

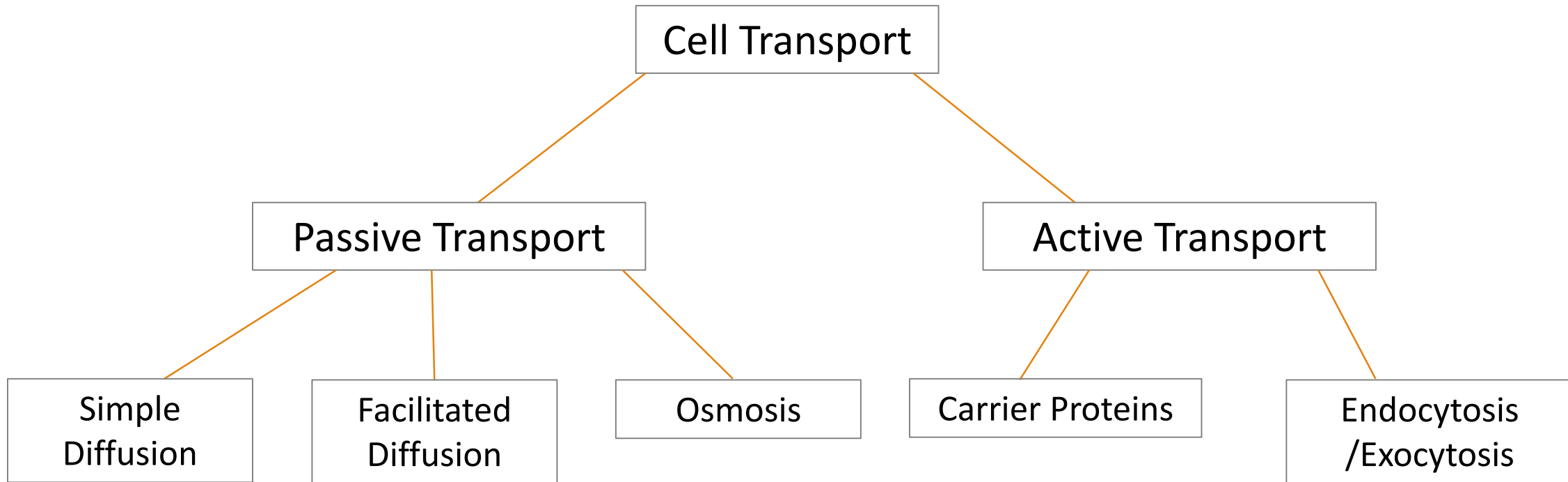
# Active Transport

---

SBI4U

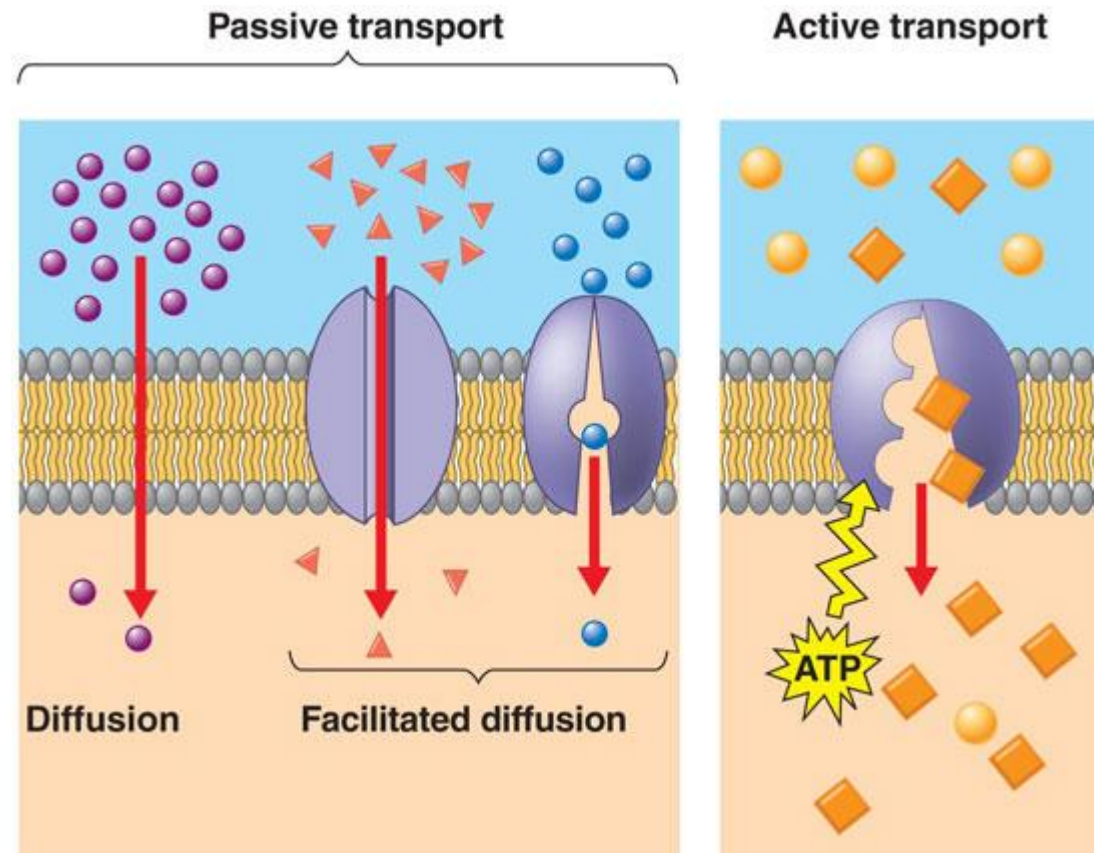
# Cell Transport Overview

---



# Cell Transport Overview

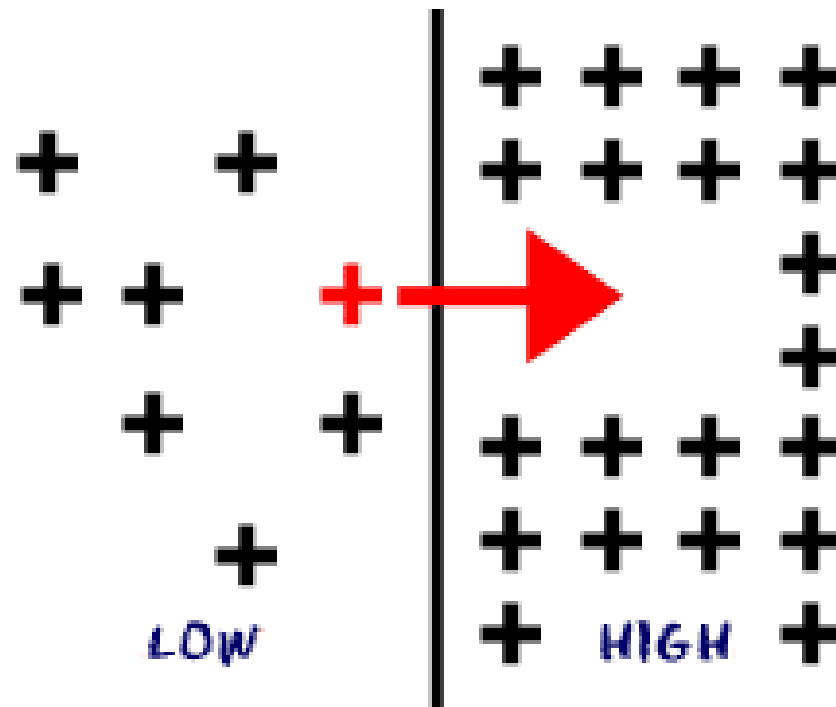
---



# Active Transportation

---

Molecules are moving from a low concentration to a high concentration  
*(against their concentration gradient).*

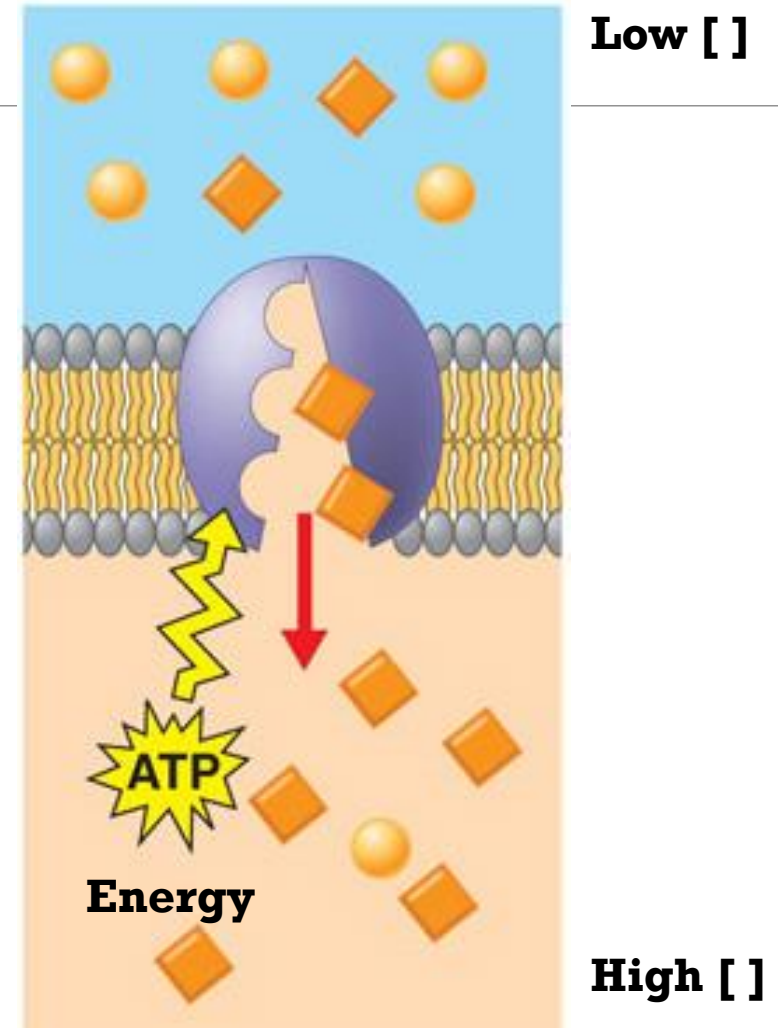


*This process requires energy.*

# Active Transportation

## Characteristics of Active Transport:

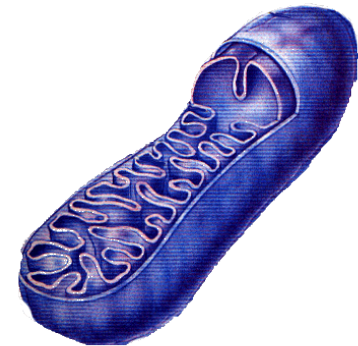
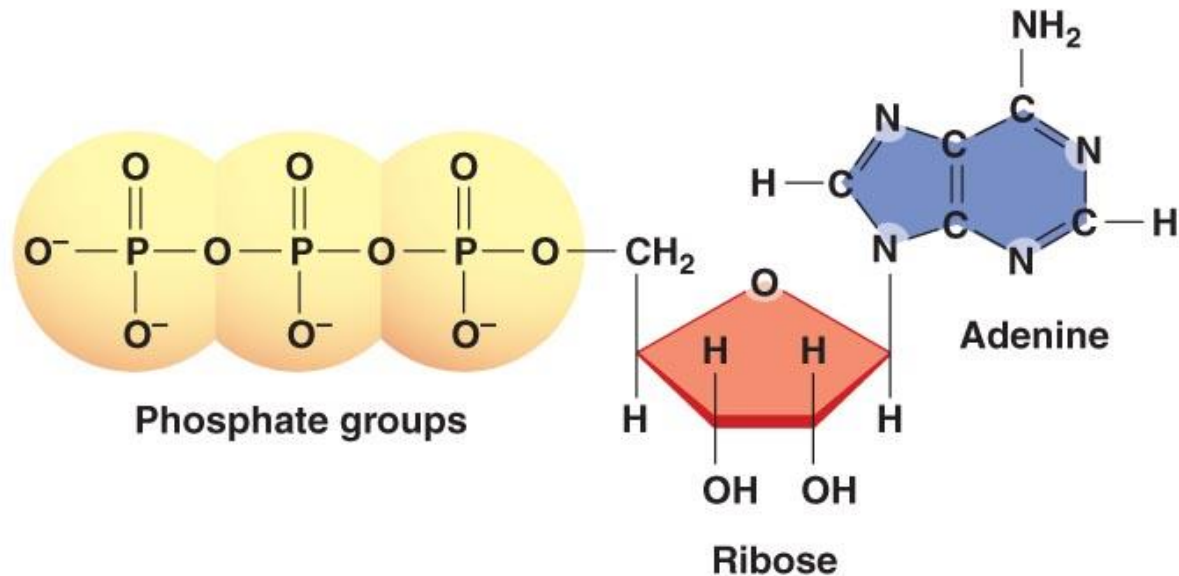
- 1) Pumps the molecules against their concentration gradient (low to high concentration)
- 2) ATP is required
- 3) Carrier proteins are required



# Active Transportation

Active transport required energy in the form of **ATP (Adenonsine triphosphate)**.

(a) ATP consists of three phosphate groups, ribose, and adenine.

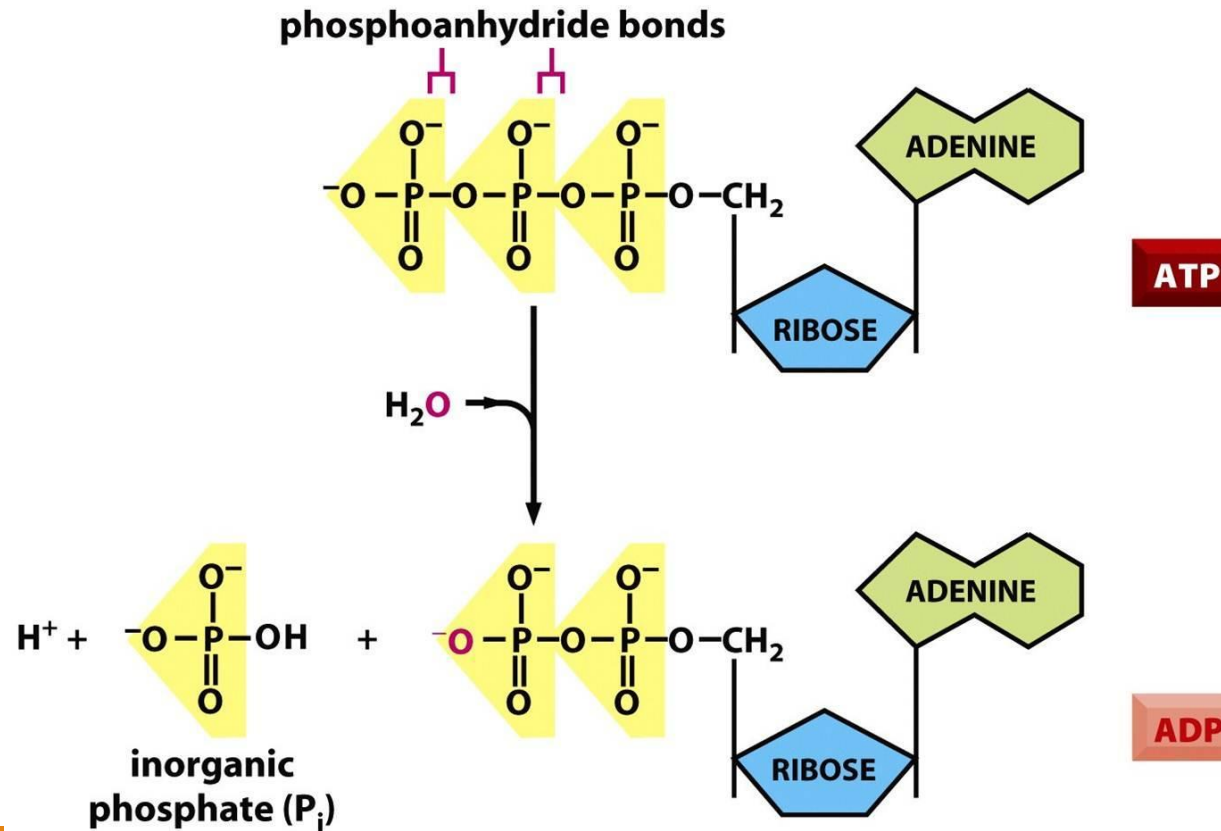


*ATP is produced in the mitochondria through cellular respiration.*

# Active Transportation

The hydrolysis of ATP releases energy that is used by the cell.

*Inorganic Phosphate is released during this process.*



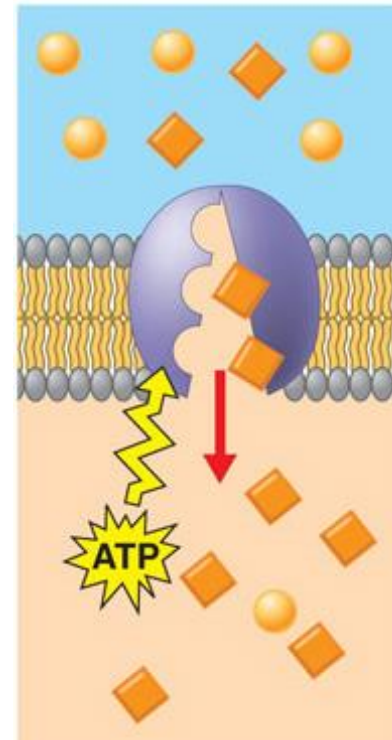
# Active Transportation

---

**Carrier Proteins:** the cells contain carrier proteins that help to pump the nutrients into the cell against its concentration gradient.

Carrier proteins use the energy from the ATP breakdown to move the nutrients across the cell.

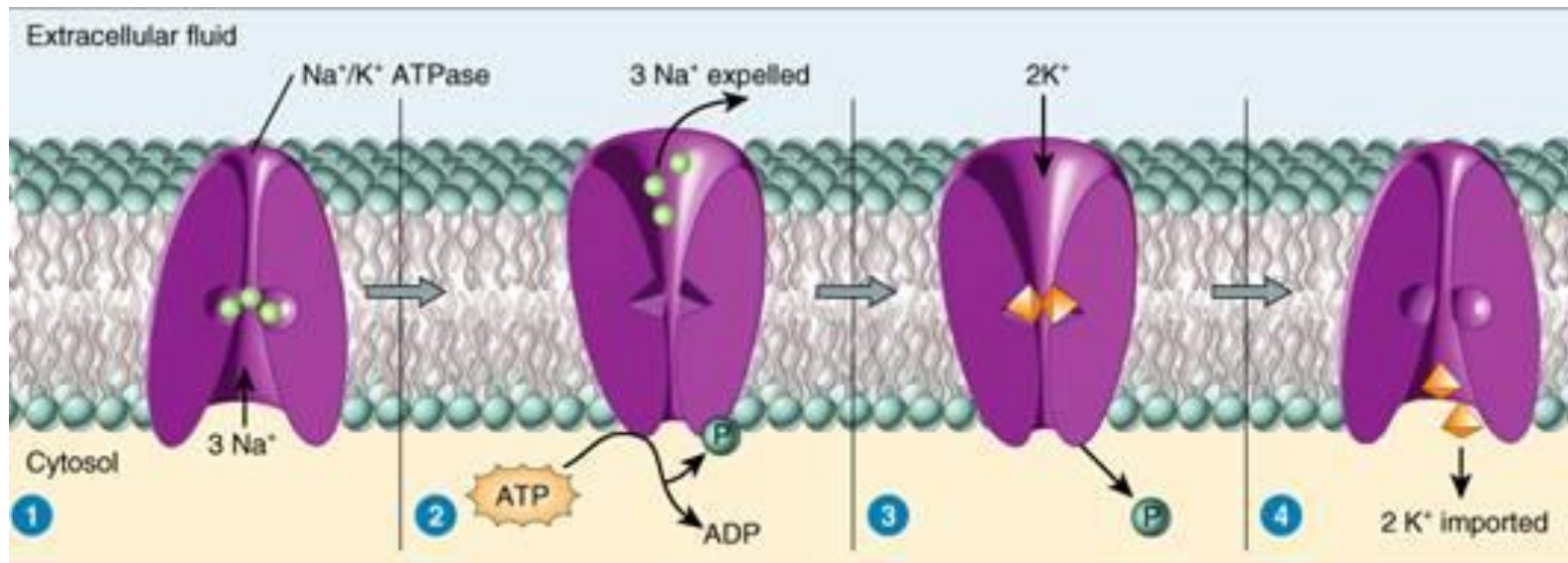
Carrier proteins enable molecules to move from a low concentration to a high concentration.





# Active Transportation

## Process of Active Transport:



Solute binds to the protein.

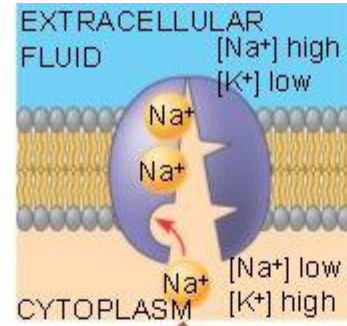
Protein is phosphorylated by ATP to change protein conformation

Other solute binds and the phosphate is removed to change protein conformation.

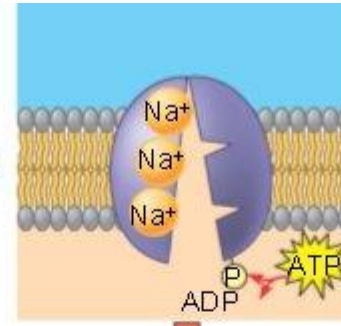
Solute is released into the cell

# Active Transportation – Na<sup>+</sup>/K<sup>+</sup> Pump

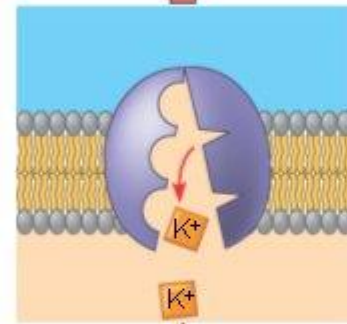
1 Cytoplasmic Na<sup>+</sup> binds to the sodium-potassium pump.



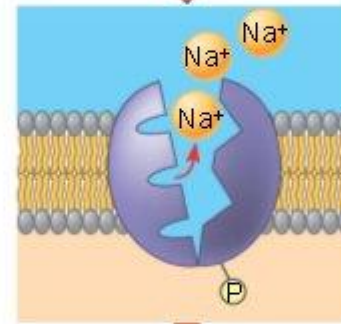
2 Na<sup>+</sup> binding stimulates phosphorylation by ATP.



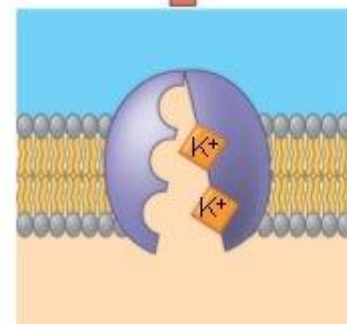
3 K<sup>+</sup> is released and Na<sup>+</sup> sites are receptive again; The cycle repeats.



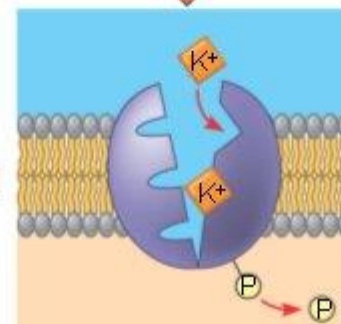
4 Phosphorylation causes the protein to change its conformation, expelling Na<sup>+</sup> to the outside.



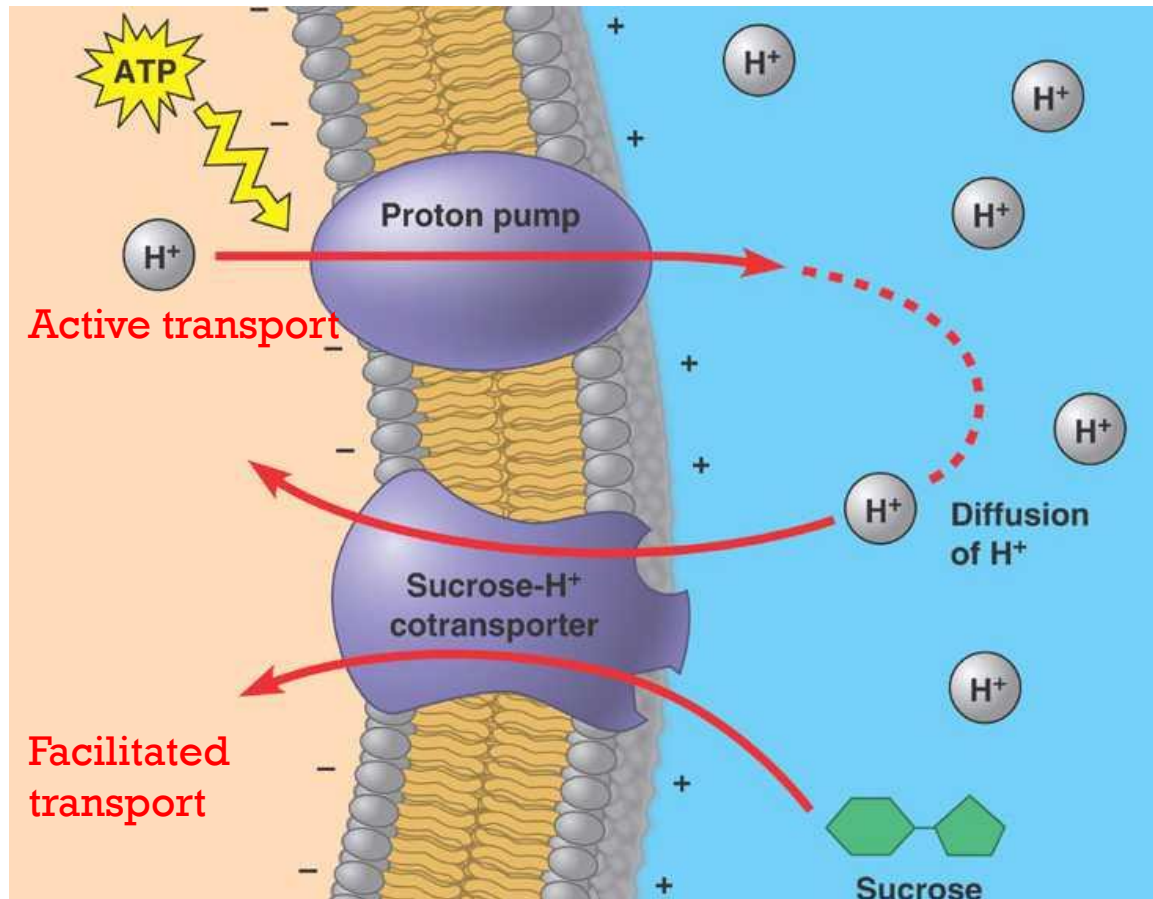
5 Loss of the phosphate restores the protein's original conformation.



6 Extracellular K<sup>+</sup> binds to the protein, triggering release of the Phosphate group.



# Active Transportation – Co-transporter (proton pump)



*The proton pump can also help with the production of ATP in the process of photosynthesis.*

# Active Transportation

---

**Membrane-assisted transport:** transport method used to move materials that are too large to move across the cell membrane through a channel or carrier protein.

There are two forms of membrane-assisted transport:

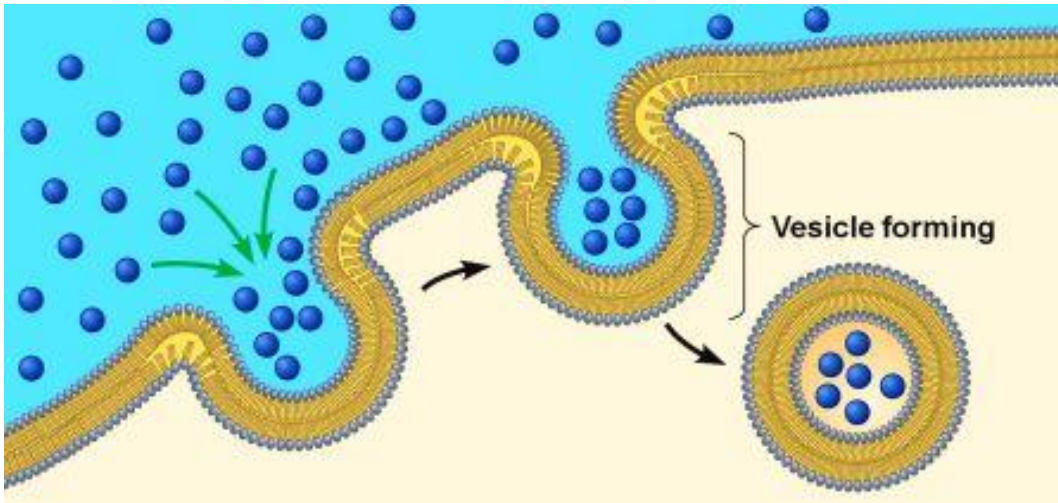
1) Endocytosis

2) Exocytosis

# Active Transportation

---

**1) Endocytosis:** exterior medium is brought into the cell by folding the cell membrane and pinching off to form a vesicle.



*Part of the cell membrane is removed to form the vesicle, thus decreasing its surface area.*

# Active Transportation

---

*There are 3 types of endocytosis:*

1) Phagocytosis

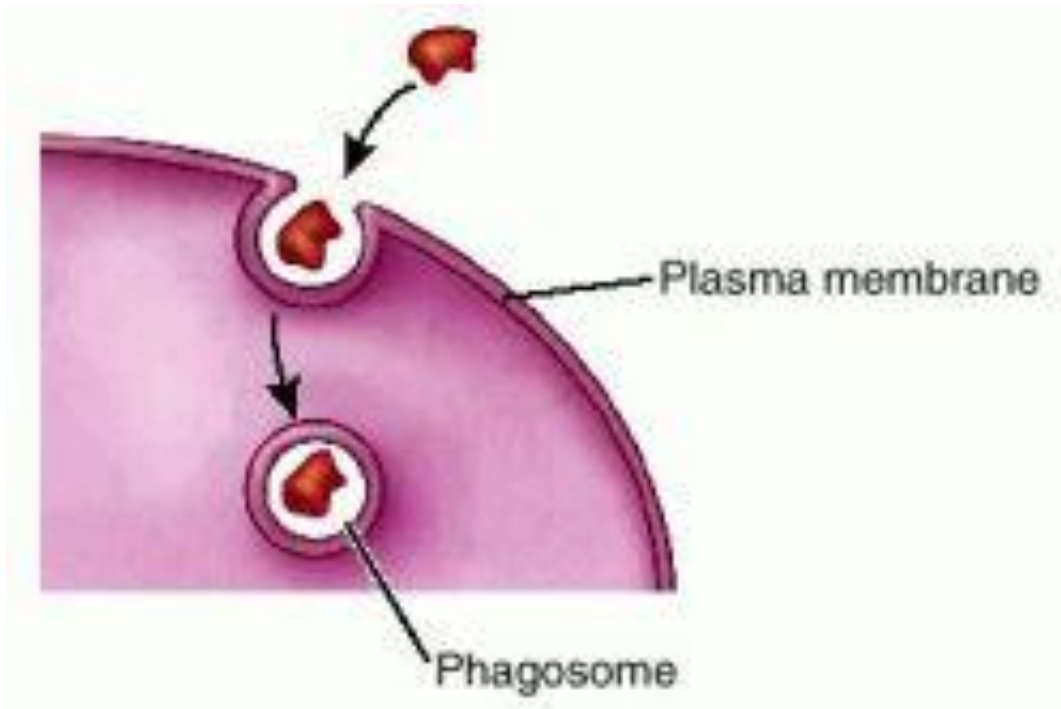
2) Pinocytosis

3) Receptor-mediated Endocytosis

# Active Transportation - Phagocytosis

---

## A) Phagocytosis (aka cell eating):

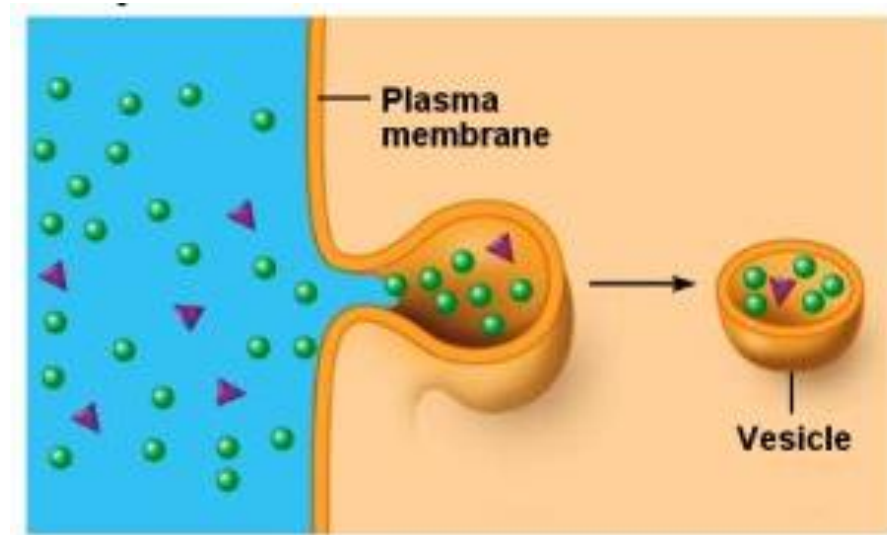


The large particle is enclosed within a membrane-enclosed vacuole. Particles are digested when the vacuole binds to a lysosome.

# Active Transportation - Pinocytosis

---

## B) Pinocytosis (aka cell drinking):

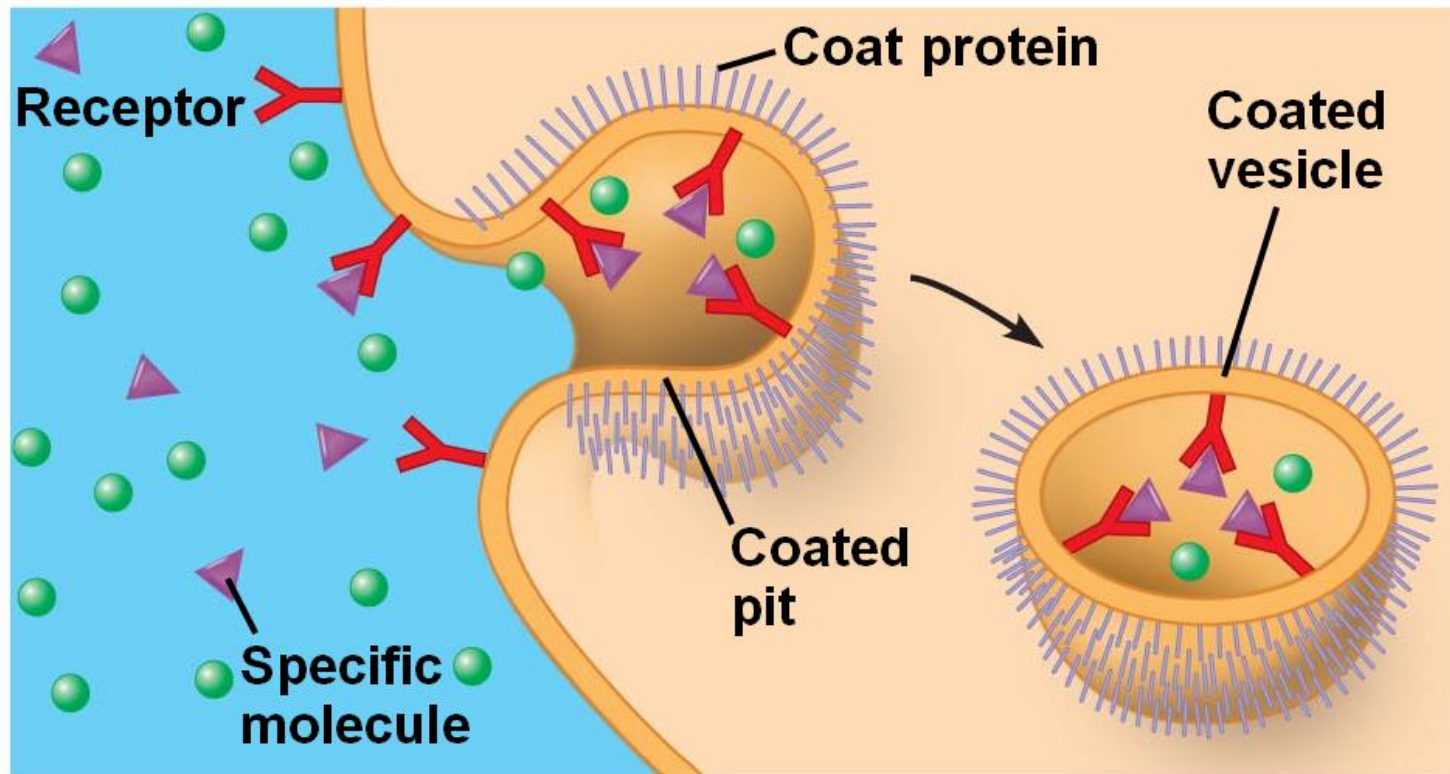


*The cell gulps droplets of extracellular fluid into vesicles.*



# Active Transportation – Receptor-Mediated

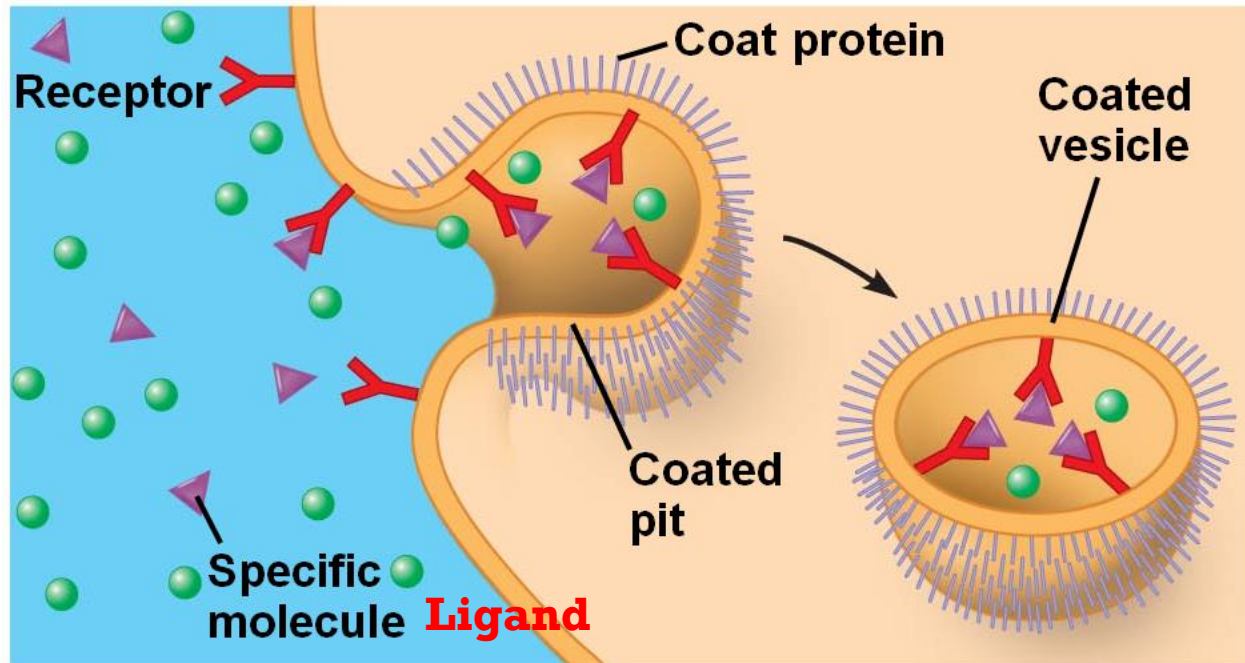
## B) Receptor-Mediated:



*The membrane has receptors that bind to specific molecules.*

*The receptors are clustered in '**coated pits**' which are coated proteins that line the interior part of the cell.*

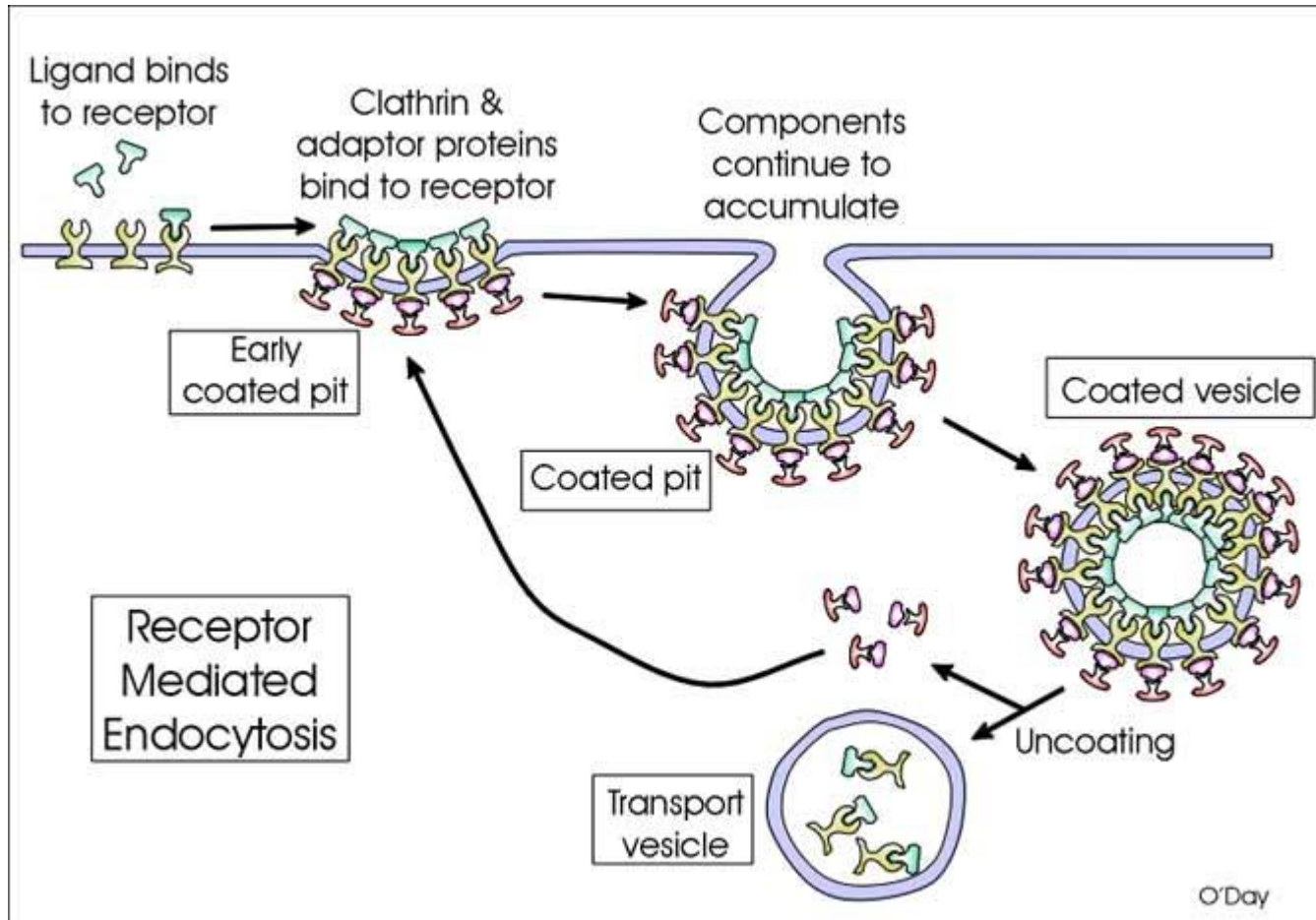
# Active Transportation – Receptor-Mediated



The **ligand (specific molecule)** binds to the receptor on the cell surface which causes the coated pits to form a vesicle.

Once ingested the receptor molecules are recycled back onto the surface of the cell.

# Active Transportation – Receptor-Mediated

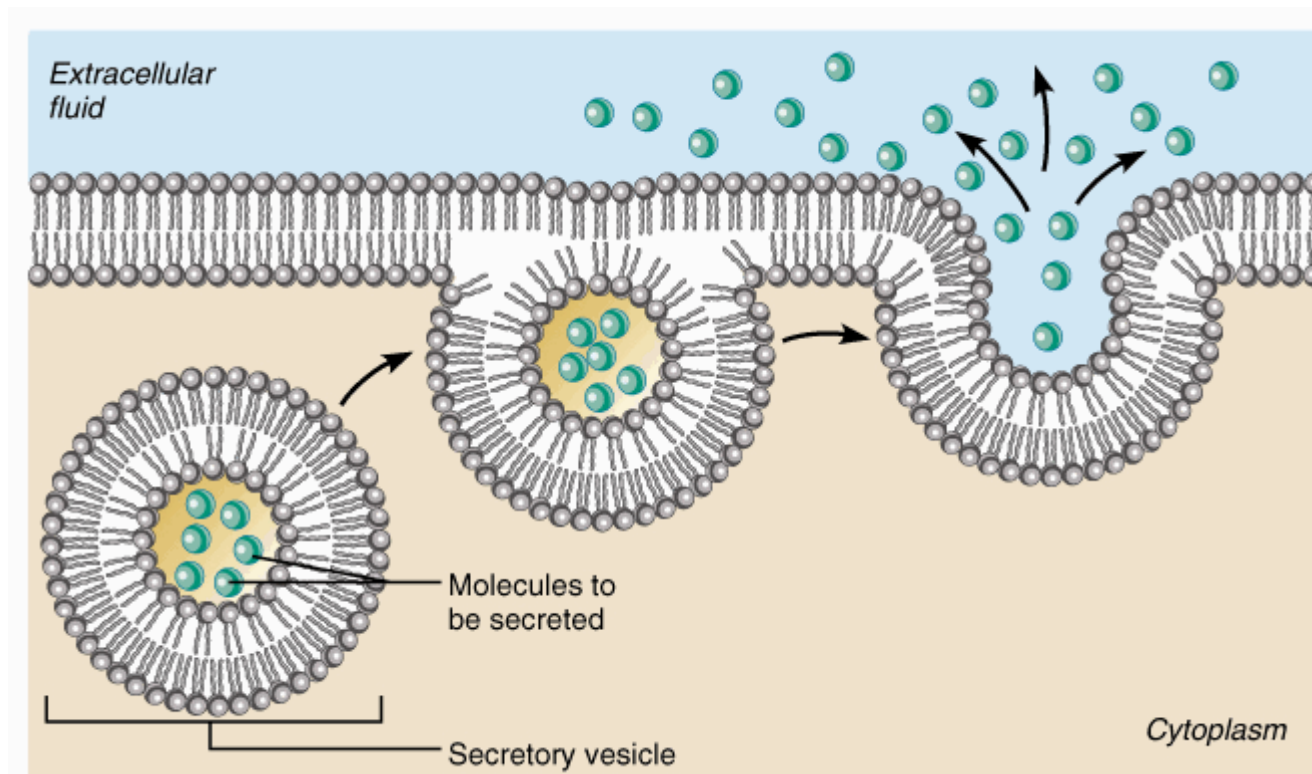


- LDLs are ligands that bind to the LDL receptors on the surface of the membrane.
- Cholesterol enters the cell through receptor-mediated endocytosis.
- Defective protein receptors can lead to hypercholesterolemia (accumulation of cholesterol in the blood)

# Active Transportation – Exocytosis

2) **Exocytosis:** The cell secretes macromolecules by fusing a vesicle with the cell membrane.

*The vesicle membrane becomes part of the plasma membrane, thus increasing its surface area.*



# Checking for Understanding

---

In which of the following does the membrane of a vesicle become part of the cell membrane?

- A) pinocytosis
- B) exocytosis
- C) phagocytosis
- D) Active transport
- E) Facilitated transport

# Checking for Understanding

---

What form of membrane-assisted transport would a white blood cell use to ingest a bacterial cell?

- A) exocytosis
- B) Phagocytosis
- C) Receptor-mediated endocytosis
- D) Pinocytosis
- E) Secretion

# Checking for Understanding

---

1) How is an electrochemical gradient similar to and different from a concentration gradient?

2) Distinguish between primary active transport and secondary active transport.

# Homework

---

Complete handouts given in class.