CHAPTER 10

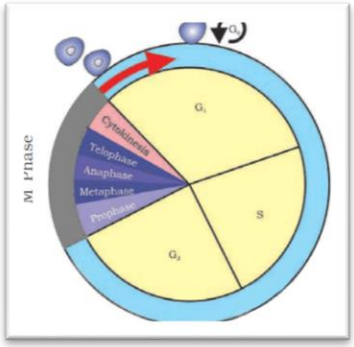
CELL CYCLE AND CELL DIVISION

CELL CYCLE

The sequence of events occurring in a cell from the time of division to next division is called cell cycle.

The main events involved are **cell growth, DNA replication and cell division**.

PHASES IN CELL CYCLE

<table>
<tr><td colspan="2">Interphase
• The phase when the actual cell division or mitosis occur.
• It includes G1 phase, S phase and G2 phase.</td><td>M Phase (Mitosis phase)
• The phase between two successive M phases.
• It includes Karyokinesis and cytokinesis.</td></tr>
<tr><td>G1 phase (Gap 1)</td><td>Cell is metabolically active and continuously grows.</td><td rowspan="2">Karyokinesis
Division of nucleus occur.
Daughter chromosomes are separated.</td></tr>
<tr><td>S phase (Synthesis)</td><td>DNA synthesis or replication takes place.</td></tr>
<tr><td>G2 phase (Gap 2)</td><td>Proteins are synthesised in preparation for mitosis.
Cell growth continues.</td><td>Cytokinesis
Division of cytoplasm occur.</td></tr>
<tr><td colspan="3"> 

G_0 Phase

This phase is called quiescent stage.
The cell which does not undergo division enter into G_0 phase</td></tr>
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Mitosis

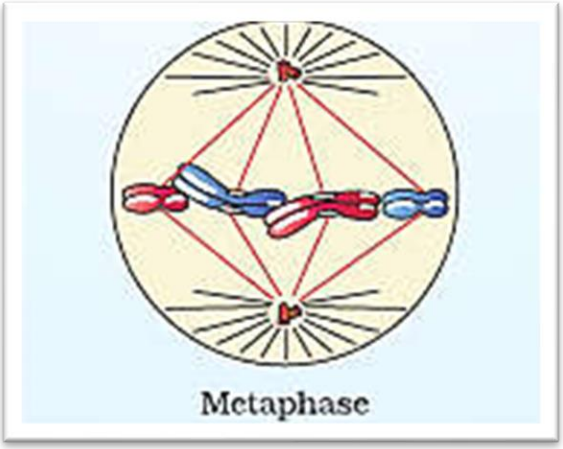
It is also called as equational division.

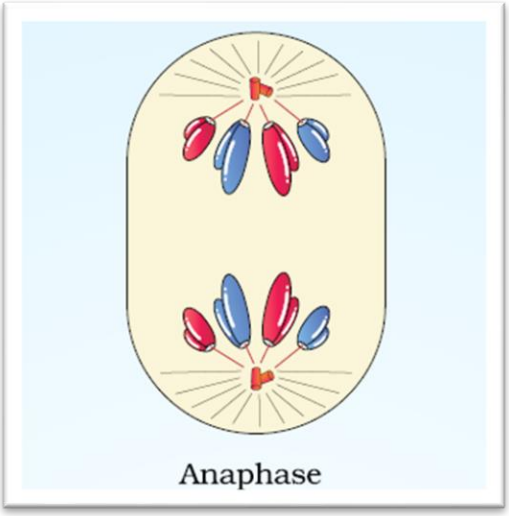
During the mitotic division number of chromosomes in the parent and progeny cells is the same.

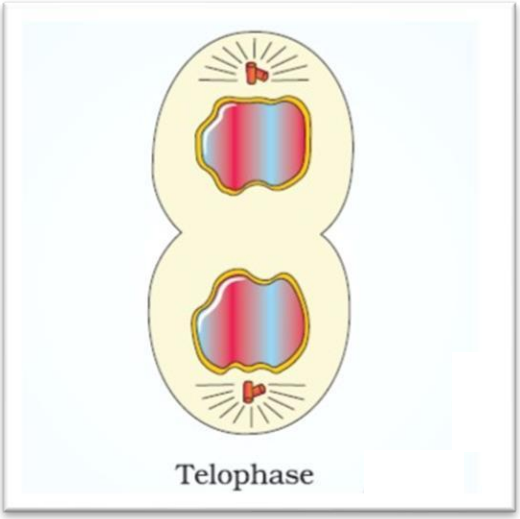
Karyokinesis (Nuclear division)

It includes four substages such as prophase, metaphase, anaphase and telophase.

Substage	Features
Prophase	• Chromosomal material condenses to form compact mitotic chromosomes. • Chromosomes consist of two chromatids attached together at the centromere. • Centrosome begins to move towards opposite poles of the cell.
Metaphase	• Spindle fibres attach to kinetochores of chromosomes. • Chromosomes are aligned along metaphase plate (equator). • spindle fibres from both poles are attached to either side of kinetochore.
Anaphase	• Centromeres split and chromatids separate. • Chromatids move to opposite poles.
Telophase	• Chromosomes reach at opposite poles. • Nuclear envelope develops around the chromosome. • Nucleolus, golgi complex and ER reform.







Cytokinesis

Animal cell

This is achieved by the appearance of a furrow in the plasma membrane.

The furrow gradually deepens and ultimately joins in the centre dividing the cell cytoplasm into two.

Plant Cells

cell wall develops with the formation of cell-plate.

Syncytium

If karyokinesis is not followed by cytokinesis it leads multinucleate condition called syncytium.

e.g. :- liquid endosperm in coconut.

Significance of Mitosis

It maintains the same number of chromosomes in daughter cells.

Multicellular organisms grow due to mitosis.

Mitosis helps in cell repair.

Mitotic divisions in the meristematic tissues in plants help in growth.

MEIOSIS

Meiosis is specialised kind of cell division that reduces the chromosome number by half.

Meiosis ensures the production of haploid phase.

It involves two sequential cycles of nuclear and cytoplasmic division called meiosis - I and meiosis - II.

Prophase - I:

Prophase - I of meiosis - I is the longest phase and more complex compared to prophase of mitosis.

Prophase - I have following five phases.

Leptotene, Zygotene, Pachytene, Diplotene and Diakinesis.

Phase	Features
Leptotene	• Chromosomes become gradually visible.
Zygotene	• Chromosomes start **pairing**. • Process of pairing is called **synapsis**. • Synapsis is accompanied by the formation of protein complex called **synaptonemal complex**. • Pair of synapsed homologous chromosomes is called a **bivalent or a tetrad**.
Pachytene	• **Recombination nodules** appear. • **Crossing over** occurs between non-sister chromatids of the homologous chromosomes leading to **recombination**. • Crossing over is mediated by the enzyme called **recombinase**.
Diplotene	• **Dissolution of the synaptonemal complex.** • **Chiasmata** formation occur.
Diakinesis	• **Terminalisation of chiasmata** occur. • Nucleolus & nuclear envelope disappear.

Interkinesis :- The stage between the two meiotic divisions is called interkinesis.

SIGNIFICANCE OF MEIOSIS

Help in production of gametes for sexual reproduction.

It results in crossing over and recombination that create variability in new generation.

Specific chromosome number is maintained during sexual reproduction.

MITOSIS	MEIOSIS
• It occurs in somatic cells. • Two daughter cells are produced. • Daughter cells have equal number of chromosomes to that of parental cell. • It is called equational division. • Crossing over and recombination absent.	• It occurs in reproductive cells (Gamete producing cells). • Four daughter cells are produced. • Daughter cells have half the number of chromosomes to that of parental cell. • It is called reduction division. • Crossing over and recombination present.