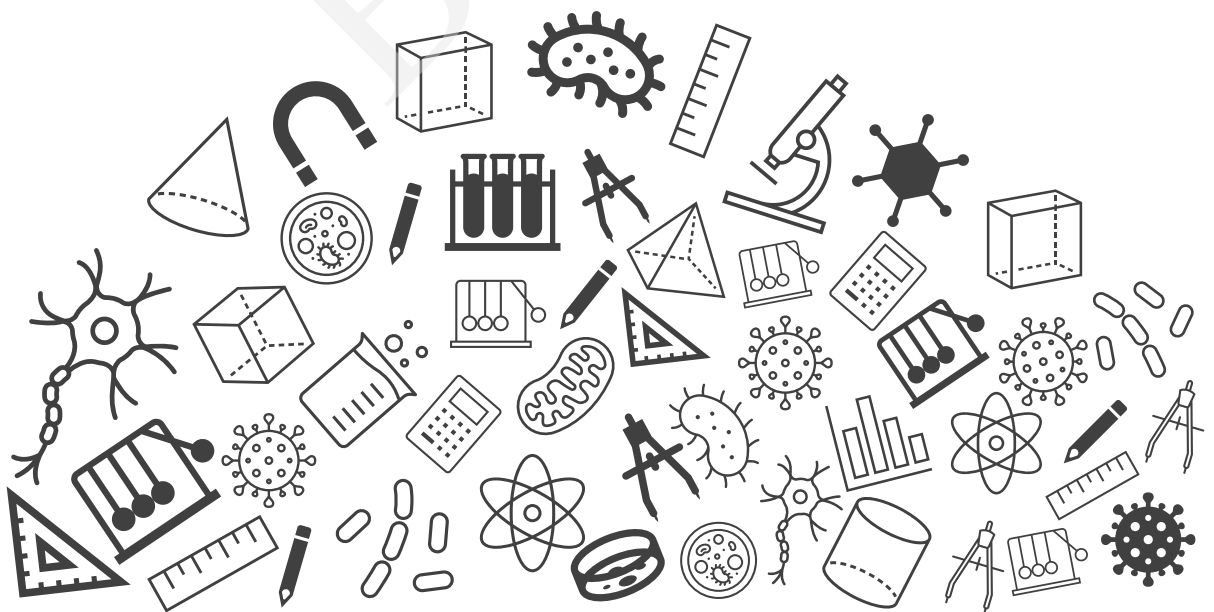




Grade 09
Science Chapter Notes





BYJU'S Classes

Chapter Notes

The Fundamental Unit of Life

Class 09



Topics to be Covered

B

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- Introduction to Cell

- 1.1 Definition
- 1.2 Basic Characteristics of Cell
- 1.3 Cell Discovery
- 1.4 Cell Theory

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- Types of Cells

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- Cells of Different Sizes and Shapes

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- Basic Components of a Eukaryotic Cell

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- 5.2 Cytoplasm
- 5.3 Cell Membrane



Topics to be Covered

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– Cell Membrane

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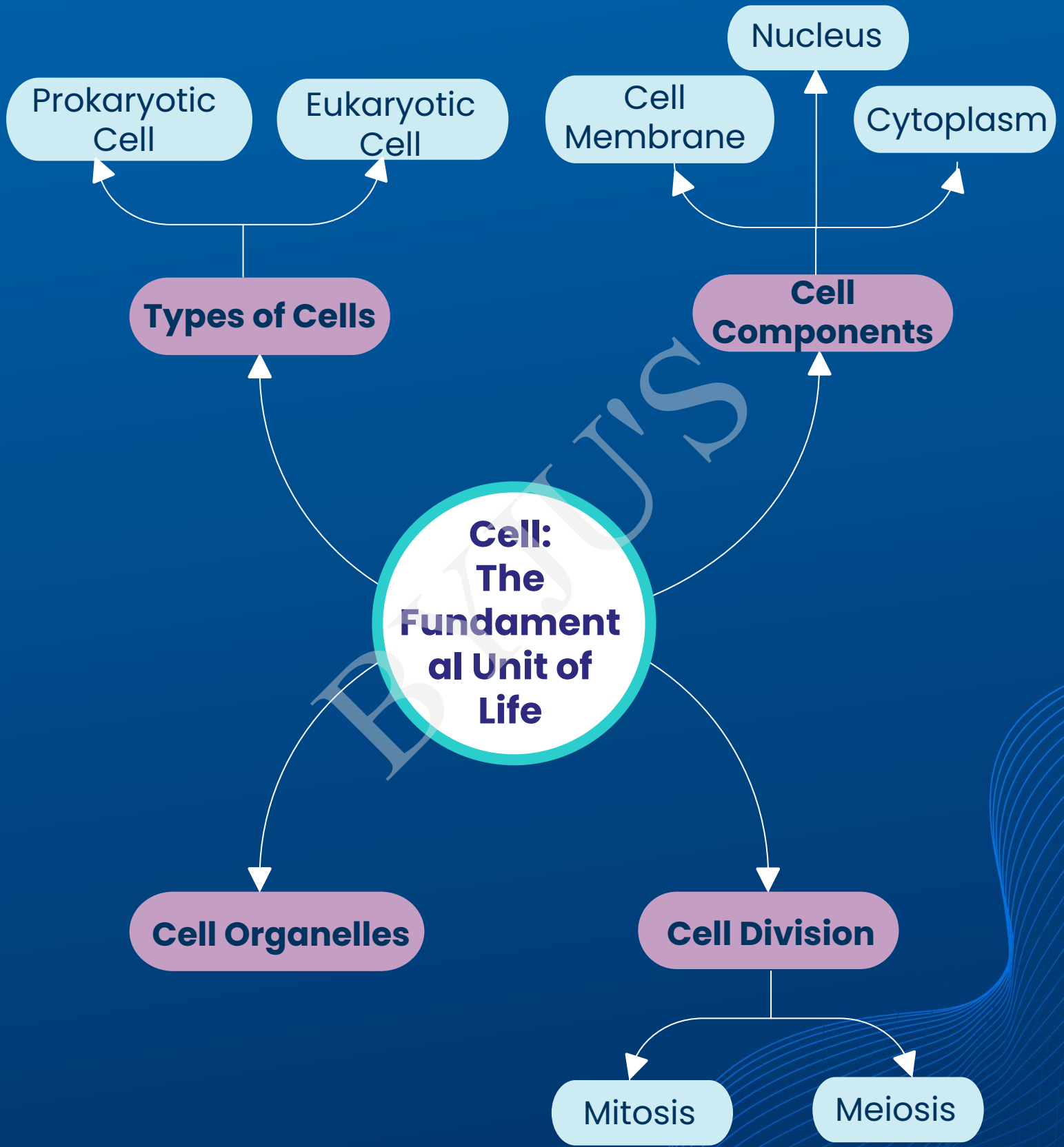
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– Cell Division

10.1 Mitosis

10.2 Meiosis

Mind Map



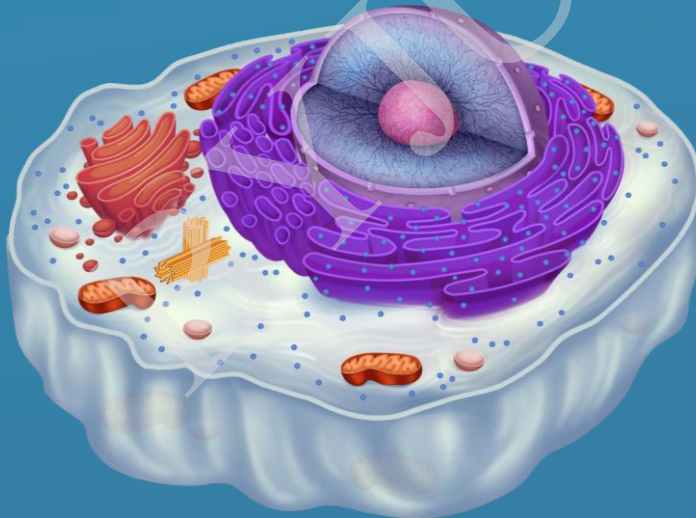
1. Introduction

1.1 Definition

A cell is defined as **the smallest, basic unit of life that is responsible for all of life's processes.**

Cells are the structural, functional, and biological units of all living beings.

1.2 Basic Characteristics of Cell



A Typical Animal Cell

- Stores hereditary information
- Capable of reproducing
- Acquires and utilises energy
- Site of various bio-chemical reactions
- Able to respond to stimuli

1.3 Cell Discovery



Robert Hooke

- Examined a thin slice of cork and observed tiny compartments which he called "cells"
- Cork is obtained from the bark of a tree and contains dead plant cells.



Anton Van Leeuwenhoek

- A Dutch lens maker who improved the design of microscopes.
- Observed the first living cells and called them "animalcules"

1.4 Cell Theory

- The cell theory was given by Schleiden and Schwann, which was later modified by Rudolf Virchow.
- The three postulates of cell theory are:
 - ✓ All living organisms are composed of one or more cells.
 - ✓ Cell is the basic structural and functional unit of living organisms.
 - ✓ All cells arise from pre-existing cells.

2. Microscopes

A microscope is an instrument that magnifies small objects, thus revealing details too small to be seen by the naked eye.

2.1 Simple Microscope



A single lens

Total magnification is limited to one lens

Used to magnify the size of small objects

2.2 Compound Microscope

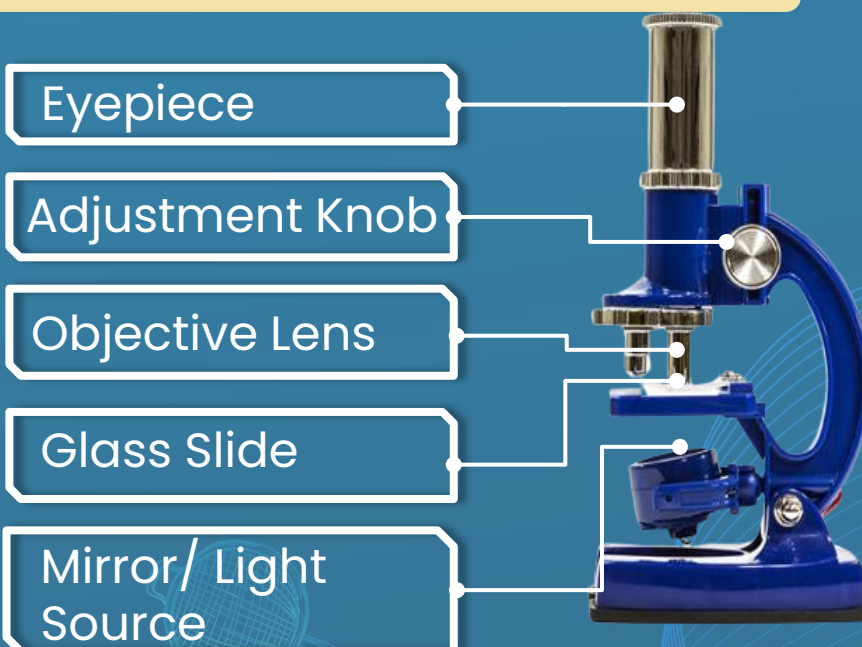


Multiple lenses

Total magnification is product of objective lens and eyepiece

Used to magnify and study micro-organisms

2.3 Parts of a Compound Microscope



Eyepiece

Adjustment Knob

Objective Lens

Glass Slide

Mirror/ Light Source

3. Types of Cells

Regardless of the complexity as well as type of organism, cells are mainly divided into two categories.

Mentioned below are the distinctions between the 2 major types of cells -

	3.1 Prokaryotic Cell	3.2 Eukaryotic Cell
Nucleus	Absent Instead, they have a nucleoid region in the cell	Present and surrounded by a nuclear membrane
Cell Size	Size ranges from 0.2 μm - 2.0 μm in diameter.	Size ranges from 10 μm - 100 μm in diameter.
Ribosomes	Present	Present
Membrane-bound cell organelles	Absent	Present
Examples	Bacteria and Archaea	Plant and Animal cell

4. Cells of Different Sizes and Shapes

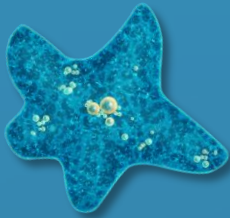
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Cells of Different Sizes

Blue Whale's Neuron

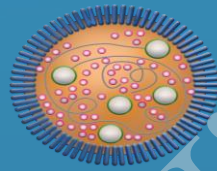


Amoeba



0.01– 0.1 mm

Mycoplasma



0.0002 mm

Ostrich's Egg



130–170 mm

Cells of Different Shapes

Shape of a cell depends on the function of the cell.

Neuron



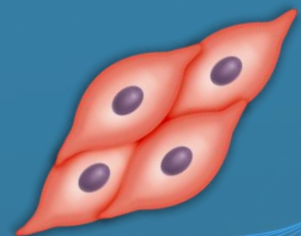
Branched- To connect with other neurons

Red Blood Cell



Biconcave Discs- To maximise the oxygen carrying capacity

Muscle Cell



Spindle Shaped- To align properly & to contract & relax with ease

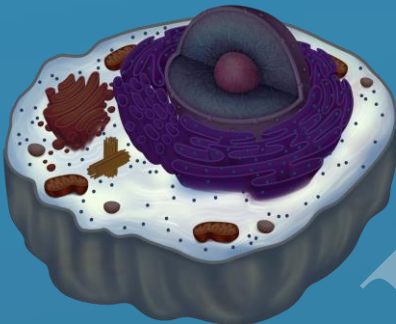
5. Basic Components of a Eukaryotic Cell

5.1 Nucleus



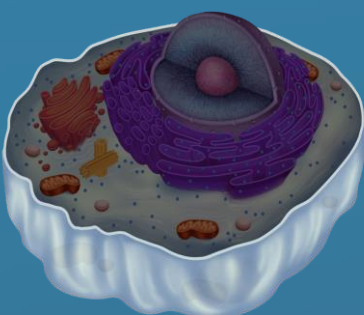
- Contains the hereditary material of the cell, the DNA which is organised as chromosomes
- Controls growth and metabolic activities of the cell
- Surrounded by the nuclear envelope that separates the DNA from the rest of the cell

5.2 Cytoplasm



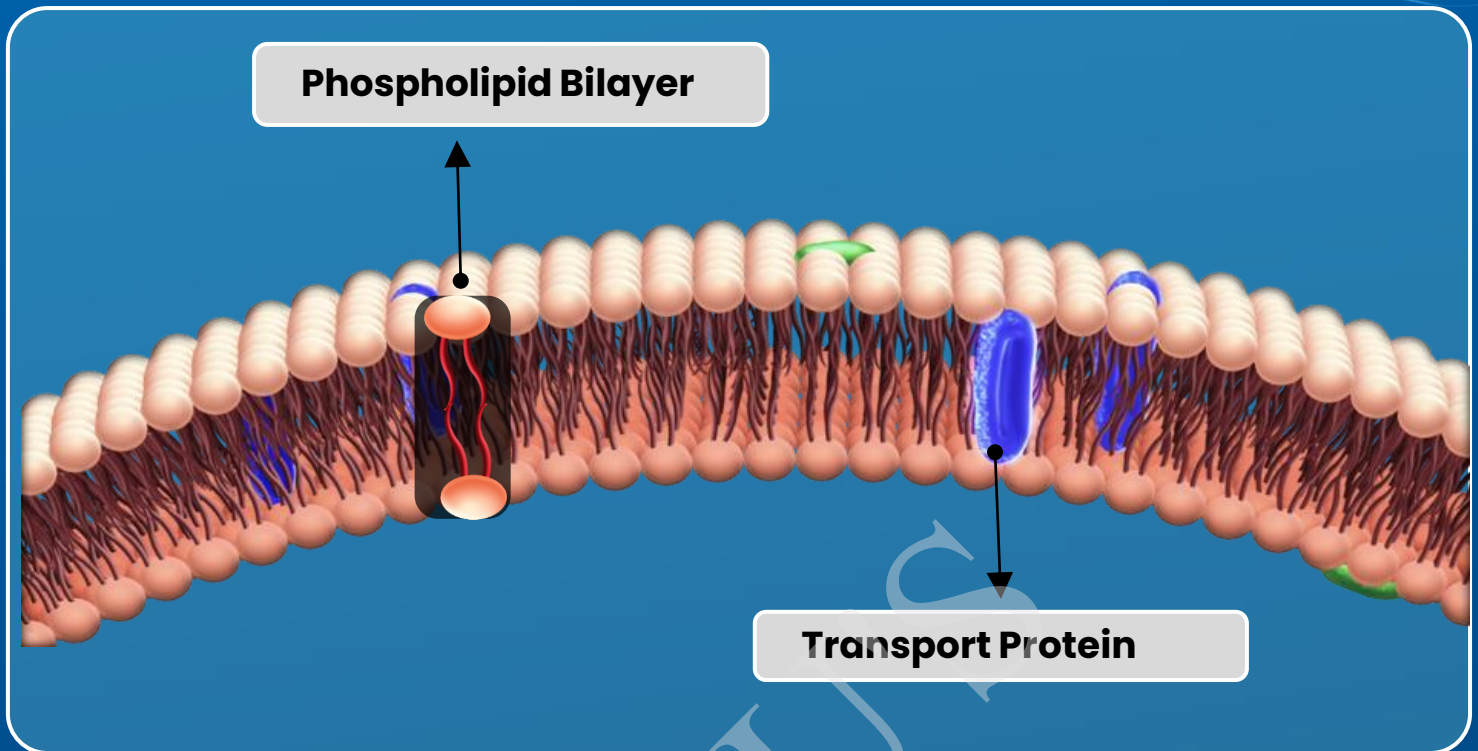
- Thick, jelly-like substance present inside the cell membrane and external to the nuclear membrane
- Mainly composed of water, salts, proteins and suspended cell organelles
- Site for most of the bio-chemical reactions

5.3 Cell membrane



- Flexible, living and selectively permeable membrane
- Outermost layer of the animal cells
- Present in both plant and animal cell

6. Cell Membrane



6.1 Structure and Functions

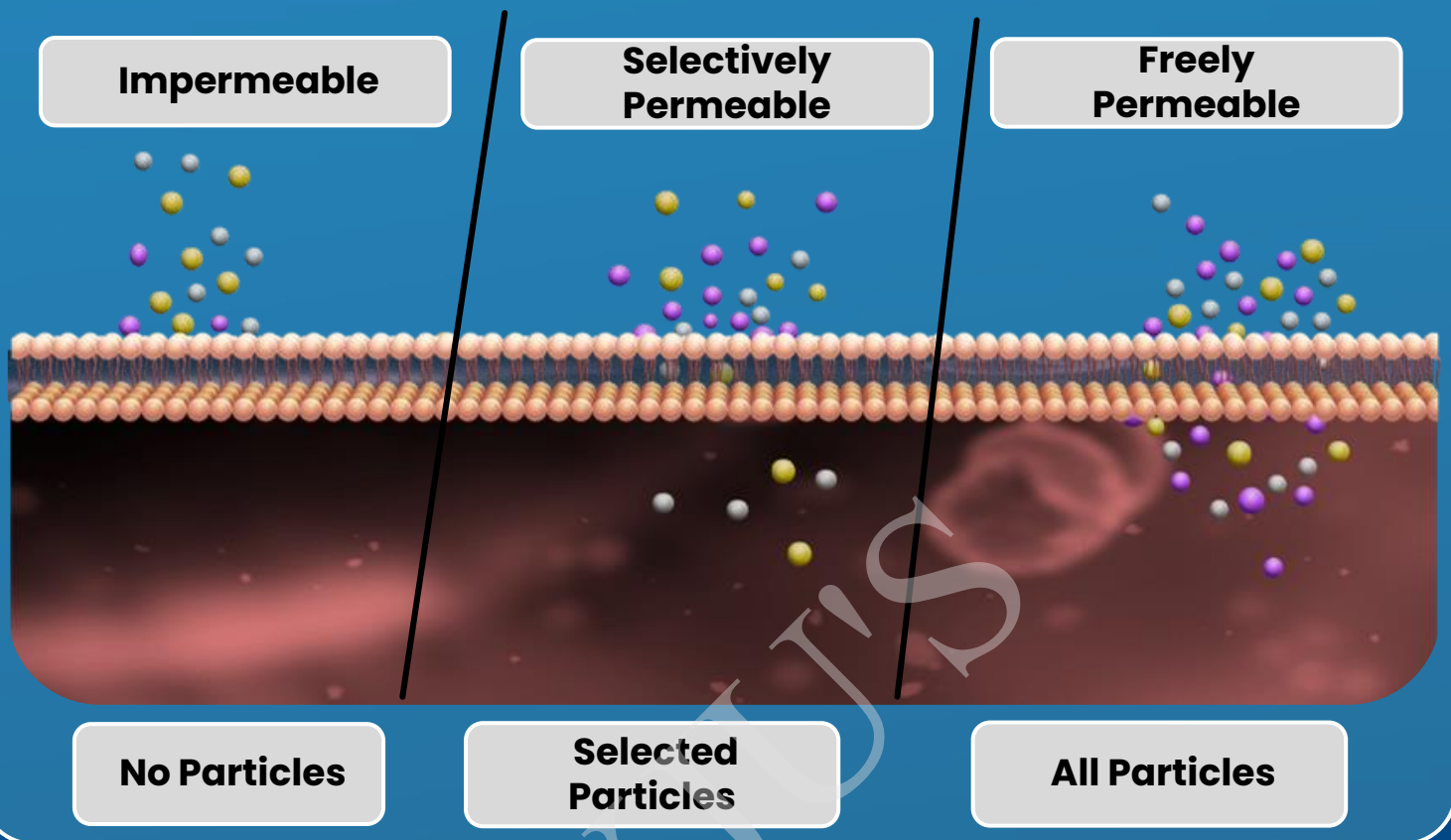
Structure:

- The cell membrane is made up of lipids and proteins.
- Phospholipids are the main component of the cell membrane, and they are arranged in 2 layers called the phospholipid bilayer.
- The lipid bilayer is embedded with proteins that help in transport of certain substances.

Functions:

- Encloses the components of the cell and protects it
- Monitors what goes in and out of the cell

6.2 Permeability



There are 3 types of membranes: impermeable, selectively permeable and freely permeable.

- **Impermeable membrane:**
No particles can move across the membrane.
- **Selectively permeable membrane:**
Only selected molecules are allowed to cross the membrane.
- **Freely permeable membrane:**
All the molecules are allowed to pass through it without any resistance.

6.3 Types of Transport

Based on energy requirements, transportation of molecules in living systems can be of two following types:

Active Transport

Movement of molecules across the membrane against their concentration gradient by using cellular energy in the form of ATP.

Carrier proteins are required.

Large molecules and ions need active transport to cross the membrane.

Example- Uptake of minerals and ions by plant roots

Passive Transport

Movement of molecules across the membrane down their concentration gradient without the use of energy.

Carrier proteins are not required.

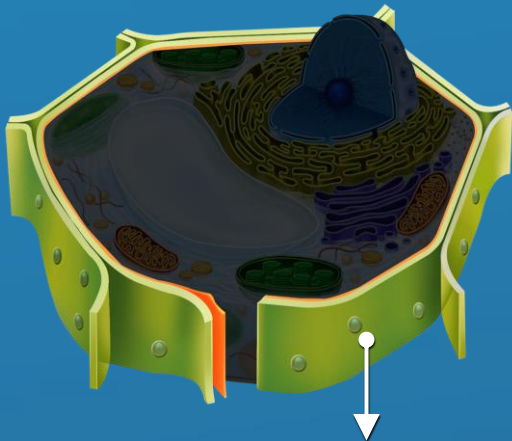
Molecules like oxygen and carbon dioxide can pass through the membrane by passive transport.

Example- Diffusion of gases in alveoli



7. Cell Wall

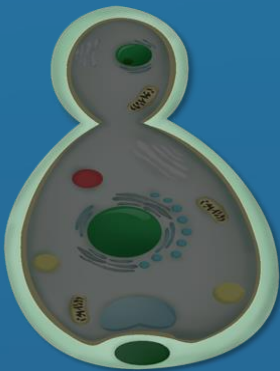
7.1 Cell Wall in Plant Cell



Cell Wall

- The outermost layer in plant cells
- Responsible for maintaining the rigid structure and providing mechanical strength to the plant cell
- Composed of cellulose

7.2 Cell Wall in other Organisms



Fungi



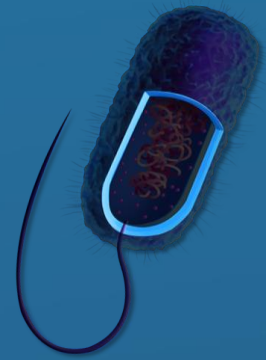
Chitin



Algae



Cellulose



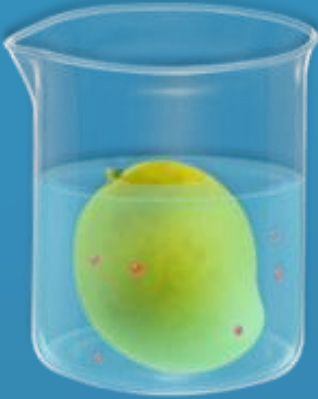
Bacteria



Peptidoglycan

8. Cell in Different Solutions

8.1 Hypotonic Solution



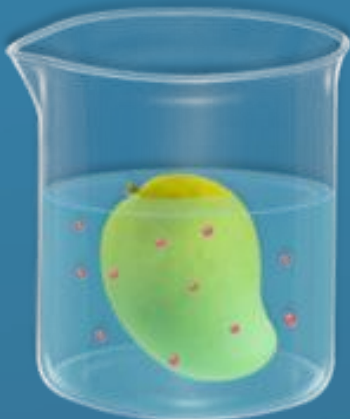
- If the medium surrounding the cell has a higher water concentration than the cell, meaning that the outside solution is very dilute, the cell will gain water by osmosis.

8.2 Hypertonic Solution



- If the medium has a lower concentration of water than the cell, meaning it is a very concentrated solution, the cell will lose water by osmosis.

8.3 Isotonic Solution

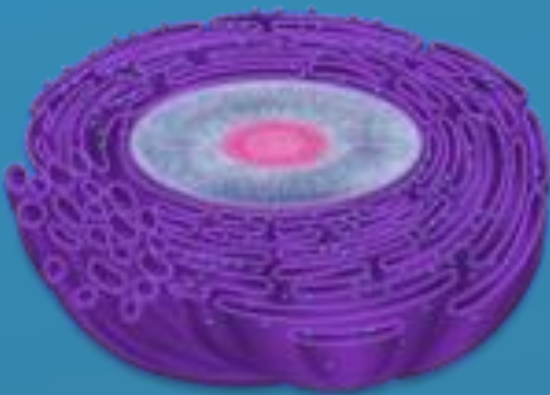


- If the medium has exactly same water concentration as the cell, there will be no net movement of water across the cell membrane.

9. Cell Organelles

An organelle is **a subcellular structure that has one or more specific jobs to perform in the cell**, much like an organ does in the body.

9.1 Endoplasmic Reticulum



- Transportation system of eukaryotic cell

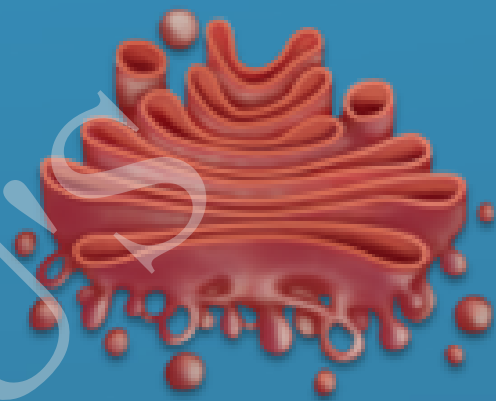
RER

- Ribosomes attached to its membrane.
- Synthesis proteins and enzymes

SER

- Ribosomes are not attached to its membrane.
- Synthesises lipids and steroids

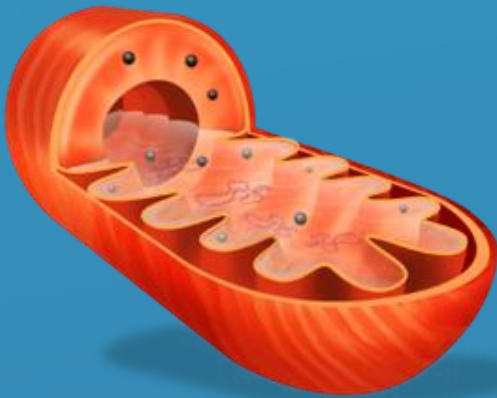
9.2 Golgi Body



- Consists of smooth flattened membrane-bound, sac-like structures called cisternae
- Packages materials synthesised in the cell and transports it
- Involved in the formation of lysosomes



9.3 Mitochondria



Structure:

- Double-membrane organelle found in eukaryotic cell
- Contains smooth outer membrane and an inner membrane with infoldings called cristae
- Has its own DNA and ribosomes to make proteins

Function:

- Helps to generate energy in the form of ATP

9.4 Chloroplast



Structure:

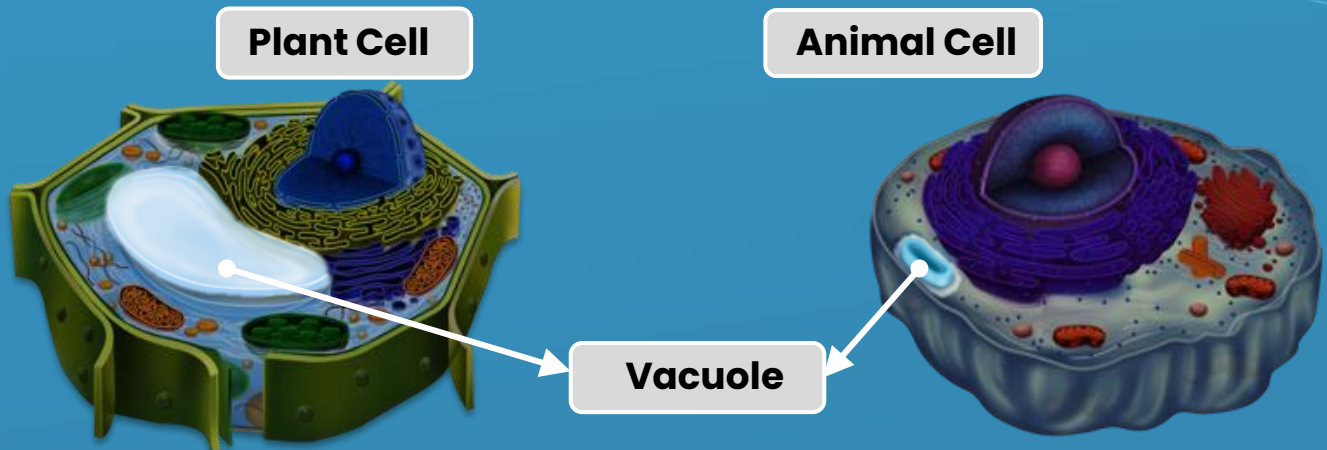
- Double-membrane organelle found in all higher plants
- Contains grana which are stacks of disc-shaped structures known as thylakoids
- Stroma is the homogenous matrix which contains grana, various enzymes, DNA, and ribosomes.

Function:

- Site of photosynthesis in plants



9.5 Vacuole



- Membrane-bound cell organelle present in the cytoplasm and filled with a watery fluid containing various substances
- In plant cells, vacuoles store food, water and excretory products. As vacuoles are full of the cell sap, they provide turgidity and rigidity to the cell.
- Animal cells contain one or more vacuoles, and their size is relatively smaller as compared to the plant cell vacuole.

9.6 Ribosome

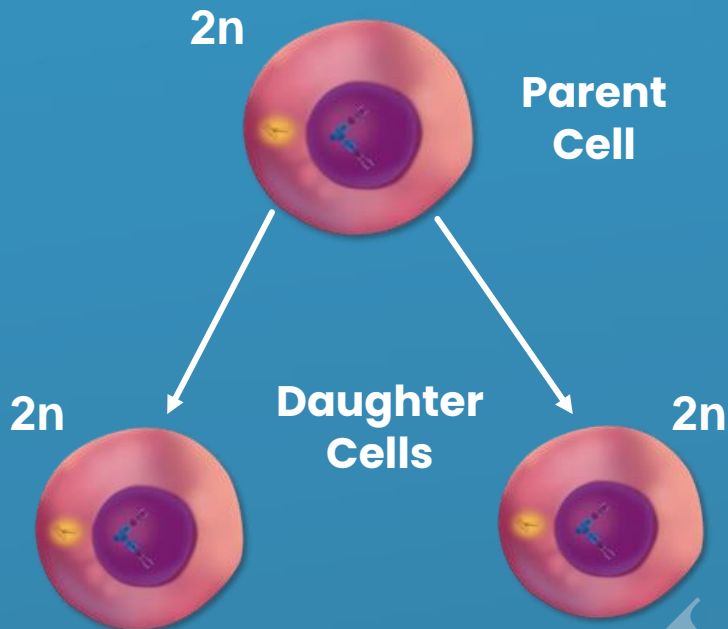
- Site of protein synthesis
- In prokaryotic cell ribosomes are found in the cytoplasm.
- In eukaryotic cell ribosomes are found as particles attached to RER and suspended in the cytoplasm.

9.7 Lysosome

- Contains hydrolytic enzymes that break down complex molecules into simpler ones
- Performs digestion of foreign bodies, breaks down a damaged organelle and disposes off toxic wastes out of the cell

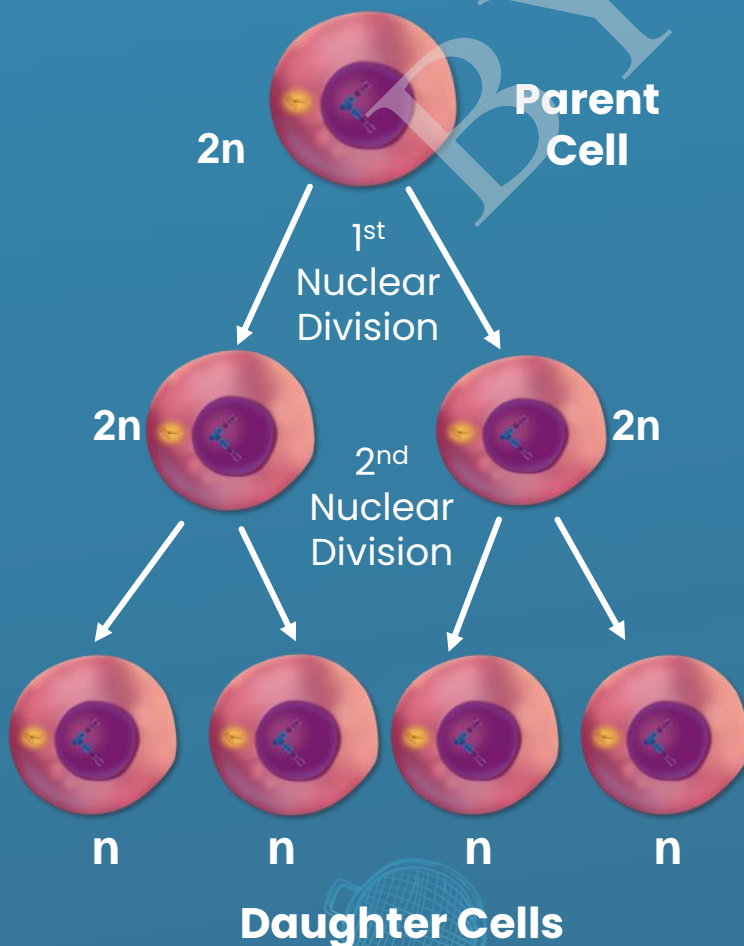
10. Cell Division

10.1 Mitosis



- Mitosis occurs in somatic cells
- Only one nuclear division occurs
- Results in two diploid daughter cells
- Chromosome number remains same

10.2 Meiosis



- Meiosis occurs in germ cells
- Two nuclear divisions occur
- Results in four haploid daughter cells
- Chromosome number is reduced to half