

Cell structure and function

* Defination of cells: a cell is the smallest unit that capable of performing life function.

* Cell theory + modern interpretation

1. All living things are made up with cells.
2. Smallest working units of all living things.
3. All living cells arise from pre-existing cells by cell division.
4. It's the fundamental unit of structure and function in all living organism.
5. The activity of an organism depends on the total activity of independent cells.
6. Energy flow occurs within cells.
7. Cells contain DNA which found in chromosome and RNA found in the cell nucleus and cytoplasm.
8. All cells of similar species share the same chemical composition in organism.

* Cells are two types

1. Prokaryotic	2. Eukaryotic
Unicellular	multicellular
no nucleus 0.1 to 0.5 μm	have nucleus 10 to 100 μm
Lysosome and Peroxisomes absent	lysosome and peroxisomes present
Microtubules absent	microtubules present
Endoplasmic reticulum absent	Endoplasmic reticulum present
Reproduce by asexually	Reproduce by sexually and asexually.

** Prokaryotic cells **

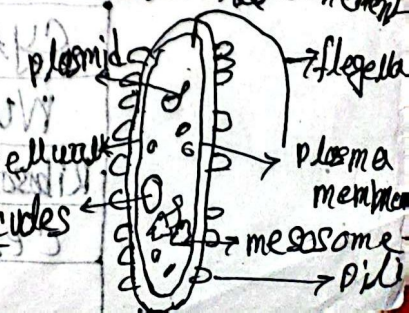
Characteristic

1. Don't have structure surrounded by membranes
2. Doesn't have a nucleus
3. Single-celled microorganism like bacteria
4. The cell size is (0.1 to 0.5 μm)
5. Hereditary material either DNA or RNA
6. Asexually reproduce by binary fission (conjugation)

Characteristic Feature of prokaryotic

1. Flagella: thin-tail-like structure that help in movement.
2. Plasmid: a small circular DNA molecule.
3. Capsule: layer of carbohydrate (CH_2O)
4. Cell wall: provide structure and protection from outside movement. (cell wall made by CH_2O called peptidoglycans)
5. Vacuoles: store water, nutrients and waste product.
6. Cell membrane: (plasma), separate cell from outside.
7. Nucleoid: central region that contain DNA or RNA.
8. Mesosome: help in synthesis of cell membrane, protein and DNA replication.
9. Pili: Rod like structure help in DNA transfer, attachment.

10. Ribosome: responsible for protein synthesis



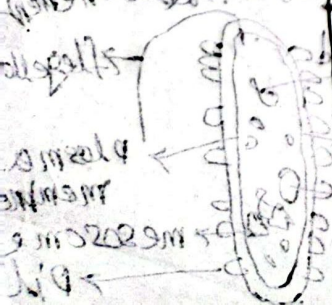
Eukaryotic cells

Characteristics

1. Structure surrounded by membranes.
2. have a nucleus.
3. ~~most~~ multicellular
3. most multicellular organisms/plant/animals/fungi/protists
4. The cell size is (10 to 100 μm).
5. The plasma membrane is responsible for transport and cell to cell communication.
6. Reproduce by sexually and asexually.
7. Chloroplast, central vacuoles, plastids are in only plant cell.

* Key difference between animal vs plant

Animal	Plant
Cytoplasm	Cytoplasm
Nucleus	Nucleus
Ribosome, mitochondrion	Ribosome, mitochondrion
Cell membrane	Chloroplast, plastid
	cell wall, vacuoles



cell membrane

class-8

Cell component

* Cell wall: (only present in ~~an~~ plant cell, also in some bacteria and fungal cells)

definition+function:

It's an outer non-living rigid layer of cells.

It gives rigidity (non-soft), mechanical support and protection to the cell.

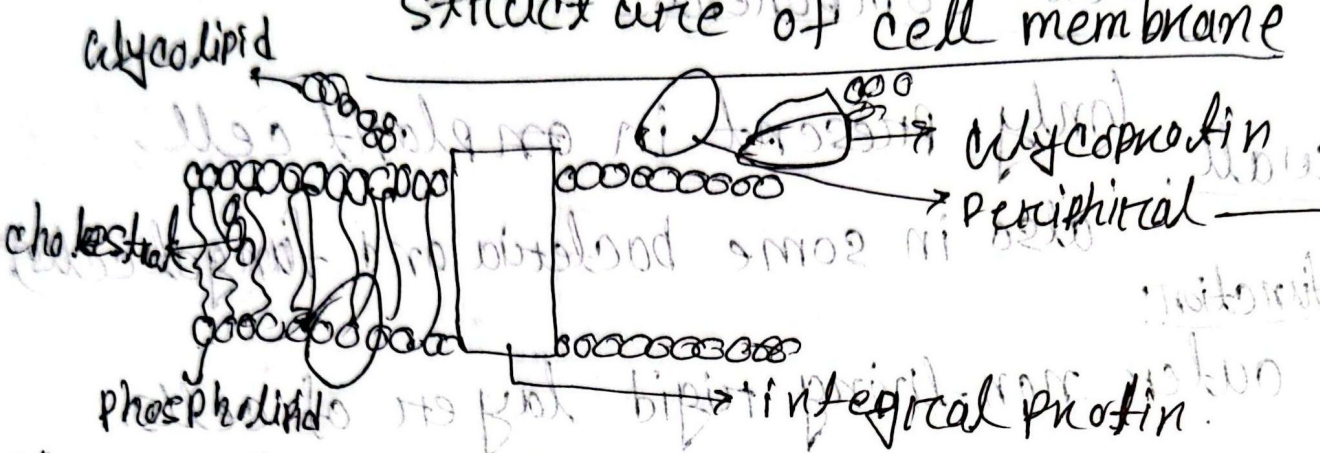
cell wall absent in animal cell, That's why animal cell are more flexibility.

* Cell membrane: (also known as plasma membrane)

definition: It's a dynamic and fluid semipermeable lipid bilayer that separate cells from its exterior environment.

functions: It allows the outward and inward movement of molecules across it. ^{gatekeeper} ^{receive signal from outside} by diffusion, osmosis, active transport, phagocytosis (cell eating) and pinocytosis (cell drinking).

Structure of cell membrane



3 types of protein

1. Integral protein: (Transmembrane protein)

spanned throughout the bilayer has hydrophobic and hydrophilic side.

2. Peripheral protein: linked to cytoplasmic surface, chain and external cell surface.

3. Lipid anchored proteins and glycoproteins present.

3 types of lipid

1. Phospholipid: The head (phosphate group) which is ^{water loving} hydrophilic and the tail is hydrophobic (water fearing) (non polar)

2. Glycolipids: protective, insulators and receptor binding

3. Cholesterol: makes bilayer less deformable.

cell wall	cell membrane
0.1 to μm in thickness	7.5-10 nm in thickness
gives rigidity	gives flexibility
receptor absent	receptor present
present in some cell	present in every cell

* Movement through the membrane. (molecule movement)

1. Passive transport (no energy required)

* Diffusion (high $\rightarrow$ low)

* Osmosis

* Facilitated diffusion (low $\rightarrow$ high)

2. Active transport (energy required)

* Protein pumps

* Endocytosis (indore to outdore)

* Exocytosis (outdore to indore)

Osmosis

2 types of diffusion.

* only allow water to pass easily through membrane

$\text{solution} = \text{solute} + \text{solvent}$

sugar or other

can't go through
membrane.

only water can go
through membrane.

Osmotic pressure

* Hypertonic: more solute, less water.

* Isotonic: equal solute and water.

* Hypotonic: less solute, more water.

water move from hypotonic to hypertonic

class-4

cell component in 2019 obied

*** Protoplasm: The living part of our cell, made of organic and non-organic molecules that contain all essential product. It includes cytoplasm and nucleus.

'Pukinje (1837) named it protoplasm and Huxley called it "Physical basis of life"

*** Cytoplasm: It's a jelly-like fluid between cell membrane and nuclear membrane. It contains cell organelles (living part) and ergastic (non-living part).
an cytoskeletal element. The cytoplasm without cell organelles called cytosol.

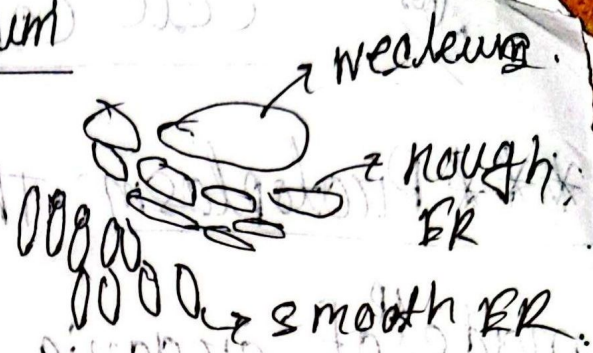
Function

- | | |
|-----------------------------------|---------------------------|
| 1. Provide structure. | 4. protect cell. |
| 2. allow material to move freely. | 5. maintain cells shapes. |
| 3. stores genetic material. | |

Endoplasmic Reticulum

Structure

1. Tube like structure.
2. Outer end connect with cell membrane and inner end connect with nuclear membrane.
3. It's two type.
 - Rough ER: ^{when} Ribosomes are attached to it.
 - Smooth ER: when alone.



function

1. main function is form supporting framework ~~to~~ of the cell.
 2. help in protein synthesis and ^{B.} transports proteins from one part of the cell to others.
- Golgi bodies

It's a curved flattened plate called cisterna. They stacked one above other. Also known as "Packaging center".

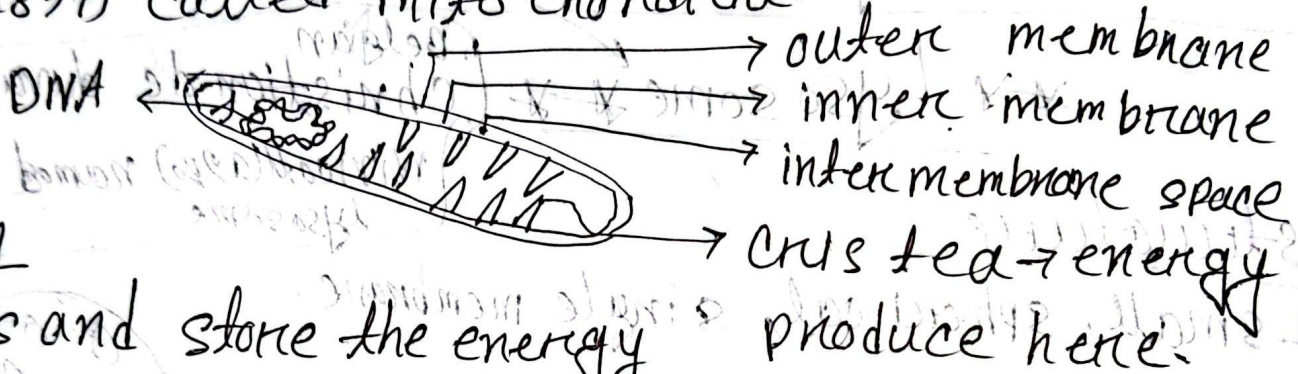
Function

1. They pack enzymes, proteins, carbohydrates ($C_6H_{12}O_6$)
2. They produce lysosomes.
3. secrete enzymes, hormones and cell wall material.

mitochondria (power house of the cell / storage batteries of the cell)

Kolliker (1880) → discovered, Altman called Bioplasts,
Benda (1897) called mitochondria.

Function
synthesis and store the energy rich molecules ATP (Adenosine triphosphate) during aerobic respiration.



Plastids (only for plant cells)

Invented by AFW Schimper (1885).

3 types of plastids:

- Chloroplasts → different colour contain (Fruit, flower)
- Leucoplasts → colourless, store food
- Chromoplasts → green colour

Leucoplasts further divide into:

- Amyloplasts (store starch)
- Elaioplasts (store lipids)
- Proteinoplasts (store protein)

Vacuoles

Animal	Plant
Several small vacuoles	one large vacuoles
Used for storage	used to store content and push against cell wall
can contain water or waste	Keeps the plant turgid

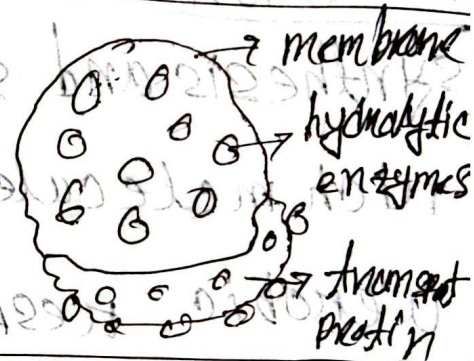
Micro bodies

Small, spherical, single membrane bound structure
Present in cytoplasm. different types of microbodies.

Lysosome Belgian
Christian de Duve (1905) discovered
in rat liver cells.
Wirtz (1950) named lysosome

Structure

1. small, spherical, single membrane.
2. Filled with hydrolytic enzymes.
3. most in animal cell, few type of plant cell.



4. produce in golgi complex.

Swicide bag

because hold enzymes
and if some among them enzymes
some out and destroy whole cell

Function

1. help in digesting of large molecules.
2. protect cell by destroying bacteria and virus.
3. break down worn-out organelles.
4. In dead cells, perform autolysis.

Centrosome

function

1. forms asters and organizes spindle fibers in cell division
2. help in formation of cilia, flagella in sperms

class - 11

Ligand and Receptors

* Ligands are biomolecules to serve a signal by bind to receptors. When ligands come to receptors, the structure is changing by open it and send a chemical signal to nucleus of cell and protein production.



non-living inclusions

1. Fragolic: reserve food materials, starch, protein, oils, enzymes, latex and mineral.

2. Cytoskeleton - like framework - It's a network of protein fibers like actin and tubulins.



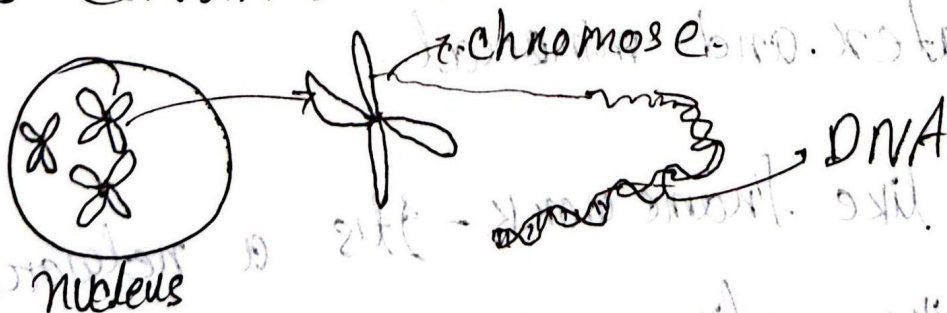
It's help in mechanical support, cell division and maintain the shapes of the cell.

Nucleus Distribution of nucleus

1. Enucleate cells → ^{have} no nucleus.
2. Uninucleate cell → ^{have} single nucleus. → monokaryotic cell.
3. Bi-nucleate cell → ^{have} two nucleus.
4. Multi-nucleate cell → ^{have} ~~multi~~ more than 2 nucleus like animal.

Chromosome

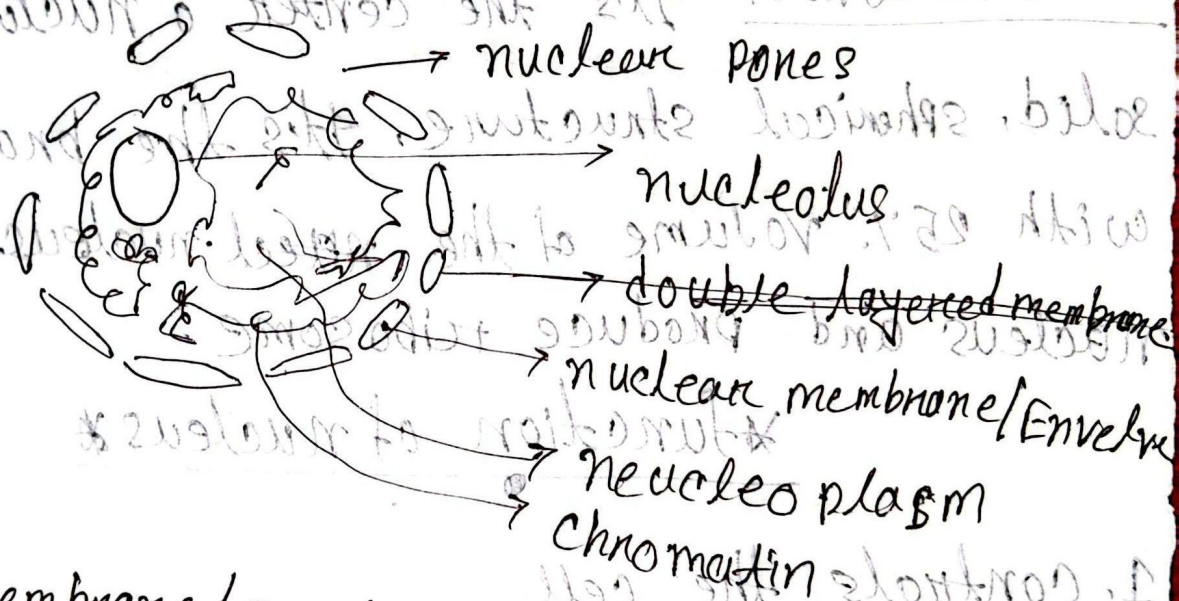
during cell division, chromatin turn into chromosome
it is contain DNA.



Nucleus → Robert Brown (1831)

Definition: This is a round structure that protected by a double-layered membrane with nuclear pores.

Characteristics



* Nuclear membrane/Envelope:

It is a double-layered membrane covering the nucleus that made by lipoprotein.

A liquid-filled gap between two layers is perinuclear space and nuclear pores allow materials exchange between nucleus and cytoplasm.

It is protecting nucleus from outside.

* nucleoplasm:

maintain nuclear shape and structure and transportation of ions, molecules and others important.

* nucleolus: It's the center of nucleus that is solid, spherical structure. It's the brain of nucleus with 25% volume of the ~~nucleus~~ nucleus. It's control nucleus and produce ribosome.

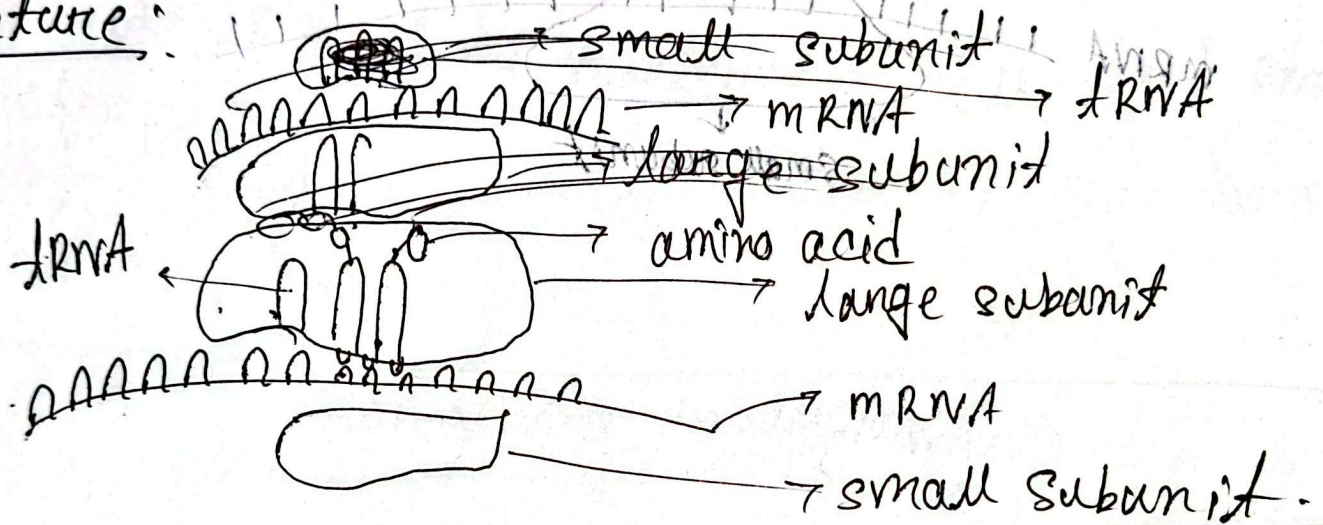
* function of nucleus *

1. Controls the cell.
2. help in protein synthesis and growth.
3. help in transcription and cell division.
4. produce mRNA for protein synthesis.
5. produce Ribosome.
6. selective transport $\rightarrow$ control movement of RNA, DNA molecules.
7. Storage genetic material like DNA.
8. storage protein and RNA.

Ribosome ~~by~~ KR Porter (1946) → d's
Robinson and Brown (1959)
↳ 60S rib

Defination: This granular, small and non-membranous structure present in cytoplasm, mitochondria, and chloroplast, rough ER, nuclear membrane.

structure:



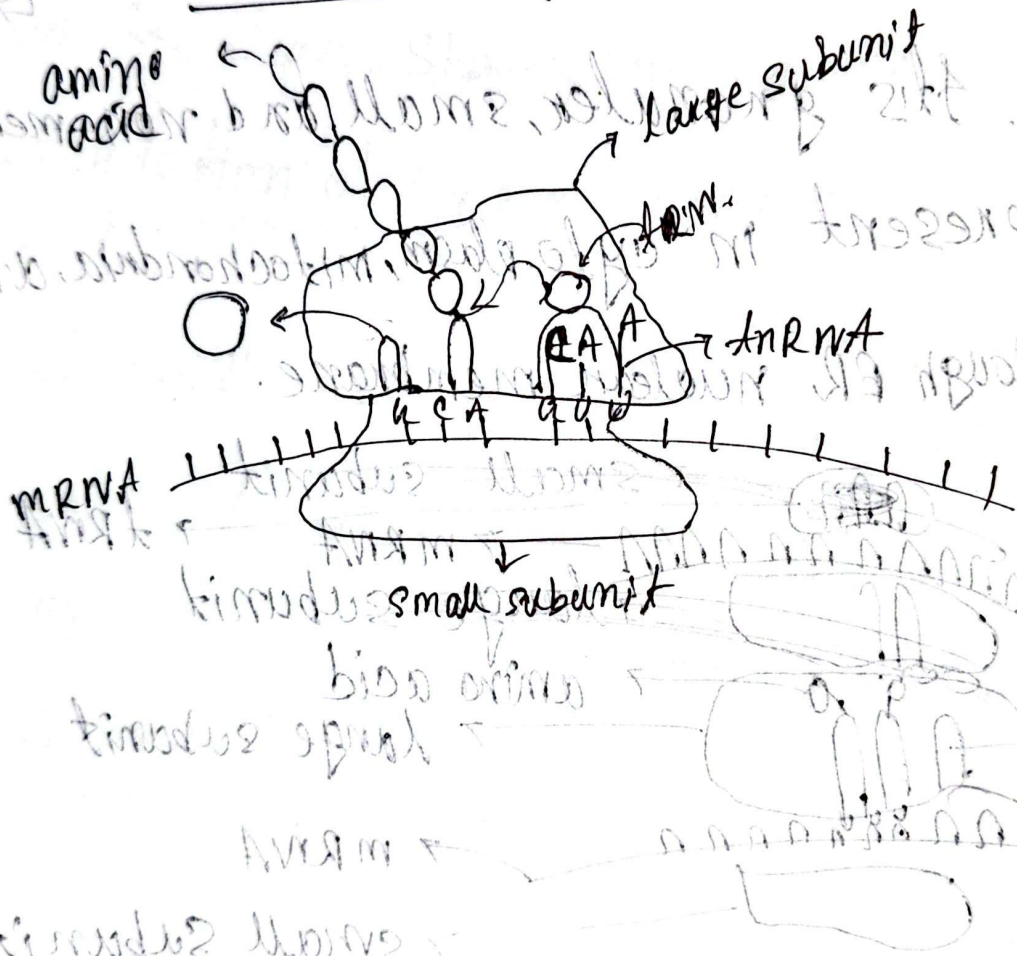
Function of Ribosome + Protein synthesis

Ribosome make protein by reading mRNA.

mRNA → message
have codons
rRNA → subunit
tRNA → transfer
20 amino acid

1. They move mRNA and reading codons only one (9) ^{Per step} ^{3 codons}
2. Each codons have anti codons and its tell which amino acid need.
3. t-RNA carry the right amino acid to ribosome.
4. Ribosome connect with amino acid and making a long chain of proteins
5. When ribosome reaches a stop codon, it releases the ^{protein.}

Protein synthesis



active site
P site
A site

3 codons
1 anticodon
1 tRNA
1 amino acid
1 ribosome
1 mRNA

Function of Ribosome + Protein synthesis
Ribosomes are made of rRNA and protein
Each codon has an anti-codon and the amino acid
tRNA carry the right amino acid to ribosome
Ribosome connect with amino acid and