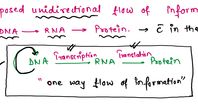
Central Dogma of Molecular biology :- (How information transfer occur in cell)

✓ It is the flow of information from DNA to m-RNA (Transcription) and then decoding the information present in m-RNA in the information of polypeptide chain or protein (Translation)

✓ In other word the four letter language of DNA is transcribed into four letter language of m-RNA which is then translated into 20 letter language of protein.

(20 a.a. → Protein)

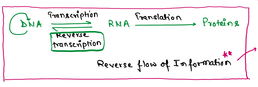
- The concept of central dogma of molecular biology was proposed by Crick in 1958. He proposed unidirectional flow of information from DNA → RNA → Protein. → ✓ in the cells of present



↓ ↓ DNA Progeny

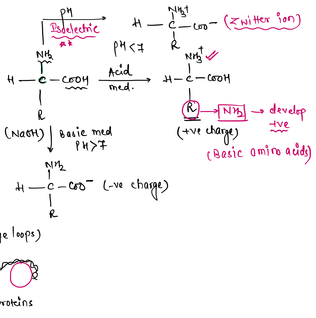
- Temin (1970) and Baltimore (1970) reported that the RNA of Rous Sarcoma Virus (RSV) operates a central dogma reverse (inverse flow of information)
- RNA of these viruses first synthesize DNA through reverse transcription or temlotism. This mechanism is characteristic of retroviruses eg HIV

RNA → DNA (reverse transcription)

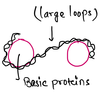


Packaging of DNA Helix :-

- 2.2 m long DNA of human present in 5 μm nucleus in human being. (6×10^{-6} m)
- 4.6×10^6 B.P. long DNA of E.coli is present in small area of 1 μm. (Nucleoid)
- This is only possible through coiling or packing.
- Packing occur by folding and attachment of DNA with basic proteins, non-histones in prokaryotes and histones in Eukaryotes.



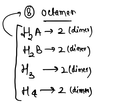
DNA packaging in Prokaryotes :→ In prokaryotes like E.coli DNA is not scattered throughout the cells. DNA being negatively charged is held by some nucleoid-associated proteins (NAP) in a region termed as nucleoid. The DNA in nucleoid region is organised in large loops held by proteins.



DNA packaging in Eukaryotes :-

- Packaging is carried out by positively charged basic proteins called Histones.
- Histones are rich in basic amino acid residues, "Lysines and arginines". (Additional -NH2 grp) They carry +ve charge on their side chains.
- Histone & DNA organised to form "Nucleosome" (Bead)
- Small segment of DNA connecting two adjacent nucleosome is called Interbead or linker DNA.
- Nucleosome and linker DNA together constitute Chromatosome.

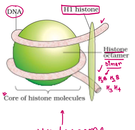
- Nucleosome in chromatin gives a "bead on string" appearance under electron microscope.



- Types of Histones :- There are 5 types of histone proteins. [amt of Arginine & lysine]

H_1, H_2A, H_2B, H_3, H_4 → These four

Non-conserved — most conserved protein — occur in pair — form histone octamer kla

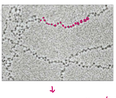


"Core Histone or Nk body"

DNA of about 200 bp makes 1¾ left Handed turn over histone octamer to form a nucleosome.

Nucleosome

- A fifth type of Histone called H_1 is attached over the linker DNA.



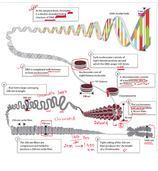
EM-Picture (Nucleosome in chromatin) (Beads on string Appearance)

Histone-DNA interactions :-

- Histone contains a large portion of the +vely charged (Basic) amino acid, lysine & arginine in their structure. DNA is -vely charged due to +ve of phosphate group on its backbone.
- The result of these opposite charges is strong attraction and ∴ high binding b/w histones & DNA.

Solenoid Model of folding :-

- The beaded string is coiled to form cylindrical coil or solenoid having 6 nucleosomes/turn.
- Actually the nucleosomal organisation has appox 10 nm thickness, which further condenced to form Solenoid of 30 nm.
- This solenoid structure undergoes further coiling to produce a chromatin fibre of 300 nm. & then a chromatid of 700nm diameter and ultimately metaphase chromosomes of 1400 nm diameter



NHC Proteins (Non-Histone chromosomal proteins) :-
The packaging of chromatin at higher level require additional set of proteins that collectively kla NHC proteins.

- Chromatin is the chromosomal material in the nuclei of cells of Eukaryotic organisms.
- Chromatin → long ds DNA + Equal mass of basic proteins (Histones) + small amt of NHC (Acidic + largely thin Histones) + small quantity of RNA.

It include enzyme involved in DNA replication & repair and the protein involved in RNA synthesis, processing and transport to cytoplasm"

- In a typical nucleus some region of chromatin are loosely packed & stain light are kla Euchromatin
- Euchromatin is transcriptionally active. It replicates earlier. (Transcriptionally active)
- The chromatin that is densely packed & stains dark is kla "Heterochromatin" as observed in interphase nucleus by EM. (Transcriptionally inactive)

Constitutive	Facultative
(always condensed) centromere, Telomere	at times condensed but at other times it is actively transcribed and thus uncondensed → X-chromosome in female

Q. Theoretically, how much beads (nucleosome) do you imagine are present in human cell. (2n)

Ans:- 200 bp ↑nt in 1 bead

6.6×10^9 bp ↑nt in = $\frac{6.6 \times 10^9}{200}$ or Nucleosome = 3.3×10^7 beads Approx.

Q. In E.coli → length of DNA is 4.6×10^6 B.P. How many nucleosomes are found in E.coli

Ans:- 2300