MITOSIS
Mitosis

- The form of cell division by which a eukaryotic somatic cell duplicates.

- Mitosis is asexual reproduction.

- Cell division is the continuation of life based on the reproduction of cells.
Mitosis

Liver Cell

2n=46

Liver Cell

2n=46

Liver Cell

2n=46

two identical daughter cells
Somatic Reproduction

• Most eukaryotic cells reproduce asexually by mitosis.

• **Somatic cells** are all **body cells (like nerve, liver, etc...)** except sperm and ova (egg).

• All Somatic cells have the same number of chromosomes.
Cell Cycle

- The **dividing** and **non-dividing** stages in the life of a cell.

- Phases:
  1. **Interphase**: growth and DNA replication
  2. **Prophase**
  3. **Metaphase**
  4. **Anaphase**
  5. **Telophase**

Mitotic division
Cell Cycle

- **Mitosis**: prophase, metaphase, anaphase, telophase
- **Interphase**: G1, S phase, G2

Cell cycle phases and mitosis stages are shown in the diagram.
Interphase

• Comprises about 90% of the cell cycle.
• Cellular growth:
  a. protein synthesis
  b. metabolic activities
  c. DNA synthesis
• Made up of three phases:
  1. G₁ phase
  2. S phase
  3. G₂ phase
Interphase

1. **$G_1$ (gap) phase:**
   a. protein synthesis and metabolic activities.
   b. *most cell are arrested in this phase.*

2. **$S$ phase:**
   a. DNA replication takes place.

3. **$G_2$ (gap) phase:**
Interphase

- **Nucleus** and **nucleolus** visible.
Question:

• What is a chromosome?
Answer:

- A **chromosome** is made up of a DNA-histone protein complex called **chromatin**.

- **Chromatin** is a long, thin fiber that is folded and coiled to form **chromosomes**.
Question:

• What is a replicated chromosome?
Answer:

- A replicated chromosome consist of two strands of identical chromosomal material called chromatids (sister chromatids).

![Diagram of chromosome and chromatid](image)
Mitotic Phase

- **Mitosis (karyokinesis)**
  - a. **nuclear** division of **genetic material**.
  - b. **prophase-metaphase-anaphase-telophase**

- **Cytokinesis**
  - a. **cytoplasmic division**.
  - b. Indicator of telophase.
Prophase

- Longest phase
- Nucleolus disappears
- Chromatin material condenses into chromosomes, consisting of two sister chromatids.
Prophase

- **Centrioles** move apart (not found in plants).
- **Spindle fibers (microtubules)** form and attach from **centrioles** to **centromeres** by **kinetochores**.
- Nuclear envelope fragments and disappears.
Prophase

early prophase \rightarrow late prophase, prometaphase

centrioles

nuclear envelope disappearing

centromere
Question:

• What attaches the spindle fibers to the centromeres?
Answer: Kinetochore
Metaphase

- **Shortest phase**

- **Centrioles** are at opposite ends of the cell and attached with **aster fibers**.

- **Chromosomes** move to the **metaphase plate** (equatorial plate - center of cell).
Metaphase

- aster fibers
- spindle fibers
- centrioles
Metaphase

- Top of spiralisation, chromatin is in max. of condensation
- Chromosomes collect at equatorial plate
- At the end of metaphase centromere start dissapears
**Anaphase**

- **Centromeres** uncouple and **spindle fibers** shorten.

- **Sister chromatids** separate and move apart.

- After separation, **chromatids** are now considered **chromosomes**.
Anaphase

• During this phase, the cell contains twice the normal number of chromosomes.

• Cell begins to elongate.

• At the end, there are equal numbers of chromosomes at the poles.
Anaphase

No longer sister chromatids, now chromosomes

spindle fibers
centrioles
aster fibers
Telophase

- Nuclear membrane reappears.

- **Chromosomes** uncoil- despirelation and decondesation

- In the end, two genetically identical nuclei (**karyokinesis** completed) are present.
Telophase

- cleavage furrow (cytokinesis)
- nuclear membrane reforming
- nucleolus reappears
Cytokinesis

- **Cytoplasmic division**
- **Cell plate** complete in **plants**
- In the end, two separate daughter cells produced with single nucleus.

![Diagram of cytokinesis](cell_plate)