Date / /

Cell : Unit of Life

Cytology : Study of cell structure.

Cell biology: Study of cell structure, function, reproduction (cell division), regulation, etc.

	Life	Cell
Inanimate things →	nonliving →	-ve → -ve
living organisms →	living →	+ve → +ve

All organisms are made of cells.

organisms
↓ (Basis: no. of cells)

unicellular (single celled)	multicellular
→ some organisms	→ most of organisms.
examples → diatoms, desmids, Euglena, Chlorella, Yeast, Paramecium, etc.	→ Animals, plants, fungi

Unicellular organisms are capable of

- Independent existence.
- performing essential functions of life.

Cell

- Basic unit of life.
- fundamental structural and functional unit of all living organisms.

↓ Reason

Anything less than a complete structure of cell does not ensure independent living.

- Invention of microscope and its improvement leading to electron microscope revealed all the detailed structure of cells.

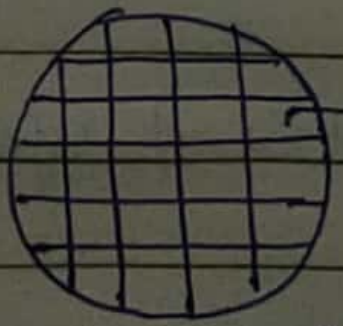
features	light microscope	electron microscope
Radiation used	light (photon) ($\lambda\uparrow$)	e⁻ beam ($\lambda\downarrow$)
magnifying power	1000x - 1500x ($\downarrow$)	100000x ($\uparrow$)
resolution power	0.2 μm ($\downarrow$)	0.5 nm ($\uparrow$)
cell studied	living cells/ dead cells.	dead cells.

nm → 10^{-9} m μm → 10^{-6} m.

Discoveries related to cell

① Robert Hooke (1665)

- discovered cells from cork of oak plant.
  - ↳ dead cells.
- discovered cell wall.
- coined the term cellula (Gk: hollow space)
  - ↓
  - term cell is derived from it.
- Note: Term cell → coined by Robert Hooke.
- He published the figure that he observed under microscope in his book Micrographia.



→ cell.
- ↳ empty dead cell.

(fig: cork of oak)

(II) Anton Von Leeuwenhoek

- 1st person to see and describe a living cell
  - → capable of moving
  - → ex: Bacteria, protozoa, RBC, Spermatozoa, etc.

(III) · Robert Brown

- discovered nucleus.

Cell theory

Ⓐ Matthias Schleiden (1838)

- German Botanist.
- Studied a large no. of plants.
- observed that all plants are made of different types of cells
  ↓ form
  plant tissue

(B) Theodore Schwann (1839)

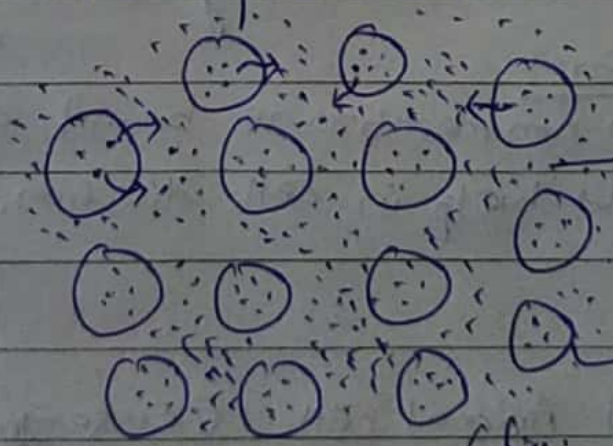
- British Zoologist
- Studied

a/ Animal cell
↳ has thin outer layers.
↓ now known as
cell membrane (plasmamembrane)

b/ plant tissue

concluded that presence of cell wall is unique character of plants.

- gave cell hypothesis
↳ Animal and plant bodies → made of cells and cell products.



(fig: tissue)
↳ of plants and animals

(C) Schleiden and Schwann (1839)

© Schleiden and Schwann (1839)
↳ of plants and animals

- gave cell theory
- did not explain how new cells develop (arise).

Ⓓ - Rudolph Virchow (1855)

- modified and gave final shape to cell theory.
- explained that new cells arise from pre-existing cells through cell division.
  ↳ called law of cell lineage
  ↳ omnis cellula e cellula (Latin language)

pre-existing cell $\xrightarrow{\text{cell division}}$ new cells.

Today cell theory is understood as

- All organisms are made of cells and their products.
- All cells develop (arise) from pre-existing cells.

Note:

Virus is an exception to cell theory.

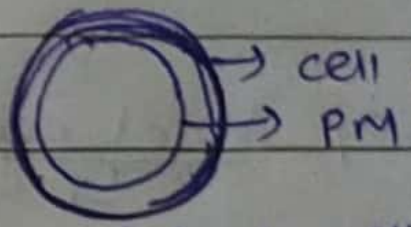
↓ reason

virus has some properties of living organisms but it lacks cells.

Overview of cell

Onion peel cell

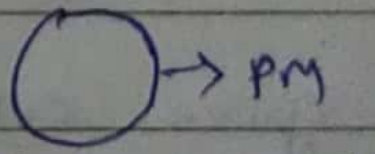
- typical plant cell.
- has distinct cell wall and plasmamembrane.
  - cell wall: outer, thick
  - plasmamembrane: inner, thin.



(plant cell)

Human cheek cell

- typical animal cell.
- has PM as outer delimiting boundary
- has centrosome
  - ↳ non membrane bound organelle
  - ↳ help in cell division.



(Animal cell)

Plant cell & Animal cell (Eukaryotic cell)

→ have membrane bound well defined nucleus
has ↓ ↳ dense

ds DNA. ← is genetic material ← contain chromosomes

· have membrane bound organelles (like ER, GB, lysosome, mitochondria, plastids etc.

· ribosomes → 70S and 80S type.
↳ present in cytoplasm, on outer nuclear membrane, on RER, in mitochondria, plastids.

Prokaryotic cells

→ membrane bound well defined nucleus -ve.

→ membrane bound organelles -ve.

→ Ribosomes → 70S type.

Prokaryotes + Eukaryotes (similarity)

Cytoplasm +ve

↳ main arena of cellular activities.

↓ reason

Various reactions take place in cytoplasm that keeps a cell in living state.

Shape, Size and activities of cells → greatly vary from cell to cell.

(A) Shape of cells

- may depend upon function performed by cell.
- may be discoid like, polygonal, cuboidal, columnar, thread like, even irregular, etc.
- Examples:

  RBC → round, biconcave

  WBC → amoeboid

  Columnar epithelial cell → long, narrow.

  nerve cell (neuron) → long, branched

  tracheid → elongated.

  mesophyll cell → round, oval

(B) Size of cells.

- Virus → 0.02 – 0.2 μm (note → virus is not a cell)
- Mycoplasma → 0.3 μm (length)
  - ↳ Smallest living cells.
  - ↳ PPLO → 0.1 μm
    - ↳ a mycoplasma.

(PPLO
Pleuropneumonia like organism)

- Bacteria could be → 3–5 μm.
- typical bacteria (PK cell) → 1–2 μm.
- typical EK cell → 10 – 20 μm
- Human RBC → 7.0 μm (diameter)

nerve cell → longest cell. (in animals)

Sclerenchyma fibres → longest cells (in plants)

Ostrich egg → largest isolated cell.

↳ 15 × 13 cm.
length width.

Extra

Thiomargarita
↳ largest bacteria

© Activities of cells

RBC → transport of O_2.

plasma cell → production of antibodies.

Tracheid → transport of water, minerals.

mesophyll cell → photosynthesis.