

**Cell division** : an important characteristic of living cells is their ability to divide , so cell division is happened in all living organism .

There is tow kinds of division : mitosis and meiosis .

**Mitosis** : is nuclear division that results in two nuclei each having the same number of chromosomes as the original nucleus , and the resulting two cells are called daughter cell .

- In multicellular organisms mitosis permits growth and repair of tissues .
- In unicellular organisms mitosis is a form of a asexual reproduction .

**Meiosis** : is a form of nuclear division in which the chromosome number is reduced by half . the same stage of nuclear division are present in meiosis as in mitosis , but these stage occur twice – meiosis (1) and meiosis (2) has two divisions , so in meiosis results four nuclei with haploid number of chromosomes . meiosis is a form of sexual reproduction in sexually reproducing organisms . Cell division undergo a sequence that includes three stages :-

- 1- Interphase
- 2- Karyokinesis or (mitosis) ( nuclear division)
- 3- Cytokinesis (cytoplasmic division )

### 1) Interphase :-

it precedes mitosis and cytokinesis during interphase , a cell doubles all its nuclear components and DNA replicates . during interphase happen :-

- the nucleus appears normal
- the cell is performing its usual cellular function
- cell increases all of its components including such organelles as the mitochondria , ribosomes and centrioles if present DNA replication

**Note** : look at cell cycle

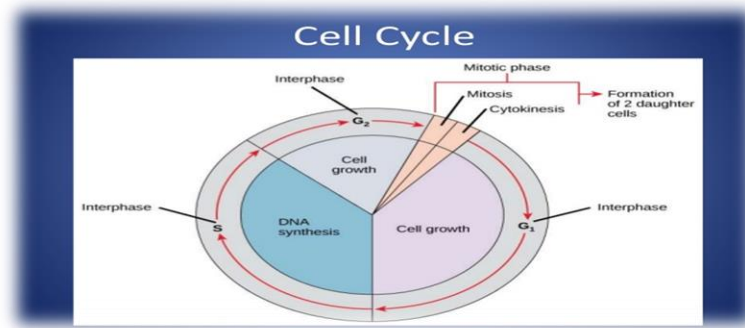


FIGURE 2-1 CELL CYCLE

## 2) karyokinesis or (mitosis) :

the stage of plant mitosis : prophase ,metaphase , anaphase and telophase

**a- prophase** :- in this stage happen

the chromosomes continue to compact , the nucleolus disappears , the nuclear envelope fragments , the spindle begins to assemble and the pairs of centrioles migrate to the poles .the chromosomes become visible within the nucleus , chromatids become shorter and thicker ,the two chromatids of each chromosome are joined by a small region called the centromer .

**b- Metaphase** :- in this stage happen

The spindle occupies the region , the spindle consists of two poles ,asters and fibers which are bundles of parallel microtubules . as well as short microtubules radiate from the pair of centrioles , chromosome are aligned at the metaphase plate and each chromosome is attached the spindle .

**c- Anaphase** :- in this stage happen

The chromatids of each chromosomes separate and move to opposite poles , each pole receives one kind of chromatide so has the diploid number of daughter chromosomes.

**d- Telophase** :- in this stage happen

New nuclear envelopes form around the daughter chromosomes at the poles each daughter nucleus contains the same number abd kinds of chromosomes as the parental cell, and a nucleolus appears in each daughter nucleus .

**Plant mitosis stages** :-

The stages of plant mitosis are exactly the same as animal mitosis, but notice that plant cells don't have centrioles and asters, plant cells do have centrosomes, the central microtubule organizing center of the cell and this accounts for the formation of a spindle.

In plants, the root tip contains tissue that is dividing and producing new cells continually. A slide of (onion) root tip cells is a good specimen for mitosis cell division.

**Note :** - each microscopic chromosome in onion cells contains a highly folded DNA molecule that is about a meter long so it is used as a good specimen for studying mitosis in plant cells.

### 3) Cytokinesis :-

When cytoplasm divides after the stage of nuclear division that is called cytokinesis, and the duplicated contents are separated and the daughter cells form. Each daughter cell is an exact copy of the parental cell and is diploid chromosomes ( $2n$ ). **Note :-**

- 1- In cytokinesis of animal cells will produce a (cleavage furrow) forming two daughter cells.
- 2- In cytokinesis of plant cells will form a (cell plate) in the center of the cell and a new plasma membrane re-formed for each daughter in this area.

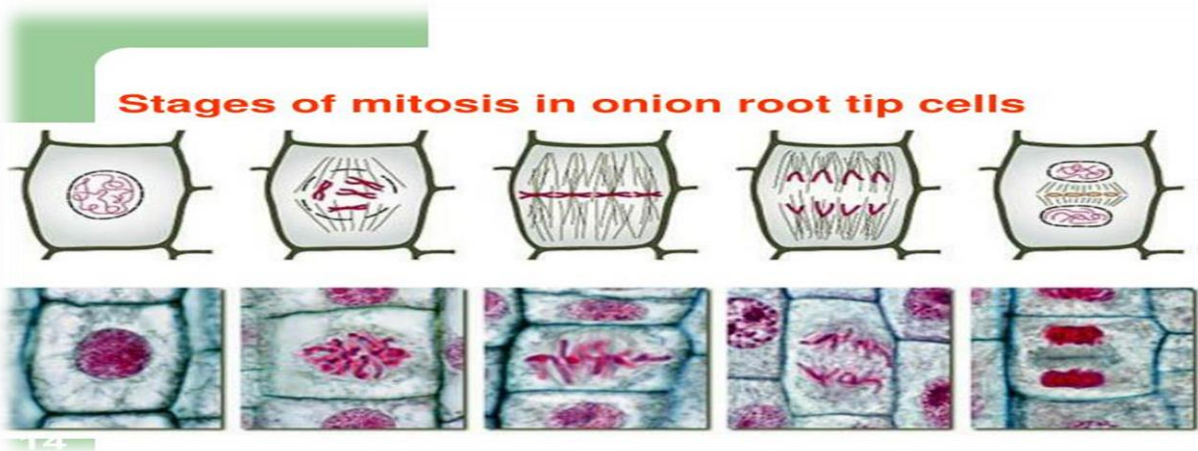


Figure 2-2 stage of mitosis in onion root tip cells

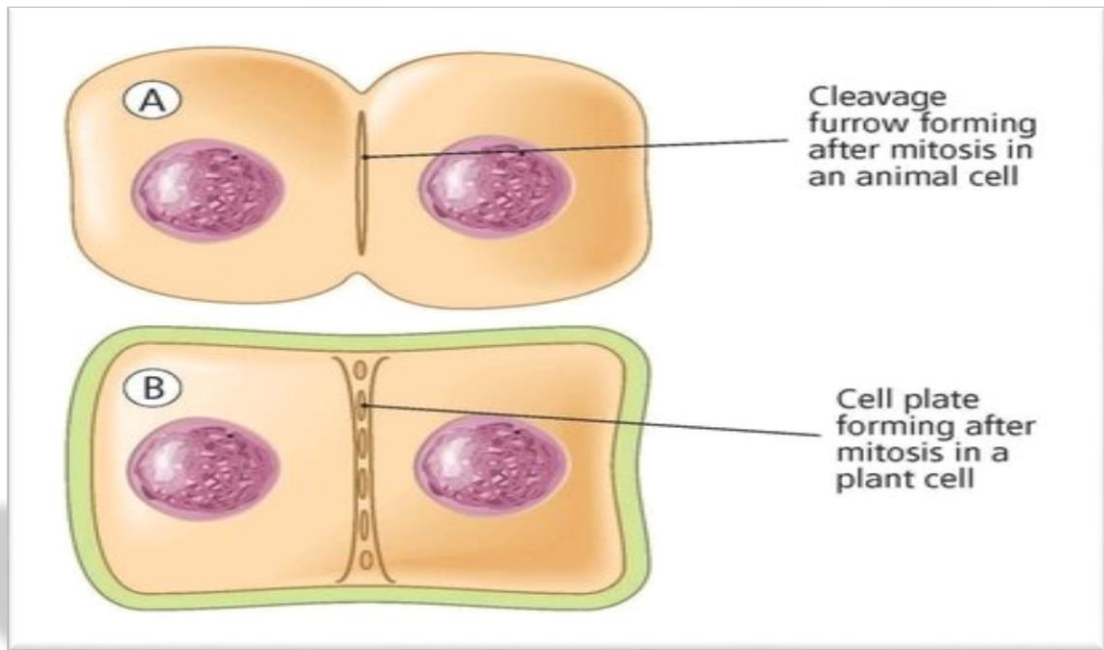


Figure 3-2 (A)cleavage furrow in animal cell

(B) cell plate in plant cell

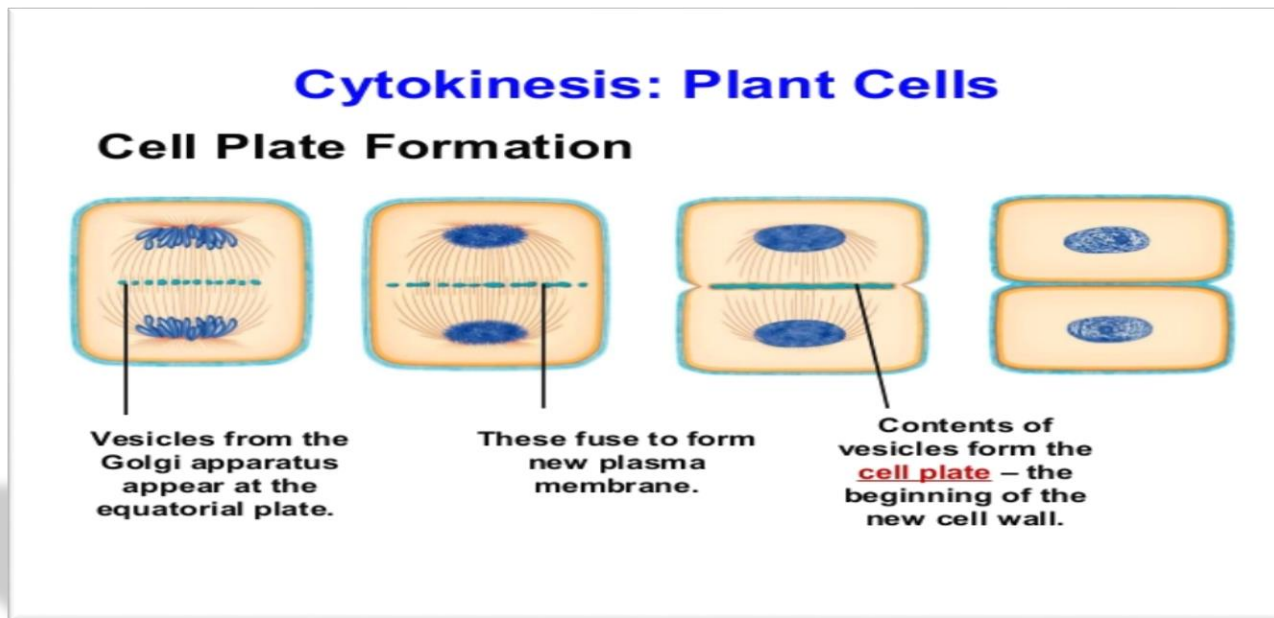


Figure 4-2 cell plate