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Nucleic acids

Nucleic acids are the linear polymer of a large number of nucleotides

Discoverer of nucleic acids

Year of discovery of nucleic acids

Term used by F. Meischer for nucleic acid

Source of discovery of nucleic acid by F. Meischer

discovered by F. Meischer 1868 from the pus cells [dead WBC] and termed nuclein.

Discoverer of purine and pyrimidine bases

Year of discovery of purine and pyrimidine base by Fisher

Fisher 1880s discovered two types of nitrogen bases i. e. purine bases and pyrimidine bases.

Person claiming nuclein for transmission of hereditary materials

Year Oskar Hertwig claimed nuclein as hereditary material

Oskar Hertwig 1884 claimed that nuclein is responsible for transmission of hereditary materials

Person coining the term nucleic acid

Year Altmann coined the term nucleic acid

Altmann 1899 gave the term nucleic acids for nuclein due to their acidic nature

Cause of name of nucleic acid of nuclein

Discoverer of pentose sugars in nucleic acids

Levene 1910 discovered two types of pentose sugar in the nucleic acids

Year of discovery of pentose sugar by Levene in nucleic acids

Components of nucleic Acid

1. Pentose sugar

2. Nitrogen bases:

3. Phosphate:

Number of types of pentose sugar

Types of pentose sugars

: There are two types of pentose sugar

Ribose sugar

Deoxy ribose sugar

Number of types of nitrogenous bases

Types of nitrogenous bases

Purine Bases

List of purine Bases

Pyrimidine Bases

List of pyrimidine Bases

Two groups of nitrogen bases
Purine bases: Double ring heterocyclic compound A and G
Pyrimidine Bases: Single ring heterocyclic compounds T, C, and U

Form of presence of phosphate in nucleic acids

It is present in the form of phosphoric acid H_3PO_4

Types of DNA:

Balanced DNA

B-DNA (Balanced DNA):

Abbreviation of Balanced DNA

In this DNA the base pairs lie at nearly right angles to the axis of helix. 10 base pairs.

Arrangement of base pairs of Balanced DNA with the axis of helix

B-DNA is more hydrated and most frequently found DNA in living cells.

Nature of activity of Balanced DNA

It is physiologically and biologically active form.

Alternate DNA

A-DNA (Alternate DNA).

Abbreviation of Alternate DNA

Another right handed duplex model here, a single turn of helix has

Number of base pairs at alternate DNA

11 base pairs.

C DNA

Number of base pairs at C DNA

C-DNA: It has 9 base pairs per turn of spiral.

D DNA

Number of base pairs at D DNA

D-DNA: The number is only 8 base pairs.

Zigzag DNA

Abbreviation of Zigzag DNA

Z-DNA (Zigzag DNA) is left-handed double helix with zigzag back-bone with

Number of base pairs at Zigzag DNA

12 base pairs and a single groove.

Circular DNA

In many prokaryotes the two ends of a DNA duplex are covalently linked to form circular DNA.

Location of circular DNA in organisms

Circular DNA is naked, that is, without association with histone proteins, though polyamines do occur.

Linear DNA

Location of Linear DNA in organisms

In linear DNA the two ends are free. It is found in eukaryotic nuclei where it is associated with histone proteins.

Functions of DNA

1. Genetic material of all cellular organisms.
 2. Synthesizes RNA through transcription.
 3. Regulation of extrinsic and intrinsic flow of information in the cell.
 4. Provides new combinations of gene through crossing over.
 5. Maintains genetic stability during cell division.
 6. Controls biochemistry of the cell.
- Unit: Three Genetics-@ 3.1

Structure of DNA

- **Type of Molecule:** DNA is a linear polymer.
- **Quantity of nucleotides :**
 - DNA is a linear polymer of millions of nucleotides.
- **Contents:**
 - DNA is a macromolecule.
 - DNA is a long chain of subunits.
 - The subunits of DNA are nucleotides.
- **Composition of DNA :**
 - Sugar
 - * DNA is composed of sugar called deoxyribose.
 - Phosphate group
 - Nitrogenous base

Location: DNA is present in:

- Nucleus
- Cytoplasm of prokaryotes
- Chloroplast

• **Measurement:**

- DNA is measured in picogram,
- $1pg = 10^{-12}gm$

• **Quantity of DNA in human:**

- One human cell contains $5.6pg$ of DNA.
- The length of DNA in a human cell is $174cm$.

History

Equality

- The amount of purine is equal to amount of pyrimidine base.

$$A = T$$

$$G = C$$

- This is the rule given by Chargaff.
- This rule was given in 1950.

Xray Diffraction

- The study was done by
 - Rosalind Franklin
 - Maurice Wilkins
- The chemical and physical properties of DNA were determined by this experiment.
- This experiment was done by x-ray diffraction method.

Double Helical Structure of DNA

- The double helical molecular model of DNA was proposed by Watson and Crick.
- The double helical molecular model of DNA was proposed in 1953 .
- This proposal was done on the basis of explanation of chemical data of:
 - Wilkins
 - Franklin
 - Chragaff
- The work for discovery of double helical structure of DNA was awarded a Nobel Prize.
- The Nobel Prize was awarded in 1962.

Characters of double helical structure of DNA

- The DNA is double helical right handed B-DNA.
- **Contents:**
 - DNA consists of two helical strands.
 - The strands are of polynucleotide chains.
 - **Contents of strand:**
 - * Phosphate Sugar is present as backbone.
 - The bond joining phosphate and sugar is called phosphodiester bond.
 - The strands are joined together by nitrogenous bases.
 - * Nitrogenous bases are joined with one another by hydrogen bonds.
 - * **Location of nitrogenous bases :**
 - Nitrogenous bases are located inside the strands.
 - Their location is arranged perpendicularly to the long axis of DNA.
- The strands are plectonimically coiled.
- The strands are antiparallel.
 - One strand runs in 5' to 3' carbon.
 - One strand runs in 3' to 5' carbon.

Base pairing of nitrogenous bases

The base pairing of nitrogenous bases is very specific.

- **A** *Adenine* pairs with **T** *Thymine*
 - There is presence of only two hydrogen bond between adenine and thymine.
- **G** *Guanine* pairs with **C** *Cytosine*
 - There is presence of three hydrogen bond between guanine and cytosine.

Structural arrangement of DNA

- **Number of base pairs in one complete spiral:** 10
- **Length of one complete spiral:** 34Å
- **Distance between two adjacent base pairs:** 3.4Å
- **Diameter of two strands:** 20Å

Nature of information

- Genetic information is not coded by both strands of DNA.
- One strand codes genetic information.
 - The strand which codes genetic information is called sense strand.
- One strand does not code genetic information.
 - The strand which does not code genetic information is called non sense strand