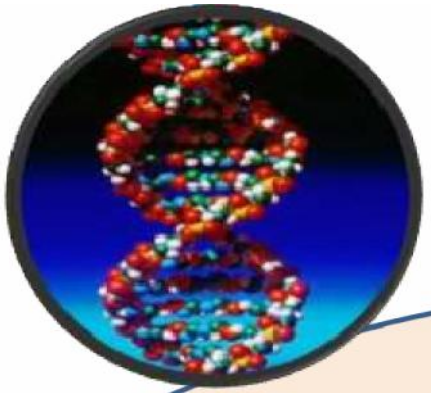
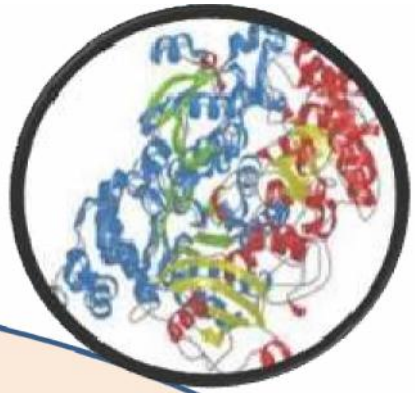
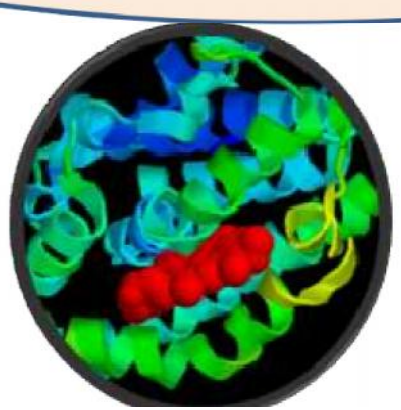




ORGANIZATION AND STRUCTURE OF GENOME: GENOME SIZE VARIATION



ORGANIZATION AND STRUCTURE O

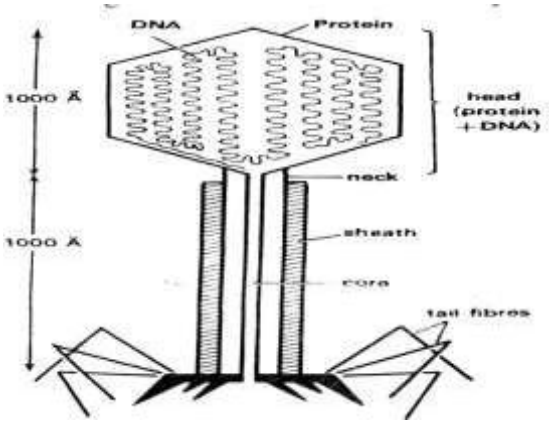
F GENOME: GENOME SIZE VARIATION

Genome

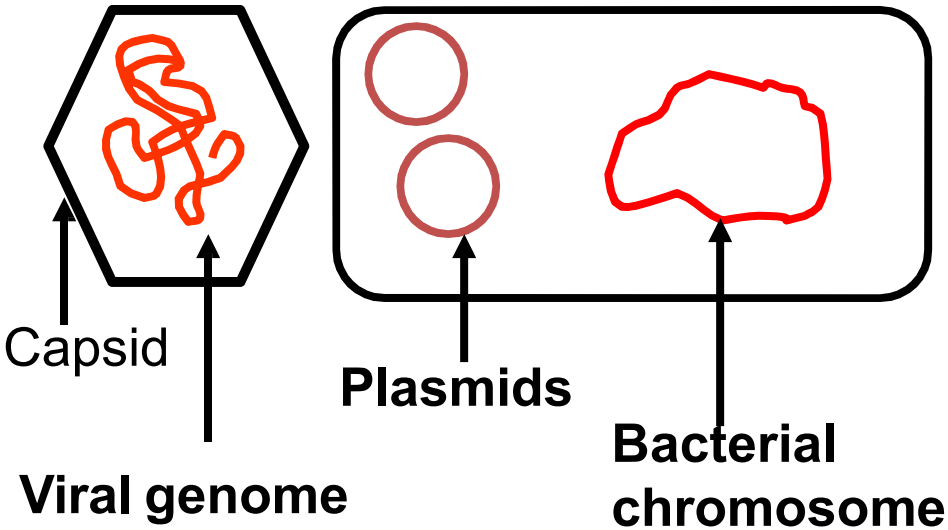
The term genome was introduced by H.Wrinkler 1920 to denote the complete set of chromosomal and extra-chromosomal genes present in an organism, including a virus. The genome is the full complement of genetic information in a cell, and contains the programme required for that cell to function.

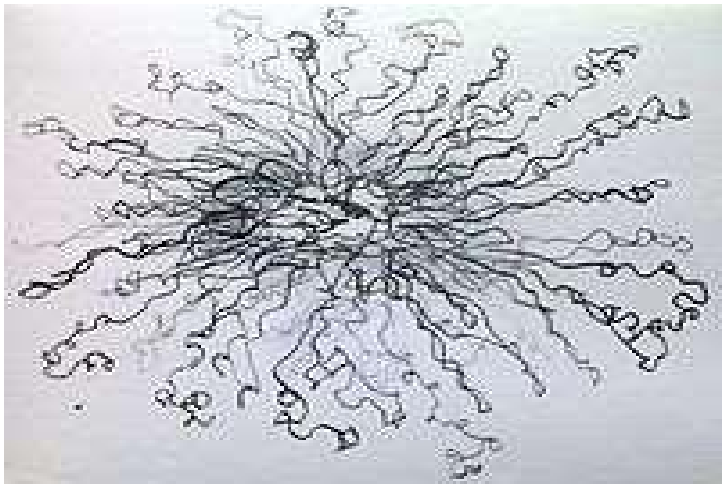
GENOME ORGANIZATION IN PROKARYOTES

- **Do not contain nucleus and membrane bound organelles**
- **Simple genome organization**
- **Genes usually do not have introns and histone protie**
- **circular double-stranded DNA molecule but may be a linear molecule in some major groups**
- **Supercoiling**

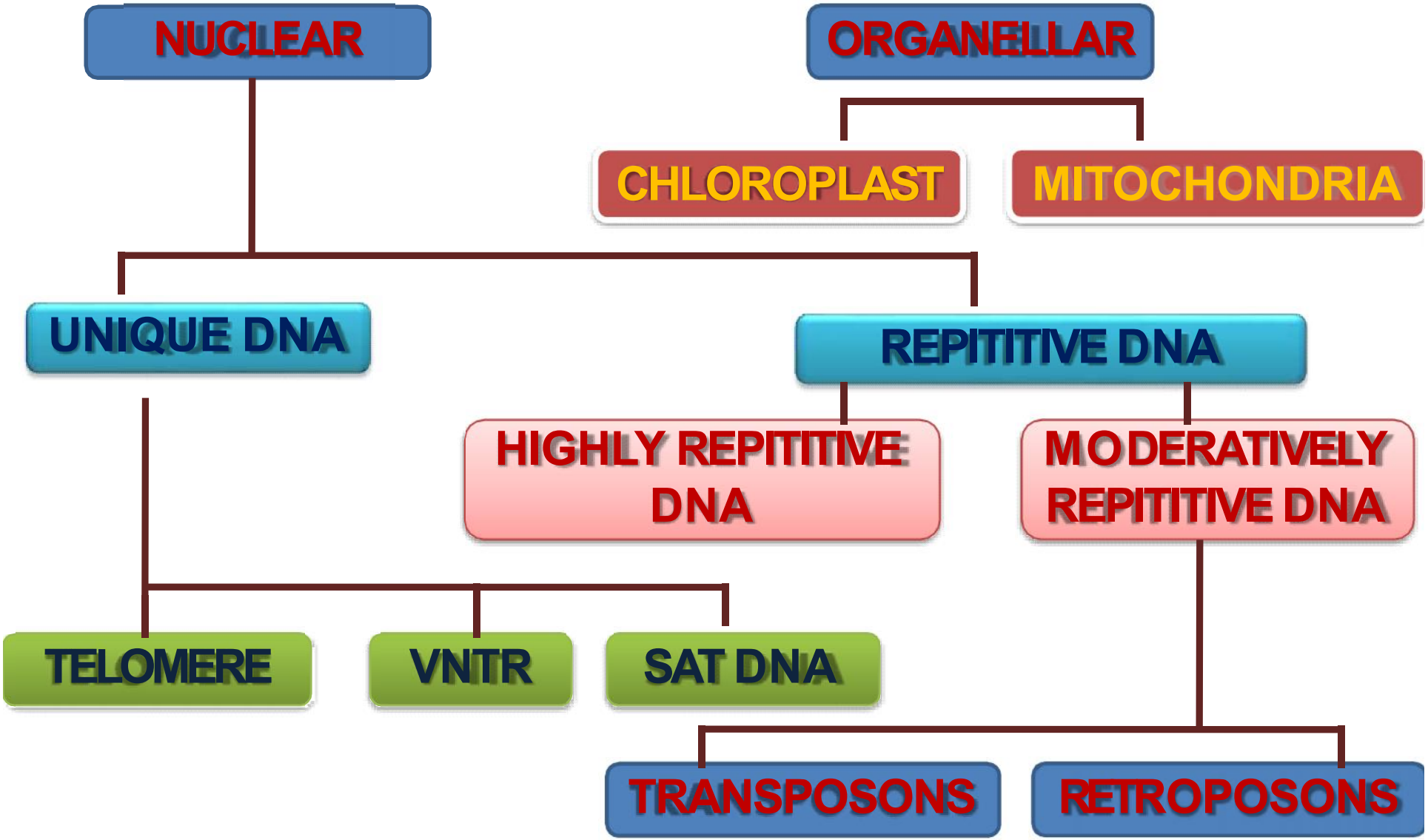


Viruses Procaryotes



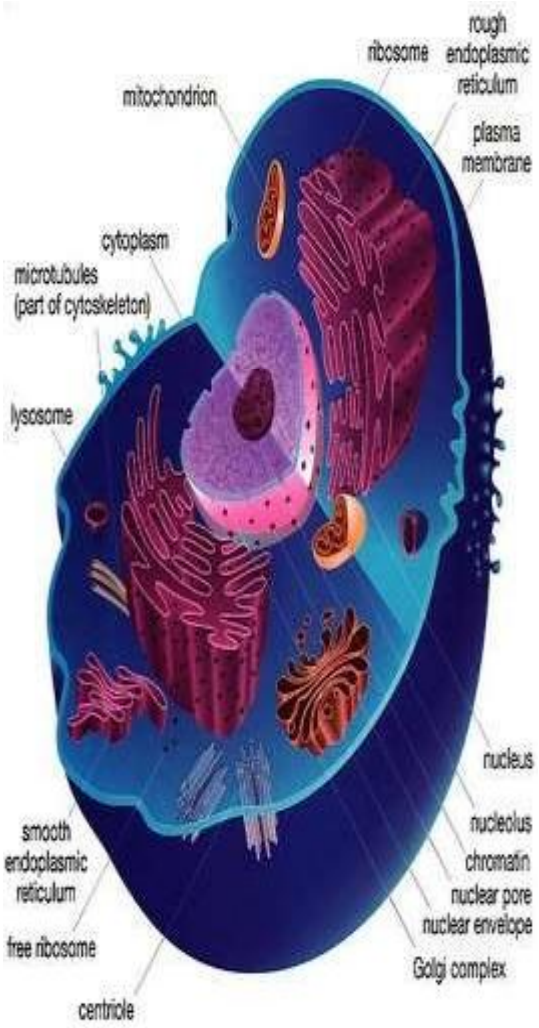


GENOME IN EUKARYOTES

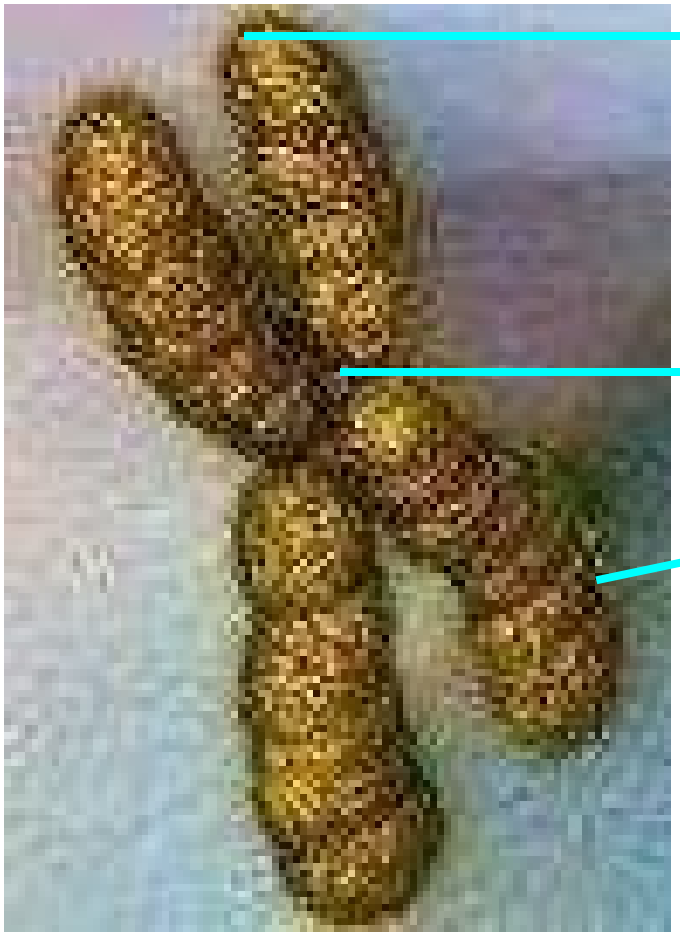


Genome organization in eukaryotes

- Much greater complexity than prokaryotes a. much more DNA in cells
- Many proteins specifically associated with DNA
- DNA in eukaryotes organized into 2 or more chromosomes
- Chromosomes have roughly equal amounts DNA & protein

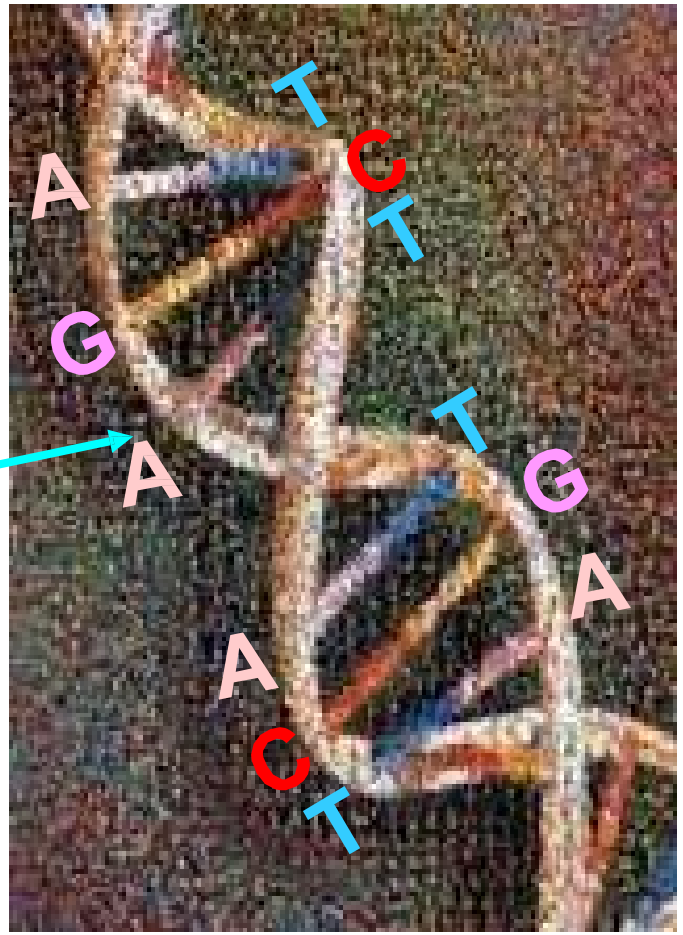


Chromosomes: The Carriers of Hereditary Material

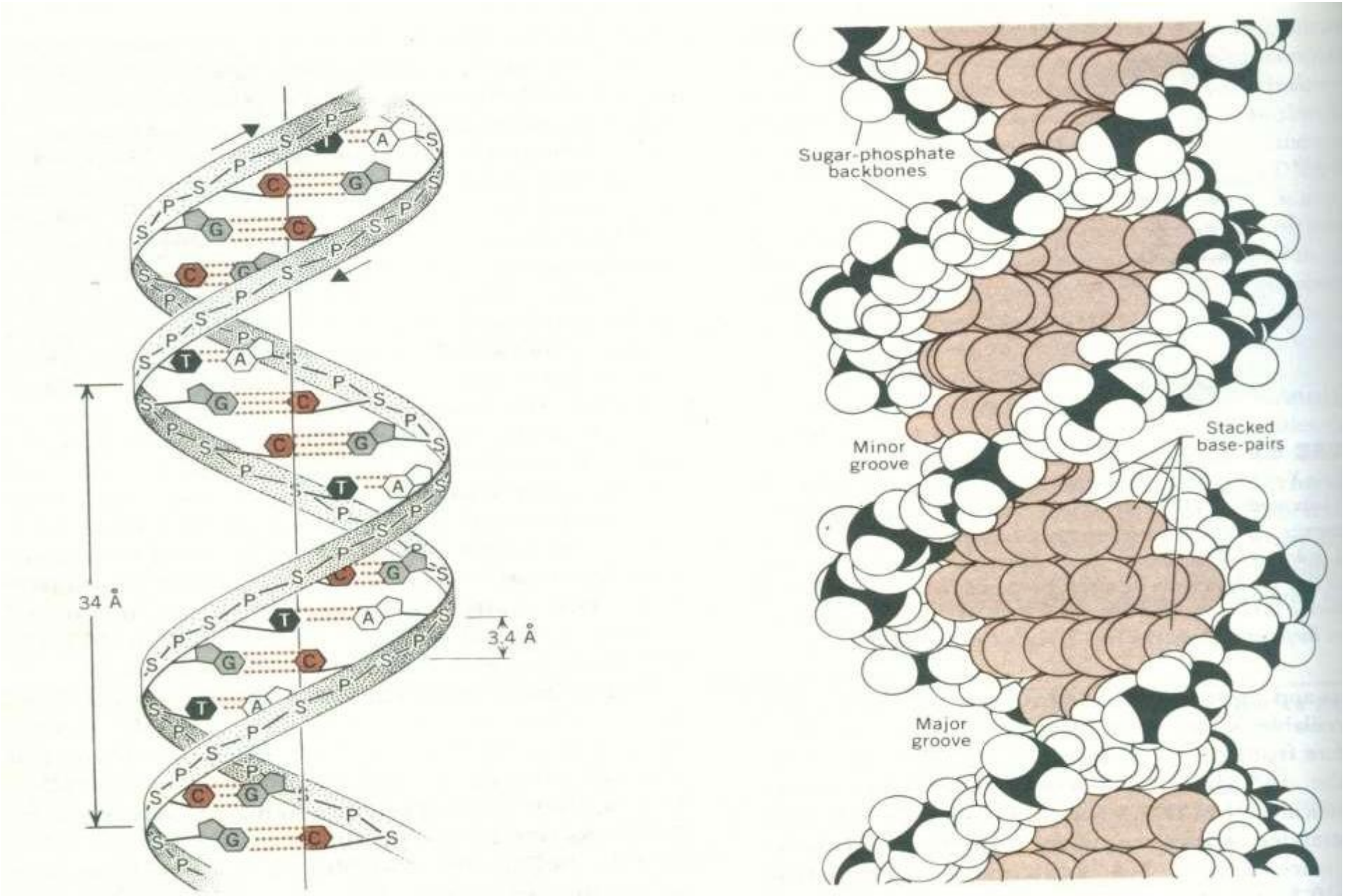


Telomere

Centromere



DNA double


34 Å
3.4 Å
Sugar-phosphate backbones
Minor groove
Stacked base-pairs
Major groove

RNA in TMV

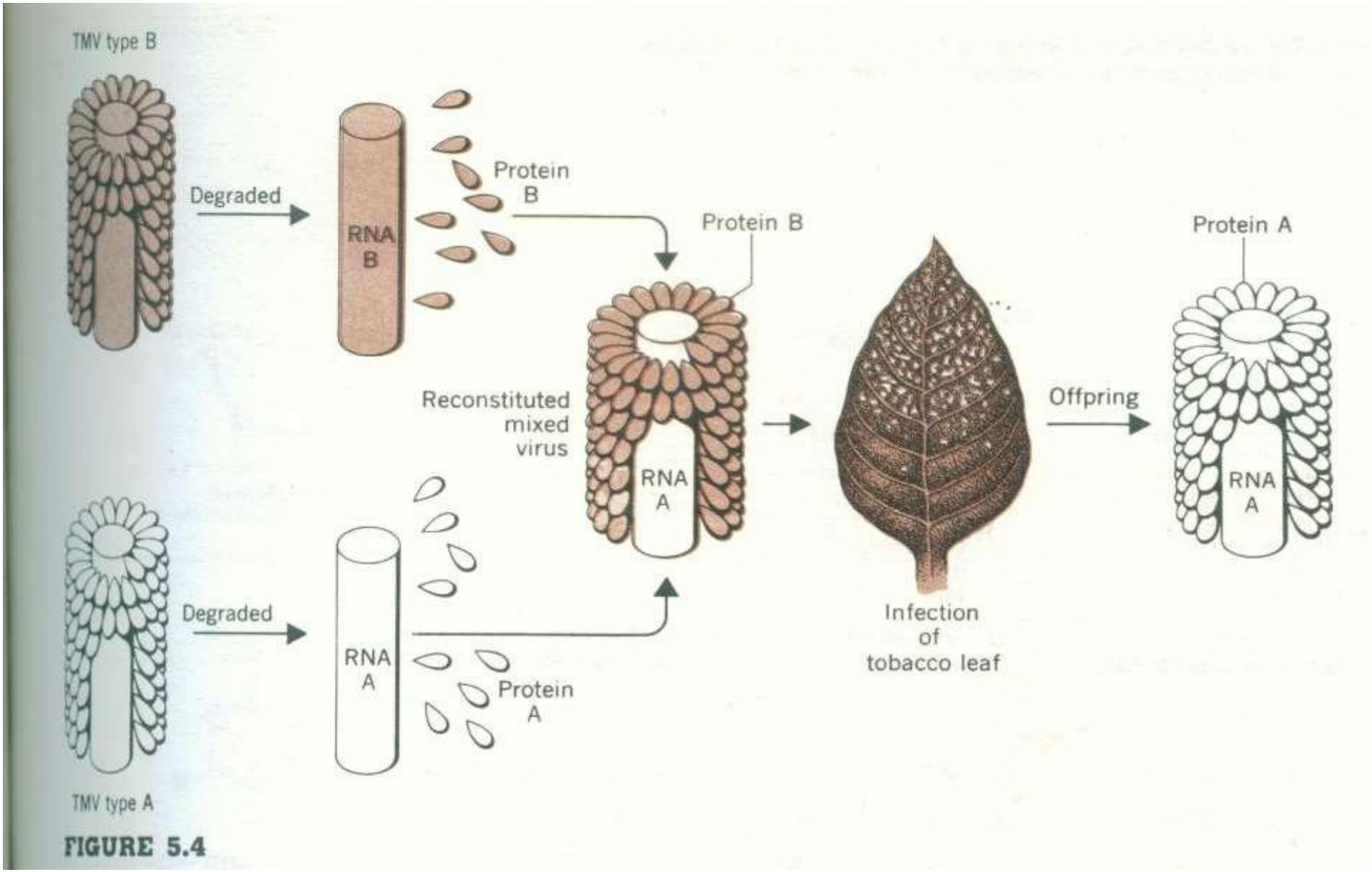
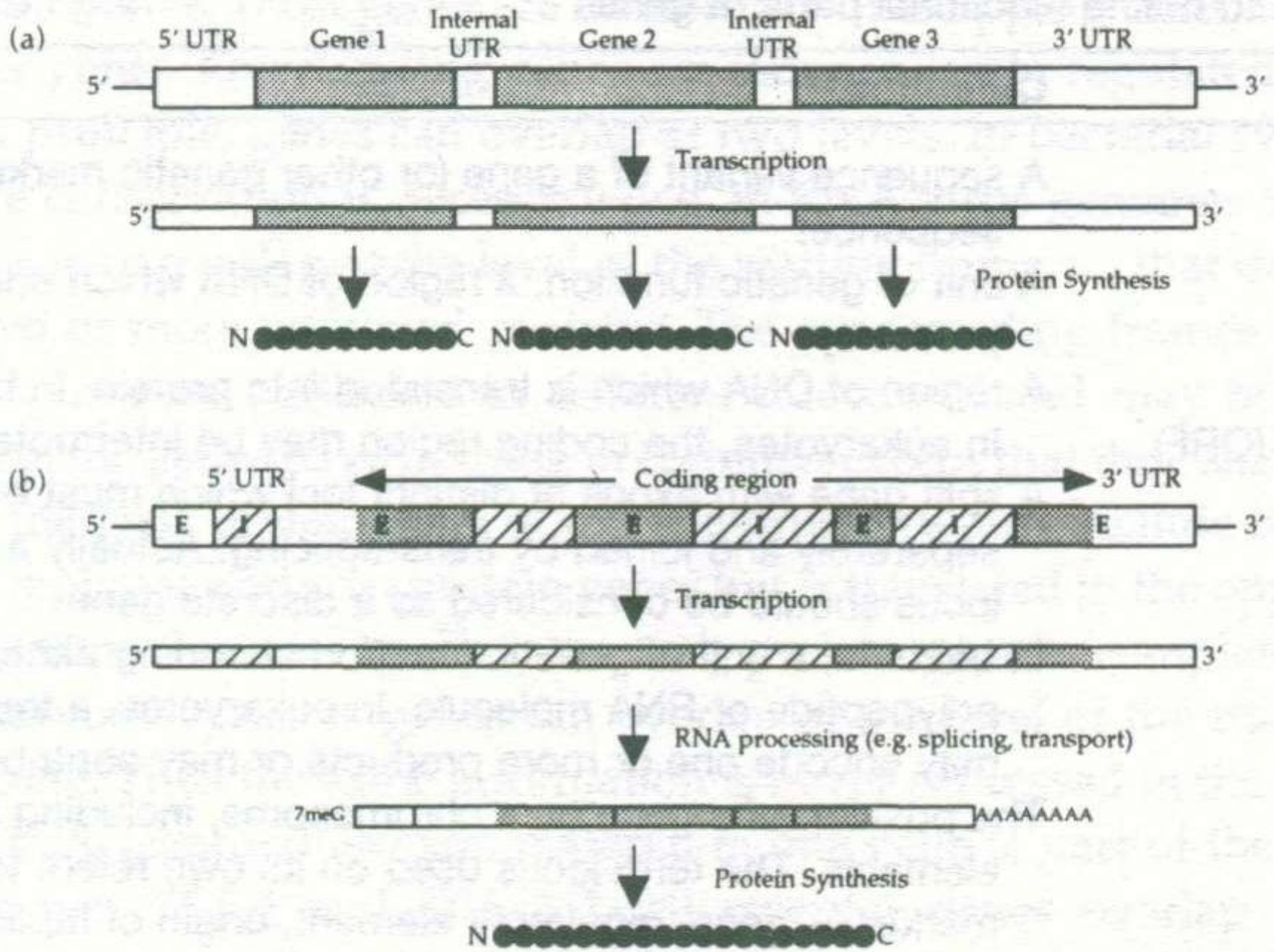


FIGURE 5.4


(a)
5′ UTR
Gene 1
Internal UTR
Gene 2
Internal UTR
Gene 3
3′ UTR
5′
3′
Transcription
5′
3′
Protein Synthesis
N
C
N
C
N
C
(b)
5′ UTR
Coding region
3′ UTR
5′
E
E
E
E
E
3′
Transcription
5′
3′
RNA processing (e.g. splicing, transport)
7meG
AAAAAAAA
Protein Synthesis
N
C

DIFFERENT MODELS FOR DNA PACKAGE IN CHROMATIN FIBRE STRUCTURE

- **Molecuar model- TAYLOR**

chromatid consists of only one DNA chain where several DNA double helices are linked end to end by protiens

Multistrand model or polyneme chromosome- RIS

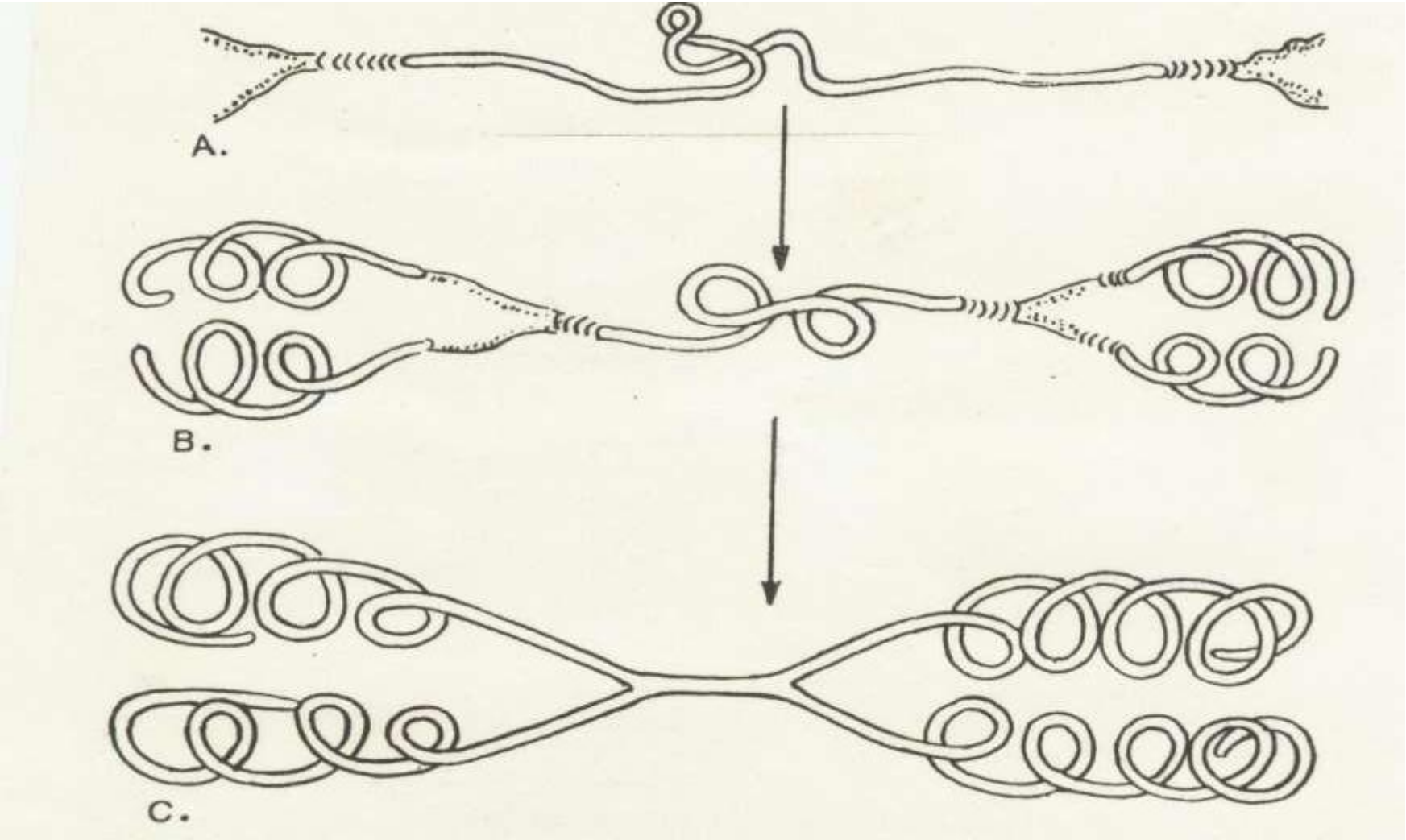
chromosome is multistranded i.e. it contains several DNA double helices arranged parallel to each other

General chromosome model- CRICK

DNA in a chromatid is a longer monomer which runs continuosly from one end to another.

Band and inter band regions are present

Folded fibre model- DUPRAW

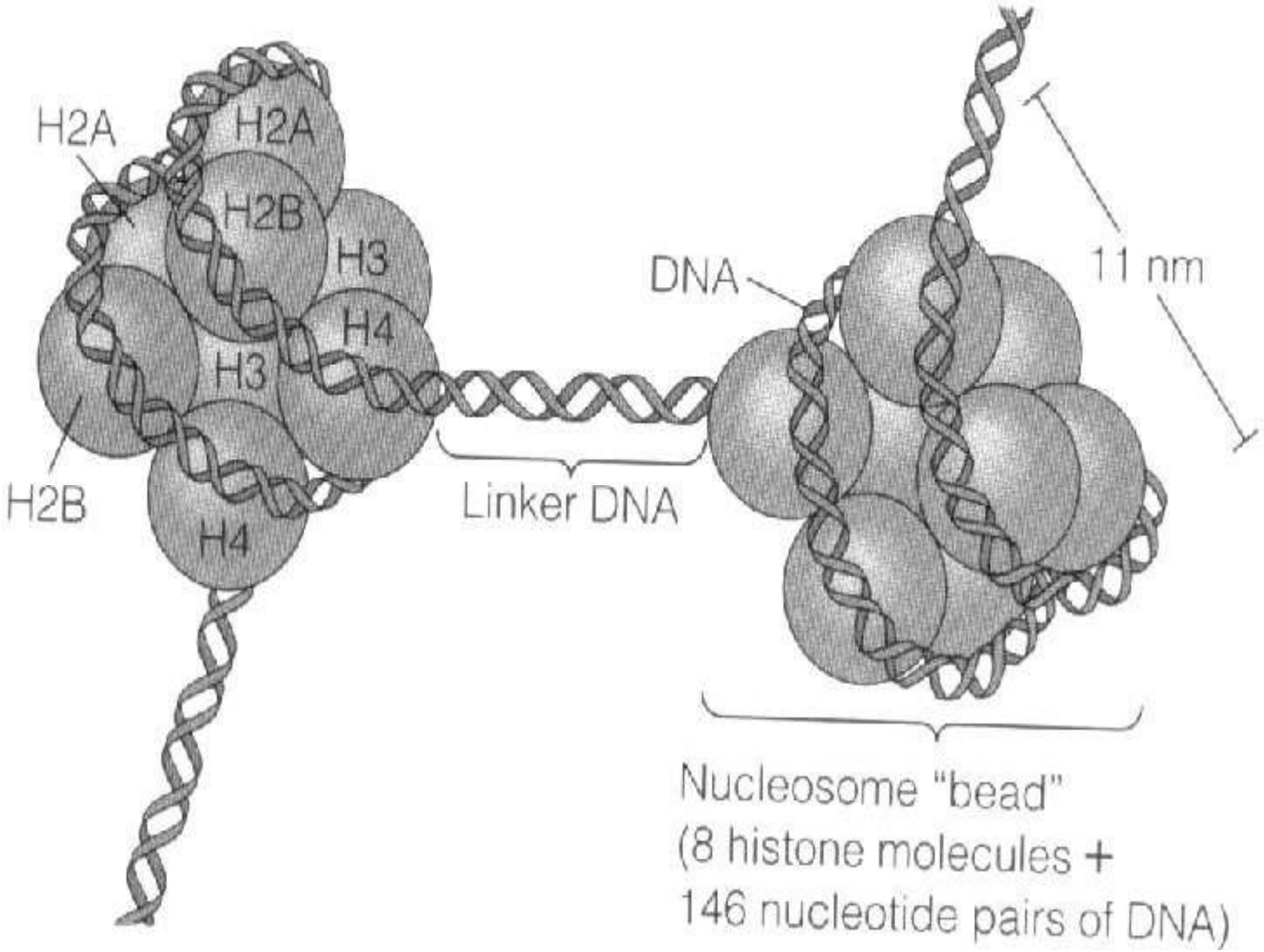


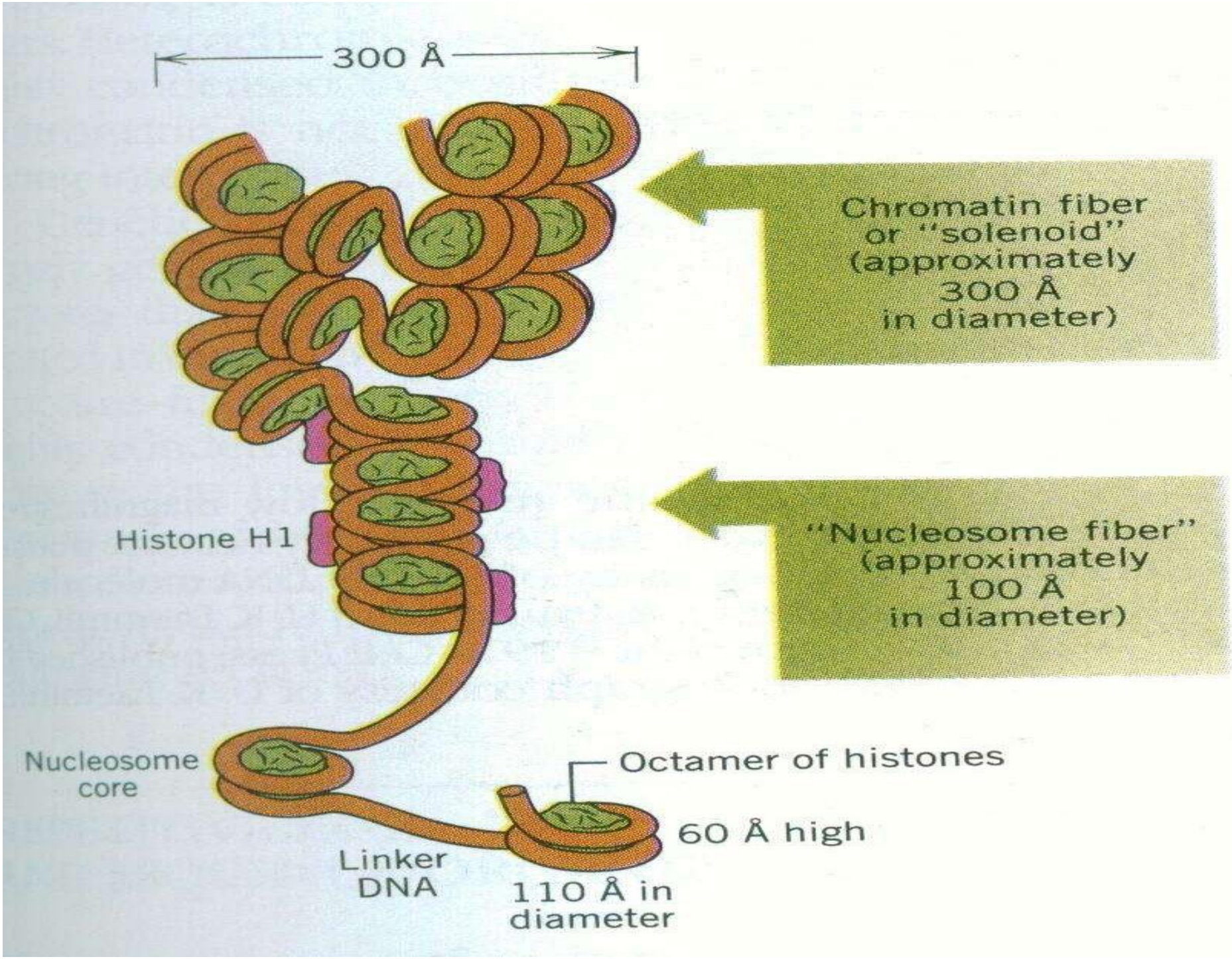
ORGANIZATION OF CHROMATIN FIBRE IN FOLDED FIBRE MODEL

- COILED DNA MODEL- DUPRAW
- NUCLEOSOME SOLENOID MODEL- KORENBERG AND THOMAS

COMPONENTS OF NUCLEOSOME

- NUCLEOSOME CORE
- LINKER DNA
- H1 PROTIEN

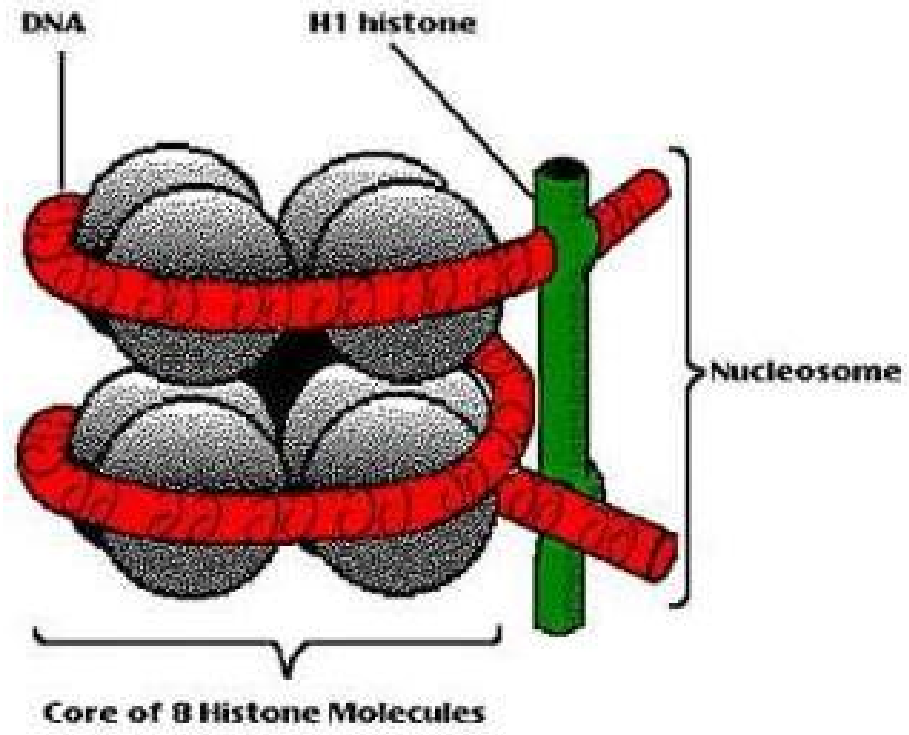

H2A
H2A
H2B
H3
H4
H3
H2B
H4
DNA
11 nm
Linker DNA
Nucleosome "bead"
(8 histone molecules +
146 nucleotide pairs of DNA)


300 Å
Chromatin fiber or "solenoid" (approximately 300 Å in diameter)
Histone H1
"Nucleosome fiber" (approximately 100 Å in diameter)
Nucleosome core
Octamer of histones
60 Å high
Linker DNA
110 Å in diameter

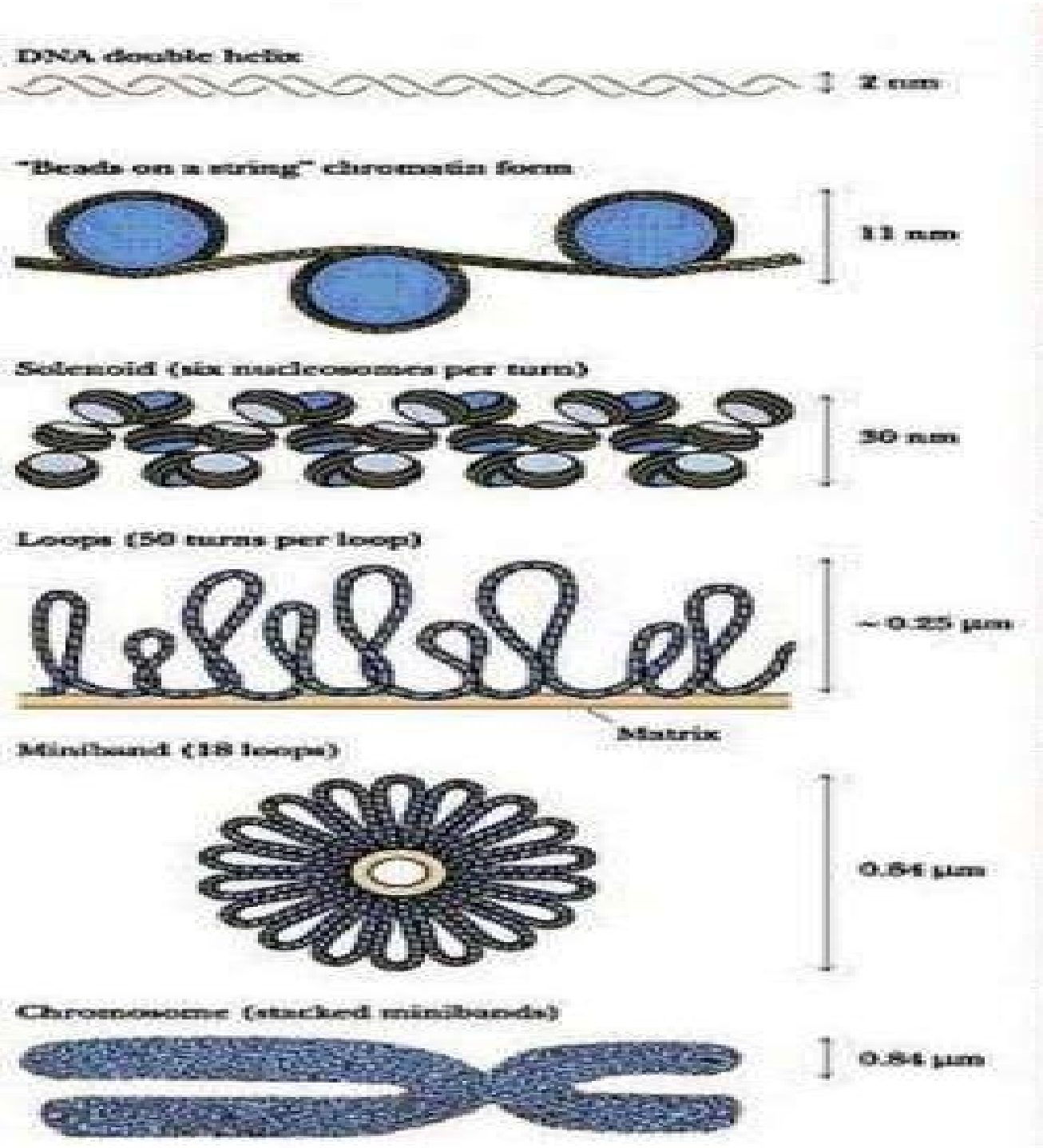
Steps involved in genome organization in eukaryotes

- Nucleosome formation
- Formation of Chromatin Fiber or Solenoid Fiber
- Loop formation
- Chromosome

Nucleosome formation



Nucleosome



Base pairs per turn	Packing ratio
10	1
80	6–7
1200	~40
60,000	680
~1.1×10^6	1.2×10^4
18 loops/ miniband	1.2×10^4

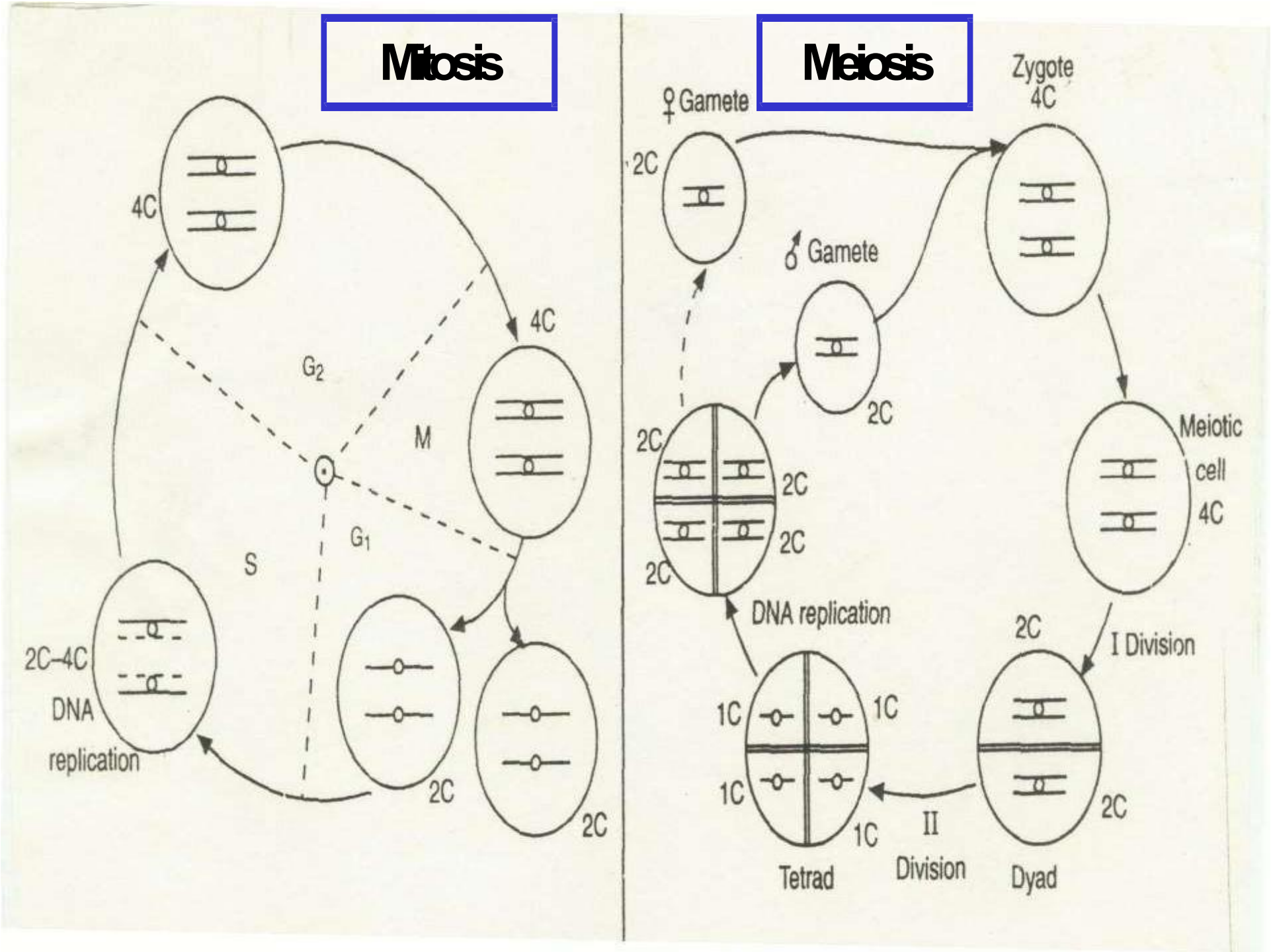
GENOME SIZE

- **Genome size is the total amount of DNA contained within one copy of a genome**
- **It is typically measured in terms of mass in picograms (pg) or megabases (Mb)**

Plant	Genome Size	No. of genes (chromosome no.)	Status (year)
Arabidopsis	130 Mbp	25,498 (5)	Completed (2000)
Rice	430 Mbp	37,544 (12)	Completed (2004)
Maize	2.5 Gbp	32,500 (10)	Completed (2009)
Sorghum	700 Mbp	34,496 (10)	Completed (2007)
Pigeonpea	833.07 Mbp	48,680 (11)	Completed (2011)
Soybean	950 Mbp	46,430 (20)	Completed (2010)
Potato	840 Mbp	39,031 (24)	Completed (2011)
Brassica	283.8 Mbp	41,174 (10)	Completed (2011)
Populus	480 Mbp	41,377 (19)	Completed (2006)
Papaya	372 Mbp	28,629 (9)	Completed (2008)
Grapes	500 Mbp	26,346 (19)	Completed (2007)
Medicago	240 Mbp	-	Completed (2011)
Castor	320 Mbp	31237 (10)	Completed (2010)
Apple	742.3 Mbp	57,386 (17)	Completed (2010)
Lotus	450 Mbp	-	Completed (2008)
Foxtail Millet	406 Mbp	32,095 (9)	Completed
Cucumber	243.5 Mbp	26,682 (7)	Completed (2009)
Brachypodium	335 Mbp	25,532 (5)	Completed (2010)

C value

- **Cvalue means, it's the total amount of DNA in haploid genome.**
- **Cvalue = mass of DNA / haploid genome. It's characteristic of each genome of species.**
- **Its measured using cot technique.**


Mitosis
4C
4C
G2
M
G1
S
2C–4C
DNA
replication
2C
2C
Meiosis
♀ Gamete
2C
♂ Gamete
2C
Zygote
4C
2C
2C
2C
2C
DNA replication
Meiotic
cell
4C
I Division
2C
1C
1C
1C
1C
II
Division
2C
Tetrad
Dyad

Eukaryotes

Densitometric measurements of Feulgen -stained nuclei (previously using specialized densitometers) or flow cytometry.

Prokaryotes

Pulsed – field gel electrophorosis and complete genome sequencing method

Genome size variation

- Cell size
- Cell division
- Organ size
- Organ complexicity
- Body size developmental rate
- Chromosomal mutations
- Insertions and deletions
- Transposable elements