Al-Mustaqbal University
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Intelligent Medical Systems
Department

جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

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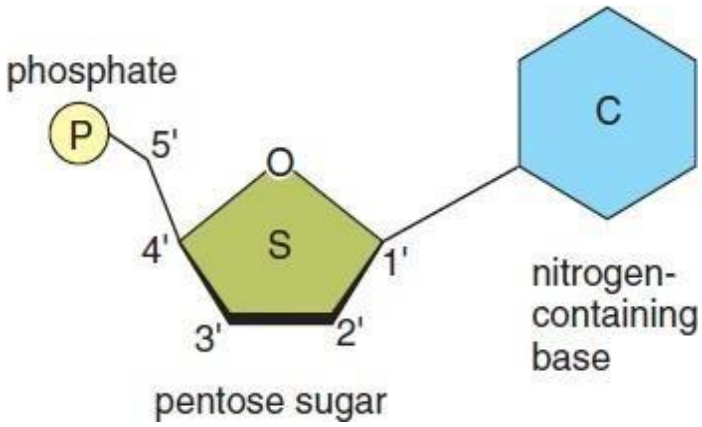
LECTURE: (3)

Subject: Molecular biology lab
Level: First
Lecturer: MSc. Sura Mohammed jasim

DNA

The two types of nucleic acids are **DNA (deoxyribonucleic acid)** and **RNA (ribonucleic acid).** Both DNA and RNA are polymers of nucleotides. Every **nucleotide** is a molecular complex of three types of subunit molecules—phosphate (phosphoric acid), a pentose sugar, and a nitrogen-containing base:



Genes: are pieces of deoxyribonucleic acid (DNA) that contain a code for a specific protein that works in one or more cell types in the body.

STRUCTURE OF NUCLIEC ACID (DNA AND RNA)

1- The nucleotides in DNA contain the sugar deoxyribose, and the nucleotides in RNA contain the sugar ribose.

2- There are four different types of bases in DNA: A _ **adenine,** T _ **thymine,** G _ **guanine,** and C _ **cytosine.** The base can have two rings (adenine or guanine) or one ring (thymine or cytosine).

3- In RNA,the base **uracil** replaces the base thymine.

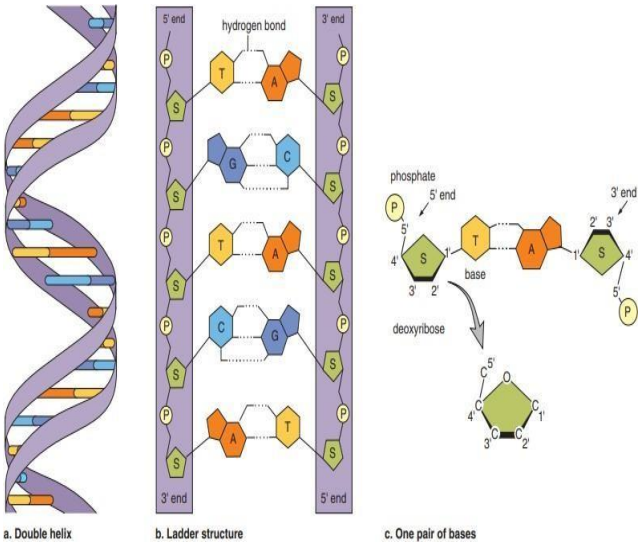
4- The nucleotides form a linear molecule called a strand, which has a backbone made up of phosphate-sugar phosphate- sugar, with the bases projecting to one side of the backbone.

5- DNA is double stranded, with the two strands twisted about each other in the form of a double helix. the two strands are held together by hydrogen bonds between the bases.

6- Thymine (T) always pairs with adenine (A), and guanine(G) always pairs with cytosine (C). Complementary bases have shapes that fit together.

7- The bases are purines with a double ring including (Adenine & Guanine) and pyrimidines with a single ring including (Thymine & Cytosine).

8- Complementary base pairing allows DNA to replicate in a way that ensures the sequence of bases will remain the same.



ATP (Adenosine Triphosphate)

1- When adenosine (adenine plus ribose) is modified by the addition of three phosphate groups instead of one, it becomes **ATP (adenosine triphosphate),** an energy carrier in cells.

2- the energy of glucose is converted to that of ATP molecules. ATP contains an amount of energy that makes it usable to supply energy for chemical reactions in cells.

3- ATP is a high-energy molecule because the last two phosphate bonds are unstable and easily broken.

4- Usually in cells, the terminal phosphate bond is hydrolyzed, leaving the molecule **ADP (adenosine diphosphate)** and a molecule of inorganic phosphate P.

5-The energy released by ATP breakdown is used by the cell to synthesize macromolecules such as carbohydrates and proteins.

RNA

Ribonucleic acid (**RNA**) is a polymeric molecule that is essential for most biological functions, either by performing the function itself (Non-coding RNA) or by forming a template for the production of proteins (messenger RNA). RNA and deoxyribonucleic acid (DNA) are nucleic acids. The nucleic acids constitute one of the four major macromolecules essential for all known forms of life

single strand of RNA

Types of 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:

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

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

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

Structures of RNA

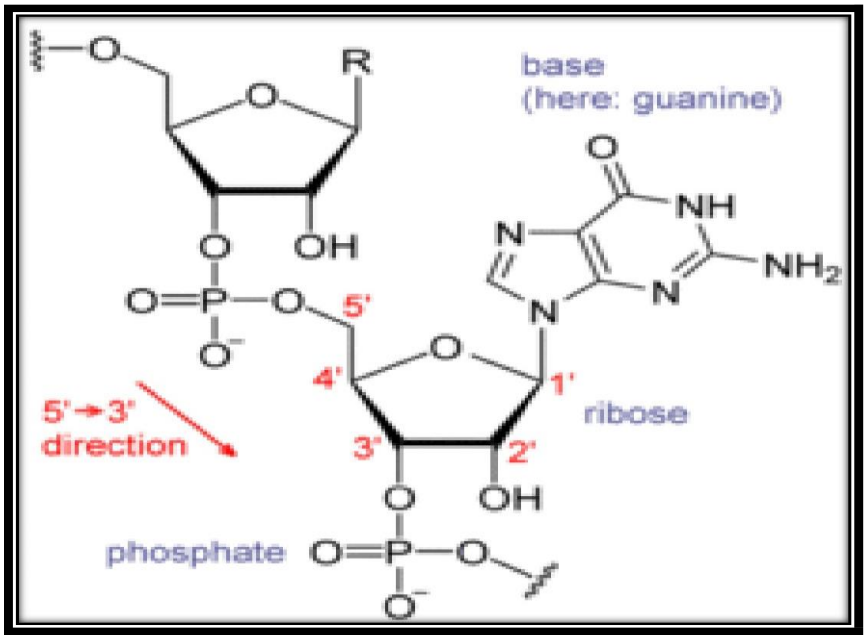
1_ Each nucleotide in RNA contains a ribose sugar, with carbons numbered 1' through 5'.

2_ in general, adenine (A), cytosine (C), guanine (G), or uracil (U). Adenine and guanine are purines, cytosine and uracil are pyrimidines. A phosphate group is attached to the 3' position of one ribose and the 5' position of the next.

3_ The phosphate groups have a negative charge each, making RNA a charged molecule (polyanion).

4_The bases form hydrogen bonds between cytosine and guanine, between adenine and uracil and between guanine and uracil.

5_An important structural component of RNA that distinguishes it from DNA is the presence of a hydroxyl group at the 2' position of the ribose sugar.



Structure of a fragment of an RNA

Comparision between DNA and 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