XI CLASS BIOLOGY NOTES
CHAPTER 8 : CELL - THE UNIT OF LIFE

All organisms are made of cells or aggregates of cells. Cells vary in their shape, size and functions. Based on the presence or absence of a membrane bound nucleus and other organelles, cells can be named as Prokaryotic or Eukaryotic.

Cell is the fundamental structural and functional unit of all living organisms. Anton Von Leeuwenhoek first observed and described a liver cell. Robert Brown later discovered the nucleus.

**Cell theory** – Given by Schleiden and Schwann (later Virchow)
- All living organism are made of cells and their products.
- All cells arise from pre – existing cells.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Prokaryotes</th>
<th>Eukaryotes</th>
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<tbody>
<tr>
<td>Size of cell</td>
<td>Typically 0.2–2.0 mm in diameter</td>
<td>Typically 10–100 mm in diameter</td>
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<tr>
<td>Nucleus</td>
<td>No nuclear membrane or nucleoli (nucleoid)</td>
<td>True nucleus, consisting of nuclear membrane &amp; nucleoli</td>
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<tr>
<td>Membrane-enclosed organelles</td>
<td>Absent</td>
<td>Present; examples include lysosomes, Golgi complex, endoplasmic reticulum, mitochondria &amp; chloroplasts</td>
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<tr>
<td>Flagella</td>
<td>Consist of two protein building blocks</td>
<td>Complex; consist of multiple microtubules</td>
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<tr>
<td>Glycocalyx</td>
<td>Present as a capsule or slime layer</td>
<td>Present in some cells that lack a cell wall</td>
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<tr>
<td>Cell wall</td>
<td>Usually present; chemically complex (typical bacterial cell wall includes peptidoglycan)</td>
<td>When present, chemically simple</td>
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<tr>
<td>Plasma membrane</td>
<td>No carbohydrates and generally lacks sterols</td>
<td>Sterols and carbohydrates that serve as receptors present</td>
</tr>
<tr>
<td>Cytoplasm</td>
<td>No cytoskeleton or cytoplasmic streaming</td>
<td>Cytoskeleton; cytoplasmic streaming</td>
</tr>
<tr>
<td>Ribosomes</td>
<td>Smaller size (70S)</td>
<td>Larger size (80S); smaller size (70S) in organelles</td>
</tr>
<tr>
<td>Chromosome (DNA) arrangement</td>
<td>Single circular chromosome; lacks histones</td>
<td>Multiple linear chromosomes with histones</td>
</tr>
<tr>
<td>Cell division</td>
<td>Binary fission</td>
<td>Mitosis</td>
</tr>
<tr>
<td>Sexual reproduction</td>
<td>No meiosis; transfer of DNA fragments only (conjugation)</td>
<td>Involves Meiosis</td>
</tr>
</tbody>
</table>
**Prokaryotic cell:**  Bacteria, Blue-green algae, Mycoplasma, PPLP (Pleuro Pneumonia Like Organisms.

- Glycocalyx, cell wall, plasma membrane present
- Based on staining property gram + and gram –ve bacteria.
- Mesosome, chromatophores (extension of plasma membrane) are present
- Motile, non motile,
- Flagellum- three parts are – filament. Hook, and basal body
- Pili, fimbriae – surface structure do not play a role in motility but helps in attachment
- Ribosomes (70S) and inclusion bodies.
- Ribosomes. 15-20 nm, 2 sub – units 50S and 30S- together form 70S. – help in Protein synthesis – polysomes/ polyribosomes on m RNA.
- **Inclusion bodies.** Reserve materials: Phosphate granules, Cyanophycean , Glycogen granules, Gas vacuoles.

![Prokaryotic cell diagram](image-url)

**Eukaryotic cell:**

- Protists, Fungi, Plant cell and animal cell are placed in eukaryotes

- Cells contain well organized nucleus with nuclear membrane. The genetic materials are arranged in chromosomes.

- Plants cells differ in having cell wall, plastids and large central vacuole as compared to animal cells. Animal cells have centrioles, which are absent in plant cells.
**Cell wall**

It gives shape, mechanical support, cell-to-cell interaction – made of cellulose, hemicelluloses, pectins (in plants) and cellulose, galactans, mannans, calcium carbonate (in algae).

- **Primary cell wall** – in young plant cell, capable of growing till cell matures
- **Secondary cell wall** – formed on the inner side of the cell.
- **Middle lamellae** – calcium pectate
- The cell wall middle lamellae may be traversed by plasmodesmata which connect the cytoplasm of neighboring cells.

**Cell membrane**

Cell **membrane** is composed of lipids that are arranged in bilayer. The lipid component is mainly composed of phosphoglycerides. Later it was found that protein is also present in cell membrane. Ratio of protein and lipids varies in different cells. Membrane protein may be integral or peripheral. Integral protein remains buried in membrane but peripheral protein lies on the surface.

- Singer and Nicholson (1972) proposed **fluid mosaic model**. According to this model the quasi-fluid nature of lipid enables lateral movement of protein within the bilayer of lipids.
Endoplasmic reticulum
- SER – no ribosomes on its surface, appears smooth (helps in lipid synthesis/steroids)
- RER – ribosomes are present on its surface, appears rough surface (helps in protein synthesis)

Golgi apparatus –
First observed by Camillo Golgi - packaging unit - makes glycoprotein and glycolipids.

Lysosomes
Lysosomes are membrane bound vesicular structures formed by the process of packaging in the Golgi apparatus. They are rich in hydrolytic enzymes - lipase, protease,
carbohydrases active at acidic PH. These enzymes are capable of digesting carbohydrates, proteins, lipids and nucleic acids.

**Vacuoles**

**Vacuoles** are membrane bound space found in cytoplasm containing water, sap and excretory product. They are bound by single membrane. They form contractile vacuole and food vacuole in many organisms. Membrane is known as tonoplast

**Mitochondria** –

Power house of the cell – sites of aerobic respiration, produce energy capsules ATP, double membrane structure, inner compartment is known as Matrix. Inner membrane forms a number of infoldings called Cristae to increase the surface area. Matrix possesses single circular DNA, few RNA and ribosomes (70S).

![Figure 8.7 Structure of mitochondrion (Longitudinal section)](image)

**Plastids**

Three types –Chloroplast (perform photosynthesis), Chromoplast(give colors to petels) and Leucoplasts (store food)

Leucoplasts - amyloplasts, (store starch); Elaioplasts (store oil/fat),Aleuroplasts (store proteins).
Ribosomes (George Palade)
Composed of RNA and proteins.
Eukaryotic ribosomes are 80 S ‘S’stand for the sedimentation coefficient (Svedbergs unit).
Site of protein synthesis.

Cytoskeleton
Network of filaments proteinaceous structures in the cytoplasm. Made up of microtubules and microfilaments.
Functions: - Mechanical support, motility, maintenance of the shape of the cell.

Cilia and flagella
Core is called axoneme - has 9 pairs of doublets of microtubules on peripheraland one pair in the centre 9+2 array emerged from centriole like structure called the Basal bodies.

Figure 8.9 Section of cilia/flagella showing different parts : (a) Electron micrograph (b) Diagrammatic representation of internal structure
**Centrosome and centrioles**

Centrosome contains 2 centrioles. Each centriole has a cartwheel-like organization with 9 evenly spaced microtubules. Triplets connected to central hub by radial spokes – produces spindle apparatus during cell division.

**Nucleus** (Robert Brown, 1831):

- Chromatin named by Flemming.
- Nucleoli – active ribosomal RNA synthesis
- Nucleoplasm – nucleolus + chromatin
- Nuclear membrane – with perinuclear space
- Chromosome – DNA + histone proteins
- Centromere – primary constriction – disc is known as kinetochores
- No nucleus in erythrocytes (RBC) of mammals and sieve tube cells in vascular plants
- Based on the position of centromere
- Metacentric, sub-metacentric, acrocentric, telocentric

**Microbodies**: Minute vesicles containing various enzyme (in plant and animal cell).