

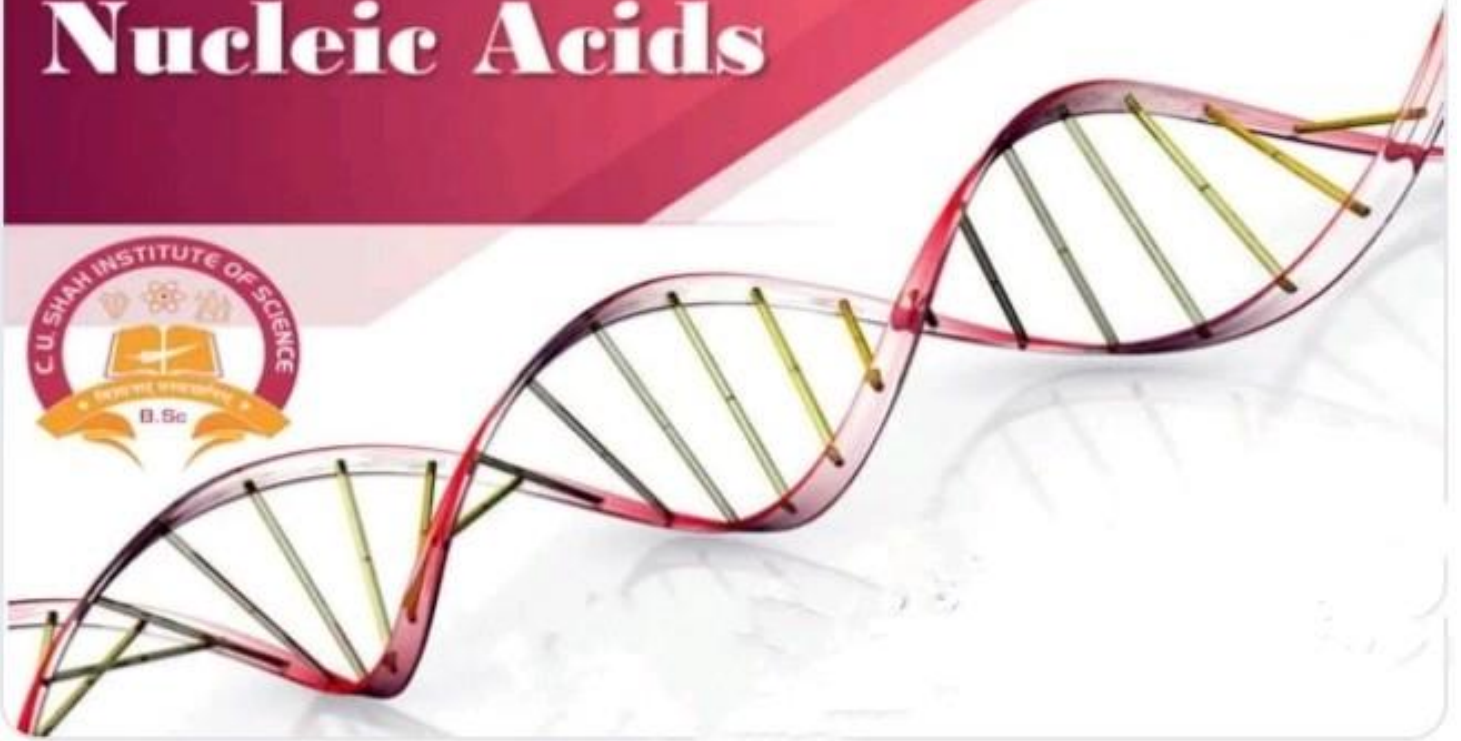
DANTULARI NARAYANA RAJU COLLEGE
(ATONOMUS)

ADIKAVI NANNAYA UNIVERSITY

SEASON – 2022
DEPARTMENT OF BIOCHEMISTRY

GUIDANCE BY
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Nucleic Acids



Definition



- Nucleic acids are the biopolymers, or large biomolecules, essential to all known forms of life. The term nucleic acid is the overall name for DNA and RNA.
- They are composed of nucleotides, which are the monomers made of three components: a 5-carbon sugar, a phosphate group and a nitrogenous base.
- If the sugar is a compound ribose, the polymer is RNA (ribonucleic acid); if the sugar is derived from ribose as deoxyribose, the polymer is DNA (deoxyribonucleic acid).

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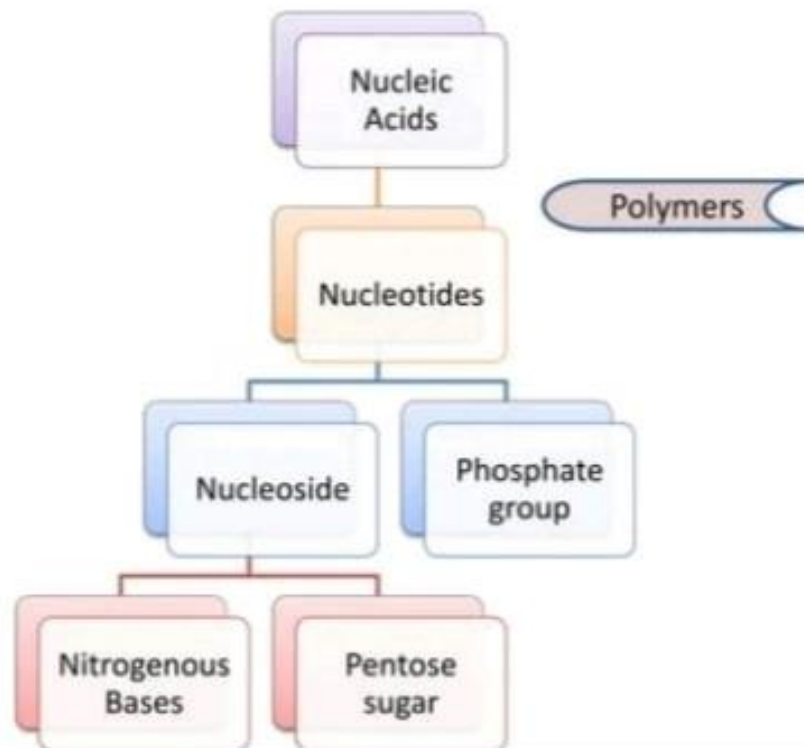
History



- Nuclein were discovered by Friedrich Miescher in 1869.
- In the early 1880s Albrecht Kossel further purified the substance and discovered its highly acidic properties. He later also identified the nucleobases.
- In 1889 Richard Altmann creates the term nucleic acid.
- In 1938 Astbury and Bell published the first X-ray diffraction pattern of DNA.
- In 1953 Watson and Crick determined the structure of DNA.

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Structural Composition



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Nitrogenous bases



- A nitrogenous base, or nitrogen-containing base, is an organic molecule with a nitrogen atom that has the chemical properties of a base.
- The main biological function of a nitrogenous base is to bond nucleic acids together.
- Nitrogenous bases are typically classified as the derivatives of two parent compounds, **pyrimidine** and **purine**.

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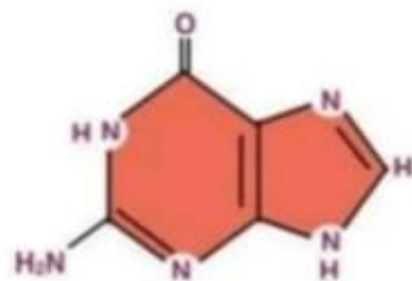
Purines



- Purine is a heterocyclic aromatic organic compound that consists of a two rings in their structure. It is water-soluble.



Adenine **A**



Guanine **G**

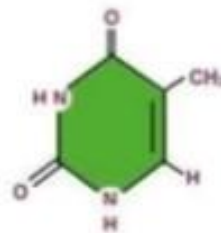
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Pyrimidine

- Pyrimidine is an aromatic heterocyclic single ring organic compound similar to pyridine.
- it has the nitrogen atoms at positions 1 and 3 in the ring.



Cytosine C



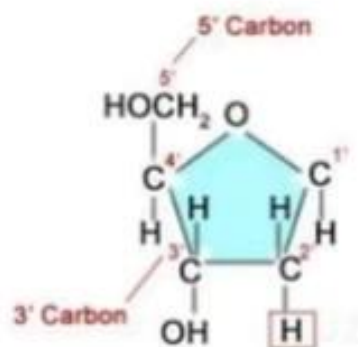
Thymine T



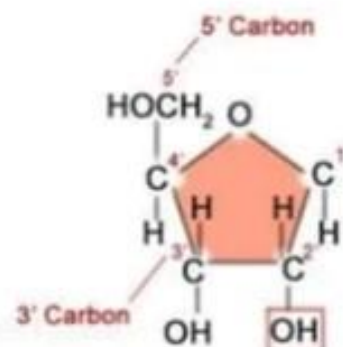
Uracil U

Pentose Sugar

- A **pentose sugar** is a monosaccharide with 5 carbon atoms. It can be Ribose (RNA) or deoxyribose (DNA).

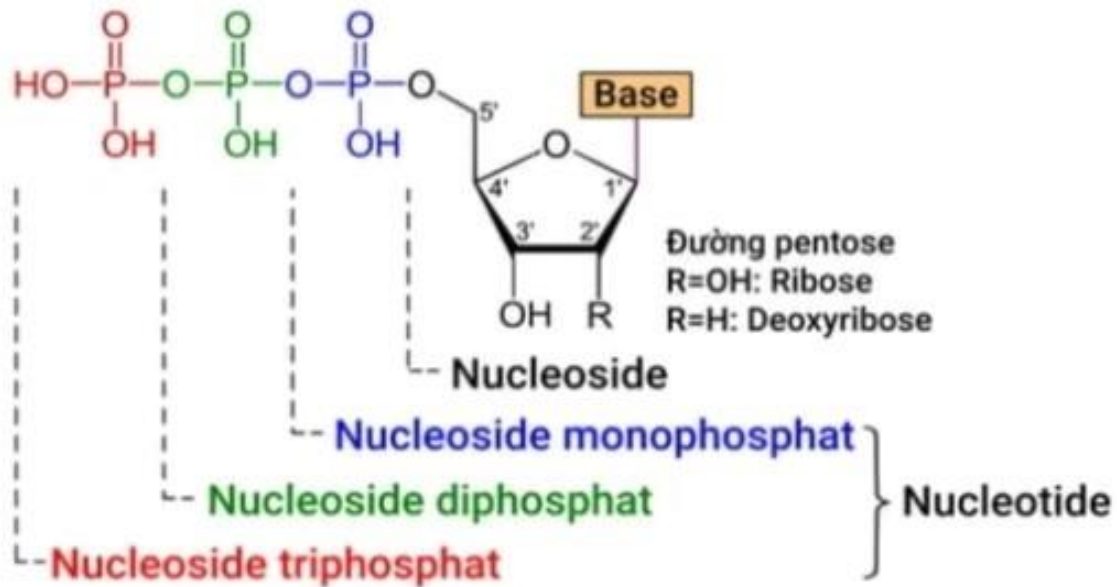


2 Deoxyribose



Ribose

Nucleoside & Nucleotide



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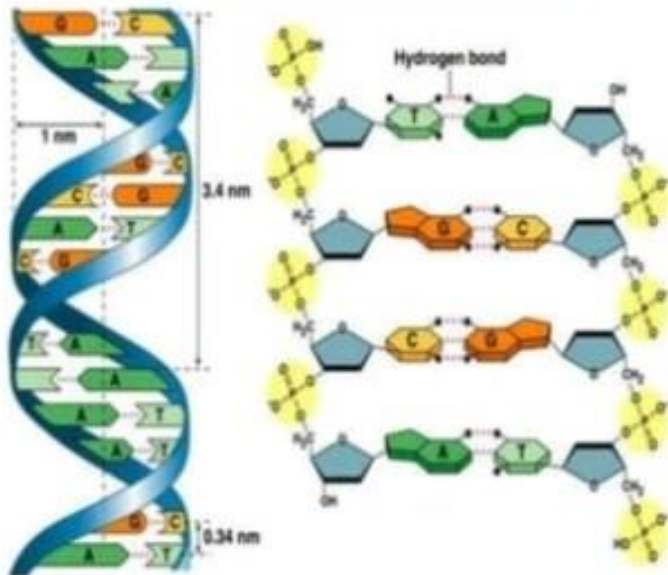
Polynucleotide



- A polynucleotide molecule is a biopolymer composed of 13 or more nucleotide monomers covalently bonded in a chain. DNA (deoxyribonucleic acid) and RNA (ribonucleic acid) are examples of polynucleotides with distinct biological function.
- The nucleotides can be held together by phosphodiester linkage to form polymer.

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Composition of DNA



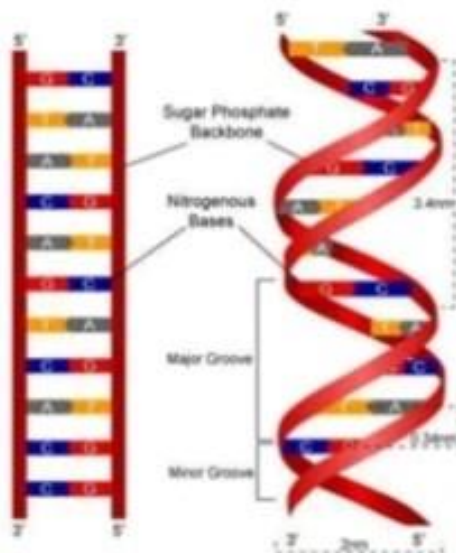
(a) Key features of DNA structure

(b) Partial chemical structure

- In all species it is composed of two helical chains, bound to each other by hydrogen bonds. Both chains are coiled around the same axis, and have the same pitch of 34 angstroms (\AA) (3.4 nanometres).
- The pair of chains has a radius of 10 angstroms (1.0 nanometre).
- According to another study, when measured in a different solution, the DNA chain measured 22 to 26 angstroms wide (2.2 to 2.6 nanometres), and one nucleotide unit measured 3.3 \AA (0.33 nm) long.

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Composition of DNA



- Twin helical strands form the DNA backbone.
- Another double helix may be found tracing the spaces, or grooves, between the strands. These voids are adjacent to the base pairs and may provide a binding site.
- As the strands are not symmetrically located with respect to each other, the grooves are unequally sized. One groove, the major groove, is 22 angstroms (\AA) wide and the other, the minor groove, is 12 \AA wide.

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Types of RNA



- There are 4 types of RNA, each encoded by its own type of gene:
- mRNA - Messenger RNA: Encodes amino acid sequence of a polypeptide.
- tRNA - Transfer RNA: Brings amino acids to ribosomes during translation.
- rRNA - Ribosomal RNA: With ribosomal proteins, makes up the ribosomes, the organelles that translate the mRNA.
- snRNA - Small nuclear RNA: With proteins, forms complexes that are used in RNA processing in eukaryotes. (Not found in prokaryotes.)



messenger RNA



ribosomal RNA



transfer RNA

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Thank you