Cell

Cell: It is the smallest unit of life capable of performing all living functions.

Properties of cell

- The Cell is the smallest living unit of life.
- It is so small that it is not visible to the naked eye.
- The shape of the cell varies in different organisms and within an organism.
- Size of cells also differs.
- All living cells exhibit certain basic properties like respiration, growth, metabolism etc.
- Cells originate from a pre-existing cell. A mother cell divides to produce daughter cells. Hence, cells exhibit cell division.

Milestones in Cell Biology

Biologists	**Major contributions**
Robert Hooke	Discovered cell
Leeuwenhoek	Discovered microscope
Robert Brown	Nucleus
Purkinje	Coined term protoplasm
Schleiden and Schwann	Presented Cell theory
Camillo Golgi	First described Golgi apparatus

Invention of Microscope

- The first, simple microscope was constructed by Antony van Leeuwenhoek. He used biconvex lens to make the microscope.
- The invention of compound microscope was done by Robert Hooke. These compound microscopes consisted of concave lens.

- The modern compound microscopes are a modification of one made by Robert Hooke. Their magnification power has been improved up to 2,000 times.
- Electron microscopes are the one that use electronic beams to magnify the objects. Their magnification power is over 2,00,000 times.

Cell theory

- All plants and animals are composed of cells
- The cell is the basic unit of life.
- This was further expanded by Virchow by suggesting that all cells arise from pre-existing cells.

Classification of Cell on the basis of their cellular complexity

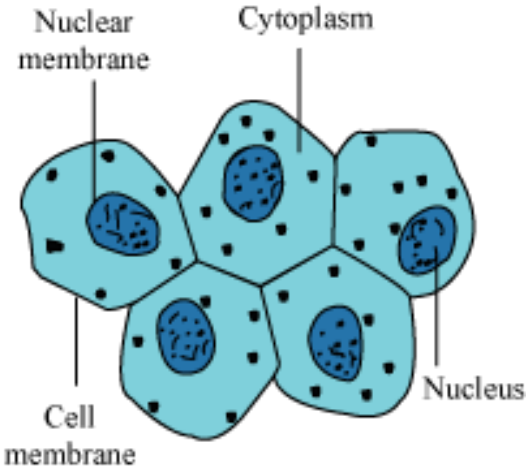
- **Prokaryotic cell -**

1. The nuclear region is poorly defined; membrane-bound organelles are absent. The undefined nuclear region containing only nucleic acid called nucleoid.
2. Prokaryotes are unicellular organisms, while eukaryotes are usually multicellular organisms. Yeast is exceptionally a unicellular eukaryote.

- **Eukaryotic cell**

1. Nuclear region is well defined, bounded by nuclear membrane. Other membrane-bound organelles are also present.

- **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.

Organelles visible under compound microscope

- **Cell wall -** Outermost structure present in plant, fungal, and some bacterial cells; it is absent from animal cells
- **Plasma membrane or cell membrane -** Covering of the cell, separating the contents of the cell from the external environment

Important functions of **cell membrane:**

1. Regulates the entry and exit of substances in and out from the cell
2. Performs certain physical activities such as diffusion and osmosis

- **Cytoplasm -** Fluid that fills the cell; contains all cell organelles. It is amorphous, translucent, colloidal fluid. Organic molecules and enzymes float in it. It helps in exchange of materials between the cell organelles.

- **Nucleus -** Controls all the cellular activities of the cell; acts like the brain of a cell

Important components of **nucleus:**

1. Nuclear membrane

2. Nucleoplasm, containing chromatin

3. Nucleolus

- **Vacuole -** Found in both plant and animal cells. Provide turgidity and rigidity to plant cells and store the waste products of a cell

- **Endoplasmic reticulum –** interconnected system of membrane lined channels that run throughout the cytoplasm and helps in the synthesis and packaging of proteins and lipids

Two types:

1. SER - Smooth endoplasmic reticulum

2. RER - Rough endoplasmic reticulum

- **Ribosome -** Site of protein synthesis. They may be found free in the cytoplasm or attached to the RER.

- **Golgi apparatus -** Also known as dictyosomes in plant cells. It helps in the storage, modification, and packaging of products in vesicles and is involved in the formation of lysosomes and peroxisomes

- **Lysosome -** Contains digestive enzymes which can destroy any foreign material; also known as the ‘suicidal bag’ of a cell

- **Mitochondria -** Also known as the ‘powerhouses of the cell’. Involved in cellular respiration and production of energy in the form of ATP (Adenosine triphosphate)

- **Plastids -** Present in plant cells

Two types:

1. **Chromoplasts (coloured plastids) -** Include chloroplasts which are important for photosynthesis in plants

2. **Leucoplasts (white or colourless plastids) -** Help in the storage of carbohydrates (starch), fats, and proteins