Pakistan School
Kingdom of Bahrain

Ch.4. CELLS & TISSUES

- TOPIC. **RELATIONSHIP BETWEEN**

  CELL FUNCTION

  &

  CELL STRUCTURE

  Pages.(67,68,69,70,71,72,73,74)

OBJECTIVES OF THE LESSON

- At the end of this lesson students will be able to

- State the diversity of the cells.

- Know the cell size and surface area to volume ratio.

- Describe the passage of molecules into and out of cells.

Cell Diversity

- Cells are very diverse in terms of **shape, size, and internal organization**
- A cell's **function** influences its **physical features**

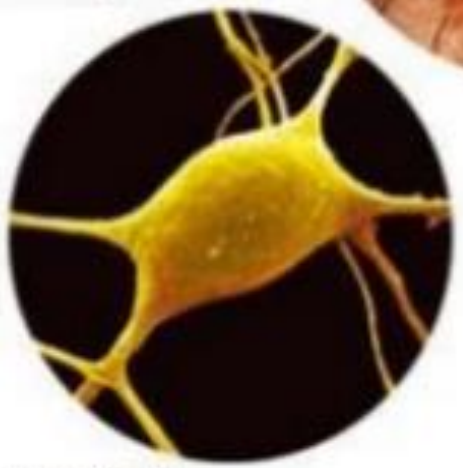
Cell Shape

- The diversity in cell **shape** reflects the different functions of cells
- A cell's shape can be **simple or complex** depending on the **function** of the cell
- Each cell has a shape that has evolved to allow the cell to **perform its function effectively**

Cell Shape

FIGURE 4-4

Cells have various shapes. (a) Nerve cells have long extensions. (b) Skin cells are flat and platelike. (c) Egg cells are spherical. (d) Some bacteria are rod shaped. (e) Some plant cells are rectangular.



(a) Nerve cell

(b) Skin cells

(c) Egg cell

(d) Bacterial cells

(e) Plant cells

Cell Size

- Cells differ greatly in their **sizes**
  - Nerve cells in a giraffe's spinal cord can be 2 m long
  - A human egg cell is about the size of a period at the end of a sentence
  - Most cells are only about 1/500 the size of a period at the end of a sentence

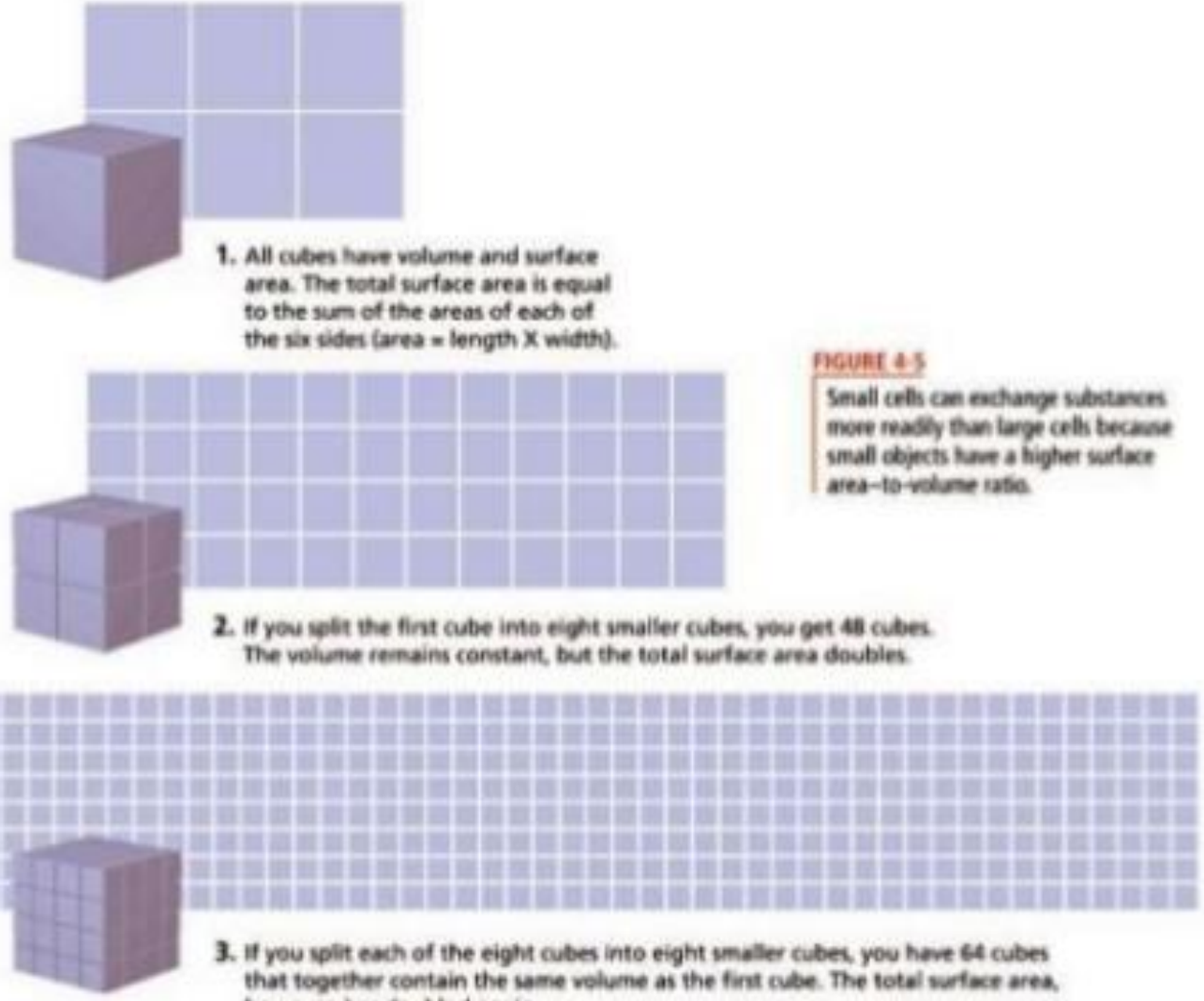
Cell Size

- The size of a cell is limited by the cell's **surface area to volume ratio**
- As a cell grows, its **volume** increases much faster than its **surface area**
- This is important because material needed by a cell (such as nutrients and oxygen) and wastes produced by a cell (such as carbon dioxide) must pass into and out of the cell through its surface

Cell Size

- If a cell became very large, there would not be enough **surface area** to allow materials to enter or leave the cell quickly enough to meet the cell's needs
- Therefore, most cells are **microscopic** in size

Cell Size



1. All cubes have volume and surface area. The total surface area is equal to the sum of the areas of each of the six sides (area = length X width).

2. If you split the first cube into eight smaller cubes, you get 48 cubes. The volume remains constant, but the total surface area doubles.

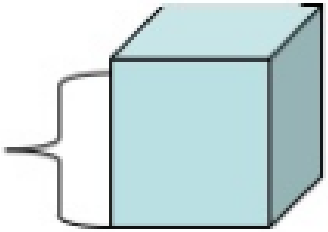
3. If you split each of the eight cubes into eight smaller cubes, you have 64 cubes that together contain the same volume as the first cube. The total surface area, however, has doubled again.

FIGURE 4-5

Small cells can exchange substances more readily than large cells because small objects have a higher surface area–to-volume ratio.

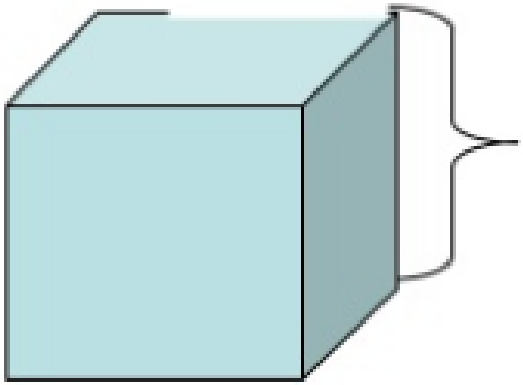
Example

Cube 1



2 cm

Cube 2



4 cm

Cube 1

Surface Area of Cube 1= Length x Width x

_____

Surface Area of Cube 1= 2 cm x 2 cm x 6 = _____

Volume of Cube 1= _____ x width x _____

Volume of Cube 1 = 2 cm x 2 cm x 2 cm

Volume of Cube 1 = _____

Surface area to Volume ratio= Surface area/volume

Surface Area to Volume ratio of Cube 1=

24 cm^2/8 cm^3 = _____

Cube 2

Surface Area of Cube 2= Length x Width x 6 Sides

Surface Area of Cube 2= 4 cm x 4 cm x 6 =

_____

Volume of Cube 2= length x width x height

Volume of Cube 2 = 4 cm x 4 cm x 4 cm

Volume of Cube 2 = 64 cm^3

Surface area to Volume ratio= Surface area/volume

Surface Area to Volume ratio of Cube 2=

96 cm^2/64 cm^3 = _____

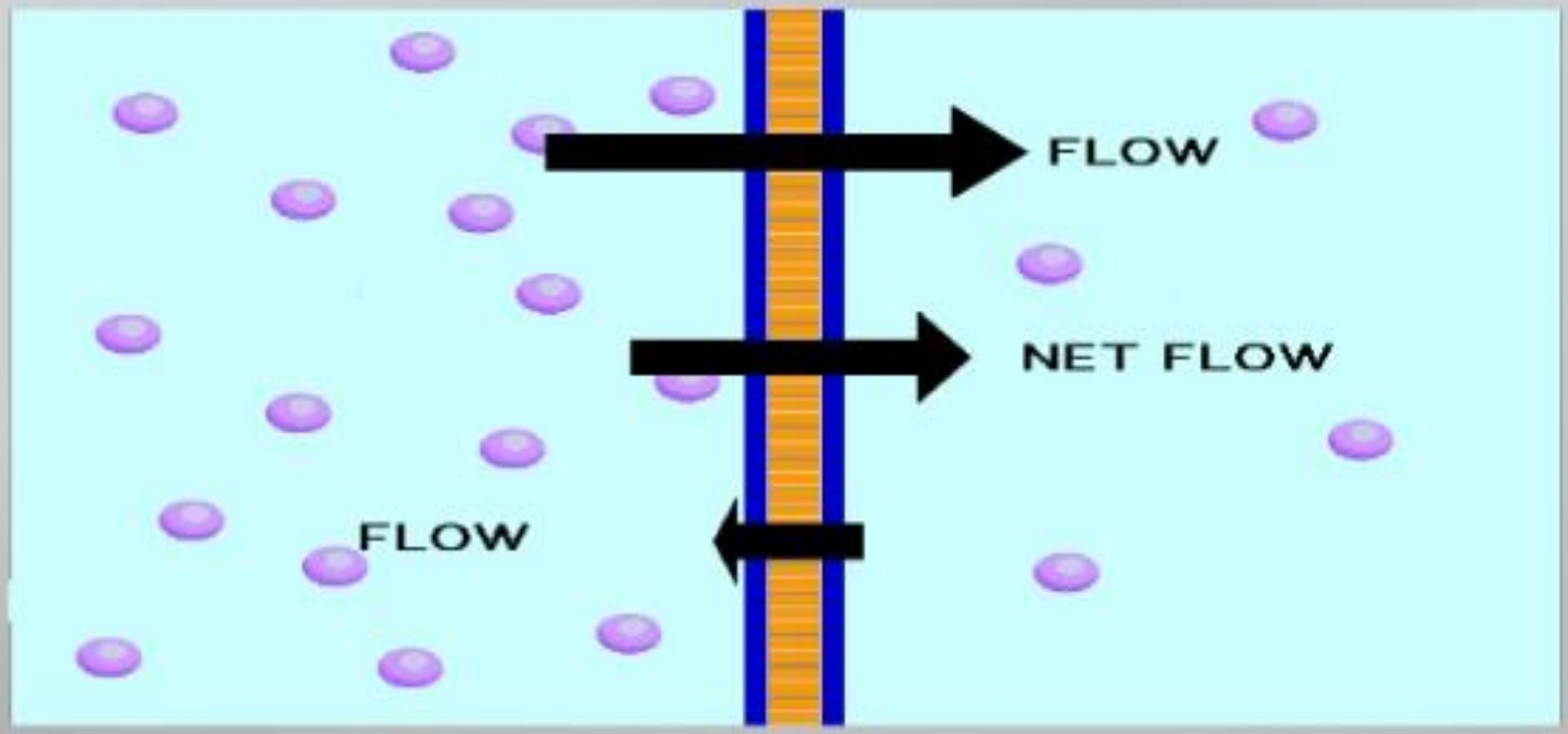
TYPES OF MOVEMENT ACROSS THE CELL MEMBRANE

Passive Transport

- Passive transport is the movement of molecules across the cell membrane and does not require energy.
- It is dependent on the permeability of the cell membrane.
- There are three main kinds of passive transport - Diffusion, Osmosis and Facilitated Diffusion.

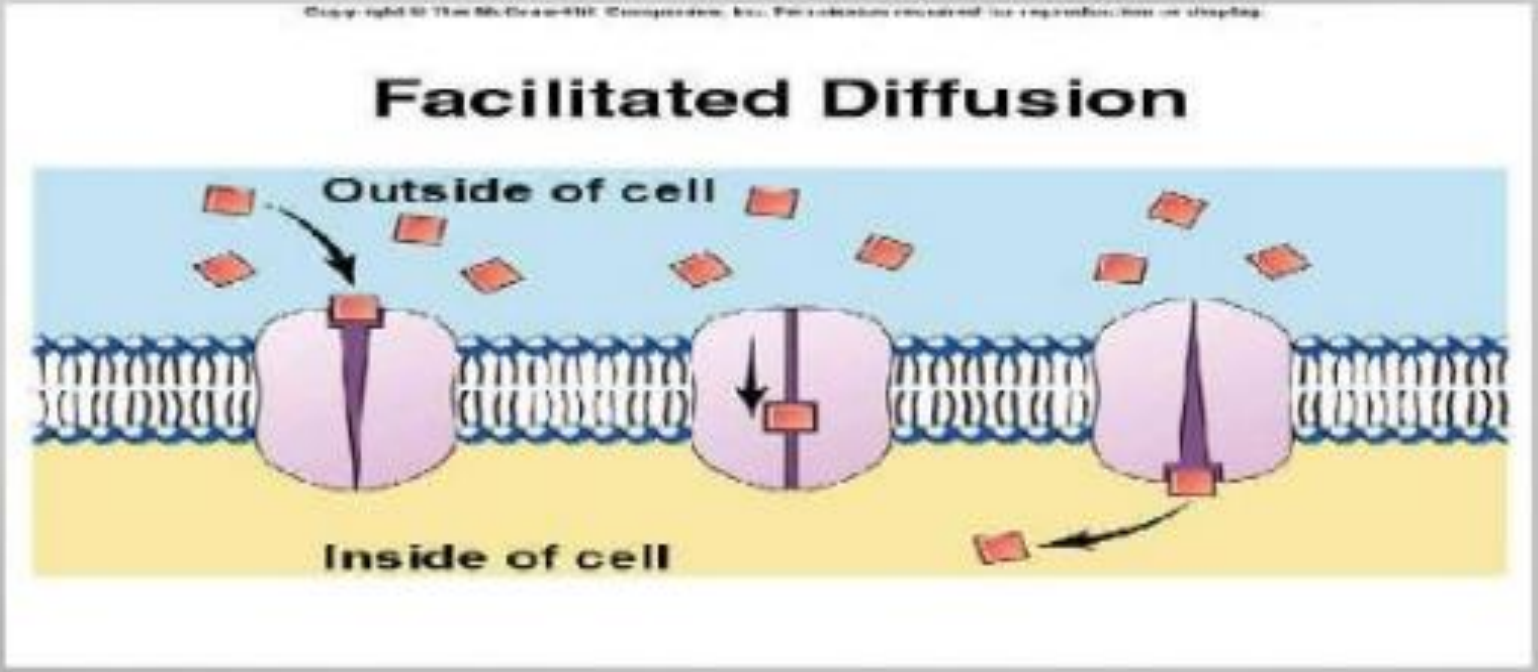
Diffusion

- The movement of molecules from a region of higher concentration to a region of lower concentration.



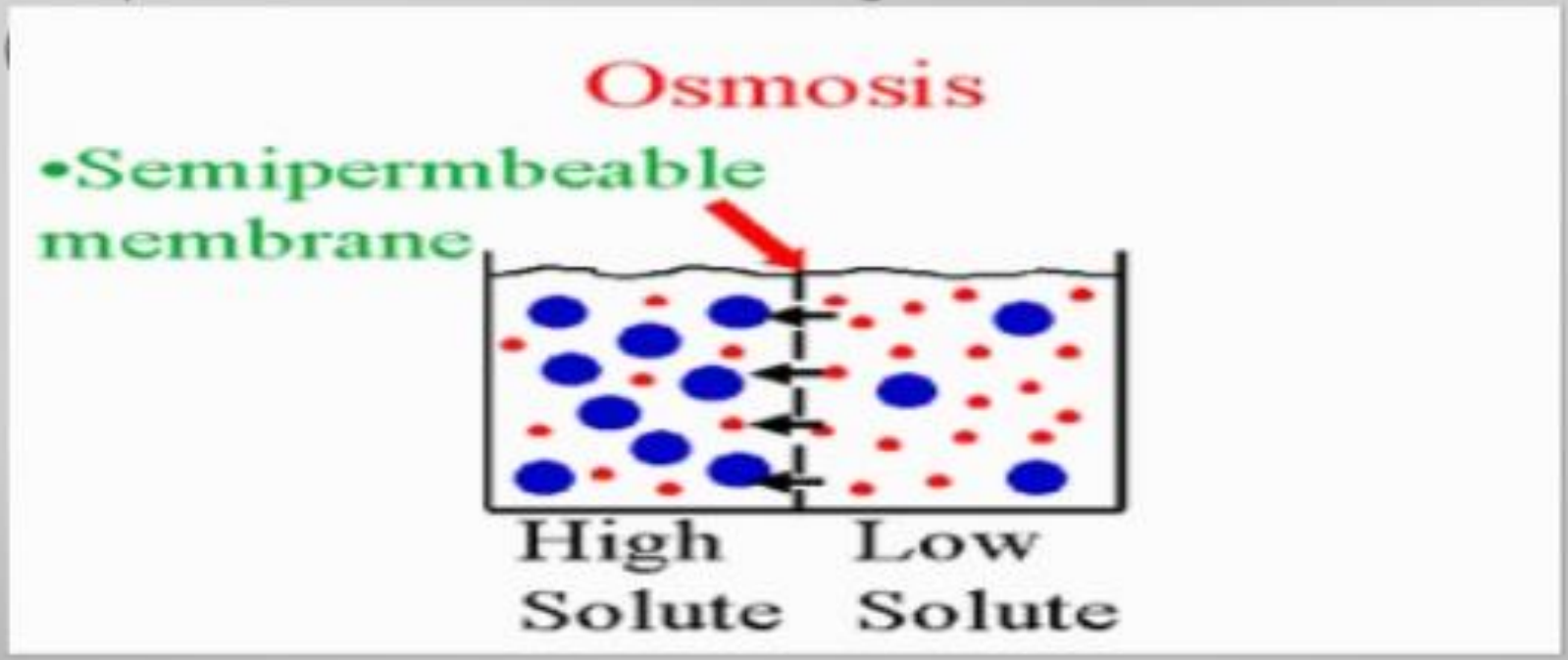
Facilitated diffusion

- This process does not require ATP but does require cell membrane proteins which are called carrier proteins to carry the molecules across the cell membrane from an area of higher concentration to an area of lower concentration



Osmosis

- The movement of water across a semi permeable membrane.
- Osmosis is the movement of water (red dots) through a semipermeable membrane to a higher concentration of solutes

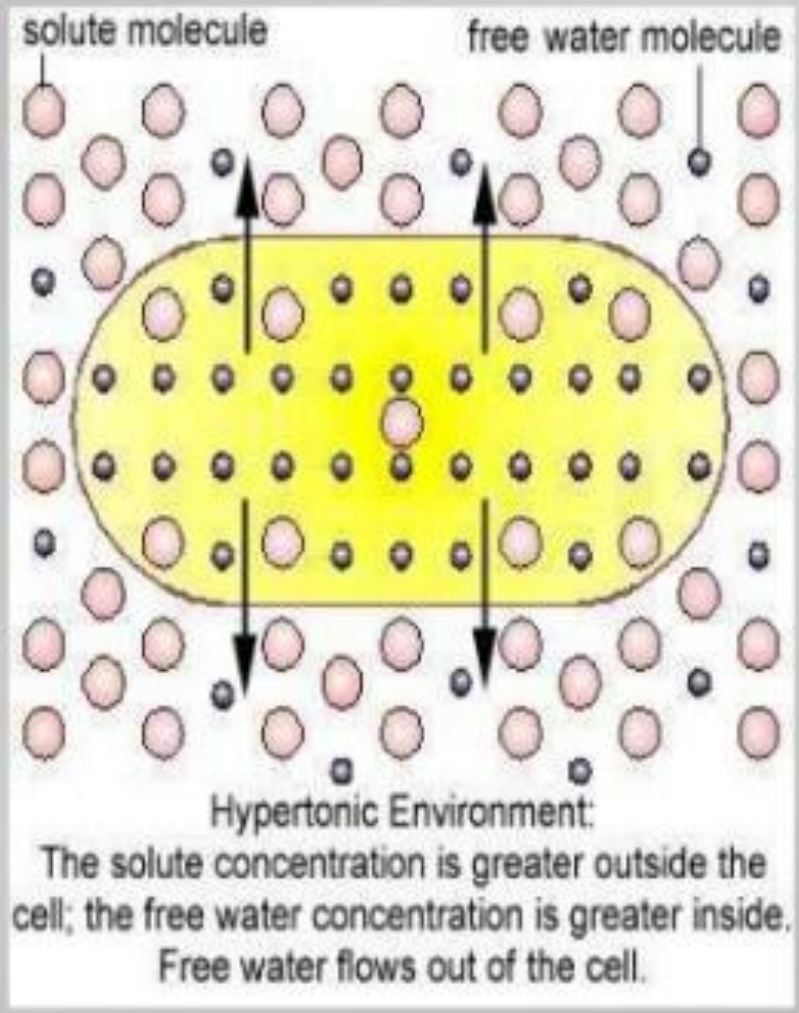


How Do Hypotonic, Hypertonic, and Isotonic Solutions Affect the Water Movement of a Cell?

Hypertonic Solution

lypertonic solution contain a high concentration of ıte in relation to the solution within the cell (e.g. the 's cytoplasm).

en a cell is placed in a hypertonic solution, the water uses out of the cell, causing the cell to shrivel up.

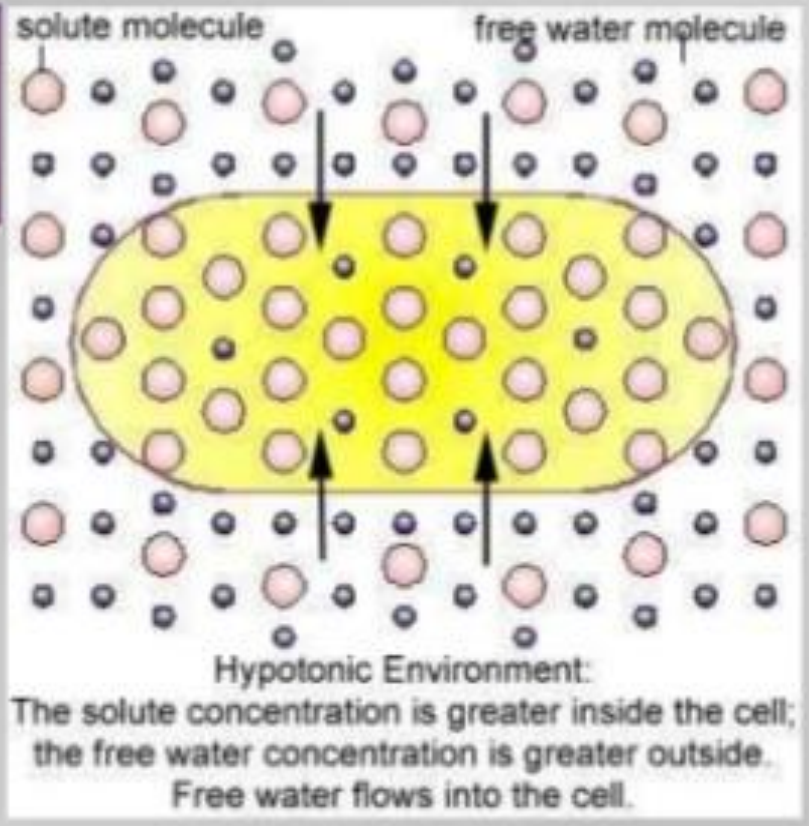


Hypertonic Environment:
The solute concentration is greater outside the cell; the free water concentration is greater inside. Free water flows out of the cell.

Hypotonic Solution

A hypotonic solution contain A solution with a lower salt concentration than in normal cells

When a cell is placed in a hypotonic solution, the water diffuses into the cell, causing the cell to swell and possibly explode.

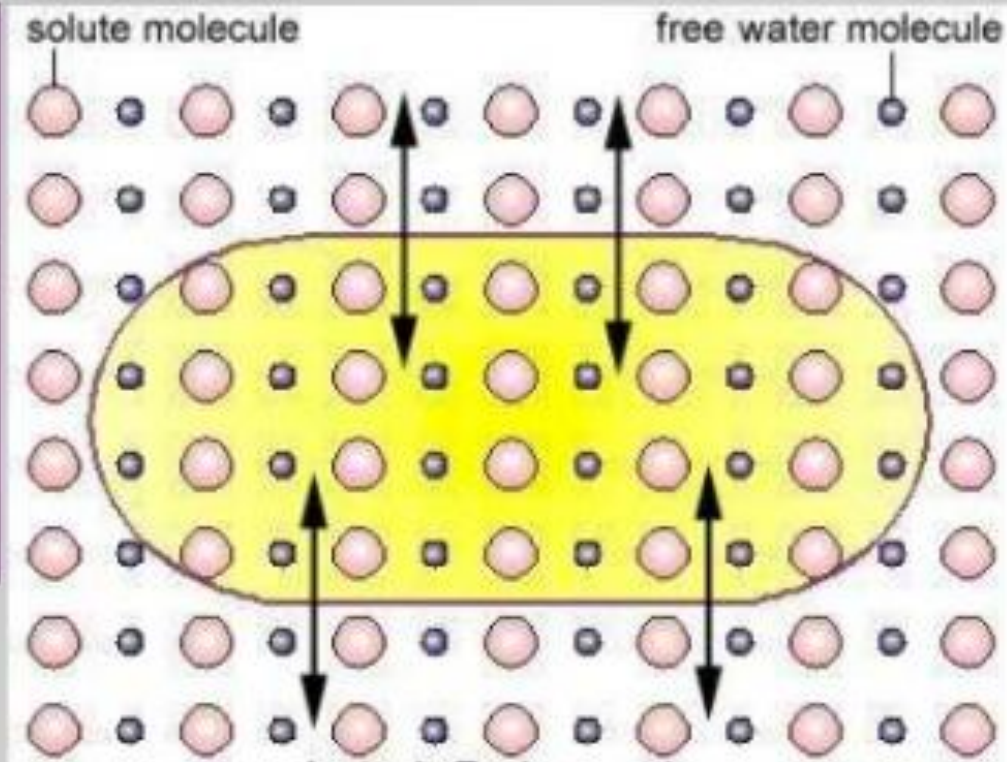


Hypotonic Environment:
The solute concentration is greater inside the cell; the free water concentration is greater outside. Free water flows into the cell.

Isotonic Solution

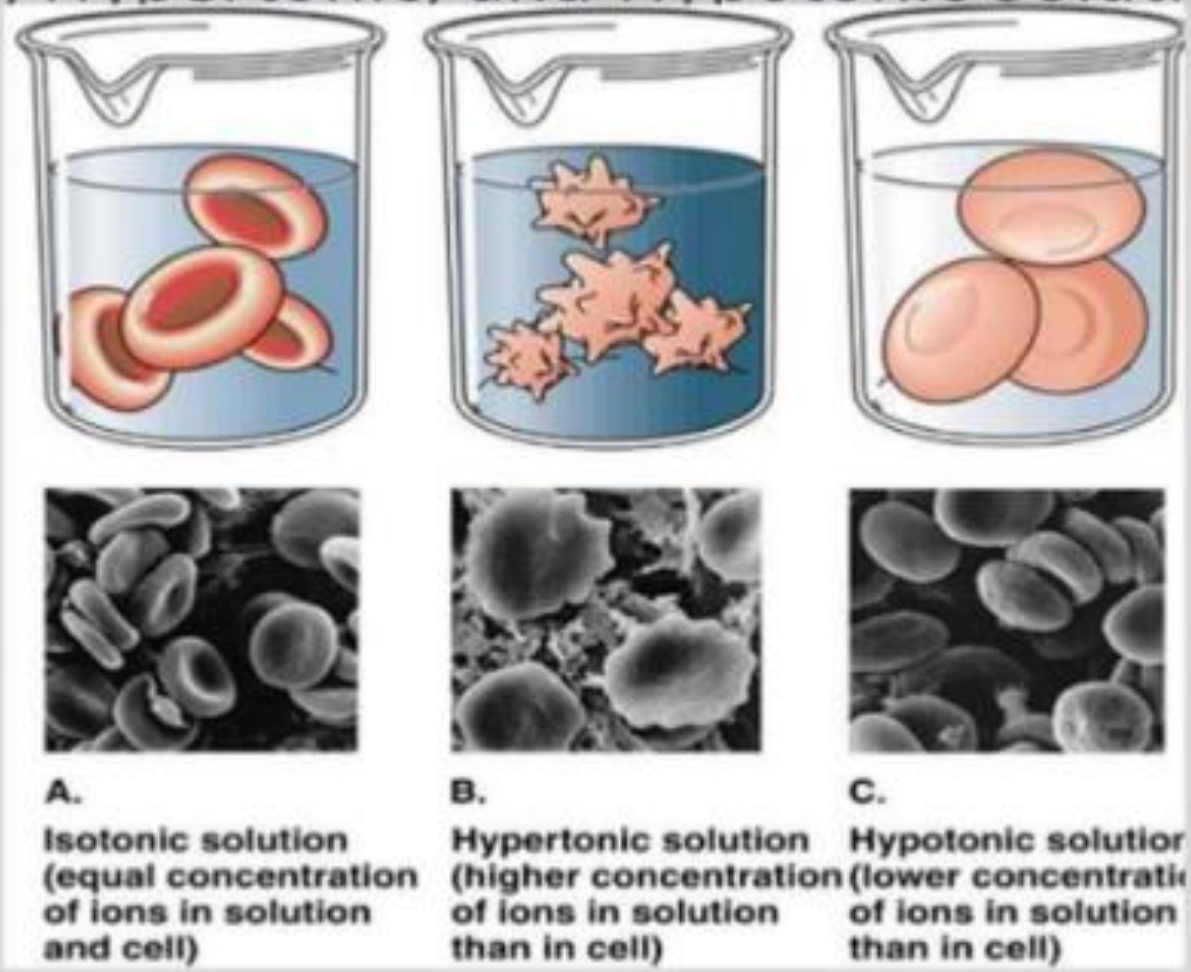
A solution that has the same salt concentration as the normal cells of the body and the blood.

When a cell is placed in an isotonic solution, the water diffuses into and out of the cell at the same rate. The fluid that surrounds the body cells is isotonic.



Isotonic Environment:
The solute concentration and the free water concentration are the same inside and outside the cell.
Water flows in and out of the cell at an equal rate.

Isotonic, Hypertonic, and Hypotonic Solutions



A.
Isotonic solution (equal concentration of ions in solution and cell)

B.
Hypertonic solution (higher concentration of ions in solution than in cell)

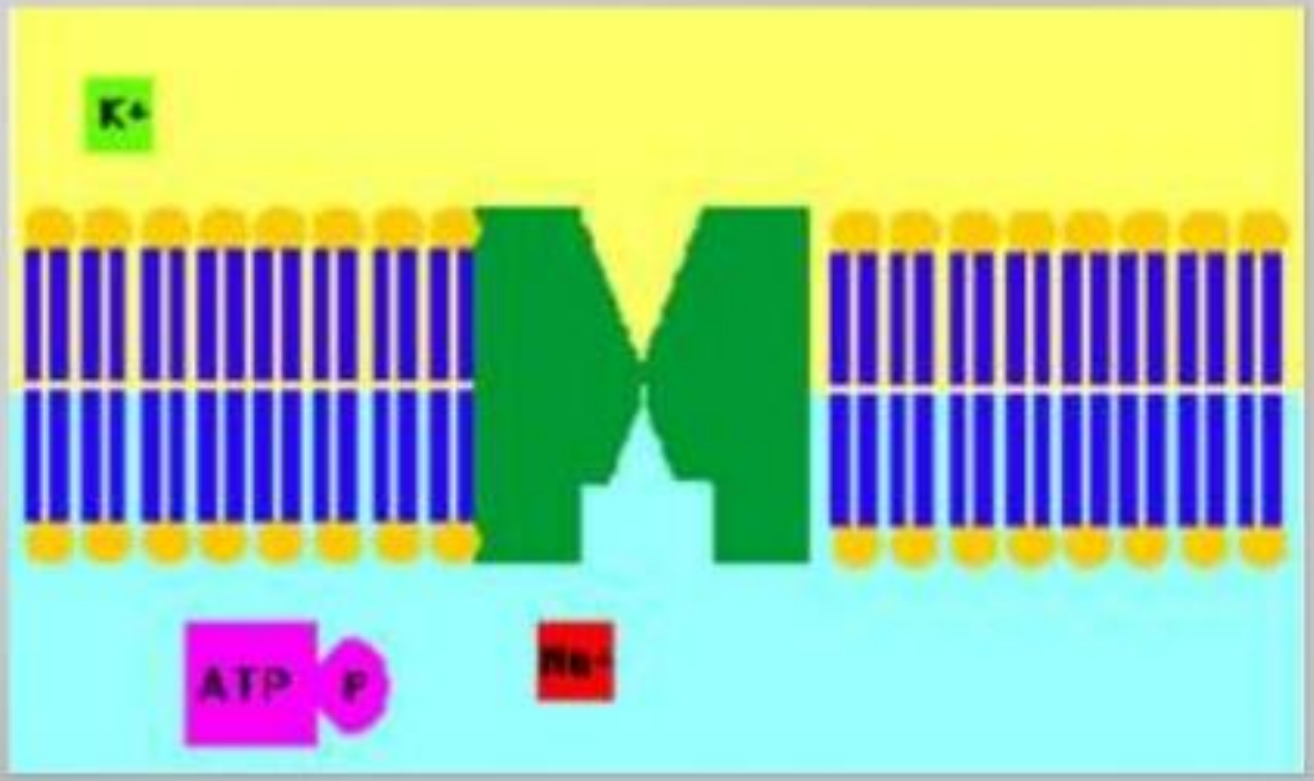
C.
Hypotonic solutior (lower concentrati of ions in solution than in cell)

Active Transport

- Active Transport requires the cell to use energy, usually in the form of ATP.
- Active Transport creates a charge gradient in the cell membrane. For example in the mitochondrion, hydrogen ion pumps pump hydrogen ions into the intermembrane space of the organelle as part of making ATP.

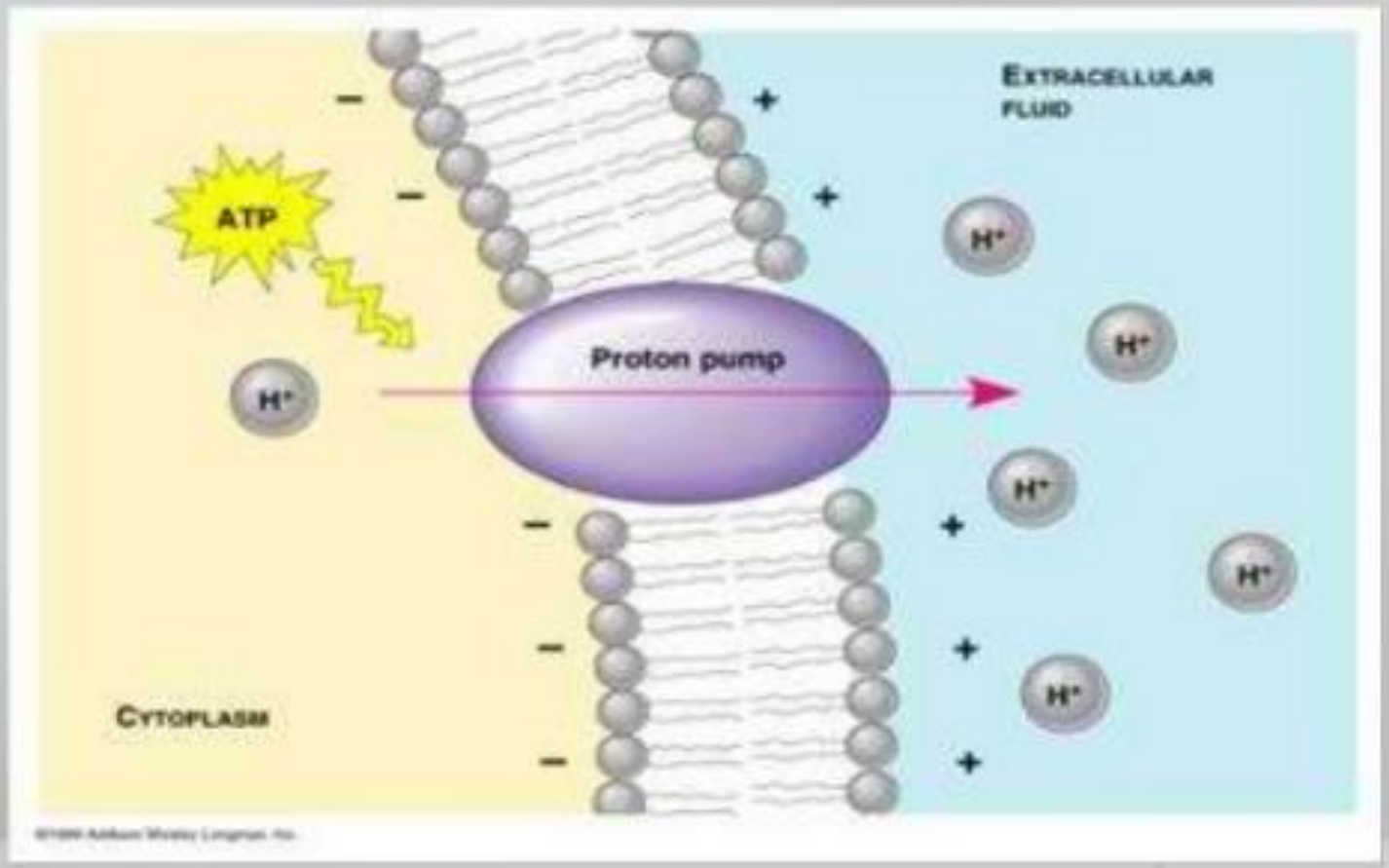
Active Transport

Active Transport keeps unwanted ions or other molecules out of the cell that are able to diffuse through the cell membrane.



Active Transport

- Active transport uses energy to send substances against the direction they would travel by simple diffusion: that is from a region of low concentration to a region of high concentration.

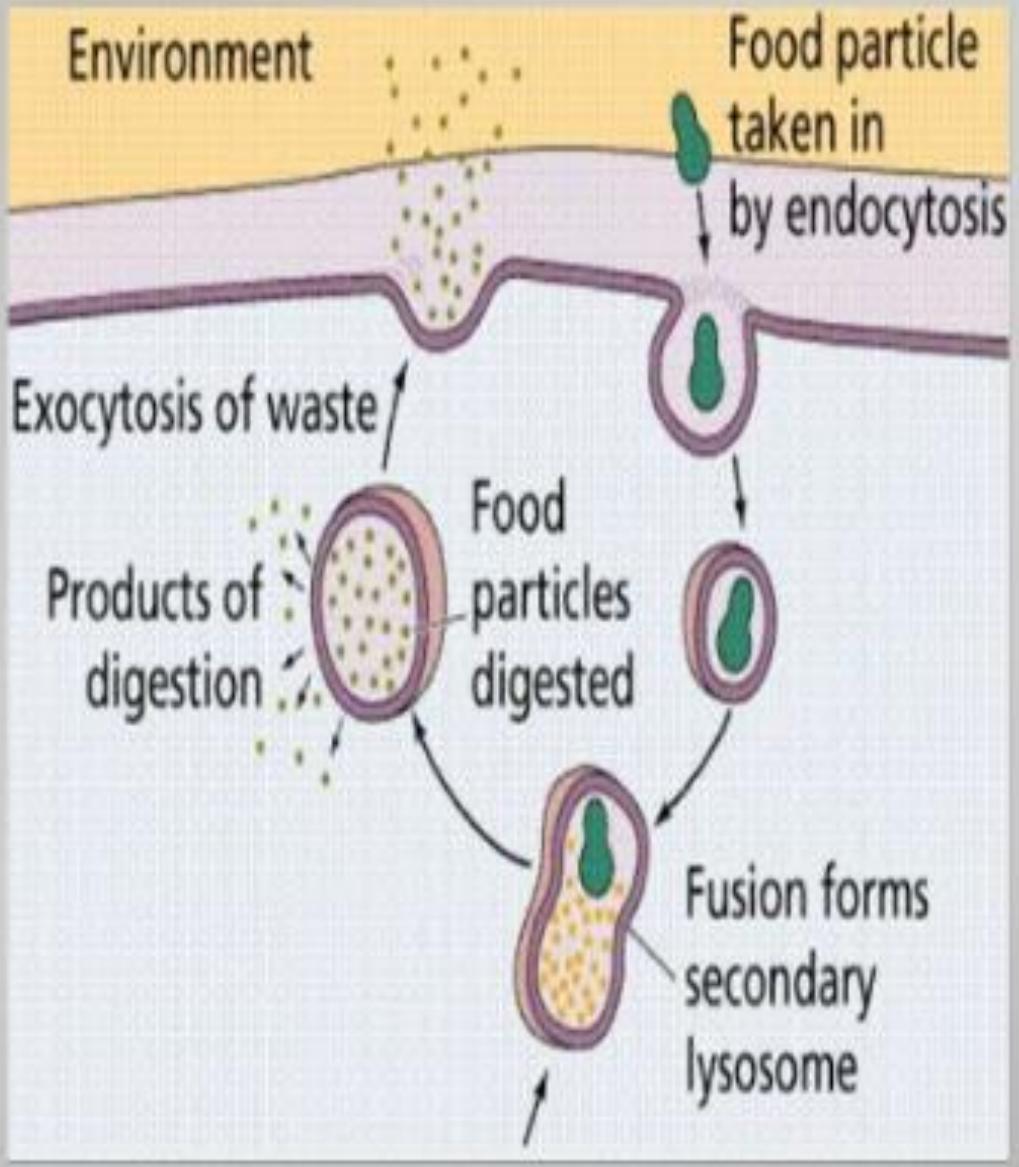


Moving other Materials and Substances into and out of the cell

- ENDOCYTOSIS-Endo (within) cytosis (cell)) is a process in which a substance (e.g. proteins) gains entry into a cell without passing through the cell membrane.

- EXOCYTOSIS-Exo (exit) cytosis (cell)) is a process in which a substance is exited from the cell without passing through the cell membrane.

- Examples of things that migth be exited include secretion of proteins like enzymes, hormones and antibodies.



MOVEMENT THROUGH THE CELL MEMBRANE

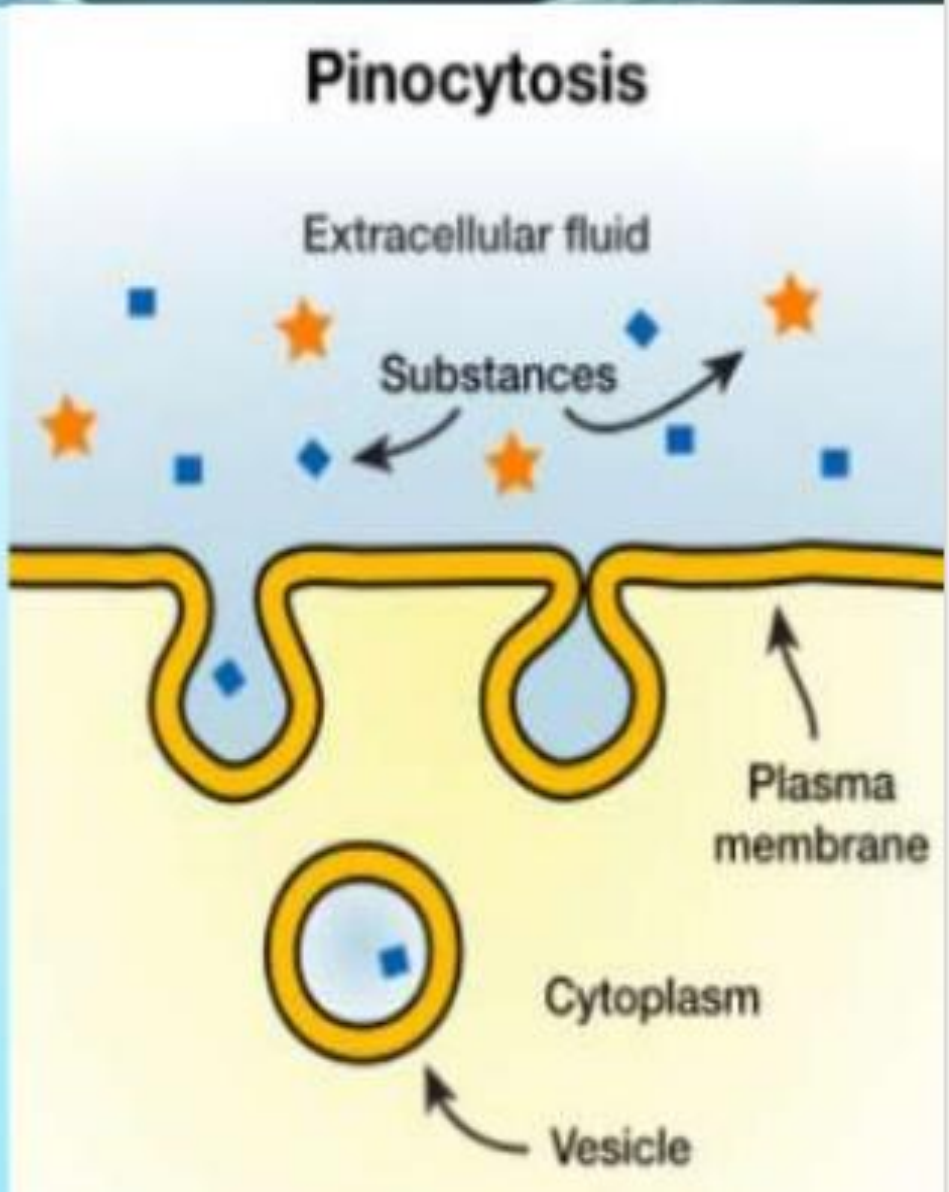
PHAGOCYTOSIS

- A part of the cell membrane that extends around a particle and fuses it into the cell membrane.

MOVEMENT THROUGH THE CELL MEMBRANE

PINOCYTOSIS

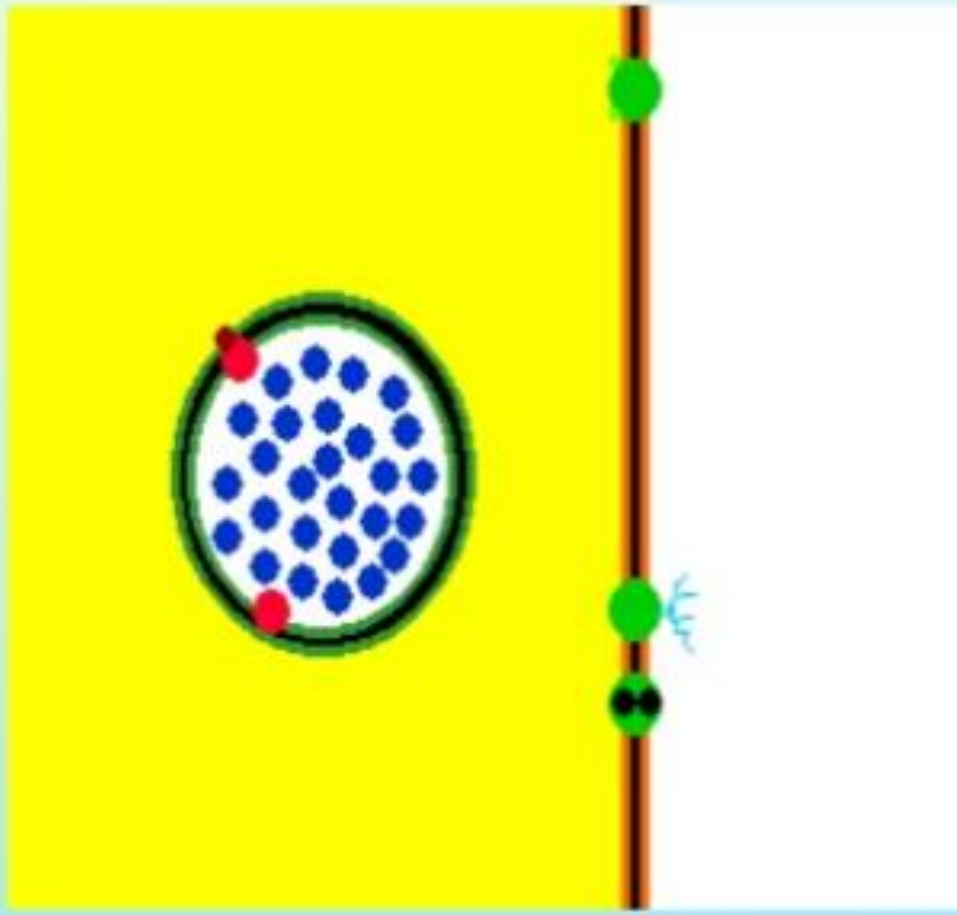
- Forms smaller vesicles and contain liquid rather than particles.



MOVEMENT THROUGH THE CELL MEMBRANE

EXOCYTOSIS

- Allows the release of materials from the cells.



ACTIVITY

- **Give answers of the following.**

i. Name the different shapes of cells.
ii. Name the largest cell and smallest cell.
iii. Define permeability of a cell.
iv. What is passive transport?
v. Define osmosis.
vi. Differentiate between endocytosis and exocytosis.

CLOSURE

- Today we have done the topic----------.
- Movement of molecules against concentration gradient requires energy in the form of---------.
- Movement of molecules into the cell is called----------and out of the cell is called----------.

HOME WORK

- Explain what would happen when a plant and an animal cell is placed in a hypertonic solution.
- State the relationship between cell function and cell structure.

THE END!!!

- Thank you for your cooperation and attention!!
- Hope you learned some new, exciting things.