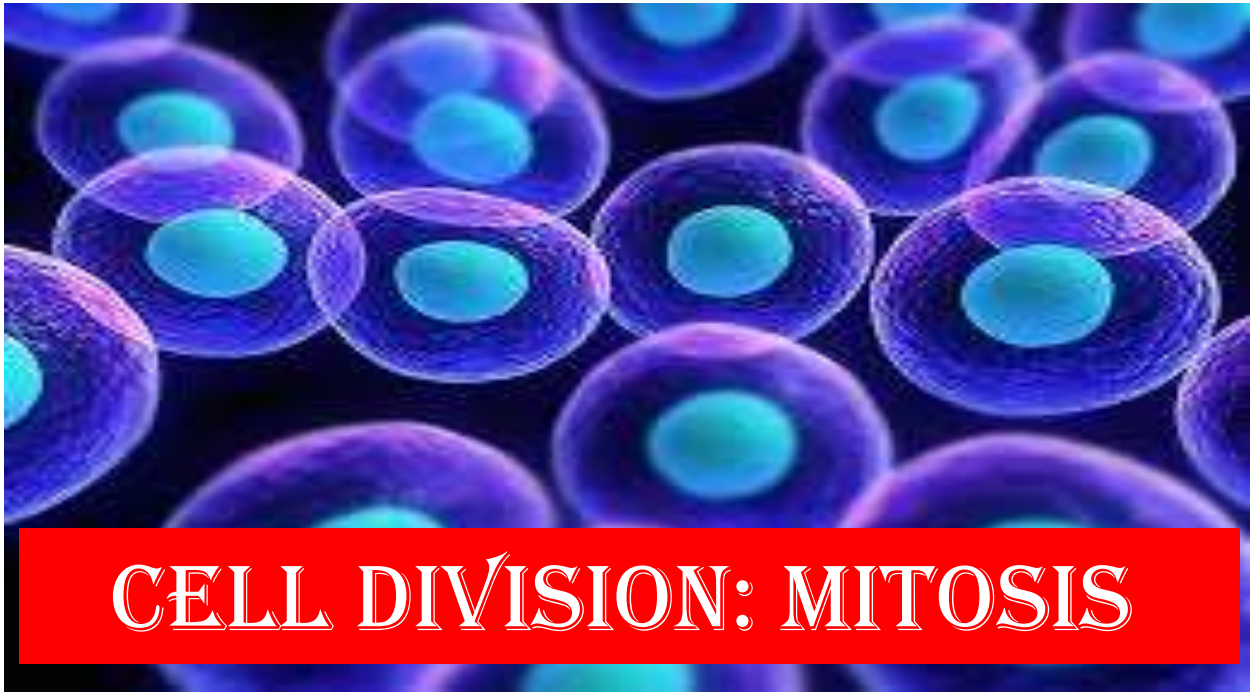

For B.Sc. Part I

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Cell division

All the cell arise from pre-existing cell by the process of cell division. Cell division is the phenamena of production of daughter cell from parent cell. The development of all multicellular organisms is by means of cell division.

Why cell divide???

There is definite ratio between nucleus and cytoplasmic mass of cell called nucleo-cytoplasmic ratio. Due to continuous cell growth, this balance is disturbed that leads to cell division.

Cell Cycle

A typical cell goes through four phases or stages, which collectively constitute the cell cycle.

Four phases of cell cycle are

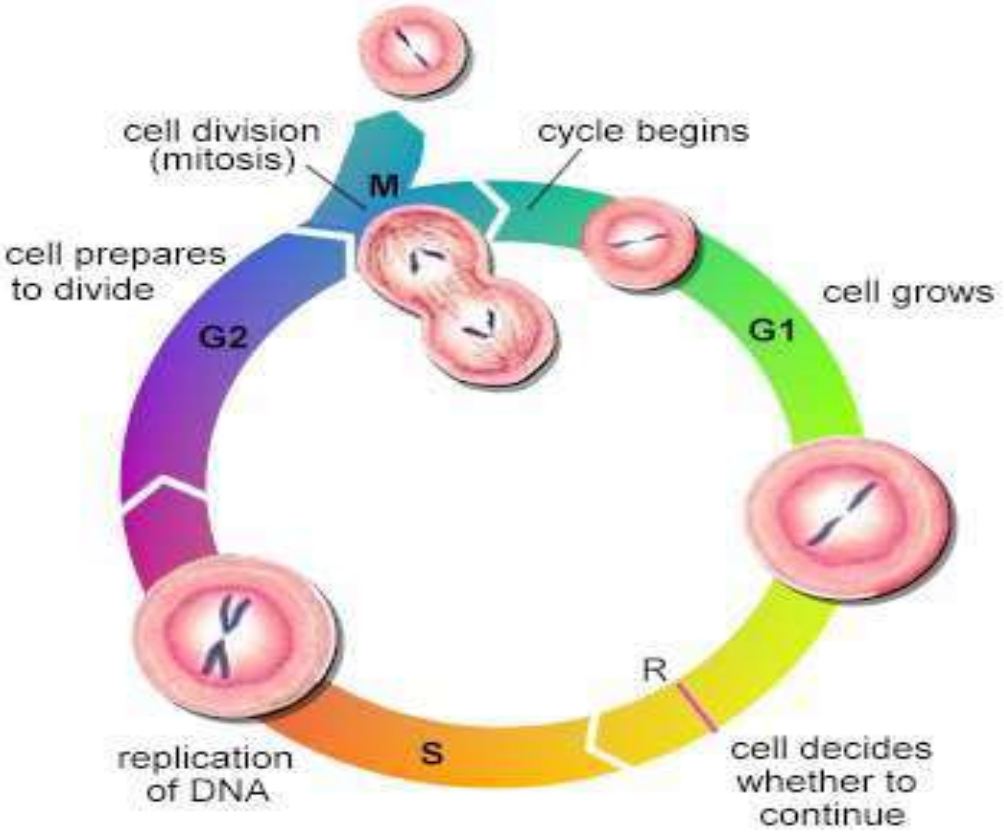
1. **G1 phase**
2. **S-Phase**
3. **G2 phase**
4. **M-phase**

1. **G1 phase or first gap phase or first growth phase or pre-DNA synthesis phase**

✓Synthesis of RNA, proteins and ribosomes occur during this phase

✓Time taken for completion of this phase is 30-40% of the total cell cycle

✓This phase is having high metabolic activity



2. S-Phase or DNA synthesis phase:

G1 phase is followed by S phase

✓Synthesis of DNA (DNA replication) as well as histone proteins

✓DNA polymerase enzyme is functionally active

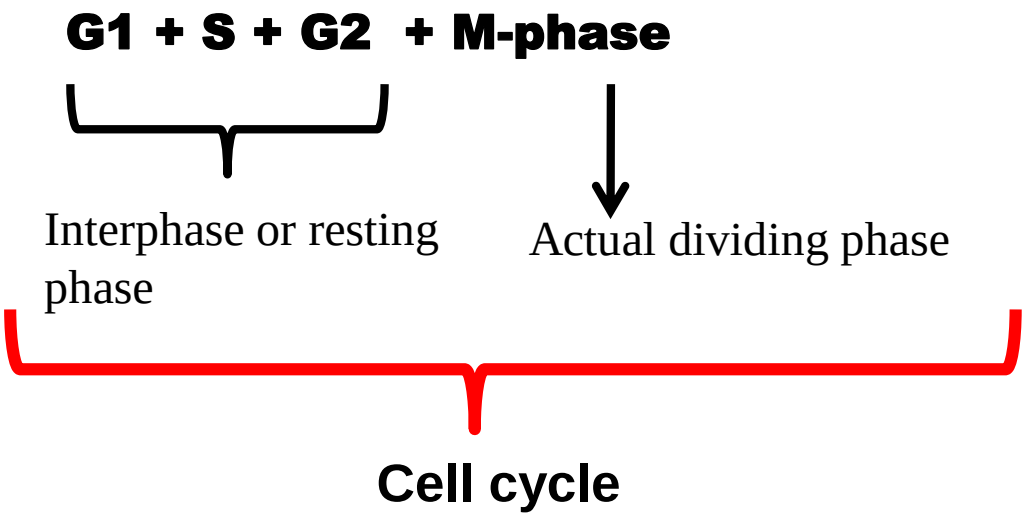
3. G2 phase or second gap phase or post DNA synthesis phase

✓In this phase division of cell organelles (mitochondria, chloroplast , division of centrioles and synthesis of proteins for spindle formation

✓Preparation of cell division occurs in this phase

4. M-phase or mitotic phase or actual cell division phase

✓ G-2 phase is followed by actual dividing phase i.e. M-phase



➢ Duration of these different phases varies in different organism and also in different tissue of same organism

Types of Cell Division

Cell division are mainly two types

1. **Mitosis or equational cell division**
2. **Meiosis or reductional cell division**

MITOSIS OR EQUATIONAL CELL DIVISION

Mitosis is a type of cell division that results in two daughter cells each having the same number and kind of chromosomes as the parent cell.

Characteristics of Mitosis

➢ Mitosis generally takes place in somatic cells or vegitative cells

➢ Daughter cells exactly resembles with parent cell both qualitatively as well as quantitatively

- Mitosis can be easily observed in meristematic cells of plant
- Onion root tip are considered best material for study of mitosis
- Chromosomes number remains the same.
- Mitosis was first observed in plants by **E. Strasburger** (1875) and in animals by **W. Flemming** (1879)

The actual mitotic phase (M -phase) completed in two steps

(A) Karyokinesis : Division of nucleus into two

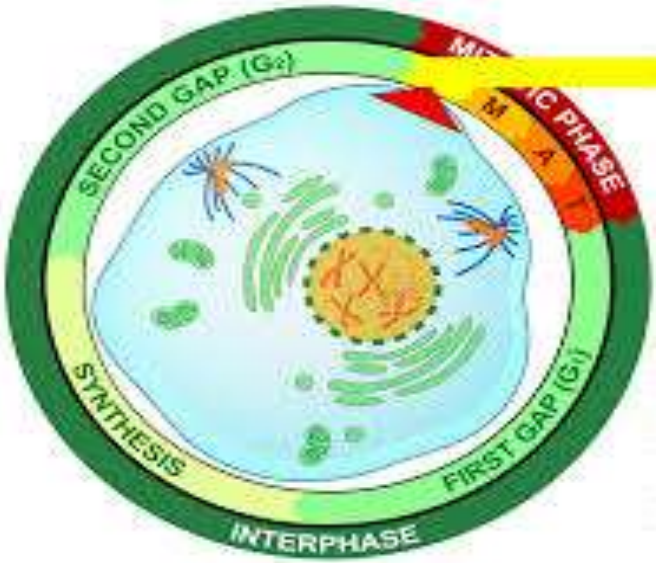
(B) Cytokinesis : Division of cytoplasm in two cells

Karyokinesis consist of following four stages

1. Prophase
2. Metaphase
3. Anaphase
4. Telophase

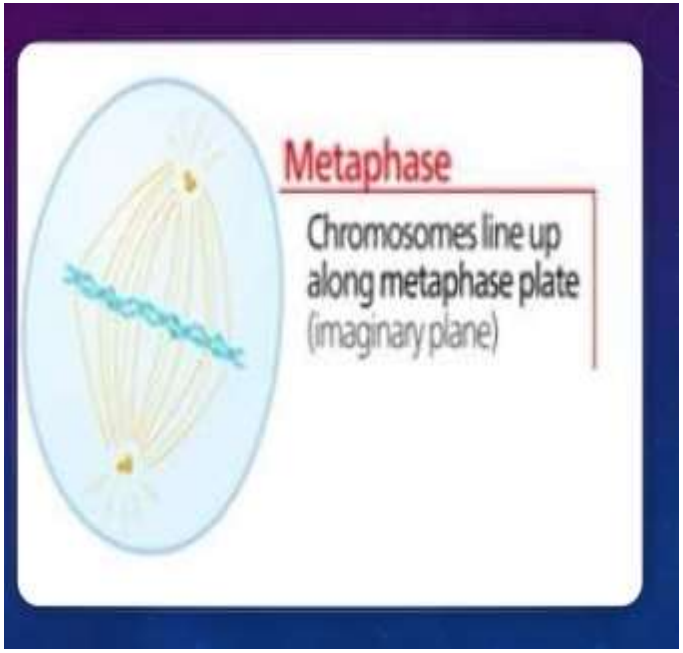
Prophase:

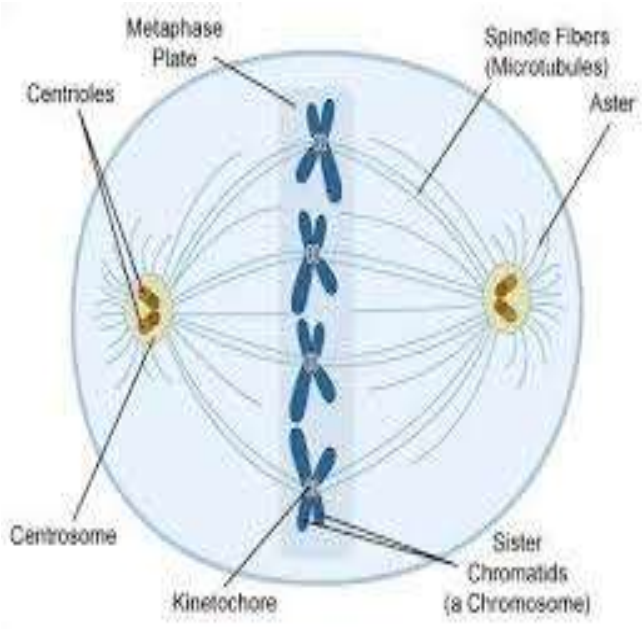
- Largest phase of mitosis
- Prophase is most active of all the stages of M-phase
- Chromatin condenses into chromosomes
- The nuclear membrane breaks down
- Nucleolus disappears or get dispersed
- The centrioles near the nucleus begin to separate and move to opposite sides of the cell.
- A spindle starts to form
- Spindles are fibers that are made out of microtubules



Metaphase:

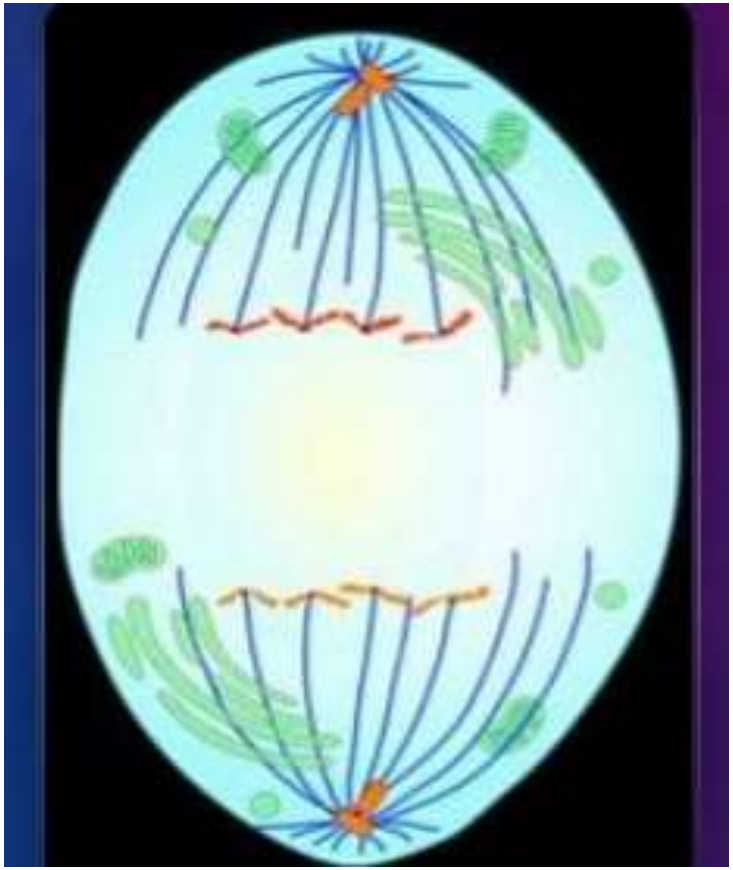
- At this stage chromosome get maximally distinct due to furthure contraction
- Size of the chromosome is measured at mitotic metaphase
- Spindle fibers attach to the centromeres of each pair of the sister chromatids.
- The sister chromatids line up at the equator, or middle of the cell.
- The spindle fibers ensure that the separation of the sister chromatids goes well.

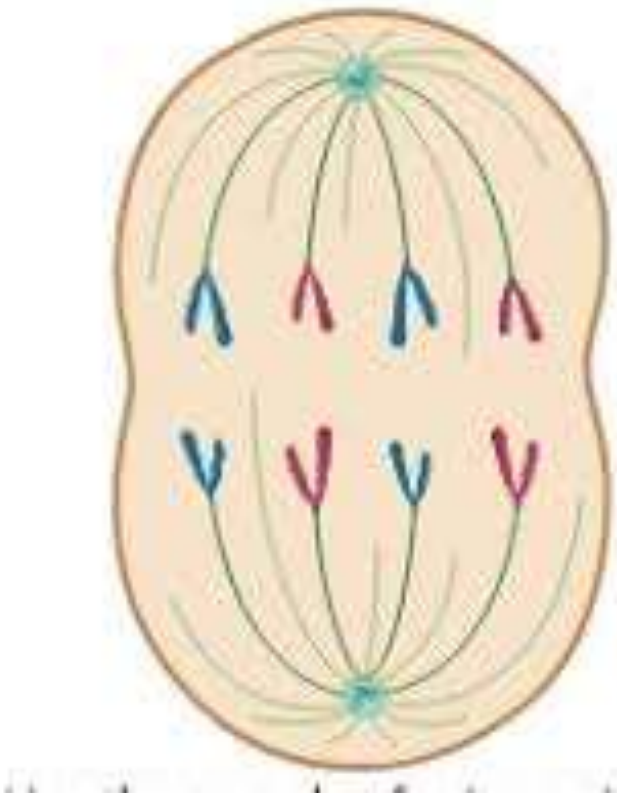




Anaphase:

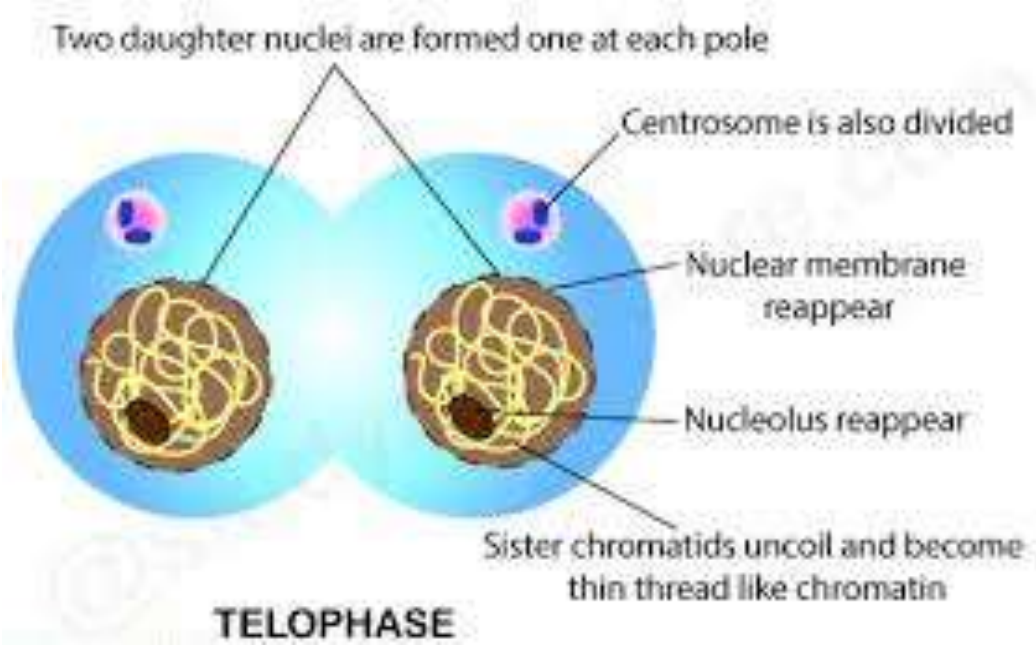
- Chromosomes break at centromeres or kinetochore and the sister chromatids move to opposite sides of the cell.
- This is the shortest stage of mitosis





Telophase

- Chromosome reach opposite poles of spindle
- Chromosomes now become decondensed and uncoiled
- Disintegration of spindle fibers occur at this stage
- Nuclear membrane reappears around each group of chromosomes



Cytokinesis

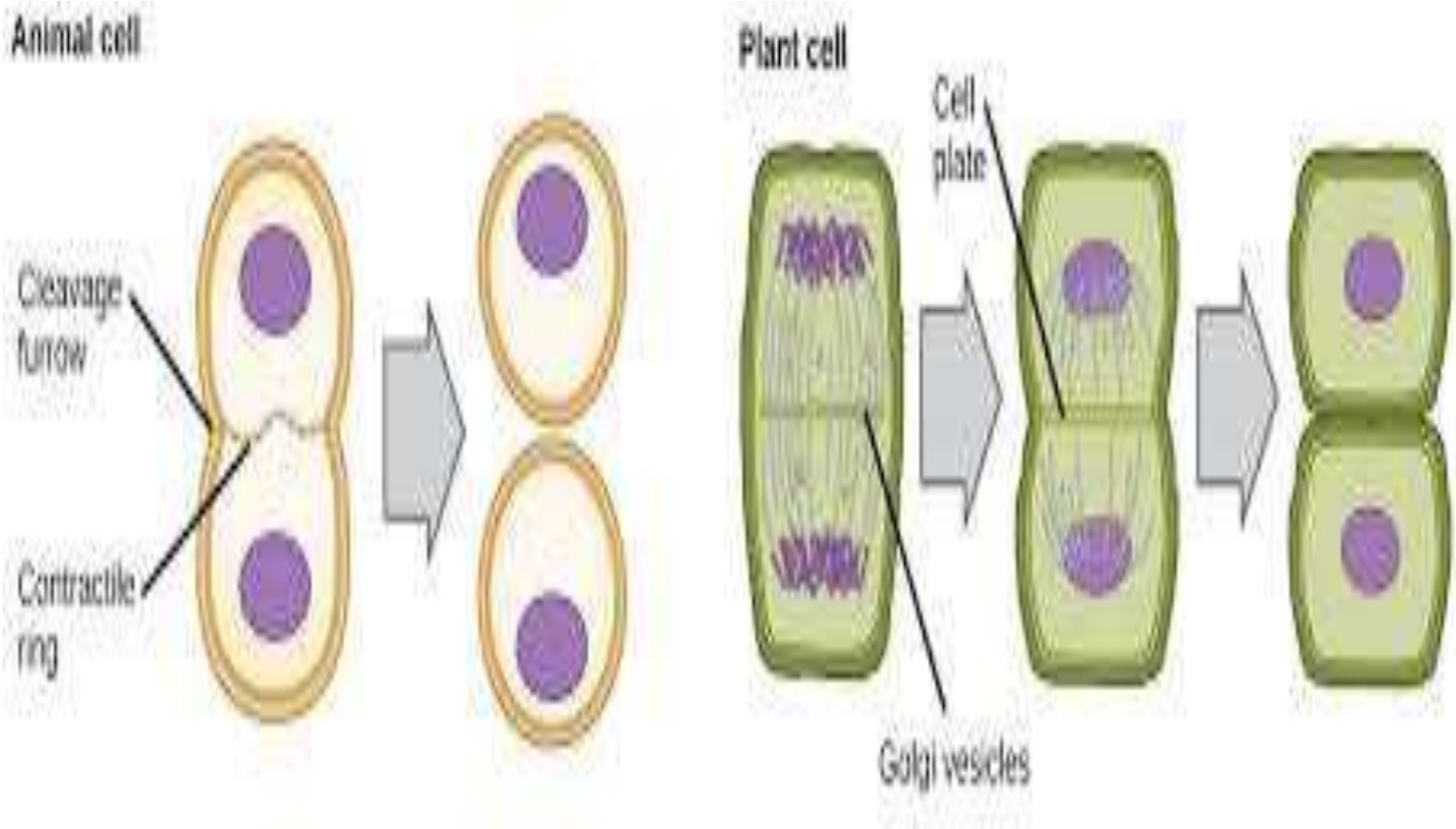
- Karyokinesis is followed by division of cytoplasm (cytokinesis) thus forming two daughter cells
- In animal cells, a cleavage furrow forms and separates daughter cells.
- In plant cells, a cell plate forms and separates daughter cells

Cell furrow method:

- This is a characteristics of animal cell. Animal cell lac cell wall here, more flexible plasma membrane forms the outer layer of cell
- A circular constriction or invagination appears at centre or equator, which deepens gradually and finally two daughter cell are separated.

Cell Plate method:

- This is characteristics of plant cell
- The vesicles provided by golgi apparatus unite to form phragmoplasts, which join to form cell plate
- Cell plate first form in centre and proceed towards periphery (Centrifugal plate formation)


Animal cell
Cleavage furrow
Contractile ring
Plant cell
Cell plate
Golgi vesicles

➢ Cell wall materials are now laid down on both side of cell plates and thus forming two daughter cells

❖ Colchicine is called **mitotic poision** as it inhibit the mitotic division by inhibiting spindle formation, which occurs at metaphase

Significance of Mitosis

➢ Mitotic division of vegitative or somatic cells are responsible for growth mantainence and repair.

➢Mitotic cell division results in daughter cells , which are both qualitatively and quantitatively similar to parent cell and thus responsible for genetic stability.

Thank You !!