

Cell Division:

Cell Division is the Process by which cells reproduce themselves. It consists of nuclear division (mitosis and Meiosis) and cytoplasmic division (Cytokinesis).

Cell division that replaces cells or add new ones is called Somatic cell division and involves mitosis and Cytokinesis.

Cell division that results in the Production of gametes (Sperm & ova) is called reproductive cell division and consists of meiosis and Cytokinesis.

1. Somatic Cell Division:-

The cell cycle is an orderly sequence of events in which somatic cell duplicates its contents and in two daughter cells.

It consists of interphase and a mitotic phase. Human somatic cells contain 23 pairs of chromosomes and are thus diploid ($2n$).

① Interphase:-

It is the period between cell

divisions. The Chromosomes are not visible under light microscope. Interphase is a state of high metabolic activity, the cell grows in size. Interphase consists of 3 phases: G_1 , S, G_2 .

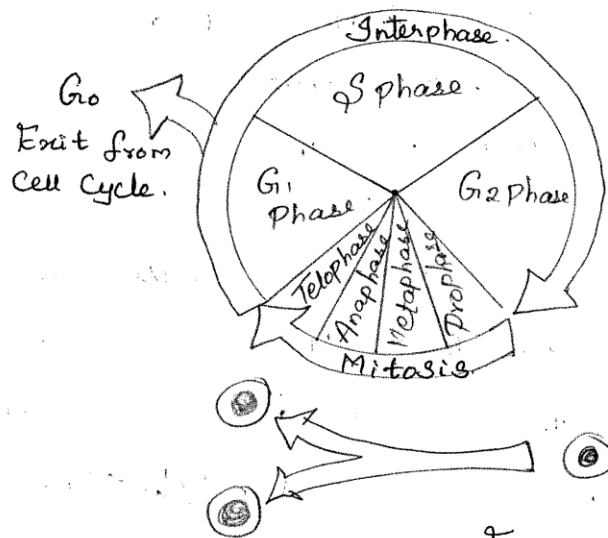


Fig:- The cell cycle.

(a) G_1 Phase:

→ Metabolically active cell duplicates organelles and cytosolic components. The events that lead to replication of chromosomes occur in this phase.

(b) S phase:-

→ DNA replication occurs. Each chromosome duplicates to form its identical chromatids.

(c) G_2 Phase:-

→ The cell growth, enzyme and protein

* Synthesis Continues in this Phase. The replication of Centrosomes is Completed. The events leading to mitotic (M) Phase.

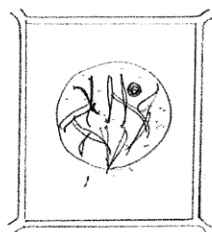
2. Mitotic (M) Phase:-

Parent Cell Produces identical cells with identical chromosomes. The chromosomes are visible under light microscope.

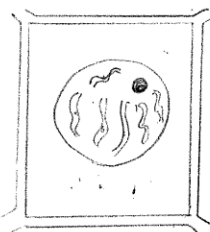
(a) Mitosis (Nuclear division):

→ Mitos - = thread, It is the distribution of two sets of chromosomes into two separate nuclei. For convenience, the process is divided into four stages.

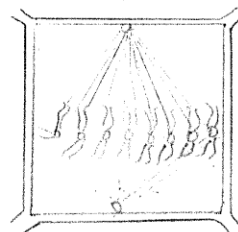
- * Prophase.
- * Anaphase
- * Metaphase.
- * Telophase.



Early Prophase



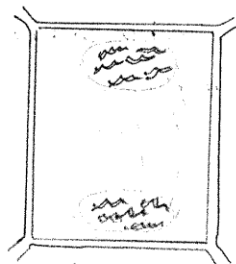
Late Prophase



Metaphase.



Anaphase



Telophase.

Fig:- Mitosis

(i) Prophase

(a) Early Prophase

→ The Chromatin begins to Condense. Initially the Chromosomes appear as long and slender thread-like structure.

(b) Late Prophase

→ Microtubules and Spindle apparatus begins to assemble.

→ Disappearance of nuclear membrane, nucleolus and Certain Organelles like ER and Golgi Complex.

→ Chromosomes Continue to get Condensed and get randomly Scattered in the cytoplasm.

(ii) Metaphase:-

→ Centromeres holding Chromatid Pairs of each Chromosome attach to the Spindle fibres from either of the Poles.

(iii) Anaphase:-

→ The Centromeres split and separated Paired Chromatids of each Chromosome move toward opposite poles of the cell along with the shortening Spindle fibres attached to them.

(iv) Telophase:-

→ Nuclear envelopes and nucleoli reappear

in each daughter nucleus. Chromosomes resume chromatin form due to decondensation.

Mitotic spindle disappears.

(b) Cytokinesis (cytoplasmic division):-

It usually begins in late anaphase and ends once mitosis is complete. A cleavage furrow forms at the cell's metaphase plate and progresses inward, pinching in through the cell to form two separate portions of cytoplasm.

2. Reproductive cell division:

In sexual reproduction, each new organism is the result of the union (fertilization) of two different gametes (sperm and ovum), one from each parent.

Meiosis is the process that produces haploid gametes from the diploid ($2n$) reproductive cells in the gonads.

Meiosis:-

meios- = reducing

-osis = condition of.

Meiosis occurs in two successive stages after the duplication of chromosomes during S phase of interphase: meiosis I and meiosis II.

Each Chromosomes Consists of two Sister Chromatids, which are attached to their Centromeres.

1. Meiosis I

It Consists of 4 Phases:

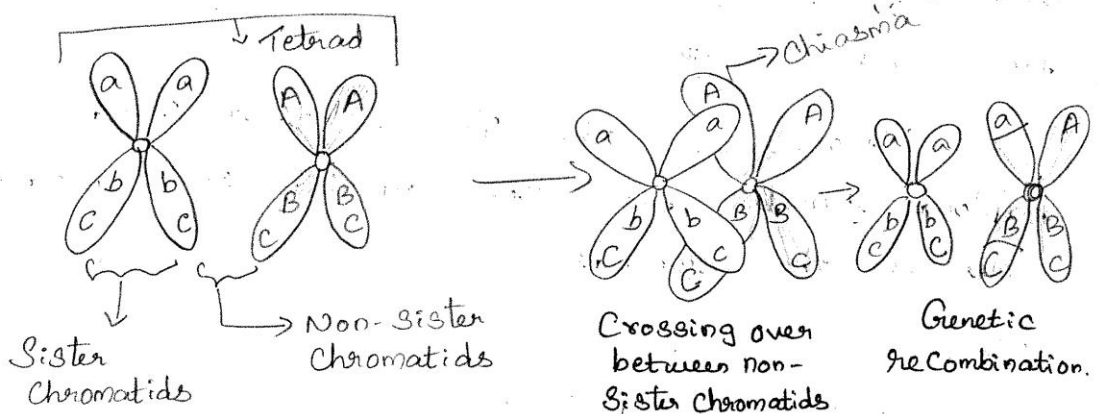
Prophase I, Metaphase I, Anaphase I, and Telophase I.

(a) Prophase I

→ Chromosomes Shorten and thicken.

At earlier stage, Chromosomes appear as single thin threads due to closely associated Sister Chromatids.

→ The homologous chromosomes Pair off, an event called Synapsis.



(b) Metaphase - I

The tetrads or bivalents line up along the metaphase plate of the cell, with homologous chromosomes side by side.

(c) Anaphase - I:

Members of each homologous pair of Chromosomes are pulled apart by the microtubules attached to the Centromeres.

(d) Telophase - I.

Nuclear envelope reappears but Chromosomes usually remain Condensed.

2. Meiosis - II:

Meiosis-II also Consists of four Phases:

Prophase - II, Metaphase - II, Anaphase II and telophase-II

(a) Prophase - II.

The Chromosomes attach to the Spindle fibres after the degeneration of nuclear envelope at late.

(b) Metaphase - II.

The Chromosomes move to the equator where Centrosomes move to the equator where Centromeres line up at the Plate.

(c) Anaphase - II.

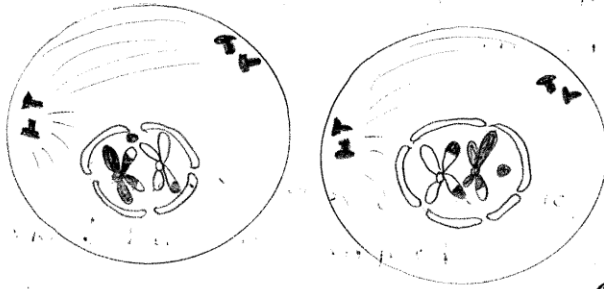
The Centromeres split, and the Sister Chromatids Separate and move toward opposite Poles of the Cell.

(d) Telophase - II

Nuclear envelopes and nucleoli reappear and the Chromosomes undergo decondensation.

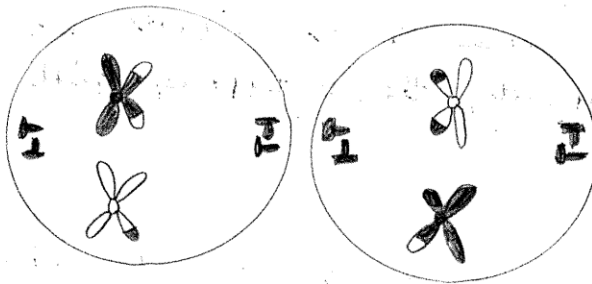
(c) Cytokinesis - II

Cytokinesis results in the formation of four daughter cells each with haploid number of chromosomes.

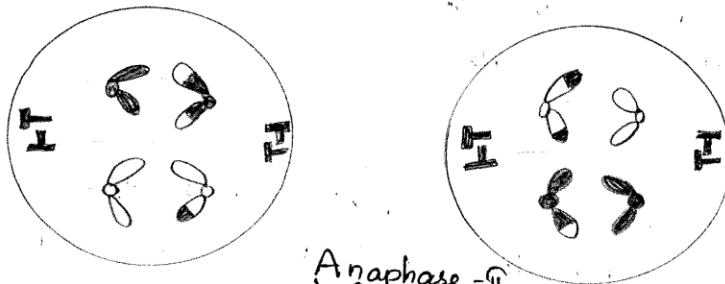


Daughter Cells with half the number of Parental Chromosomes

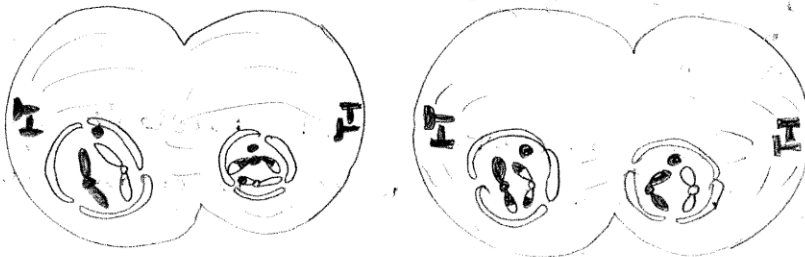
Prophase - II



Metaphase - II



Anaphase - II



Telophase - II