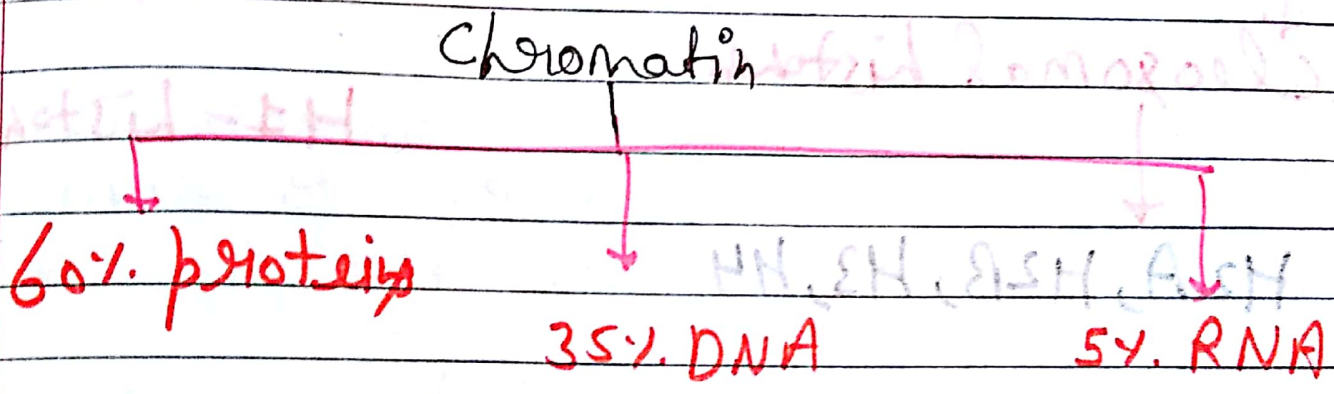


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# Nucleosome model of chromosome

- According to Dupraw (1965-76) and HARRIS (1976) each chromatid of eukaryotic chromosome is formed of a single, greatly elongated and highly folded fibre of DNA with its associated proteins.
- This is known as unistranded or unitenic concept.



- 3 Structural proteins or packaging proteins
- The DNA molecule of individual human chromosome range from 1.7 to 8.5 cm. in length when uncoiled.
- Such long DNA strands remain packed into chromatin fibres with the help of structural proteins or packing proteins.
- These are non-specifically binding proteins.

→ These are bound to DNA along most of its length and help to package it without preventing the access of other DNA-binding proteins. These are called histones.

## Histones

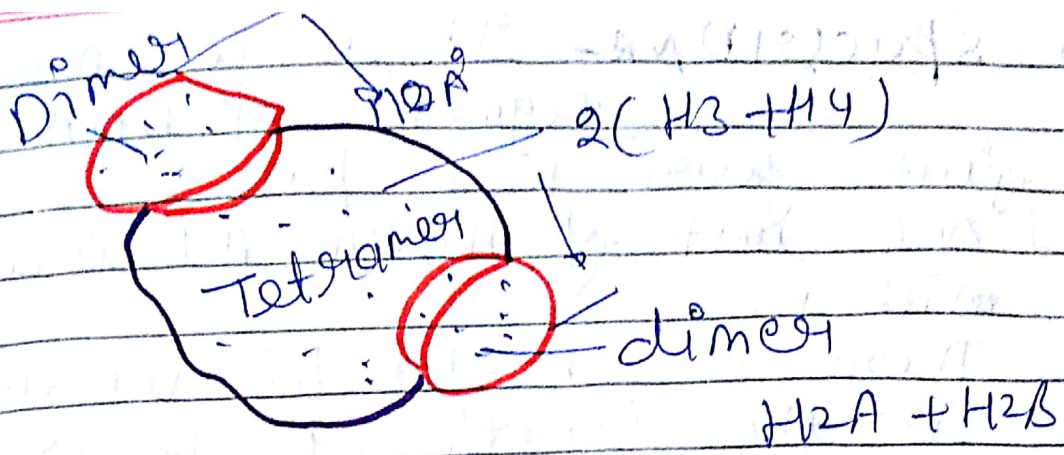
↓  
Nucleosomal histones

↓  
H1-histones

↓  
H2A, H2B, H3, H4

→ Histones are main structural proteins found in eukaryotic cells. These are low molecular weight proteins with high proportion of positively charged amino-acids (arginine and lysine)

The positive charge helps histones to bind to DNA and play a crucial part in packaging long DNA molecules.

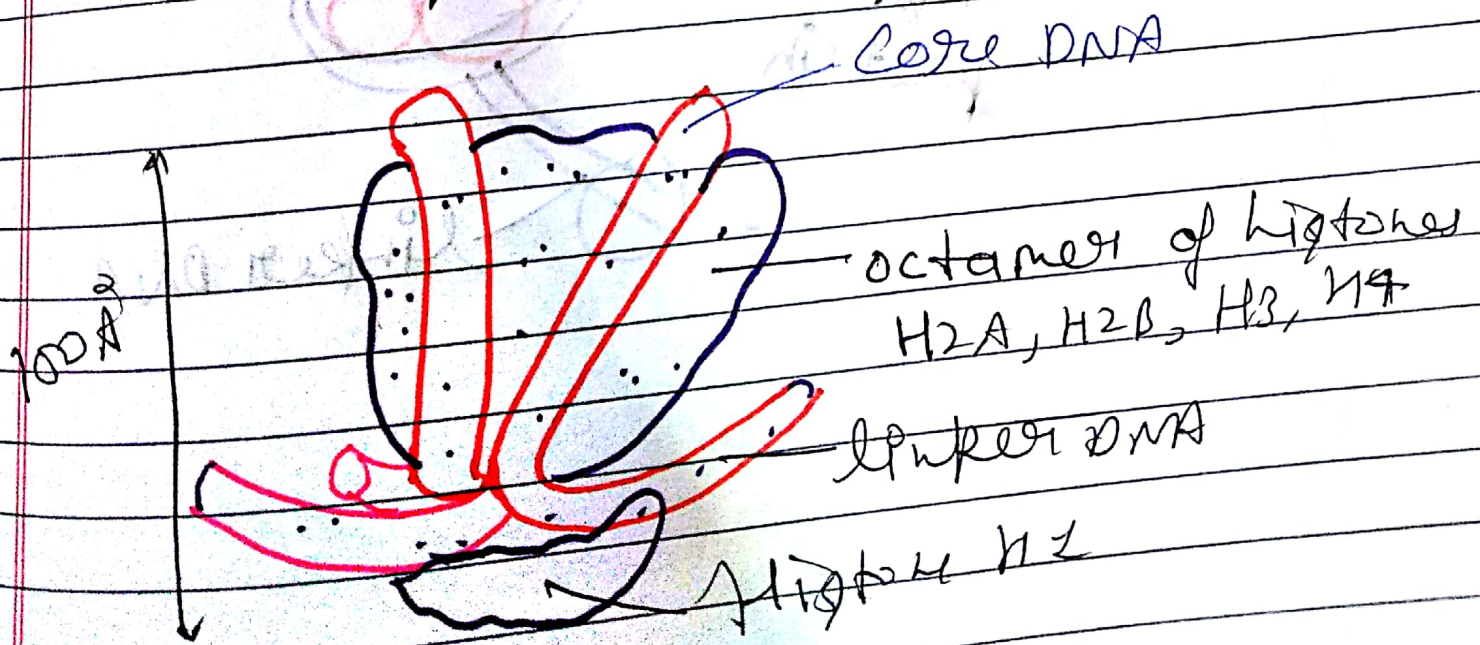


→ core particles in nucleosome

## Nucleosome -

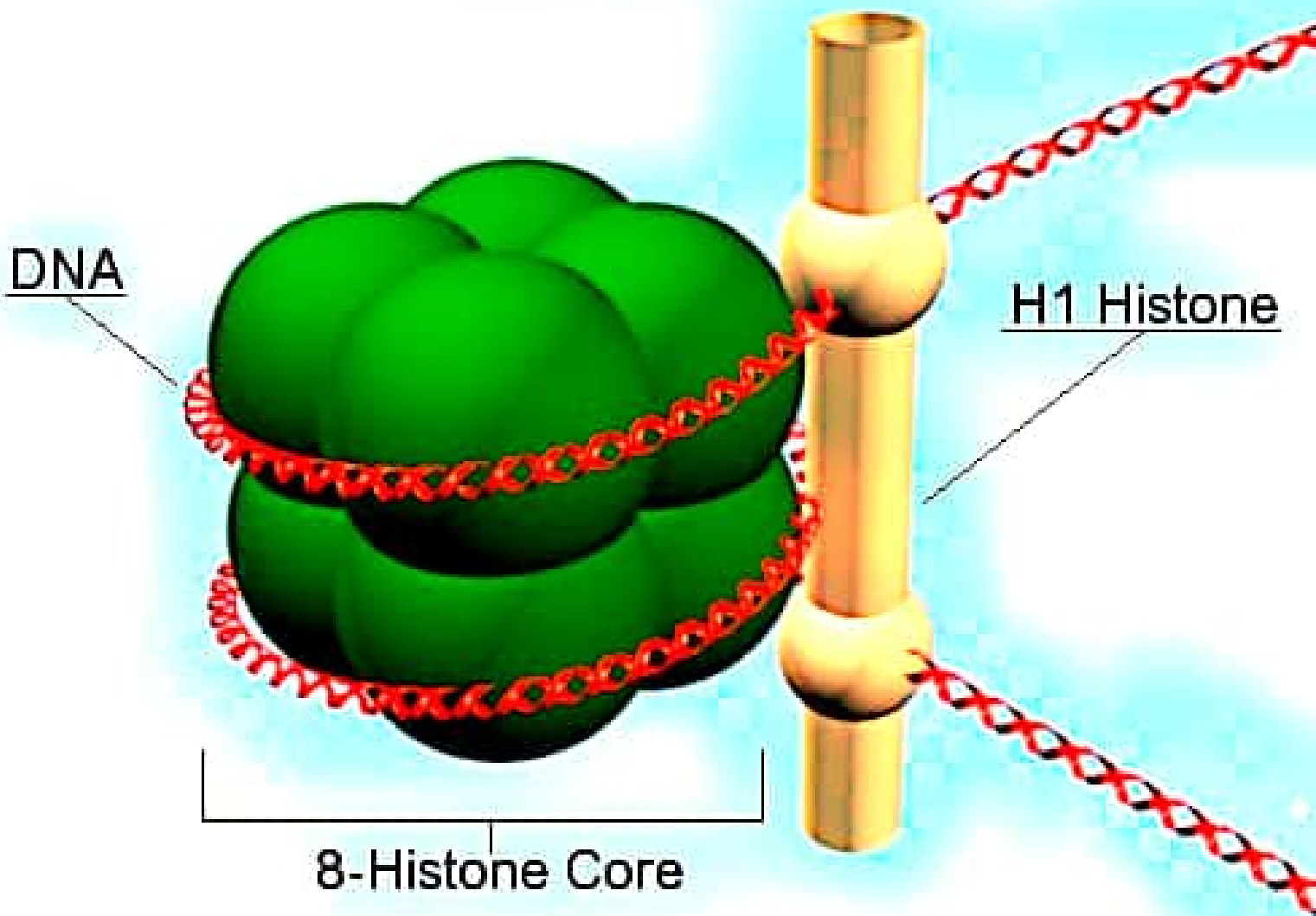
→ Nucleosome are the fundamental packing units of chromatin and give chromatin the "beads on string" appearance.

→ Each nucleosome is disc-shaped about 10nm in diameter. It consists of a core particle and a smaller spacer or linker DNA.



- spacer DNA - It is a small segment of DNA having just four base pairs.
- One unit of histone H1 is associated with it.
- There is considerable variation in the length of spacer region in different species varying from one base pair to about 80 base pairs in sea-urchin sperm.

# Nucleosome



## Nucleosome packing -

First level - It is the formation of nucleosomes and their joining together in a linear fashion to be packed upon one another to form a chromatin fibre or nucleoprotein fibre with a diameter of about 10nm.

The 10nm nucleoprotein fibre represents the first level of organisation of chromatin and is seen in interphase nucleus when chromatin is most extended.

Short region of DNA double helix



2 nm

"Beads on a string" form of chromatin



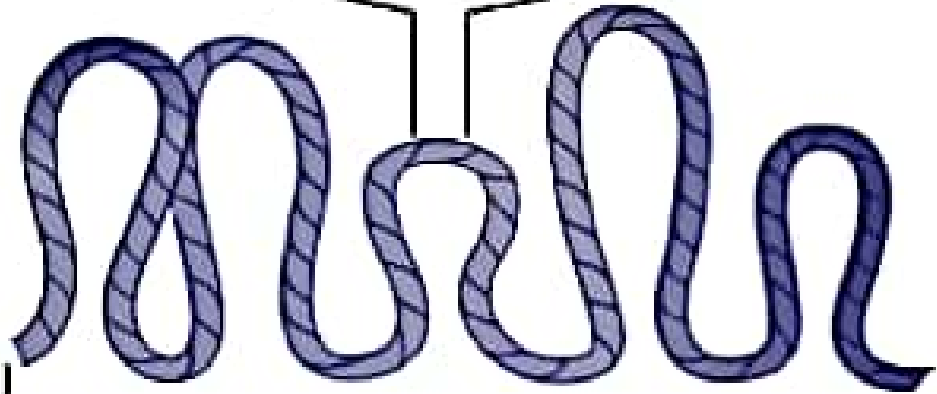
11 nm

30-nm chromatin fibre of packed nucleosomes



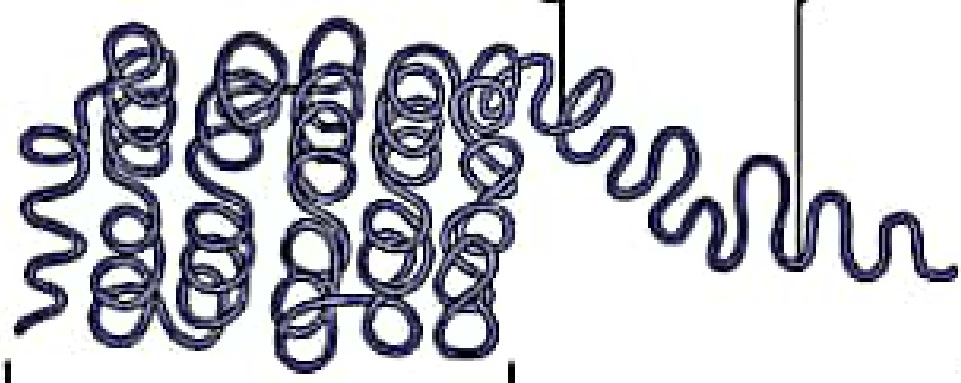
30 nm

Section of chromosome in an extended form



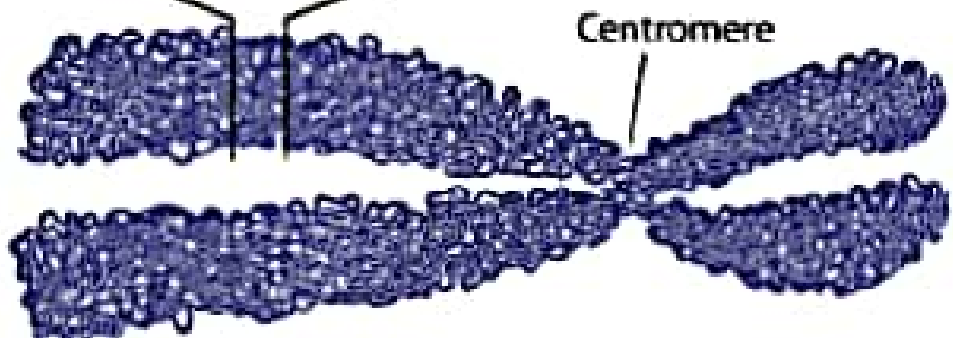
300 nm

Condensed section of chromosome



700 nm

Entire mitotic chromosome



1,400 nm

② Second level of packaging - The 30 nm

thick chromatin fibre arises by the spiral coiling of thin 10 nm chromatin fibre.

- 97 represents second level of coiling and solenoid type of ultrastructure
- 97 has 6 nucleosomes per turn.

③ Third level of packaging.

→ In mitotic chromosomes the solenoid is further coiled into a super-solenoid with a diameter of 700 nm.

→ In a super-solenoid, the 30 nm chromatin fibre is attached to a protein scaffold and is coiled around it.

→ The super-solenoid is condensed further to produce the final shape and dimensions of metaphase or anaphase chromosome having a thickness of 700 nm.



