Cell division

Cell division is an integral part of the cell cycle; it is the process by which a parent cell divides into two or more daughter cells.

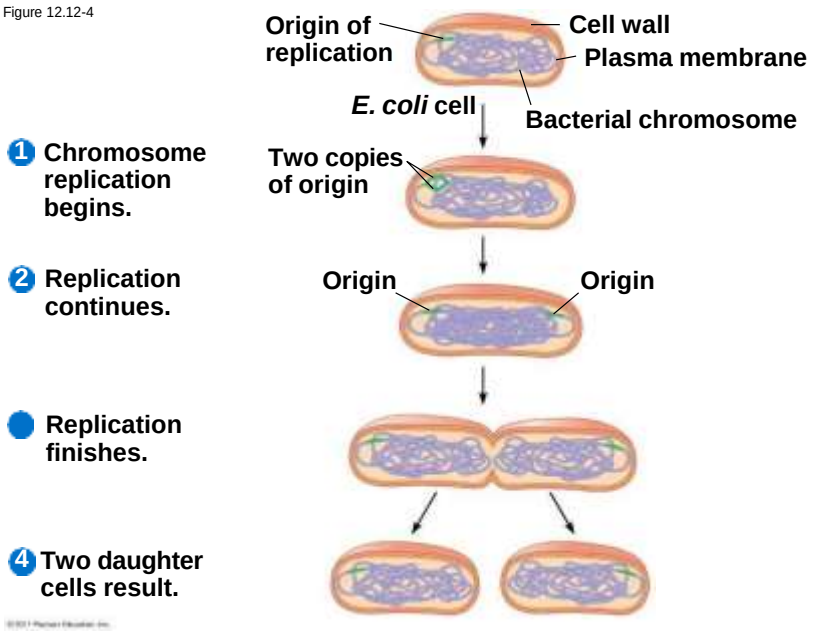
- In **unicellular organisms**, division of one cell reproduces the entire organism.

- **Multicellular organisms,** depend on cell division for development from a fertilized cell, growth and repair.

- Most cell division results in daughter cells with identical genetic information DNA, The exception with meiosis, a special type of division that can produce sperm and egg cells.

Binary Fission in Bacteria

- Prokaryotes (bacteria and archaea) reproduce by a type of cell division called binary fission
- In binary fission, the chromosome replicates and the two daughter chromosomes actively move apart.
- The plasma membrane pinches inward, dividing the cell into two.



- **<u>Eukaryotic cell</u>**

  Eukaryotic cell division consists of:

- **Mitosis**, the division of the genetic material in the nucleus.
- **Cytokinesis**, the division of the cytoplasm.

- Gametes are produced by a variation of cell division called **meiosis.**
- Meiosis yields **non-identical daughter** cells that have only one set of chromosomes, half as many as the parent cell.

Mitosis.

The part of cell division which results in two identical daughter cells from a single parent cell.

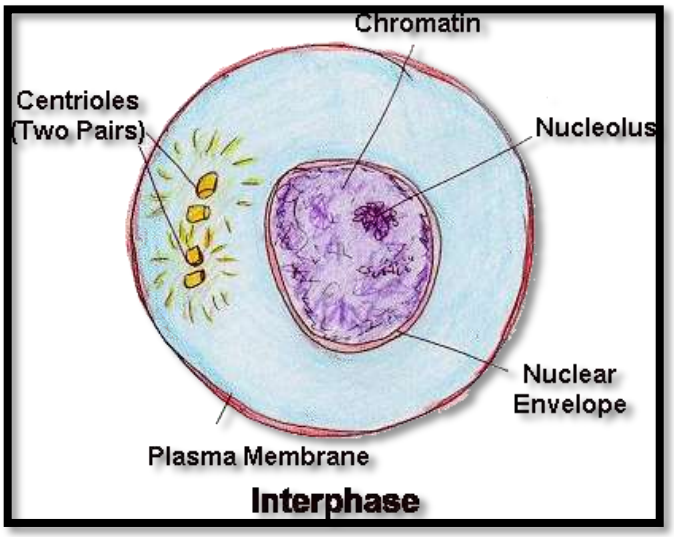
Cell Division can be divided into stages

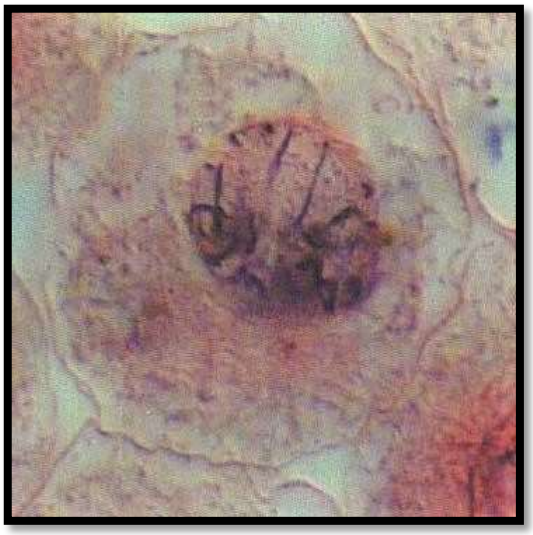
- Interphase
- Prophase
- Metaphase
- Anaphase
- Telophase
- Cytokinesis

1- Interphase

The cell prepares for division

- DNA replicated (copied)
- Makes new organelles (synthesis)
- Cell increases in size (growth)

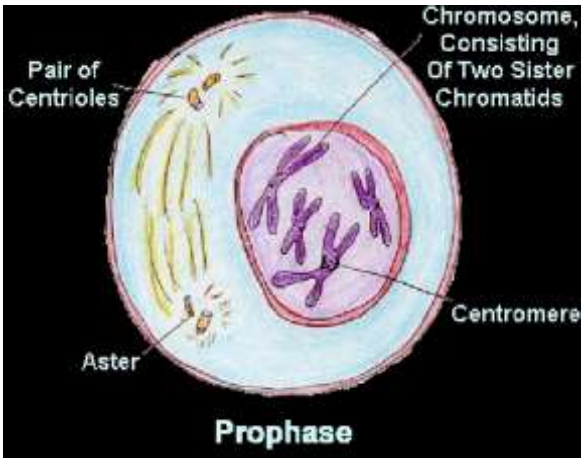




2- Prophase

The cell prepares for nuclear division

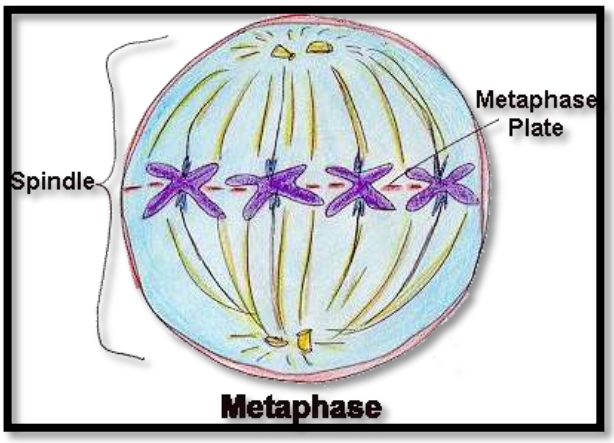
- Chromosomes appear –
– Centrioles separate & spindles form
– Nuclear envelope disappears
– Longest phase in mitosis.



3- Metaphase:

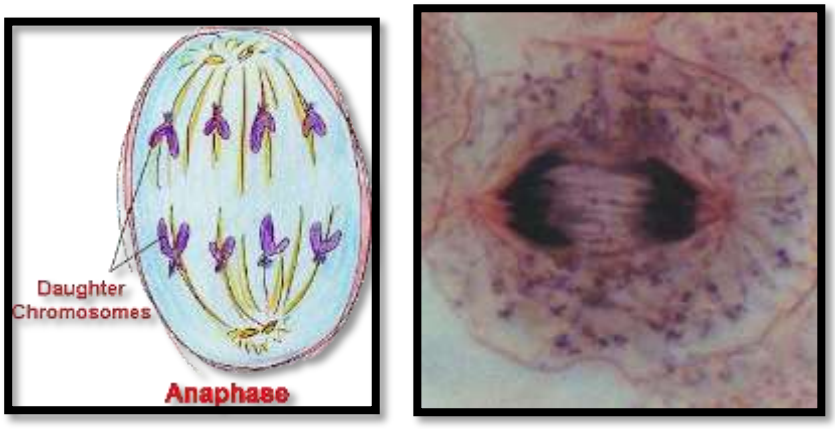
The cell prepares chromosomes for division.

– Chromosomes line up at the middle of the cell
– Spindle fibers attach to chromosomes at the centromere
– Shortest phase of mitosis



3- Anaphase

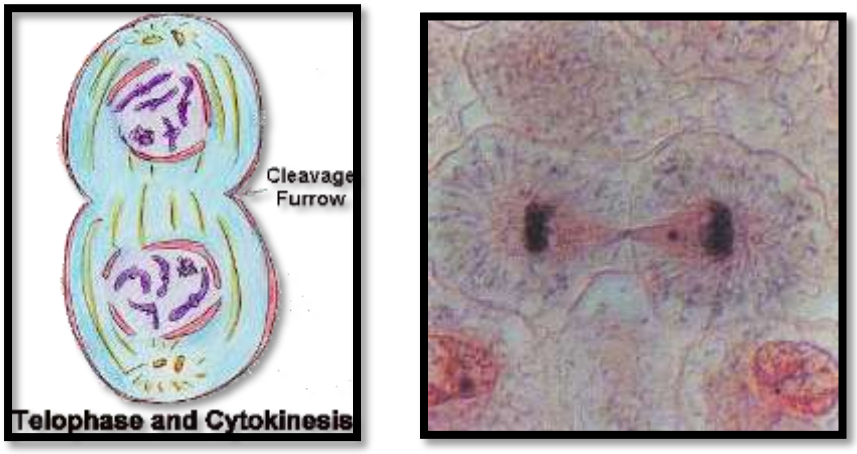
- The chromosomes divide
– Spindle fibers pull chromosomes apart
– ½ of each chromosome (called chromatid) moves to poles of cells



4- Telophase

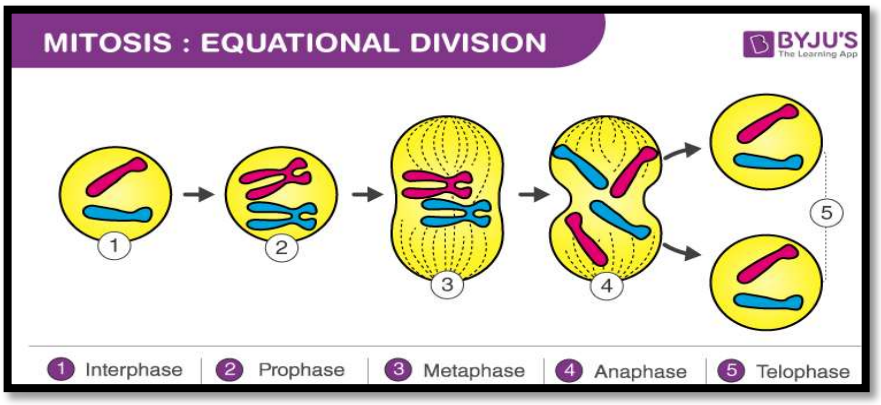
The cytoplasm divides

– DNA uncoils & appears as chromatin again
– 2 nuclei form
– Cell membrane pinches in to form the 2 new daughter cells



5- Cytokinesis

- Division of the cytoplasm- creating 2 new cells
- Begins in telophase



- Meiosis.

Meiosis is the form of eukaryotic cell division that produces **haploid** sex cells or

- Meiosis.

Meiosis is the form of eukaryotic cell division that produces **haploid** sex cells or gametes (which contain a single copy of each chromosome) from **diploid** cells (which contain two copies of each chromosome). The process takes the form of one DNA replication followed by two successive nuclear and cellular divisions (Meiosis I and Meiosis II). As in mitosis, meiosis is preceded by a process of DNA replication that converts each chromosome into two sister chromatids.

Meiosis I

Meiosis I separates the pairs of homologous chromosomes**,** a special cell division reduces the cell from diploid to haploid.

1- Prophase I

The homologous chromosomes pair and exchange DNA to form recombinant chromosomes. Prophase I is divided into **five phases**:

- Leptotene: Chromosomes start to condense.

- Zygotene: Homologous chromosomes become closely associated (synapsis) to form pairs of chromosomes (bivalents) consisting of four chromatids (tetrads).

- Pachytene: Crossing over between pairs of homologous chromosomes to form chiasmata.

- Diplotene: Homologous chromosomes start to separate but remain attached by

chiasmata.

- Diakinesis: Homologous chromosomes continue to separate, and chiasmata move to the ends of the chromosomes.

2- Prometaphase I

Spindle apparatus formed and chromosomes attached to spindle fibers by kinetochores.

3- Metaphase I

Homologous pairs of chromosomes (bivalents) arranged as a double row along the metaphase plate.

4- Anaphase I

The homologous chromosomes in each bivalent are separated and move to the opposite poles of the cell.

5- Telophase I

The chromosomes become diffuse and the nuclear membrane reforms.

6- Cytokinesis

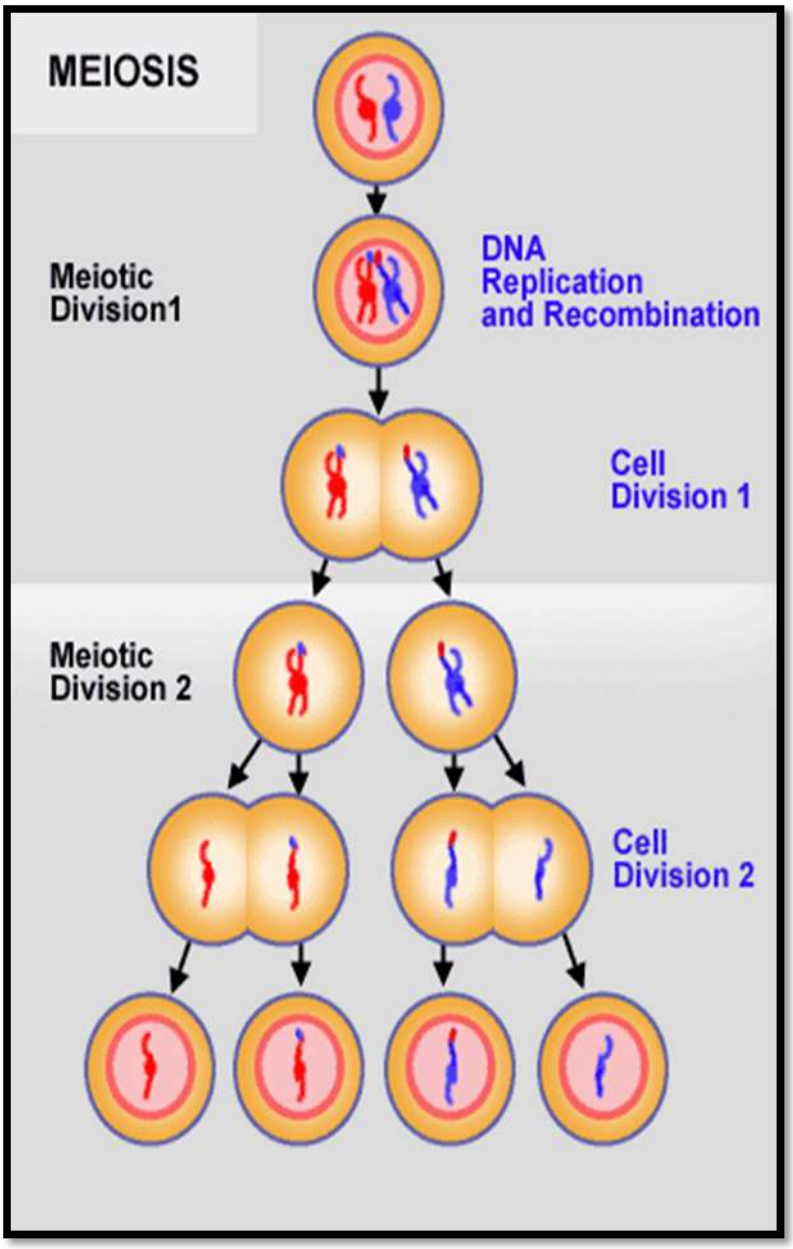
The final cellular division to form two new cells, followed by Meiosis II.
Meiosis I is a reduction division: the original diploid cell had two copies of each chromosome; the newly formed haploid cells have one copy of each chromosome.

Meiosis II

- Meiosis II separates each chromosome into two chromatids.

- The events of Meiosis II are analogous to those of a mitotic division, although the number of chromosomes has been halved.

- Meiosis generates **genetic diversity** through the exchange of genetic material between homologous chromosomes during Meiosis I.


MEIOSIS
Meiotic Division1
DNA Replication and Recombination
Cell Division 1
Meiotic Division 2
Cell Division 2