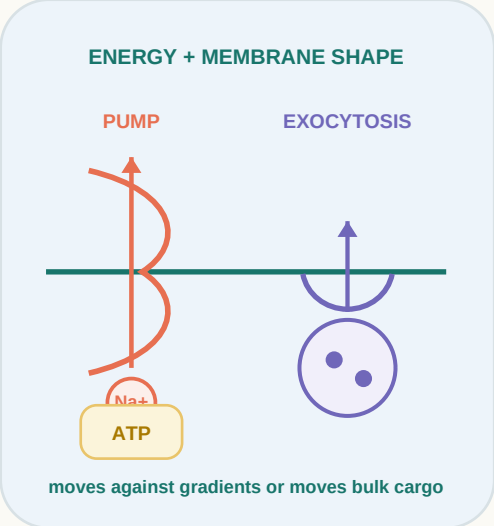
AP BIOLOGY | UNIT 2

# TOPIC 2.8

# Mechanisms of Transport

Cells use ATP-powered pumps, stored electrochemical gradients, and membrane vesicles to move difficult cargo.




## THE CORE CAUSAL CHAIN

| ENERGY | → | MECHANISM | → | MOVEMENT | → | HOMEOSTASIS |
|---|---|---|---|---|---|---|
| ATP or stored gradient | | pump or vesicle | | against gradient or bulk | | maintained differences |

## BY THE END, YOU SHOULD BE ABLE TO...

1. Explain ATP-powered membrane pumps.
2. Connect electrochemical gradients to stored energy.
3. Compare endocytosis and exocytosis.

**BIG IDEA**

Active and bulk transport allow cells to move substances that cannot follow a simple down-gradient route through the bilayer.

# 1 Pumps and electrochemical gradients

ATP-powered pumps create concentration and charge differences that store potential energy across membranes.

## HOW A PUMP MOVES CARGO

### 1 CARGO BINDS




A specific ion or molecule binds on one side of the membrane.

### 2 ATP HYDROLYSIS




Released energy changes the pump's shape.

### 3 CARGO RELEASES




The substance is released against its gradient.

## THE ELECTROCHEMICAL GRADIENT

### CONCENTRATION



Unequal particle concentration across the membrane.

### ELECTRICAL

\+ + + - -

Unequal charge across the membrane.

### TOGETHER

POTENTIAL ENERGY

The combined difference can drive cellular work.

## GRADIENT COUPLING

ATP BUILDS GRADIENT → GRADIENT DRIVES COTRANSPORT

**Stored energy can move another substance.**

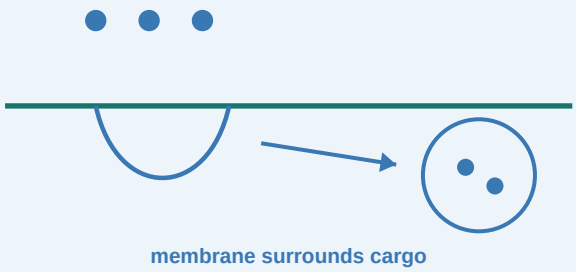
**ENERGY ACCOUNTING**

**Primary active transport uses ATP directly. Secondary active transport uses energy stored in a gradient built by another process.**

# 2 Bulk transport with vesicles

Large molecules, particles, and volumes of fluid move by membrane remodeling rather than passing through a transport protein.

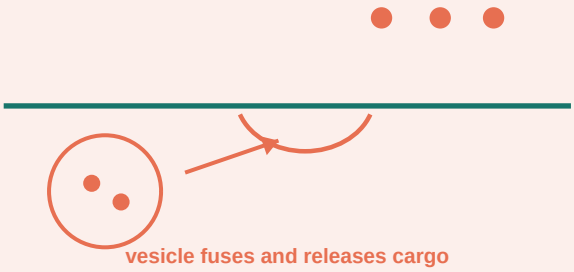
### ENDOCYTOSIS



membrane surrounds cargo

Material enters when the plasma membrane folds inward and pinches off as a vesicle.

### EXOCYTOSIS



vesicle fuses and releases cargo

Material exits when a vesicle membrane fuses with the plasma membrane.

## SIDE-BY-SIDE

| | ENDOCYTOSIS | EXOCYTOSIS |
|---|---|---|
| **DIRECTION** | Into the cell | Out of the cell |
| **MEMBRANE** | Invaginates and pinches off | Vesicle fuses with membrane |
| **CARGO** | Fluid, particles, macromolecules | Secretions, wastes, proteins |
| **ENERGY** | Required | Required |

## ENDOCYTOSIS TYPES

**PHAGOCYTOSIS**

large particles or cells

**PINOCYTOSIS**

extracellular fluid

**RECEPTOR-MEDIATED**

specific ligands bind receptors

**COMMON ERROR**

**Vesicle transport does not move cargo through the lipid bilayer. The membrane bends, encloses, or fuses around the cargo.**