Active Transport

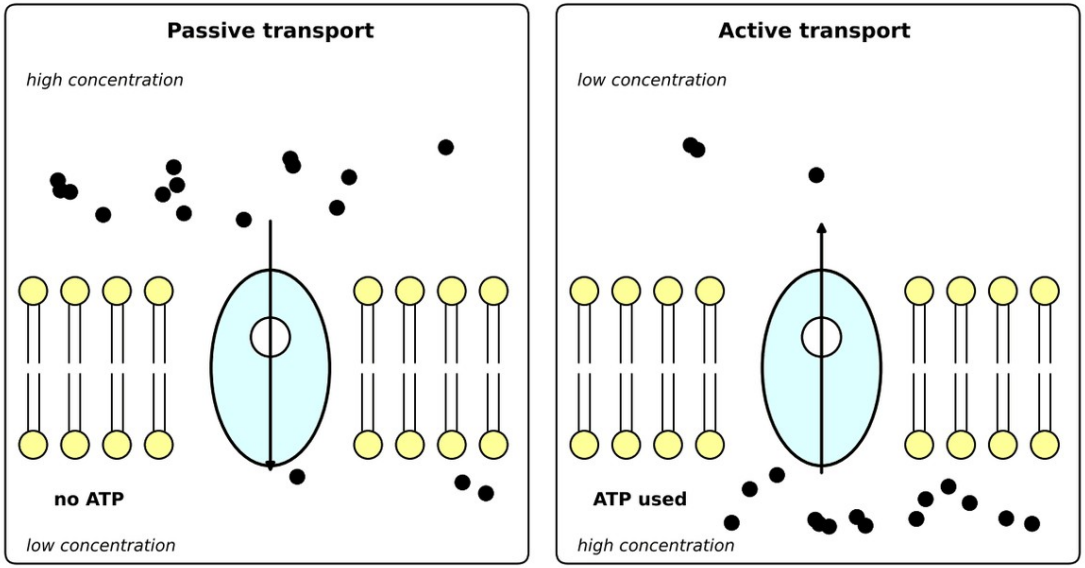
Essential Question

How do cells move substances against a concentration gradient?

Active Transport

Moving Against the Gradient

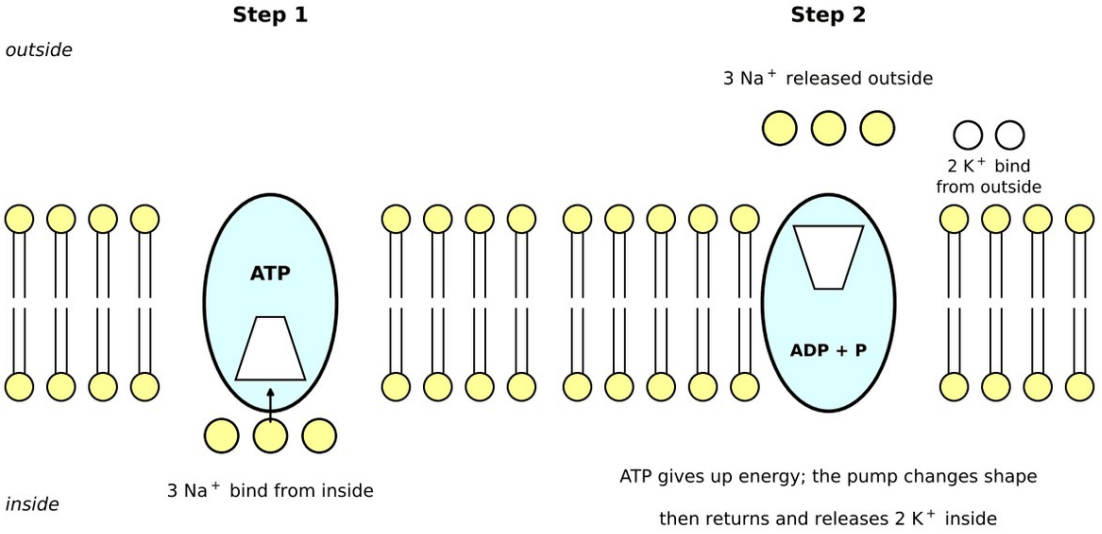
- Passive transport moves substances down the gradient
- Active transport moves them against the gradient
- Moving up a gradient needs energy
- The energy comes from ATP



Active Transport

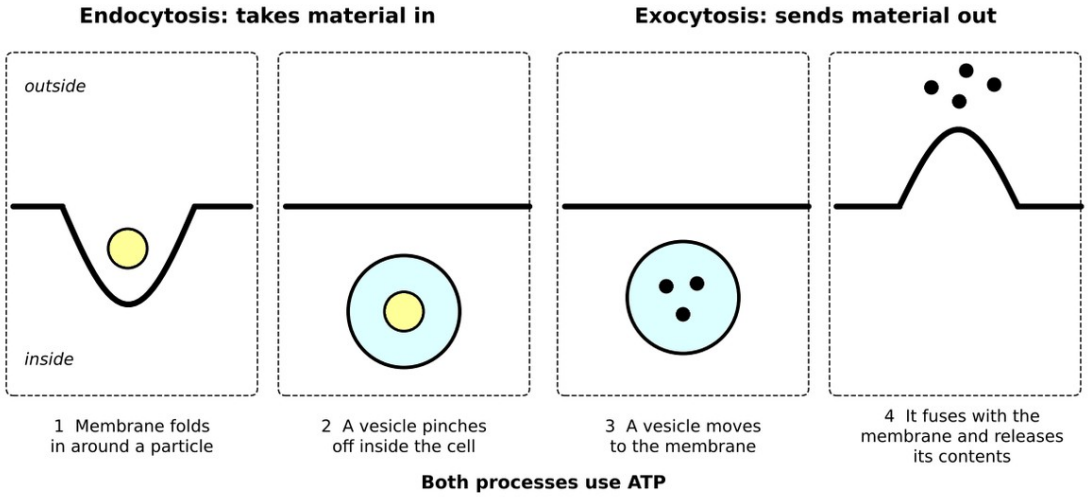
Protein Pumps

- Pumps are carrier proteins that use ATP
- The sodium-potassium pump moves 3 Na+ out
- It moves 2 K+ in for each ATP used
- The pump changes shape with each cycle



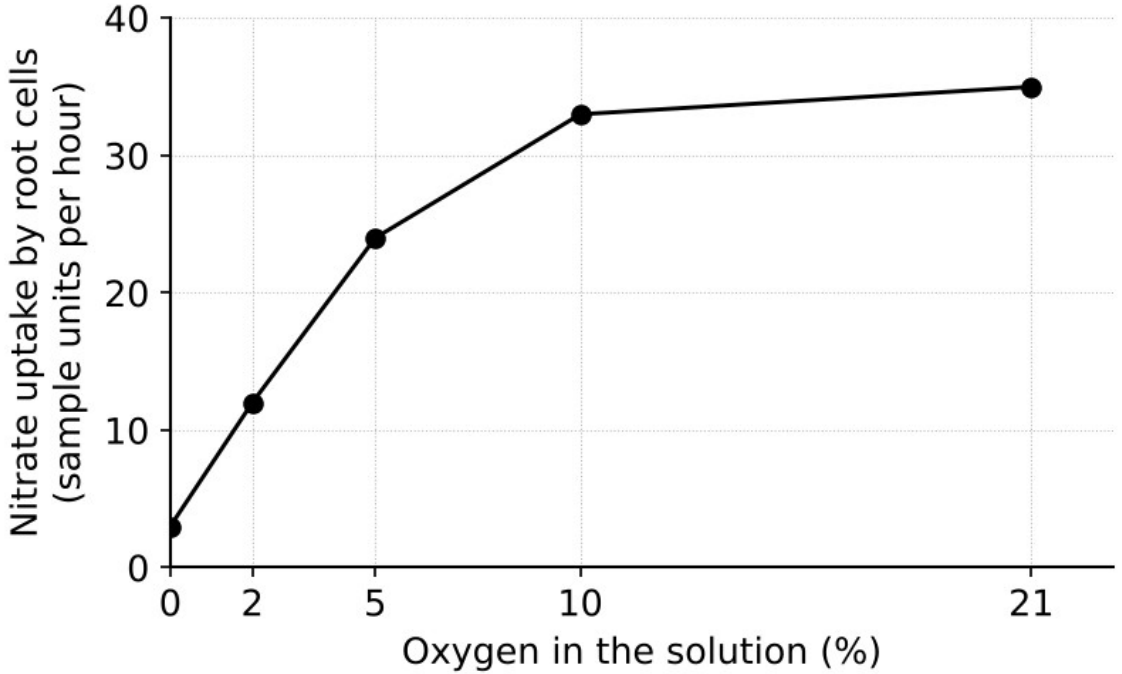
Endocytosis and Exocytosis

- Large particles move in vesicles
- Endocytosis takes material into the cell
- Exocytosis sends material out of the cell
- Both processes use ATP



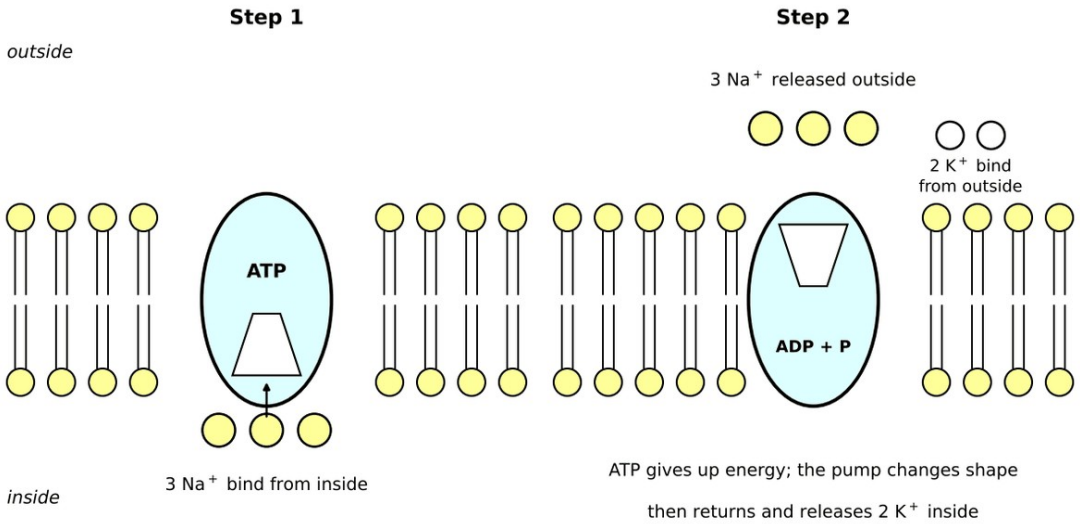
Active Transport Needs ATP

- Active transport stops when ATP is not available
- ATP comes from cellular respiration
- Respiration in most cells needs oxygen
- Passive transport does not depend on ATP



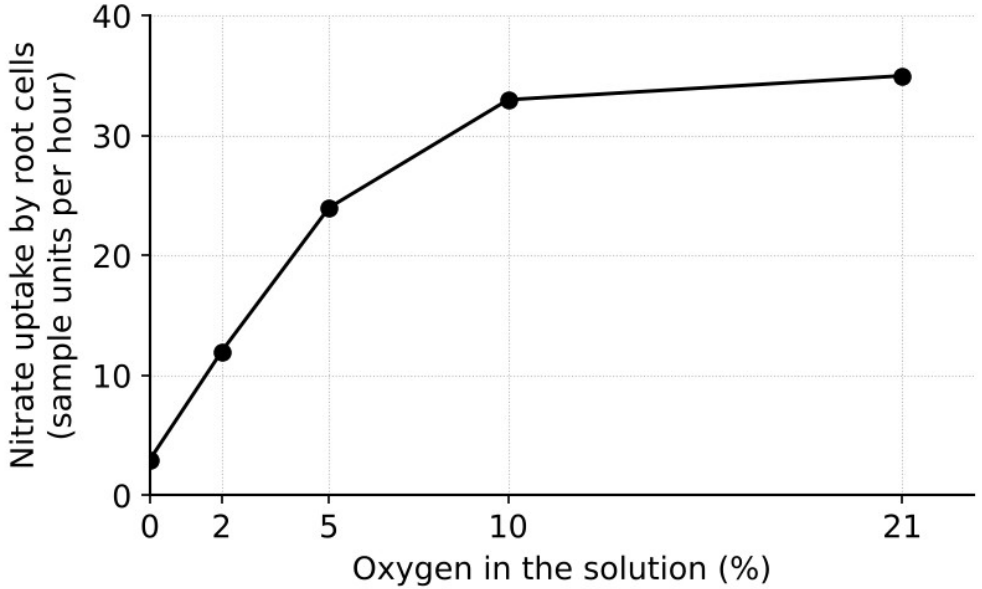
Example: Count the Pump Cycles

A sodium-potassium pump moves 3 Na+ out of a cell and 2 K+ into the cell for each ATP it uses. How many ATP are needed to move 600 Na+ out of the cell, and how many K+ enter the cell during that time?



Example: Oxygen and Uptake

Root cells took up nitrate at different oxygen levels (sample data). Write a claim, evidence, and reasoning about how oxygen affects uptake.



Example: Passive or Active?

For each substance, compare the concentrations outside and inside the cell, and decide whether the movement is passive or active.

Substance	Outside (mM)	Inside (mM)	Moves
Glucose (through a carrier)	5	1	Into the cell
Potassium ion	5	150	Into the cell
Sodium ion	145	15	Out of the cell

Active Transport

Big Ideas

- Active transport moves substances against their gradient
- It uses ATP, usually through pumps
- The sodium-potassium pump moves 3 Na+ out and 2 K+ in per ATP
- Endocytosis and exocytosis move large materials in vesicles
- Passive transport is down the gradient and uses no ATP