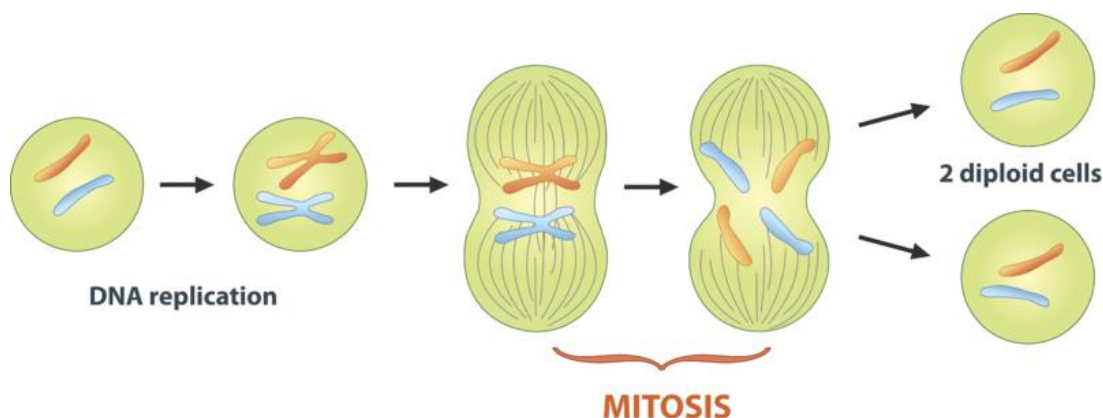


Mitosis Reading Packet

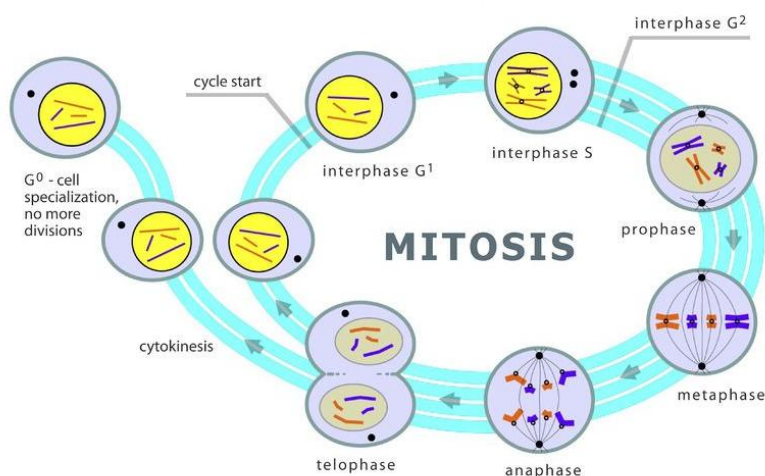
Mitosis

Mitosis is the division of the cell's nucleus, the final step before two daughter cells are produced. Prior to mitosis the cell goes through a interphase composed of three stages G₁, S, and G₂. During mitosis, when the nucleus divides, the two chromatids that make up each chromosome separate from each other and move to opposite poles of the cell. This is shown in **Figure** below.



Mitosis is the phase of the eukaryotic cell cycle that occurs between DNA replication and the formation of two daughter cells. What happens during mitosis?

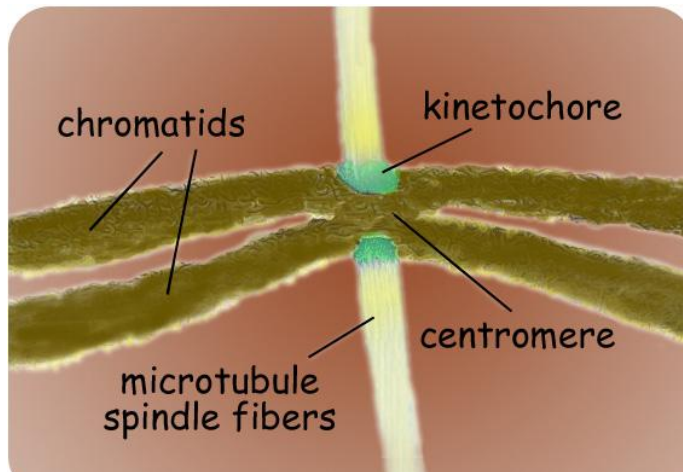
Mitosis actually occurs in four phases. The phases are called prophase, metaphase, anaphase, and telophase. They are shown in **Figure** below and described in greater detail in the following sections. Overall, mitosis is the cellular division of a cell producing two identical daughter cells through a process of four stages prophase, metaphase, anaphase, and telophase.



Mitosis in the Eukaryotic Cell Cycle. Mitosis is the multi-phase process in which the nucleus of a eukaryotic cell divides

Prophase

The first and longest phase of mitosis is **prophase**. During prophase, chromatin condenses into chromosomes, and the nuclear envelope, or membrane, breaks down. In animal cells, the centrioles near the nucleus begin to separate and move to opposite poles of the cell. As the centrioles move, a spindle starts to form between them. The spindle, shown in **Figure** below, consists of fibers made of microtubules.

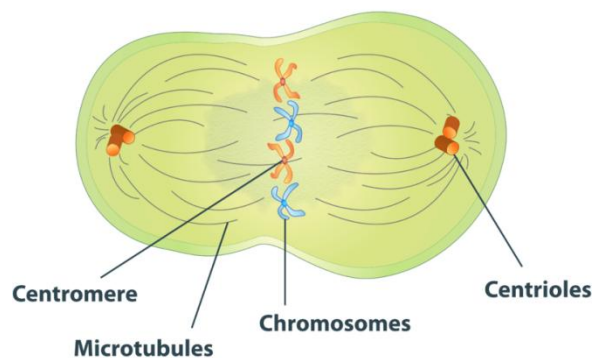


Spindle. The spindle starts to form during prophase of mitosis. Kinetochores on the spindle attach to the centromeres of sister chromatids.

Metaphase

During **metaphase**, spindle fibers attach to the centromere of each pair of sister chromatids (see **Figure** below). The sister chromatids line up at the equator, or center, of the cell. The spindle fibers ensure that sister chromatids will separate and go to different daughter cells when the cell divides.

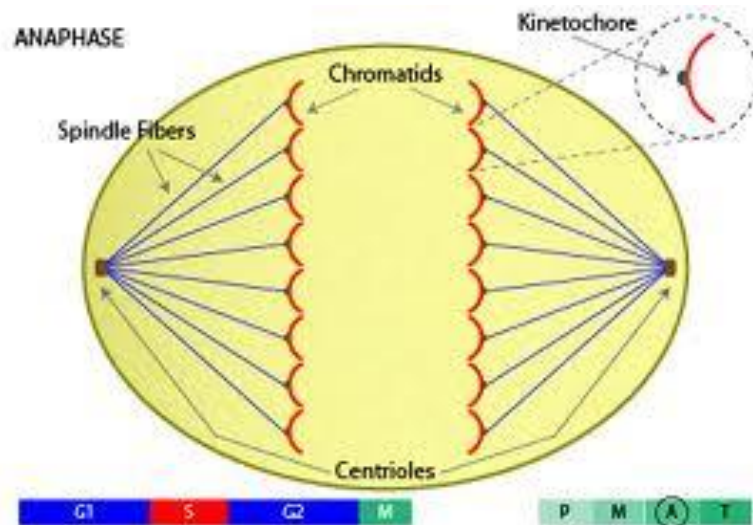
METAPHASE



Chromosomes, consisting of sister chromatids, line up at the equator of the cell during metaphase.

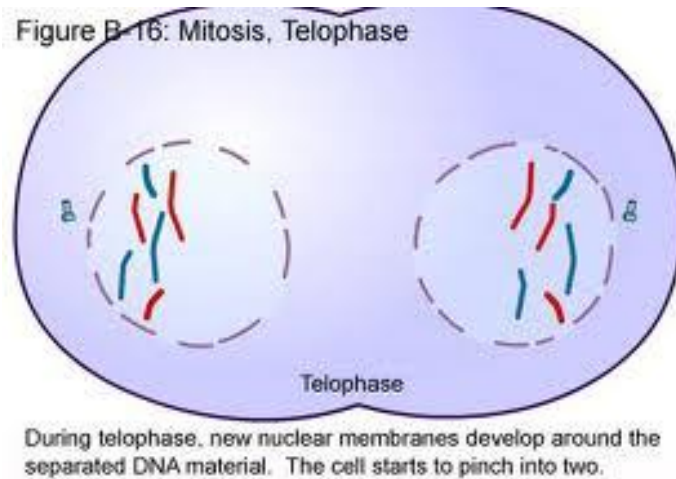
Anaphase

During **anaphase**, sister chromatids separate and the centromeres divide. The sister chromatids are pulled apart by the shortening of the spindle fibers. This is like reeling in a fish by shortening the fishing line. One sister chromatid moves to one pole of the cell, and the other sister chromatid moves to the opposite pole. At the end of anaphase, each pole of the cell has a complete set of chromosomes.



Telophase

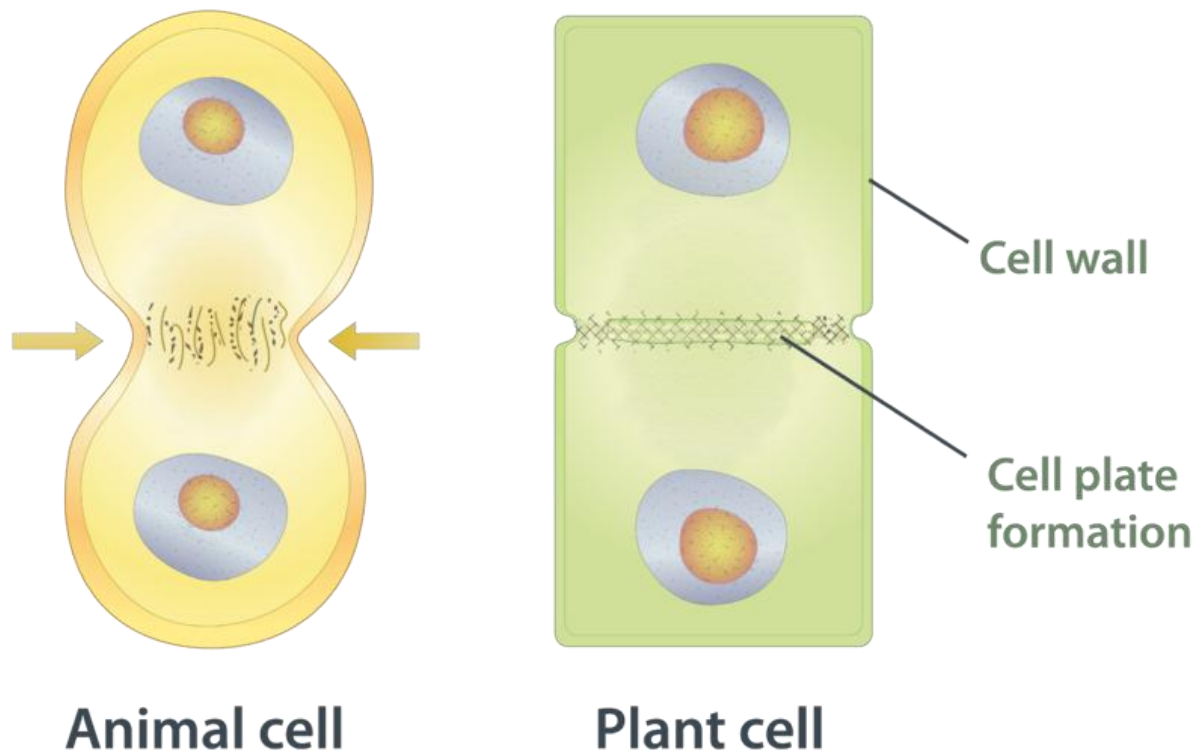
During **telophase**, the chromosomes begin to uncoil and form chromatin. This prepares the genetic material for directing the metabolic activities of the new cells. The spindle also breaks down, and new nuclear membranes form.



Cytokinesis

Cytokinesis is the final stage of cell division in eukaryotes as well as prokaryotes. During cytokinesis, the cytoplasm splits in two and the cell divides. Cytokinesis occurs somewhat differently in plant and animal cells, as shown in **Figure** below. In animal cells, the plasma membrane of the parent cell pinches inward along the cell's equator until two daughter cells form. In plant cells, a cell plate forms along the equator of the parent cell. Then, a new plasma membrane and cell wall form along each side of the cell plate.

CYTOKINESIS



Cytokinesis is the final stage of eukaryotic cell division. It occurs differently in animal and plant cells.

Vocabulary

autosomes: Chromosomes that are not directly involved in determining the sex of an individual.

binary fission: Asexual reproduction in prokaryotic organisms; produces identical offspring.

cell cycle: A repeating series of events, during which the eukaryotic cell carries out its necessary functions, including metabolism, cellular growth, and division, resulting in two genetically identical daughter cells.

cell plate: Forms during cytokinesis in plant cells; a new membrane grows along each side of the cell plate, with a new cell wall forming on the outside of each new membrane.

centriole: Structure from which spindle fibers originate.

centromere: Region of a chromosome where sister chromatids are joined together.

chromosome: Structure made of DNA and proteins that contains the genetic material of a cell.

cytokinesis: Division of the cytoplasm forming two daughter cells.

diploid: A cell containing two sets of chromosomes; in human cells, two sets contains 46 chromosomes.

gametes: An organism's reproductive cells, such as sperm and egg cells.

haploid: A cell containing one set of chromosomes; in human gametes, one set is 23 chromosomes.

homologous chromosomes: A pair of chromosomes (one from each parent) consisting of two chromosomes that are similar in size, shape, and genes; also known as homologues.

metaphase plate: The center (equator) of a cell during mitosis; chromosomes line up at the metaphase plate to ensure the proper separation of the chromatids.

nucleus: Eukaryotic cell structure that contains the genetic material, DNA.

sex chromosomes: Contain genes that determine the sex of an individual.

sister chromatids: Two identical copies of a chromosome.

spindle fibers: Thin, cage-like fibers made out of microtubules; used to move chromosomes and to separate the sister chromatids during mitosis.

zygote: The first cell of a new individual.