The Cell - Structure and Functions

- **Cell**
  - Cells are the basic structural units and the building blocks of all living organisms.
- **Discovery of the Cell**
- Cell was discovered by Robert Hooke in 1665 after observing a piece of cork under a magnifying device.
- Robert Hooke coined the term “cell”.

1. Schleiden and Schwann proposed the cell theory. According to cell theory-

   Cells are the basic structural and functional units of life.

   All living organisms are made up of one or more cells.

   New cells arise from pre-existing cells.

- **Number of Cells**
- Organisms made of only a single cell are called unicellular organisms.
- For example: *Amoeba* and *Paramecium*
- Single cell in these organisms performs all the basic functions such as digestion, respiration, excretion, etc.
- Organisms made up of more than one cells are called multicellular organisms.
- For example: Humans, cow, rose, etc.
- In these organisms, the cells show division of labour as particular set of cells are involved in performing a specific body function.
- **Shape of the Cells**

- Most of the cells have a definite shape.
- Some cells such as that in *Amoeba* have no definite shape.
- The human red blood cell (RBC) is spherical-shaped.
- The muscle cells in humans are spindle-shaped.
- The human nerve cells have elongated branched structure.
- In plants and bacteria, the cell is enclosed in a protective covering called cell wall, which gives shape and rigidity to the cells.
- **Size of the Cells**
- The smallest cell is 0.1 to 0.5 micrometre in bacteria.
- The largest cell is of size 170 mm x 130 mm, which is the egg of an ostrich.
- Size of a cell has no relation with the size of an organism.
- **Cell Structure and Functions**
- In multicellular organisms, each organ system is made up of several organs.
- Organs are further made up of tissues.
- Tissues are groups of similar cells performing a specific function.

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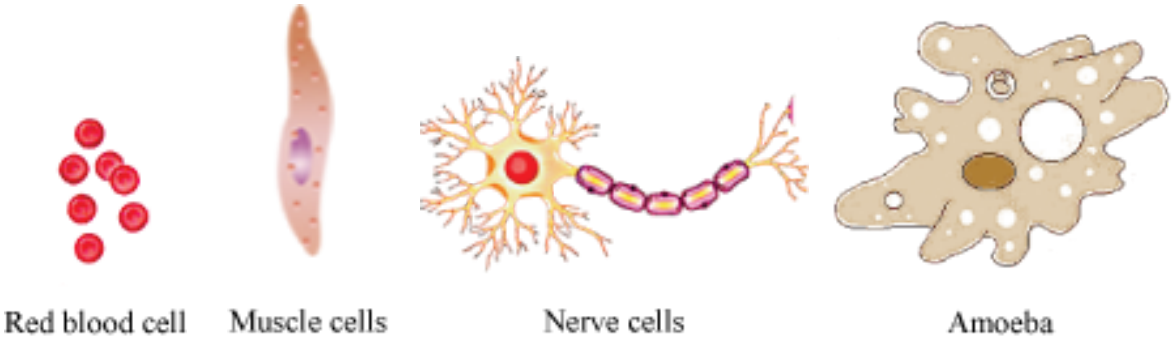

Red blood cell Muscle cells Nerve cells Amoeba

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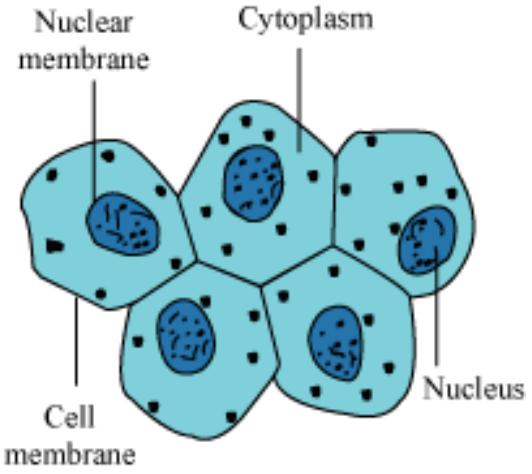
- **Tissues are groups of similar cells performing a specific function.**
- **Types of cell**
  - **Prokaryotic cells -** Cells which do not have a well defined nuclear membrane and the nuclear material lies freely in the cytoplasm of the cell. For example - bacteria, blue green algae.

  - **Eukaryotic cells -** Cells having nucleus with well defined nuclear membrane. For example - plant and animal cells

- **Components of the cell**



Human cheek cells

- **Cell membrane**
  - It is the protective layer that surrounds the cell.
  - Cell membrane selectively allows the entry of only some substances and prevents the movement of other materials. Hence, it checks the transport of substances in and out of the cell.
- **Cell wall**
  - In plants, an extra protective covering of a polysaccharide, cellulose is present.
  - It is called cell wall that protects plant cells from environmental variations.
- **Cytoplasm**
  - It is a jelly-like substance present between cell membrane and nucleus.
  - It contains various cell organelles such as mitochondria, Golgi bodies, lysosomes etc.
- **Nucleus**
  - It is a dense spherical body located at the centre of the cell.
  - It is surrounded by porous nuclear membrane.
  - It contains spherical body called nucleolus.
  - It also contains thread-like structures called **chromosomes**.
  - Chromosomes are the structures that carry genes and play an important role in inheritance.
  - **Genes** are the structural and functional unit of inheritance.
  - The entire living substance in a cell is known as **protoplast**.
- **Vacuoles**
  - Vacuoles are fluid-filled membrane-bound structures in the cell.
  - In plant cells, a single large vacuole is present.
  - In animal cells, numerous small vacuoles are present.
- **Plastids**

    - They are present only in plant cells.
    - Plastids that contain green colour pigment **chlorophyll** are known as chloroplasts. It is the chlorophyll that gives green colour to the leaves.
- **Chloroplast traps solar energy and utilizes this energy to manufacture food for the plant.**

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4. The membrane of the vacuole is called tonoplast. This membrane encloses a fluid called cell sap.

- **Plastids**

1. They are present in plant cells.

2. Chloroplast is a plastid containing green pigment called chlorophyll that is required in photosynthesis.

3. Plastids are of two types – leucoplasts and chromoplasts

4. Leucoplasts are colourless and are used to store food while chromoplasts are plastids containing pigments. Chloroplasts are a type of chromoplasts.

5. Chloroplasts consist of two regions – grana (stacks of sac like membrane bound structures that contain pigment chlorophyll) and stroma (ground substance containing enzymes and starch grains)

- **Endoplasmic Reticulum (ER)**

They are of two types:

1. Rough Endoplasmic Reticulum (RER) is important for synthesis and packaging of proteins.

2. Smooth Endoplasmic Reticulum (SER) acts as storage organelle. It also helps in lipid (fat) synthesis.

- **Golgi Apparatus**

1. It is made up of parallel arranged membrane-bound vesicles called cisternae.
2. It helps in storage, modification, and packaging of products in vesicles.
3. It helps in formation of glycoproteins and glycolipids.

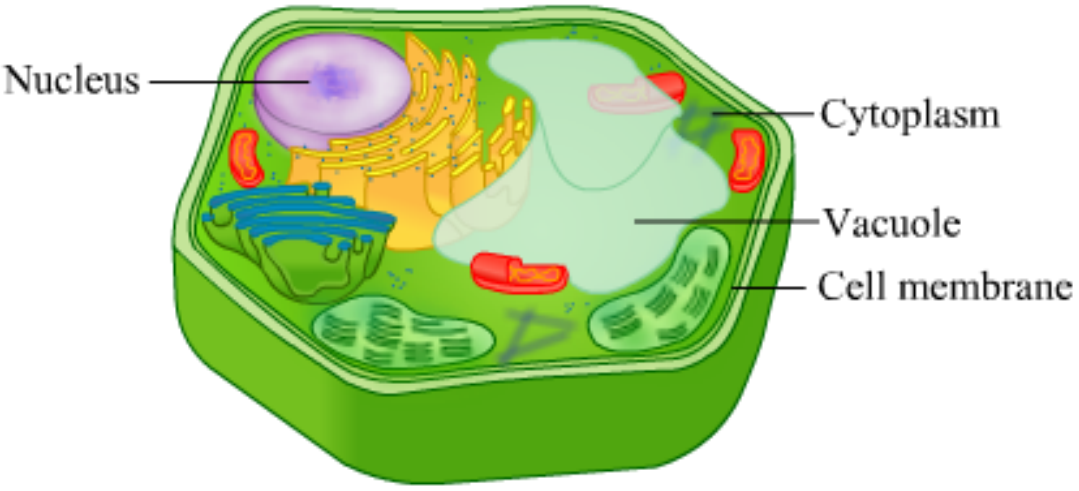
- **Lysosomes**

1. It is a membrane-bound structure that holds variety of enzymes.
2. Rich in all types of hydrolytic enzymes, which are active at acidic pH.
3. It is involved in the digestion of carbohydrates, proteins, lipids, and nucleic acids.

- **Mitochondria**

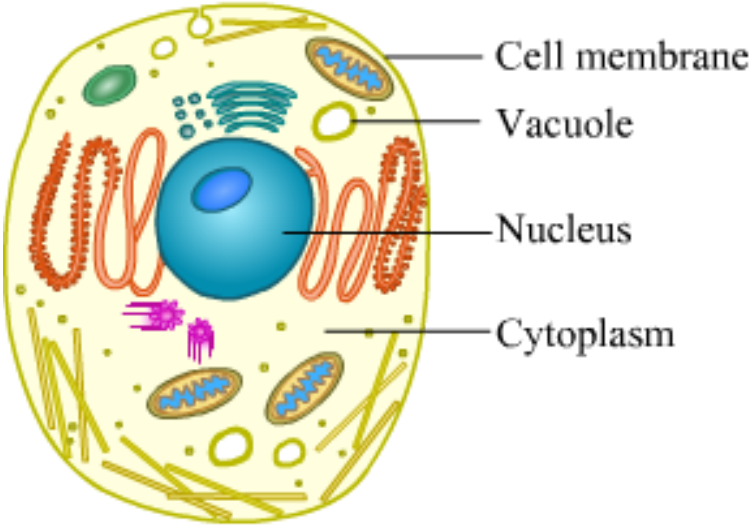
1. It is a double membrane-bound structure.
2. The inner membrane of mitochondria is deeply folded to form cristae.
3. Cristae increase the surface area in the organelle.
4. It is the site of cellular respiration and hence known as ‘power house of cell’.
5. They have their own circular DNA.
6. They divide by fission.

- **Differences between plant and animal cells**
- **Plant cell**
    - Cell wall is present.
    - Nucleus is located in the periphery of the cell.
    - Plastids are present.
    - A large single vacuole is present in the centre of the cytoplasm.



Plant Cell

- **Animal cells**
  - Cell wall is absent.
  - Nucleus is located in the centre of the cell.
  - Plastids are absent.
  - Numerous small vacuoles are present in the cytoplasm.



Animal Cell