

# Practical Notes: Study of Mitosis and Meiosis

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## 1. Cell Cycle

The cell cycle is the sequence of events that a cell undergoes during its life. It includes phases of growth, DNA replication, and cell division. The main phases are:

- G<sub>1</sub> phase: Cell growth and preparation for DNA synthesis.
- S phase: DNA replication (chromosomes duplicate from single chromatid to sister chromatids).
- G<sub>2</sub> phase: Preparation for mitosis or meiosis.
- M phase: Cell division, which can be mitosis (equational division) or meiosis (reductional + equational).

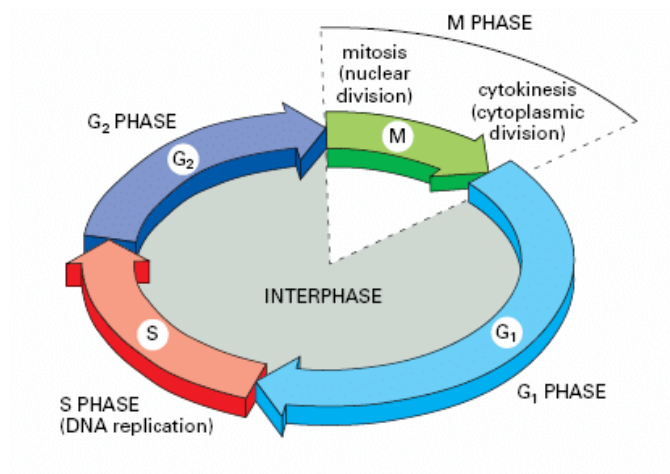


Figure 1: The eukaryotic cell cycle showing G<sub>1</sub>, S, G<sub>2</sub>, and M phases.

## 2. Chromosomes Before and After S Phase

Before S phase: Chromosomes are single-stranded (single chromatid). After S phase: Each chromosome is duplicated and consists of two sister chromatids joined at the centromere.

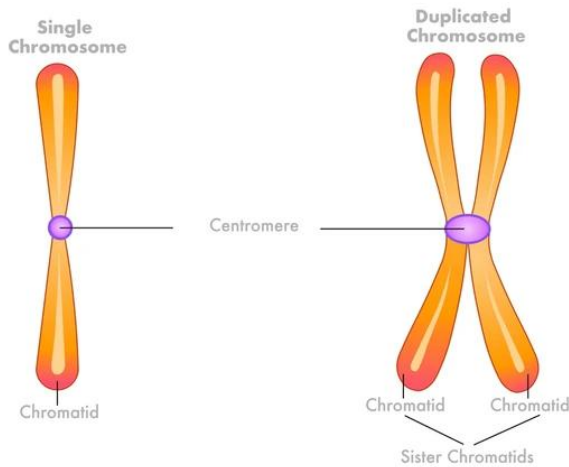


Figure 2: Single chromosome before S phase and duplicated chromosome after S phase.

### 3. Study of Mitosis

Mitosis is the type of cell division that produces two genetically identical daughter cells ( $2n \rightarrow 2n$ ). It occurs in somatic cells for growth and repair.

Stages of mitosis:

- Prophase: Chromosomes condense and become visible; spindle forms.
- Metaphase: Chromosomes align at the equatorial plate.
- Anaphase: Sister chromatids separate and move towards opposite poles.
- Telophase: Chromatids reach poles, nuclear envelope reforms, cytokinesis follows.

Purpose: Growth, tissue repair, asexual reproduction.

Example: Root tip cells of onion.

Video Reference: Mitosis practical demonstration:

<https://youtu.be/pljZCq7yO2A?si=zU0g650rmAKHgdyQ>

### 4. Study of Meiosis

Meiosis is the type of cell division that reduces the chromosome number by half ( $2n \rightarrow n$ ), producing four haploid cells. It occurs in reproductive organs to form gametes.

Meiosis involves two successive divisions:

- Meiosis I (Reductional Division): Homologous chromosomes separate; chromosome number is halved.
  - Prophase I: Crossing over occurs between homologous chromosomes.
  - Metaphase I: Homologous chromosomes (tetrads) align side by side at equator.

- Anaphase I: Homologous chromosomes move to opposite poles.
- Telophase I: Daughter cells with half chromosome number are formed.
- Meiosis II (Equational Division): Sister chromatids separate, similar to mitosis.
  - Produces four haploid daughter cells.

Purpose: Gamete formation, maintenance of chromosome number across generations, and variation due to crossing-over.

Example: Formation of pollen grains in anthers.

Video Reference: Meiosis practical demonstration:

<https://youtu.be/XCwyPkAAP1c?si=NfYstSP3bDRhKQM0>

## 5. Mitosis vs Meiosis

- Location: Mitosis occurs in somatic cells; meiosis in germ cells.
- Purpose: Mitosis for growth/repair; meiosis for sexual reproduction.
- Chromosome number: Mitosis maintains  $2n \rightarrow 2n$ ; meiosis reduces  $2n \rightarrow n$ .
- Stages: Mitosis has one division; meiosis has two successive divisions.
- Variation: No crossing over in mitosis; crossing over and genetic variation in meiosis.

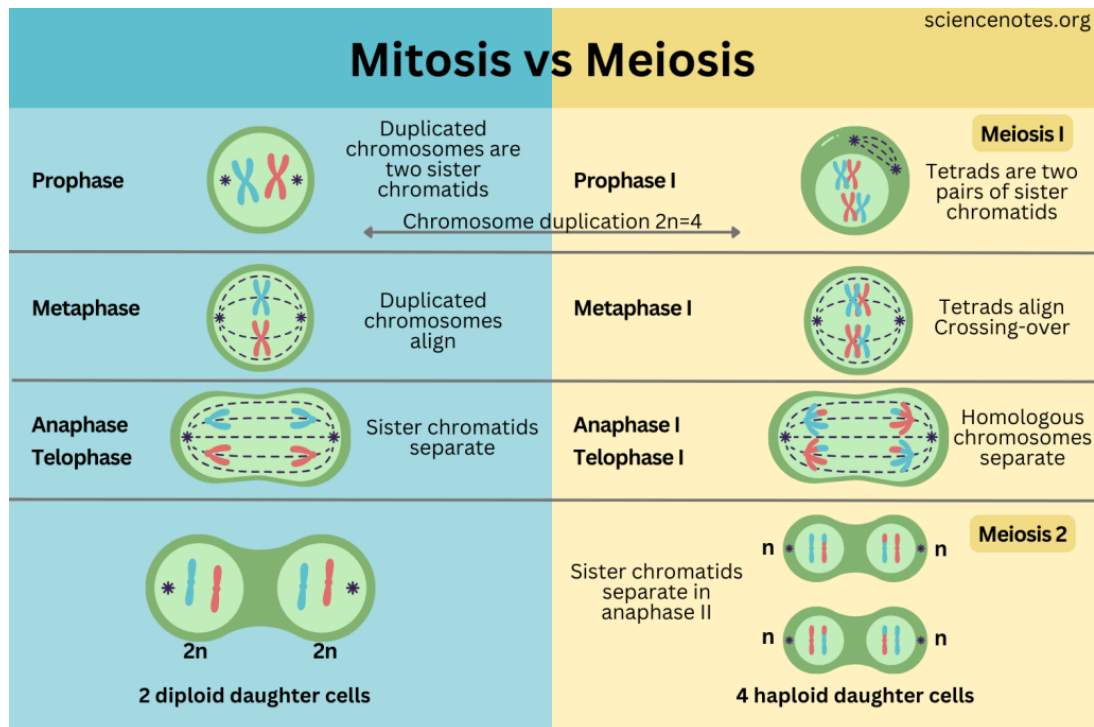


Figure 3: Comparative stages of mitosis and meiosis.