MAMMOTH

SCIENCE

Unit 4 - Cellular Transport & Homeostasis

- *Know that one way cells maintain homeostasis is by controlling the movement of substances across their cell membrane.*
- *Know that the concentration gradient is a difference in the concentration of a substance across a space*
- *Explain diffusion as the movement of a substance from an area of high concentration to an area of lower concentration caused by the random motion of the particles of the substance.*

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Menu

Homeostasis & The Cell Membrane

Cell Membrane Structure

Movement of Materials - Passive vs Active Transport

Types of Solutions - Summary

Homeostasis & The Cell Membrane

Cellular Transport Processes

I. Homeostasis

B. Homeostasis is the maintaining the same internal state when the external is changing.

C. Example

4. Sweating maintains proper body temperature.

V. Homeostasis & the Cell Membrane

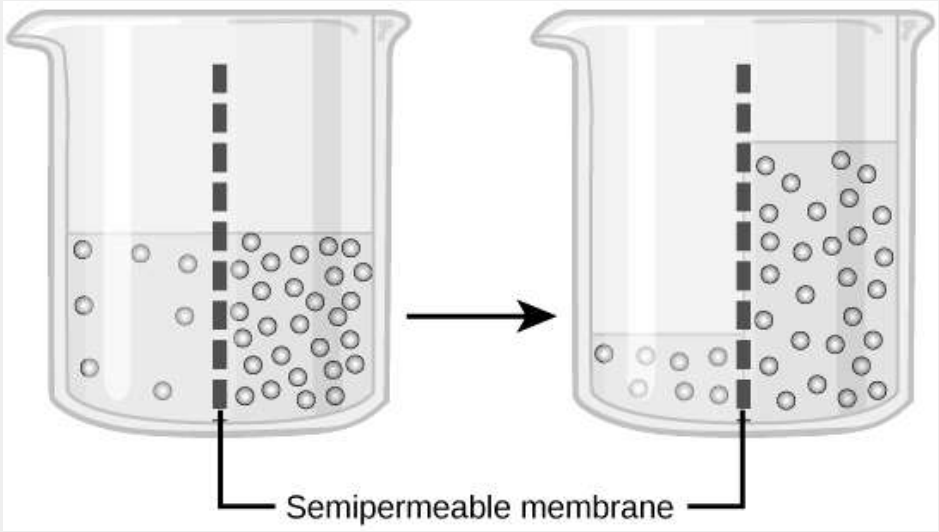
F. The cell membrane maintains cell homeostasis by being **semi-permeable**.

7. Semi-permeable: allows only some substances through under specific conditions

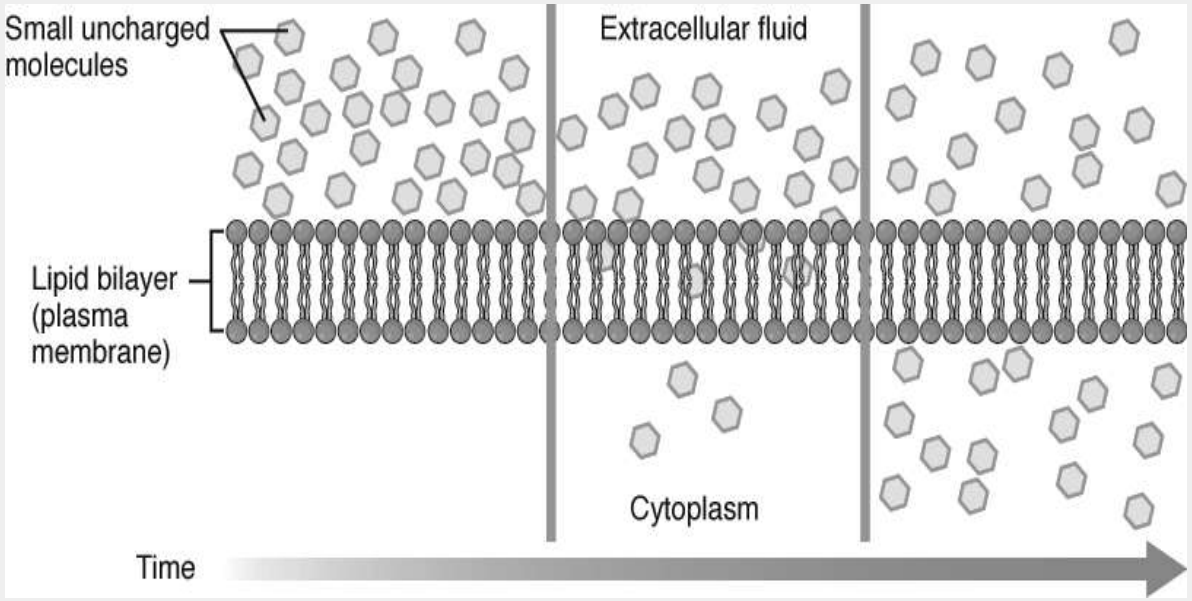
8. Permeable: allows all substances to pass through

9. Impermeable: does not allow any substance to pass through

J. Semi-Permeable membranes are membranes that allow some substances to pass through, but not others.



Concentration Gradient



1. Sets up a **concentration gradient** – whereby the amount of solute on one side of the membrane will differ from the amount on the other.

B. Why?

3. Cells need to get rid of wastes while keeping other molecules in.

   d. Endocytosis – take in or ingest nutrients

   e. Exocytosis – to release or remove waste

2. Likewise, they must let things in (like nutrients) while keeping others out (like toxins).

Structure of the Cell Membrane

01

Phospholipids

III. Structure of the Cell Membrane

A. The cell membrane is a phospholipid bi-layer

2. ***Phospho*** = phosphate heads

c. Hydrophilic – "water loving"

4. Lipid = fatty acid tail

e. Hydrophobic – "water scared"

6. ***Bi*** = two

02

Membrane Proteins

B. Membrane Proteins

1. Each layer is made up of a sheet of lipid (fat) molecules
2. with protein molecules embedded (Like raisins in a slice of raisin bread) in the lipid bi-layers.

03

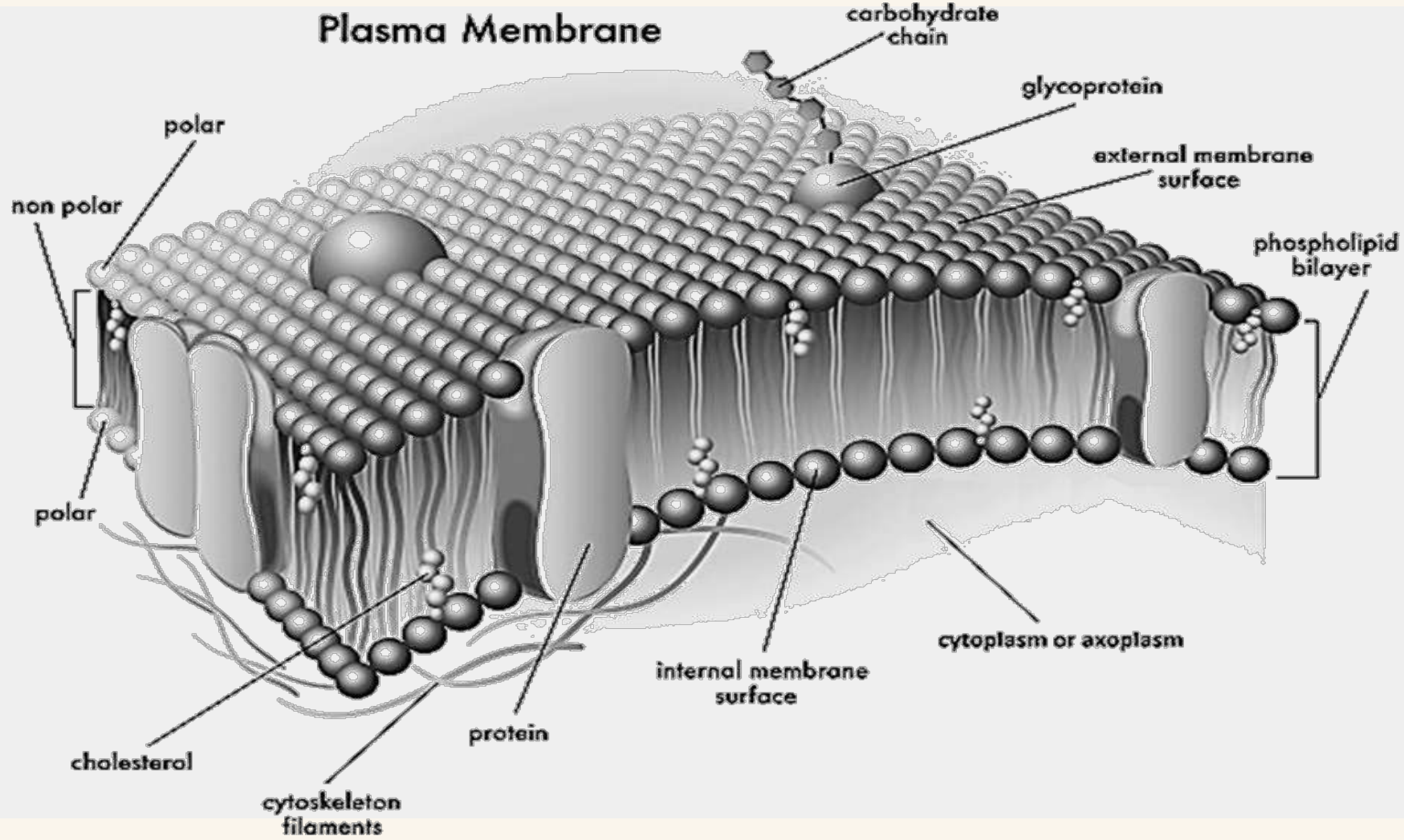
Types

a. Carrier Proteins allow substances that are too large to fit through the bi-layer into the cell

b. Receptor proteins - Receptors are protein molecules, embedded in either the plasma membrane (cell surface receptors) or the cytoplasm or nucleus (nuclear receptors) of a cell, to which one or more specific kinds of signaling molecules may attach.

c. Channel Proteins - are pore-forming proteins that help establish and control the voltage gradient (charge) across the plasma membrane of cells by allowing the flow of ions down their ***electrochemical gradient***

Phospholipid Bilayer



Passive Transport - 3 Forms

A. Types of Transport – Passive Transport: the movement of substances across a cell membrane without the use of energy (ATP)

b. Diffusion

3. Movement of particles/ "Stuff" from more concentrated to an area of lesser concentration.
4. Particles tend to distribute themselves evenly within a solution
5. Occurs until equilibrium is reached
6. An example of diffusion

G. Spraying perfume in an area. It is very strong in that area at first, and then it spreads out through the room and is not as strong.

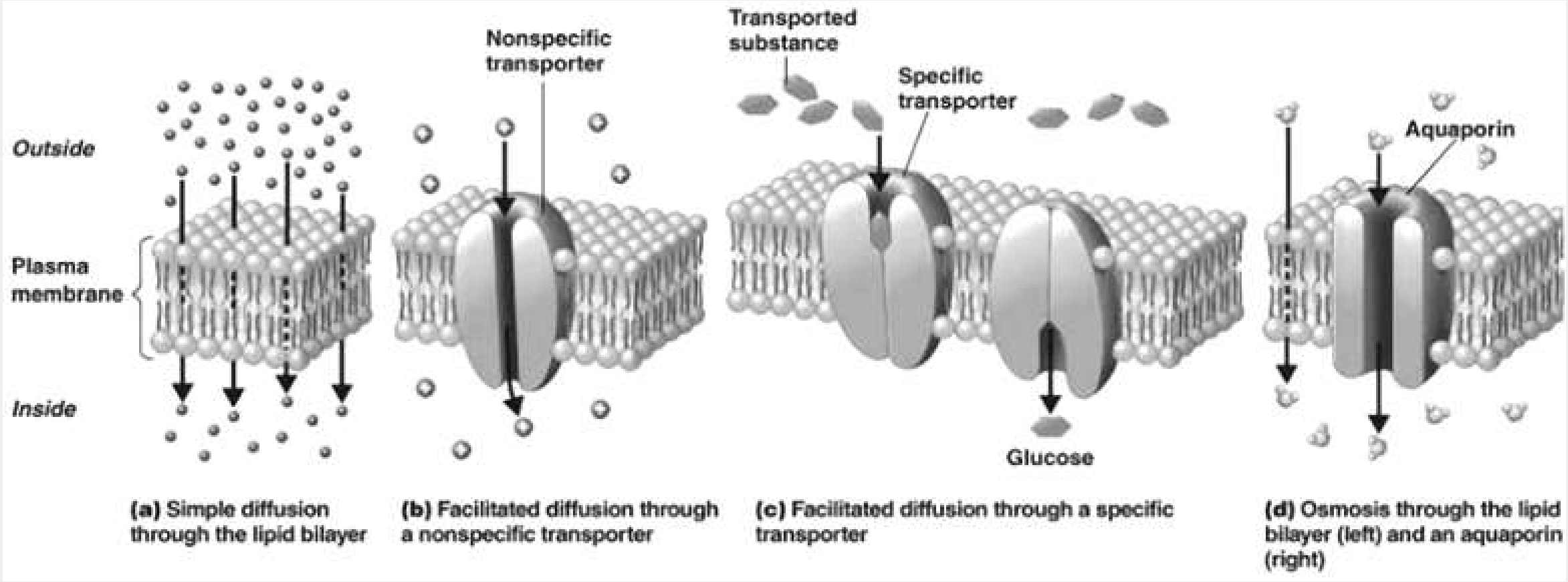
b. Facilitated Diffusion – the transport of substances through a cell membrane along a concentration gradient with the aid of carrier proteins.

1. No energy
2. Needs a Protein

c. Osmosis

1. The diffusion of **water** molecules.
2. Water molecules move from an area of high concentration to an area of low concentration.
3. Osmosis is when water moves from an area of LOW solute concentration (low osmolarity) to an area of HIGH solute concentration (high ***osmolarity***) through a semipermeable membrane.
4. Osmosis is one of the most important ways that plants and animals achieve homeostasis. Keeping the body's conditions stable makes it possible for living things to survive.
5. Osmosis plays an important role in the human body, especially in the gastro-intestinal system and the kidneys. Osmosis helps you get nutrients out of food. It also gets waste products out of your blood.

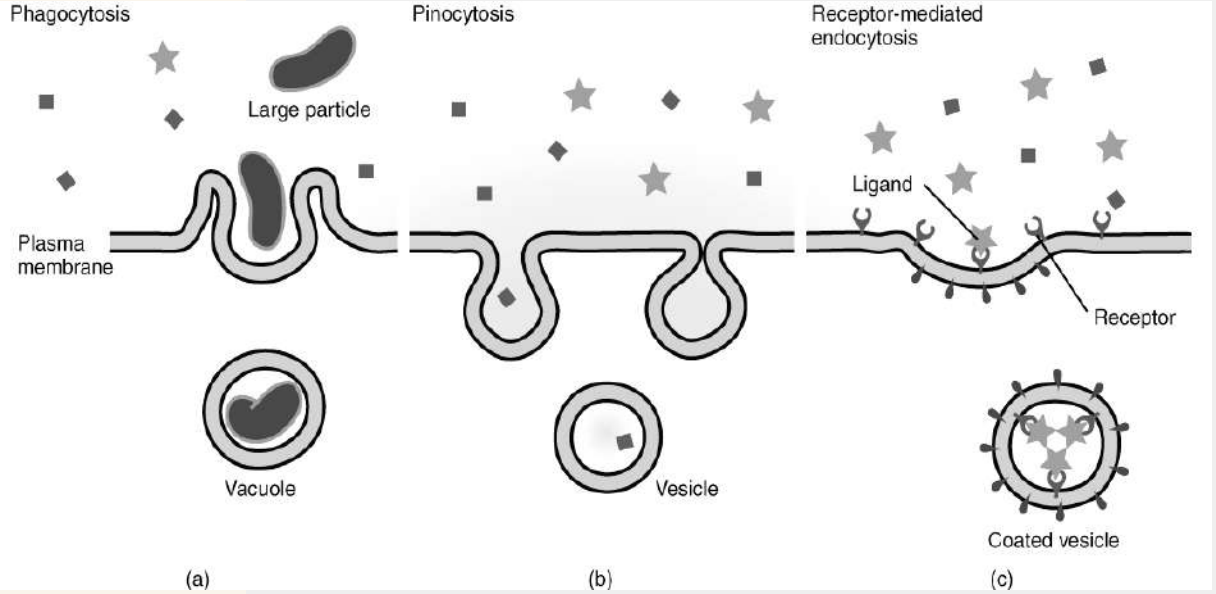
Passive Transport

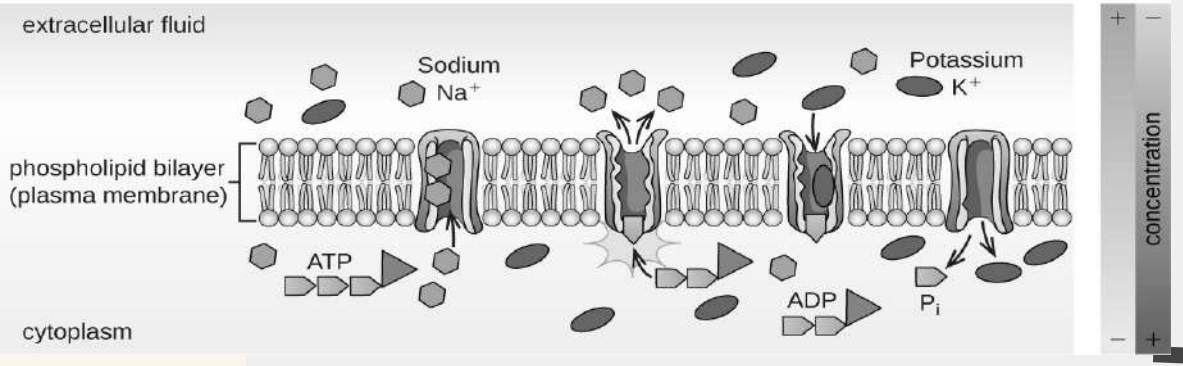


Active Transport

b. Active Transport: the movement of substances across a cell membrane, against a concentration gradient and requires the cell to use energy (ATP)

1) Requires a membrane protein
2) Examples:
   - **c) Endocytosis**:
     - **Receptor Mediated Endocytosis**
     - **Pinocytosis** – "cell drinking"
     - **Phagocytosis** – "cell eating"





Solution Types

01

Hypotonic - hypo" = below/low

2. **Hypotonic solutions**
   a) A **hypotonic solution** is a solution whose solute concentration is lower than the solute concentration inside a cell
   b) Example: Distilled water
      3) High concentration of water = outside
      4) Low concentration of water = inside
      5) So the water will flow from outside to inside a cell
      6) Cell will burst

02

Hypertonic - "hyper" = excessive

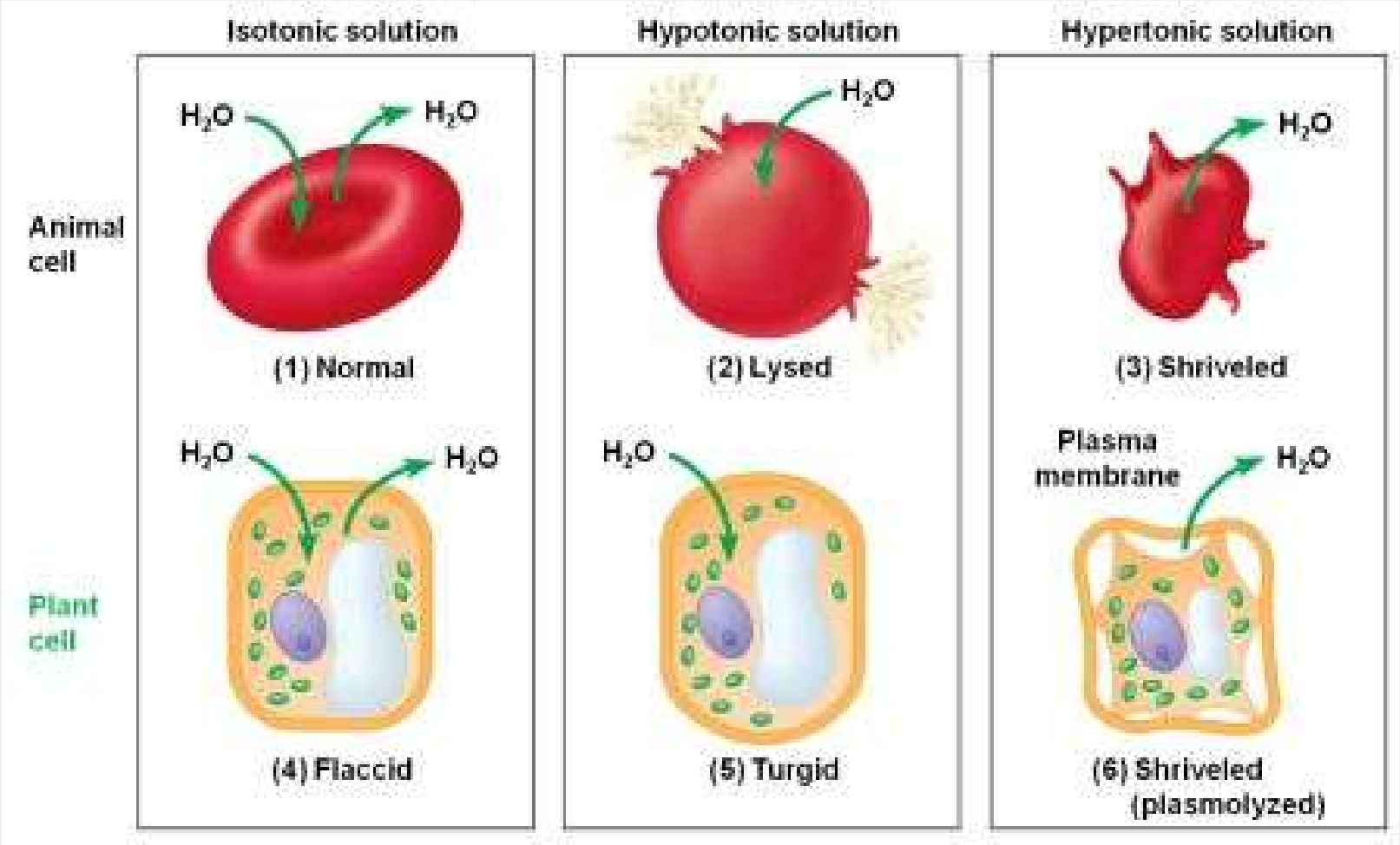
3. **Hypertonic solutions**
   a) A **hypertonic solution** is a solution whose solute concentration is higher than the solute concentration inside the cell.
   b) Example: Salt Water…the ocean!
      3) High concentration of water = inside
      4) Low concentration of water = outside
      5) So the water will flow from inside to outside the cell
      6) Cells will shrivel. Think Dehydration

03

Isotonic - "iso" = equal

4. **Isotonic solutions**
   a) An **isotonic solution** is a solution whose solute concentration outside the cell is equal to the solute concentration inside the cell.
   b) Cells are in **equilibrium**: concentrations do not change, but materials still move in and out of the cell
   c) Example: Our blood!

Tonic solutions Effect on Cells



Thank you!

Do you have any questions?

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