

Date:

CELL DIVISION

→ every living cell has the ability to produce on the next generation of their own kind

Genetic Molecule

→ involved in cell division process

→ entangled mass of threads: chromatin material

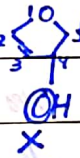
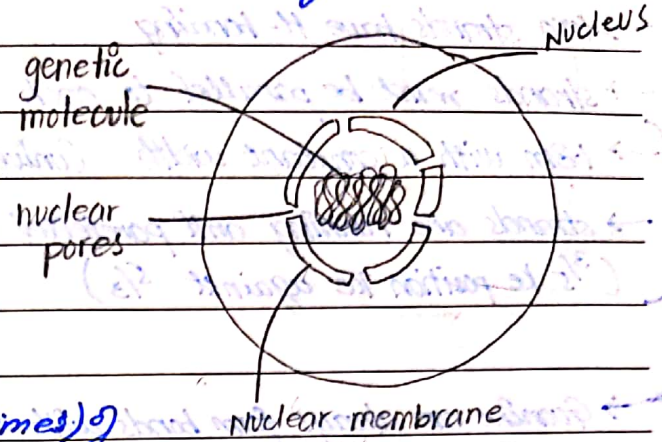
↳ made up of chemical known as DNA

→ formed of DNA

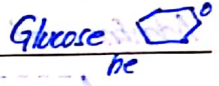
↳ a type of polymer (one molecule is repeating no. of times) of

nucleotide: (1) Sugar - Ribose (5 cornered ring)

↳ Deoxy Ribose



Deoxy Ribonucleic Acid



(2) Phosphate group (PO_4^-)

(3) Nitrogenous base - 4 types

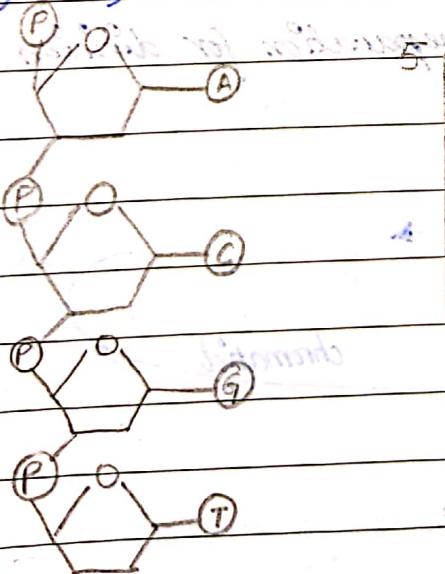
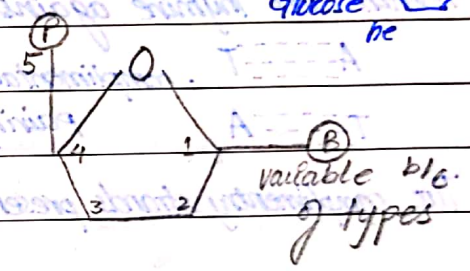
(i) Adenine, A } large bases (2 rings)

(ii) Guanine, G } (bc they have 2 rings)

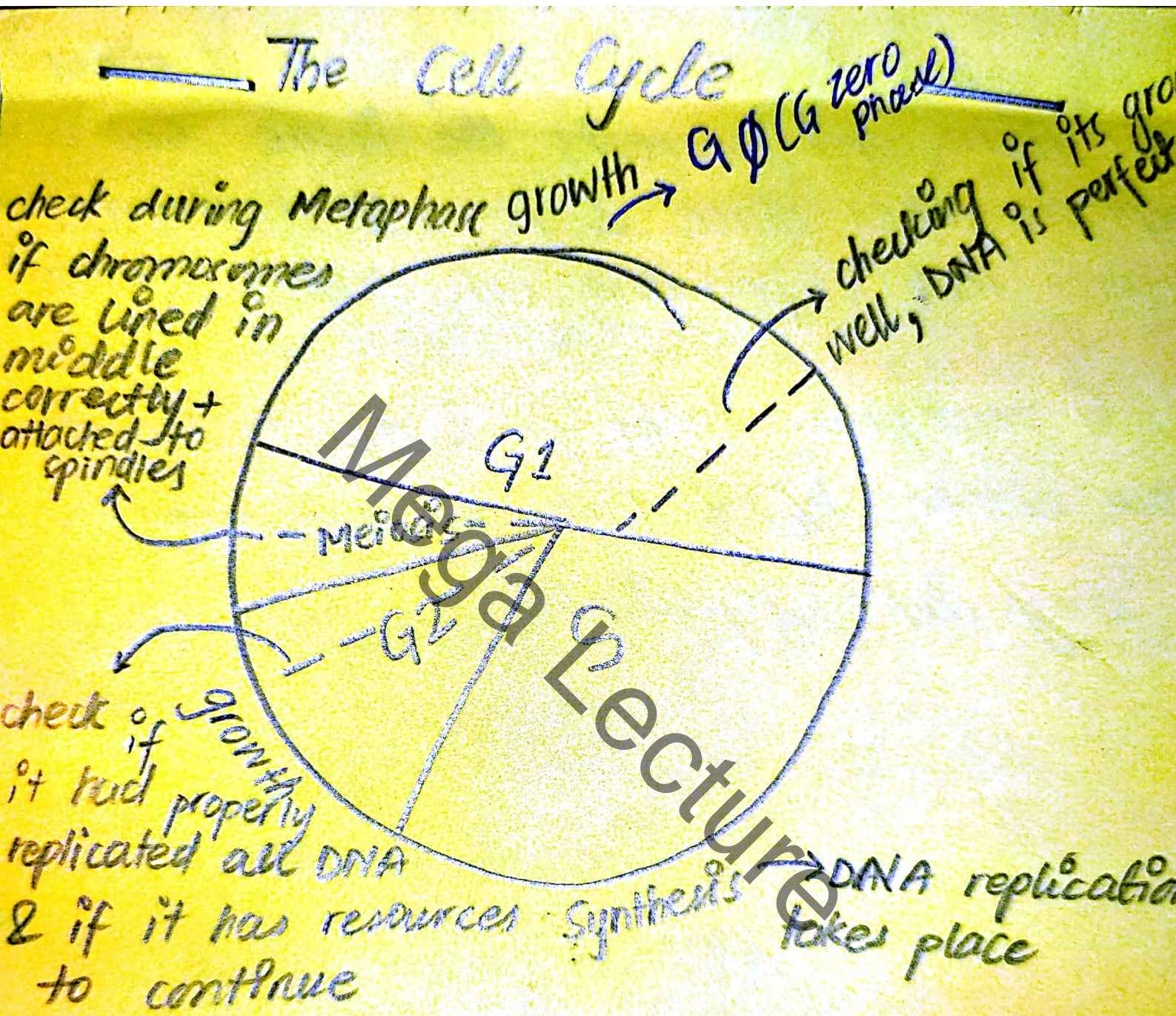
(iii) Cytosine, C } small bases

(iv) Thymine, T } (bc they have 1 ring)

1 DNA (universal for all living organisms)

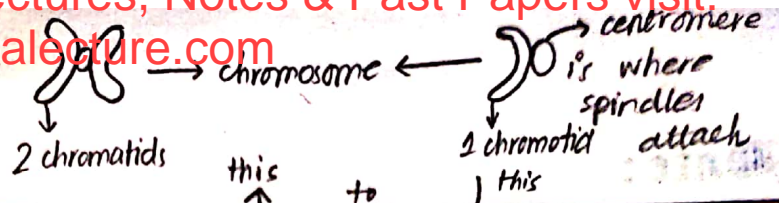


DALMATIAN



waits there and corrects the issue or
apoptosis takes place & it self destructs
ensures that irreparable cell doesn't divide

In G zero phase cells go & stay & do not
grow either b/c lack of resources or
b/c they don't replicate.



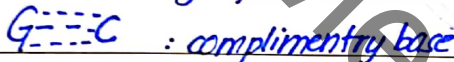
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DNA

- two strands present side by side to each other linked by H bonds
- double helix shape
- two strands have H-bonding
- strands must be parallel to each other to maintain width
- 1.8m with a constant width (universal)
- strands are running anti parallel to each other (3' to 5' position against 5' to 3')

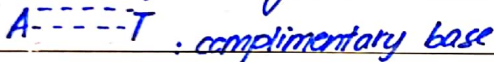
happens during DNA replication in interphase

→ Guanine can always form bonds with cytosine

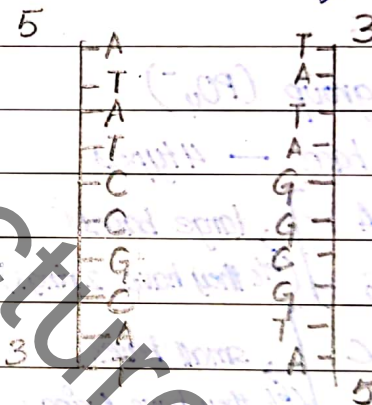


Applies in the Tree & the Car in the Garage

Adenine and Thymine against each other

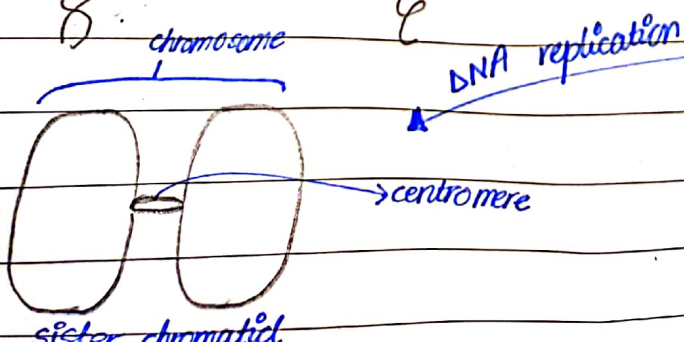
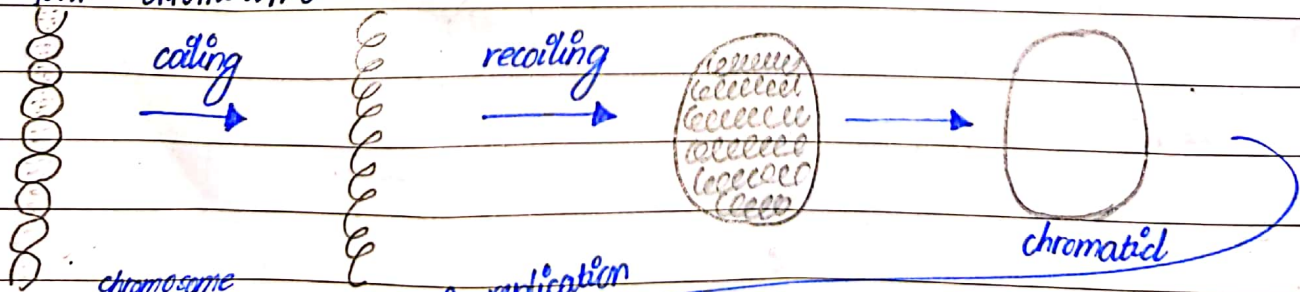


Two complimentary strands present side by side



→ DNA condensation takes place when cell starts preparation for division

↳ to form chromosomes



shapes:



Date:

→ chromosome shapes, sizes and lengths can vary due to position of centromere

e.g/
Human : 46 chromosomes - 96 sister chromatids 1 (n)
 ↓
 diploid - 2n (complete set) sets of chromosomes
 - 23 pairs of chromosomes : $2n \rightarrow$ In humans, this means
 (shape & sizes) → Homologous pairs 2 sets of chromosomes, 1 from
 - Haploid - 1n (half set / one member of each pair) father & 1 from
 only in sex cells / gametes mother
 $23 + 23 \rightarrow 46$

Onion : 18 chromosomes - 9 pairs
 diploid number is even except in bacteria → single chromosomes

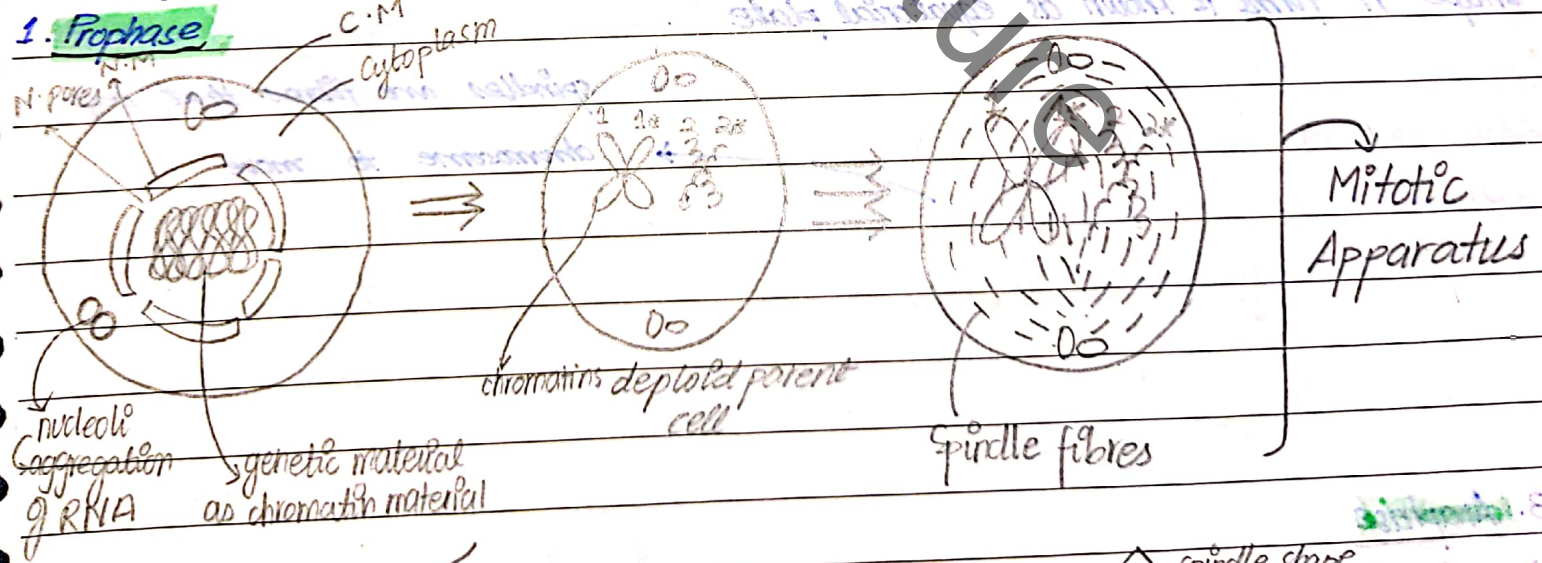
→ two types of cell division : ① Mitosis ② Meiosis

MITOSIS:

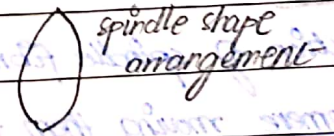
→ a single parent cell divides to form two daughter cells which are smaller in size and identical to their parent cells PMAT

→ 4 major phases : 1. Prophase 2. Metaphase 3. Anaphase 4. Telophase

1. Prophase



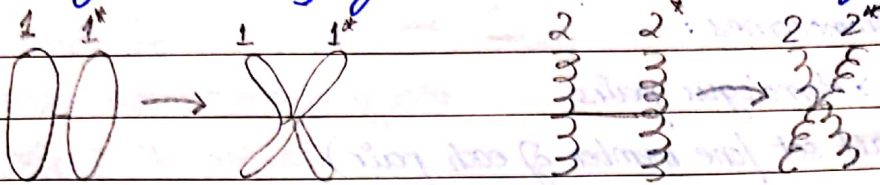
A normal cell ready for division :
 Resting / Interphase (non-dividing)



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- ⊖ division of centrioles into two pairs each moving towards a opposite poles
- ⊖ disintegration of nuclear membrane (dotted line)
- ⊖ disintegration of nucleoli
- ⊖ coiling and re-coiling of the DNA : condensation of DNA → chromosomes



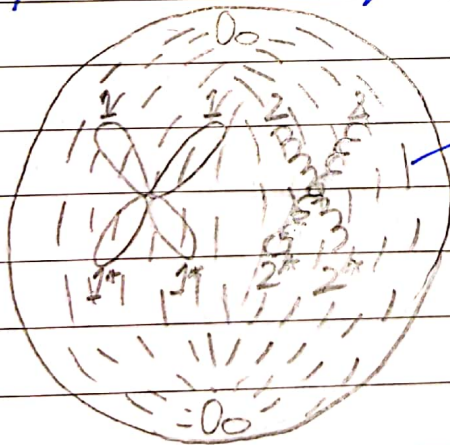
- ⊖ assembling of tubulin into spindle fibres
protein present in cytoplasm

- ⊖ attachment of the chromosomes on spindle fibres in such a way that the arms : are free and attachment is at centromere, random attachment

→ Prophase is a stage in which we are forming mitotic apparatus

2. Metaphase

- chromosomes will arrange on equator of spindle fibre making it thicker and the shape it forms is known as equatorial plate



spindles are fibres that help chromosome to move

3. Anaphase

- contraction of spindle fibres results in detachment of sister chromatids at level of centromere moving them towards their respective poles

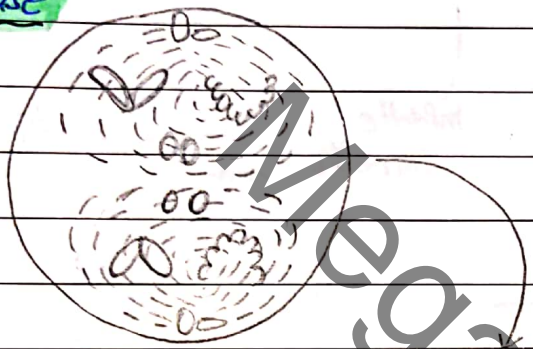
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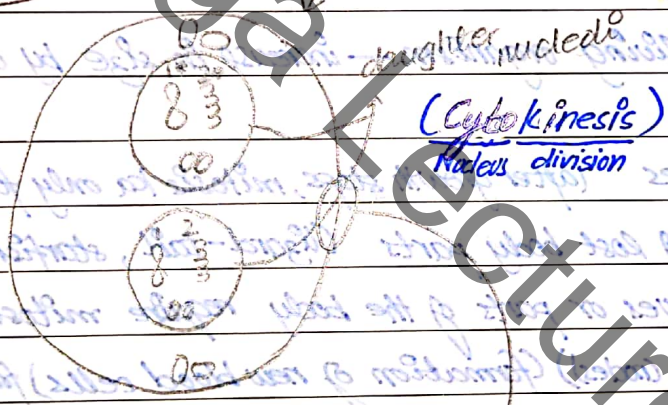
4. Telophase

→ Early:



- * disassembling of spindle fibres
- * reappearance of nuclear membrane
- * reappearance of nucleoli giving us the darkly stained region

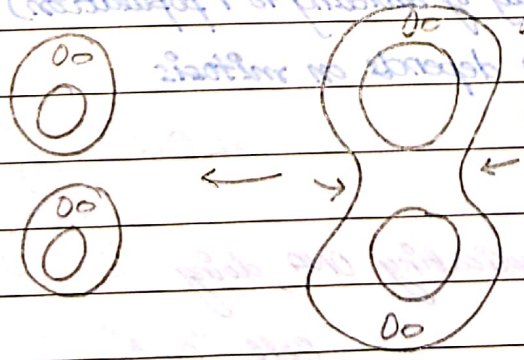
→ Late:



→ reverse of prophase

→ cell division process completes by division of cytoplasm (Cytokinesis)

↳ In animals starts from outside of the cell & moves inside in a cleavage furrow



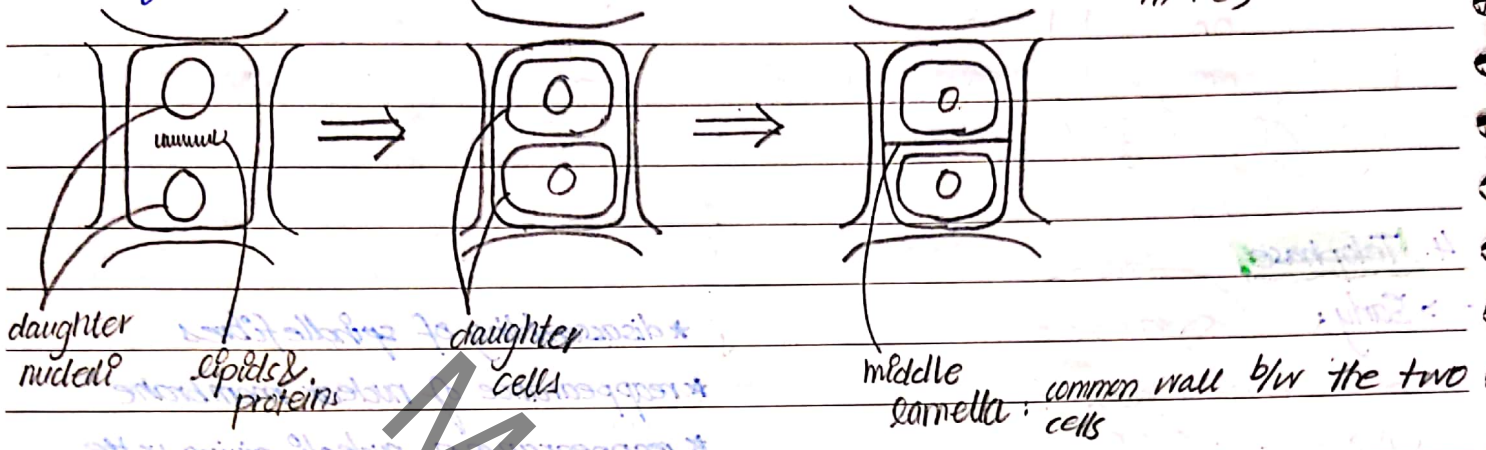
P → M → A → T

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Cytokinesis in Plant Cells

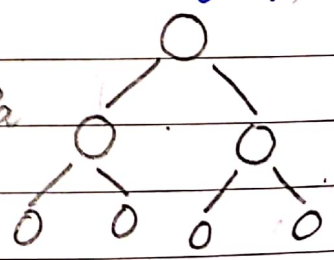
⊖ thickening in centre — extending towards outside

(centrioles are absent in PC)

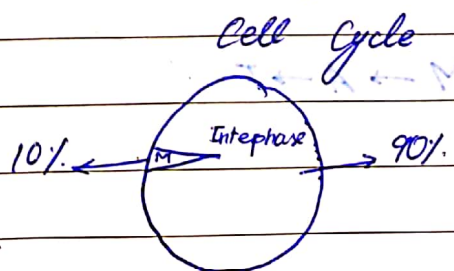


•• Significance of Mitosis

- required for growth of a living organism — increase in size by adding on new identical cell.
- repair of damaged tissues (after growth stops, mitosis ka only function in body)
- regeneration, recovering of lost body parts (lizard-tail, starfish-arm)
- Synthesis of specific tissues or parts of the body require mitosis (lateral branches in plants at start of spring (nodes) (formation of new blood cells from bone marrow stem cells))
- A-sexual reproduction (an efficient way of dividing to ↑ population); single parent requirement and consumes less time, also depends on mitosis (identical next generation in less time)



Interphase: The cells are growing, replicating DNA, doing (90% of cell cycle) their cell functions

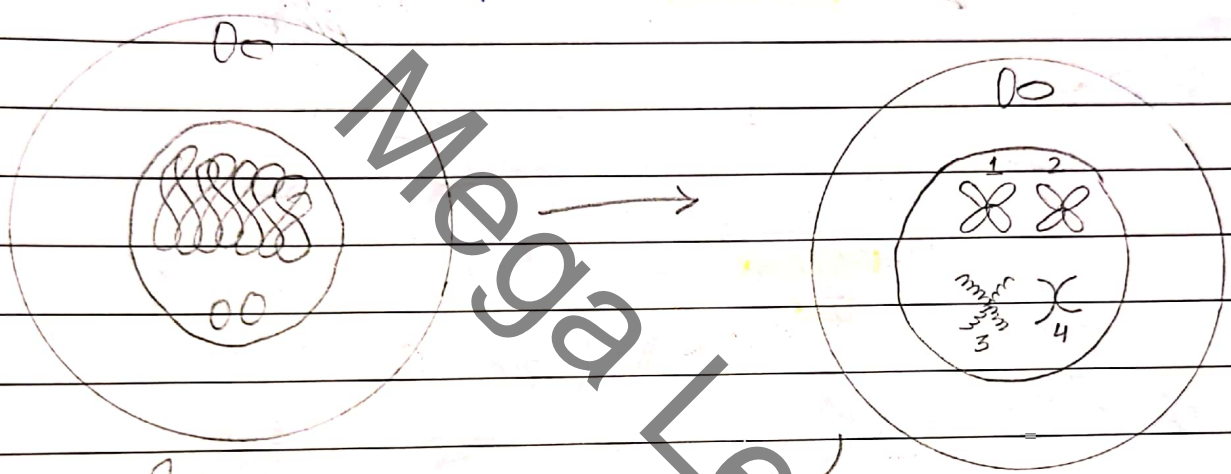


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MEIOSIS

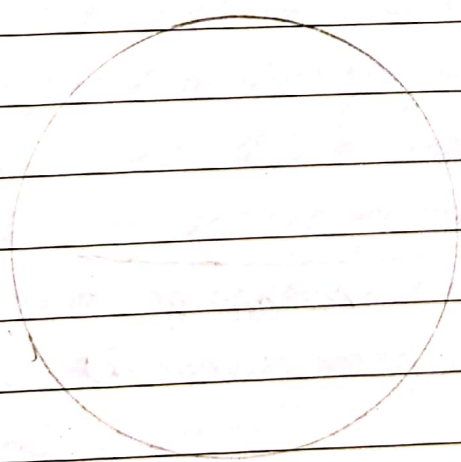
- a single parent cell divides to form 4 daughter cells, having half chromosome number and smaller in size as compared to the parent cell (genetic material)
- each daughter cell is not identical to either the parent cell or the other daughter cells
- Meiosis I and Meiosis II

1. Prophase

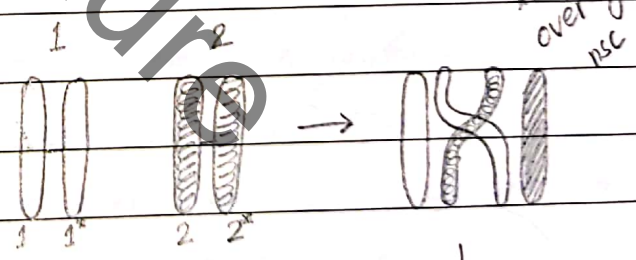


Interphase

Parent Cell $2n$

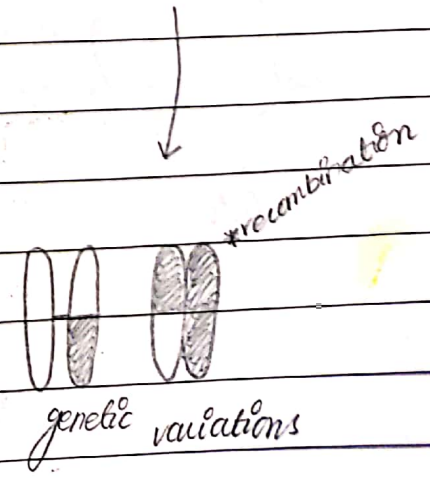


Mitotic Apparatus is about to disappear



non-sister chromatid (two chromatids of a pair)

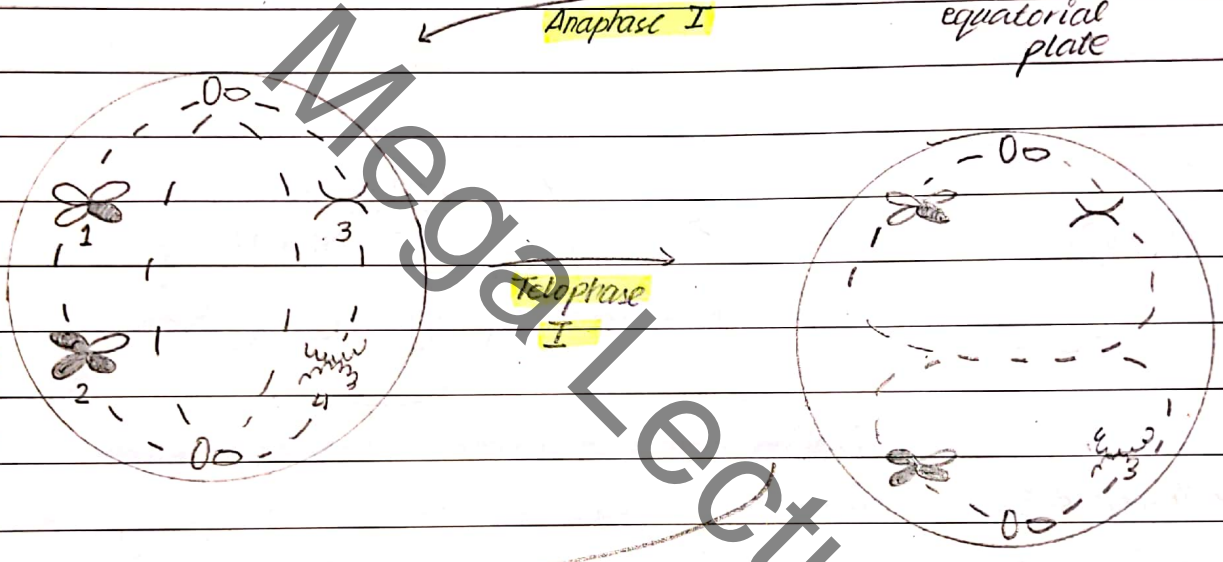
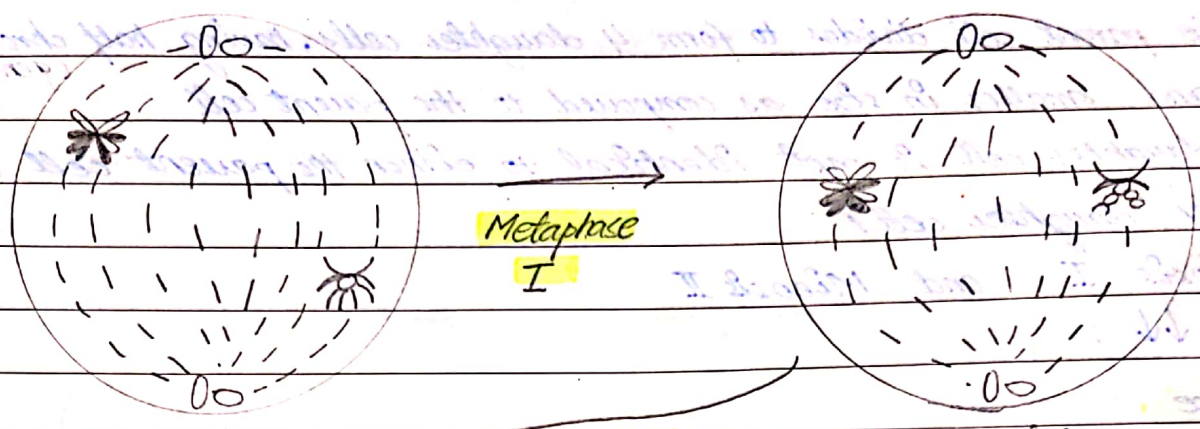
crossing over of nsc



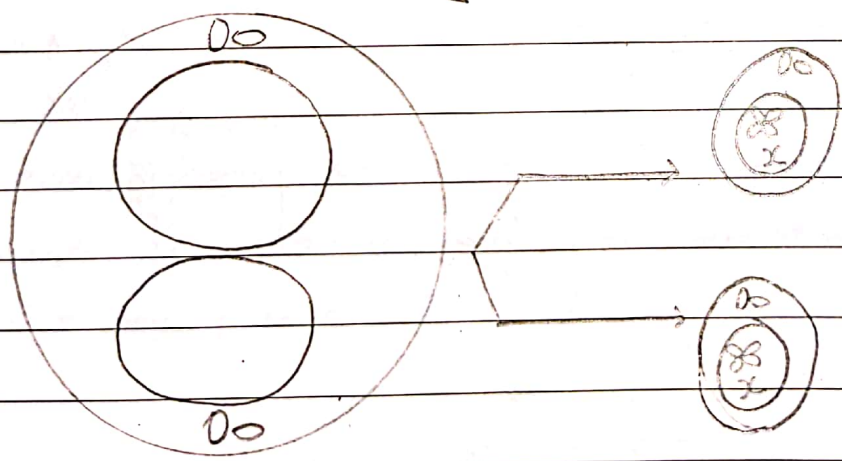
genetic variations

1 and 2 } homologous pairs
 3 and 4 }

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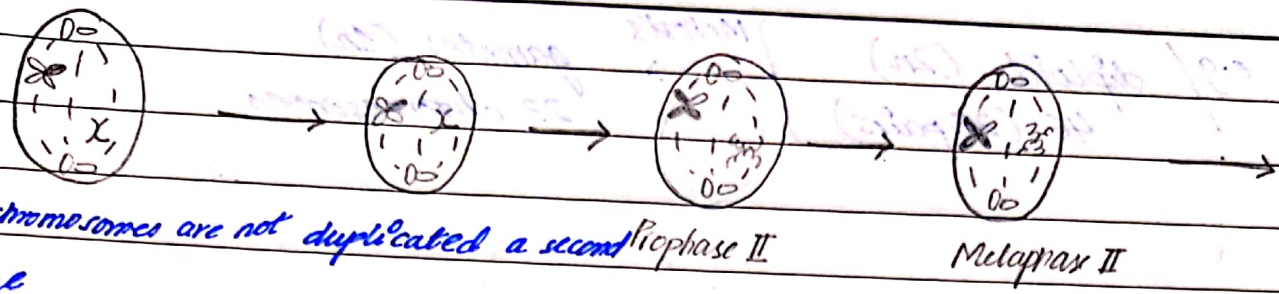
their separation might be different (e.g) 1 and 4 2 and 3



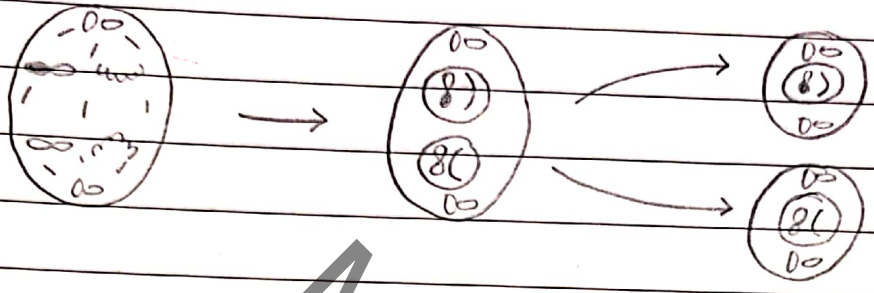
Meiosis II (same as Mitosis)

*only in ovaries & testes

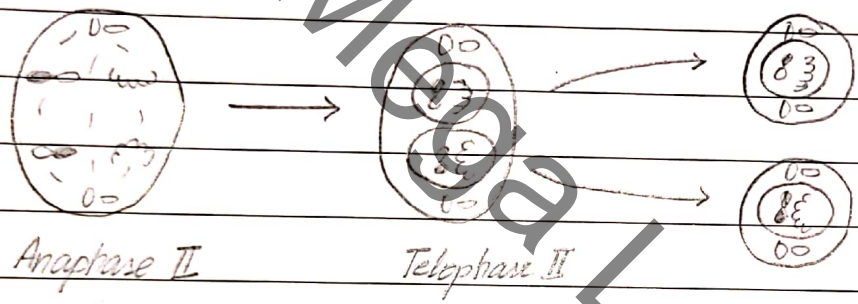
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* chromosomes are not duplicated a second time



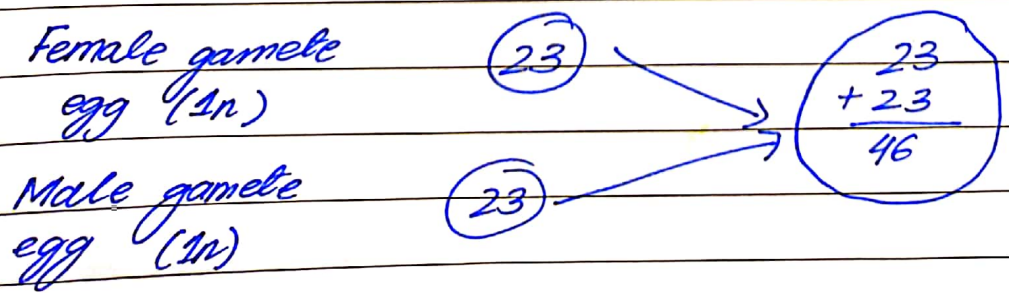
Meiosis in males is going to produce sperm cells & in females it's going to produce egg cells



Daughter cells — In $P_1 \rightarrow M_1 \rightarrow A_1 \rightarrow T_1 \rightarrow P_2 \rightarrow M_2 \rightarrow A_2 \rightarrow T_2$ (gametes - sex cells)

Significance of Meiosis

- is required to develop genetic variation in the next generation
- type of cell division required for the formation of gametes
- required for sexual reproduction process and maintains specie specific chromosome number constant generations after generations
- tends to increase gene pool of a population therefore avoiding genetic disorders



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Humans e.g. diploid ($2n$) } ^{Meloni's} → gametes ($1n$)
46 (23 pairs) } 23 chromosomes

Mega Lecture