

LESSON-4 CELL – STRUCTURE AND FUNCTION

All organisms are composed of structural and functional units of life called 'cells'. Cells vary in size and structure as they are specialized to perform different functions. But the basic components of the cell are common to all biological cells. This lesson deals with the structure common to all types of the cells

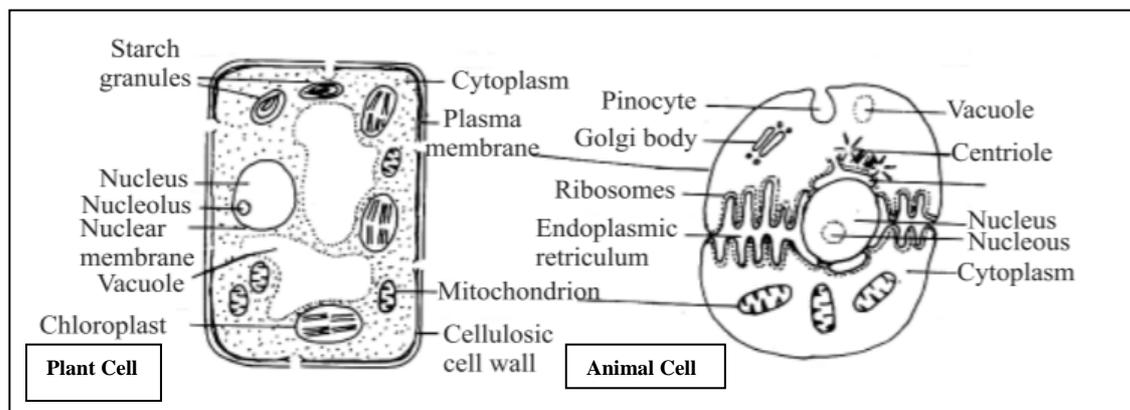
- In 1838 M.J. Schleiden and Theodore Schwann formulated the “**cell theory.**” Which maintains that: all organisms are composed of cells.
- Cell is the structural and functional unit of life, and z cells arise from pre-existing cells.
- every cell has three major components:
- 1. Plasma membrane 2. Cytoplasm 3. DNA (naked in bacteria) and enclosed by a nuclear membrane in all other organism

Eukaryotic cell (eu = true, karyon = nucleus)	Prokaryotic cell (Pro = early/primitive)
1. Nucleus distinct, with well formed nuclear membrane.	1. Nucleus not distinct, it is in the form of a nuclear zone 'nucleoid'. Nuclear membrane absent.
2. Double-membraned cell organelles (Chloroplasts, mitochondria, nucleus) and single membraned (Golgi apparatus, lysosomes, vacuole, endoplasmic reticulum) are present	2. Single-membraned cell bodies like mesosomes present. Endoplasmic reticulum, plastids, mitochondria, microbodies like lysosomes, and Golgi body absent.
3. Ribosomes - 80 S	3. Ribosomes - 70 S
4. Distinct compartments in the cell i.e. the cytoplasm and the nucleus	4. No compartments.
5. Depending upon the species number of chromosomes per nucleus varies from two to many.	5. There is only one chromosome per cell.
6. Each chromosome is linear with its two ends free.	6. The chromosome is circular and remains attached to cell membrane at one point.
7. Each chromosome has one linear double-stranded DNA complexed with histones	7. The chromosome has single double-stranded circular DNA molecule and is not associated with histones.
8. Each chromosome has one centromere that divides a chromosome into two arms. However, if the centromere is terminal, the chromosome would have only one arm	8. The chromosome lacks a centromere.




➤ The plant cell and the animal cell also differ in several respects

Plant Cell	Animal Cell
Cellulose cell wall present external to cell membrane	No cell wall, outermost structure is cell membrane or plasma membrane
Vacuoles are usually large	Generally vacuoles are absent and if present, are usually small.
Plastids present	Plastids absent.
Golgi body present in the form of units known as dictyosomes.	Golgi body well developed having 2 cisternae
Centriole absent.	Centriole present.



1.	Organelle	Function
2.	Cell membrane (Plasma membrane)	Encloses the cell contents, regulates movement of substance into and out of the cell. It is termed as 'selectively permeable'.
3.	Cell wall	Protects the delicate inner parts of the cell.
4.	Cytoplasm	The liquid that fills the Cell.
5.	Mitochondria - the energy transformer	'Power house' of the cell.
6.	Plastids	Chloroplasts are the site of photosynthesis
7.	Endoplasmic reticulum (ER),	Provides internal framework, transports enzymes and other materials throughout the cell.
8.	Golgi body	Packaging and secretion of proteins.
9.	Vacuole	Stores water, Salt and Carbohydrates
10.	Ribosomes	Site for protein synthesis.
11.	Microbodies (Lysosomes)	Help in nutrition of the cell by digesting food,
12.	Cilia and flagella	The organelles for motility
13.	Centriole	involved in cell division
14.	Nucleus	Maintains the cell in a working order. Co-ordinates the activities of other cell co-ordinates the activities of other cell organelles

MOLECULES OF THE CELL

- The cell and its organelles are made of organic chemicals such as proteins, carbohydrates, nucleic acid and fats. These are aptly termed **biomolecules**. Inorganic molecules such as water and minerals are also present in a cell.

CELL DIVISION

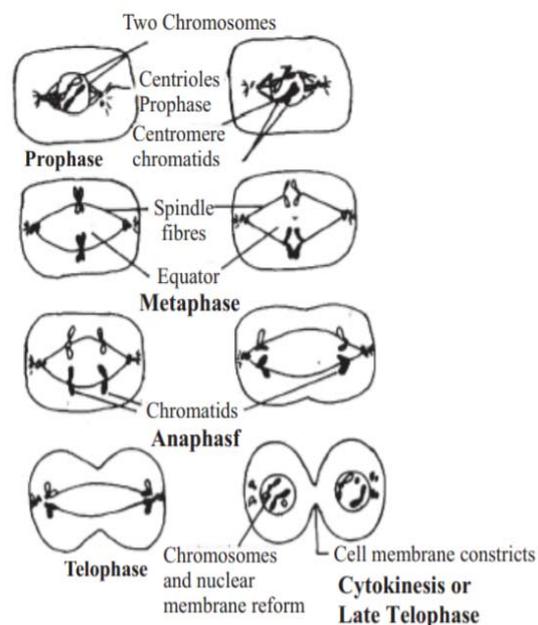
- The living cells divide by mitotic cell division to produce new cells.
- Growth in body occurs due to increase in the number of cells.
- The continuity of the chromosomal set is maintained by cell division.
- The life cycle of a cell includes interphase (G₁, S & G₂) and M-phase (mitosis or meiosis)

KINDS OF CELL DIVISION

- There are two kinds of cell division- mitotic cell division and meiotic cell division
- Mitotic cell division occurs in somatic cells or reproductive cells that results in the formation of identical cells, both qualitatively and quantitatively
- The significance of mitosis is growth and reproduction where the product of reproduction is identical.

MITOSIS

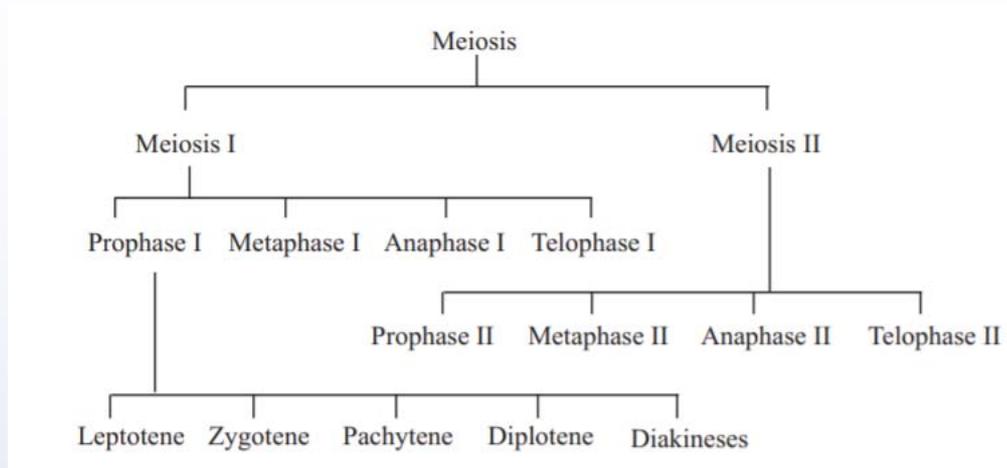
Mitosis (mitos = thread) Mitosis is divided into 4 phases or stages termed as (i) Prophase (ii) Metaphase (iii) Anaphase (iv) Telophase



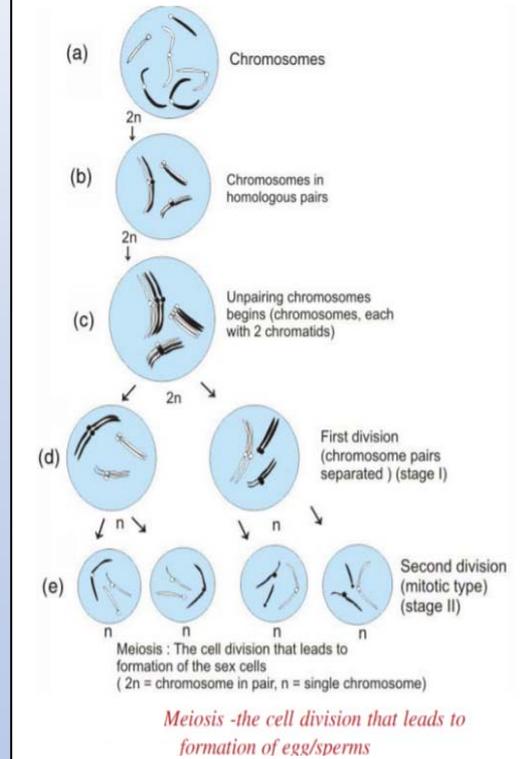
The nucleus divides first and then the whole cell divides. Division of one nucleus to produce two daughter nuclei is called (**karyokinesis**). Division of cytoplasm to give two daughter cells is called **cytokinesis**.

Meiosis

Meiosis is characterized by two successive divisions of the nucleus (meiosis I and II) and cytoplasm, whereas the chromosomes divide only once.



- Meiosis occurs in germ cells only i.e. testis and ovary. This is a reduction division where the chromosome number becomes half.
- Meiotic cell division occurs in the gonads for sexual reproduction to produce gametes. The resultant cells, egg (in female) and sperms (in male), possess half the chromosome number of that present in the parent cell.
- Meiotic cell division takes place only in diploid cells responsible for production of haploid spores or gametes. The significance of meiosis is in sexual reproduction where ova and sperm both have half the number of chromosomes i.e. 23 each in human gametes (but normal number of chromosome of human is 46 or 23 pair) and on fertilization the chromosome number becomes normal.



Chromosomes can be seen distinctly only at metaphase. They are then photographed, cut and arranged in pairs according to size. Such an arrangement of homologous chromosomes of an individual in descending order according to size, is termed as a **karyotype**

Test Yourself

1. Write the down the main functions of the following organelles: Endoplasmic reticulum, Golgi body, Lysosome.
2. Draw labelled diagrams of various stages of mitosis.
3. List out the main differences between mitosis and meiosis.