Cell division

Each of us began as a single cell. This cell couldn't move, think, see, or do things like laugh and talk but the one thing it could do, and do very well, was divide- and divide it did. A cell division under microscope was first discovered by German botanist Hugo von Mohl in 1835 as he worked over Green algae *Cladophora glomerata*. In 1943, cell division was filmed for the first time by Kurt Michelwith, using a phase-contrast microscope

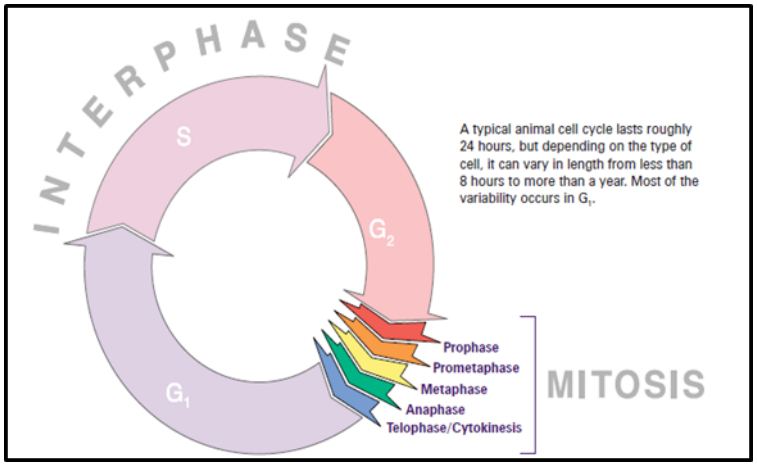
Cell division is the process by which a parent cell divides into two or more daughter cells. Cell division usually occurs as part of a larger cell cycle. In eukaryotes, there are two distinct types of cell division: a vegetative division, whereby each daughter cell is genetically identical to the parent cell (mitosis), and a reproductive cell division, whereby the number of chromosomes in the daughter cells is reduced by half to produce haploid gametes (meiosis).

Prokaryotes (bacteria) undergo a vegetative cell division known as binary fission, where their genetic material is segregated equally into two daughter cells. For simple unicellular microorganisms such as the amoeba, one cell division is equivalent to reproduction – an entire new organism is created.

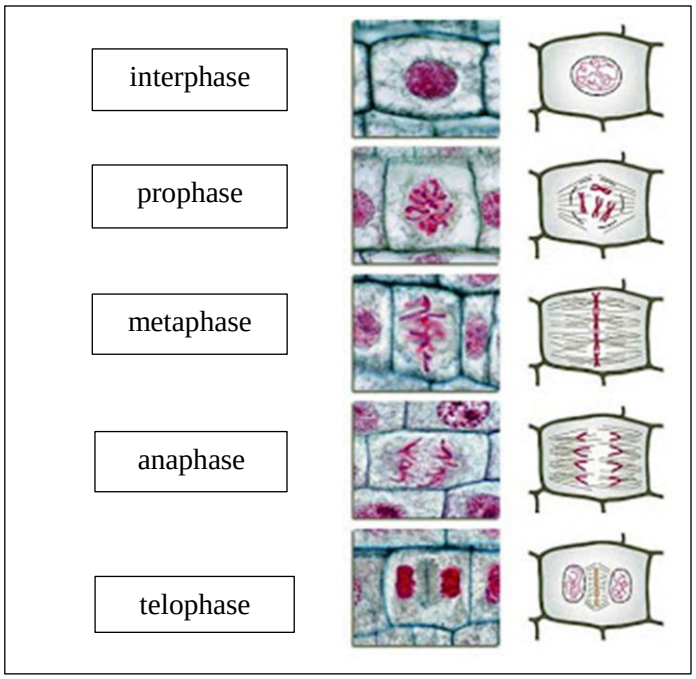
The cell cycle

The cell cycle begins when the cell is produced by mitosis and runs until the cell undergoes its own mitosis and splits in two. The cycle is divided into distinct phases: G_1 (gap 1), S (synthesis), G_2 (gap 2), and M (mitosis). The time (phases G_1 through G_2) is known as **interphase**.

During interphase the chromosomes (the genetic material) are copied, and cells typically double in size. While this is happening, cells continue to do their jobs. In contrast, most of these activities cease during mitosis while the cell focuses on dividing but not all cells in an organ undergo mitosis at the same time. While one cell divides, its neighbors work to keep the body functioning.



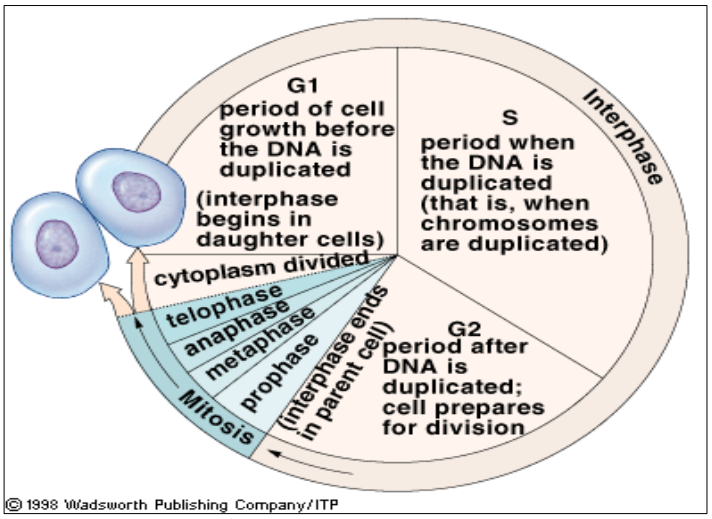
Mitosis is essentially a duplication process that replicates chromosomes and produces two genetically identical "daughter" cells from a single "parent" cell. Mitosis has the following phases: prophase, metaphase, anaphase, telophase and cytokinesis.



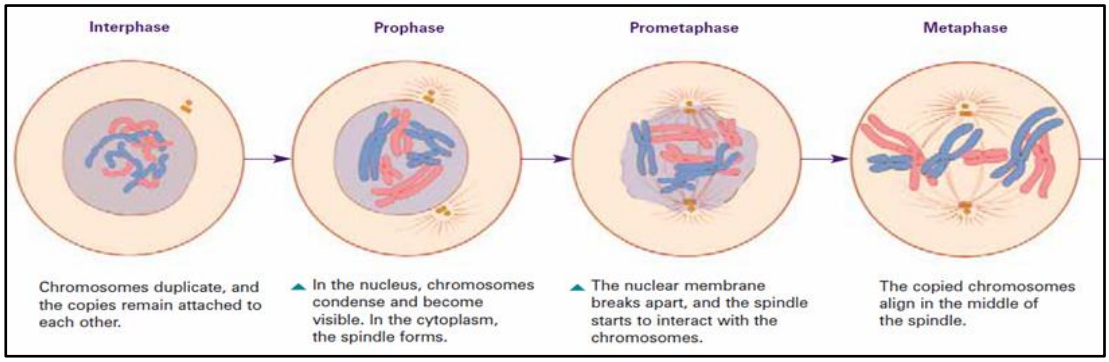
Interphase: The DNA duplicates during interphase to prepare for mitosis. Chromosomes are not clearly discerned in the nucleus.
Prophase: Chromatin in the nucleus begins to condense and becomes visible in the light microscope as chromosomes. The nuclear membrane dissolves. Microtubules attach at the kinetochores and the chromosomes begin moving.

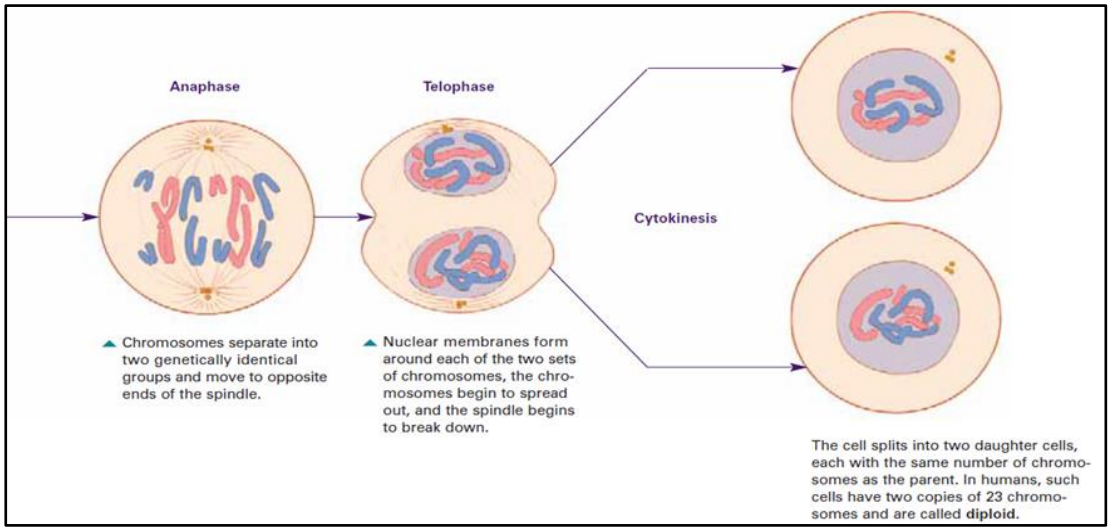
Metaphase: Spindle fibers align the chromosomes along the middle of the cell nucleus. This line is referred to as the metaphase plate. This organization helps to ensure that in the next phase, when the chromosomes are separated, each new nucleus will receive one copy of each chromosome.

Anaphase: The paired chromosomes separate at the kinetochores and move to opposite sides of the cell. Motion results from a combination of kinetochore movement along the spindle microtubules and through the physical interaction of polar microtubules.
Telophase: New membranes form around the daughter nuclei while the chromosomes disperse.



The first five phases do the job of splitting the nucleus and its duplicated genetic information in two, while in the final step cytokinesis; the entire cell is split into two identical daughter cells. Mitosis is essential for growth, repair and replacement. The primary goal of mitosis is to make sure that each daughter cell gets one copy of each chromosome. Other cellular components, like ribosomes and mitochondria, also are divided between the two daughter cells. For simplicity, the following illustrated cells with only six chromosomes.





Meiosis: sex, heredity, and survival

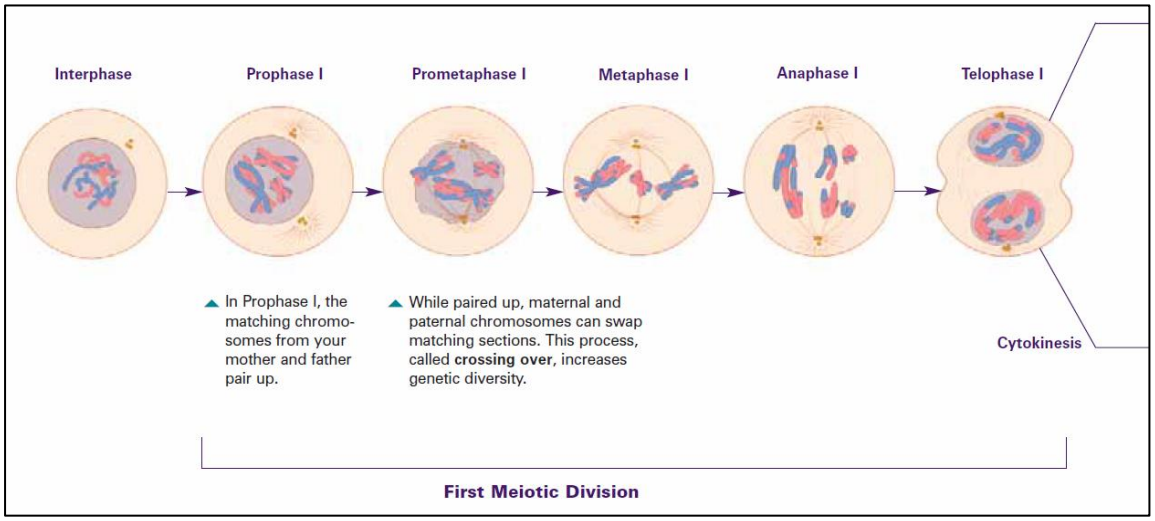
Meiosis is a special type of cell division that occurs in sexually reproducing organisms. Nearly all multicellular organisms reproduce sexually by the fusion of an egg and a sperm. The new cell (a zygote) has a full contingent of 23 pairs of chromosomes. But what about its parent cells, the sperm and egg???

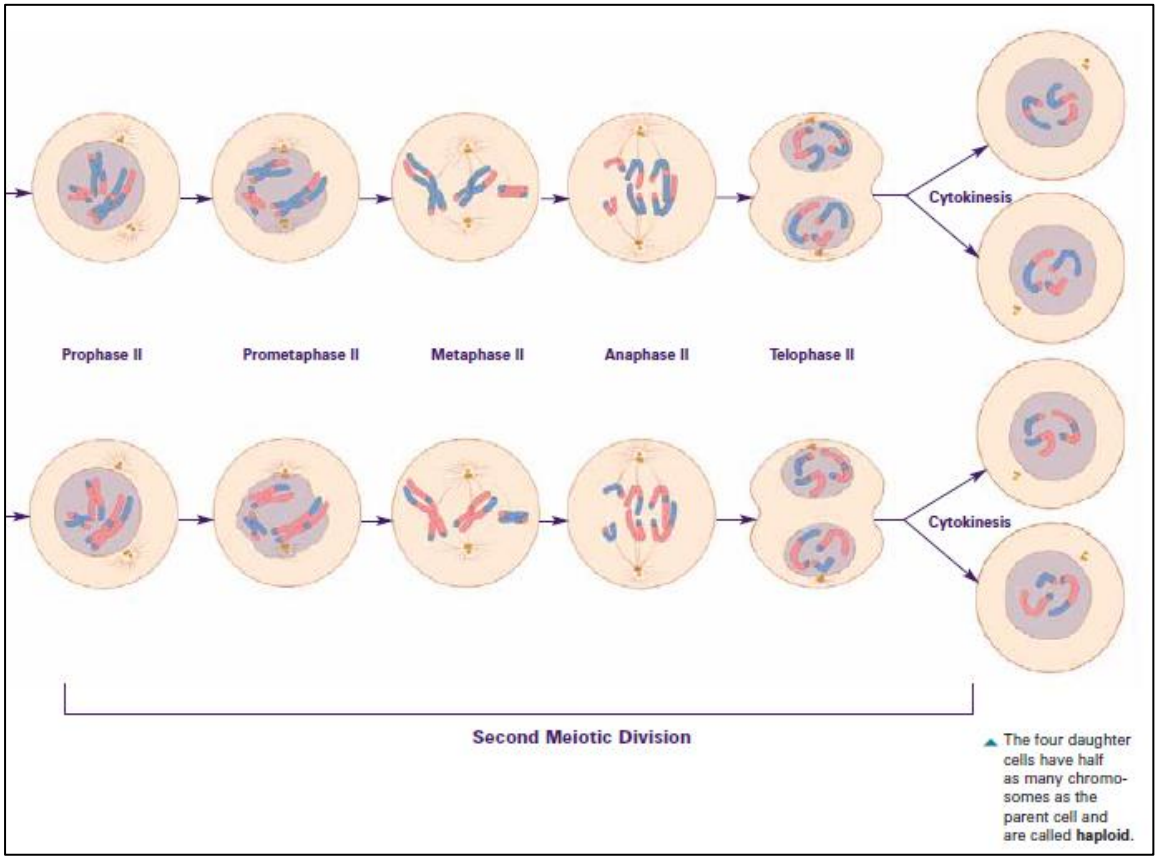
If the egg and sperm each had 23 chromosome pairs, their union would result in a zygote with 46 pairs (double the usual number). Theoretically, this cell would then grow into a person with 46 pairs of chromosomes per cell (rather than the usual 23 pairs). Subsequent generations would have even more chromosomes per cell. Clearly, this is not what actually happens. Even early cell biologists realized that there must be a way to cut in half the number of chromosomes in egg and sperm cells. To accomplish that task, meiosis occur. In preparation for meiosis, the chromosomes are copied once, just as for mitosis, but instead of one cell division, there are two. The result is four daughter cells, each containing 23 individual chromosomes rather than 23 pairs. Generating daughter cells are distinct from one another and from the original parent cell.

Meiosis is divided into phases just like mitosis, and although the phases have the same names. Also, since there are two cell divisions in meiosis, each phase is followed by an I or II, indicating to which division it belongs.

Phases of meiosis

Meiosis is used to make sperm and egg cells. During meiosis, cell's chromosomes are copied once, but the cell divides twice. For simplicity, we have illustrated cells with only three pair of chromosomes.





The differences between mitosis and meiosis

Item	Mitosis	Meiosis
Definition	A process of asexual reproduction in which the cell divides in two producing a replica, with an equal number of chromosomes in each resulting diploid cell.	A type of cellular reproduction in which the number of chromosomes are reduced by half through the separation of homologous chromosomes, producing four haploid cells.
Function	Cellular Reproduction & general growth and repair of the body	sexual reproduction
Type of Reproduction	Asexual	Sexual
Genetically	identical	Different
Crossing Over	No, crossing over cannot occur.	Yes, mixing of chromosomes can occur.
Number of Divisions	1	2
Number of Daughter Cells produced	2 diploid cells	4 haploid cells
Chromosome Number	Remains the same	Reduced by half
Steps	The steps of mitosis are Interphase, Prophase, Metaphase, Anaphase, Telophase and Cytokinesis	The steps of meiosis are Interphase, Prophase I, Metaphase I, Anaphase I, Telophase I, Prophase II, Metaphase II, Anaphase II and Telophase II.

Creates	Makes everything other than sex cells	Sex cells only: Female egg cells or Male sperm cells
Discovered by	Walther Flemming	Oscar Hertwig