Eukaryotic cell:
-Plasma membrane (Cell Membrane)

MEDICAL BIOLOGY/L 4

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EUKARYOTIC CELL

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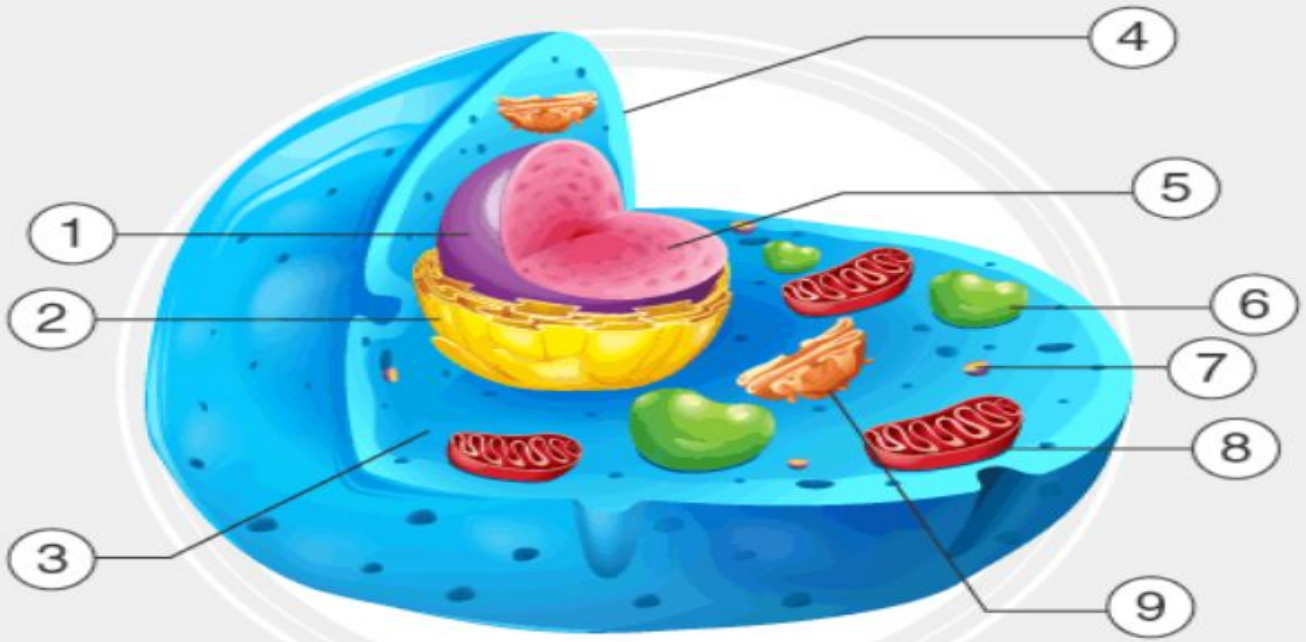


1 Nucleus | 2 Endoplasmatic Reticulum | 3 Cytoplasm | 4 Cell Membrane | 5 DNA

6 Lysosome | 7 Ribosome | 8 Mitochondrion | 9 Golgi Apparatus

Eukaryotic cells

- have a nucleus enclosed within the nuclear membrane and form large and complex organisms. Protozoa, fungi, plants, and animals all have .eukaryotic cells. They are classified under the kingdom Eukaryota

- They can stay alive in different environments with a single cell that allows them to carry out various metabolic reactions. This helps them grow many times larger than the prokaryotic cells (Typical prokaryotic cells range from 0.1 to 5.0 micrometers (μm) in diameter and are significantly smaller than eukaryotic cells, which usually have .diameters ranging from 10 to 100 μm.)

The features/ Characteristics of eukaryotic cells are as :follows

- Eukaryotic cells have the nucleus enclosed within the nuclear .1 .membrane
- .The cell has mitochondria .2
- .Flagella and cilia are the locomotory organs in a eukaryotic cell .3
- .A cell wall is the outermost layer of the eukaryotic cells .4
- .The cells divide by a process called mitosis .5
- .The eukaryotic cells contain a cytoskeletal structure .6
- The nucleus contains linear DNA, which carries all the genetic .7 .information

Structure of Eukaryotic Cell The eukaryotic cell structure•
:comprises the following

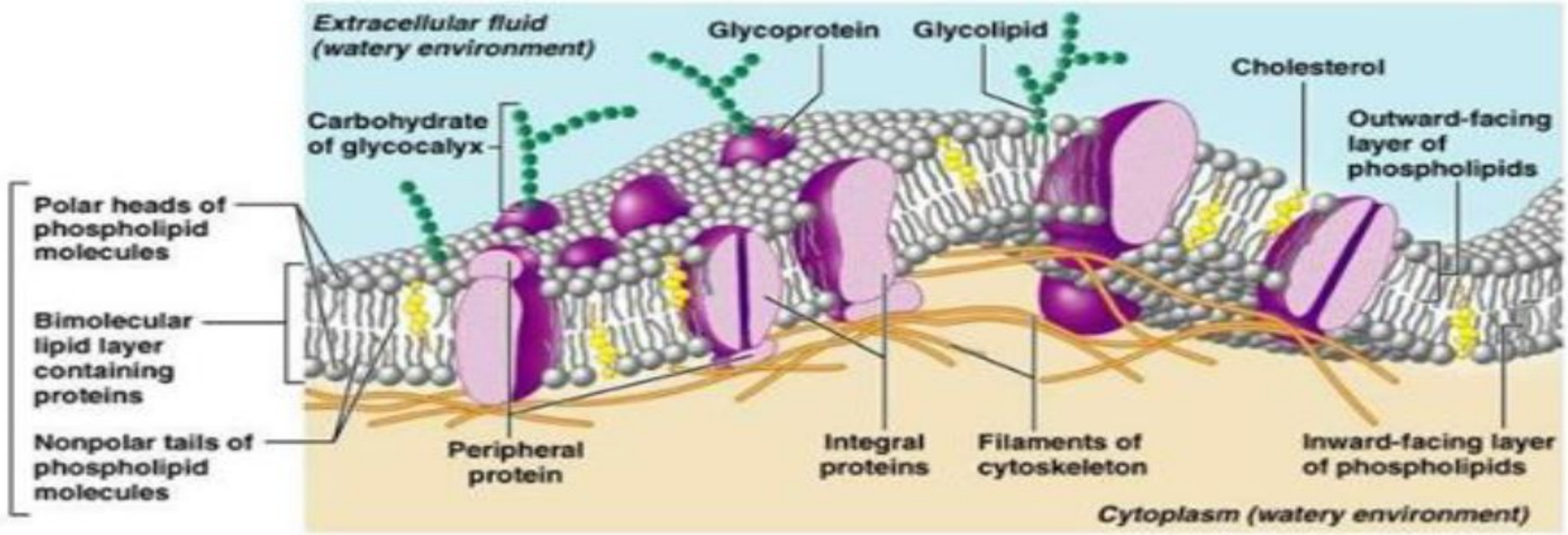
■ Cell Membrane .1►►►•

The cell membrane (plasma membrane) is a thin semi-permeable•
.membrane that surrounds the cytoplasm of a cell

:STRUCTURE►

- The most widely accepted model of plasma membrane structure is the **fluid mosaic model** of Singer & Nicolson (1972). The fluid mosaic model indicates that the cell membrane is not solid. It is flexible and has a similar consistency to vegetable oil. Mosaic refers to something that contains many different parts. The plasma membrane is a mosaic of **phospholipids, cholesterol molecules, proteins and .carbohydrates**

Fluid Mosaic Model



:THE COMPONENTS OF PLASMS MEMBRANE

- **Phospholipids** – The phospholipid bilayer is arranged so that the polar ends of the molecules (hydrophilic heads) form the outermost and innermost surface of the membrane while the non-polar ends .(hydrophobic tails) form the center of the membrane -1

- **Cholesterol** – Found in animal cell membranes and functions to improve stability and reduce fluidity. -2

Proteins – May be either integral (trans-membrane) or peripheral-3 •
:and serve a variety of roles

Channel proteins form pores for the free transport of small * •
.molecules and ions across the membrane

Carrier proteins for facilitated diffusion and active transport of * •
.molecules and ions across the membrane

.**Cell recognition** that identifies a particular cell * •

Receptor proteins that bind specific molecules such as hormones * •
.and cytokines

.**Enzymatic proteins** that catalyze specific chemical reactions * •

Carbohydrate– Carbohydrate groups are present only on-**4**•
the outer surface of the plasma membrane and are attached to
.protein, forming **glycoproteins,** or lipids forming **glycolipids**

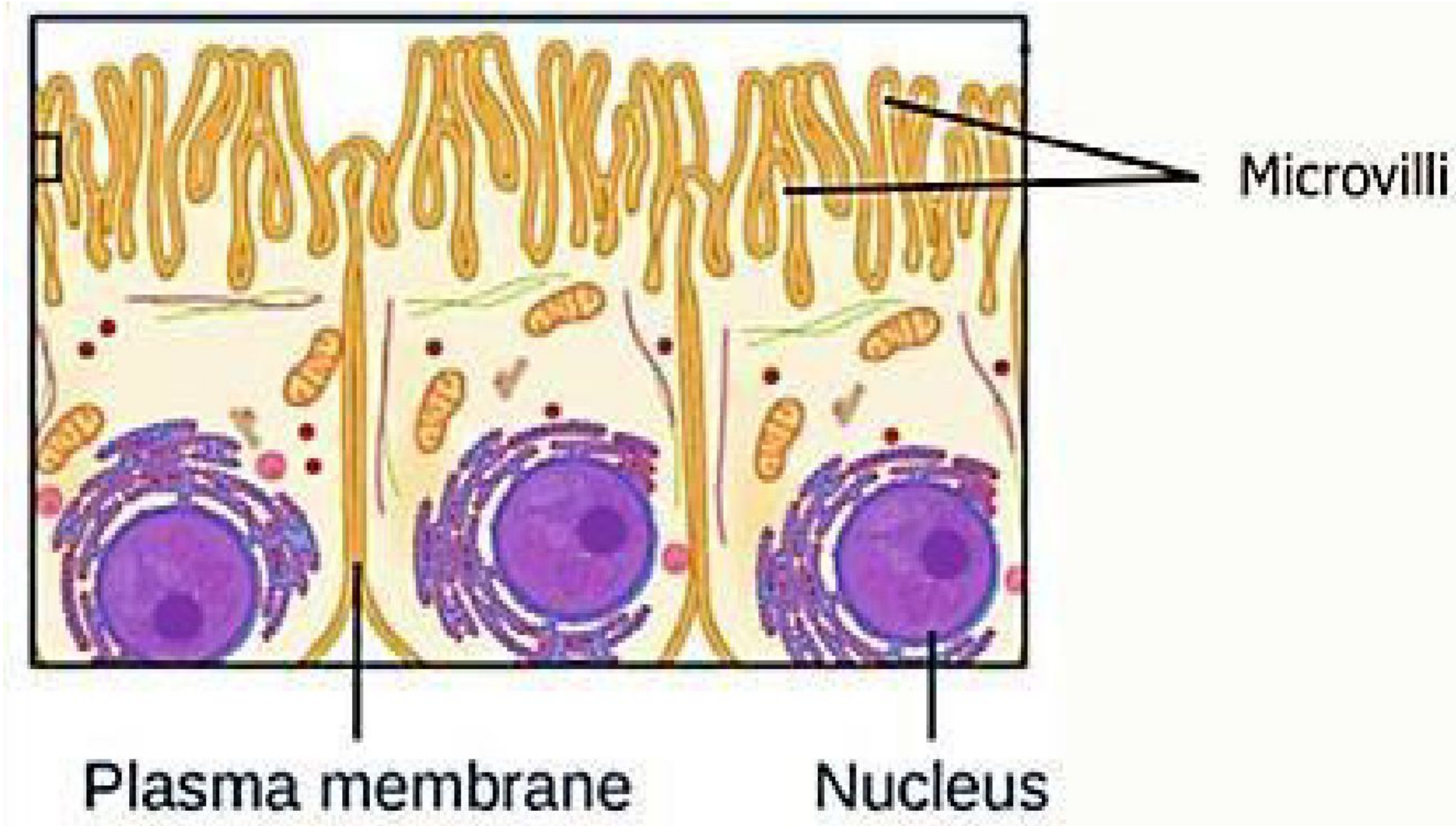
:FUNCTION OF CELL MEMBRANE

- .Isolate the cytoplasm from the external environment .1
- .Regulate the exchange of substance .2
- .Communicate with other cells .3
- .Identification .4
- The cell membrane also plays a role in anchoring the .5 .cytoskeleton to provide shape to the cell

:CELL MEMBRANE SPECIALIZATION

- Some membranes have components that are specialized for a :specific purpose

1. **Microvilli** : Fingers like extensions of plasma membrane that are particularly abundant on the surface of the cells, involved in the .absorption, such as the epithelial cells lining the intestine


Microvilli
Plasma membrane
Nucleus

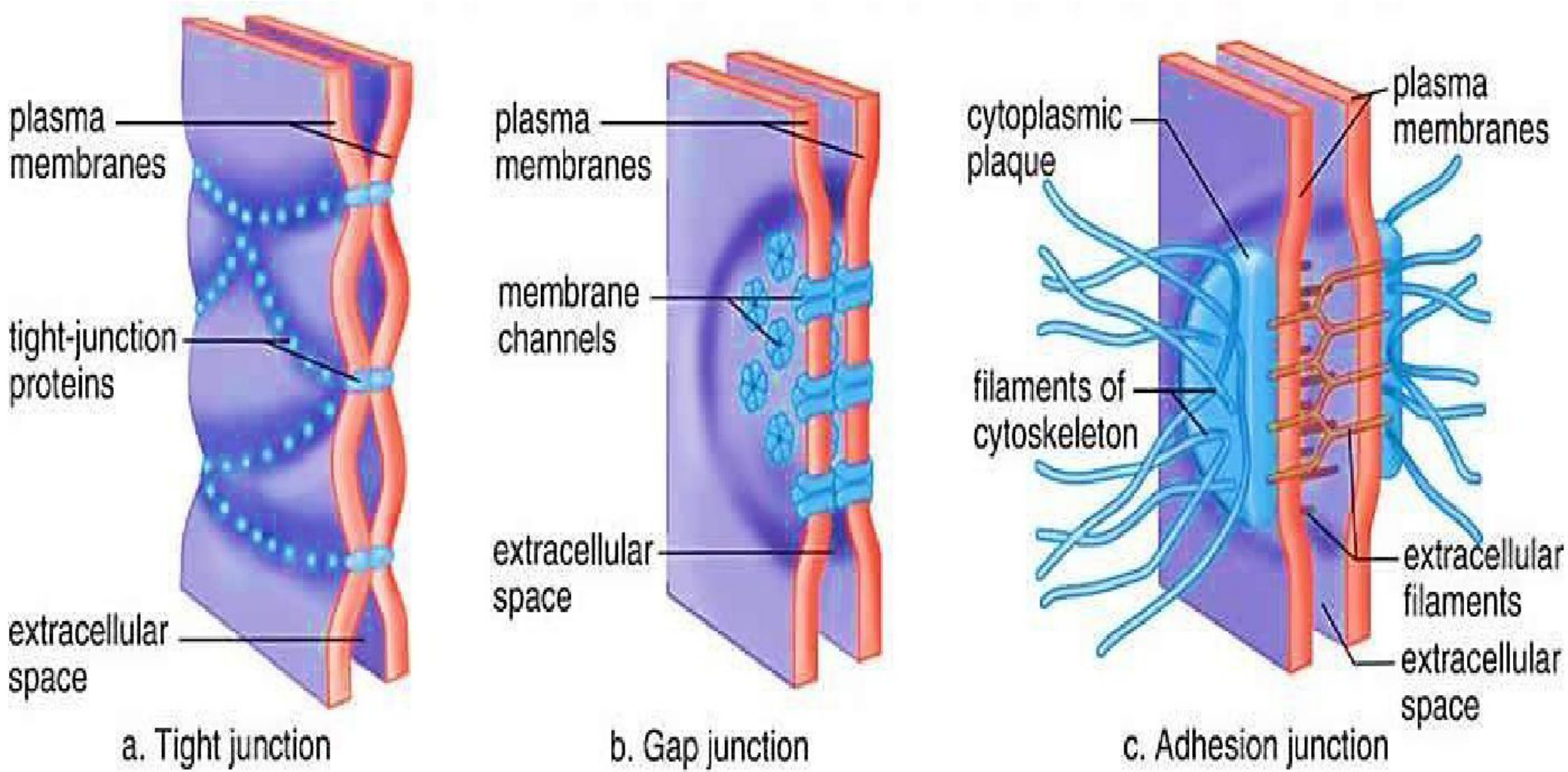
2. Intercellular junctions:

There are three main types of junctions, **tight junctions, gap junctions, and desmosomes.**

- **a) Tight junctions:** are proteins that hold adjacent cells together very tightly so nothing can penetrate between them. Cells that line the digestive and urinary tract contains many tight junctions to ensure the contents within .those hollow organs do not leak out into the outer layers or body cavity

- **b) Gap junctions:** are channels between neighboring cells for transport of ions, water, and other substances. Cells that contain gap junctions are found .within the heart muscle & smooth muscle

- **c) Desmosomes:** these junctions hold cells together by fibers, which allows movement without separation. Cells that contain desmosomes are found .within the muscle tissue and the skin


plasma membranes
tight-junction proteins
extracellular space
a. Tight junction
plasma membranes
membrane channels
extracellular space
b. Gap junction
cytoplasmic plaque
plasma membranes
filaments of cytoskeleton
extracellular filaments
extracellular space
c. Adhesion junction

Movement across Cell Membranes

- The movement of substances across the membrane can be either **"passive",** occurring without the input of cellular energy, or **"active"**, requiring the cell to expend energy in transporting it. There are two ways in :which substances can enter or leave a cell

Passive ways (1

ffusion

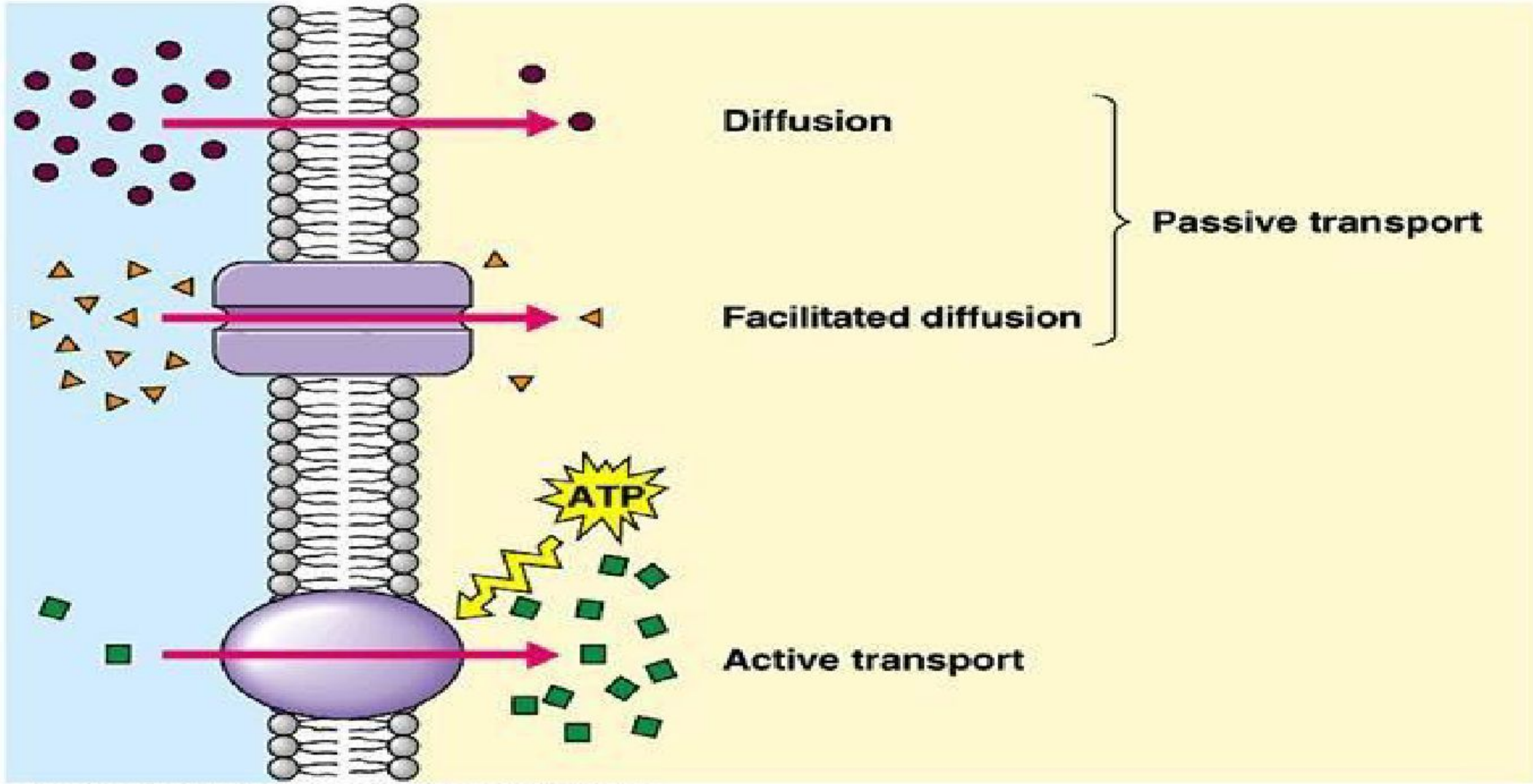
b) Facilitated Diffusion

c) Osmosis (water only)

Active ways (2

a) Active Transport

b) Vesicle Transport



Passive ways (1

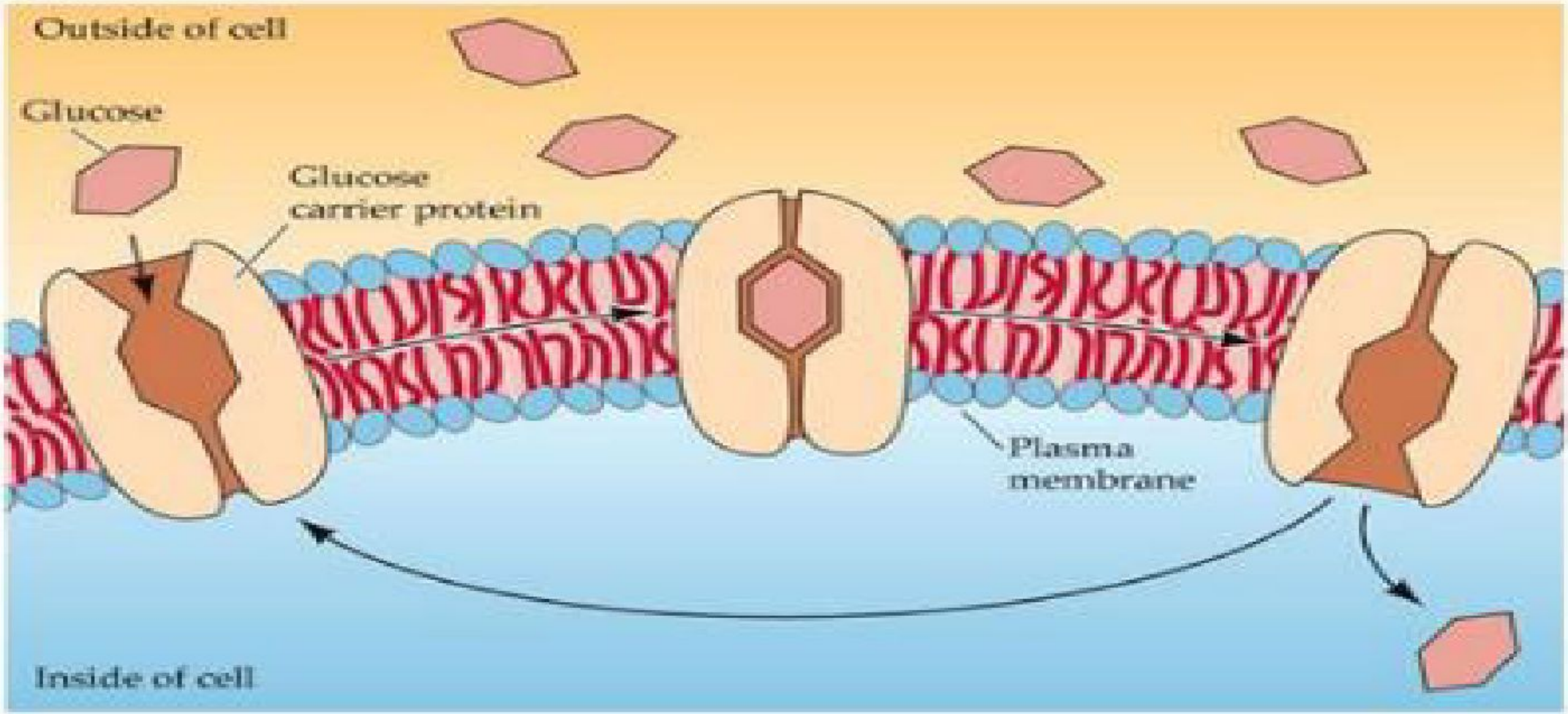
a. Diffusion

Diffusion is the net passive movement of particles (atoms, ions or molecules) from a region in which they are in higher concentration to regions of lower concentration. It continues until the concentration of substances is uniform .throughout. An example: gas exchange for respiration

b. Facilitated Diffusion

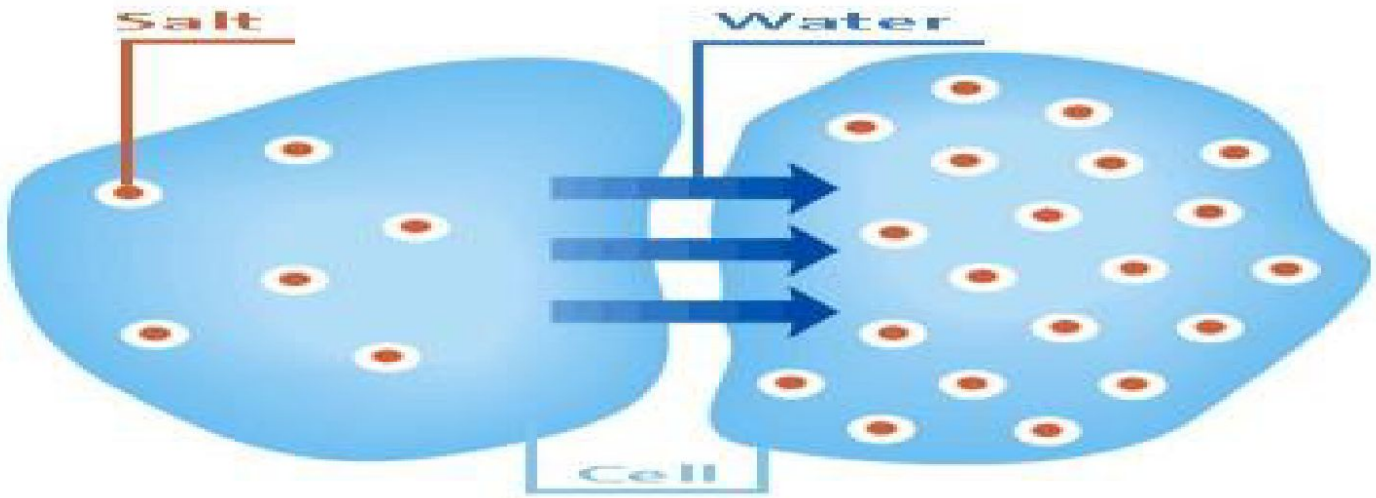
Facilitated diffusion is a type of diffusion in which the molecules move from the region of higher concentration to the region of lower concentration assisted by **a carrier protein** . It is passive and requires no energy from the cell. Common molecules entering/leaving cells this way include glucose and .amino-acids

(a)


Outside of cell
Glucose
Glucose carrier protein
Plasma membrane
Inside of cell

c. Osmosis

Osmosis is a special example of diffusion. It is the diffusion of water through a partially permeable membrane from a more dilute solution to a more concentrated solution.

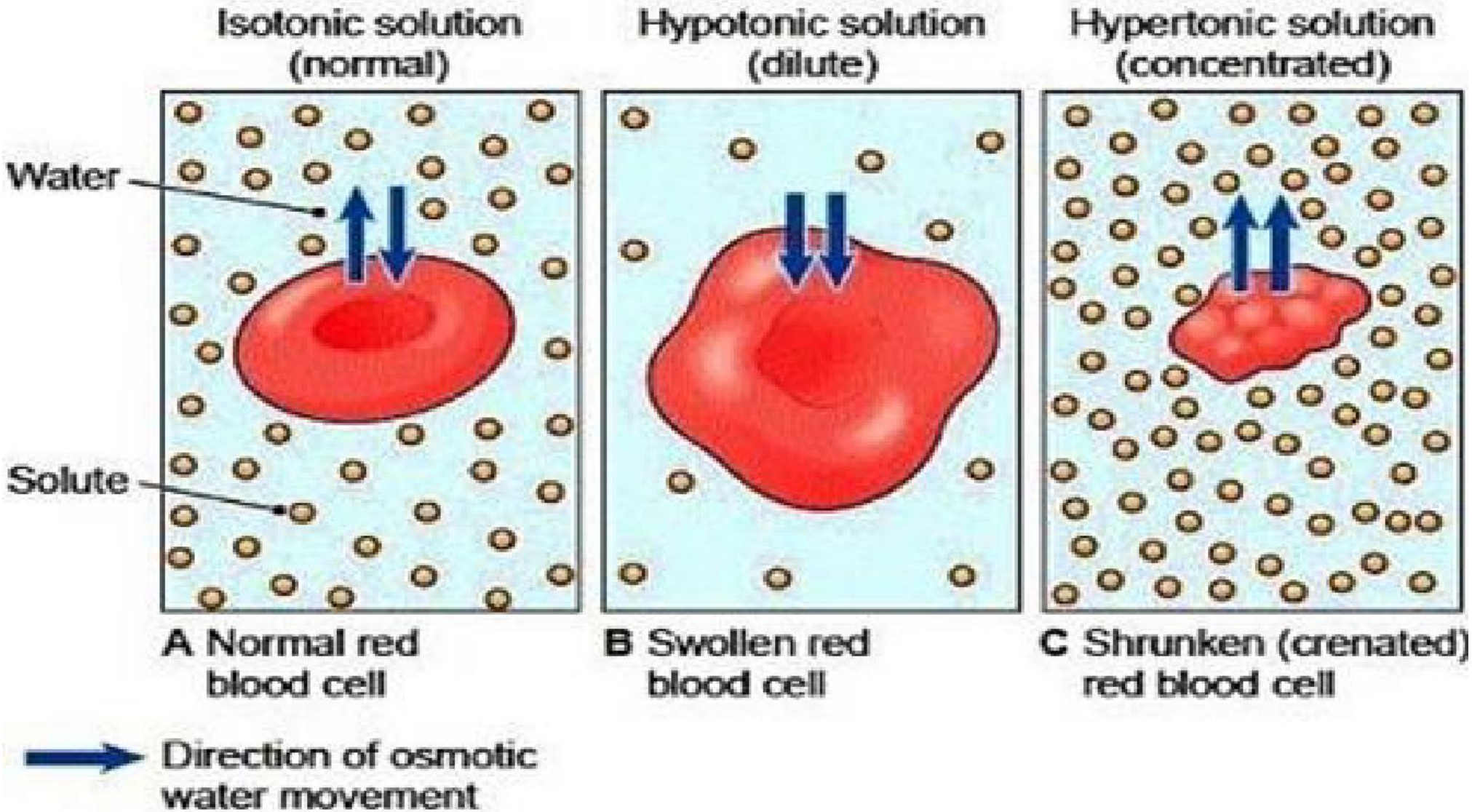


When an animal cell (for example, the red blood cell) is placed in a • medium, which is a water solution, the possible consequences are :listed below

If a cell is placed in **a hypertonic solution**, water will leave the cell, * • .and the cell will shrink

If a cell is placed in an **isotonic solution,** there is no net water * • .movement, so there is no change in the size of the cell

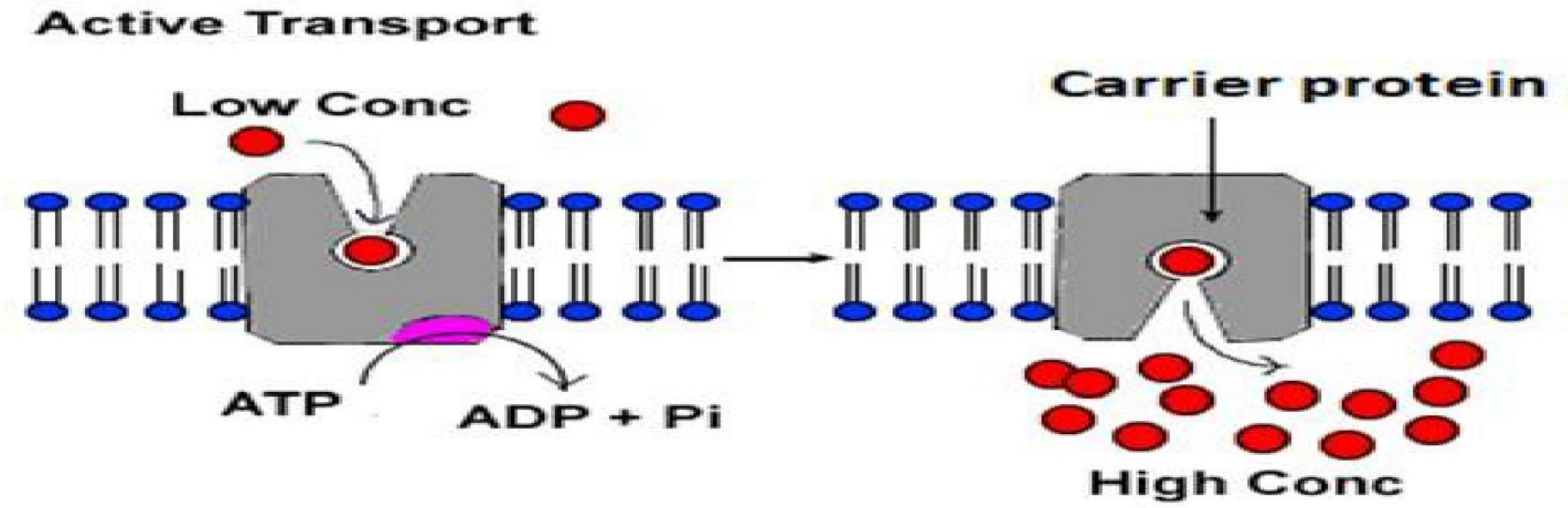
When a cell is placed in **a hypotonic solution**, water will enter the * • .cell, and the cell will swell


Isotonic solution
(normal)
Hypotonic solution
(dilute)
Hypertonic solution
(concentrated)
Water
Solute
A Normal red blood cell
B Swollen red blood cell
C Shrunken (crenated) red blood cell
Direction of osmotic water movement

Active ways (2

a. Active Transport

Active transport is the energy-demanding transfer of a substance • across a cell membrane, from lower concentration to higher concentration. Special proteins within the cell membrane act as **.carrier proteins**



b. Vesicle Transport

Some molecules or particles are just too large to pass through the plasma • membrane or to move through a transport protein. Vesicles or other bodies in the cytoplasm move macromolecules or large particles across the plasma membrane. So cells use two other active transport processes to move these macromolecules .(large molecules) into or out of the cell

Endocytosis is the process of capturing a substance or particle from outside the **.1** • cell by engulfing it with the cell membrane. **There are two main kinds of :endocytosis**

a* Pinocytosis ('cell drinking') This is the uptake of large molecules (DNA, • protein) from solution, by a form of endocytosis – the vesicles formed are minute .and short-lived

b* Phagocytosis ('cell eating') This is the uptake of solid particles by a cell e.g., • .Phagocytes engulfing bacteria

Exocytosis describes the process of vesicles fusing with **.2•** the plasma membrane and releasing their contents to the outside of the cell. Exocytosis occurs when a cell produces substances for export, such as a protein, or when the cell is .getting rid of a waste product or a toxin