INTRODUCTION TO MOLECULAR BIOLOGY

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MOLECULAR BIOLOGY

- Definition
- Nucleic acids(DNA and RNA)
- Nucleotides
- Comparison between DNA and RNA

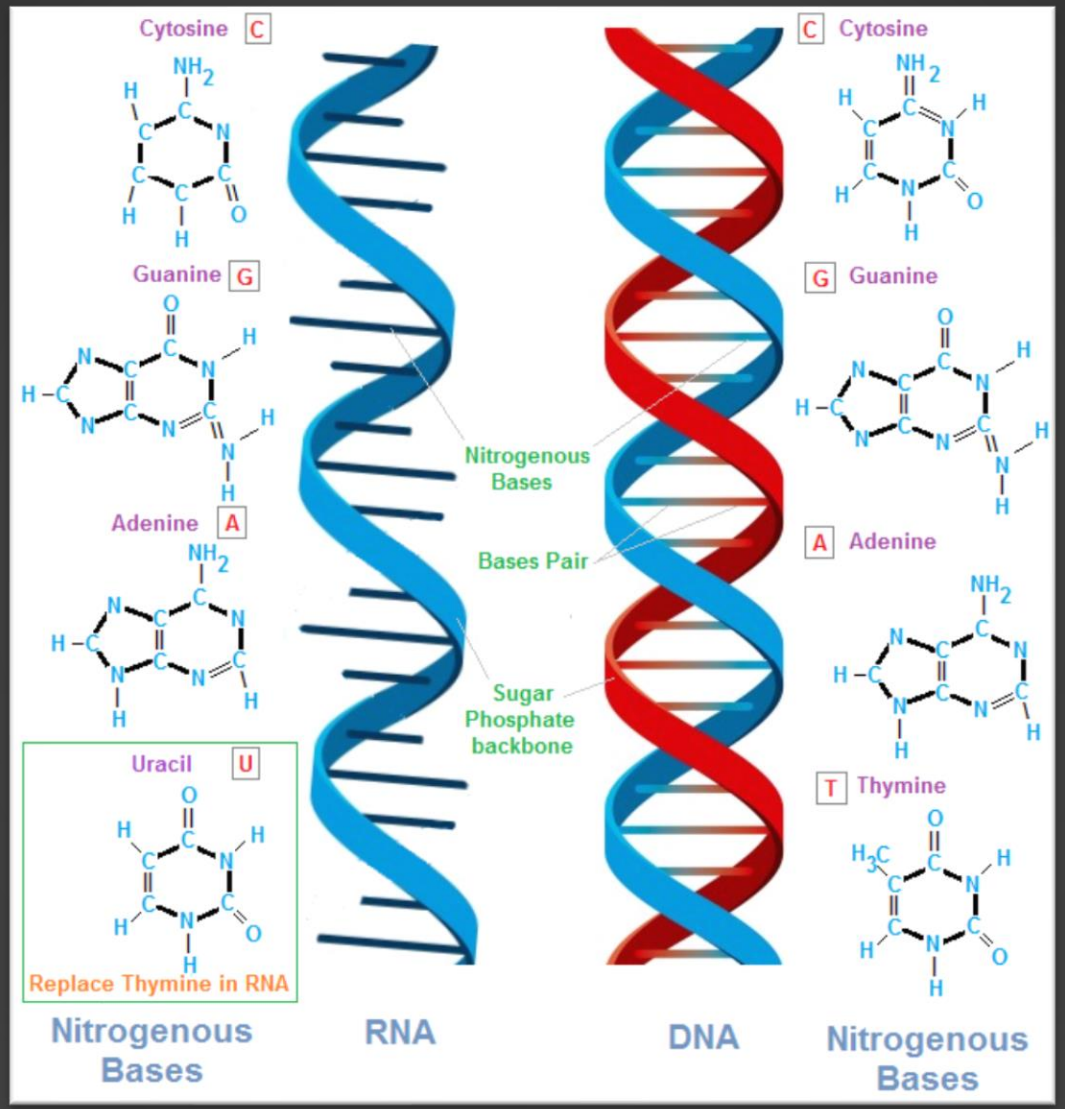
MOLECULAR BIOLOGY

- Molecular biology is the study of biology at a molecular level. The field overlaps with other areas of biology and chemistry, particularly genetics and biochemistry.

- Molecular biology chiefly concerns itself with understanding the interactions between the various systems of a cell, including the interrelationship of DNA, RNA and protein synthesis and learning how these interactions are regulated.

NUCLEIC ACID

- Nucleic acids, macromolecules made out of units called nucleotides, come in two naturally occurring varieties: deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
- DNA is the genetic material found in living organisms, all the way from single-celled bacteria to multicellular mammals.
- Some viruses use RNA, not DNA, as their genetic material, but aren't technically considered to be alive (since they cannot reproduce without help from a host).


Cytosine C
Guanine G
Adenine A
Uracil U
Replace Thymine in RNA
Nitrogenous Bases
Bases Pair
Sugar Phosphate backbone
RNA
DNA
C Cytosine
G Guanine
A Adenine
T Thymine
Nitrogenous Bases

DNA

- Deoxyribonucleic acid (DNA) is a nucleic acid that contains the genetic instructions for the development and function of living things.
- In eukaryotes, such as plants and animals, DNA is found in the nucleus, a specialized, membrane-bound vault in the cell, as well as in certain other types of organelles (such as mitochondria and the chloroplasts of plants).
- In prokaryotes, such as bacteria, the DNA is not enclosed in a membranous envelope, although it's located in a specialized cell region called the nucleoid.

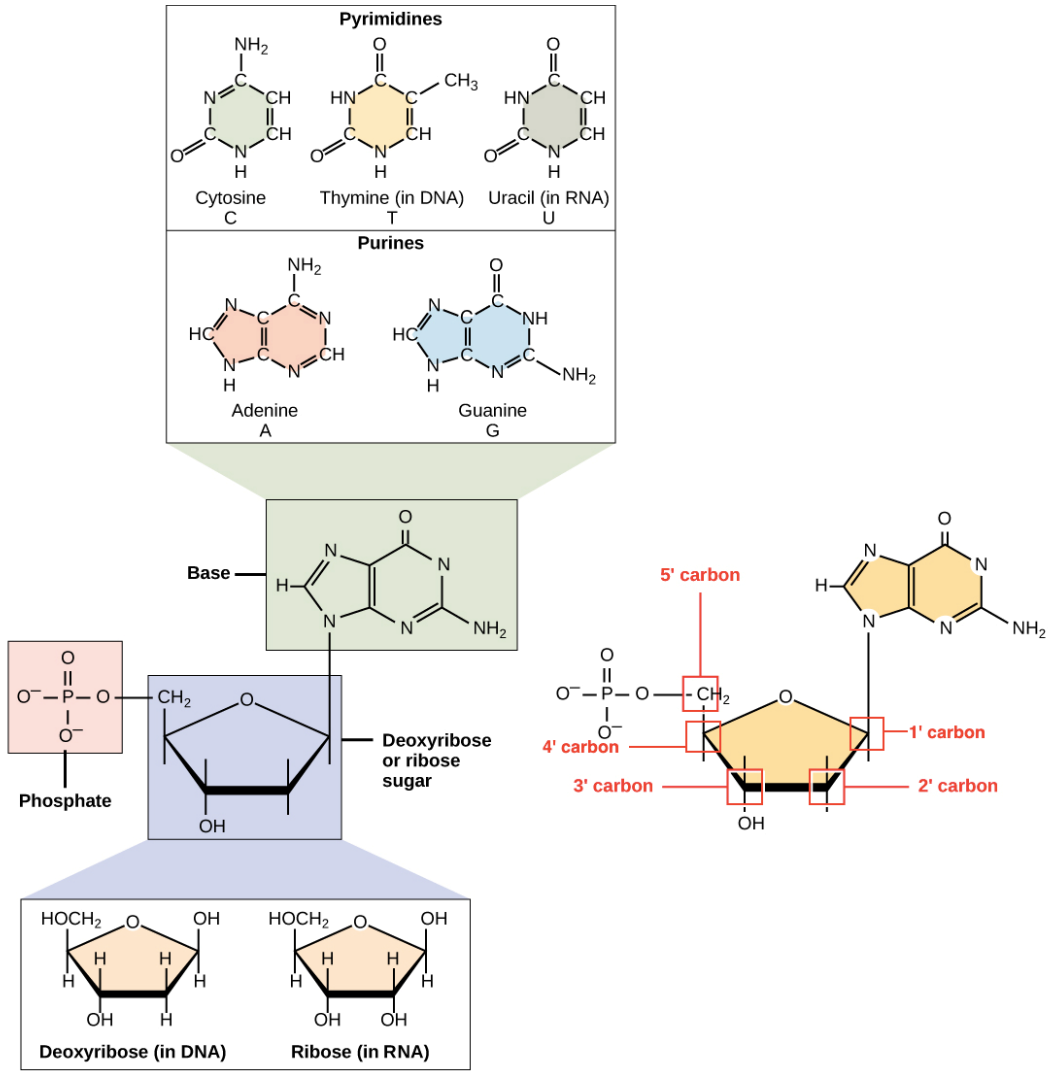
RNA

- Ribonucleic acid or RNA is a nucleic acid polymer consisting of nucleotide monomers that plays several important roles in the processes that translate genetic information from deoxyribonucleic acid (DNA) into protein products.
- Types of RNA:

1. mRNA: transcript the genes from DNA.
2. tRNA: transfer the amino acids to the ribosome for protein synthesis.
3. rRNA: structural components of ribosomes.
4. miRNAs: act as regulators of other genes.

NUCLEOTIDES

- DNA and RNA are polymers (in the case of DNA, often very long polymers), and are made up of monomers known as nucleotides.
- When these monomers combine, the resulting chain is called a polynucleotide (poly- = "many").
- Each nucleotide is made up of three parts:
- Nitrogen bases.
- Phosphates group.
- five-carbon sugar.


Pyrimidines
Cytosine
C
Thymine (in DNA)
T
Uracil (in RNA)
U
Purines
Adenine
A
Guanine
G
Base
Phosphate
Deoxyribose
or ribose
sugar
5' carbon
4' carbon
1' carbon
3' carbon
2' carbon
Deoxyribose (in DNA)
Ribose (in RNA)

NITROGEN BASES

- Each nucleotide in DNA contains one of four possible nitrogenous bases: adenine (A), guanine (G) cytosine (C), and thymine (T).
- Adenine and guanine are purines, meaning that their structures contain two fused carbon-nitrogen rings. Cytosine and thymine, in contrast, are pyrimidines and have a single carbon-nitrogen ring.
- RNA nucleotides may also bear adenine, guanine and cytosine bases, but instead of thymine they have another pyrimidine base called uracil (U). As shown in the figure above, each base has a unique structure.

SUGARS

- DNA and RNA nucleotides also have slightly different sugars. The five-carbon sugar in DNA is called deoxyribose, while in RNA, the sugar is ribose.
- These two are very similar in structure, with just one difference: the second carbon of ribose bears a hydroxyl group, while the equivalent carbon of deoxyribose has a hydrogen instead.

PHOSPHATE GROUP

- Nucleotides may have a single phosphate group, or a chain of up to three phosphate groups, attached to the 5’ carbon of the sugar.

COMPARISON

	DNA	RNA
Function	Repository of genetic information	Involved in protein synthesis and gene regulation; carrier of genetic information in some viruses
Sugar	Deoxyribose	Ribose
Structure	Double helix	Usually single-stranded
Bases	C, T, A, G	C, U, A, G

INFORMATION'S REFERENCES

- https://www.sciencedaily.com/terms/molecular_biology.htm
- https://www.sciencedaily.com/terms/dna.htm
- https://www.sciencedaily.com/terms/rna.htm
- https://www.researchgate.net/publication/279537480_Introduction_to_Molecular_Biology_and_Genetic_Engineering
- https://www.khanacademy.org/science/biology/gene-expression-central-dogma/central-dogma-transcription/a/nucleic-acids

PICTURES' REFERENCES

- https://www.thoughtco.com/nucleic-acids-373552
- https://chemistry.tutorvista.com/biochemistry/nucleic-acids.html