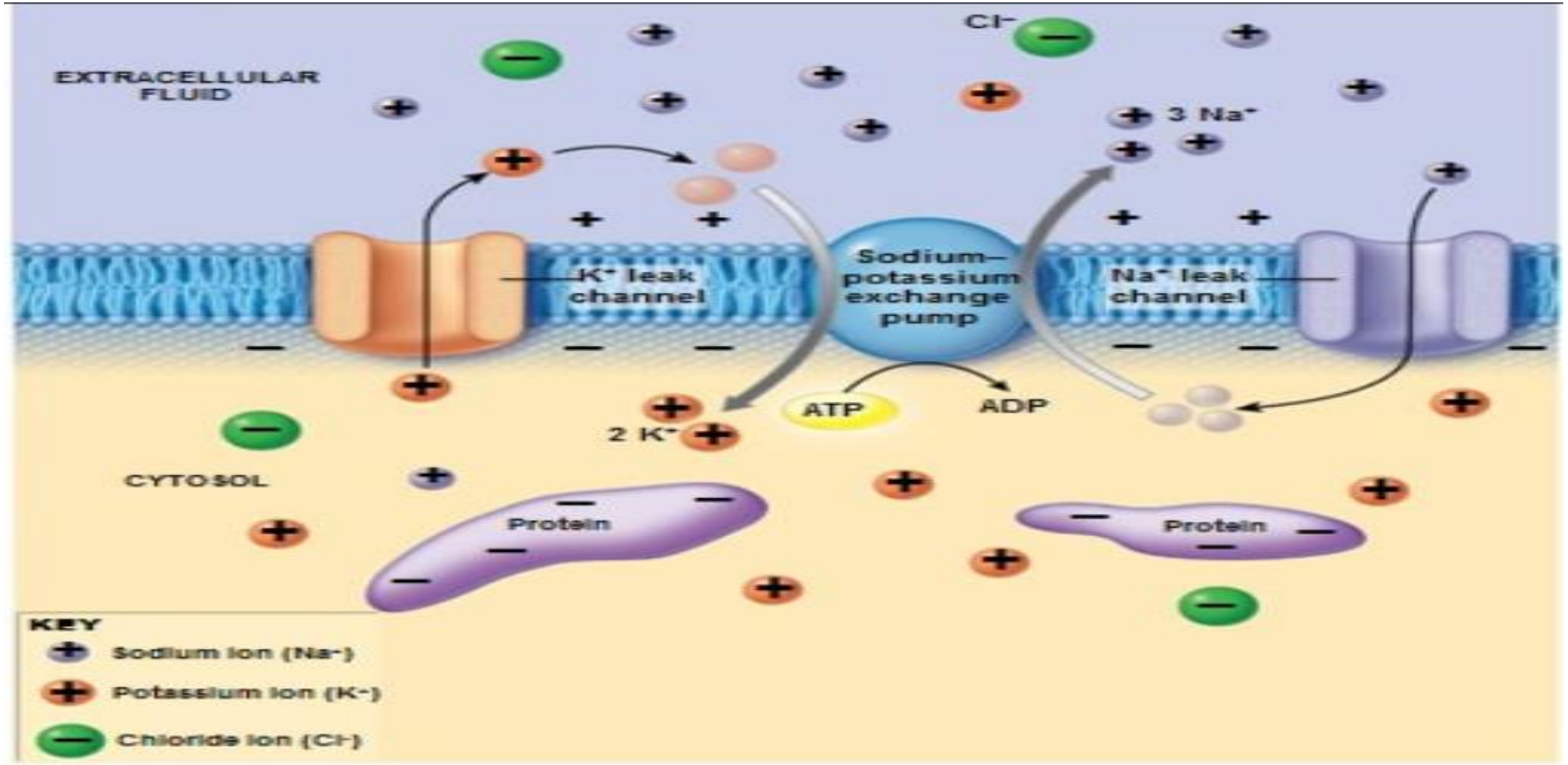
Membrane Transport and the Membrane Potential

Dr. Ban Hassan Adil



Extracellular Environment

-Includes all parts of the body outside of cells

-Cells receive nourishment

-Cells release waste

-Cells interact(through chemical mediators)

Body Fluids

-Two compartments

1- Intracellular (~ 67% of body's H_2O)

2- Extracellular (~33% of body's H_2O)

-Blood plasma:about 20% of this

-Tissue fluid (or interstitial fluid)

-includes extracellular matrix

- Lymph

Transport across cell membrane

-Plasma (cell) membrane

-**In selectively permeable**

-Generally not permeable to

-Proteins

-Nucleic acids

-**Selectively permeable to**

-Ions

-Nutrients

-Waste

-It is a biological interface between the two compartments

Transport across cell membrane

-Plasma (cell) membrane

- -Site of chemical reactions
  - -Enzymes located in it
  - -Receptors can bond to molecular signals
  - -Transporter molecules

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Transport across cell membrane

- **Transport categories**

Based on structure

- **Carrier-mediated**
  - Facilitated diffusion
  - Active transport
- **Non –carrier mediated**
  - Diffusion
  - Osmosis
  - Bulk flow(pressure gradients)
- **Vesicle mediated**
  - Exocytosis
  - Endocytosis
    - Pinocytosis
    - Phagocytosis

Transport across cell membrane

-Based on energy requirements

-Passive transport

-Based on concentration gradient

-Does not use metabolic energy

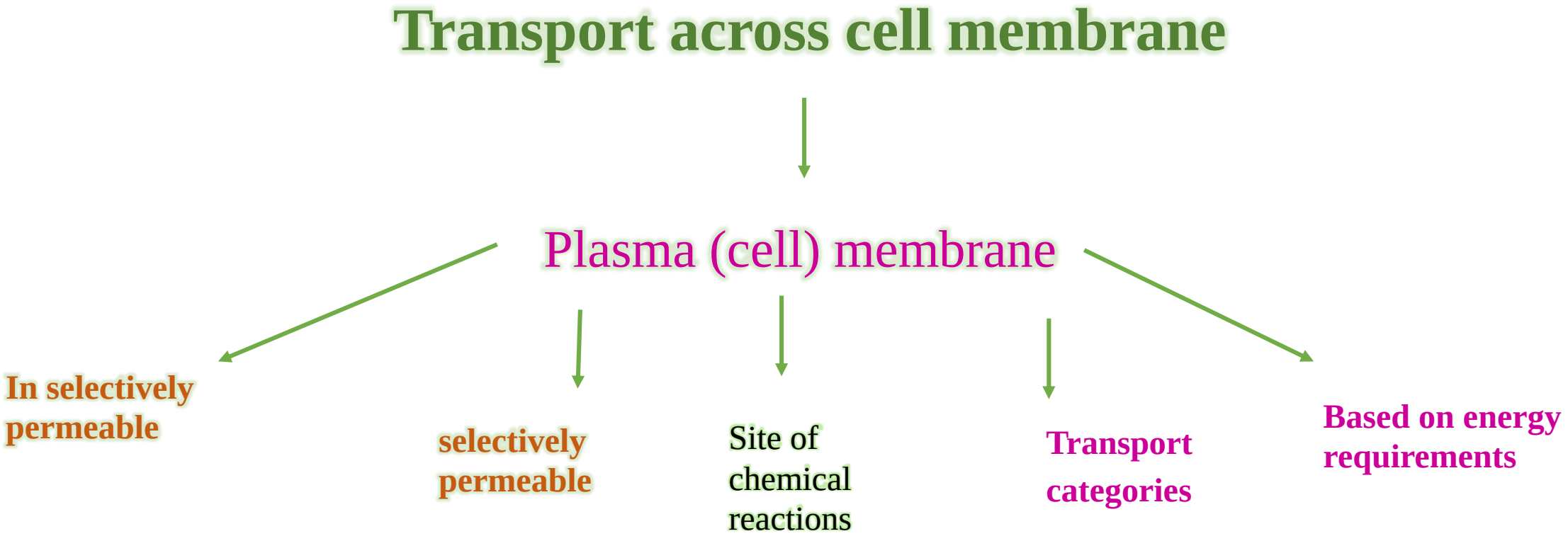
-Active transport

-Against a gradient

-Uses metabolic energy

-Involves specific carriers

summary


Transport across cell membrane
Plasma (cell) membrane
In selectively permeable
selectively permeable
Site of chemical reactions
Transport categories
Based on energy requirements

Diffusion and Osmosis

-Cell membrane separates ICF from ECF
-Cell membrane is selectively permeable
-Mechanisms to transport molecules and ions through the cell membrane
  -Carrier mediated transport
  -Non –carrier mediated transport

Diffusion and Osmosis

-Energy requirements for transport through the cell membrane:
  -Passive transport:
    -Net movement down a concentration gradient
  -Active transport:
    -Net movement against a concentration gradiant
    -Requires energy

Diffusion

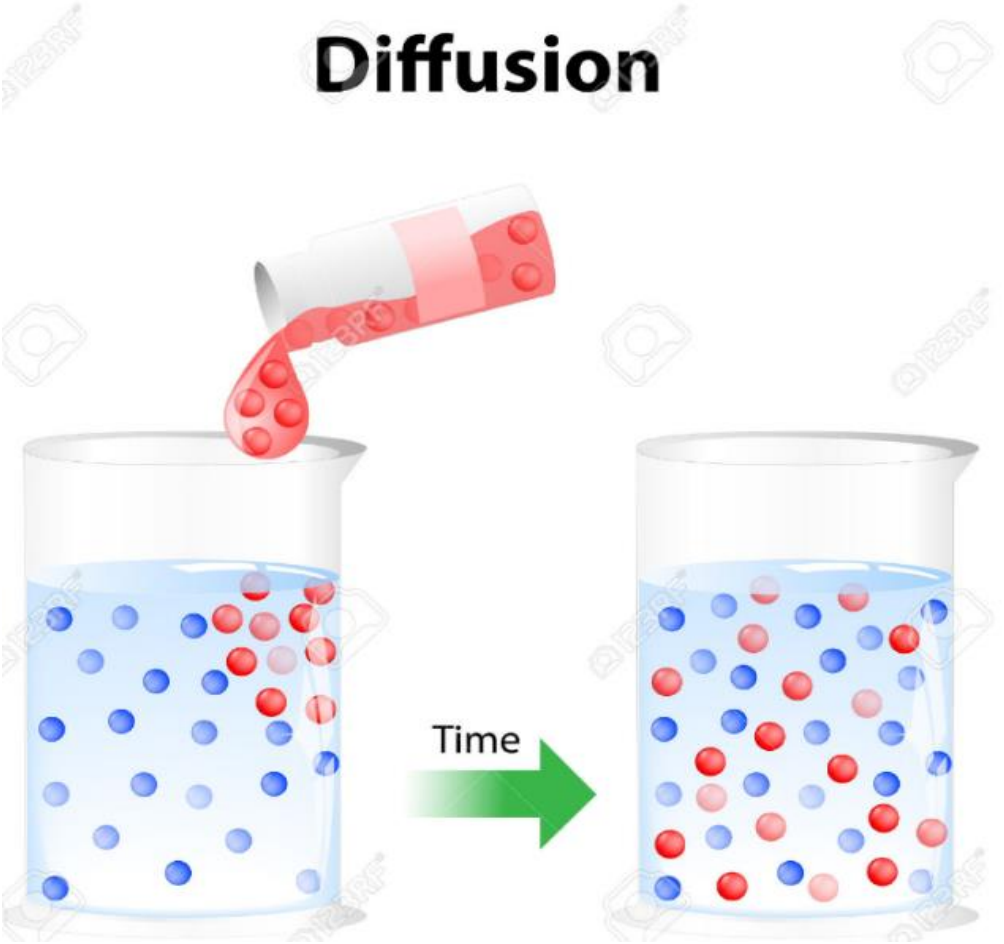
-Physical process that accurs:

-**Concentration difference** across the membrane

-**Membrane is permeable** to the diffusing substance

-**Molecules** / ions are in constant state of random motion due to their thermal energy

-Eliminates a concentration gradient and distributes the molecules uniformly



Diffusion Through Cell Membrane

-**Cell membrane permeable to**:

-Non –polar molecules (O_2)

-Lipid soluble molecules (steroids)

-Small polar covalent bonds (CO_2)

-H_2O(small size,lack charge)

-**Cell membrane impermeable to**:

-Large polar molecules (glucose)

-Charged inorganic ions(Na^+)

Rate of Diffusion

-Dependent upon:

-The magnitude of concentration gradient

-Driving force of diffusion

-Permeability of the membrane

-Neuronal cell membrane 20 x more permeable to K^+ than Na^+

-Temperature

-Higher temperature,faster diffusion rate

-Surface area of the membrane

-Microvilli increase surface area

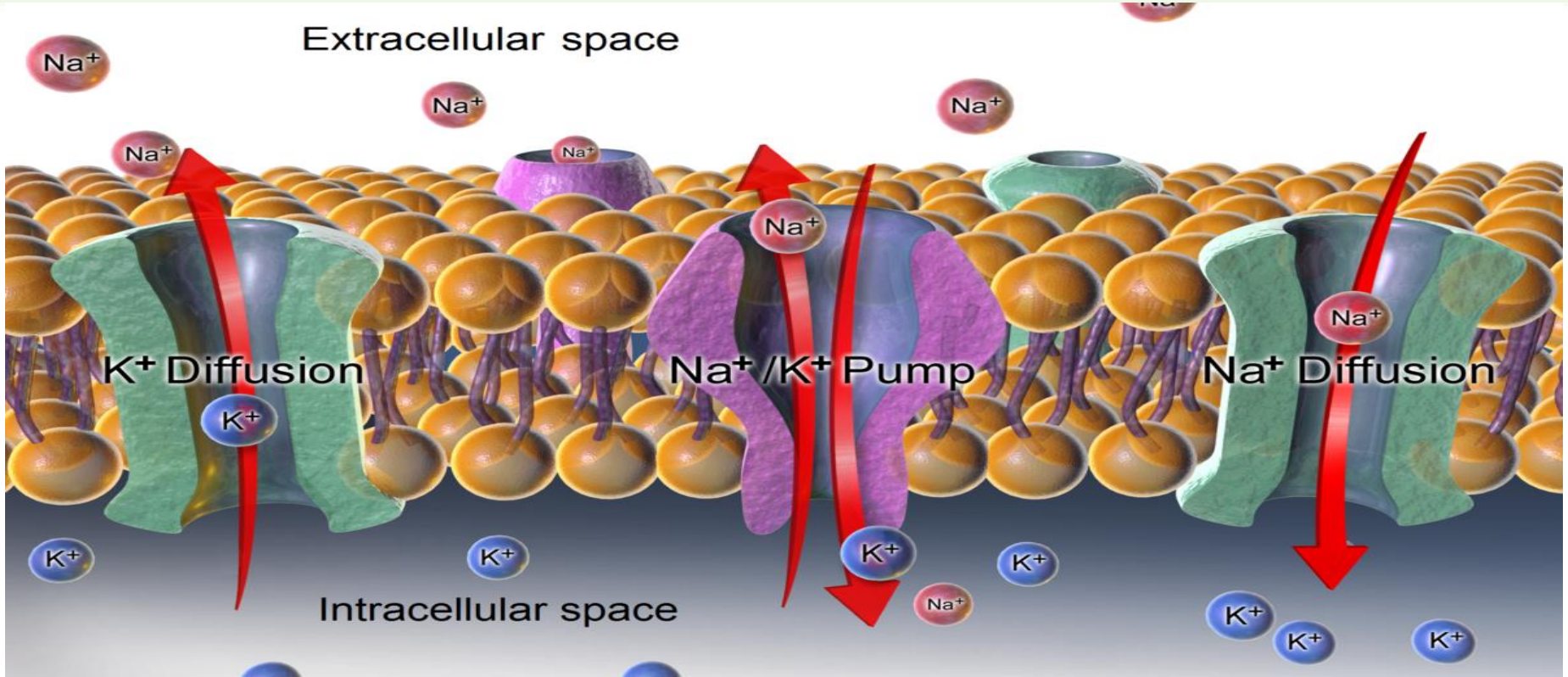
Facilitated Diffusion

-Facilitated diffusion:

-Passive:

-ATP not needed. Powered by thermal energy

-Involves transport of substance through cell membrane from higher to lower concentration



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Osmosis

-Net diffusion of H_2O across a selectively permeable membrane

-2 requirement of osmosis:

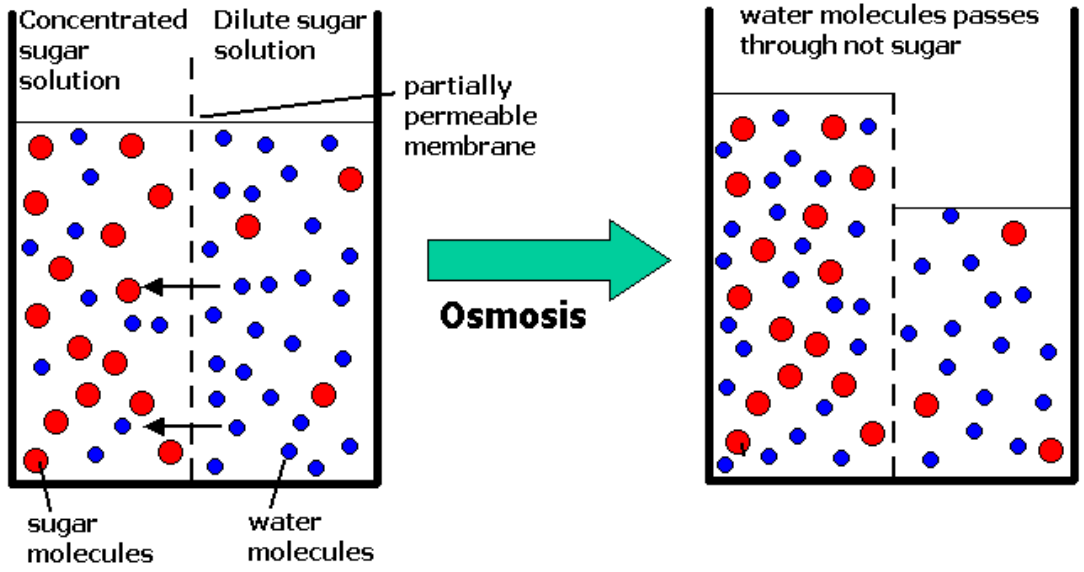
-Must be difference in solute concentration on the 2 sides of the membrane

-Membrane must be impermeable to the solute

-**Osmotically active solutes:** solutes that cannot pass freely through the membrane

Effects of Osmosis

Movement of H_2O from high concentration of H_2O to lower concentration of H_2O



Active Transport

-Movement of molecules and ions against their concentration gradients

-From lower to higher concentrations

-Requires ATP

-2 types of Active Transport:

-Primary

-Secondary

Membrane Transport of Glucose

-Glucose transport is an example of:

-Cotransport

-Primary active transport

-Facilitated diffusion