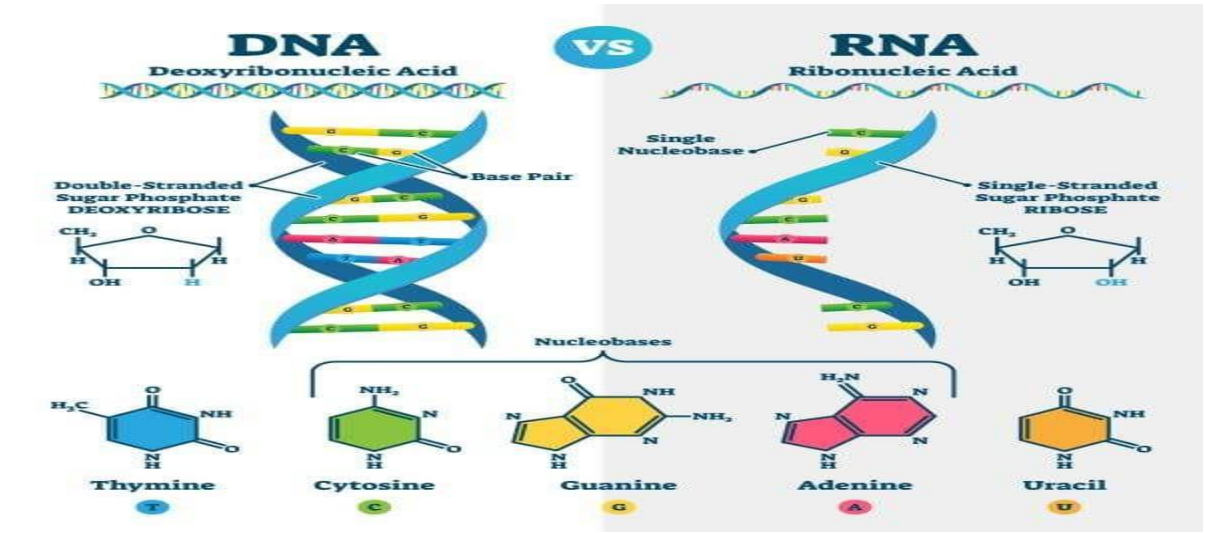
- Adenine (A) – Thymine (T)
- Cytosine (C) – Guanine (G)

Whereas the base pairs in RNA molecules are:

- Adenine (A) – Uracil (U)
- Cytosine (C) – Guanine (G)

Strand Number

DNA is a double-stranded molecule; RNA is a single-stranded molecule.



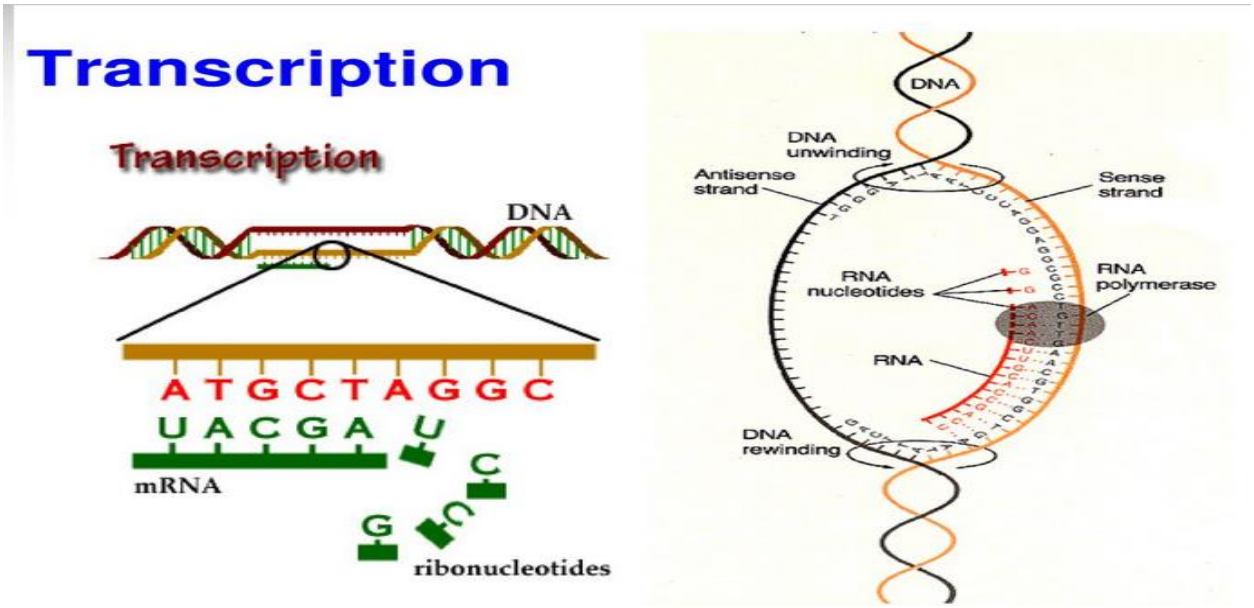
DNA vs. RNA

Function

DNA and RNA molecules have different functions. DNA stores genetic information for the cell, whereas RNA codes for amino acids and acts as a messenger between DNA molecules and the ribosomes.

Replication

DNA molecules are ***self-replicating,*** whereas RNA molecules are synthesized by a process called ***transcription.***



Genetic code : The sequence of bases in DNA forms. sequence of 5 different amino acids could determine the shape and identity of the molecule. Each amino acid (Serine, Cysteine, Valine, Glycine and Alanine) is coded for by a particular triplet of bases

Genes: A sequence of triplets in the DNA molecule may code for a complete protein