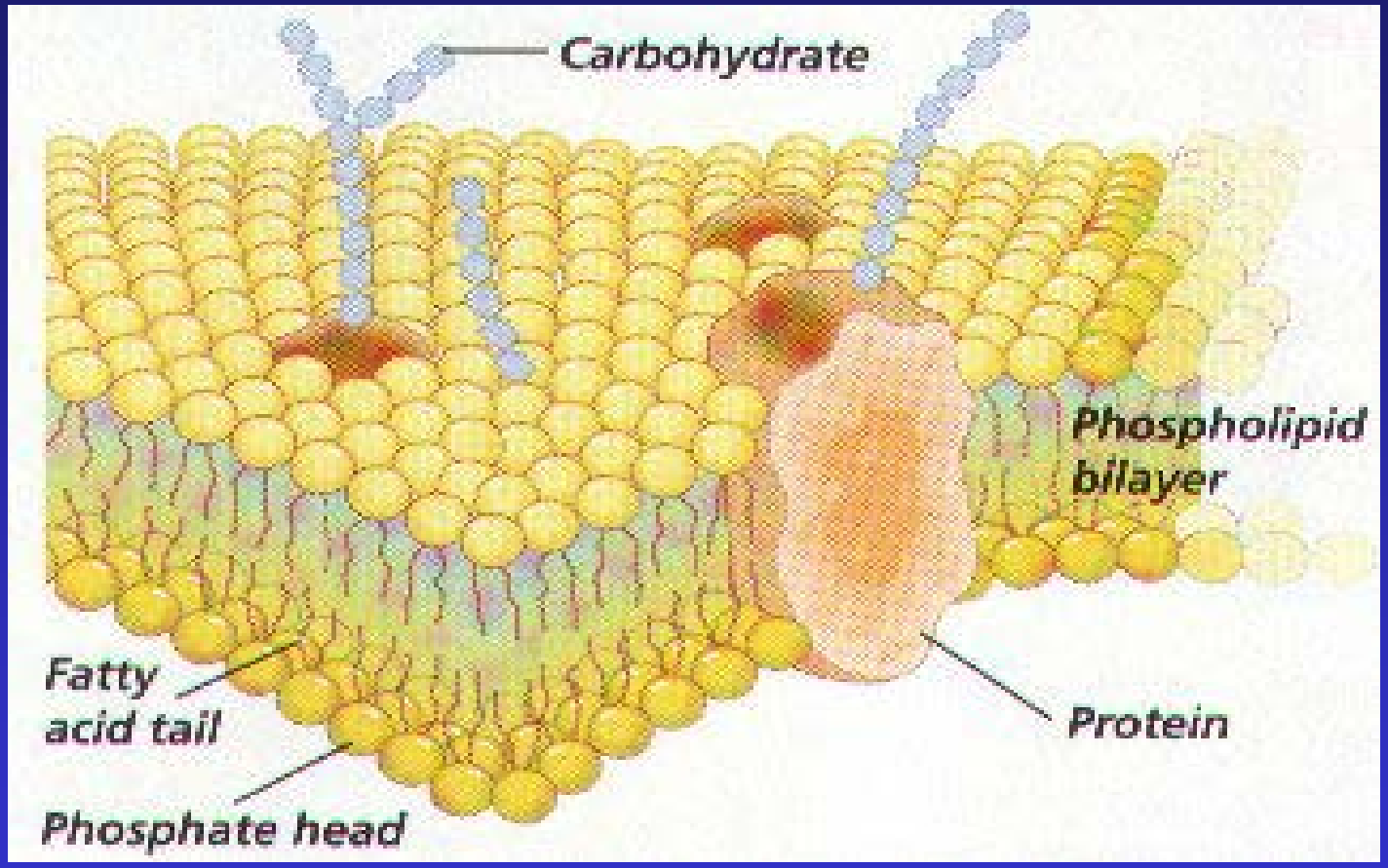
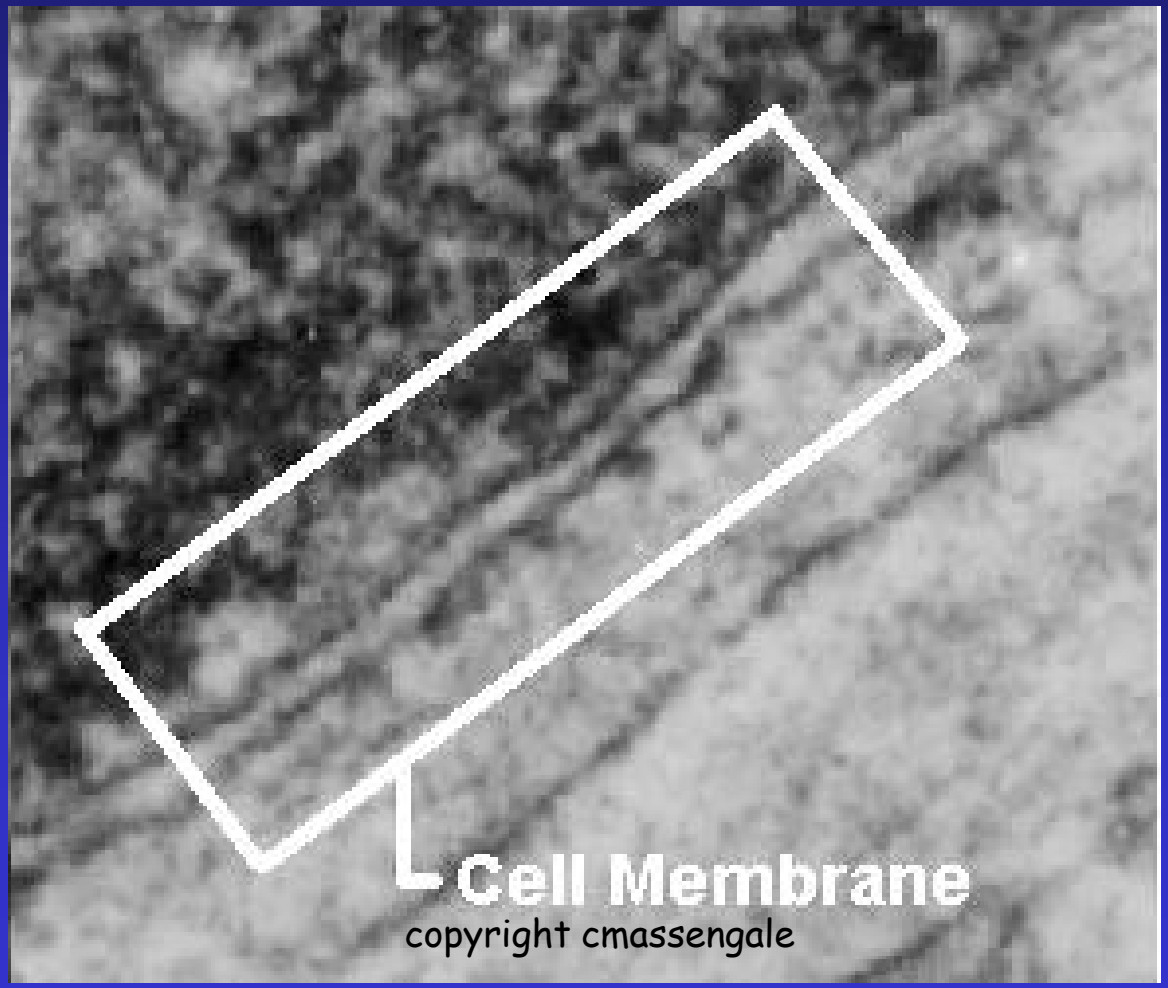
# The Plasma Membrane -




# Gateway to the Cell

# Photograph of a Cell Membrane



# Cell Membrane

The cell membrane is flexible and allows a unicellular organism to move

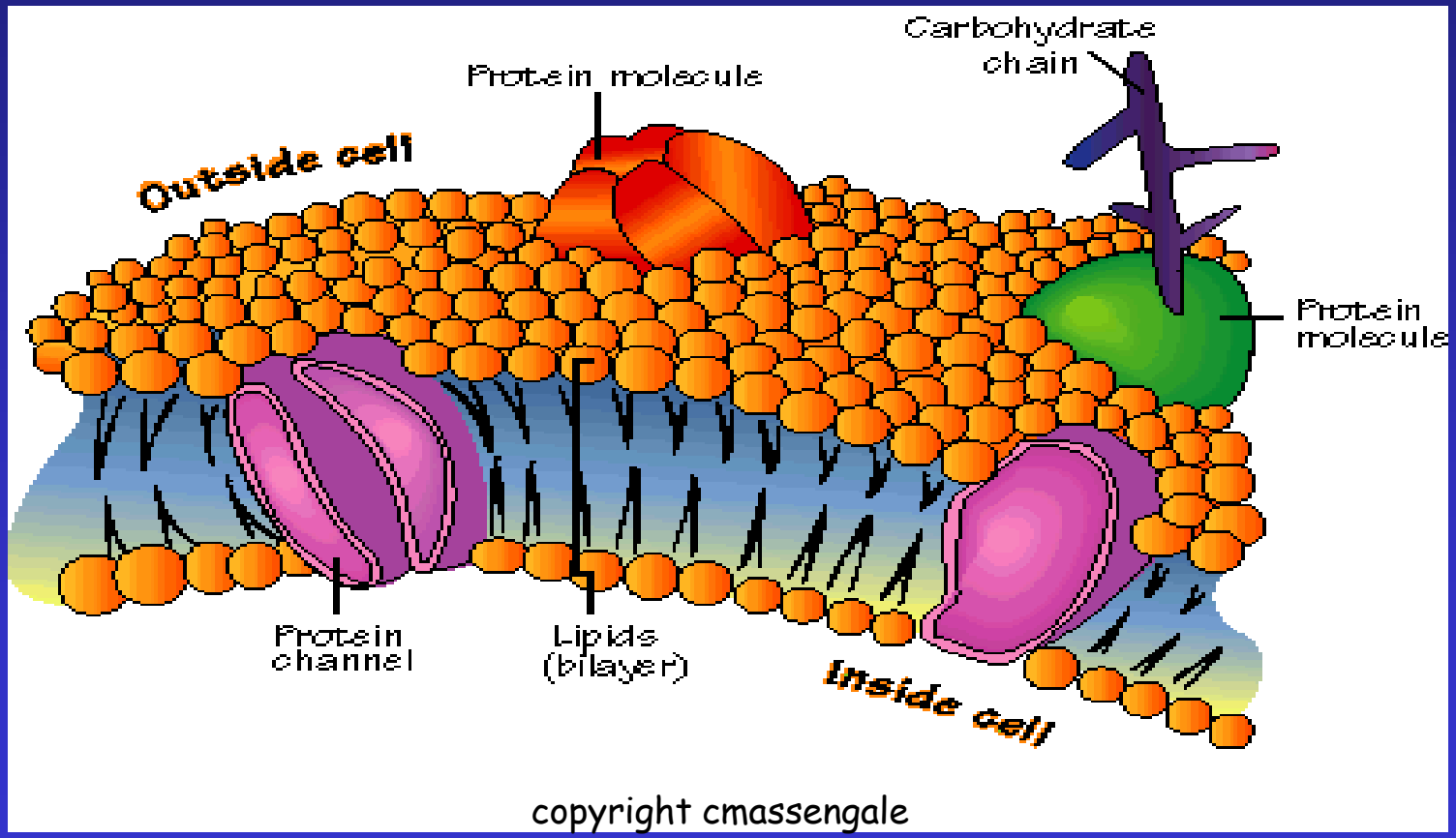
# Homeostasis

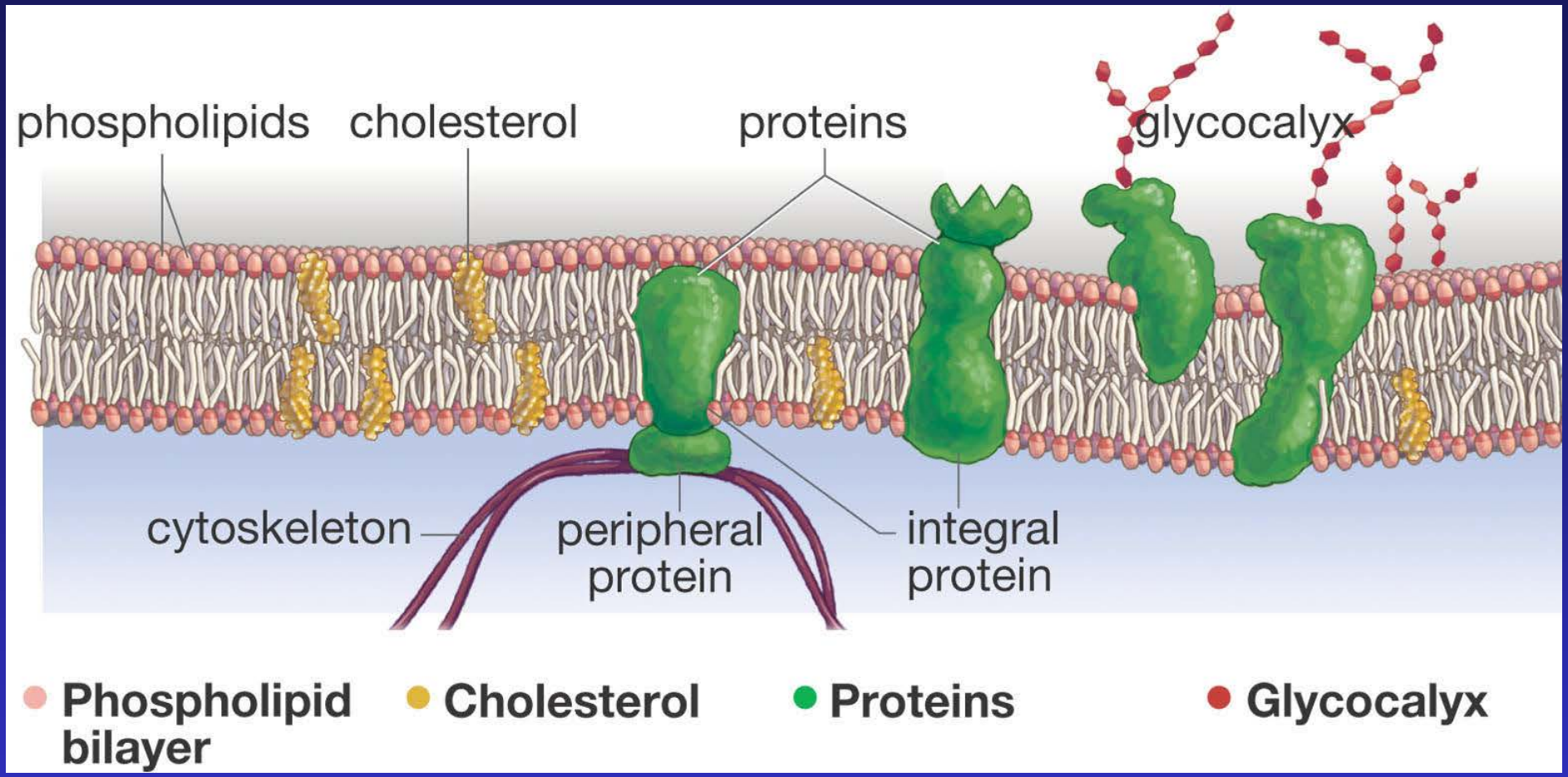
- Balanced internal condition of cells
- Also called equilibrium
- Maintained by plasma membrane controlling what enters & leaves the cell

# Functions of Cell Membrane

- ✓ Protective barrier
- ✓ Regulate transport in & out of cell (selectively permeable)
- ✓ Allow cell recognition
- ✓ Provide anchoring sites for filaments of cytoskeleton
- ✓ Contains the cytoplasm (fluid in cell)

# Structure of Cell Membrane





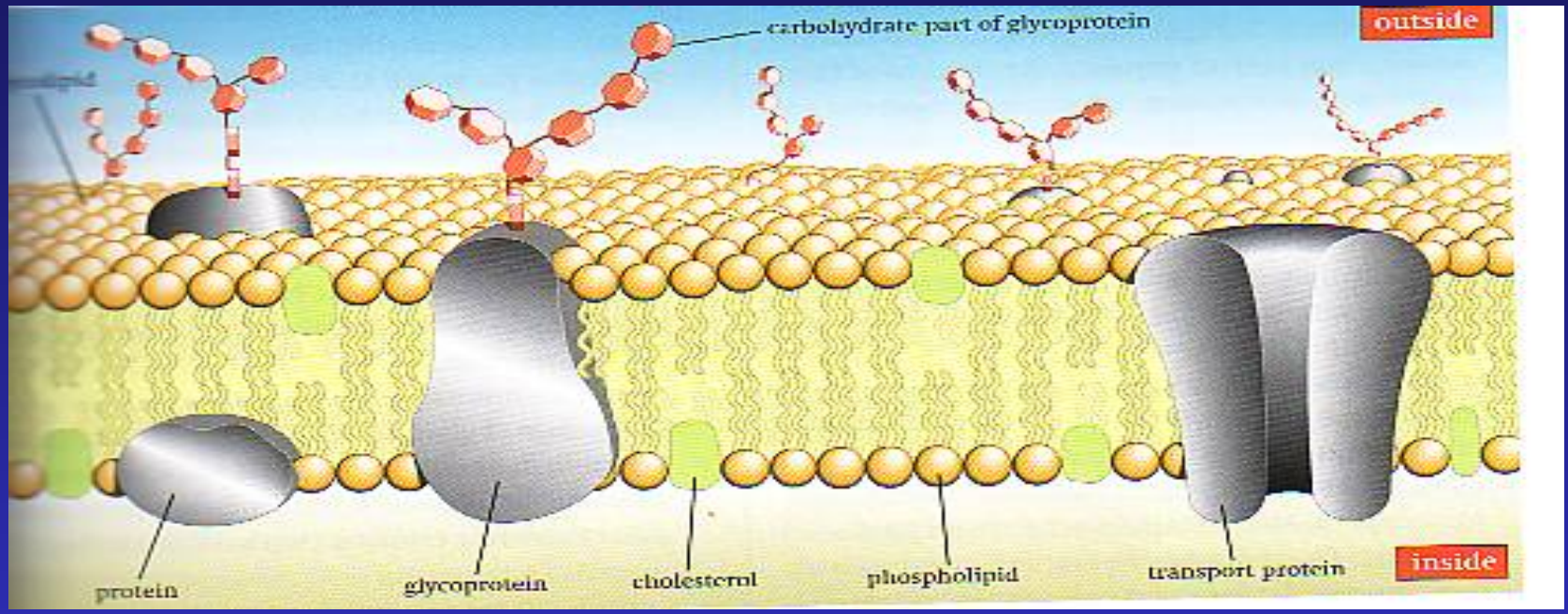

**Proteins**
(peripheral and integral)

**Phospholipids**

**Cholesterol**

**Carbohydrates** (glucose)

# FLUID MOSAIC MODEL



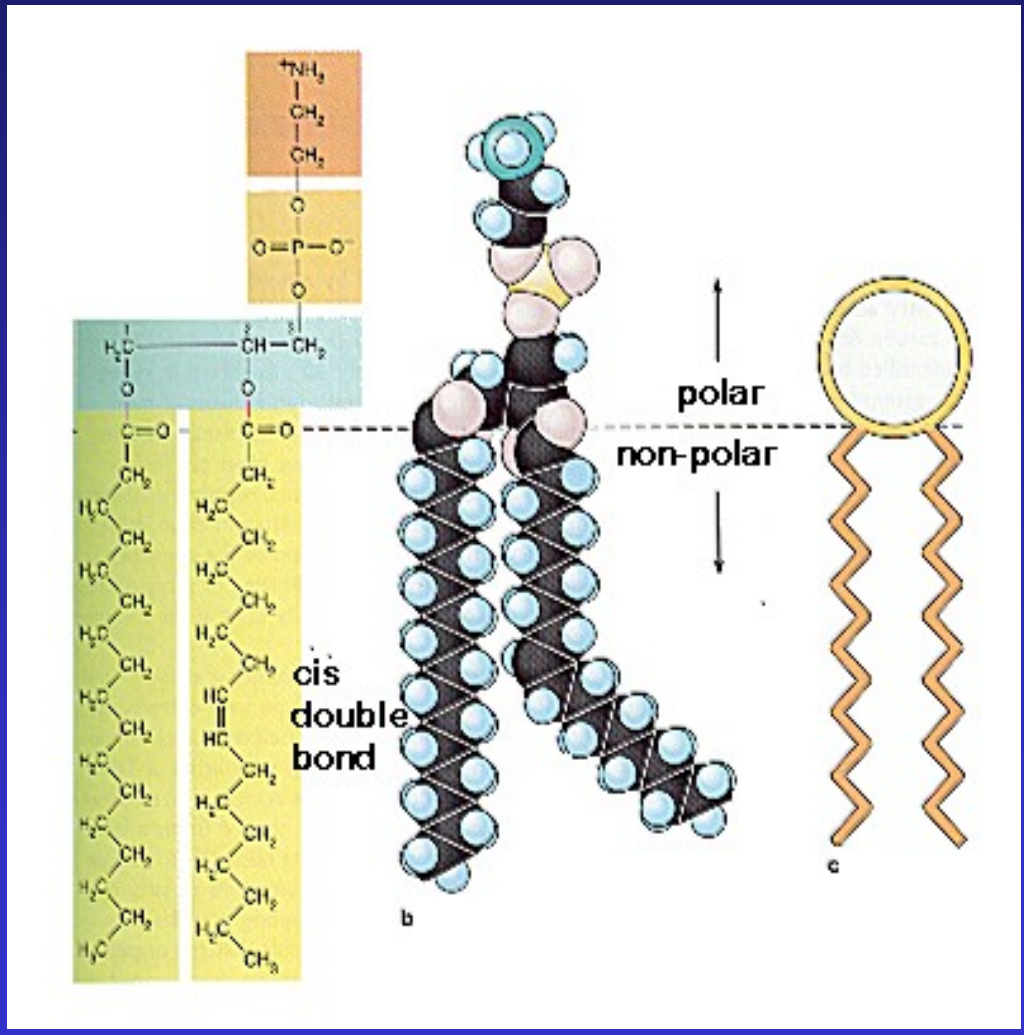

**FLUID**- because phospholipids and proteins can move within the layer, like it's a liquid.

**MOSAIC**- because of pattern made by the scattered proteins when the membrane is seen from above.

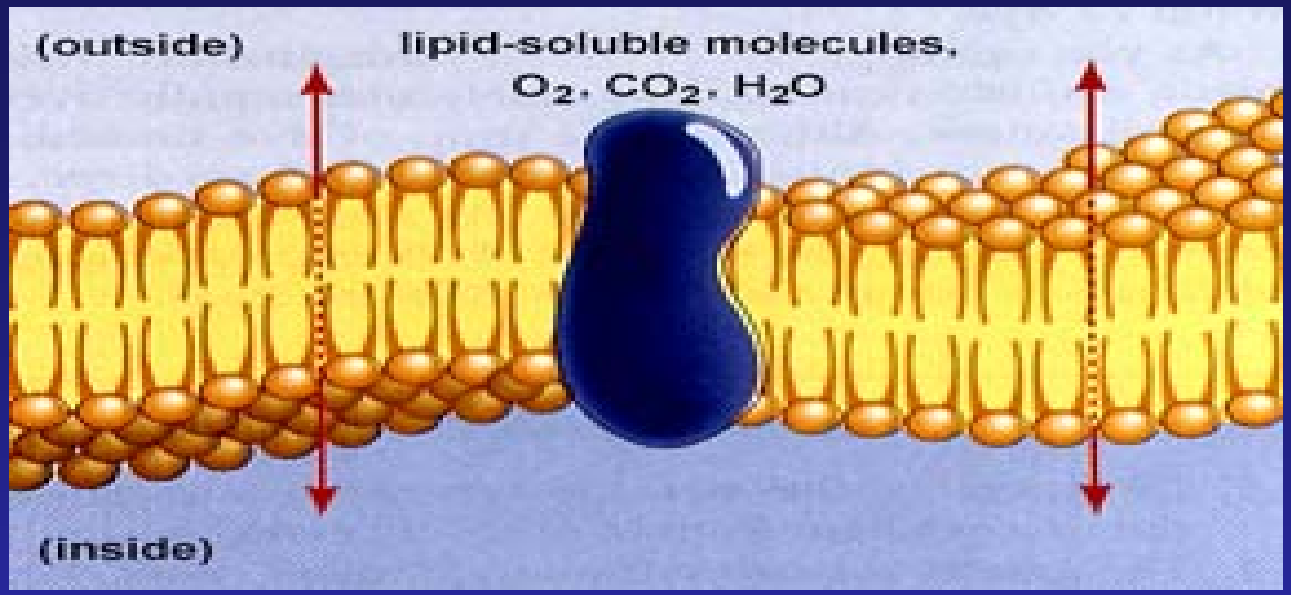
# Phospholipids

Has 2 fatty acid chains that are nonpolar

Head is polar has a $-PO_4$ group and glycerol



Made of 2 layers of phospholipids =bilayer

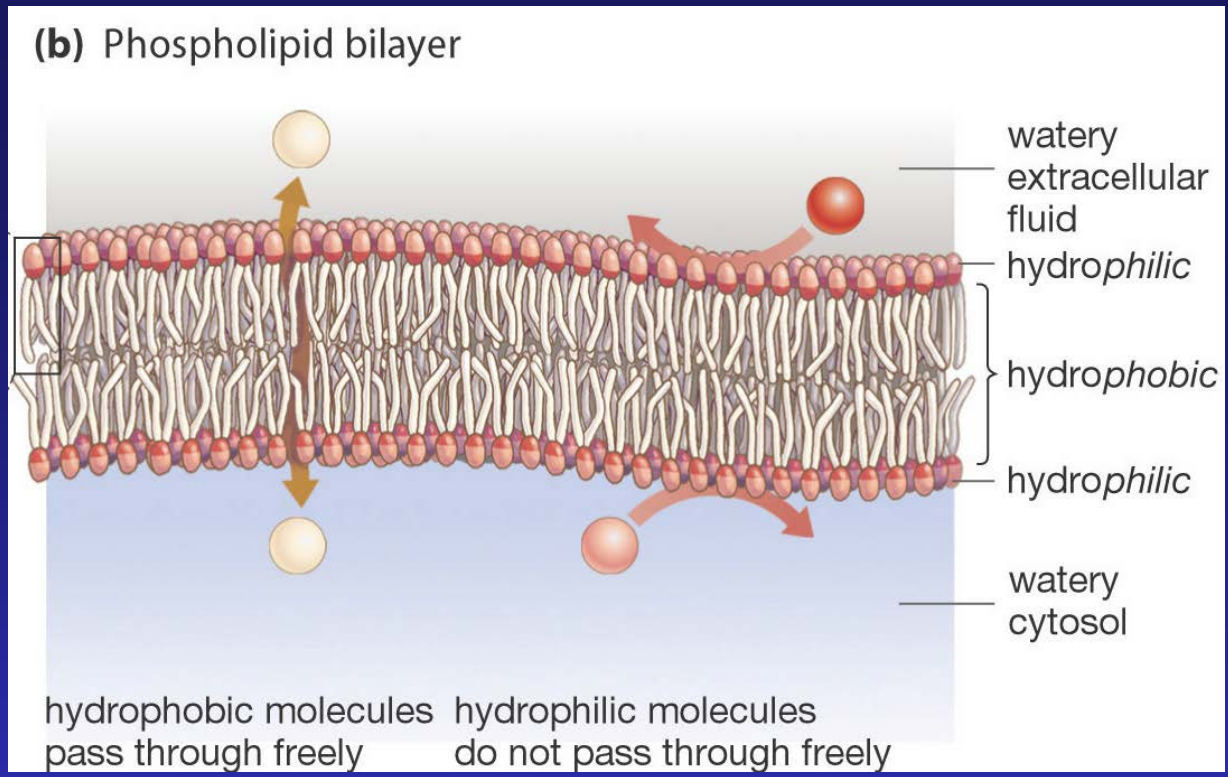



Polar heads- hydrophilic "water loving"

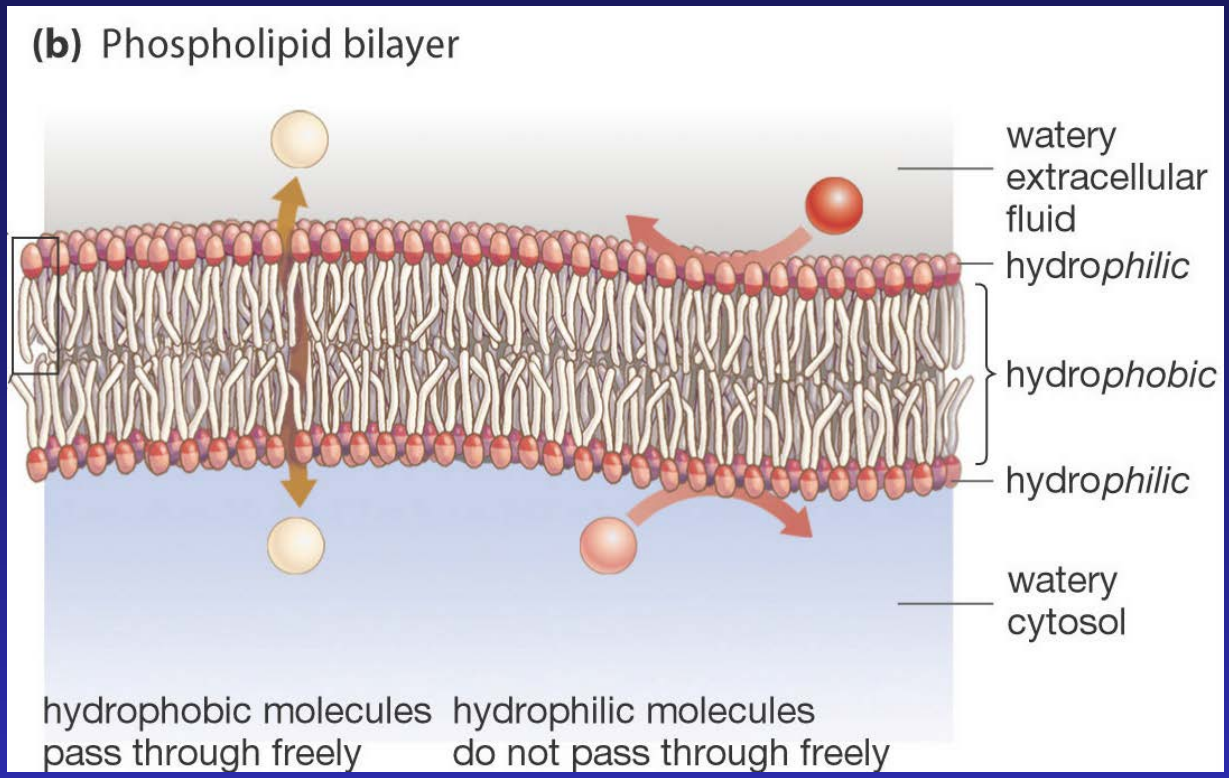
Nonpolar tails- hydrophobic "water fearing"

Makes the membrane "Selective" about what can move across, called a Semipermeable Membrane

# Solubility




Small molecules like $O_2$, $CO_2$, $H_2O$ things that are Hydrophobic (soluble in lipids) can pass through the membrane easily

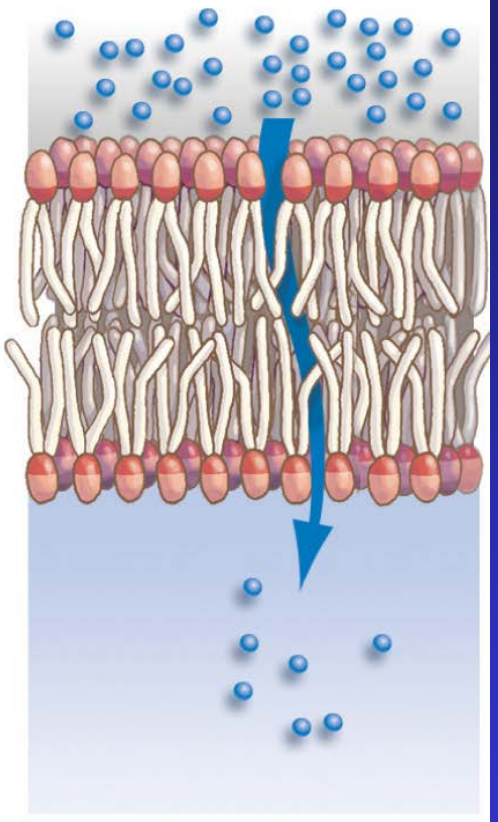



Ions, hydrophilic molecules bigger than water, and large molecules like proteins DO NOT move through the membrane on their own.

# Types of Transport Across Cell Membranes

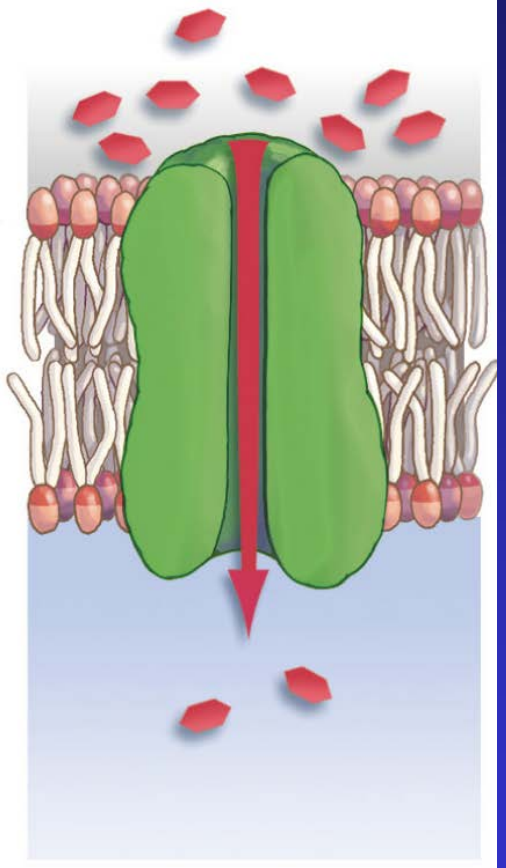
# Three Forms of Transport Across the Membrane

simple diffusion



Materials move down their concentration gradient through the phospholipid bilayer.

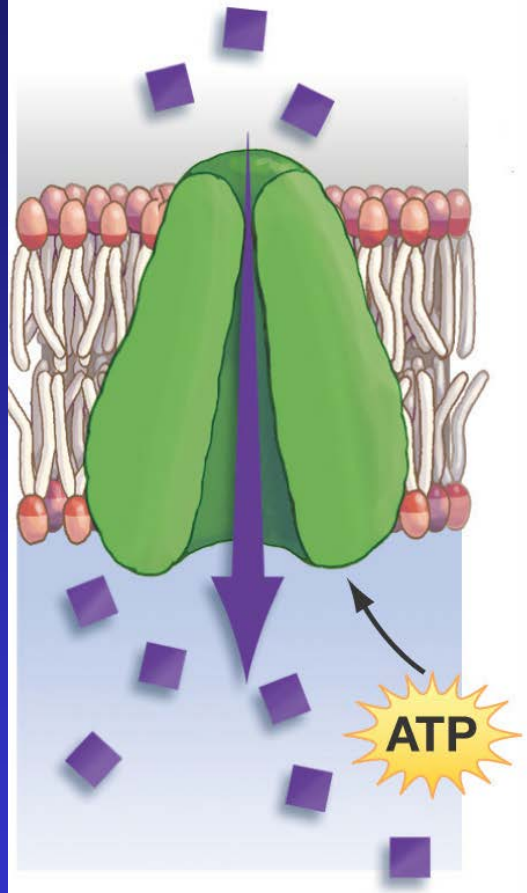
facilitated diffusion



The passage of materials is aided both by a concentration gradient and by a transport protein.



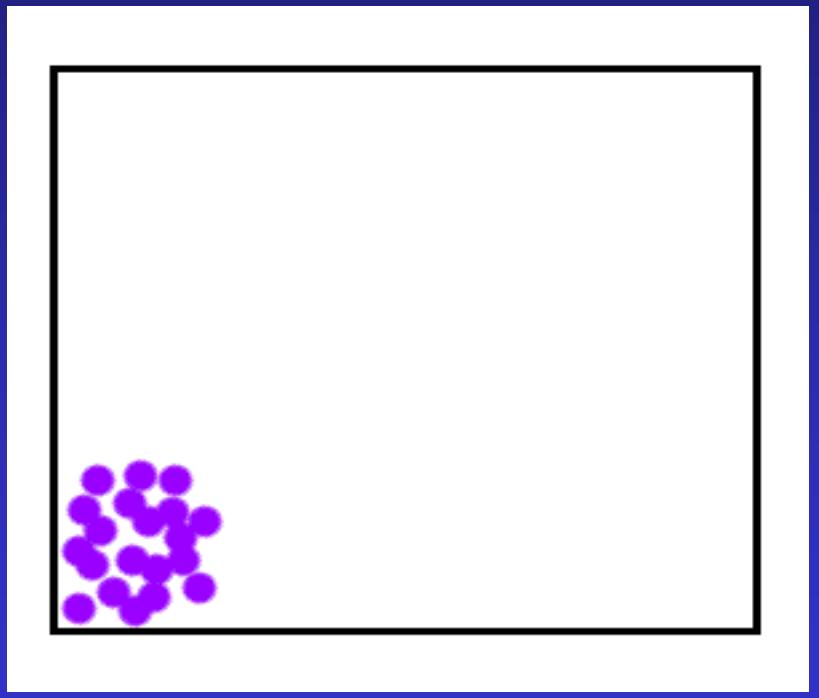
Active transport




Molecules again move through a transport protein, but now energy must be expended to move them against their concentration gradient.

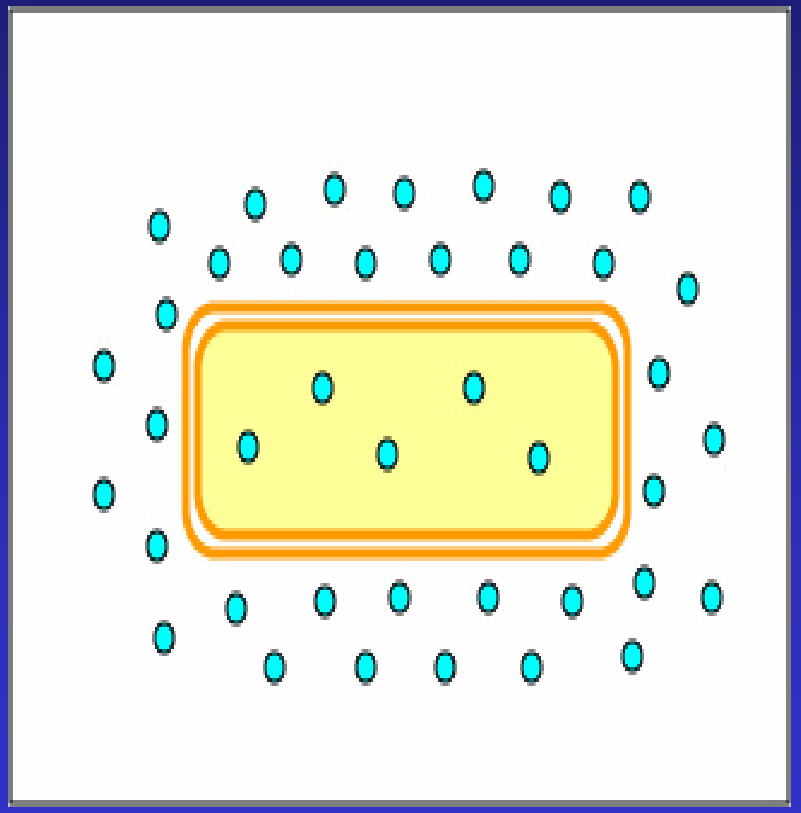
# Simple Diffusion

- Requires NO energy
- Molecules move from area of HIGH to LOW concentration

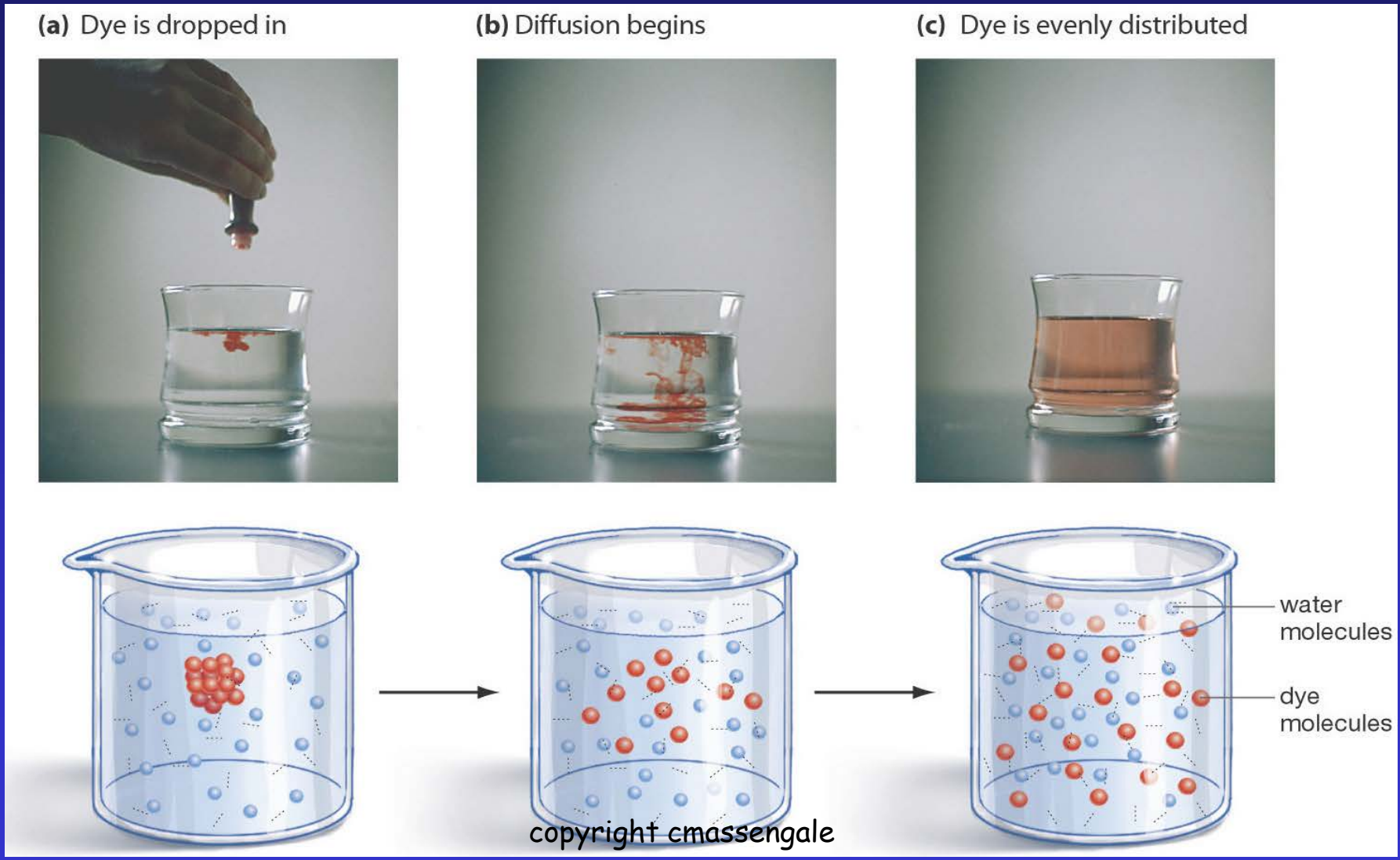


# DIFFUSION

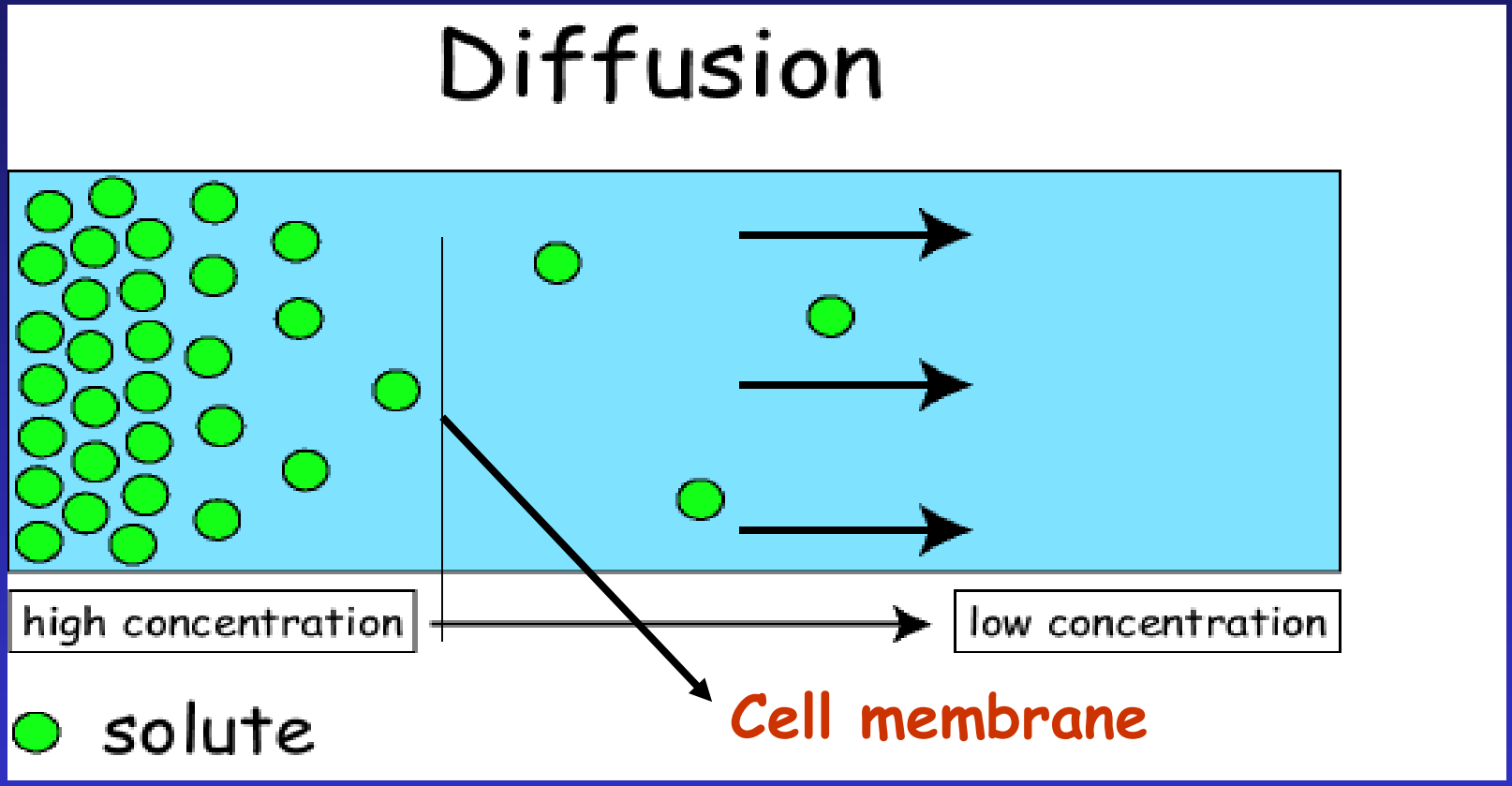
Diffusion is PASSIVE which means no energy is used to make the molecules move.



# Diffusion of Liquids



# Diffusion through a Membrane

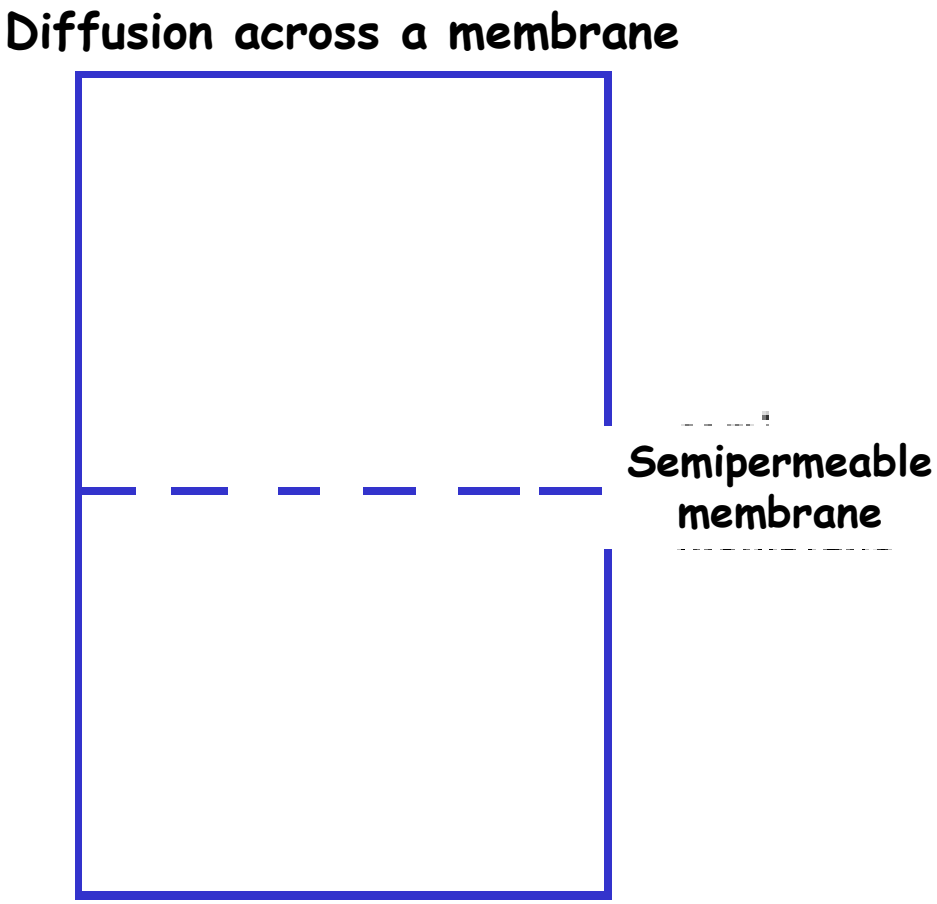



Solute moves DOWN concentration gradient (HIGH to LOW)

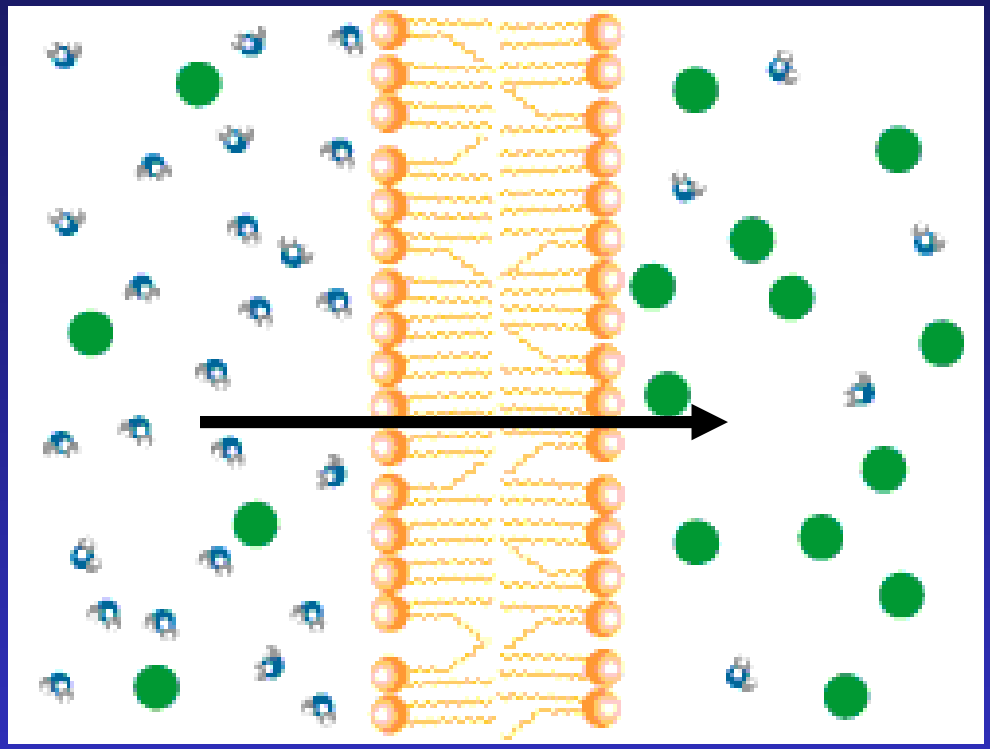
# Osmosis

- Diffusion of water across a membrane

- Moves from HIGH water potential (low solute) to LOW water potential (high solute)



# Diffusion of $H_2O$ Across A Membrane

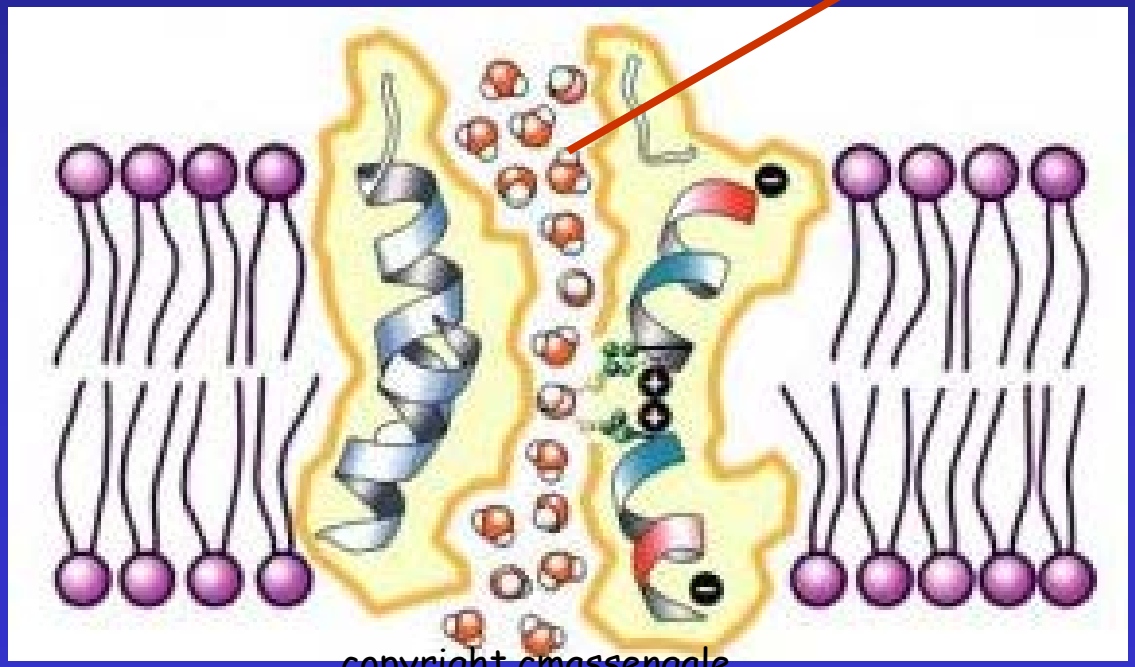


High $H_2O$ potential
Low solute concentration

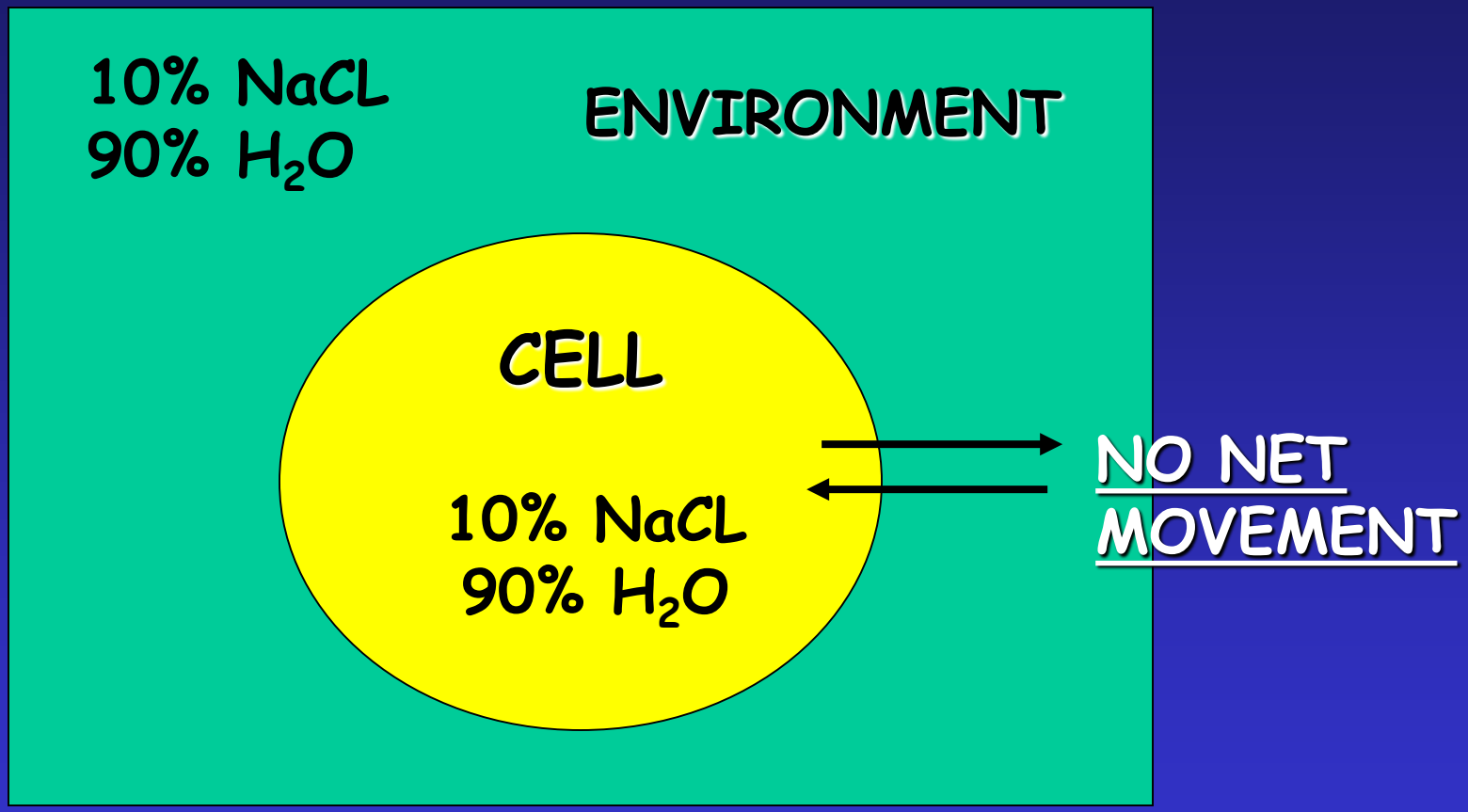
Low $H_2O$ potential
High solute concentration

# Aquaporins

- Water Channels
- Protein pores used during OSMOSIS



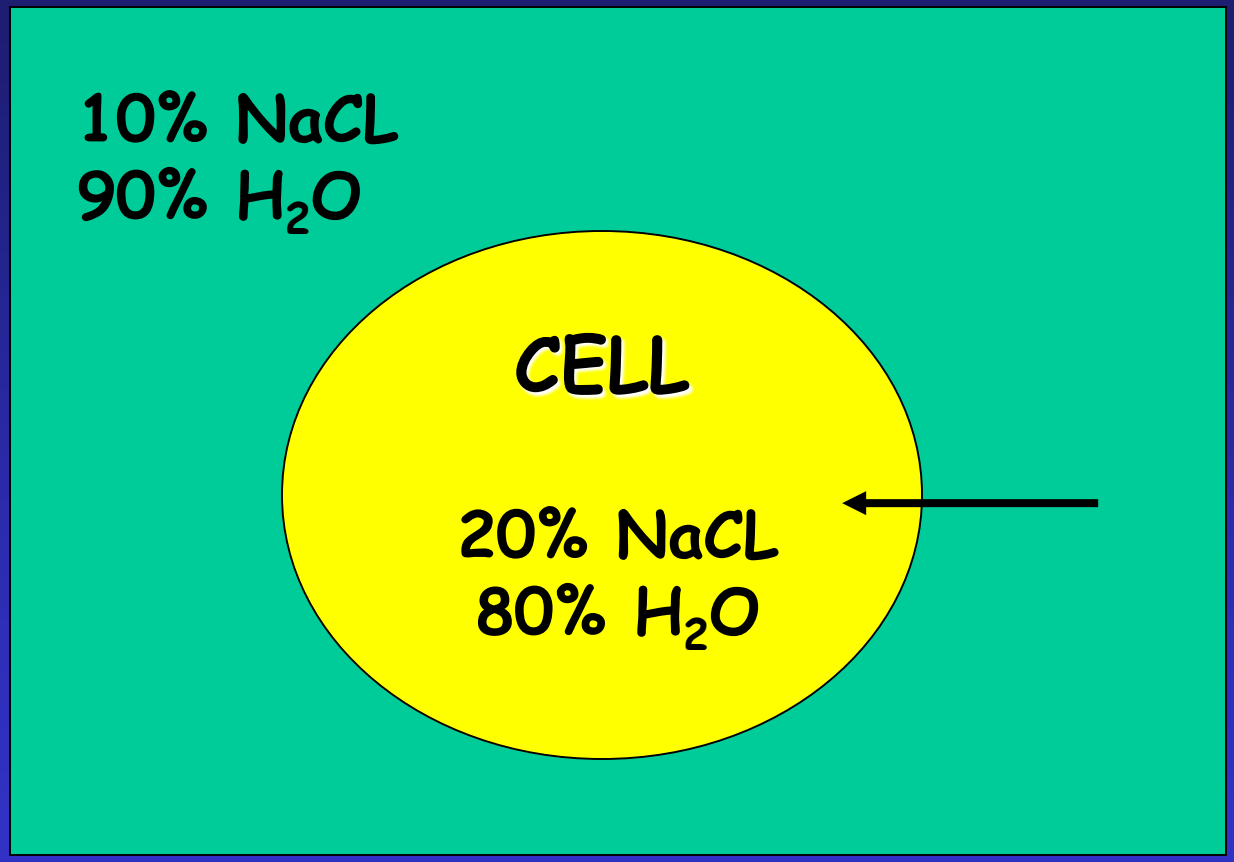
# Cell in Isotonic Solution




**What is the direction of water movement?**

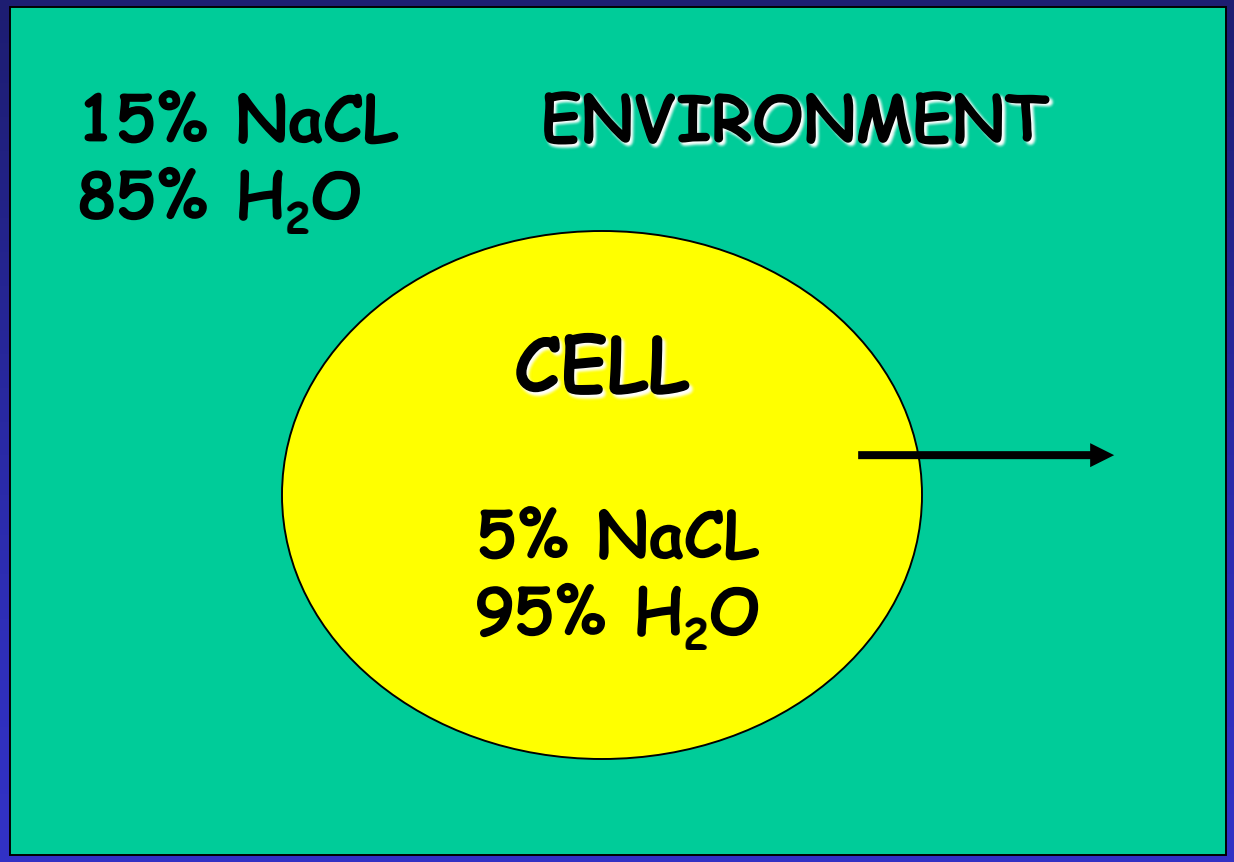
The cell is at ___equilibrium___.

# Cell in Hypotonic Solution




What is the direction of water movement?

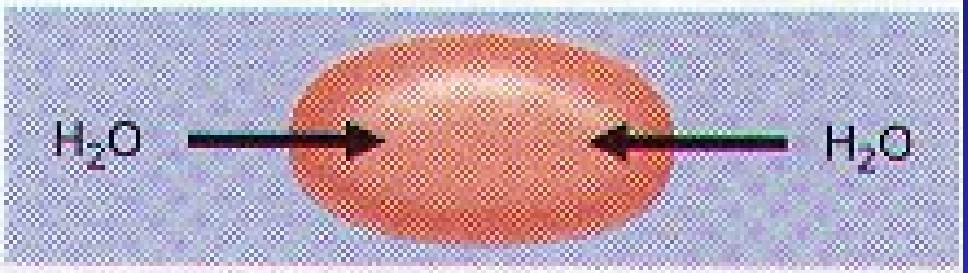
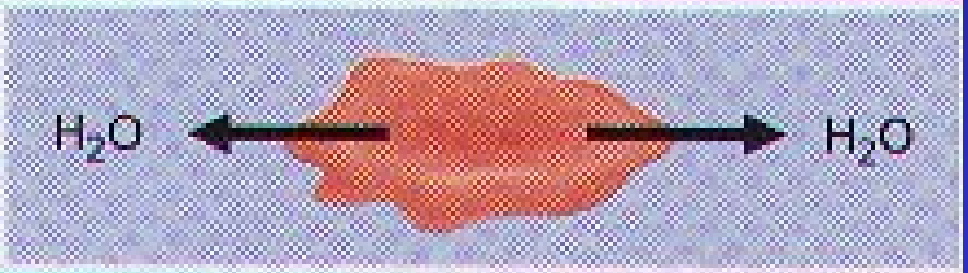
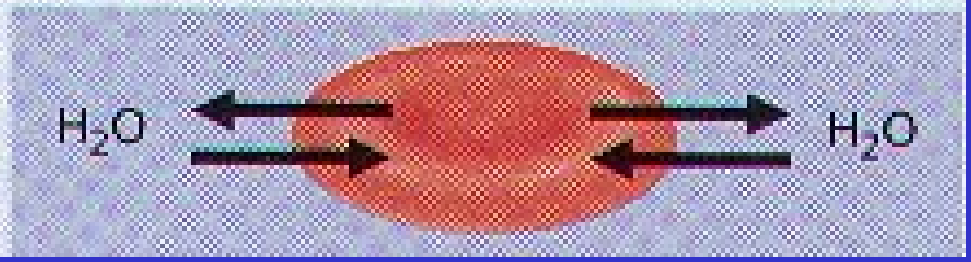
# Cell in Hypertonic Solution

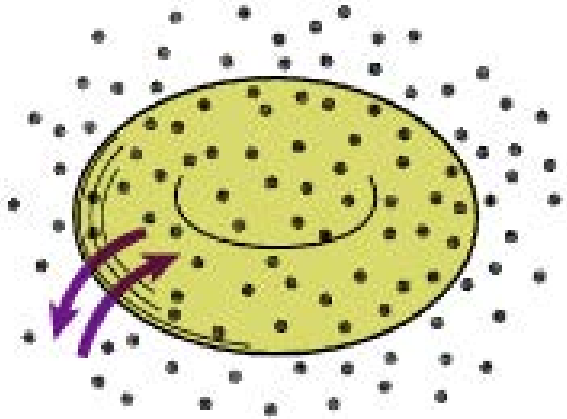


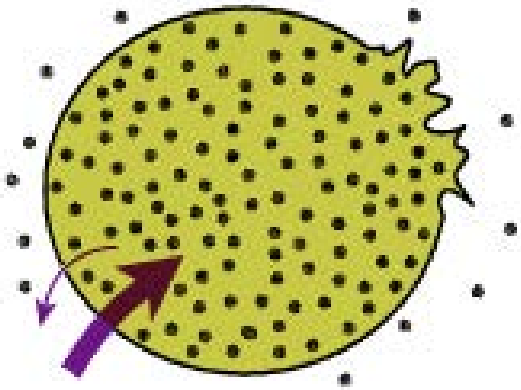

What is the direction of water movement?

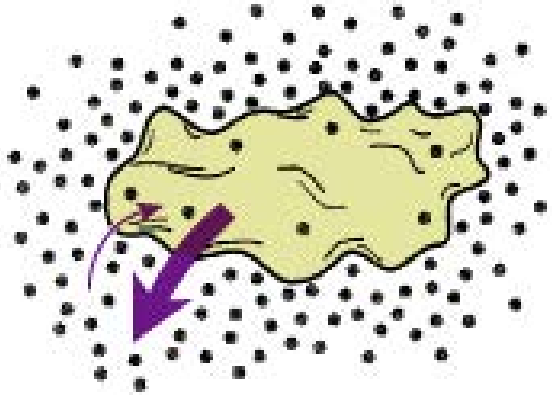
# Cells in Solutions

**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 |   |







**Isotonic Solution**

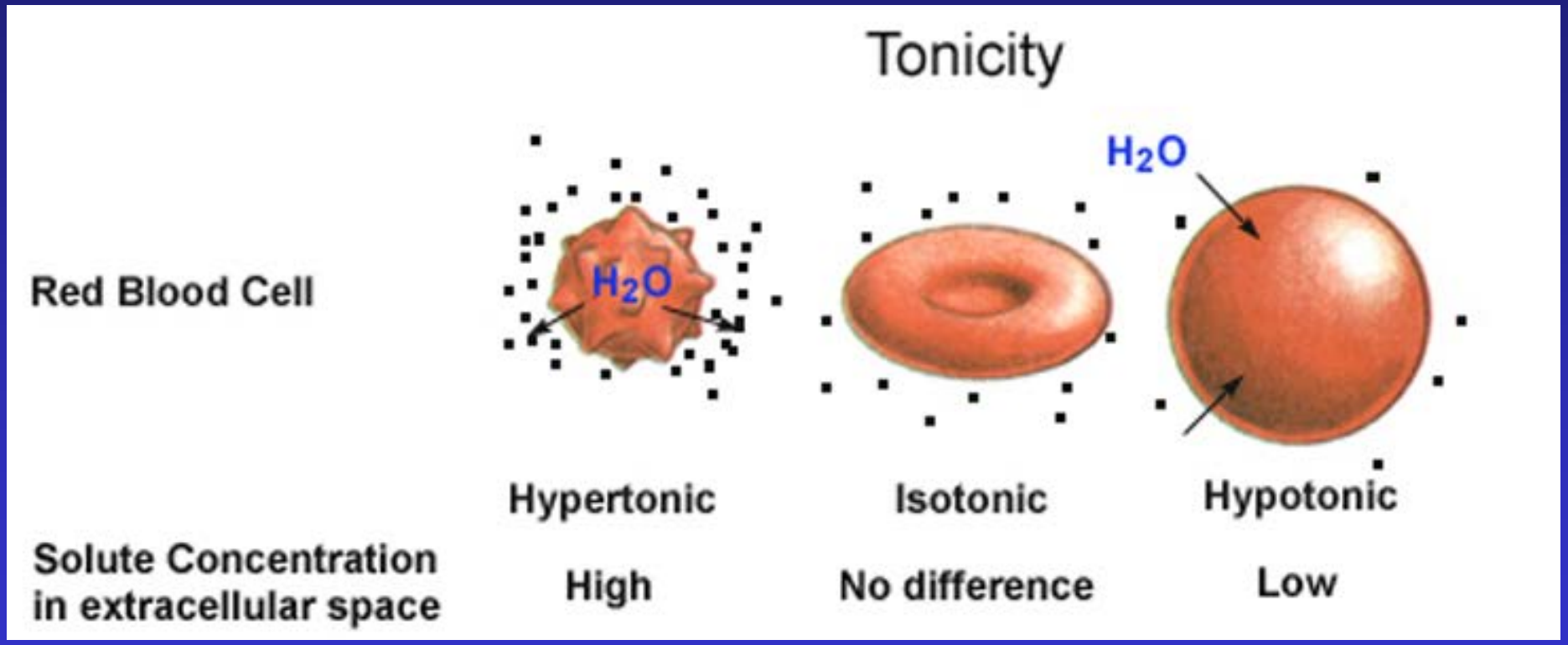
↓

**NO NET MOVEMENT OF** $H_2O$ (equal amounts entering & leaving)

**Hypotonic Solution**

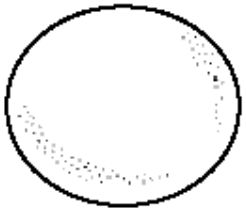
**Hypertonic Solution**

# What Happens to Blood Cells?



**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

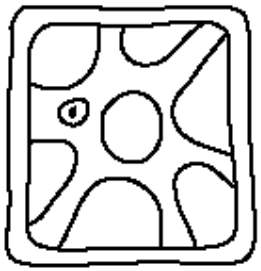


a **hypotonic**

b **hypertonic**

c **isotonic**

PLANT CELL



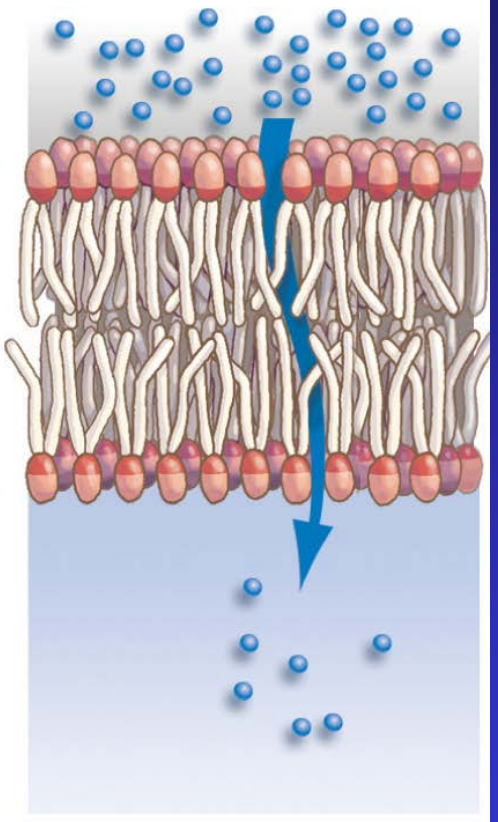
d **hypertonic**

e **isotonic**

f **hypotonic**

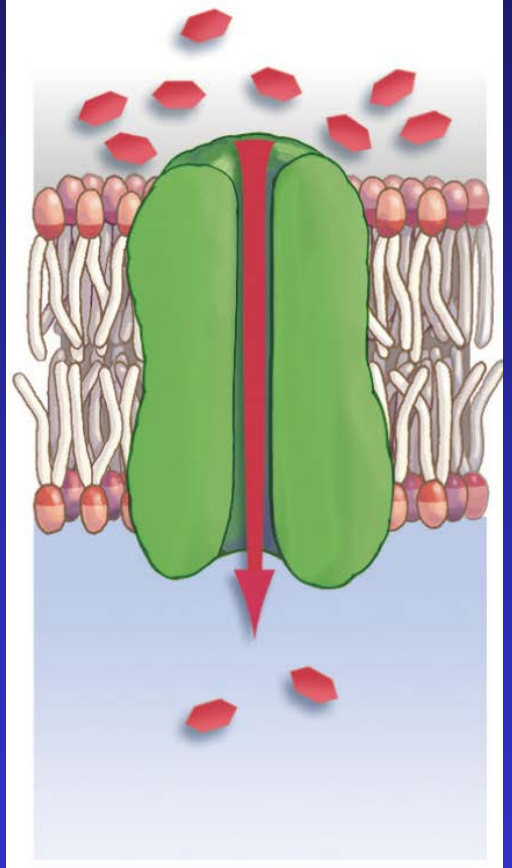
# Three Forms of Transport Across the Membrane

simple diffusion



Materials move down their concentration gradient through the phospholipid bilayer.

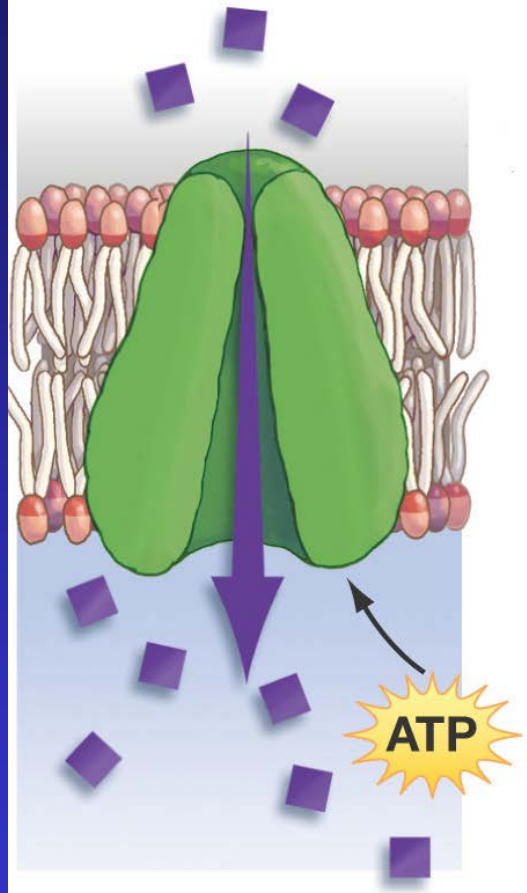
facilitated diffusion



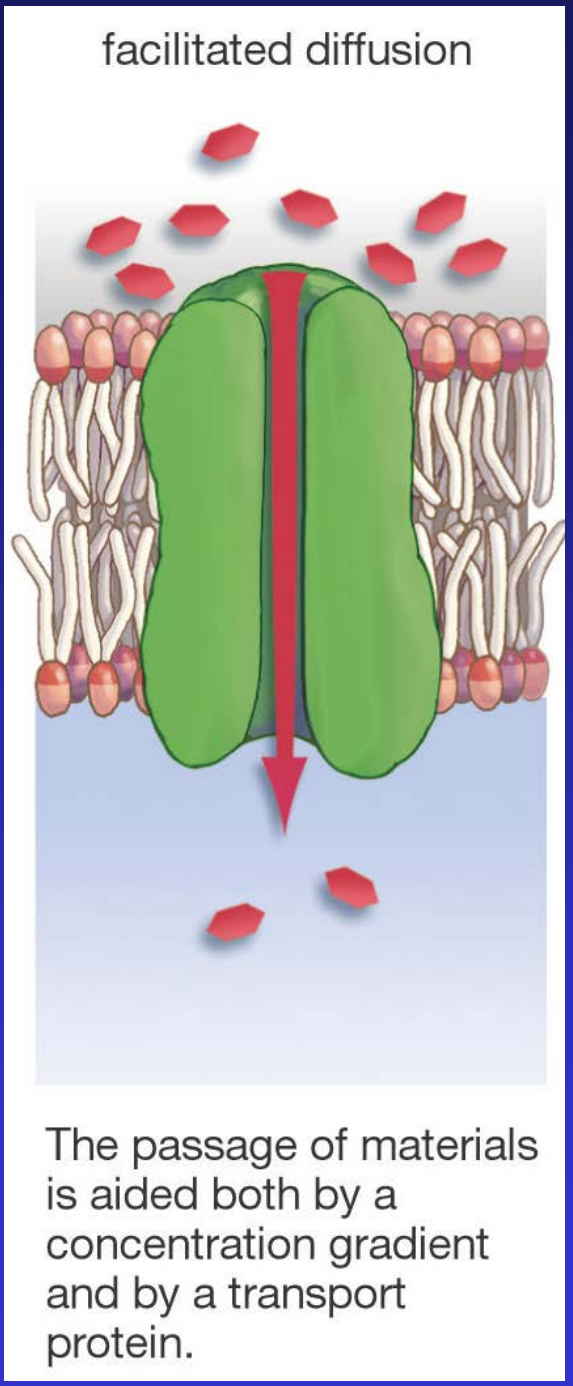
The passage of materials is aided both by a concentration gradient and by a transport protein.



Active transport




Molecules again move through a transport protein, but now energy must be expended to move them against their concentration gradient.




The passage of materials is aided both by a concentration gradient and by a transport protein.

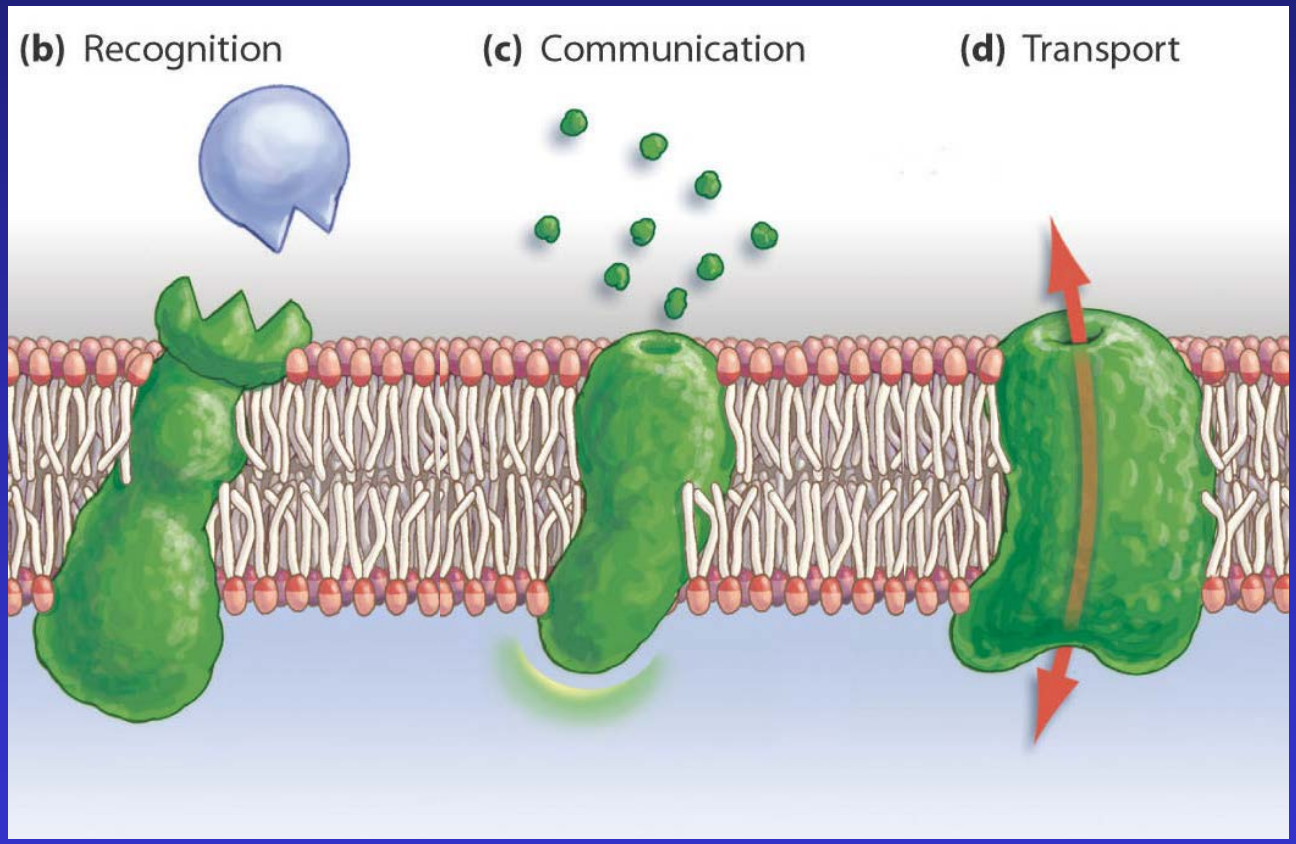
# Passive Transport

## Facilitated diffusion

- Doesn't require energy
- Uses transport proteins to move high to low concentration

Examples: Glucose or amino acids

# Proteins Are Critical to Membrane Function

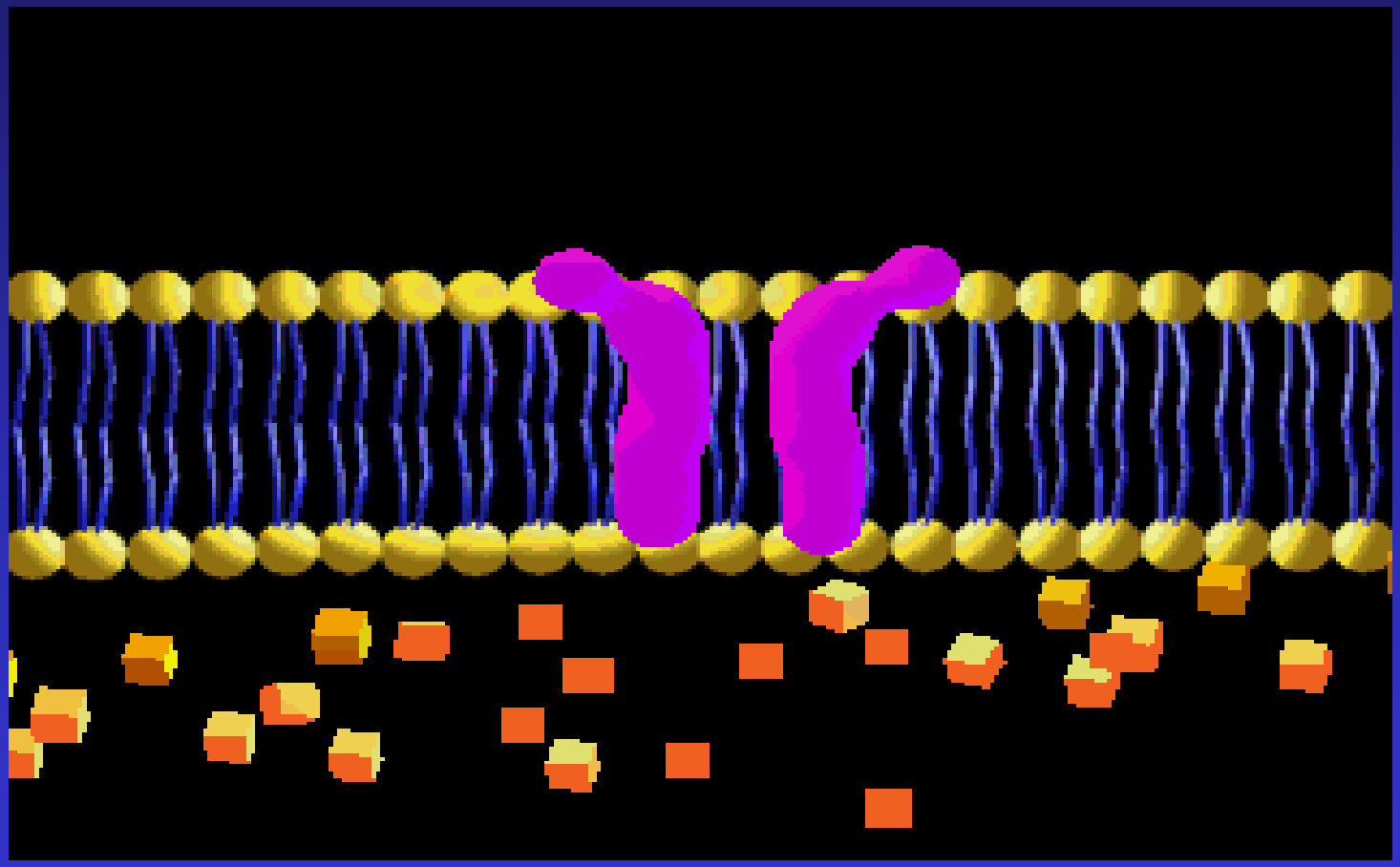


# Types of Transport Proteins

- Channel proteins are stuck in the cell membrane & have a pore for materials to cross

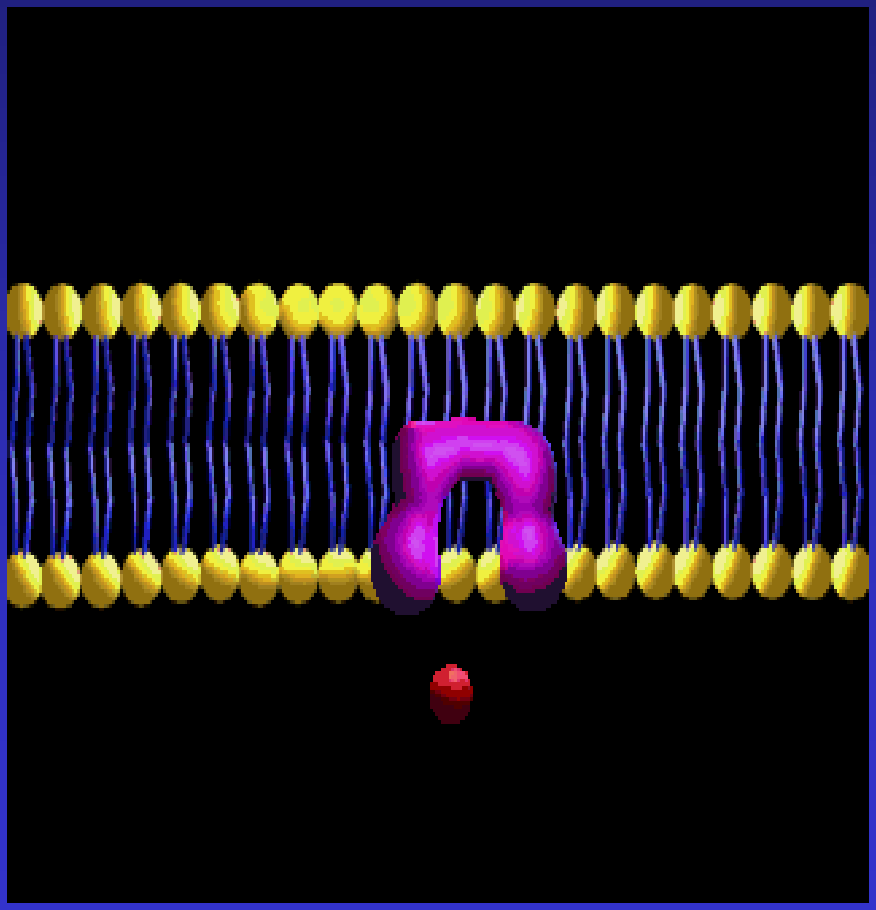
- Carrier proteins can change shape to move material from one side of the membrane to the other

Molecules will randomly move through the pores in Channel Proteins.



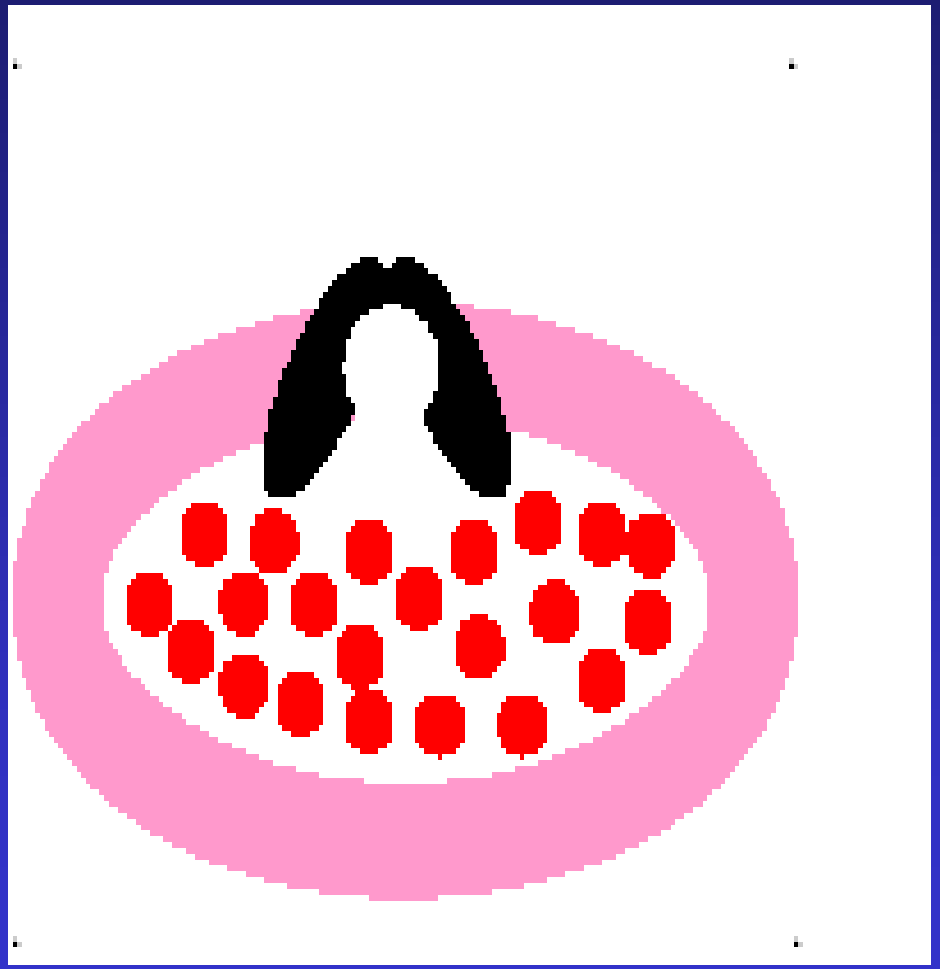
## Some Carrier proteins do not go all the way through the membrane.

- They bond to and drag molecules through the lipid bilayer and release them on the opposite side.



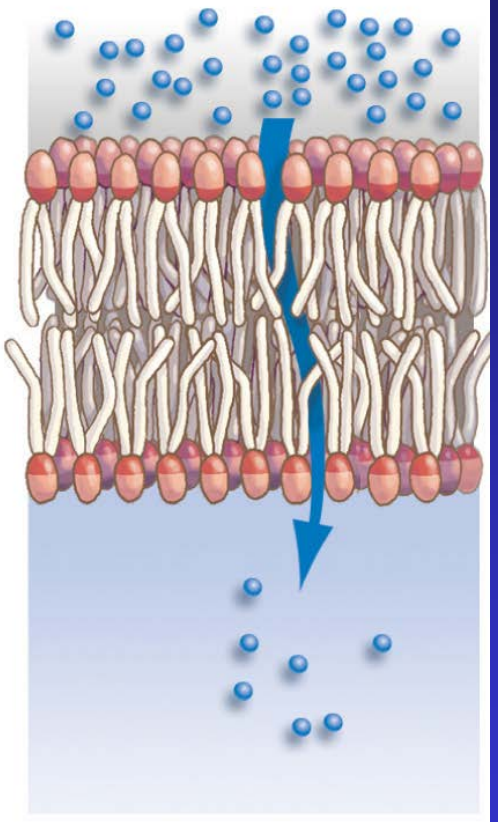
# Carrier Proteins

- Other carrier proteins change shape to move materials across the cell membrane



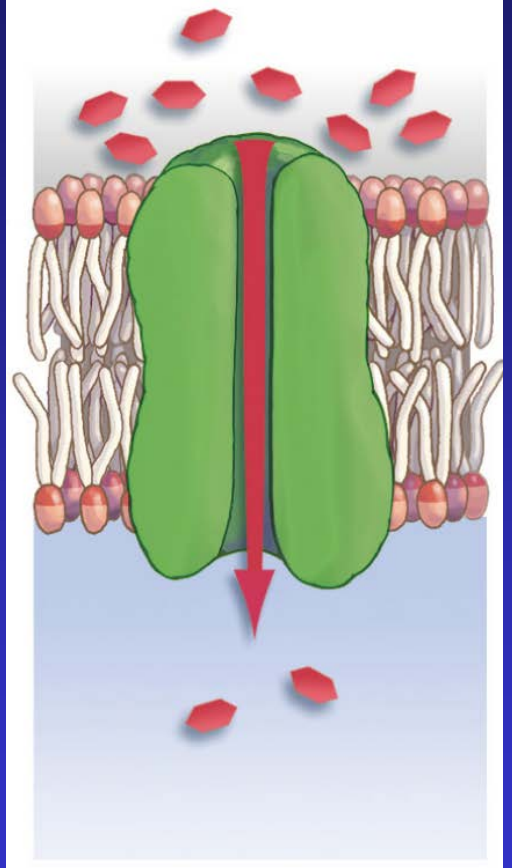
# Three Forms of Transport Across the Membrane

simple diffusion



Materials move down their concentration gradient through the phospholipid bilayer.

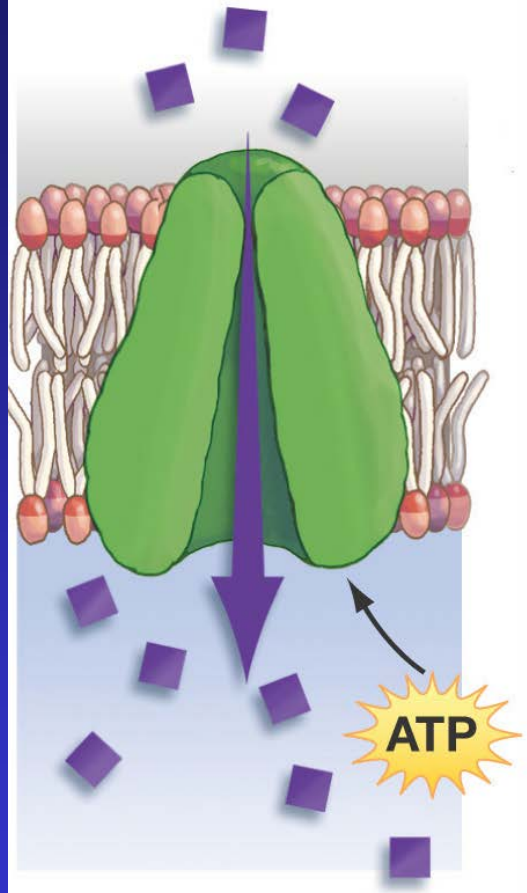
facilitated diffusion



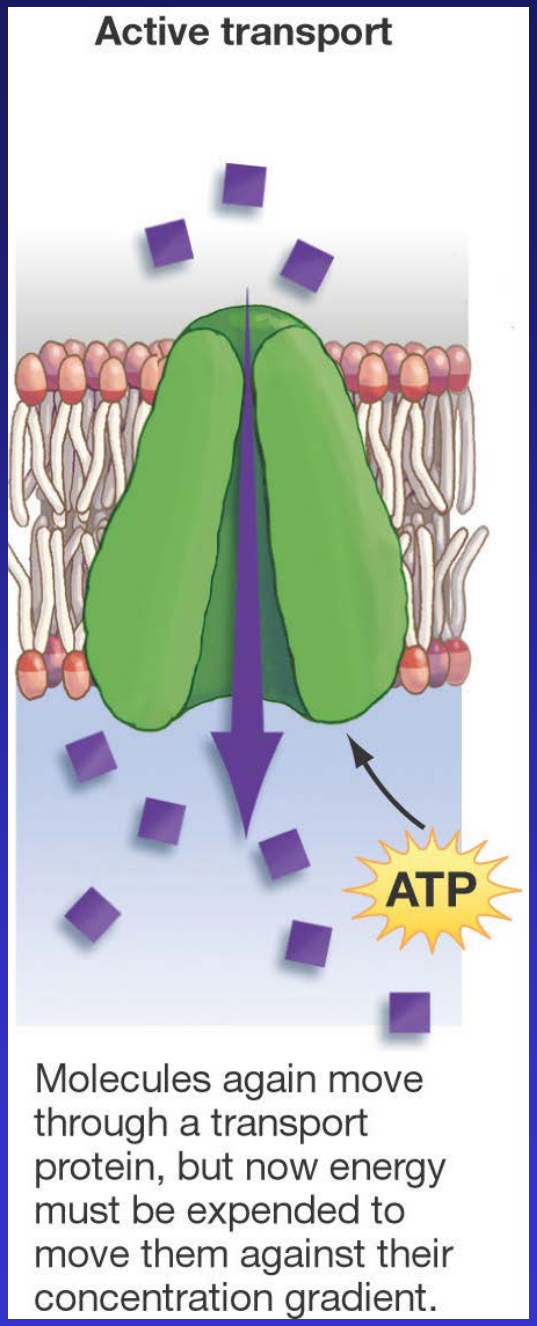
The passage of materials is aided both by a concentration gradient and by a transport protein.



Active transport

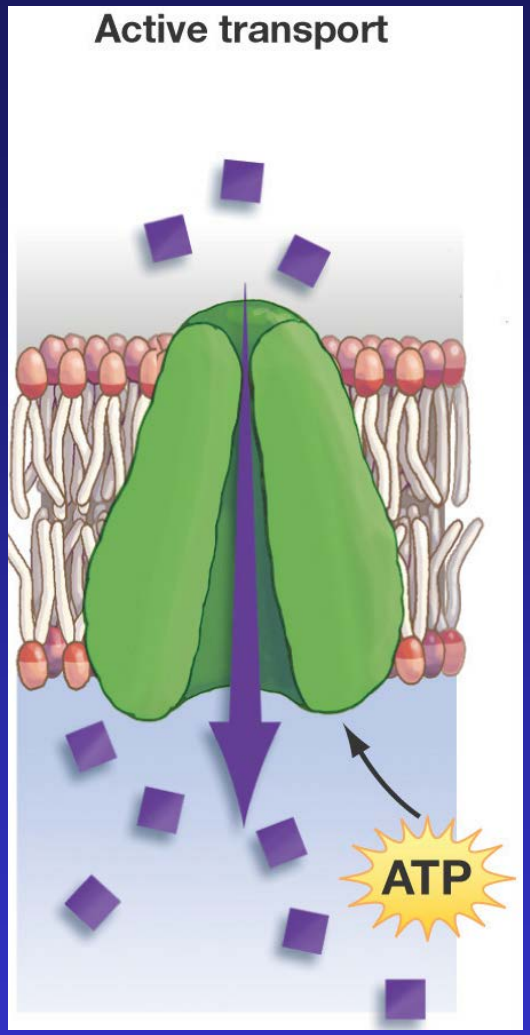



Molecules again move through a transport protein, but now energy must be expended to move them against their concentration gradient.




# Active Transport

- Requires energy or ATP
- Moves materials from LOW to HIGH concentration
- AGAINST concentration gradient

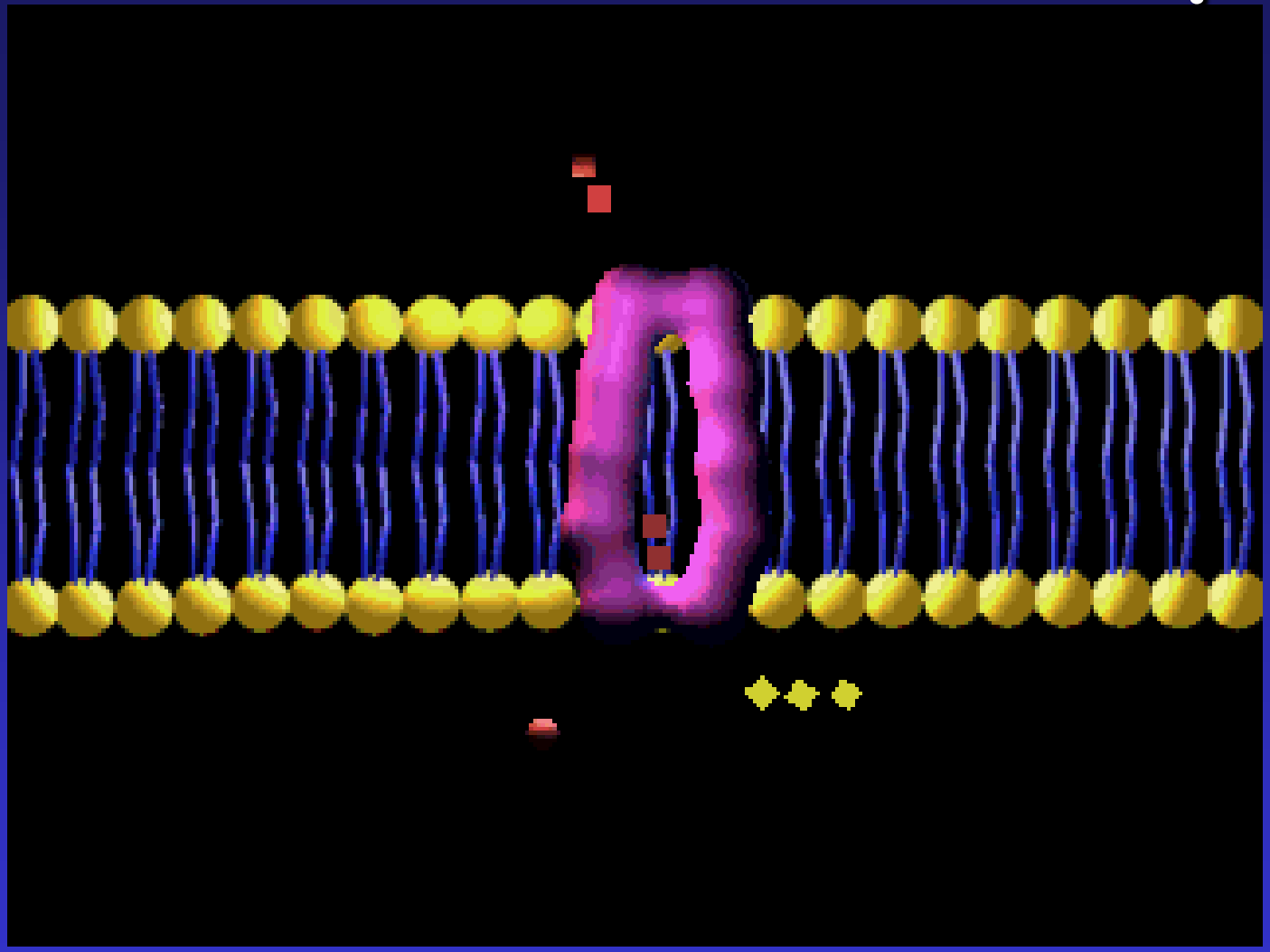



# Active transport

- Examples: Pumping $Na^+$ (sodium ions) out and $K^+$ (potassium ions) in against strong concentration gradients.

- Called Na+-K+ Pump

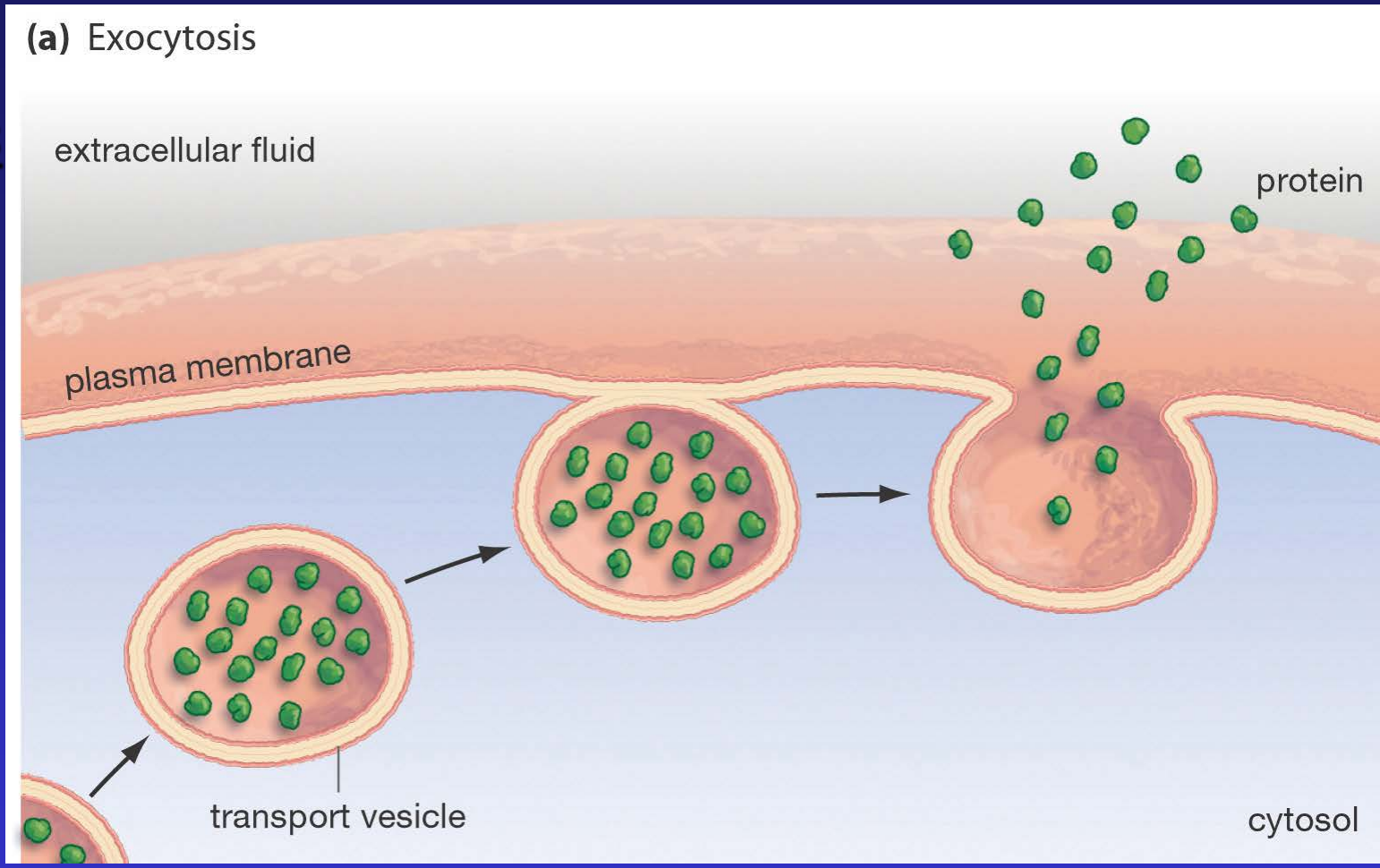
# Sodium-Potassium Pump



3 Na+ pumped out for every 2 K+ pumped in; creates a membrane potential

# Moving the "Big Stuff"

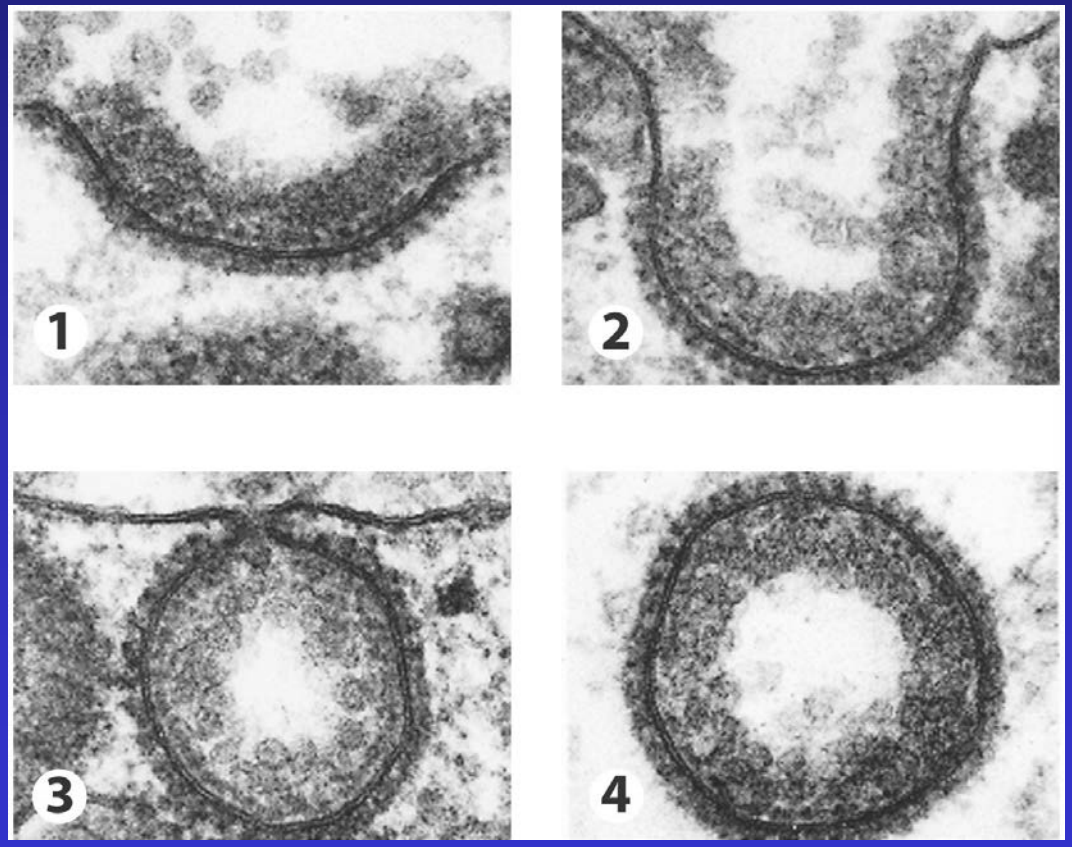
**Exocytosis - moving things out.**



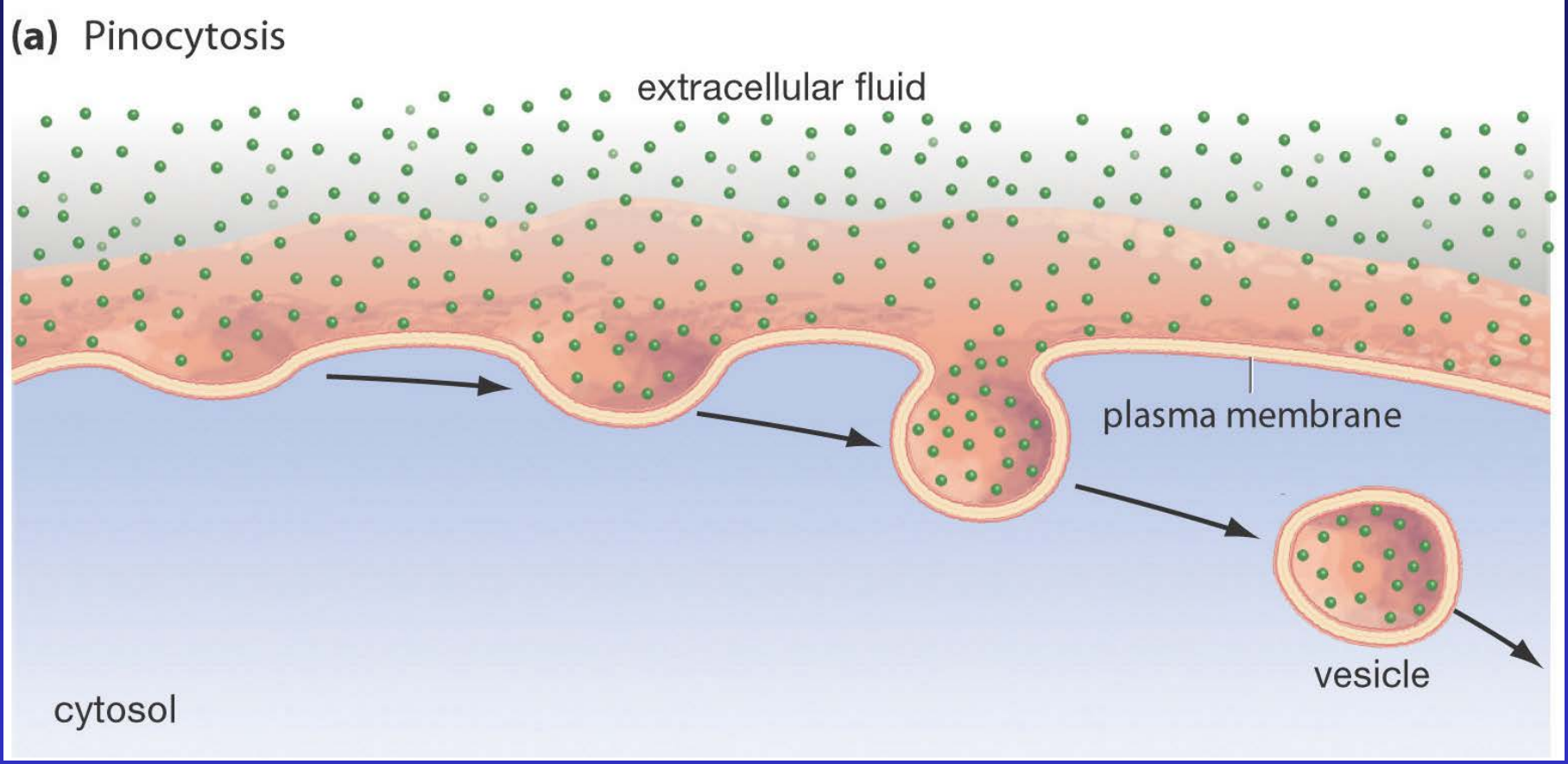

Molecules are **moved out** of the cell **by vesicles** that **fuse** with the plasma membrane.

# Moving the "Big Stuff"

Large molecules move materials into the cell by one of <u>three forms of endocytosis</u>.

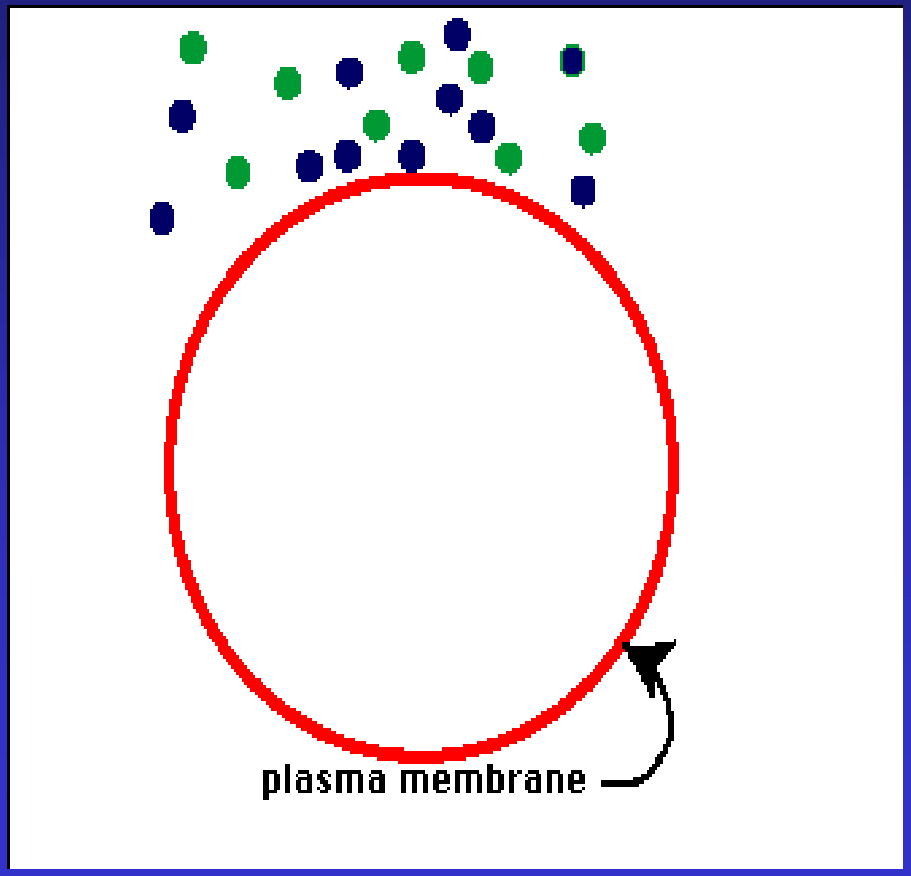


# Pinocytosis

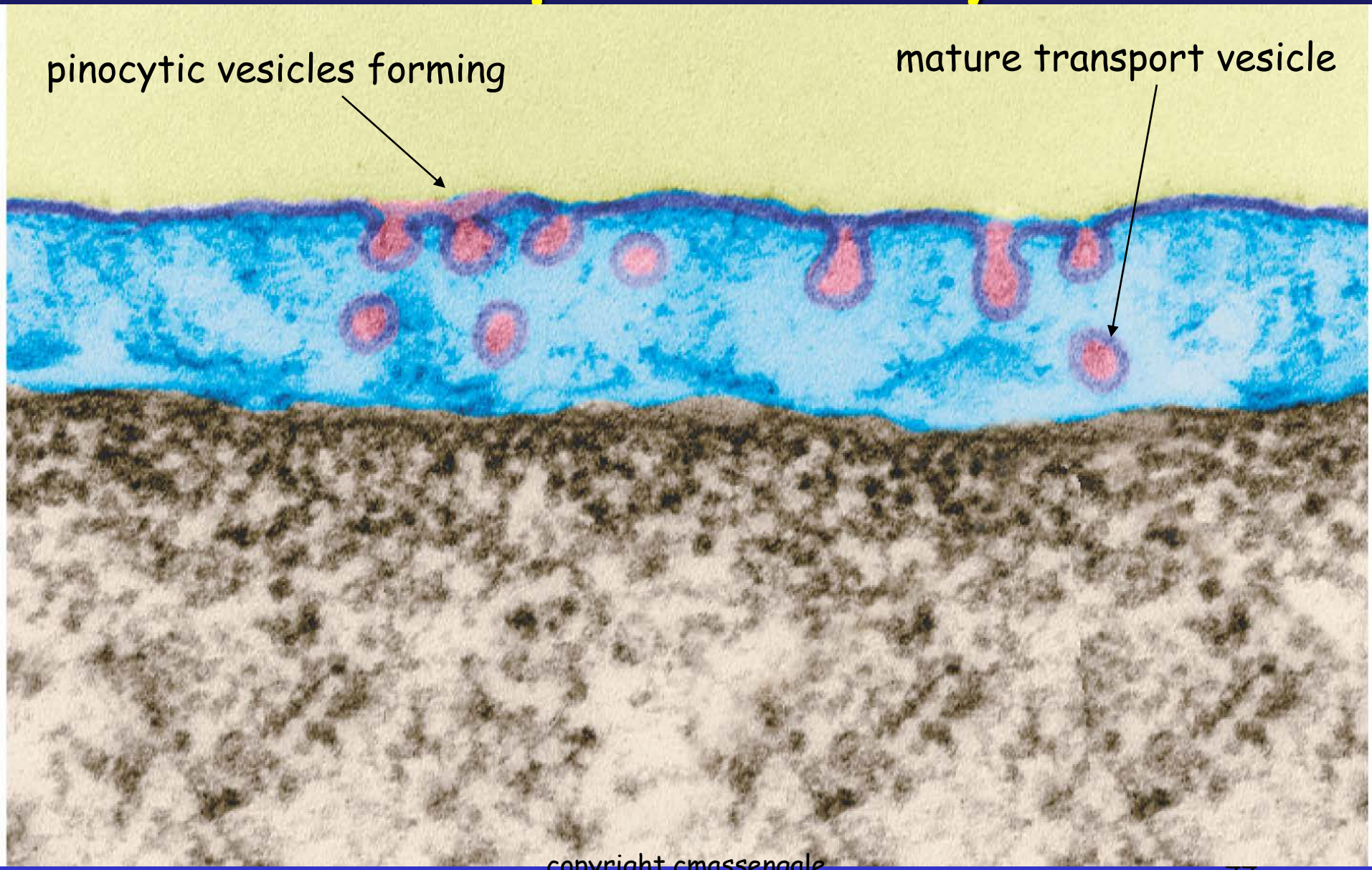



Takes in dissolved molecules as a vesicle.

# Called "Cell Drinking"



# Example of Pinocytosis

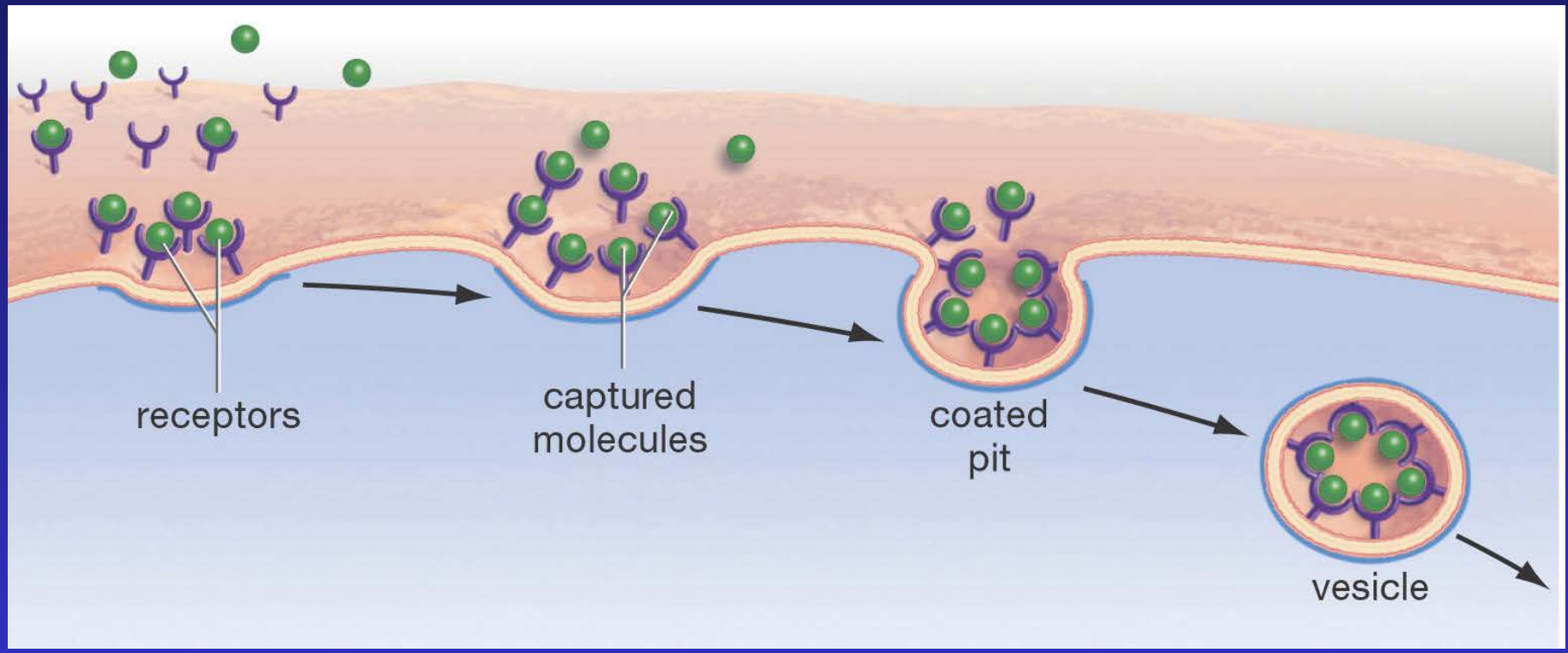






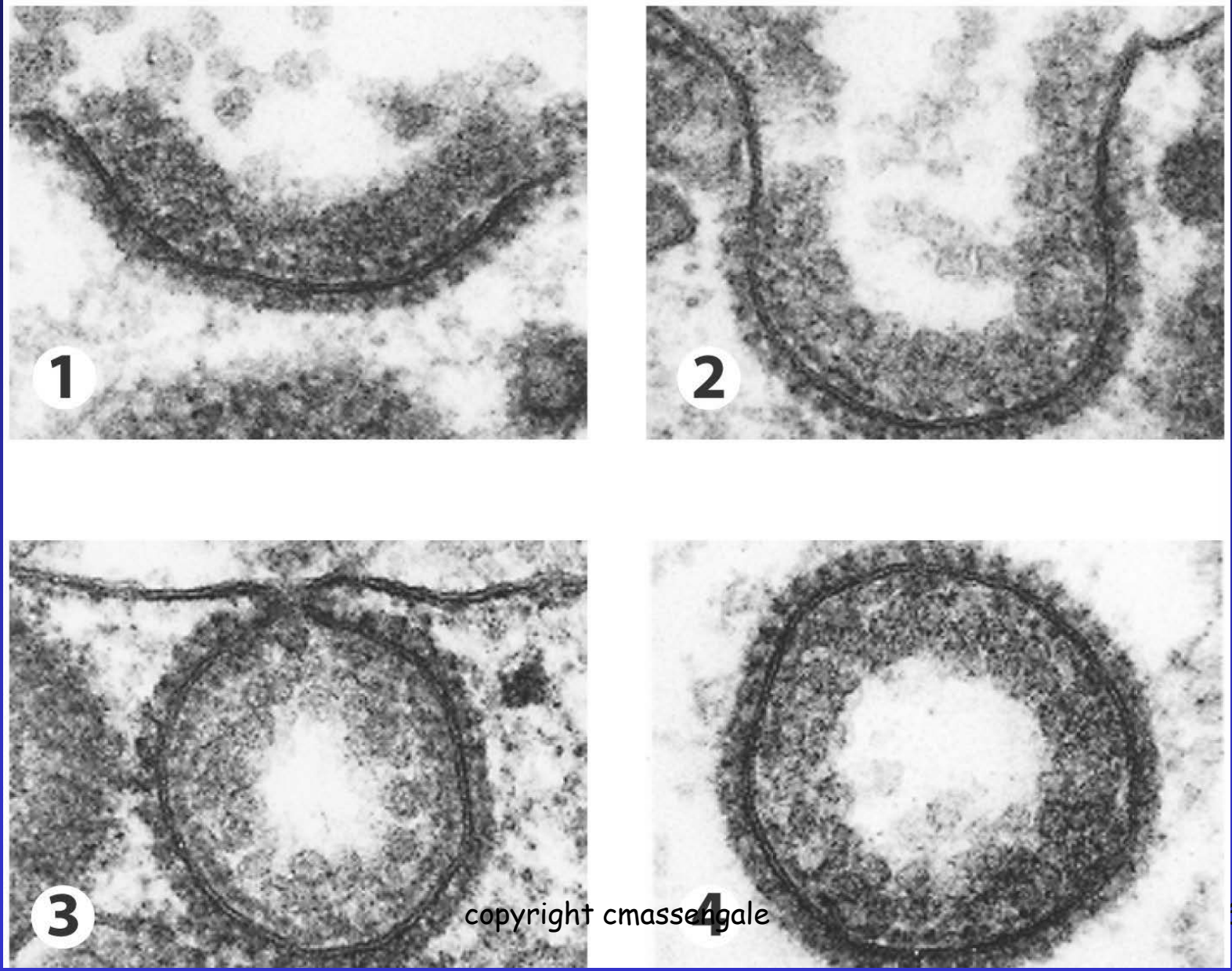

Transport across a capillary cell (blue).

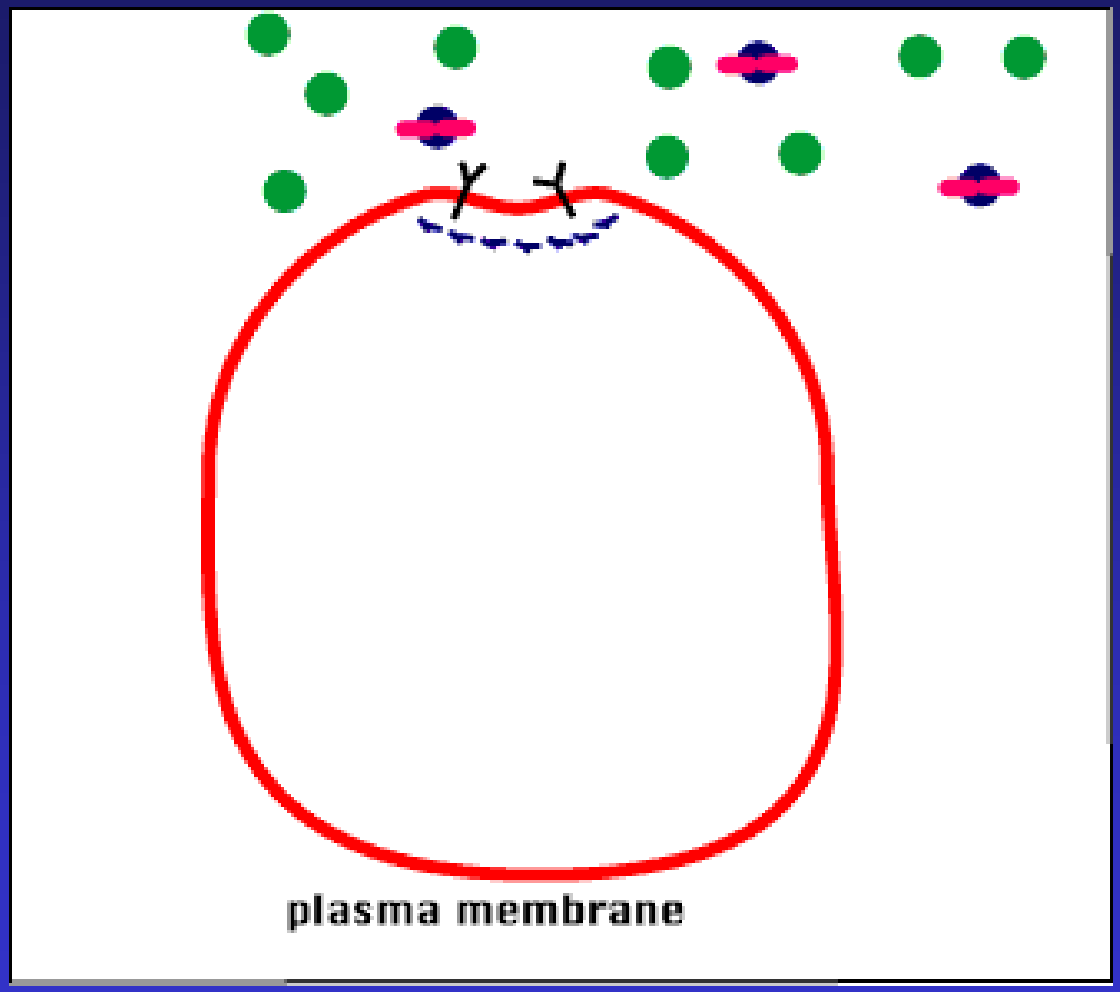
# Receptor-Mediated Endocytosis



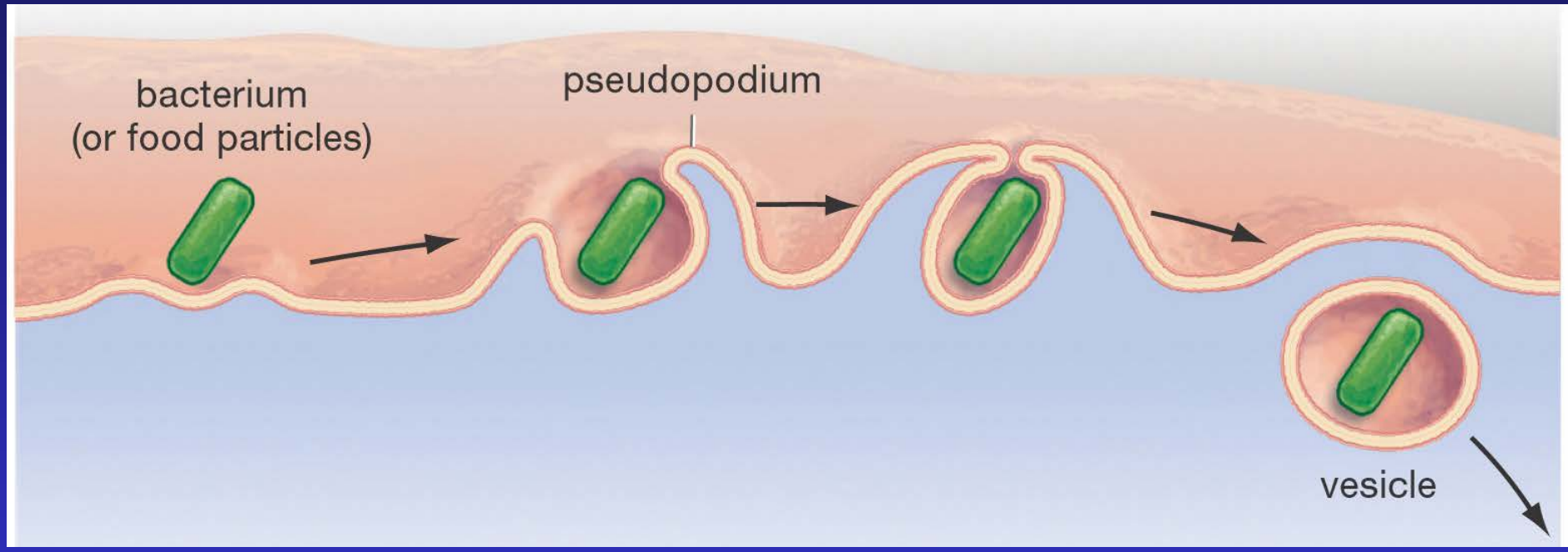

Some integral proteins have receptors on their surface to recognize & take in hormones, cholesterol, etc.

# Receptor-Mediated Endocytosis



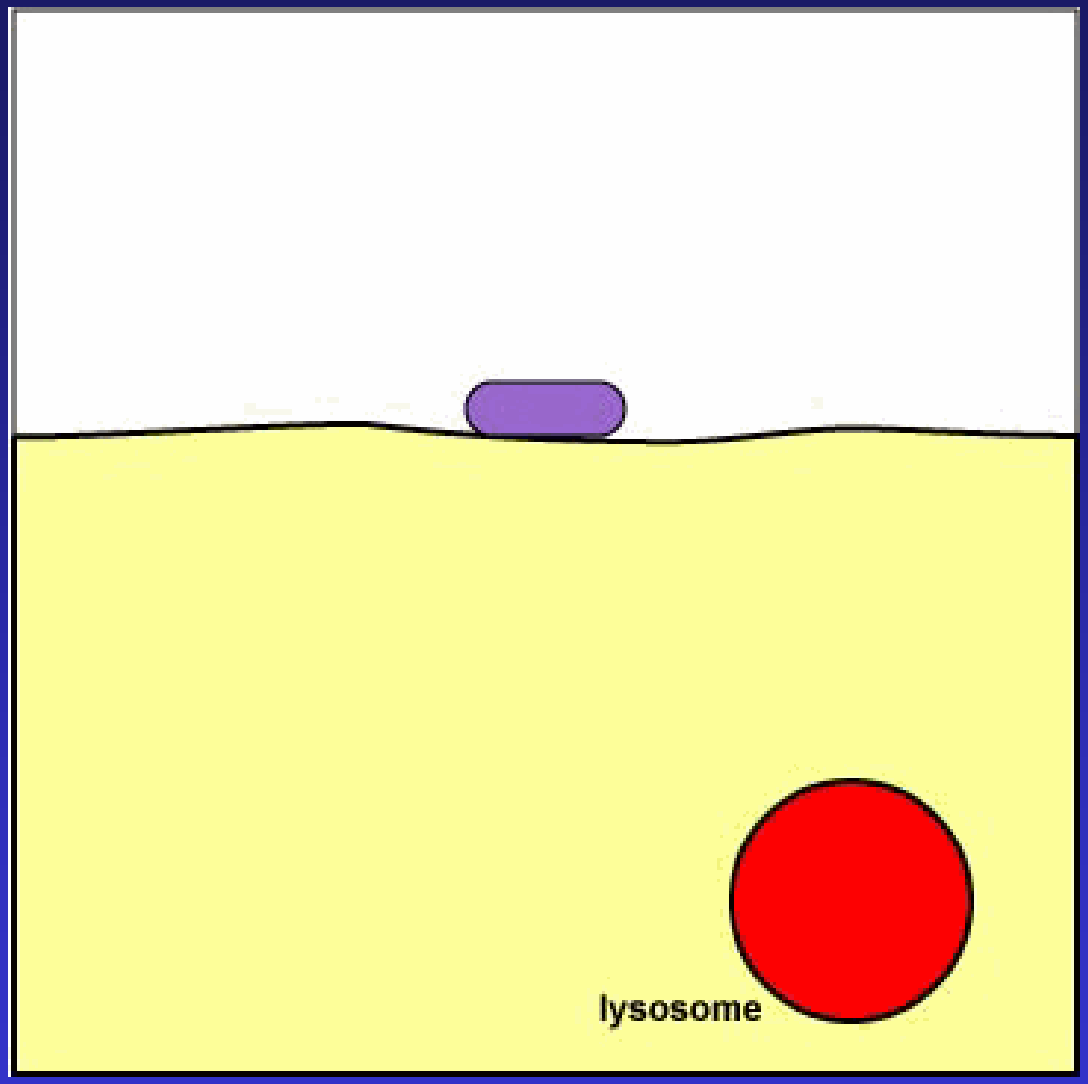


# Endocytosis – Phagocytosis




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

Called "Cell Eating"



# Exocytosis

Opposite of endocytosis **Big molecules** that are made in the cell are **released** through the cell membrane.