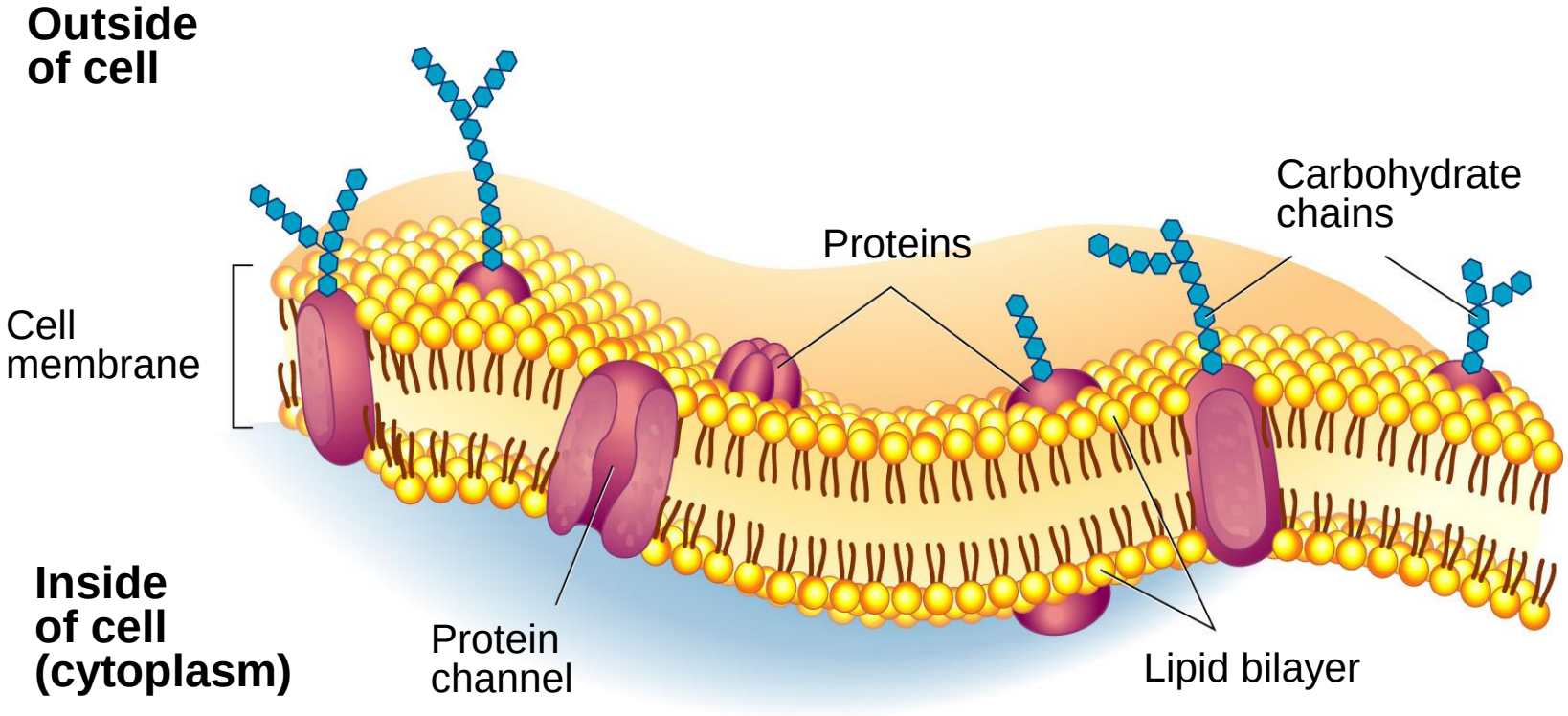
Cell Boundaries
Section 7-3

- The most important parts of a cell are its borders, which separate the cell from its surroundings.
- The cell membrane is a thin, flexible barrier that surrounds all cells.
- The cell wall is a strong supporting layer around the cell membrane found only in plant cells.

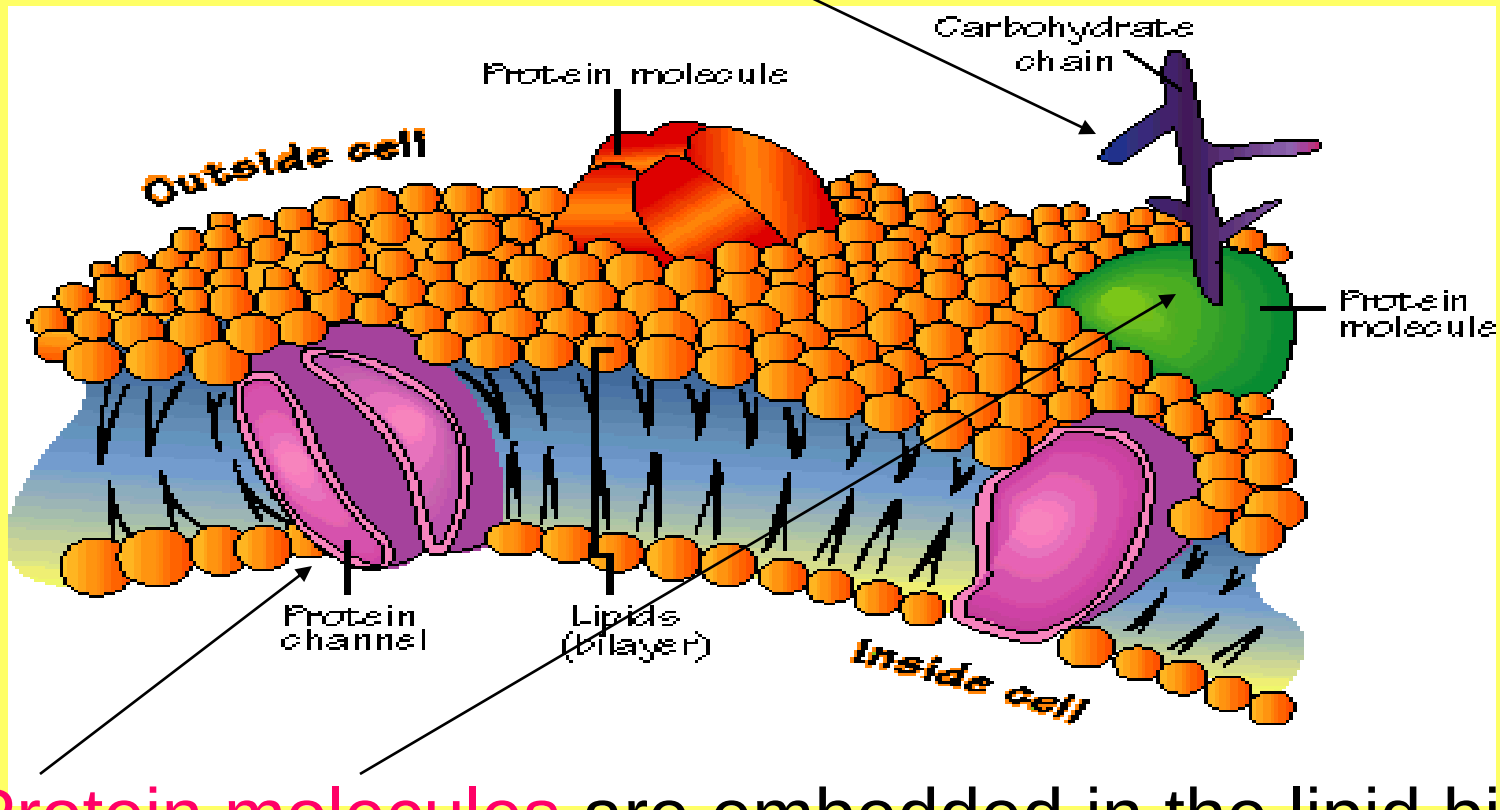
Cell Membrane

- The cell membrane regulates what enters and leaves the cell and also provides protection and support.



- A lipid bilayer is a double-layered sheet, which composes nearly all cell membranes.

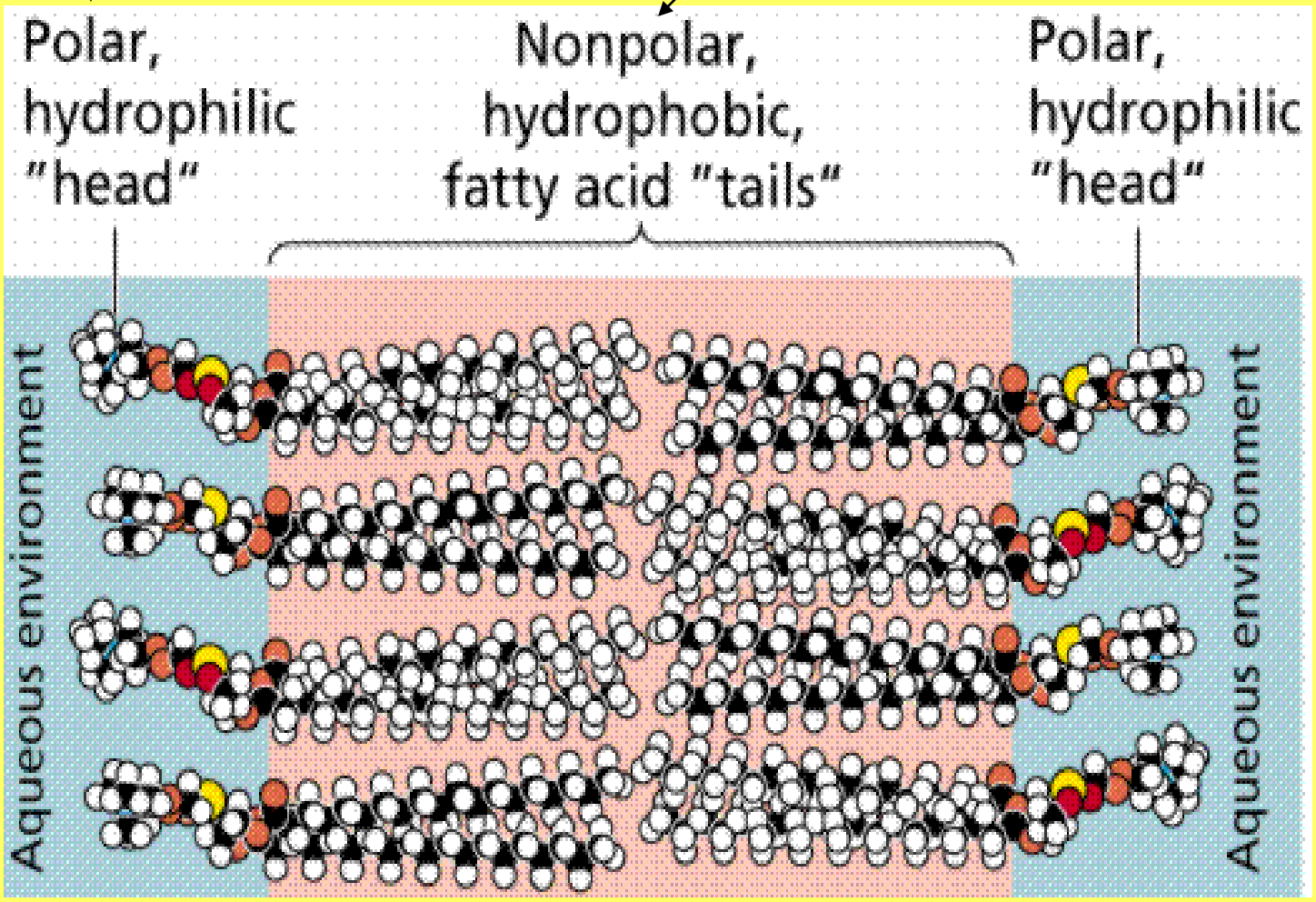
➢Carbohydrate molecules resemble tails.



➢Protein molecules are embedded in the lipid bilayer.

Outer Part
"Water Loving"

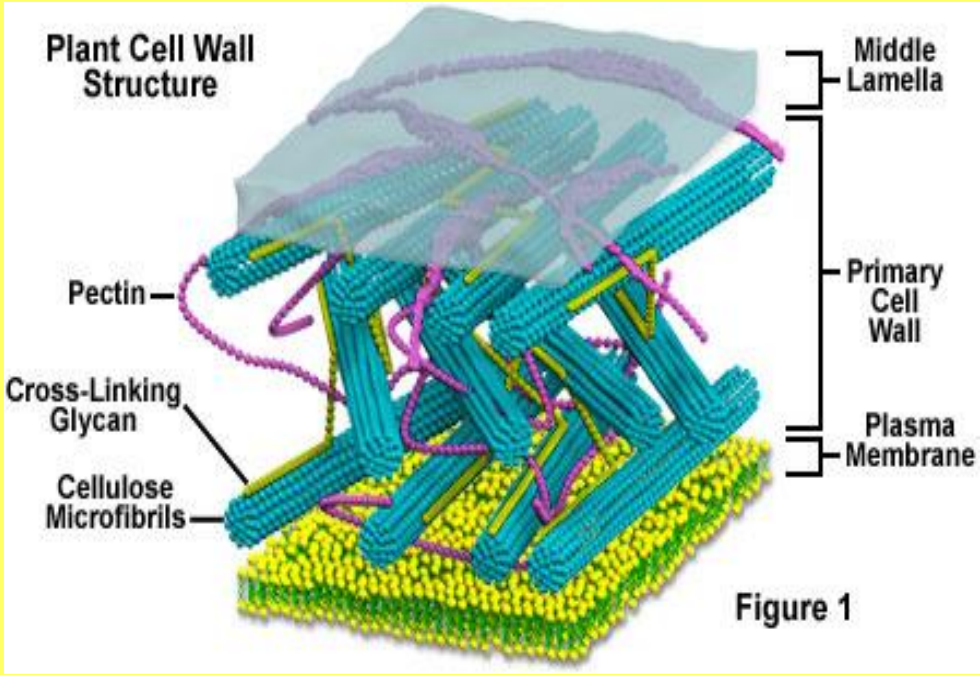
Inner Part
"Water Fearing"



Cell Wall

- Present in plants, algae, fungi, many prokaryotes
- Lie outside the cell membrane and are porous to allow H_2O, O_2, CO_2 and other substances to pass.
- Main function is to provide support and protection for the cell.

- Plant cells are mostly cellulose, a tough carbohydrate fiber.



Diffusion Through Cell Boundaries

- Every living cell exists in a liquid environment that it needs to survive.

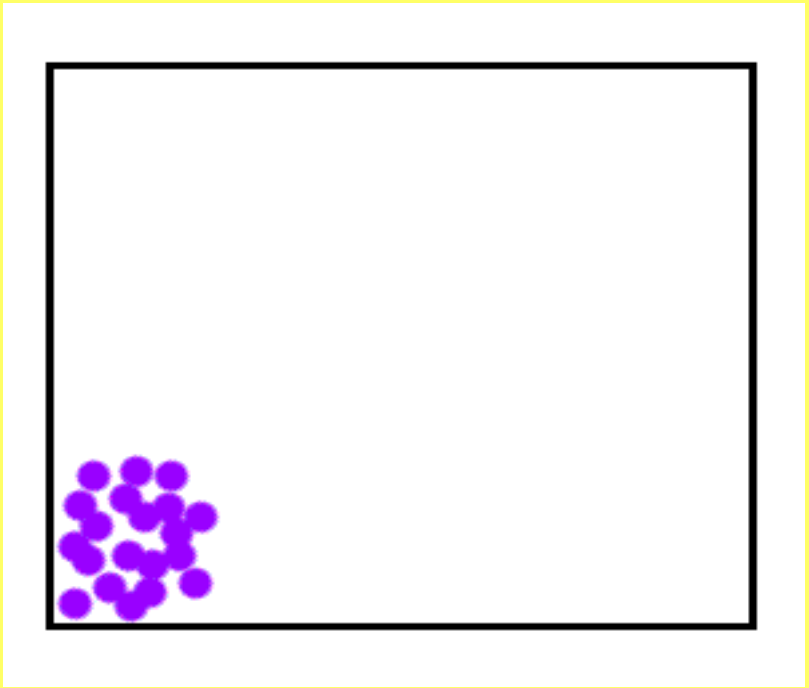
- Cell membrane regulates the movement of dissolved molecules from the liquid on one side of the membrane to the liquid on the other side.

Measuring Concentration

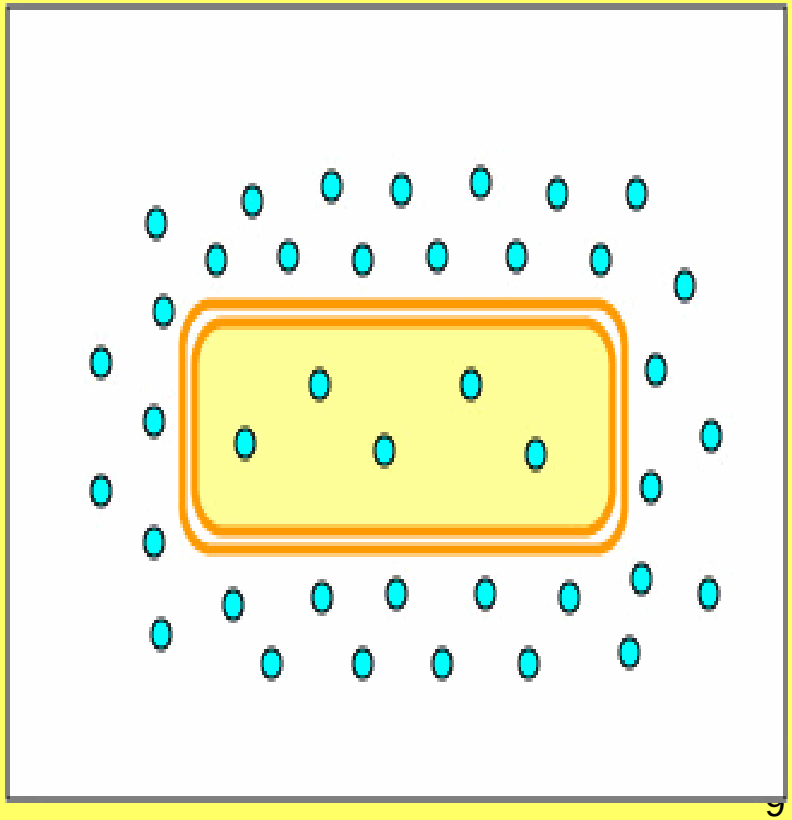
- The cytoplasm of a cell contains a solution of many different substances in water.
- The substances dissolved in the solution are called solutes.
- The concentration of a solution is the mass of solute in a given volume of a solution.

Diffusion

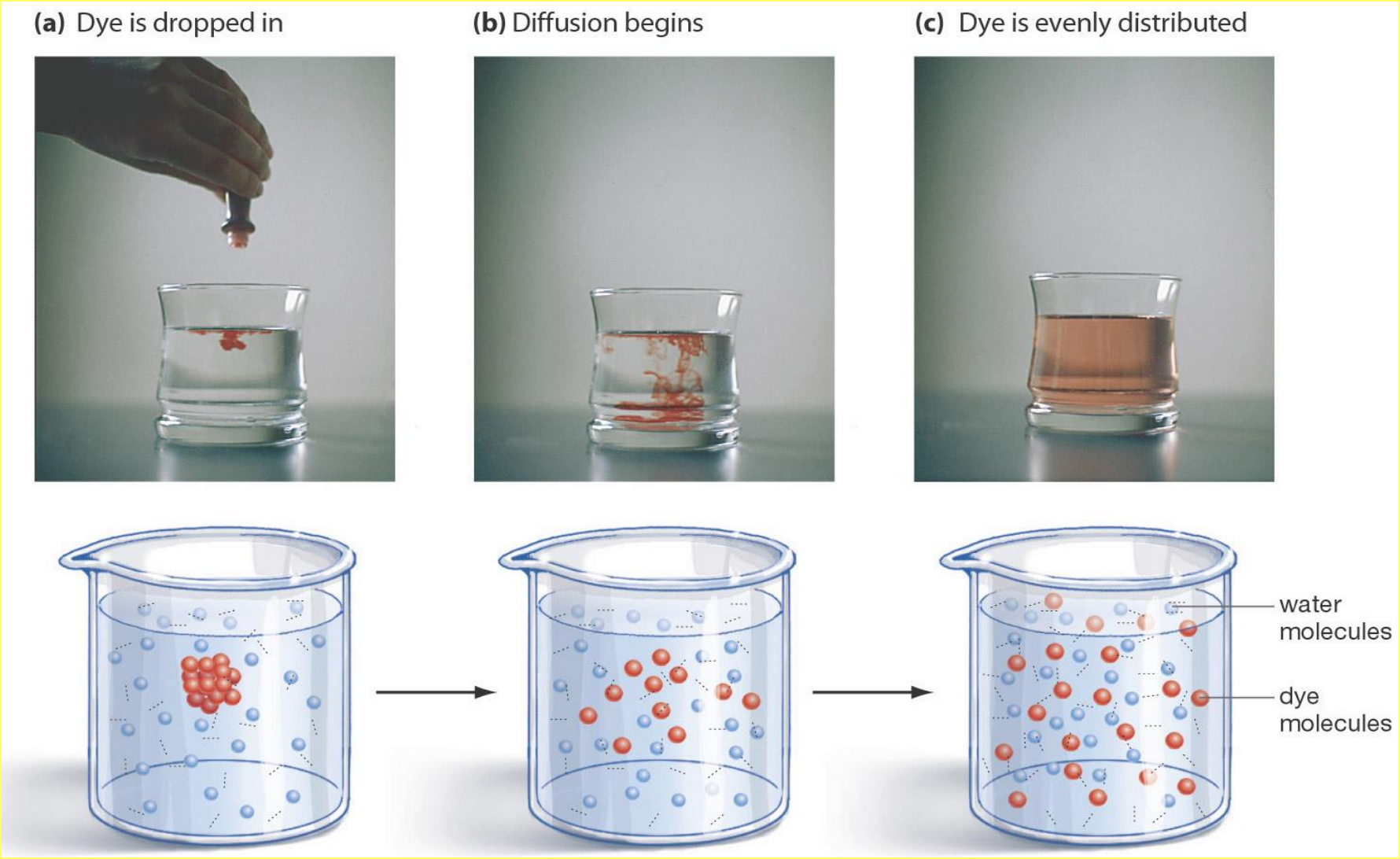
- Diffusion is when particles move from an area of higher concentration to an area of lower concentration.
- Substances diffuse across membranes without requiring energy!



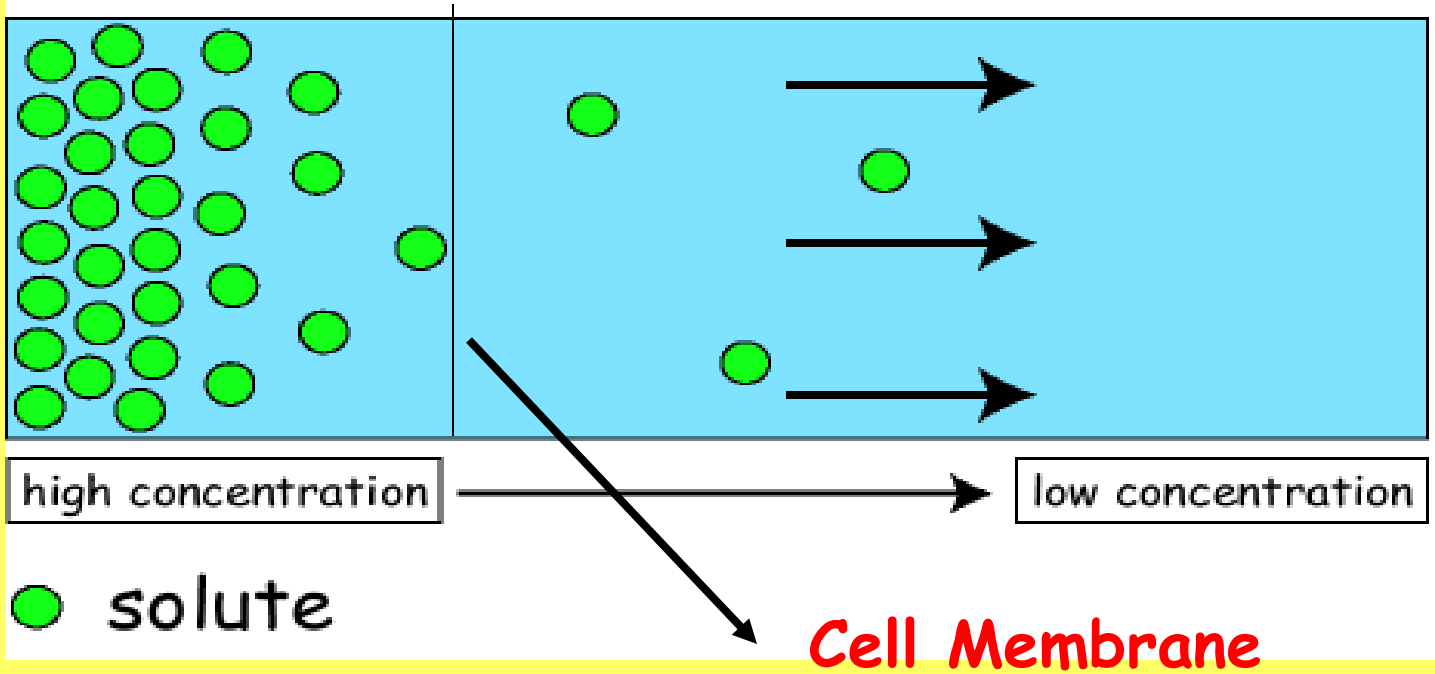
- Diffusion is a PASSIVE process which means no energy is used to make the molecules move.
- They have a natural kinetic energy.



Diffusion of Liquids



Diffusion



Solute moves DOWN concentration gradient

(HIGH to LOW)

Process of Diffusion

a. There is a higher concentration of solute on one side of the membrane as compared to the other side of the membrane.

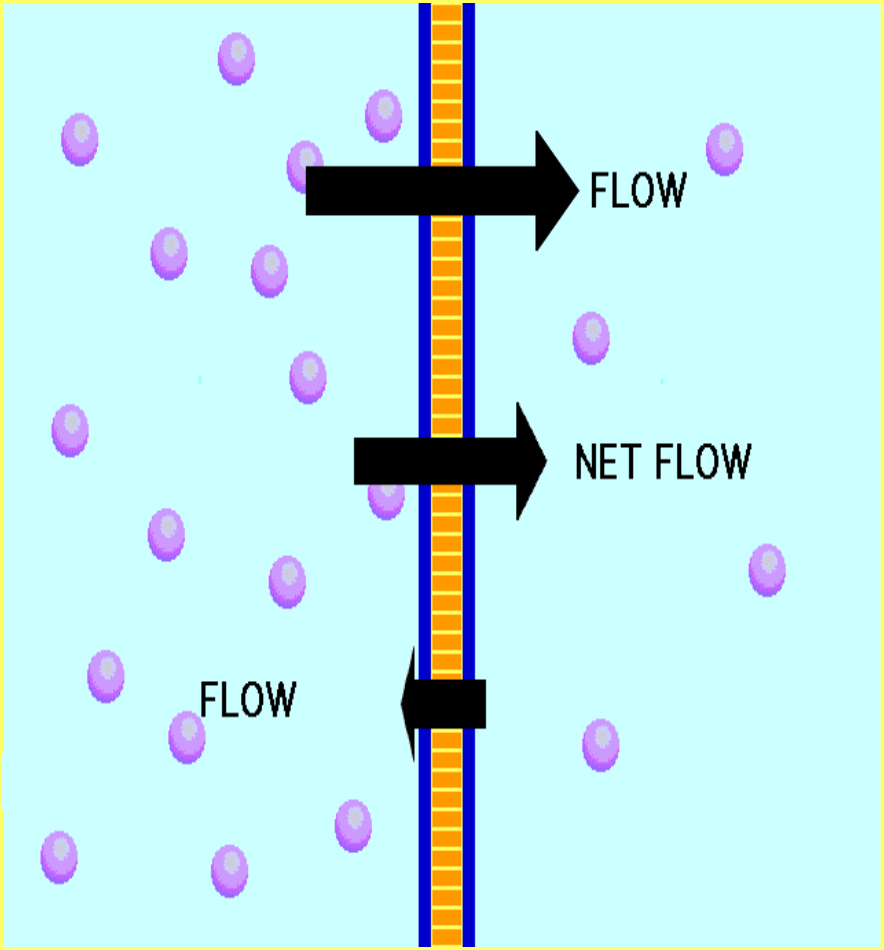
b. Solute particles move from the side of the membrane with a higher concentration of solute to the side of the membrane with a lower concentration of solute.

c. The solute particles will continue to diffuse across the membrane until equilibrium is reached.

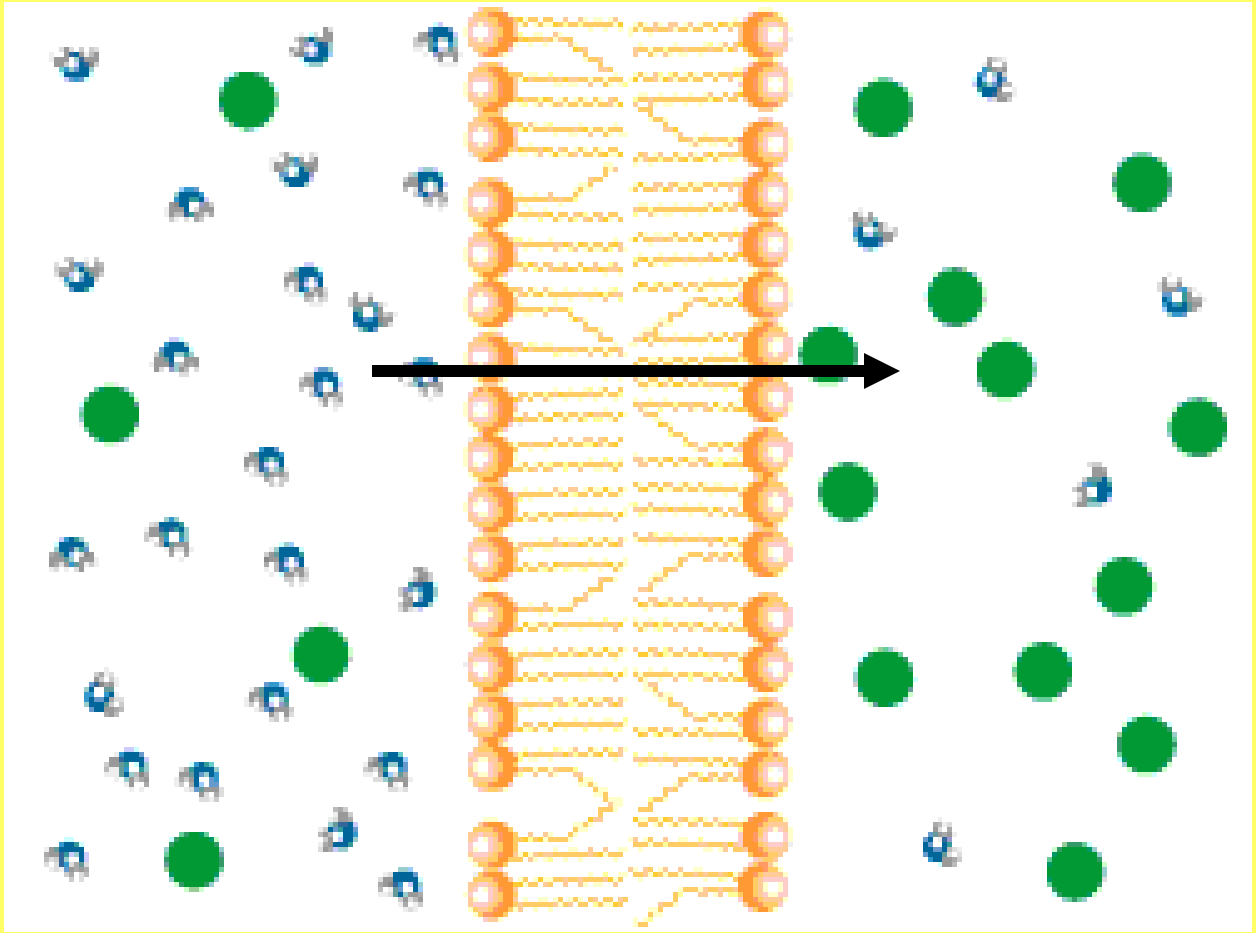
Osmosis

- If a substance is able to diffuse across a membrane, the membrane is said to be permeable to it.
- A membrane is impermeable to substances that cannot pass across it.
- Most membranes are selectively permeable, meaning that some substances can pass across them and others cannot.
- Osmosis is the diffusion of water through a selectively permeable membrane.

- In osmosis, the only movement is by the water molecules!
- Moves from High water potential (low solute) to Low water potential (high solute).
- Water can cross the membrane in both directions but solute cannot!

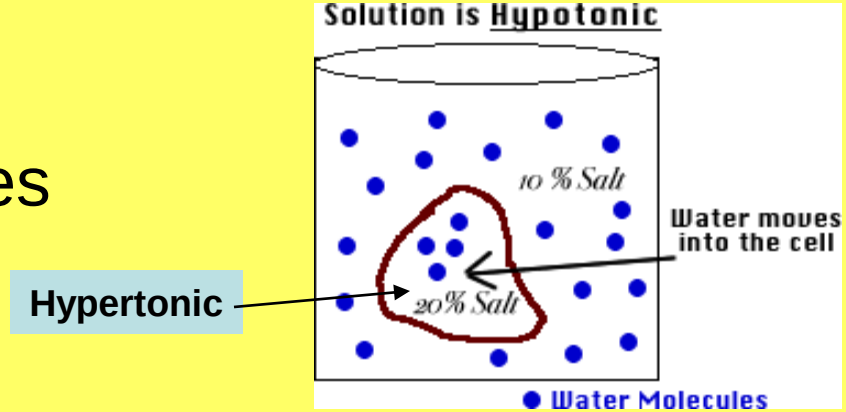


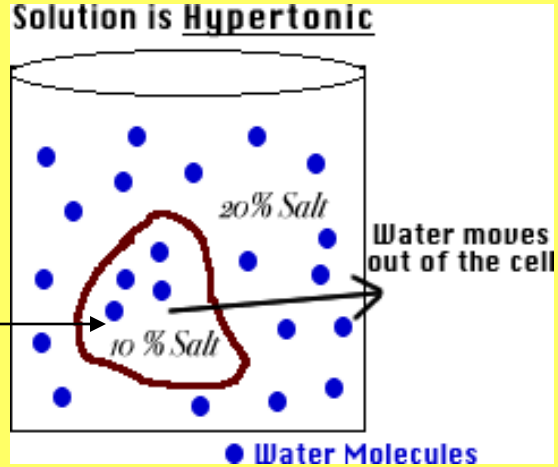
Diffusion of H_2O Across A Membrane

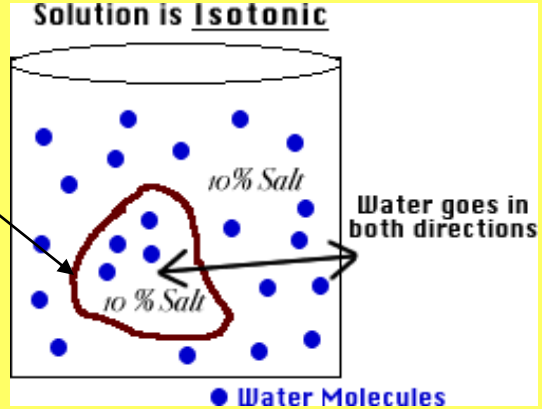


HIGH CONCENTRATION to LOW CONCENTRATION

- A hypotonic solution means a lesser concentration of solutes and a higher concentration of water outside the cell.
- A hypertonic solution means a higher concentration of solutes and a lower concentration of water outside the cell.
- An isotonic solution means the same concentration of both solute and water inside and outside the cell.

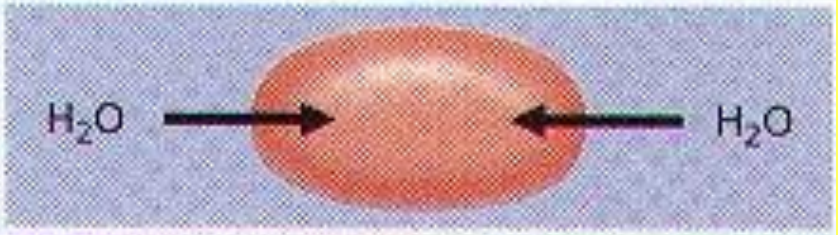
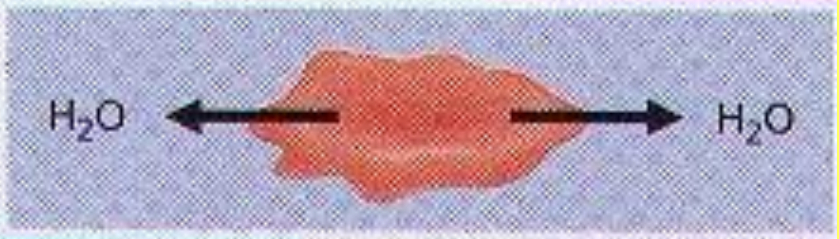






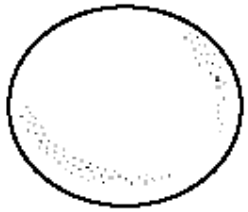
Cells in Solutions

TABLE 5-1 Direction of Osmosis

Condition	Net movement of water	
External solution is hypotonic to cytosol	into the cell	
External solution is hypertonic to cytosol	out of the cell	
External solution is isotonic to cytosol	none	

STRUCTURES AND FUNCTIONS The drawings below show the appearance of a red blood cell and a plant cell in isotonic, hypotonic, and hypertonic environments. Label each environment in the spaces provided.

RED BLOOD CELL

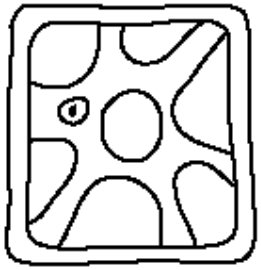


a **Hypotonic**

b **Hypertonic**

c **Isotonic**

PLANT CELL



d **Hypertonic**

e **Isotonic**

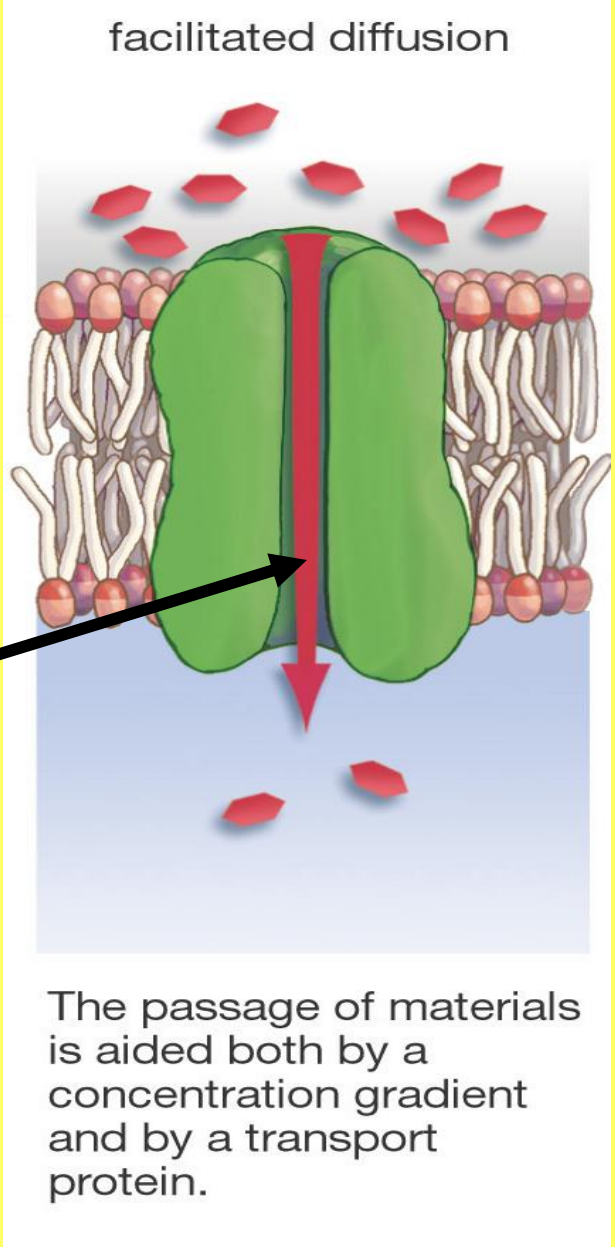
f **Hypotonic**

Osmotic Pressure

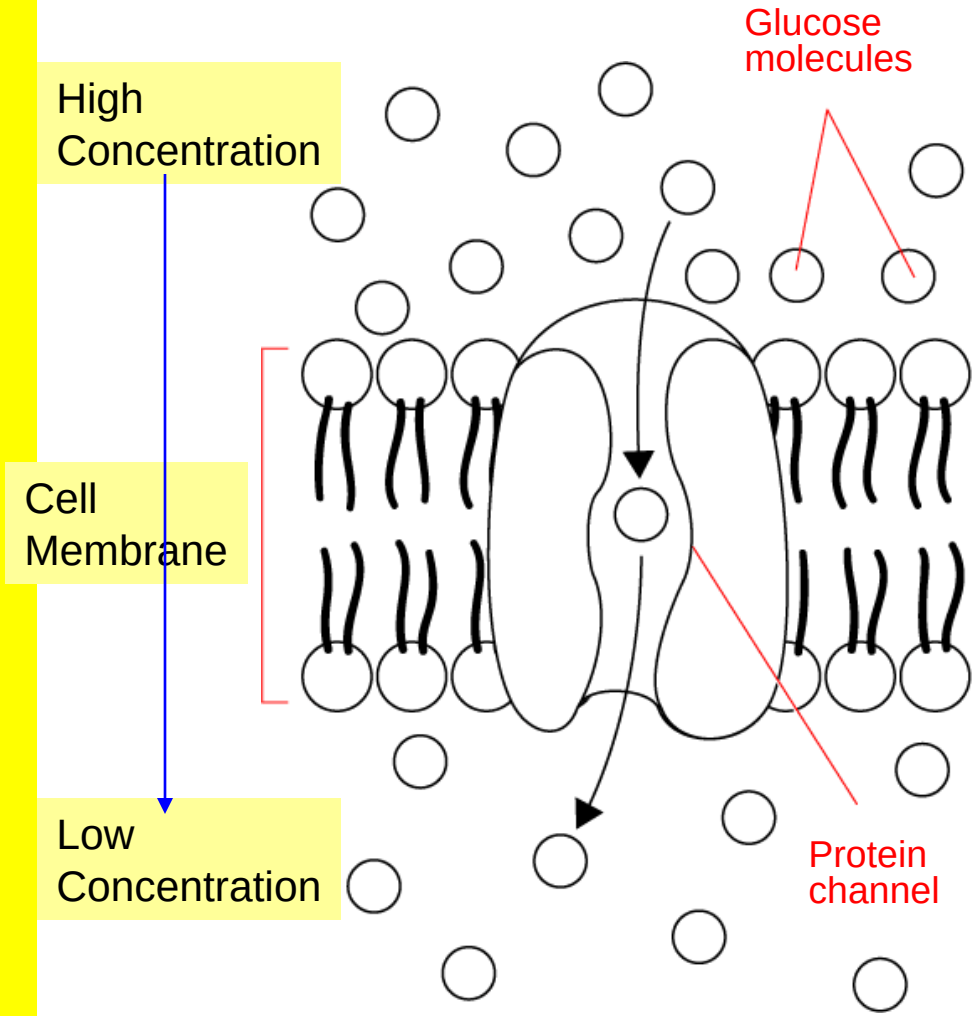
- Osmosis exerts a pressure known as osmotic pressure on the hypertonic side of a selectively permeable membrane.
- Osmotic pressure can cause serious problems for a cell.
- Osmotic pressure should produce a net movement of water into a typical cell that is surrounded by fresh water.
- This causes the volume of the cell to increase until the cell becomes swollen and may eventually burst.

Facilitated Diffusion

- The process of facilitated diffusion is said to help substances across the cell membrane.
- Cell membranes have protein channels that make it easy for certain molecules to cross the membrane.

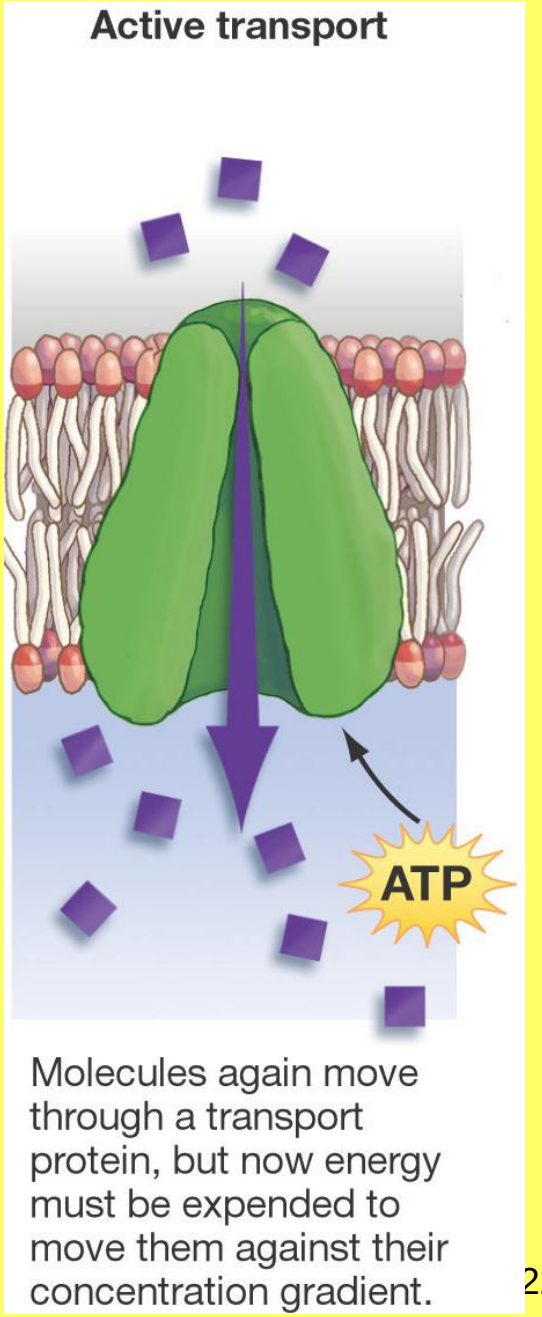


- This movement does not require energy!
- Uses transport proteins to move from a high to a low concentration.
- Examples: Glucose or amino acids moving from blood into a cell.



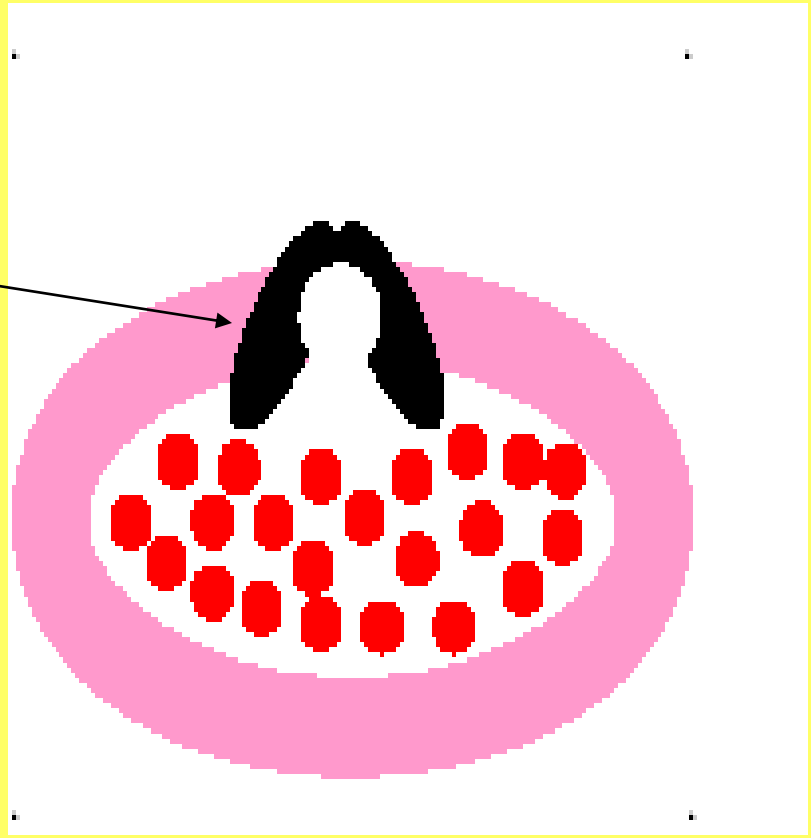
Active Transport

- Active transport requires energy or ATP and is the movement of materials in the opposite direction.
- Moves materials against the concentration gradient.
- Active transport of small molecules is carried out by transport proteins or "pumps".



Molecular Transport

- Energy requiring pumps move calcium, potassium, and sodium ions across cell membranes.
- Changes in protein shape play a role in the pumping process.

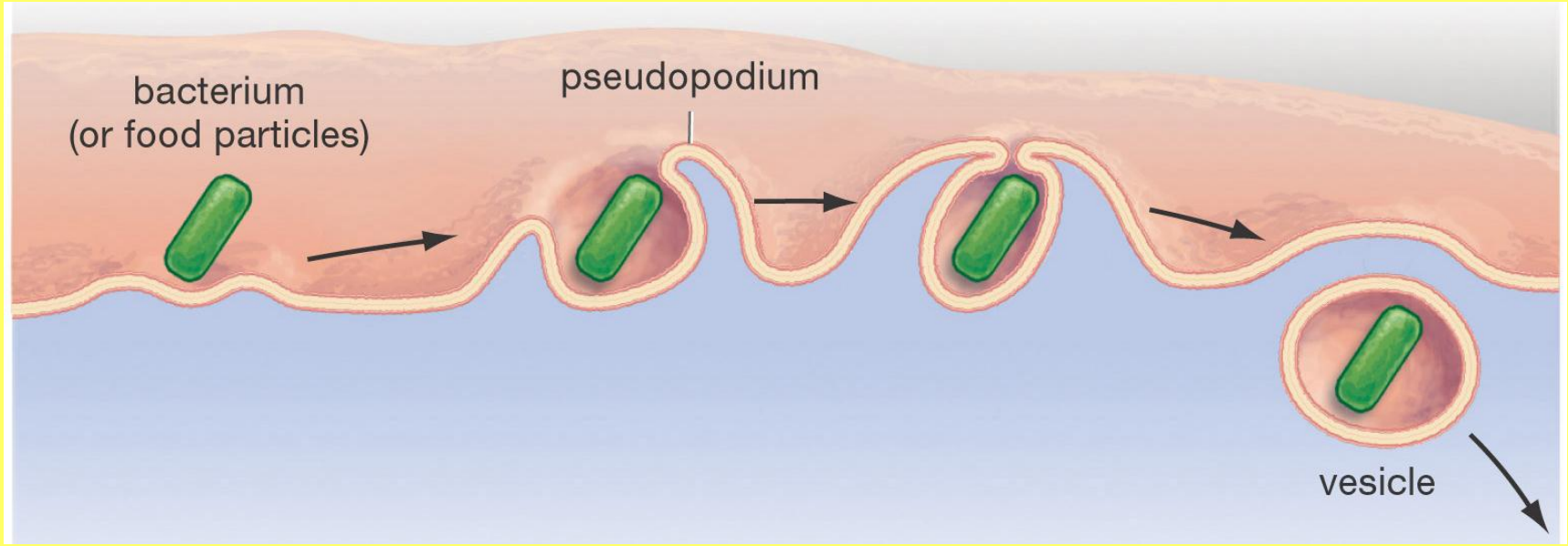


Endocytosis and Exocytosis

- Endocytosis is the process of taking material into the cell by means of infoldings, or pockets, of the cell membrane.
- The pocket breaks loose from the outer portion of the cell membrane and forms a vacuole within the cytoplasm.

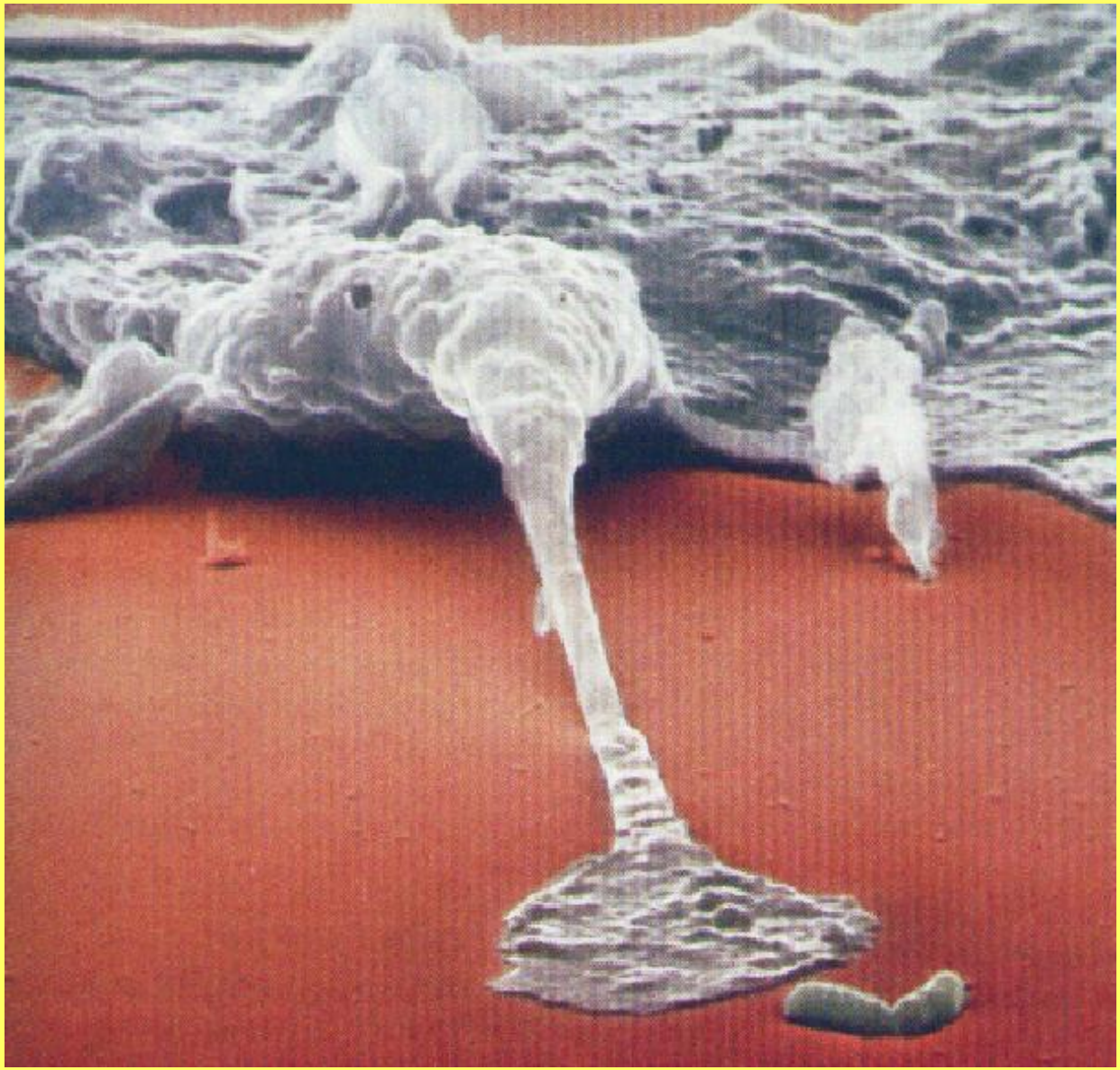
Phagocytosis

- Means "cell eating"



- Used to engulf large particles such as food, bacteria, etc. into vesicles

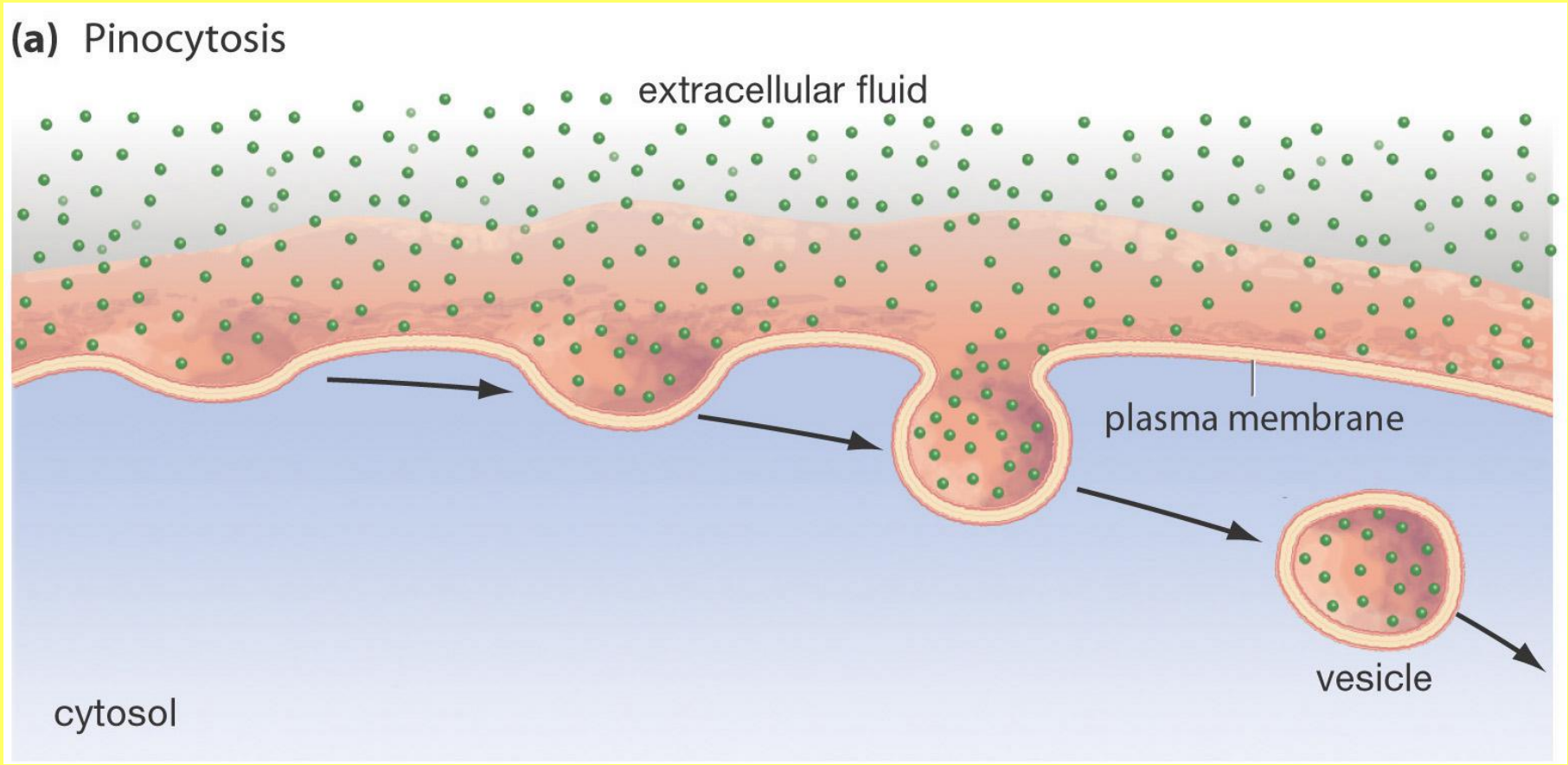
Phagocytosis About to Occur



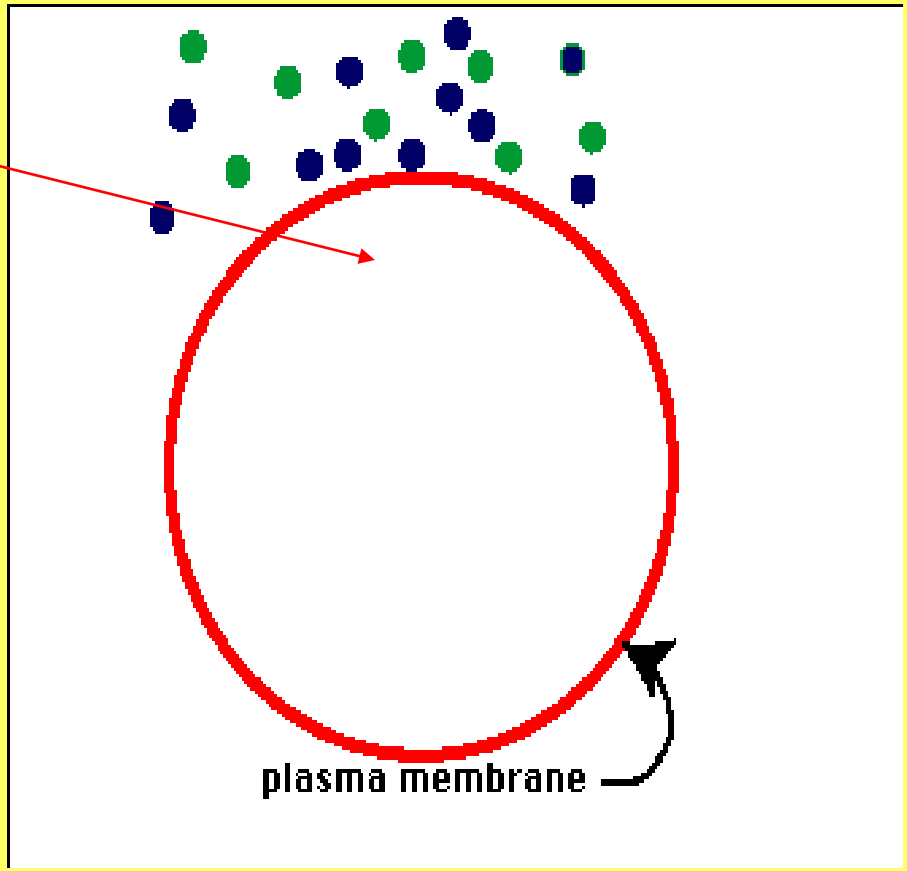
Phagocytosis - Capture of a **Yeast** Cell (yellow) by Membrane Extensions of an **Immune System Cell** (blue)

Pinocytosis

- Means "cell drinking"

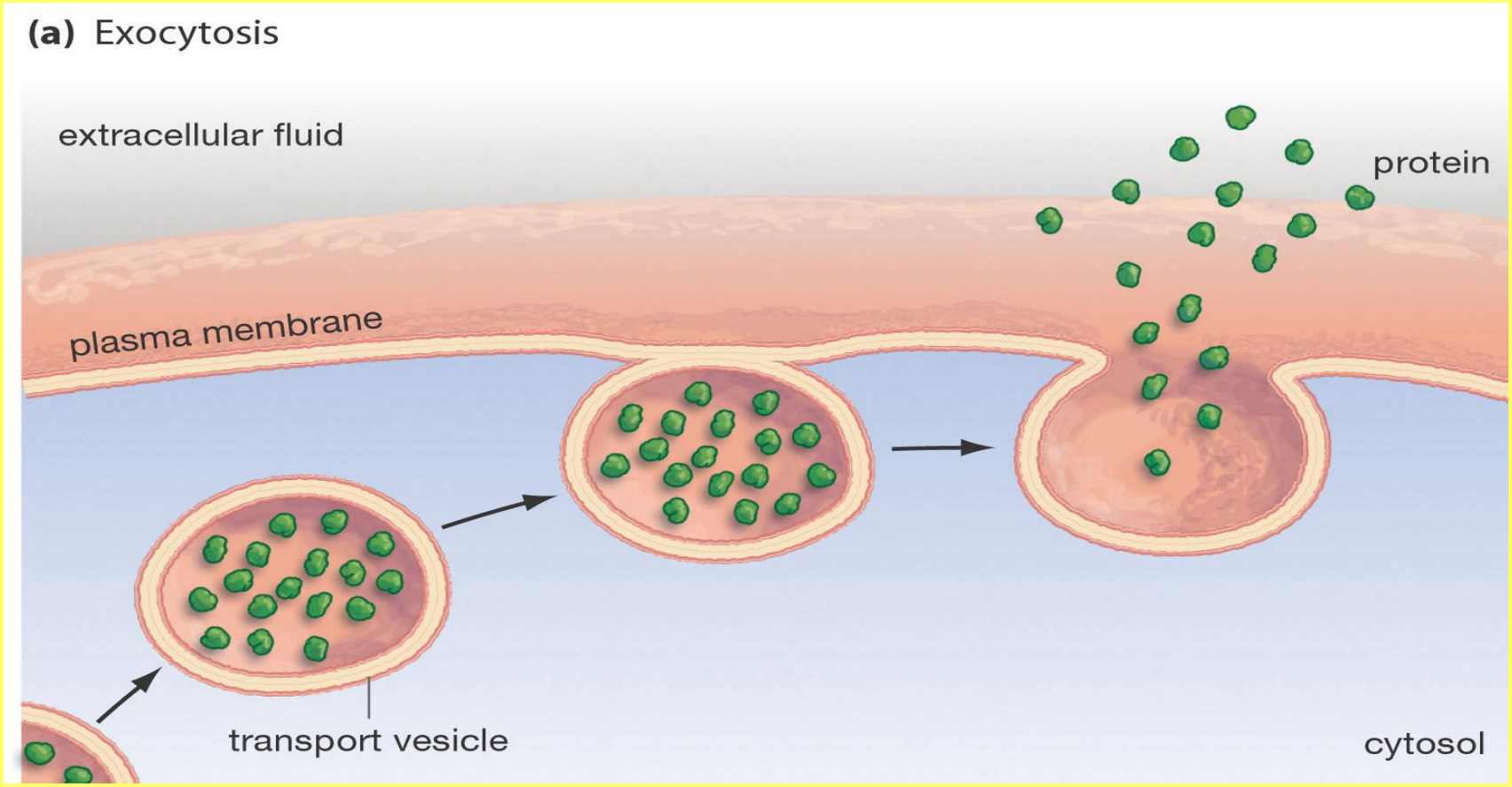


- Tiny pockets form along the cell membrane, fill with liquid, and pinch off to form vacuoles within the cell.

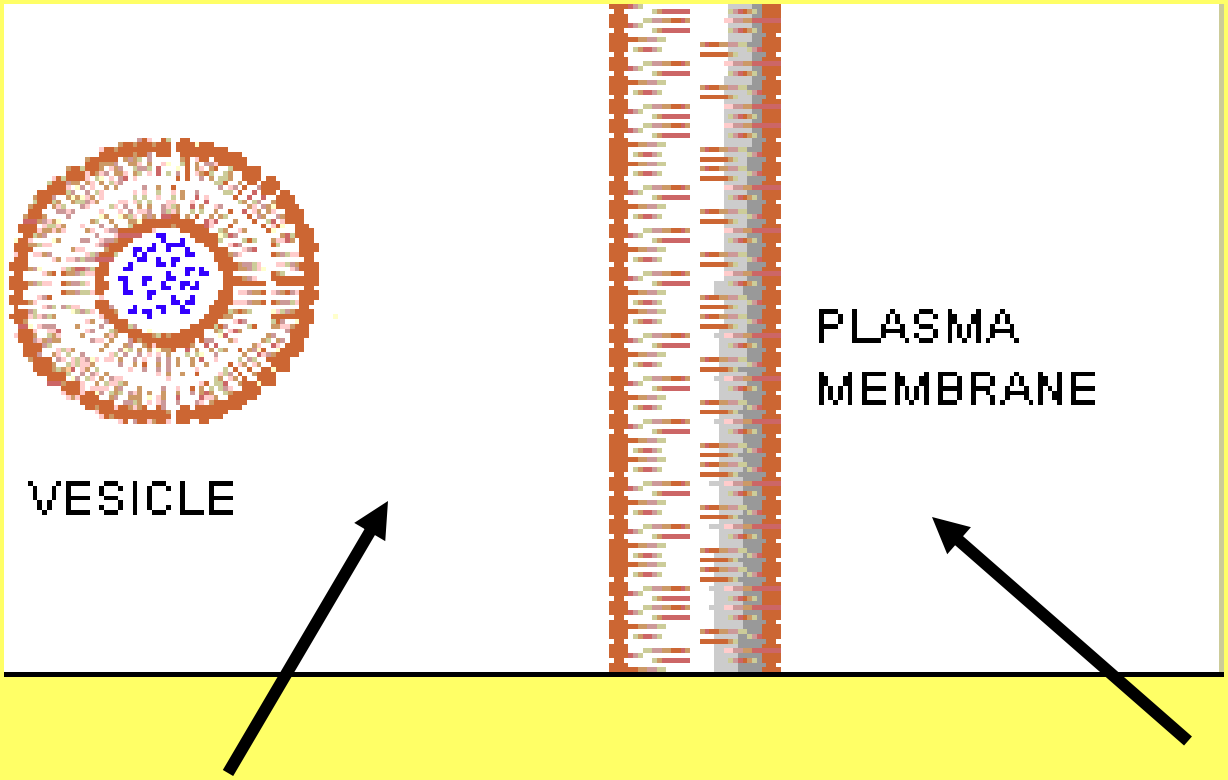


Exocytosis

- The cell releasing large amounts of material from the cell.



- The membrane of the vacuole surrounds the material, fuses with the cell membrane, forcing the contents out of the cell.



The Diversity of Cellular Life

Section 7-4

- All living things are:
  - composed of cells
  - use the same basic chemistry
  - follow the same genetic code
  - contain the same kinds of organelles
- The differences arise from the ways in which cells are specialized to perform certain tasks and the way they form multicellular organisms.

Unicellular Organisms

- A cell can be an organism and is called a unicellular organism.
- They do everything that you would expect a living thing to do - grow, respond, transform energy and reproduce.
- Unicellular organisms dominate life on Earth.

Multicellular Organisms

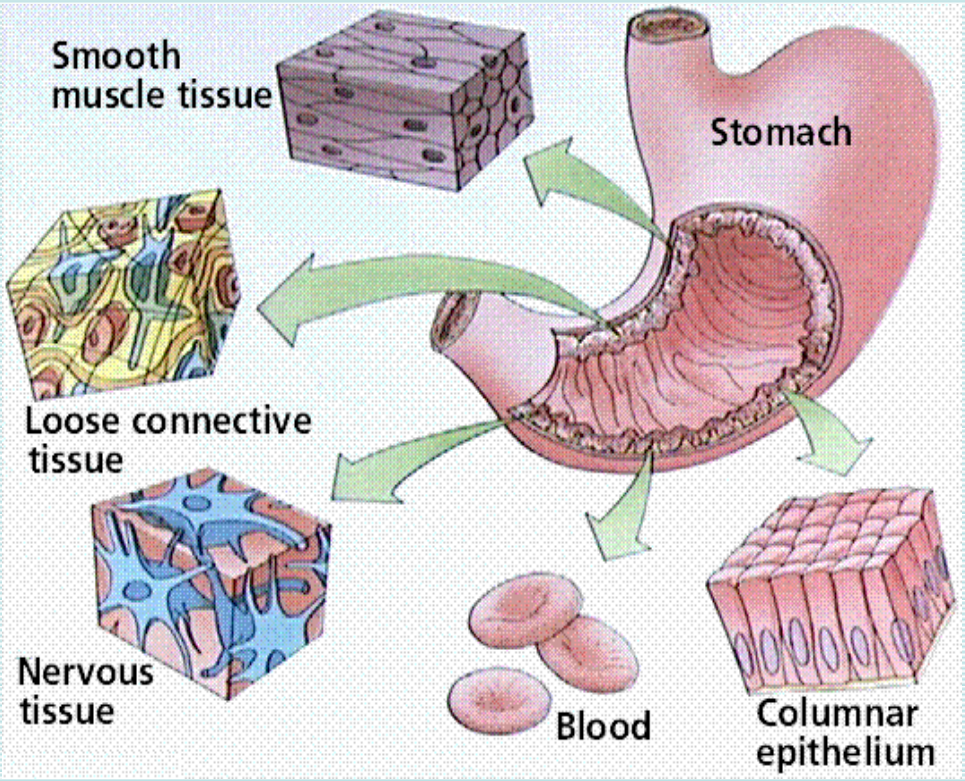
- Organisms that are made up of many cells.
- All multicellular organisms depend on communication and cooperation among specialized cells.
- Cell specialization is cells developing in different ways to perform different tasks.

Cell Specialization

- Animal Cells:
  - red blood cells transport oxygen.
  - muscle cells help in movement.
  - cells that make proteins are in the pancreas.
- Plant Cells:
  - exchange CO_2, O_2, water vapor and other gases.
  - guard cell regulate this gas exchange.

Levels of Organization

- Cells are the first level of organization in multicellular organisms.
- Tissue is a group of similar cells that perform a particular function.
- Most animals have four main types of tissue:
  - muscle, epithelial, nervous, and connective.



- An organ is many types of tissues working together.
- Each muscle in your body is an individual organ.
- Within a muscle, there is:
  - nerve tissues
  - connective tissue

- An organ system is a group of organs that work together to perform a specific function.
- This has created a division of labor to make multicellular life possible.