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The Fundamental Unit Of Life

Key Points

Cell is the basic structural and functional unit of living organisms.

Discovery of cell

Robert Hooke -1665

Observed dead cell which resembled honeycomb like structures in cork (comes from bark of tree). He called these boxes 'cell'. He published what he observed under his self-designed microscope in his book 'Micrographia'.

Anton Van Leeuwen hoek

1674

He was first to observe living cell in pond water.

Robert Brown

1831

He discovered the nucleus.

Dujardin

1835

Discovered living semi fluid substance of cell and named Sarcode.

J. E. Purkinje

1839

He used the term protoplasm for sarcode. It is living matter present inside the cell.

Huxley

1868

He called protoplasm "The physical basis of life".

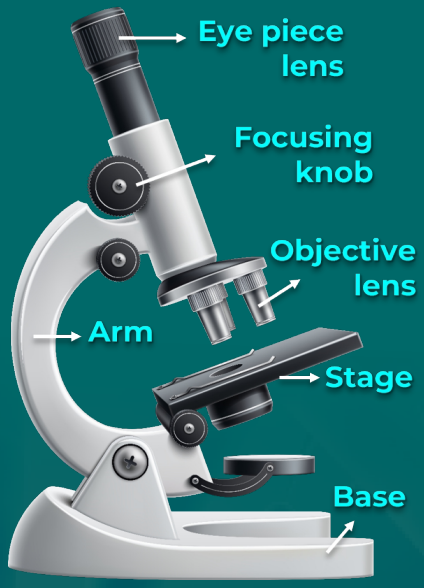
Rudolf Virchow - 1855

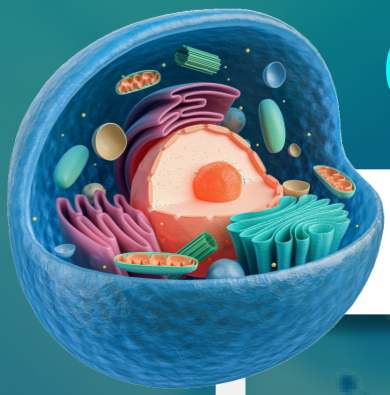
German pathologist established that all cells arise from pre-existing cells ("omnis cellula e cellula").

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Compound Microscope

The discovery of electron microscope by Knoll and Ruska, in 1939 made it possible to observe and understand the complex structure of cell and its organelles.





Cell Theory

The "cell theory" was formulated by two biologists, M.J. Schleiden (1838), and T. Schwann (1839).

01 Bodies of the living beings are made up of cells. The cell is the basic unit of life.

02 Activities of an organism are the sum total of activities of its cells.

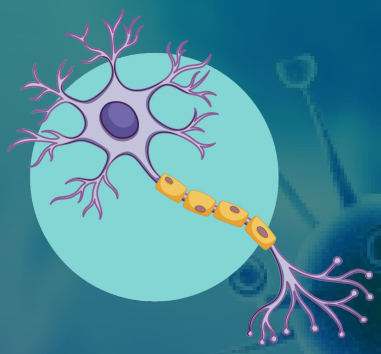
03 Every new cell arises from pre-existing cells.

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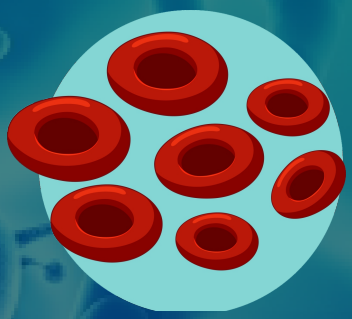
Size of cell

- Largest cell in animals is Ostrich egg.
- Longest cell in animals is Nerve cell.
- Smallest cell is PPLO-Pleuro Pneumoniae Like Organism [Mycoplasma]

Shape of cell



Elongated & branched
NERVE CELL



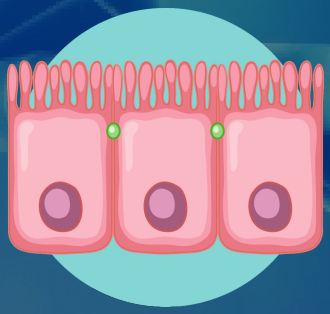
Discoidal/ saucer
RBC



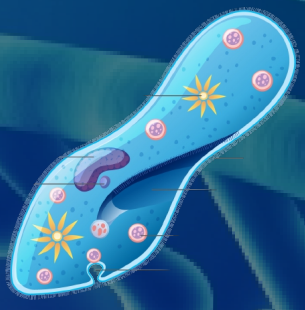
Spindle
MUSCLE CELL



Spherical
EGGS



Branched
PIGMENT CELL OF THE SKIN



Slipper shaped
PARAMECIUM

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Unicellular organisms v/s Multicellular organisms

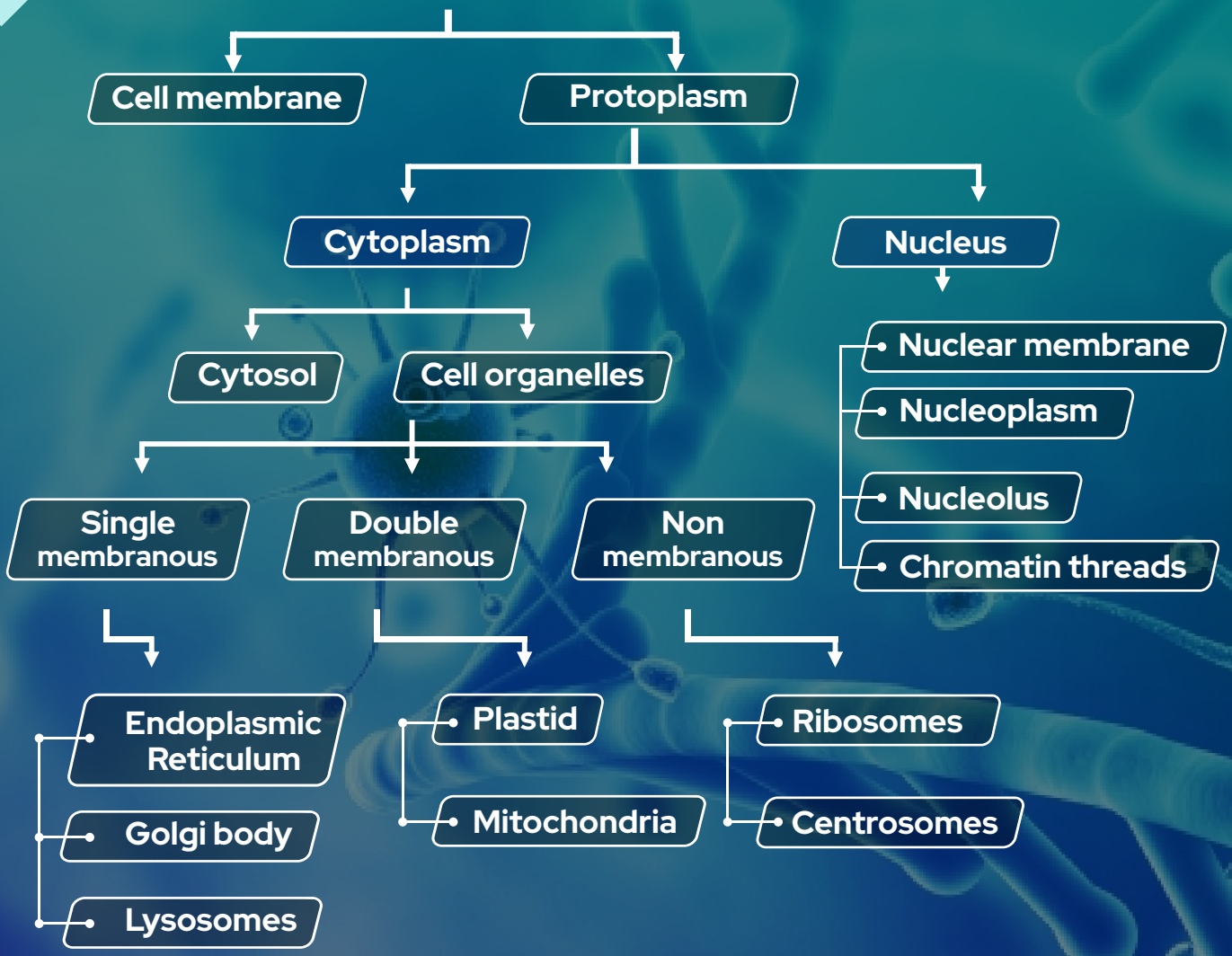
Unicellular

- The organisms which are made of single cell are called unicellular organism.
- The single cell is able to perform all life processes , like obtaining of food, respiration, excretion, and reproduction.

Multicellular

- The organisms which are made of number of cells are called multicellular organism.
- All the cells of multicellular organisms have similar basic structure and under take similar basic functions.

STRUCTURE OF CELL

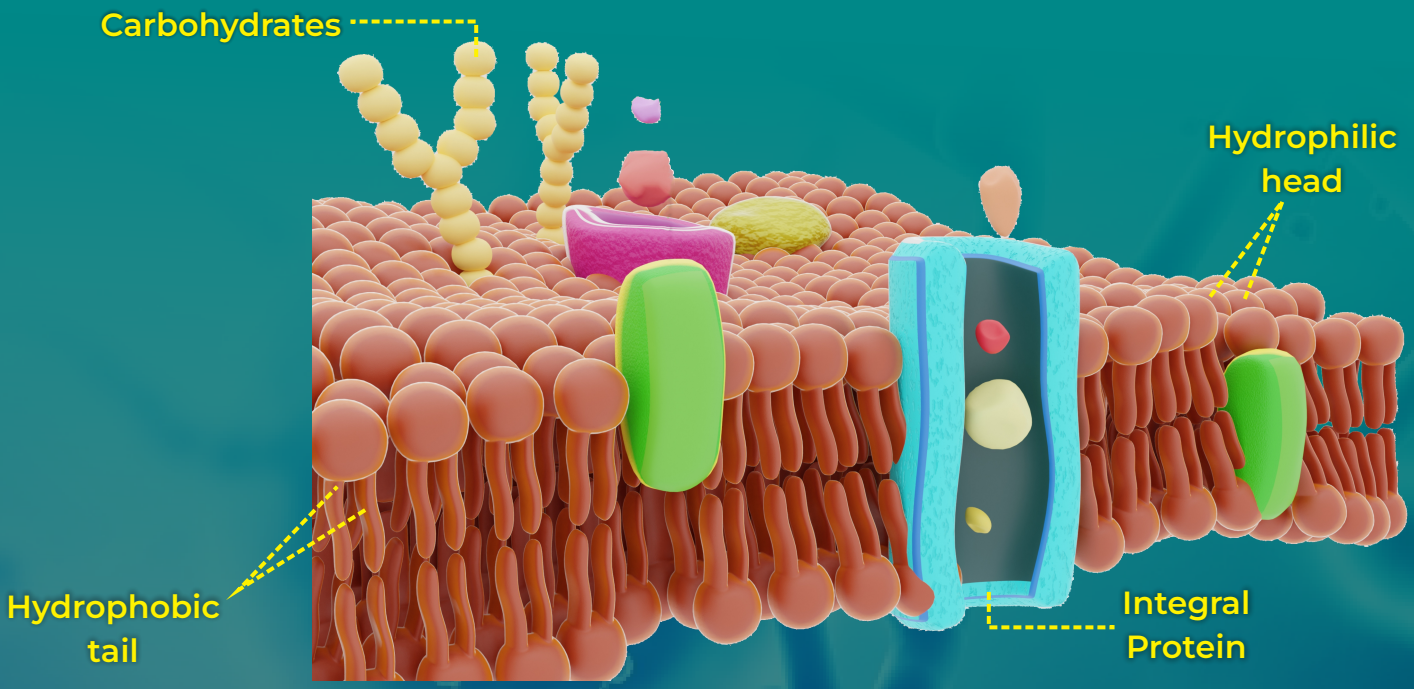


Non-living material in the cytoplasm of a cell such as pigment granules, starch granules, fat droplets, etc. are called cell inclusions.

The size of organism is dependent upon the number of cells and not on the size of the cell.

Plasma membrane

Plasma membrane is flexible and is made up of a bilayer of lipid (called phospholipids) and protiens. This structure was explained by Singer and Nicolson (1972) in the fluid mosaic model of plasma membrane.



- It regulates the movement of materials between the interior of the cell and the outer environment.
- It is selectively permeable i.e. only selective solute can pass through the membrane.
- Small molecules such as oxygen, carbon dioxide, and water are able to pass freely across the membrane but the passage of larger molecules, such as amino acids and sugars, is carefully regulated.
- Shrinking of protoplasm - In plant cell → plasmolysis, In animal cell → crenation

Cell Wall

It is outermost rigid, freely permeable layer found outside the plasma membrane in all the plant cells, bacteria, blue-green algae, some protists and all fungi.
It is absent in animal cells. It is made up of peptidoglycan in bacteria and blue-green algae and chitin in most of fungi.



Transport across plasma membrane

Passive Transport

(without expenditure of energy)

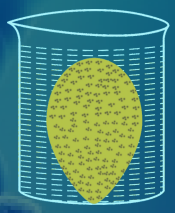
Diffusion

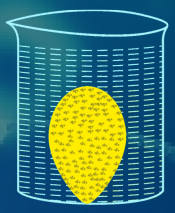
The process of movement of substance (solid, liquid & gas) from the region of its higher concentration to the region of its lower concentration to spread uniformly in the given space is called diffusion.

Osmosis

Osmosis can be defined as the diffusion of water or solvent across semipermeable membrane from the region of its higher concentration to the region of its lower concentration till equilibrium is reached.

- Endosmosis
- Exosmosis

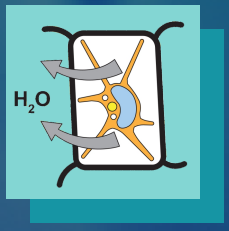


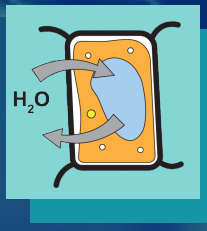


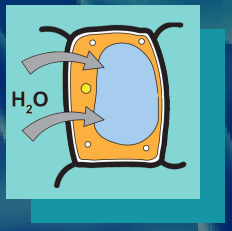
Active Transport

(With expenditure of energy)

Cell placed in solution







NUCLEUS

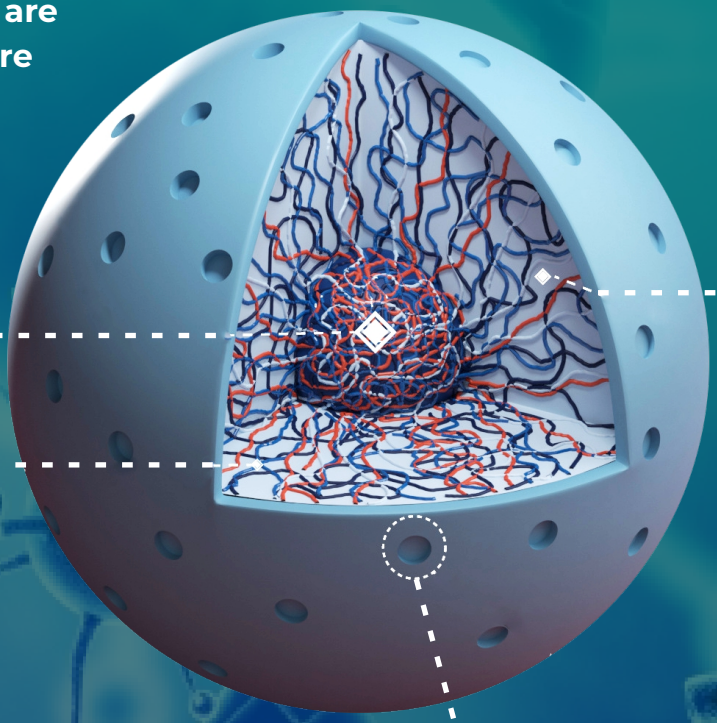
- "Nucleus is double membrane bound dense protoplasmic body, which controls all cellular metabolism and encloses the genetic information of cell".
- Nucleus is considered as controller or director of the cell.

Nuclear Membrane

Surrounds nucleus and separate the nuclear material from cytoplasm.
Composed of two membranes, Having Nucleopores.

Nucleolus

Discovered by Fontana.
Usually one nucleolus is present in each nucleus but sometimes more than one nucleoli are present. It is a store house of RNA.



Nucleoplasm

It contains chromatin threads and nucleolus.

Chromatin threads

A darkly stained network of long and fine threads called chromatin threads.
Mace Network called chromatin reticulum.
Converts into chromosomes during cell division.

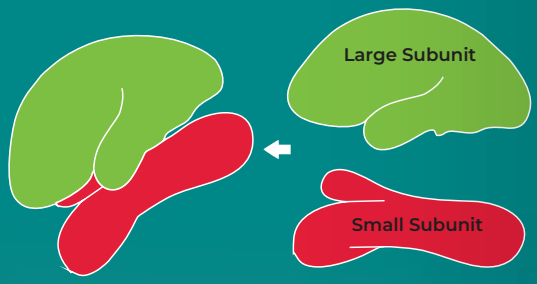
Nuclear Pores

Allow exchange of material between nucleus and cytoplasm.
Undifferentiated cell have more pores then differentiated cells.

Nucleus is the largest cell structure. Human RBC lacks nucleus. Mature sieve tube in plants also lack nucleus.
Chromosomes = DNA + histone proteins.
Functional segments of DNA are called genes.

Cell Organelle

Ribosomes

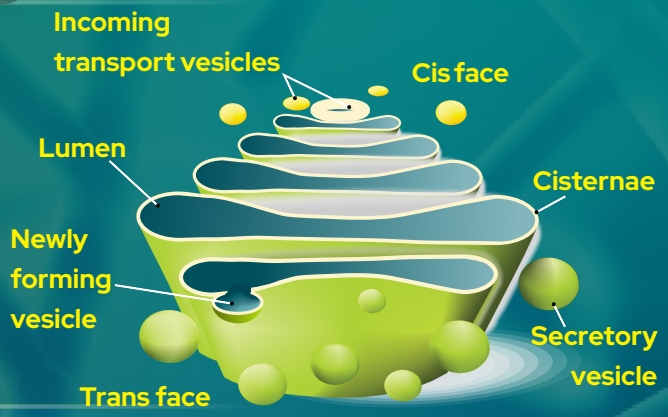


Engine of cell/protein factory of the cell.
"organelle within an organelle"
Smallest cell organelle
In prokaryotes 70 S = 30S + 50S
in eukaryotes 80S = 40S + 60S

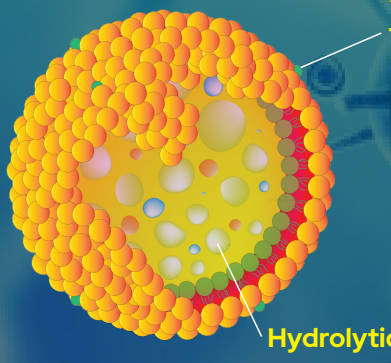
Golgi Apparatus

Traffic police of cell

It consists of stacks of membrane-bound vesicles that function in the storage, modification and packaging of substances manufactured in the cell.



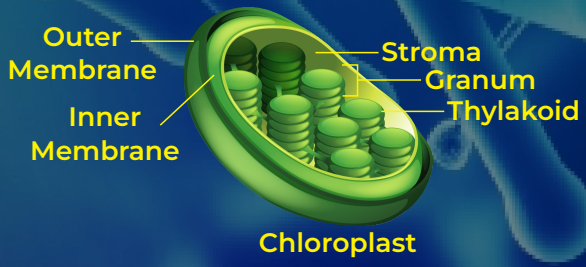
Lysosomes



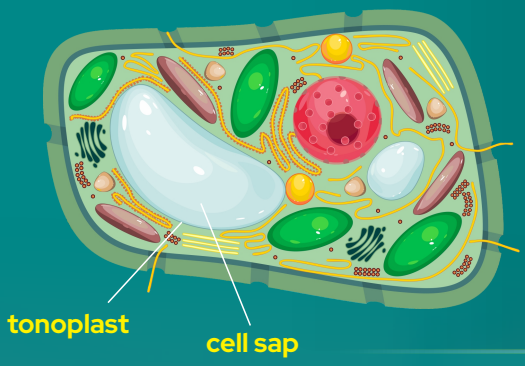
Lysosomes are called suicide bags because the enzymes they contain could digest the whole cell if they burst. Old cells are removed by autolysis.

Plastids

Site of Photosynthesis
Three types - chloroplasts, chromoplasts and leucoplasts. Chloroplasts perform photosynthesis.
Leucoplast is colourless and used to store proteins (Aleuroplast), oil (Elaioplasts) and starch (Amyloplast).



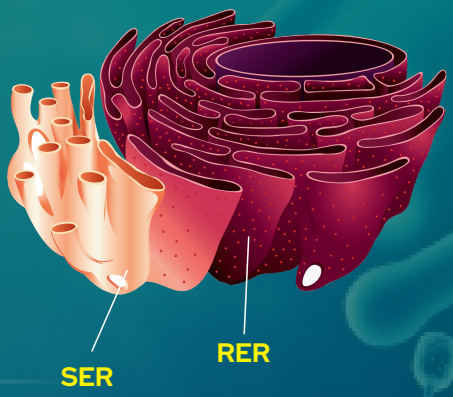
Vacuoles



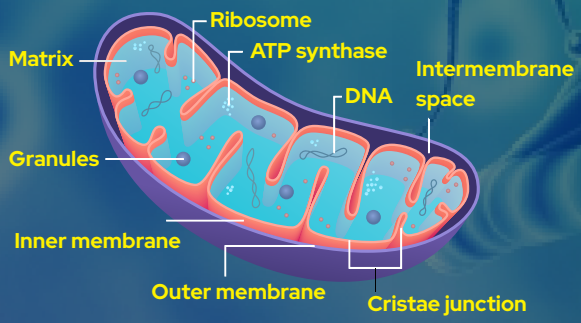
Non-cytoplasmic sacs that contain non living liquid or solid contents.
Most mature plant cells have a large central vacuole.
Helps to maintain the turgidity of the cell and stores important substances including wastes.

Endoplasmic Reticulum

Functions both as a passageway for intracellular transport and as a manufacturing surface.
it is of two types-smooth ER and rough ER.
SER - Engaged in the synthesis and storage of glycogen, fat and steroids and detoxification of drugs and poisons.
RER - Associated with protein synthesis because of ribosomes present on its surface.



Mitochondria

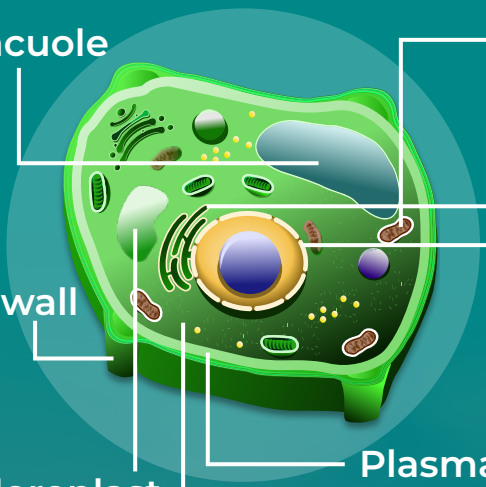


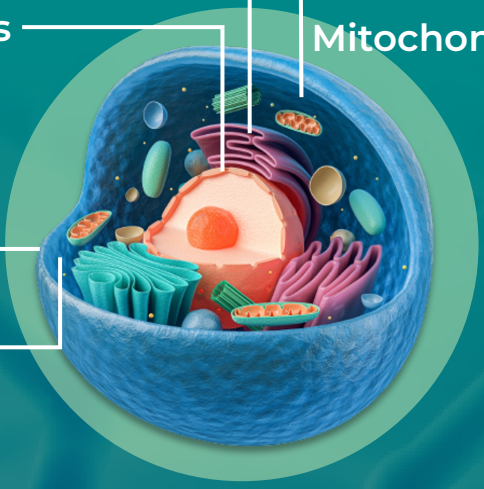
Mitochondria is known as power house of the cell or ATP generation site. Cristae bear small tennis racket like particles called elementary particles, F0-F1 particles or oxysomes.

Mitochondria and Plastid are a semi- autonomous body because it has its own DNA and ribosome and can self-replicate.

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PLANT CELL



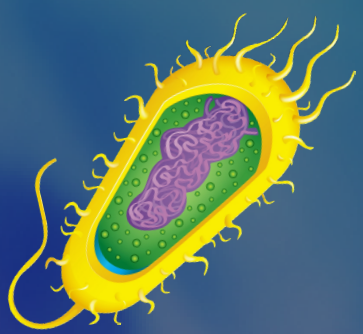


ANIMAL CELL

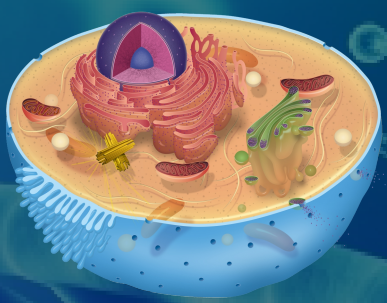
PROKARYOTES VS EUKARYOTES

Prokaryotes

Organisms whose cells lack a nuclear membrane and the genetic material (DNA, RNA) lies freely in the form of nucleoid, are known as prokaryotes. e.g. Bacteria, blue green algae.



Eukaryotes



Organisms whose cells have a well-organized nucleus with nuclear membrane are known as eukaryotes. e.g. All plant and animal cells.