



Chapter 7

Cell Structure & Function



The Cell Theory

1. All living things are made up of **cells**.
2. Cells are the basic unit of **structure** & **function** in living things
3. Cells **reproduce**



Scientists

1. **Robert Hooke** (1665): Discovered that cork was made up of tiny chambers....he call them cells.
2. **Anton van Leeuwenhoek** (1674): Observed tiny organisms in drops of pond water using a simple microscope.



Scientists (continued)

3. **Matthias Schleiden** (1838): All plants are made up of cells.
4. **Theodor Schwann** (1839): All animals are made up of cells.
5. **Rudolph Virchow** (1855): Proposed all cells come from pre-existing cells.



Basic Cell Structures

1. All cells have:

- **Cell membrane**
- **Cytoplasm**

2. Most cells have:

- **Nucleus**



Categories of cells

A. **Prokaryotes**: Have cell membrane & cytoplasm but no nucleus
----**smaller** and **simpler** than eukaryote

Example: **Bacteria (E. coli)**



Categories of Cells

B. **Eukaryotes**: Have a nucleus, cell membrane, cytoplasm, and most have organelles

Examples: Plants, animals, fungi, many microorganisms



Cell Structure

- a) Cell wall: **Plant** and **bacterial** cells **not animal** cells. It provides **support** & **protection**.
- b) Cell membrane: A thin flexible **barrier** around the **cell**. It **regulates** what enters & leaves a cell.

Cell Structure

c) Nucleus: Contains heredity information (DNA)

- Chromatin:
Uncoiled DNA

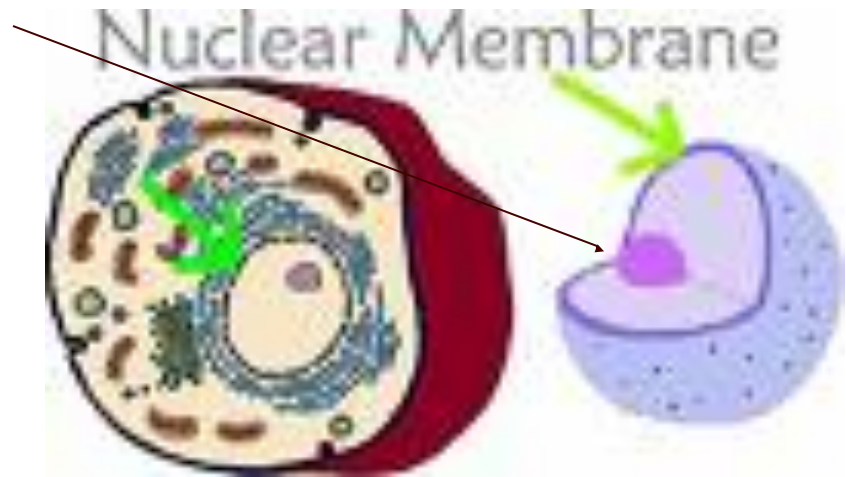


- Chromosomes:
Coiled DNA



Cell Structure

- **Nucleolus:** Site of RNA synthesis, produces ribosomes
- **Nuclear Envelope:** Surrounds the nucleus, controls what enters and leaves the nucleus.





Cell Structure

- d. **Cytoskeleton:** Network of protein, helps cell keep its shape; involved with cell motility
 - **Microtubules:** Hollow tubes of protein
 - **Microfilaments:** Long thin fibers of protein
- e. **Cytoplasm:** Material between the nucleus and the cell membrane; contains the cell organelles



Cell Organelles: Specialized

structures that perform vital cellular functions

Ribosomes:

Make proteins based on instructions that come from the nucleus (factory machines)

Endoplasmic reticulum (ER)

Rough ER: ribosomes attached to surface; pathways for transport of materials within the cell

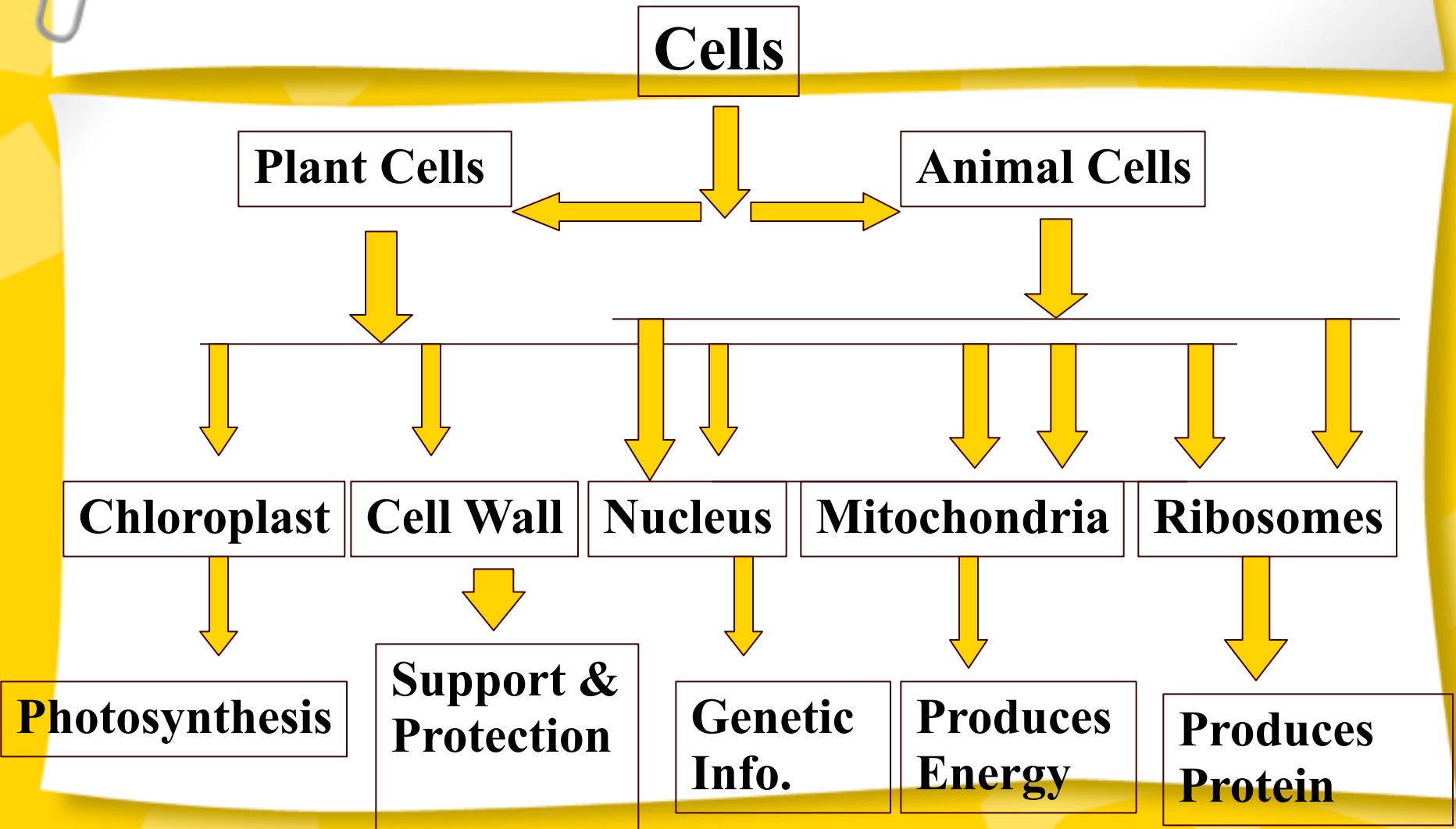
Smooth ER: No ribosomes attached; pathway for transport of materials within the cell



Cell Organelles

Golgi apparatus	Processes, packages & sends <u>proteins & lipids</u> to their final destination w/in cell (Post Office)
Lysosome	Contain <u>enzymes</u> that break down large <u>molecules</u> into smaller parts that can be used by cell; break down used <u>cell parts</u> . (Garbage men)
Vacuole	<u>Store</u> materials like <u>water, starch</u> , etc.; several small in <u>animal</u> cell; one large one in <u>plant</u> cell (Garage)


Concept Map





Cell Organelles

Chloroplast	<u>Plant</u> cells; use <u>energy</u> from the <u>sun</u> to make food; site of <u>photosynthesis</u> . (Solar power plant)
Mitochondria	Usually <u>many</u> in cell; release <u>energy</u> from <u>food</u> molecules; site of <u>cellular respiration</u> . “Powerhouse of the cell” (Power plant)
Cilia & Flagella	Locomotive <u>structures</u> made up of <u>microtubules</u>



Structure	Prokaryotic	Eukaryotic Animal Cell	Eukaryotic Plant Cell
Cell Membrane	Yes	Yes	Yes
Cell Wall	Yes	No	Yes
Nucleus	No	Yes	Yes
Ribosomes	Yes	Yes	Yes
ER	No	Yes	Yes
Golgi Apparatus	No	Yes	Yes
Lysosomes	No	Yes	No
Vacuoles	No	Small/none	Yes
Mitochondria	No	Yes	Yes
Chloroplasts	No	No	Yes
Cytoskeleton	No	Yes	yes



Cell Membrane

Selectively permeable: some substances can pass through it and some cannot

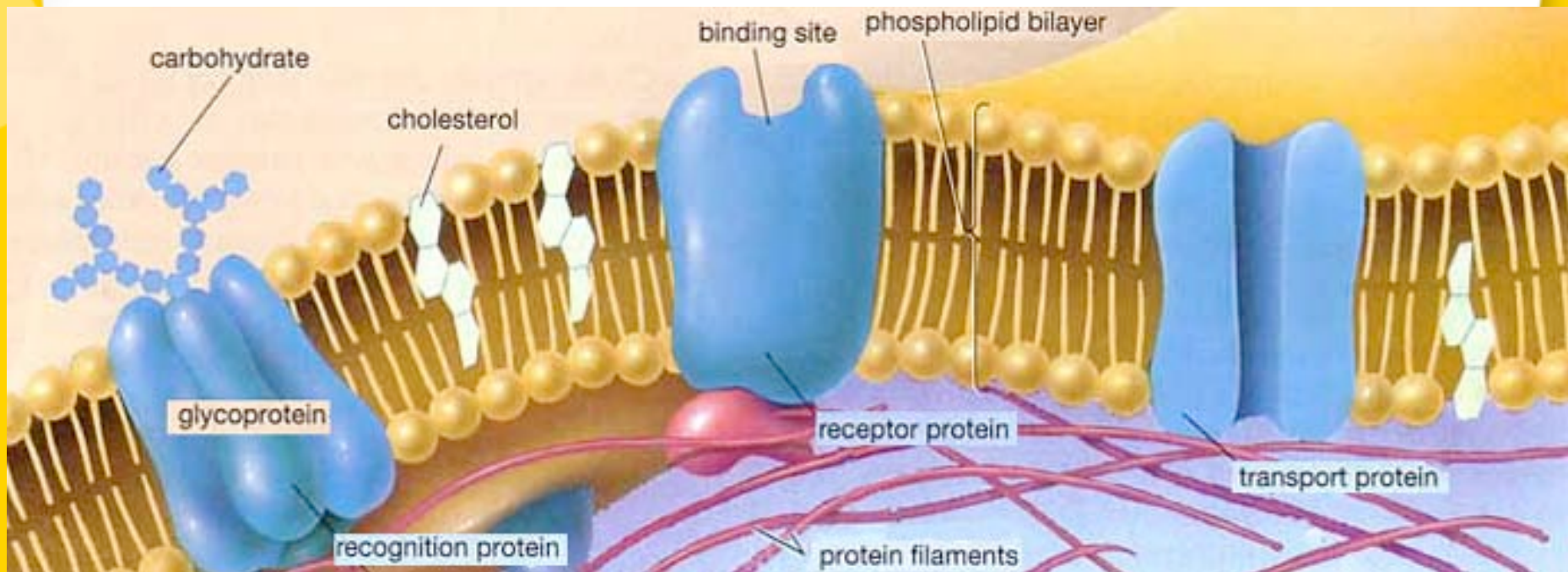
Lipid Bilayer: 2 layers of lipids that give the membrane a tough, flexible structure; forms a barrier between cell & its surroundings

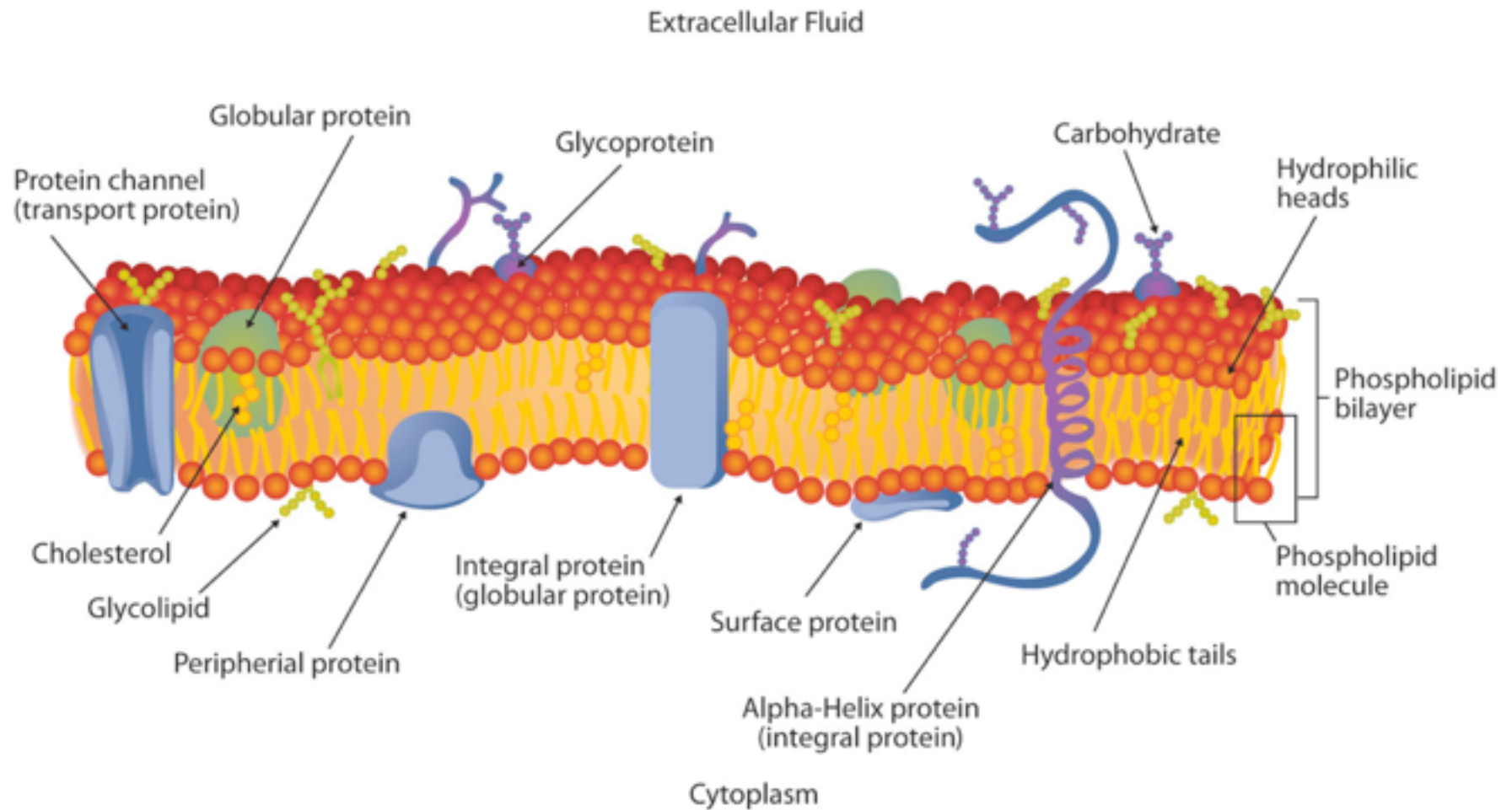


Cell Membrane

- ➔ **Protein Channels & Pumps**: embedded in the lipid bilayer; help move materials across the membrane during facilitated diffusion and active transport
- ➔ **Receptor proteins** : embedded in lipid bilayer; receive chemical messages from other cells (ex: hormones). Homeostasis can be affected if blocked.

Receptor Proteins







Movement Through the Membrane

Diffusion (passive transport): Molecules move from areas of high concentration to low concentration until equilibrium is reached.

- * **No energy is required**
- * **Equilibrium-** the net movement of particles into the cell equals the net movement of particles out of the cell
- * Once equilibrium is reached, movement of molecules still occurs but in equal amounts



Osmosis

- ➔ Diffusion of water through a selectively permeable membrane from areas of high concentration to low concentration until equilibrium is reached
- ➔ * No energy is required



Osmosis & Solutions

Isotonic Solution: Concentration of solute is **equal** on both sides of the membrane; at equilibrium

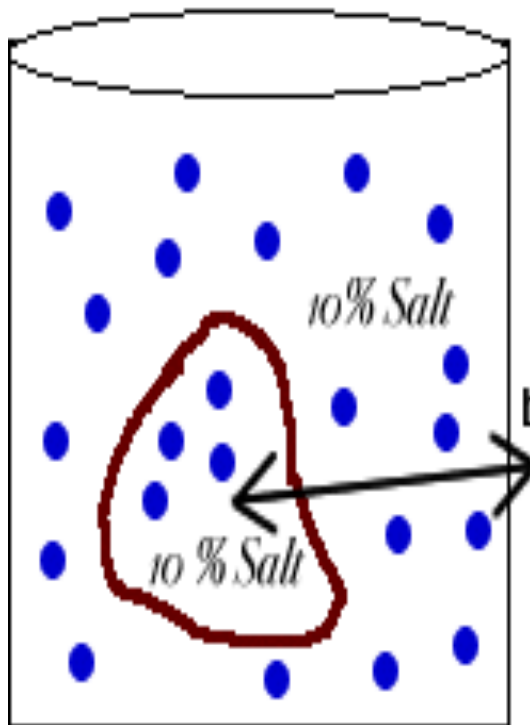
Hypotonic Solution: Concentration of **solute** is **less** outside the membrane than **within the cell** (below strength) causing water to move into the cell;

animal cells placed in a hypotonic solution: swell & burst

plant cells placed in a hypotonic solution: vacuoles swell, pushing cell content out against cell wall.

Isotonic & Hypotonic Solutions

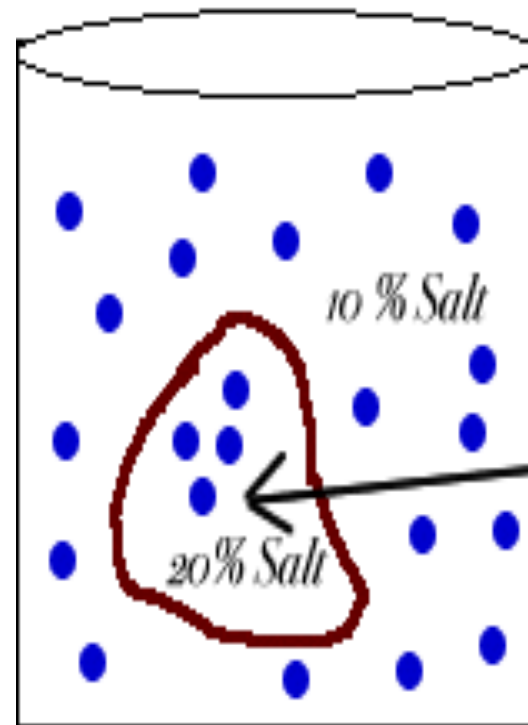
Solution is Isotonic



Water goes in
both directions

● Water Molecules

Solution is Hypotonic



Water moves
into the cell

● Water Molecules



Osmosis & Solutions

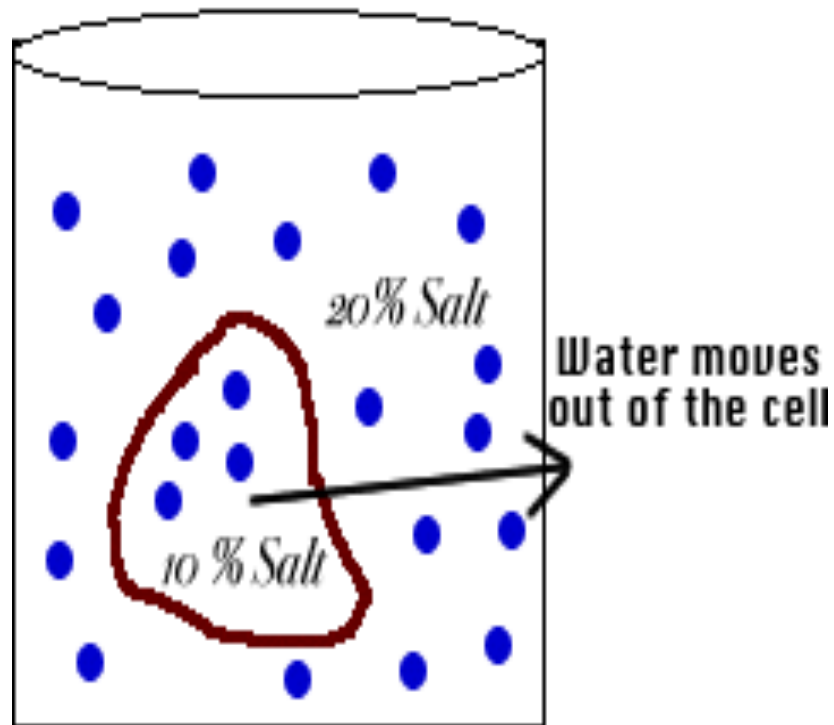
Hypertonic Solution: Concentration of solute is greater **outside** the cell membrane than **inside** the cell (above strength) causing water to leave the cell

animal cells: shrink due to water loss

plant cells: vacuoles collapse due to water loss

Hypertonic Solutions

Solution is Hypertonic



● Water Molecules



Osmotic Pressure

- ➔ pressure exerted by osmosis on the hypertonic side of the membrane
- ➔ can cause serious problems for the cell
- ➔ cell is almost always hypertonic to freshwater -this means that the net movement of water will go into the cell
- ➔ cells burst if too much water enters



Movement Through the Membrane

Facilitated Diffusion: Protein channels in membrane help molecules move across the membrane that cannot pass directly (ex: sugar)

- * From high to low

- * No energy is required



➔ **Active Transport:** Movement from low concentration to high concentration.

* Energy is required in the form of ATP

endocytosis-process of taking material into the cell by means of infoldings, or pockets of the cell membrane

phagocytosis-when large particles are taken into the cell by extensions of the cytoplasm surrounding and engulfing the particle

exocytosis-the removal of large amounts of material by the cell



Diversity of Cell Life

Unicellular Organisms (Single celled)

- Have all 8 characteristics of life
- Carry out all life functions
- Lack cell specialization (specialized to perform a specific function).

Muticellular Organisms (many cells)

- cells that are interdependent.
- All cells are specialized and work together.
- Have all 8 characteristics of life
- Carry out all life functions

Levels of Organization

Most complex

Organism

Organ Systems: Groups of organs working together to perform a specific function (Digestive, Nervous, Circulatory)

Organs: Groups of tissues that work together (Heart, Lungs, kidneys)

Tissues: Groups of similar cells that perform a specific function; 4 Types (muscle, epithelial, nervous, connective (bone, blood, cartilage))

Least complex

Cells: Perform a particular function