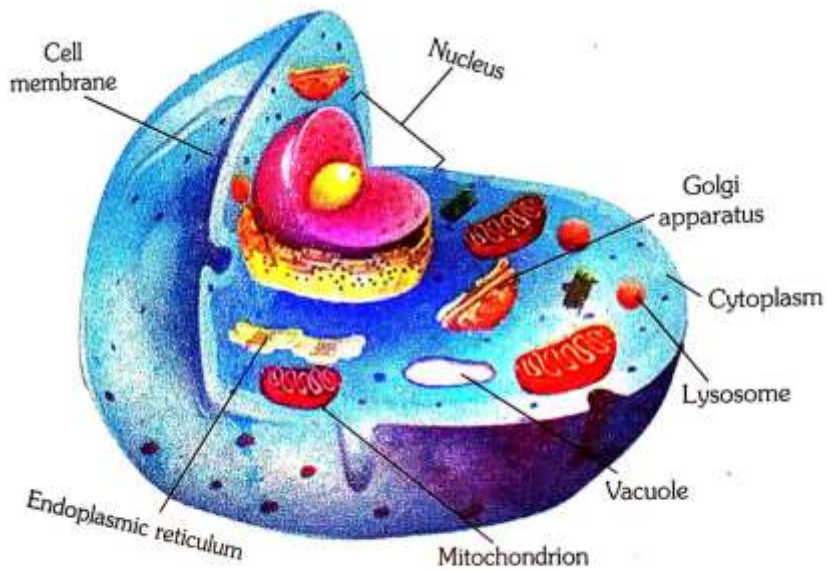


Cell Structure



Different cell organelles in cytoplasm

Part -2

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The Cell Theory

H. J. Dutrochet (1824) separated cells of Mimosa plant and gave the idea of cell theory for the first time .

He proposed that “all plants and animals are composed of cells .”

The cell theory or Cell doctrine was formulated by two German scientists **M.J. Schleiden (1838, a botanist)** and **T. Schwann(1839, a Zoologist)** independently that “Cells containing nuclei were the structural basis of the organization of both plants & animals”.

The Cell Theory is one of the important generalization of Biology.

Picture of German scientists M.J. Schleiden (1838, a botanist) and T. Schwann (1839, a Zoologist) who gave Cell theory.

Theodor Schwann and Matthais Schleiden stated that all living things are made of cells. (1839)



**Matthais Schleiden
(plants)**



**Theodor Schwann
(animals)**

Features of Cell Theory

1. Cells are fundamental units of structure and function in all living organisms.
2. Cells are Physiological units of living organisms i.e. the metabolic activities of living organisms are performed within the cells .
3. Cells are hereditary units i.e. they maintain continuity through the hereditary material (DNA/RNA).
4. New cells originate only from the pre-existing cells
5. Cell is the smallest unit of life. All activities of living organisms are the outcome of the activities of its constituent cells .

Exception to Cell Theory

Cell theory has universal application except for the following :

1. Viruses, they are made up of protein and one of the nucleic acid (DNA/RNA). Bacteriophages are the main exception .
2. *Rhizopus* , a fungus and *Vaucheria* , an algae, are multinucleate.
3. Protozoans are acellular , i.e. their body is not divisible into cells.

The difference of Cell organisation of Prokaryotes and Eukaryotes

Prokaryotic cell

1. Nuclear membrane is absent
2. Nucleolus is absent
3. DNA is dispersed & not associated with histone proteins (i.e. No Histones)
4. Chromosome single
5. Ribosomes are of 70s type (50s + 30s)
6. E.R., Golgi Complex, or Endomembranous system is absent.
7. The membrane bound organelles like chloroplast and mitochondria are absent.
8. Cell wall non cellulosic.
9. Exocytosis and Endocytosis are absent

Eukaryotic Cell

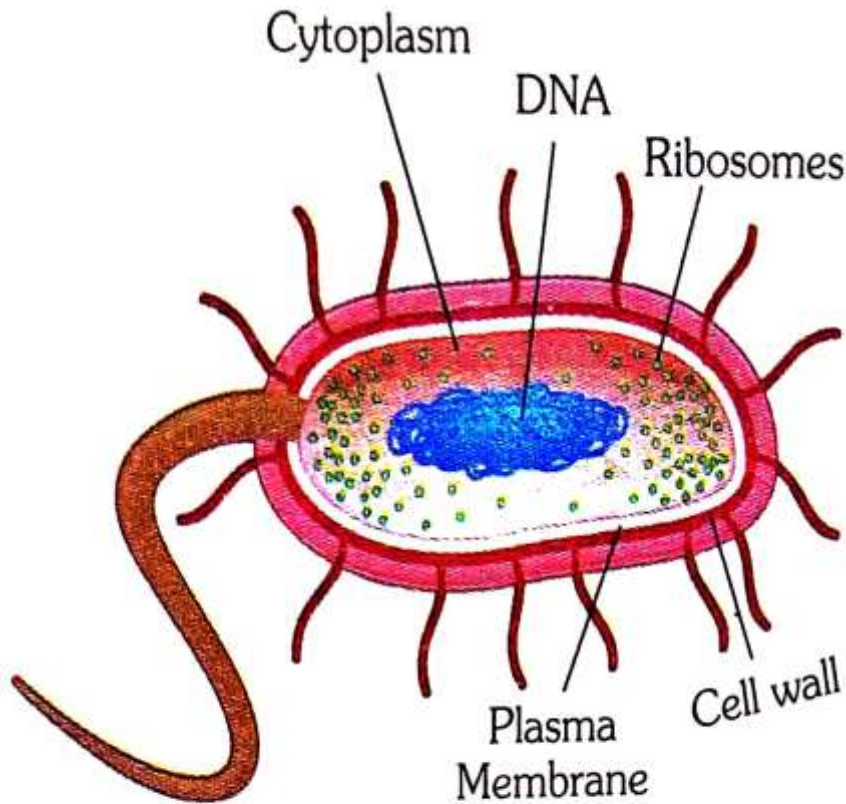
- Nuclear membrane is present
- Nucleolus is present
- DNA is associated with Histone proteins
- Chromosome multiple
- Ribosomes are of 80s type (60s + 40s)
- Endomembranous system is present.
- present
- Cellulosic cell wall only in plants.
- Exocytosis and Endocytosis are present

Differences Between Prokaryotic and Eukaryotic Cells

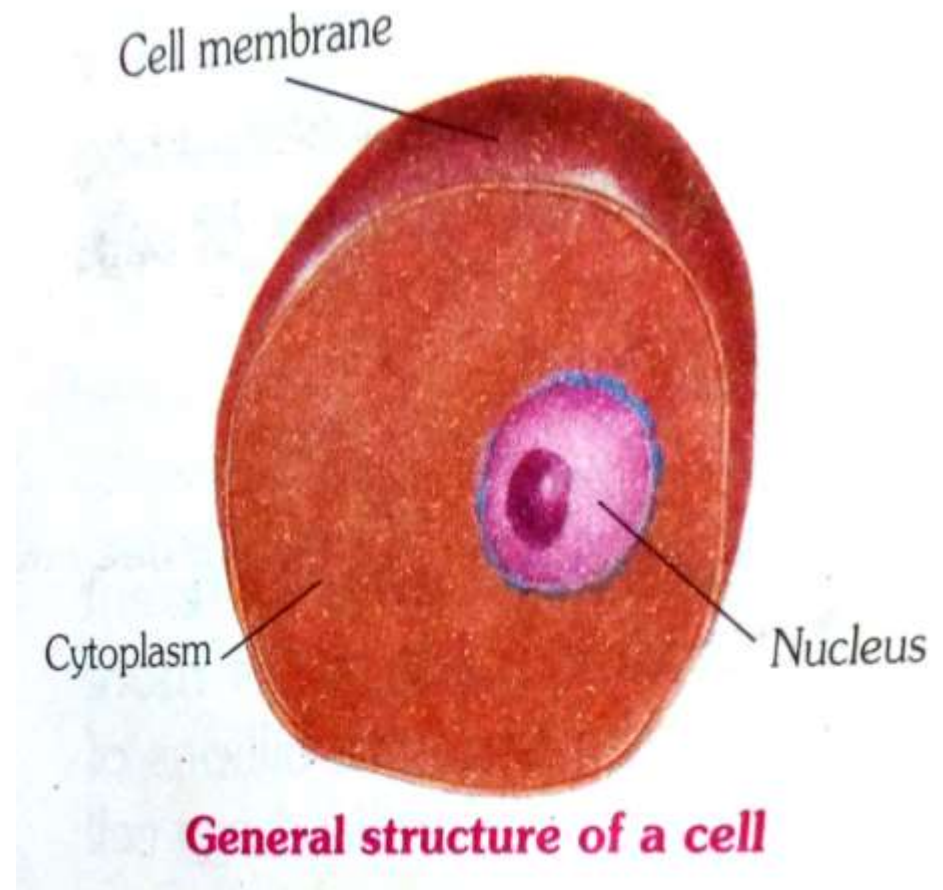
Feature	Prokaryotic Cell	Eukaryotic Cell
1. Plasma membrane	Present.	Present.
2. Cell wall	Non-cellulose, composed of amino-sugars and muramic acid. Blue-green algae have some cellulose.	Absent in animal cells, present in plant cells, mainly composed of cellulose.
3. Capsule	When present composed of mucopolysaccharides.	Absent.
4. Cytoplasm	Does not show streaming movements.	Cytoplasm exhibits streaming movements.
5. Endoplasmic reticulum	Absent.	Concerned with synthesis and cellular transport.
6. Golgi apparatus	Absent.	Concerned with cell secretion.
7. Lysosomes	Absent.	Play digestive role.
8. Ribosomes	70S (50S + 30S) : randomly scattered in the cytoplasm.	80S found attached to ER membrane and also free in cytoplasm.
9. Mitochondria	Absent.	Concerned with cell respiration and liberation of energy.
10. Microtubules and microfilaments	Absent.	Present in cytoplasmic matrix.
11. Vacuole	Absent.	Present only in plant cells.
12. Photosynthetic apparatus	In the form of membranes with chlorophyll- <i>a</i> in blue-green algae and bacteriochlorophyll in bacteria.	Chloroplasts with chlorophyll <i>a</i> and <i>b</i> are present in plant cells only.
13. Nuclear membrane	Absent.	Present.

14. Nucleoplasm	Not differentiated from the cytoplasm.	Separated from the cytoplasm by nuclear membrane.
15. Nucleolus	Absent.	Present.
16. Hereditary material	DNA.	DNA.
17. Chromosomes	Single circular structure formed of DNA only; no histones; nucleus is absent.	More than one. Composed of DNA and basic proteins called histones, enclosed in the nuclear membrane to form nucleus.
18. Flagella	Present in some species but do not have 9 + 2 fibrillar structure.	Present in some species; have 9 + 2 fibrillar structure.
19. Respiratory enzymes	Are located on the plasma membrane and its inpushings (mesosomes).	Enclosed in mitochondria.
20. Endocytosis and exocytosis	Do not occur.	Occur in animal cells and in protists.
21. Transcription and translation	Occur in the cytoplasm.	Transcription occurs inside nucleus and translation in cytoplasm.
22. Cell division	Divide by simple fission; spindle is not formed: no mitosis and meiosis.	Cells divide by mitosis or meiosis.
23. Prokaryotic cells	Haploid	Typical diploid.
Examples	Bacteria, blue-green algae and mycoplasma.	Protozoa, algae, metaphyta and metazoa.

A typical prokaryotic cell of bacteria with no nuclear membrane & nucleolus, DNA in cytoplasm. Eukaryotic cell with definite Nucleus .



**A typical prokaryotic cell :
bacteria**

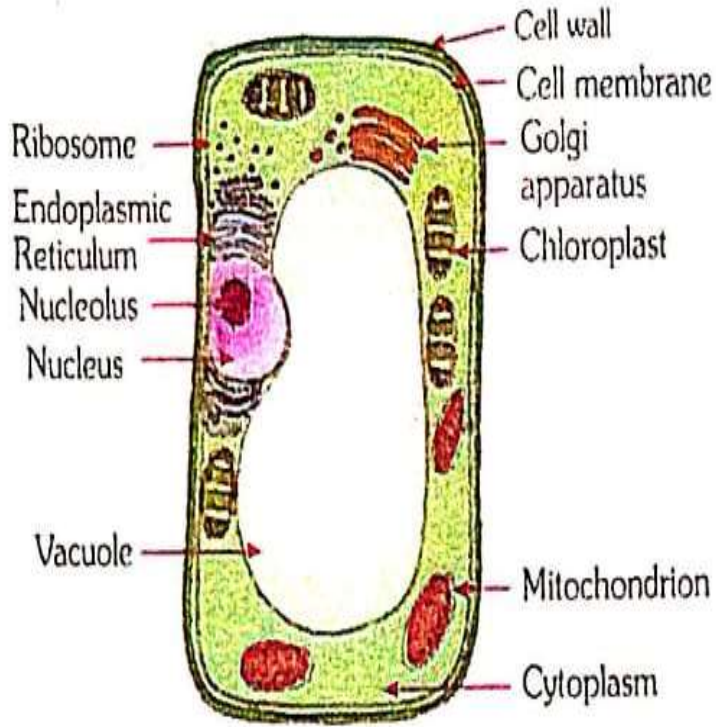


General structure of a cell

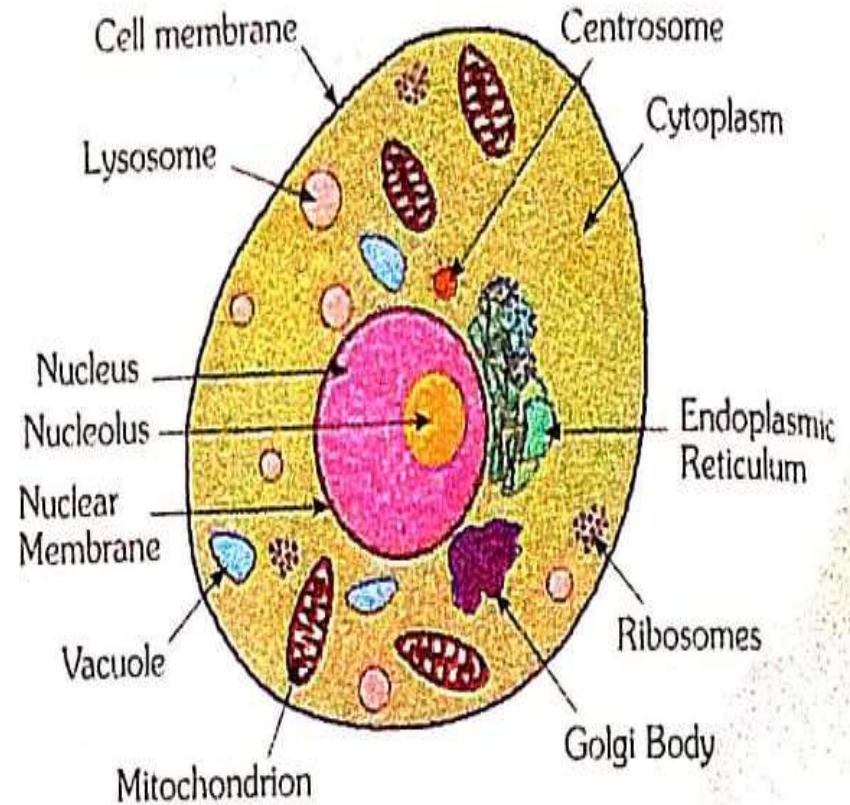
Table 1 : Differences between Plant cell and Animal cell

S. No.	Characteristics	Plant cell (Figs. 1.1, 1.2)	Animal cell (Fig. 1.3)
1.	Size	Generally larger	Usually smaller
2.	Cell wall	Cells are surrounded by a rigid cellulose cell wall	Cell wall is not found
3.	Vacuoles	Majority of the plant cells have large central sap vacuole	An animal cell often processes small vacuoles
4.	Plastids	Present, chloroplasts are found usually in green cells of plants	Usually absent in animal cells except in some protozoa e.g. <i>Euglena</i> (Fig. 1.4)
5.	Mitochondria	Comparatively fewer	Generally numerous
6.	Lysosomes	Rarely found	Typical lysosomes occur
7.	Glyoxysomes	May be present	Absent
8.	Centrioles	Usually absent except in some lower plants	Present in animal cells
9.	Spindle formation	Spindle formed during nuclear division is anastral	Spindle formed during nuclear division is amphiastral
10.	Cell division	In the cell division, the division of cytoplasm of a plant cell takes place by formation of a partition called the cell plate	Animal cells divide by a constriction during cell division
11.	Reserve food	Generally starch and fat	Usually glycogen and fat
12.	Connection with adjacent cells	Adjacent cells may be connected through plasmodesmata	Adjacent cells connected through number of junctions

Generalized structure of a plant cell and an animal cell showing differences between both of them



Generalized structure of a plant cell



Generalized structure of an animal cell

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TO BE CONTINUED...