

**Topic: Mitosis**  
**B.Sc. Botany (Sub.) I**  
**Group: C**

By

**Dr. Sanjeev Kumar Vidyarthi**

Department of Botany

Dr. L.K.V.D. College, Tajpur, Samastipur

L.N. Mithila University, Darbhanga



## Mitosis

The development of an individual from zygote to adult stage takes place through mitotic cell divisions.

Although growth also takes place through increase in cell size, but when cell size increases, surface area of cell does not increase in the same proportion as the cell volume.

Therefore, cell division helps in growth also by way of increasing surface area of the cells. Therefore, mitosis is a necessity for maintenance and perpetuation of life.

One of the basic requirements of cell division meant for growth should be that it should give rise to two daughter cells, which should resemble each other and also the parent cell qualitatively and quantitatively.

The basic outline of such a cell division is the same in all kinds of living forms.

Mitosis is the mechanism by which the chromosome content of a somatic cell (haploid or diploid) is kept constant through successive cell divisions. The division of the cell is initiated by division of the nucleus i.e. Karyokinesis followed by division of cytoplasm i.e. Cytokinesis. The stages of karyokinesis are – prophase, metaphase, anaphase and telophase .

### **Prophase:**

- In the resting nucleus the chromatin is spread out as a network. Gradually the chromosome becomes thick and condensed and each of them splits lengthwise forming two chromatids.
- The chromatids remain coiled around each other throughout their length. The chromatids coil around each other spirally.
- The chromosomes become distinct as individual units due to coiling. The nucleolus and nuclear membrane gradually disappear.

**Table . Different phases of a mitotic cell cycle.**

Parts of cell cycle	Phases	Description of phases	Duration in hours		
			<i>Vicia faba</i>	Mouse L Cells	Human He La Cells
Inter-phase	G <sub>1</sub>	Pre DNA-synthesis phase	12	12	12
	S	DNA-synthesis phase	6	6-8	10
	G <sub>2</sub>	Post DNA-synthesis phase	12	3-4	3
Mitosis	M	Mitotic phase	1	1	1

**Table . Durations of different stages of mitosis in four different materials.**

Material	Duration in minutes			
	Pro-phase	Meta-phase	Ana-phase	Telo-phase
1. Mouse (spleen)	21	13	5	4
2. Grasshopper (neuroblasts)	102	13	9	57
3. Onion (root tip)	71	6.5	2.4	3.8
4. Pea (root tip)	78	14.4	4.2	13.2

## **Metaphase:**

- A new structure, the spindle fibres, appears in the cytoplasm, which chemically, consists of long chain protein molecules oriented longitudinally between two poles.
- The chromosomes move towards the equatorial plate and get arranged at the equatorial plane.
- Centromeres divide and each chromatid moves to align itself on the equatorial plate.

## **Anaphase:**

- Anaphase follows metaphase. At the end of the metaphase the chromatids of each chromosome start moving apart in opposite directions.
- This helps in identical division of chromatids between two poles and the number of chromosomes remains constant.
- At the termination of anaphase, chromosomes form densely packed group at the two poles.

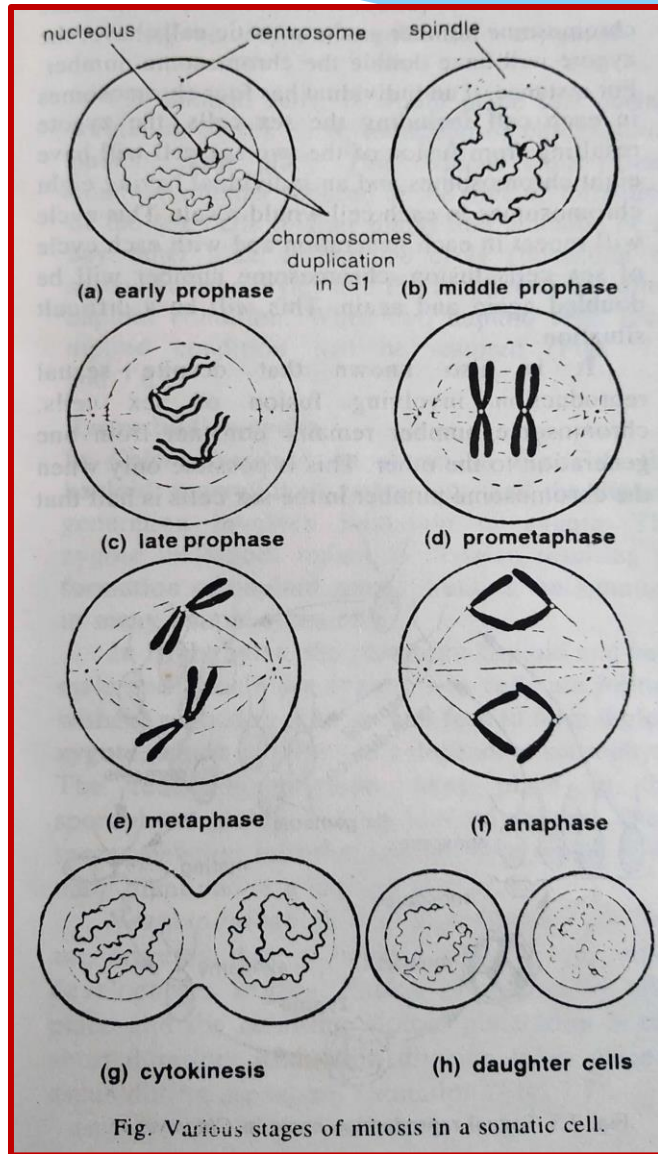


## **Telophase:**

- This is reorganization phase resulting in the formation of two daughter nuclei.
- Nuclear membrane and nucleoli reappear and surround the chromosomes.
- The newly formed nucleus contains the same numbers of chromosomes, as this was in parent nucleus.

## **Cytokinesis:**

- Just after the nuclear division, the division of cytoplasm takes place which is known as cytokinesis.
- The cytokinesis takes place in two ways-
  - the formation of cell plate on the centre extending towards the cell wall
  - formation of cytoplasmic cleavage or furrow in equatorial region that deepens to form a wall separating the two daughter nuclei.



## **Significance:**

- Mitosis contributes in growth of living matter. Each new cell formed after mitosis receives a set of chromosomes to regulate the cellular activities.
- The two identical cells formed during mitosis have the same genetic constitution, qualitatively and quantitatively, as the parental and ultimately of the organism. Mitosis helps in maintaining uniformity within the species.
- Mitotic division helps in replacing the old and damaged tissue by the new cells. This helps in repair, healing and regeneration of damaged parts.