

FROM GENOME TO GENE

GENOME



Eukaryotic cell

Nucleus

CHROMOSOME



GENE

Protein production



Protein

Cellular Hierarchy



BIOSPHERE

ECOSYSTEM

COMMUNITY

POPULATION

ORGANISM

ORGAN SYSTEM

ORGAN

TISSUE

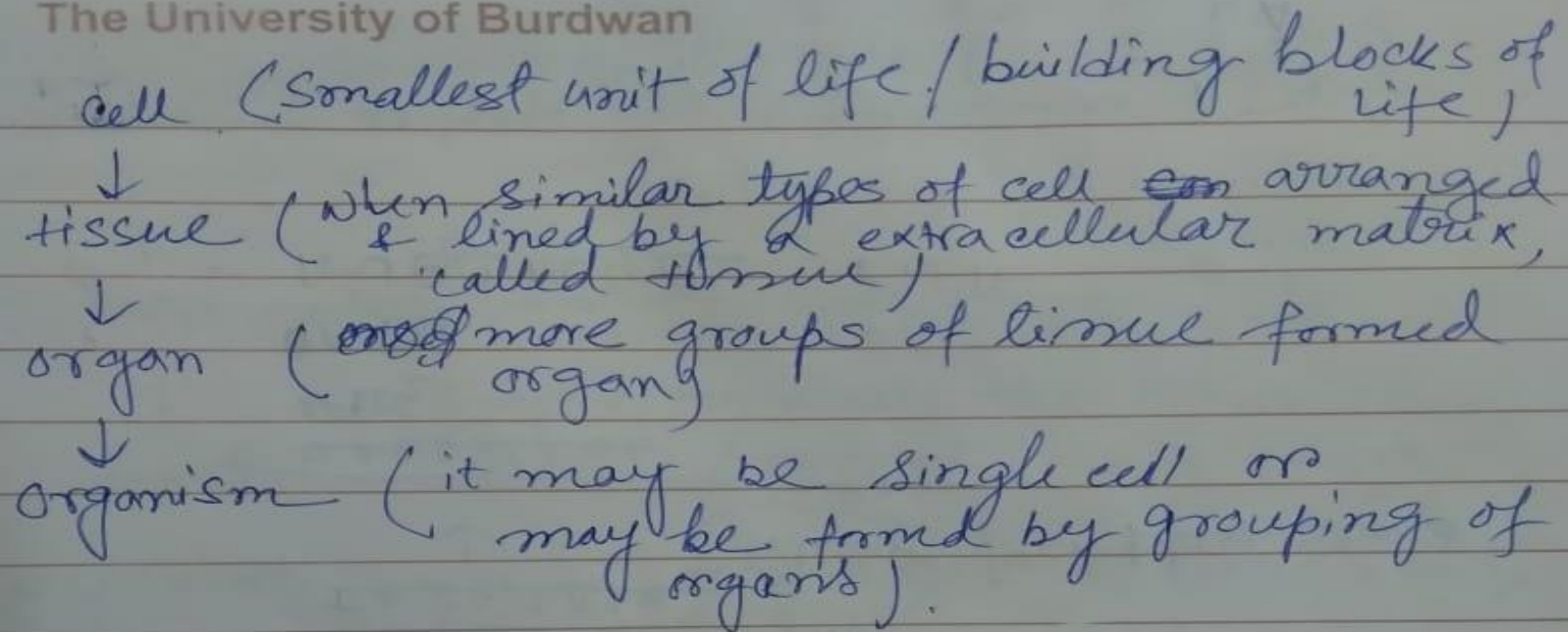
CELLS

ORGANELLES

BIOMOLECULES



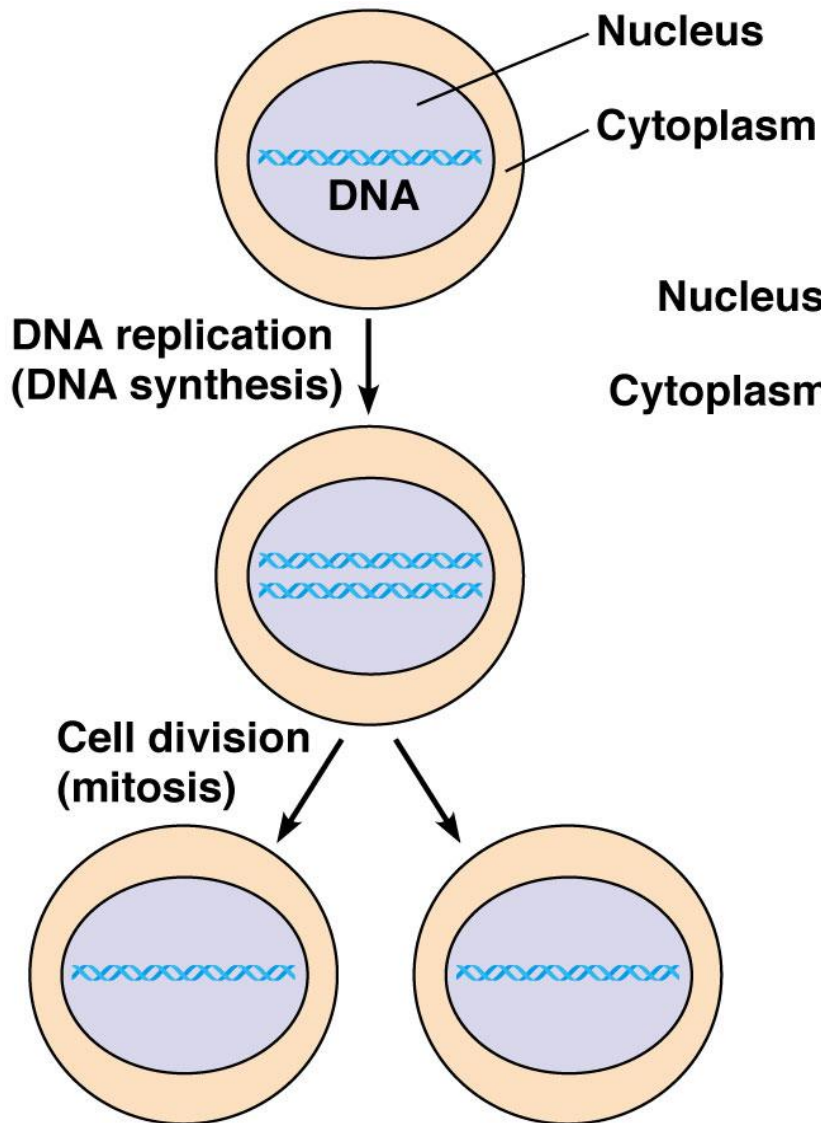
The University of Burdwan



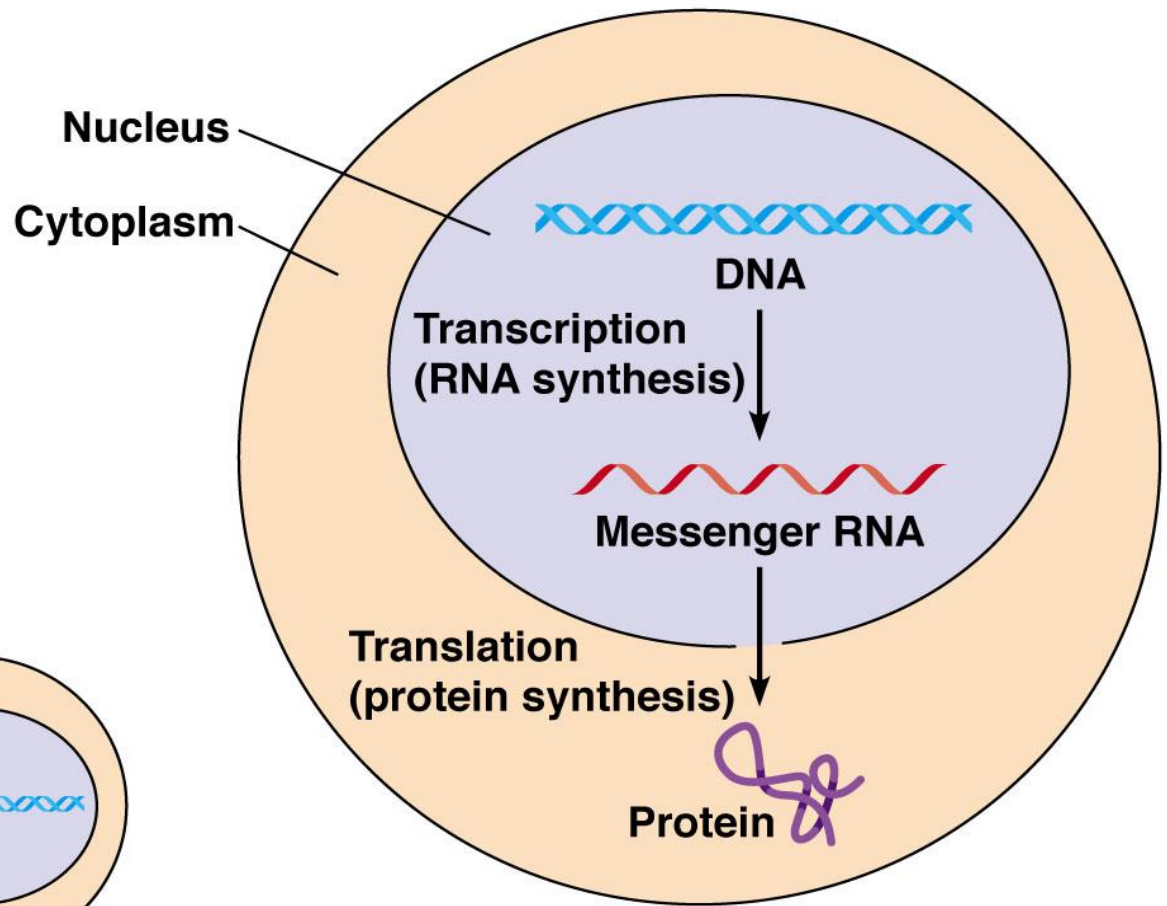
Information storage organelle

↓
Nucleus /
contain cell's
genetic material
(DNA / RNA + proteins)

In case of prokaryotic cells
↓
Don't carry nucleus
contain a single chromosome.



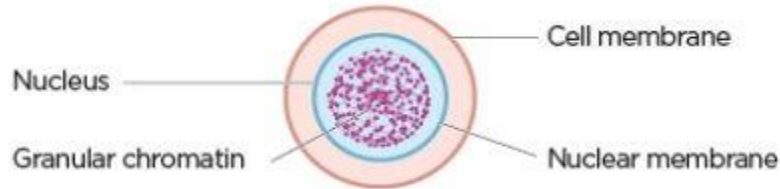
(a) The flow of genetic information between generations of cells



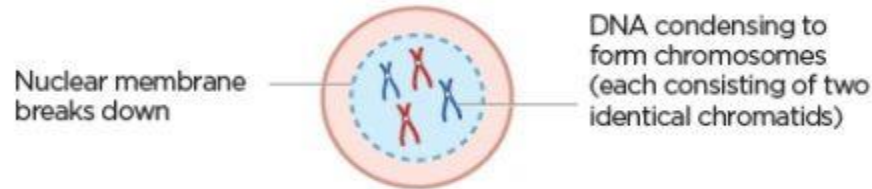
(b) The flow of genetic information within a cell: the expression of genetic information

Fig 2. **Mitosis**

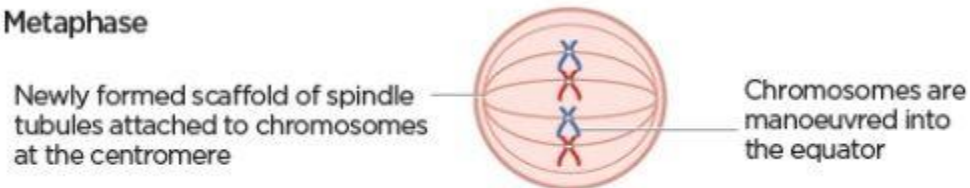
Interphase^a



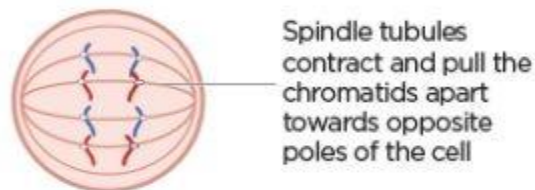
Prophase



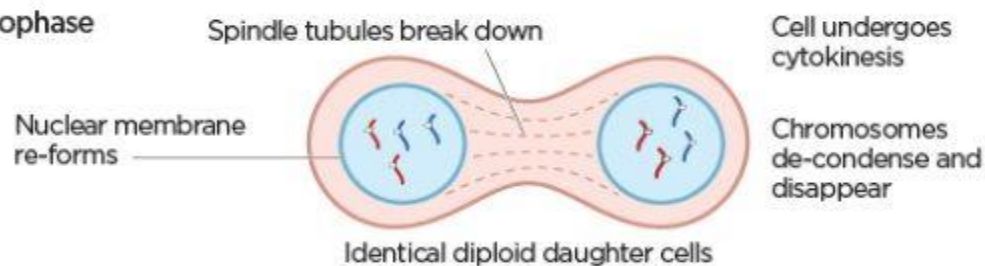
Metaphase



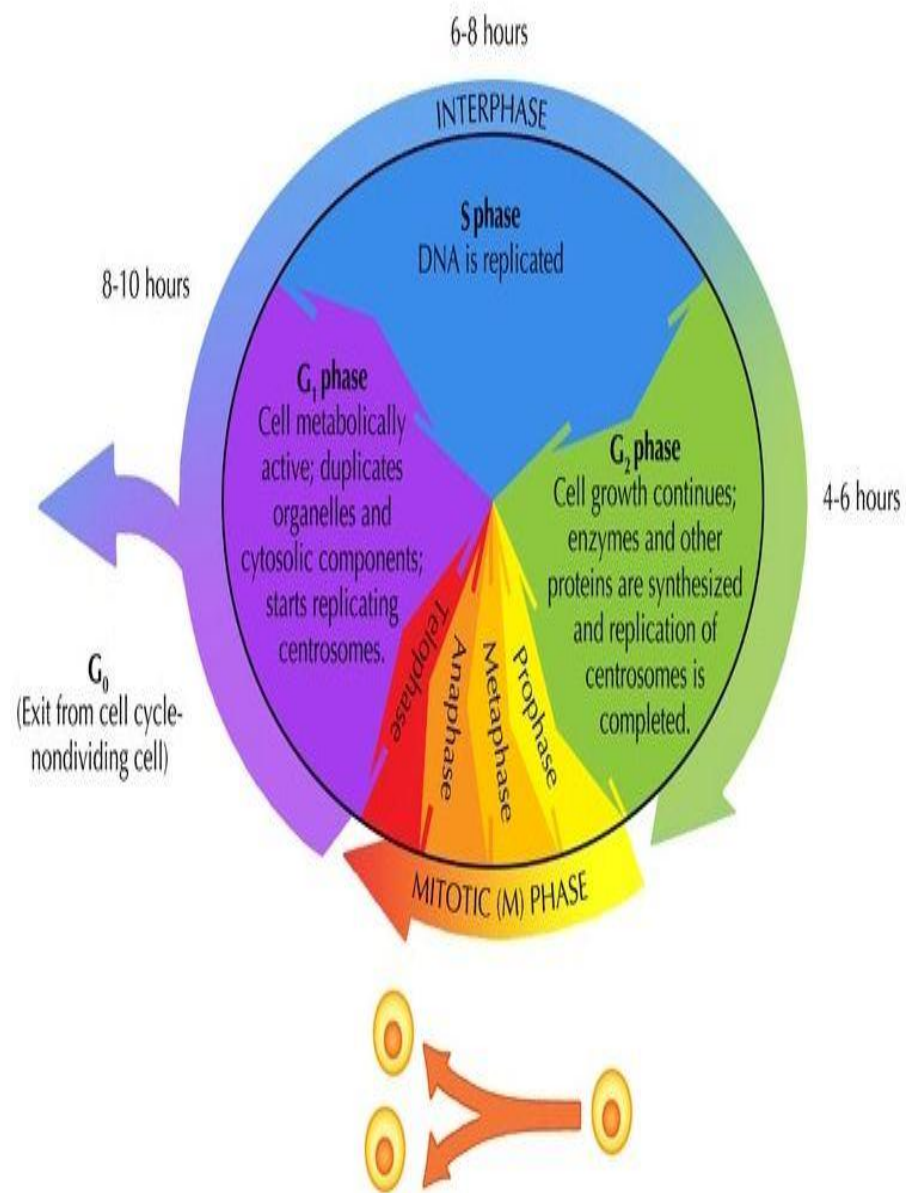
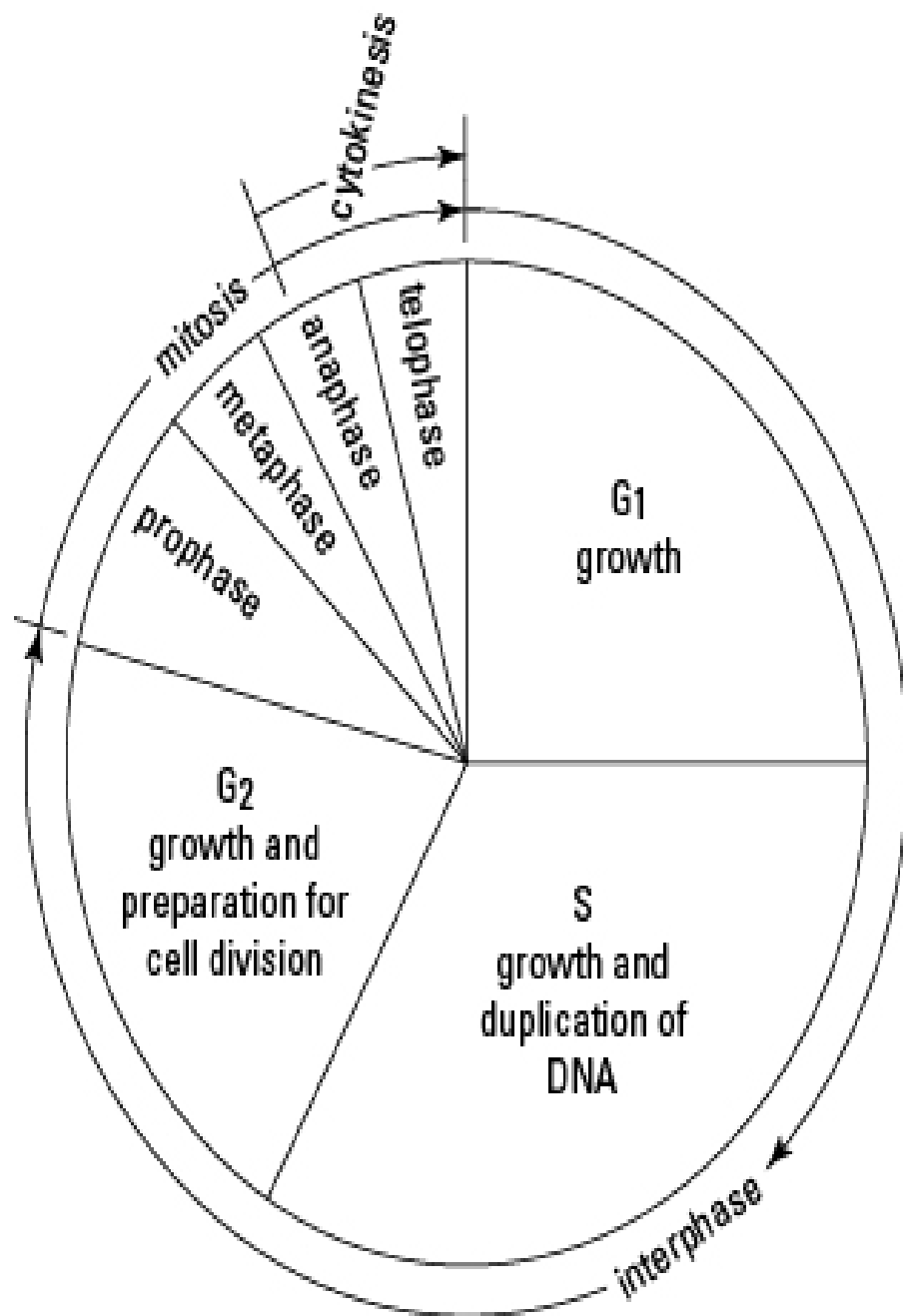
Anaphase

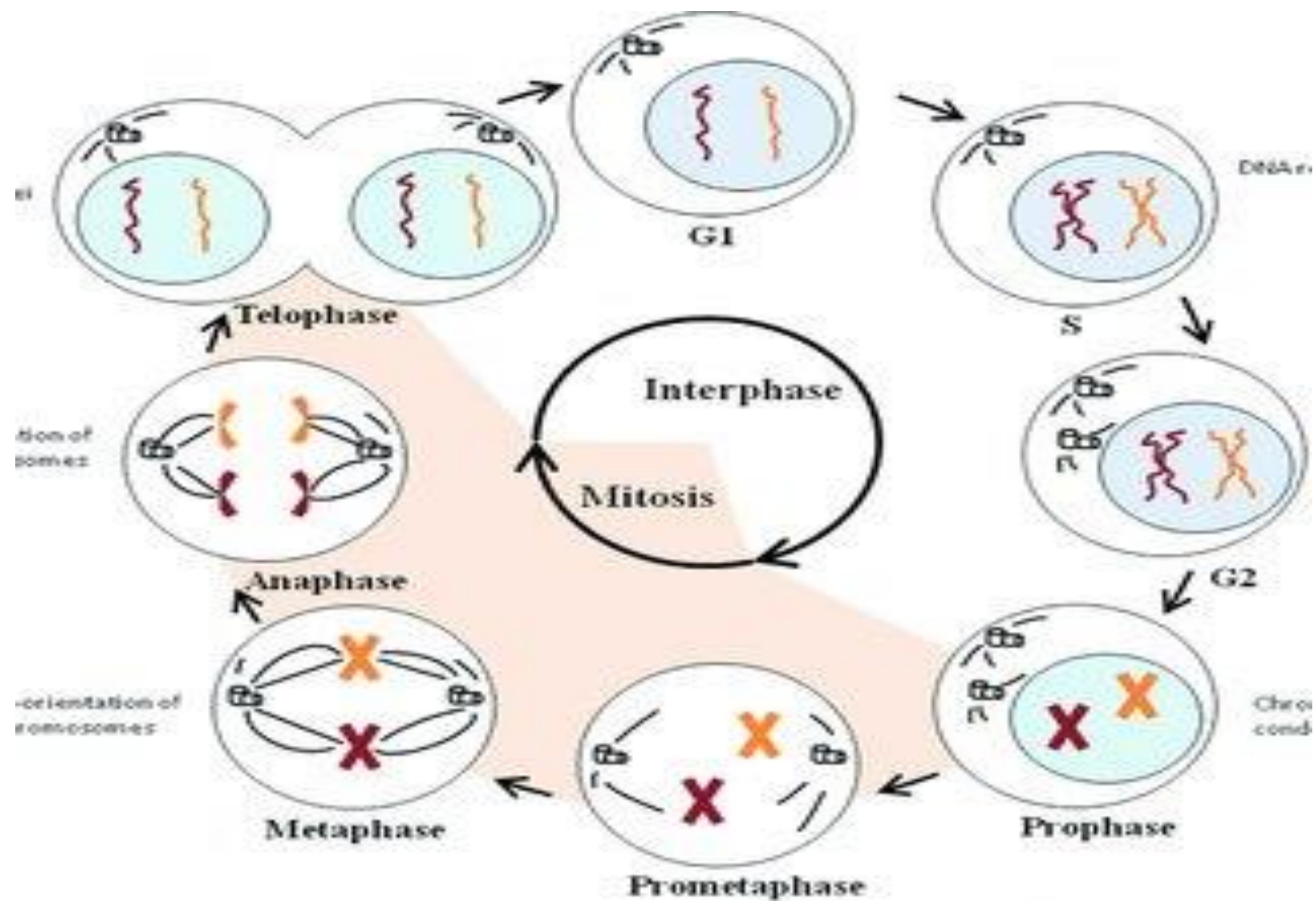


Telophase



^aInterphase is not part of mitosis but features here for clarity. DNA = deoxyribonucleic acid



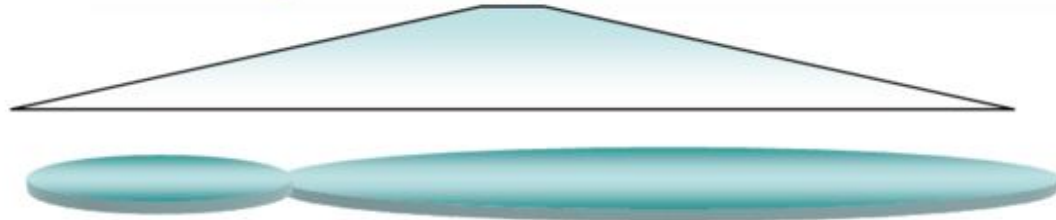


Spindle formation & nuclear envelope breakdown

Genome



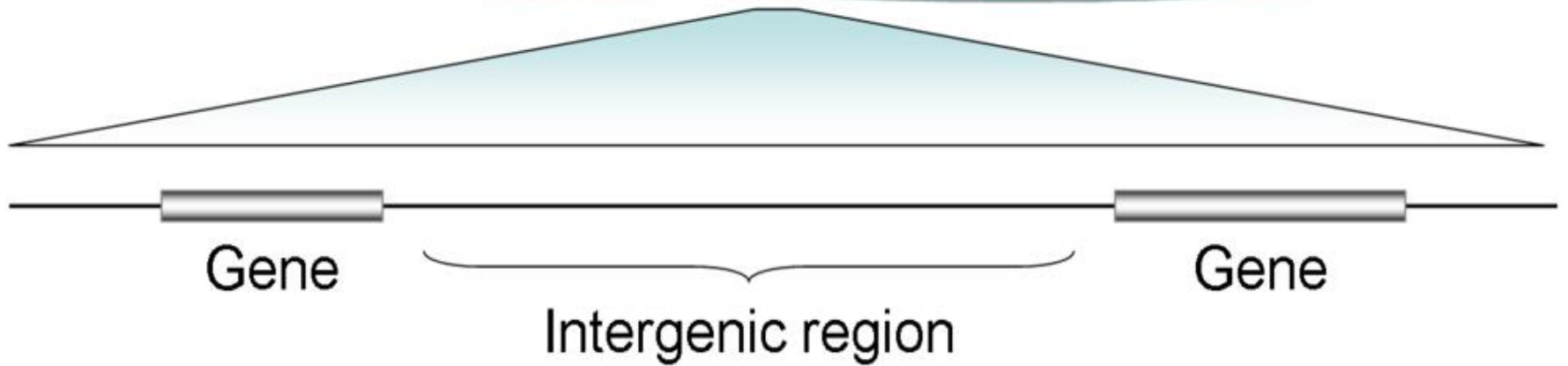
Chromosome



Gene

Intergenic region

Gene



Genome (Haploid set of chromosomes of a cell or organism.)

↓
Discrete unit of genome is chromosome.

↓
Chromosome made up of Nucleic acids (DNA/RNA) + Proteins.

↓
ATGCATGC | nucleotides /
TACGTACG
↓

↓
Gene

A part of DNA which can transcribe.

(Noncoding RNA

↓
function

mRNA (coding RNA)

↓
protein

↓
function

Chromosome (n)

(male bee)

• Haploid organism (a single set of (n))

• Diploid (2n) [n]

• Human 23

• Chimpanzee 24

• Maize 10

• Bread wheat 21

• Mouse 20

HAPLOID vs DIPLOID

- **Haploid:**

- **One set** of chromosomes
- In humans, **number (n) = 23**
- In humans, **gametes** (sperm & ova) are haploid

Haploid (N)



- **Diploid:**

- **Two sets** of chromosomes
- In humans, **2n = 46**
- In humans, all **body cells** (other than gametes) are diploid

Diploid (2N)



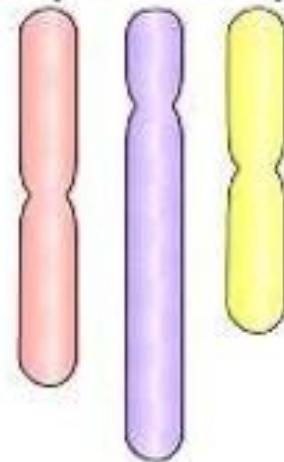
3.2.6 Diploid nuclei have pairs of homologous chromosomes

Diploid Nuclei:

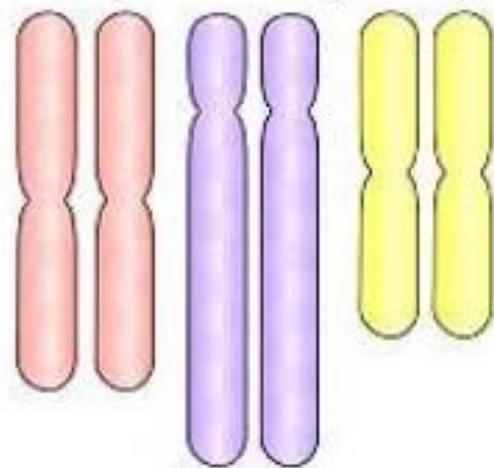
- **Two** of each chromosome type (and so 2 copies of each gene*)
- In humans, haploid cells contain **46 chromosomes** (2×23)
- Haploid sperm and egg fuse in fertilization to produce diploid Zygote, which then divides by Mitosis to form embryo
- Diploid cells are **body cells (somatic cells)**

**Males only have one copy of each gene on the X and Y sex chromosome*

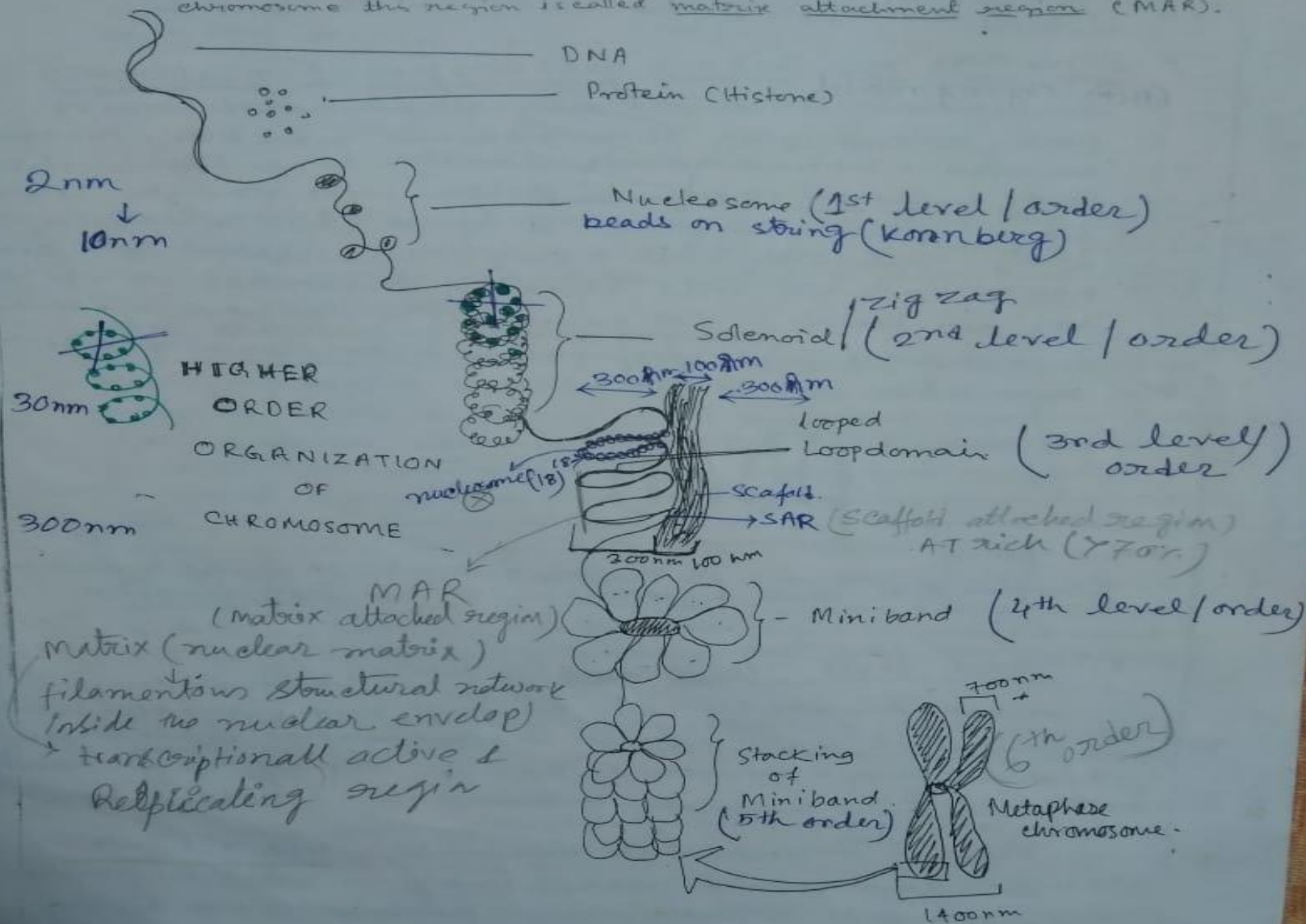
Haploid (N)



Diploid (2N)

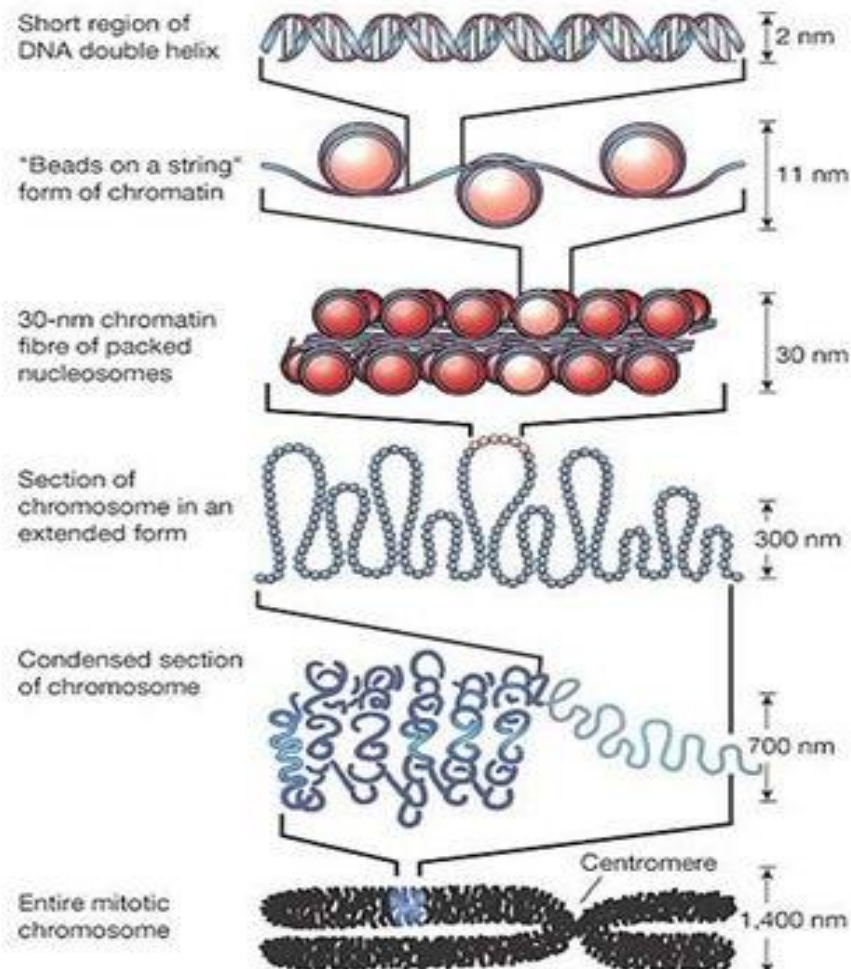


make the final metaphase chromosome. The DNA attaches with the scaffold called scaffold attachment region (SAR) in case of interphase chromosome this region is called matrix attachment region (MAR).



Chromosome Structure

See animation: http://www.biostudio.com/c_%20education%20mac.htm



Nucleosome

~ 200 bps of DNA

A histone octamer

H₁ (Histone 1) Protein.

Coarse particle

core DNA (146 bps of DNA)

H₂A

H₂B

H₃

H₄

H₂A H₂B

Dimer

tetramer

H₃ H₄

Dimer

tetramer

tetramer

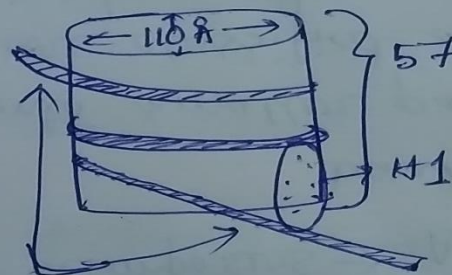
Linker particle.

Linker DNA

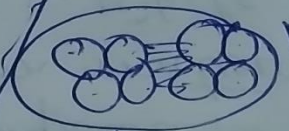
Linker region

~ 8-114 bps DNA

H₁ protein.



200 bps DNA



Histone octamer