Botany
cell biology
cell division
Genetics
virus, pectoria
plant kingdom
plant hormone
plant movement
Ecology
Plant ...

Physics
1D dimension

chemistry
chemical bonding

Other

Simple Compounds
SLCM

DATE / /
PAGE NO.

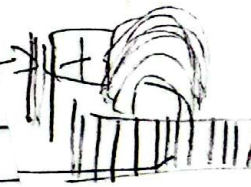
Cell Division and cell cycle

* Cell divides due to → ① To maintain the nucleo-cytoplasmic ratio
② To continue the generation.

• Cell cycle → 2 phase - ① Non-dividing (Interphase) → G_1, S, G_2
② Dividing (M-phase)

• Correct sequence of cell cycle → $G_1 - S - G_2 - M$, or $S - G_2 - M - G_1$,
or, $G_2 - M - G_1 - S$ or $M - G_1 - S - G_2$

• G_0 phase → cell arrest cycle.
eg. Neuron - can't divides in whole life.



* Cell cycle

• Interphase
→ non-dividing phase
→ preparatory phase
→ Resting phase.
→ Metabollically most active phase of cell cycle.
→ longest phase of cell cycle.

• M-phase
→ Dividing phase
→ cell division phase
→ shortest phase of cell cycle.

I F P M N
F I P M
T F N
M T F N

* Note: Longest and metabollically most active phase of ~~cell cy~~
(i) cell cycle → Interphase
(ii) ~~Inter~~ Cell division → Prophase
• shortest phase of cell cycle → M-phase
↳ cell division → Anaphase

Interphase: Resting phase, non-division phase, preparatory phase,
→ Nucleus has maximum size. [IOM, CEE 2023]
→ has 3 substage:-

DATE / /
PAGE NO.

① G1 phase (Gap I / Growth 1st / post mitotic / pre-DNA synthesis)
→ also known as pre-DNA synthesis phase.
→ synthesis of ribosome, rRNA and protein.
→ synthesis of Histone protein — starts in → G1, occurs in → S
→ Decision of cell division occurs in

② S-phase [DNA synthesis]
→ metabolically most active phase of interphase.
→ Replication of DNA and synthesis of histone protein occurs.

③ G2 phase / Gap II / Growth 2nd / pre-mitotic
→ also known as post-DNA synthesis phase.
→ Preparation of cell division occurs.
→ synthesis of microtubules, centrioles, spindle fibres occurs.

Note: At the end of G2 phase → DNA content is doubled.

~~Mitotic Cell Division~~
Cell-Division

① Mitosis :- The formation of 2 daughter cell having same no. of chromosome and half amount of DNA as compared to parent cell is called mitosis.

② Meiosis :- The formation of 4 daughter cell having half no. of chromosome and half amount of DNA as compared to parent cell.

DATE / /
PAGE NO.

- **Amitosis :-** Cell division without spindle fibre formation.
→ also known as direct cell division / incipient / primitive cell division.
→ Most common method of cell division in prokaryotic & yeast cell is ~~amitosis~~ amitosis.
→ e.g. → Budding, Fission, Fragmentation, Gemma cup formation.

(1) **Mitotic cell division : Mitosis**
→ also called as Somatic / indirect / equational cell division.
→ Termed by : Flemming
→ First observed by → (i) In plant → Strasburger
(ii) In animal → Flemming
– Occurs in → Haploid, Diploid, Polyploid, Somatic cells, reproductive cell.
→ Cell undergoing mitosis is → Mitocyte
– Best material to study mitosis → Onion root tip cell

A. **Karyokinesis :** Division of nucleus.

- Phase of Karyokinesis : 4 phase @PMAT
(1) Prophase
(2) Metaphase
(3) Anaphase
(4) Telophase

(1) **Prophase :-** ~~@TBC~~
→ 1st, longest and metabolically most active phase of cell division.
→ Chromatin / DNA strands become condensed & change into chromosome.
– show spiralisation.
↳ plectonemical coiling
– Nucleolus & Nuclear membrane starts to disappear.
• Late prophase → spindle fibre formation starts.

DATE / /
PAGE NO.

(2) Metaphase:

→ Chromosome are thickest with visible centromere & chromatids.
→ Structure, size and counting of no of chromosome.
→ Chromosome are arranged in single line at equator.
→ Spindle fibre is well developed.

(4n) (8n)

Note: Colchicine treatment is done in metaphase.
└ induce spindle fibre formation.
→ induced polyploidy.

(3) Anaphase:

→ shortest phase of cell division.
→ Shape of chromosome is best studied.
→ Separation of chromatids due to splitting

(4) Telophase

→ also called as reorganization phase.
→ Nuclear membrane and nucleolus starts to reappear.
→ It is just reverse of prophase

B. Cytokinesis

Characters	by cell plate	by cell furrow
→ Plane is determined by	Microtubule	Microfilament
→ Growth of cell plate occurs in	Centrifugal manner	Centripetal manner
→ Occurs	Plants cell	Animal cells

Physics | chemistry
... dimension | → chemical bonding

Simple squamous
... code - BLEM

DATE / /
PAGE NO.

• Significance of Mitosis

- Mitosis division of vegetative / somatic cells are responsible for growth, maintainence and repair of ~~gamete~~ damaged cell.
- → Mitotic cell division result in daughter cell which are both qualitatively and quantitavely similar to parent cell. and thus, responsible for genetic stability.

• Special points

- → for production of n daughter cell :- Mitosis → n-1
- → No. of daughter cell produced after division / generation → 2^n

* Meiotic Cell Division → / Meiosis

- → also known as reductional cell division.
- → Termed by :- Former and Moore.
- Occurs in → reproductive cells / germinal cell,
  - → Diploid cell / polyploid cell
  - → never occurs in haploid cells.
  - → Pollen mother cell, oocyte, spermatocyte.
- cell undergoing meiosis is → Meiocyte → (Diploid / polyploid) - never haploid.
- Best material to study meiosis → Anther of onion, or Tradescantia

• Types of Meiosis:

1. Zygotic meiosis: ocurs in zygote.
   eg. Thallophyte.
2. Sporic meiosis: occurs for spore formation.
   eg. ~~Sp~~ Embryophyta
3. Gametic meiosis: occurs for gamete formation.
   eg. ~~Gametic~~ Animal cell.

Meiosis I	Meiosis II
→ Chromosome no. is halved & DNA amt is same	→ Chromosome no. is same & DNA amt is halved.
→ also known as actual reductional division.	→ also known as equational cell division.

→ Meiosis I —(interkinesis / resting phase)→ Meiosis II

• Meiosis I

Stages of Meiosis I:

A. Prophase I:
B. Metaphase I
C. Anaphase I → Segregation of homologous chromose / Dis junction of chrom
D. Telophase I

• Meiosis II

Stages of Meiosis II

A. Prophase II
B. Metaphase II
C. Anaphase II ← Centromere division [TOM]
D. Telophase II:

* Stages of ~~Phase~~ Prophase I

→ Most active, longest and most complex phase of meiosis I.

5 substages :-

① Leptotene
② Zygotene

Botany
cell biology
cell division

Physics
... dimension

chemistry
→ chemical bonding

other

DATE / /
PAGE NO.

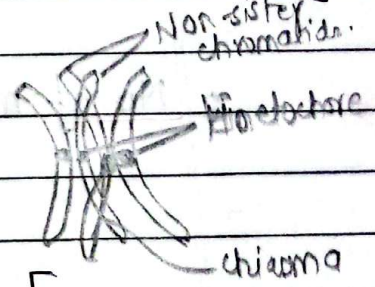
③ Pachytene
④ Diplotene
⑤ Diakinesis

① **Leptotene:** → also called as boquet stage formation.
→ ~~Best~~ Chromosome changes into beaded & thread like str called chromomere.
→ Best stage for the observation of chromomere.

② **Zygotene:**
→ pairing of two homologous chromosome called synapsis.
also called syndesis, Zipping
due to chemical protein called Synaptonemal complex

→ Bivalent formation occurs.
→ crossing over starts.
→ Tetrad formation starts.

③ **Pachytene:**
→ crossing over occurs.
exchange of DNA segments between 2 non-sister chromatids of homologous chromosome.
→ Tetrad formation → 4 chromatids को formation.
→ Chiasma formation starts.
The point where crossing over takes place.



Homologous chromosome → 2
chromatid → 4
centromere → 2
Kinetochore → 4

④ **Diplotene:-**
→ chiasmata formation → occurs.
→ longest in human female.

DATE / /
PAGE NO.

5. Diakinesis
→ Terminalization occurs.

* Cytokinesis in Meiosis

① Successive: Both meiosis I & meiosis II followed by wall formation.
eg. → Formation of isobilateral tetrads.
eg. monocot

② Simultaneous:

Anishek singh

Significance of Meiosis
→ It maintains the chromosome no. constant from generation to generation.
→ Variation → continous variation → due to crossing over (major source of variation)
discontinuous variation → leads to mutation. (ultimate source of variation)

• No. of meiotic division required to produce n seed/grains/fruits:
= n sperm + n ova
= n/4 + n
= 5n/4