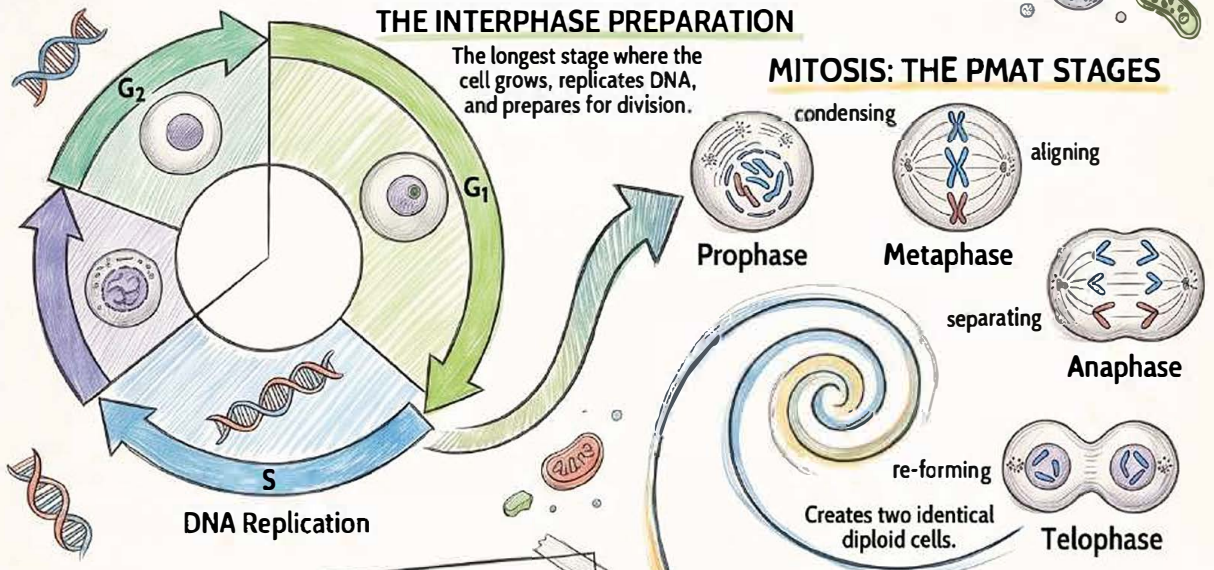


Cell Division: The Blueprint of Life

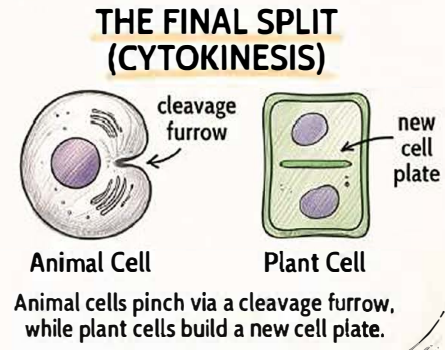
Context Summary: Cell division is the fundamental process where a parent cell creates daughter cells for growth, repair, and reproduction. It involves Karyokinesis (nuclear division) and Cytokinesis (cytoplasmic division), occurring within a strictly regulated cell cycle.

The Standard Cycle & Mitosis

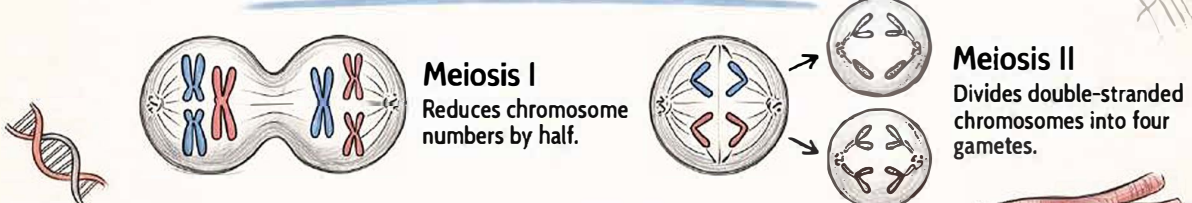


Mitosis vs. Meiosis Comparison

Feature	Mitosis	Meiosis
Cell Type	Somatic (Body) Cells	Gonad (Reproductive) Cells
Outcome	2 Genetically Identical Cells	4 Genetically Unique Cells
Ploidy	Diploid (2n)	Haploid (n)

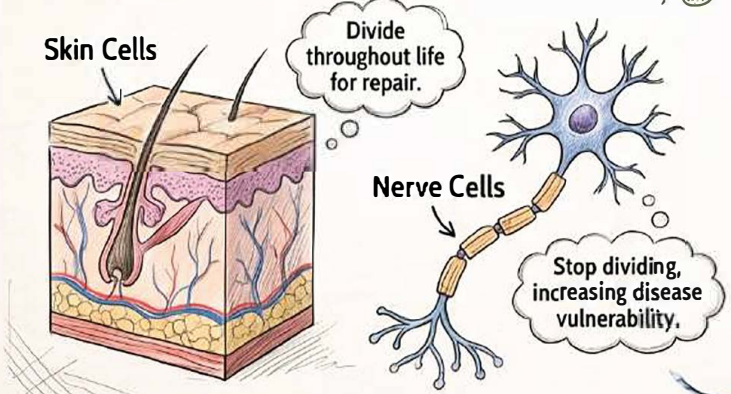


MEIOSIS: TWO-STAGE REDUCTION

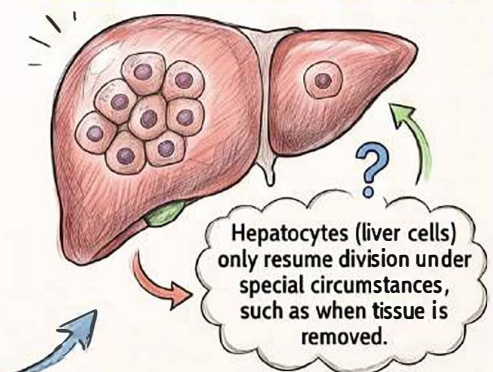


Specialized Cell Behavior

SKIN VS. NERVE CELL LONGEVITY



THE REGENERATIVE LIVER

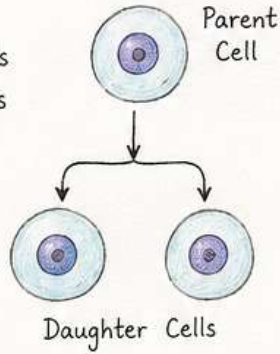


CELL DIVISION

The process by which a parent cell divides to form new cells.

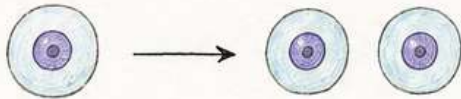
1. NORMAL CELL DIVISION

It is a natural process that increases the number of cells in an organism. The new cells are identical to the parent cell and have the same number of chromosomes.



3. MITOSIS

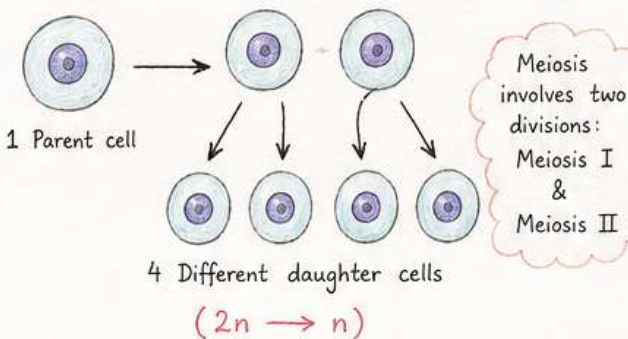
- It is a type of cell division in which one parent cell divides to form two genetically identical daughter cells.
- Occurs in somatic (body) cells.
- Maintains the chromosome number.



1 Parent cell → 2 Identical daughter cells
($2n \rightarrow 2n$)

4. MEIOSIS

- It is a type of cell division in which one parent cell divides twice to form four genetically different daughter cells.
- Occurs in germ cells (sex cells) in the reproductive organs.
- Reduces the chromosome number to half.



2. STAGES IN CELL DIVISION (MITOSIS)

- 1) INTERPHASE**
 - Cell grows.
 - DNA replicates.
 - Chromosomes are not visible.
- 2) PROPHASE**
 - Chromosomes condense and become visible.
 - Nuclear membrane breaks down.
 - Spindle fibres begin to form.
- 3) METAPHASE**
 - Chromosomes line up at the center (equator) of the cell.
 - Spindle fibres attach to centromeres.
- 4) ANAPHASE**
 - Sister chromatids separate.
 - They are pulled to opposite poles of the cell.
- 5) TELOPHASE**
 - Nuclear membrane reforms.
 - Chromosomes decondense.
 - Spindle fibres disappear.
- 6) CYTOKINESIS**
 - Cytoplasm divides.
 - Two identical daughter cells are formed.

5. IMPORTANCE OF CELL DIVISION

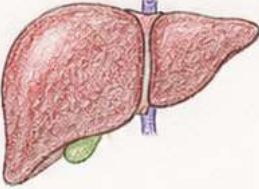

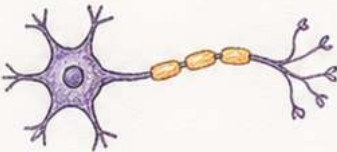
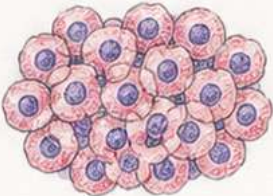
- 1) GROWTH**
 - Increases the number of cells, helping in the growth of organisms.
- 2) REPAIR AND HEALING**
 - Replaces old, damaged or dead cells and helps in the healing of wounds.
- 3) REPLACEMENT OF WORN OUT CELLS**
 - Continuously replaces cells that wear out (e.g., skin cells, blood cells).
- 4) REPRODUCTION**
 - Meiosis helps in the formation of gametes (sperm and egg) for sexual reproduction and maintains chromosome number in next generation.
- 5) GENETIC STABILITY**
 - Ensures equal distribution of DNA so that each daughter cell receives the same genetic information (in mitosis).

MITOSIS VS MEIOSIS

	MITOSIS	MEIOSIS
DIVISIONS	One division	Two divisions (Meiosis I & II)
DAUGHTER CELLS	Two	Four
CHROMOSOME NUMBER	Same as parent cell ($2n \rightarrow 2n$)	Half of parent cell ($2n \rightarrow n$)
GENETIC MAKEUP	Genetically identical	Genetically different
OCCURS IN	Somatic (body) cells	Germ (sex) cells in reproductive organs
FUNCTION	Growth, repair, replacement	Formation of gametes, sexual reproduction

HOW CELL DIVISION VARIES IN DIFFERENT CELLS

Cells in our body do not all divide at the same rate. The ability of a cell to divide depends on its function.

TYPE OF CELL	HOW CELL DIVISION VARIES	REASON / FUNCTION
<p>1. LIVER CELLS</p> 	<ul style="list-style-type: none"> Liver cells divide by mitosis actively. They can replace old, damaged or dead cells. The liver has a high ability to regenerate. 	<p>→ The liver performs many important functions and needs to repair itself frequently, so cells divide regularly.</p>
<p>2. HEART CELLS</p> 	<ul style="list-style-type: none"> Heart muscle cells divide very little. Most heart cells stop dividing after birth. Repair of heart tissue is slow and limited. 	<p>→ Heart tissue is highly specialised to pump blood continuously, so cells rarely divide. Damage is repaired very slowly.</p>
<p>3. NERVE CELLS</p> 	<ul style="list-style-type: none"> Nerve cells (neurons) do not normally divide. Once formed, they remain permanent. If damaged, they are usually not replaced. 	<p>→ Neurons are highly specialised for transmitting messages. Losing them affects body functions, so they do not divide.</p>
<p>4. CANCER CELLS</p> 	<ul style="list-style-type: none"> Cancer cells divide by mitosis rapidly and uncontrollably. They do not respond to normal control signals. They continue dividing and form tumours. 	<p>→ Cancer cells lose control of the cell cycle. They keep dividing without stopping, invading nearby tissues and spreading.</p>

SUMMARY : Liver cells divide actively, heart cells divide very little, nerve cells do not divide, and cancer cells divide uncontrollably.