Passive transport is diffusion across a membrane

-diffusion of a substance across a biological membrane is called passive transport

-molecules diffuse across membrane down its concentration gradient

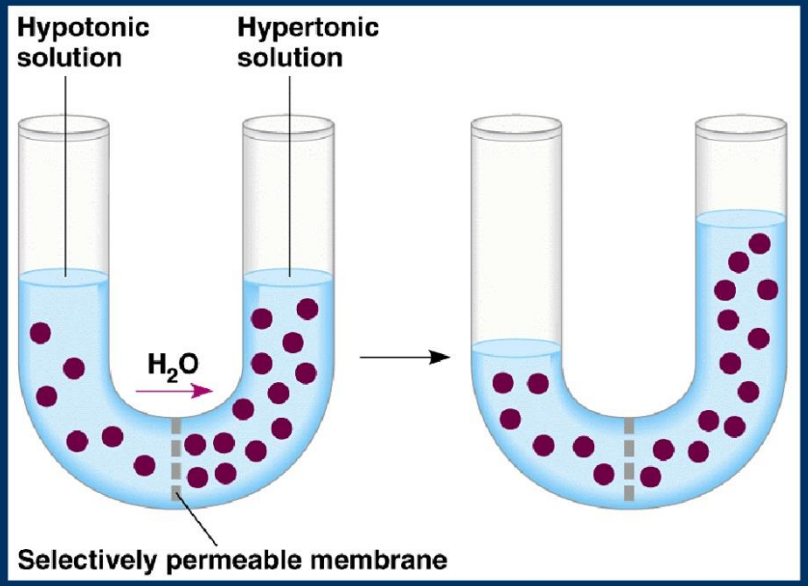
-spontaneous process: does not need energy

Osmosis is the passive transport of water

Hypertonic solution = solution with higher concentration of solute

Hypotonic solution = solution with lower solute concentration

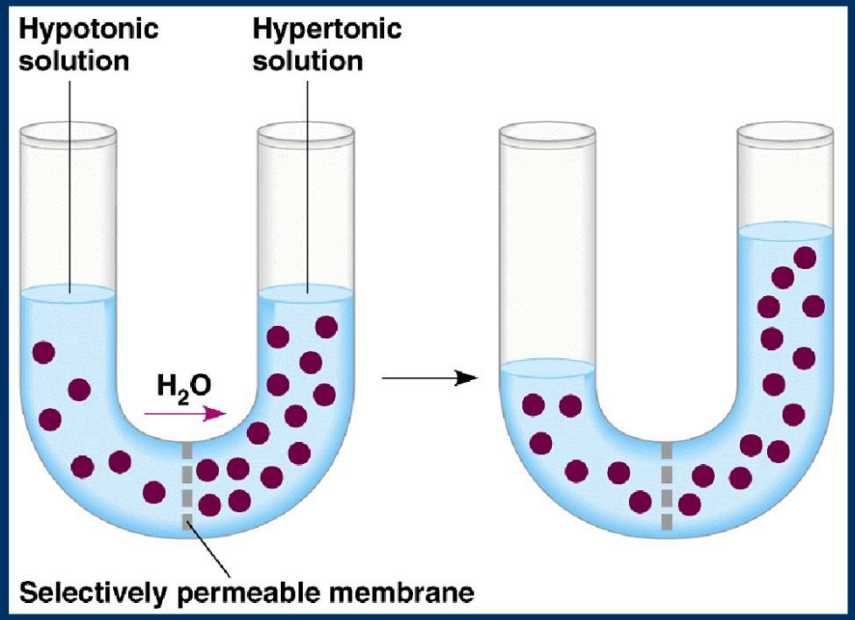
Isotonic solution = solution of equal solute concentration



U-shaped vessel with a selectively permeable membrane separating 2 sugar solution of different concentration.

The membrane pores are too small for sugar molecule to pass but large enough for water

Water diffuses across membrane from hypotonic solution to the hypertonic solution. This diffusion of water = osmosis



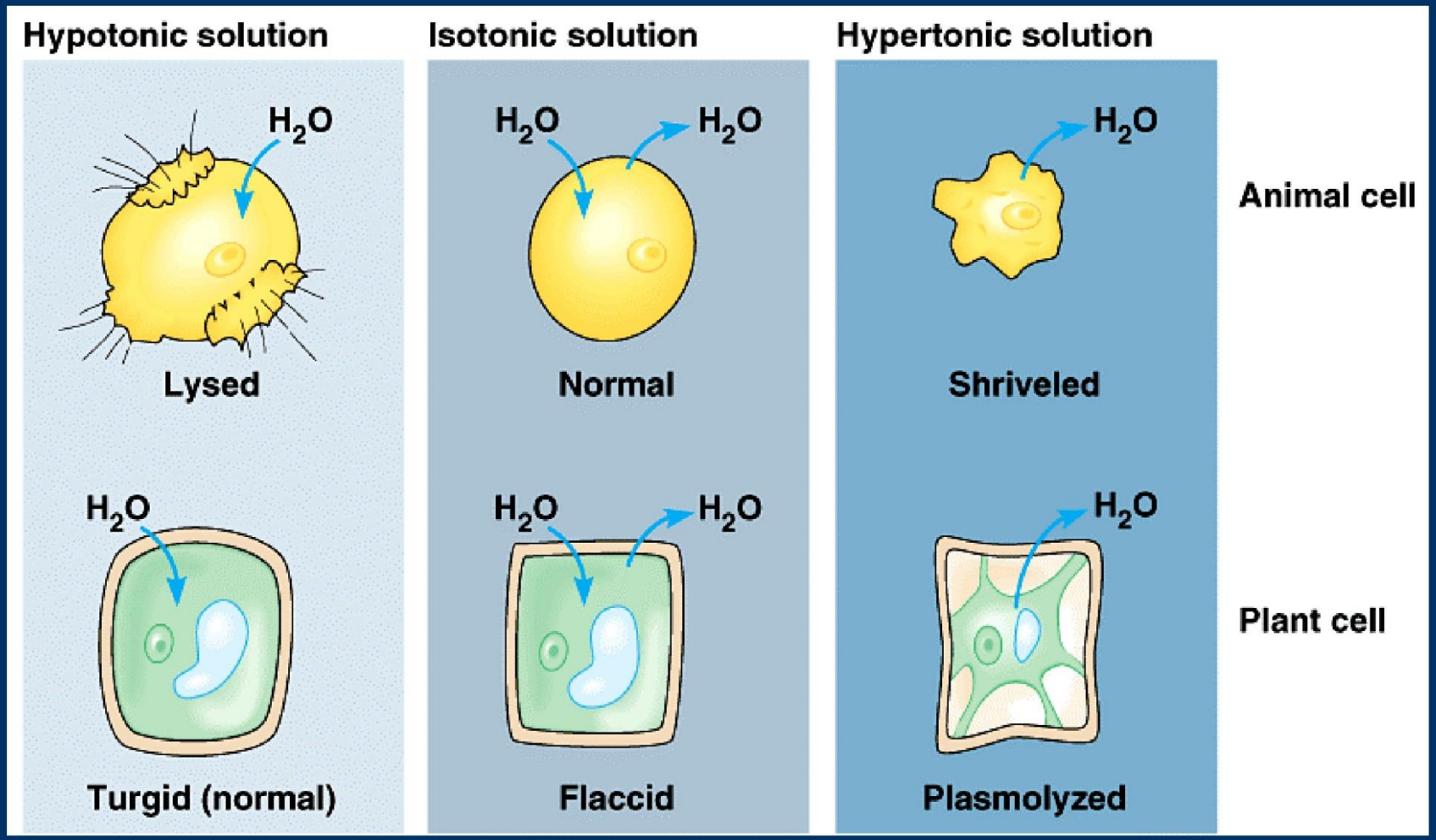
Direction of osmosis is determined only by a different in total solute concentration.

Water diffuses from hypotonic to a hypertonic even if the hypotonic solution has more kinds of solutes.

(Water from seawater (containing a great variety of solutes) will diffuse to a very concentrated sugar solution)

For isotonic solutions, water moves across membrane in both direction at an equal rate.

Water balance of cells



Osmoregulation: the control of water balance

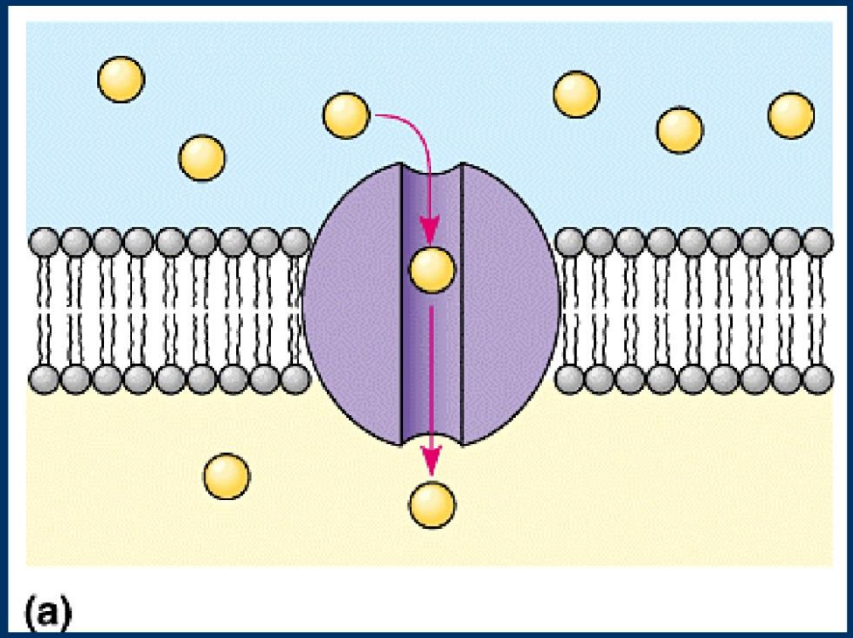
The protist *Paramecium* lives in pond water which is hypotonic to the cell.

Its contractile vacuole forces water out of the cell as fast as it enters by osmosis.

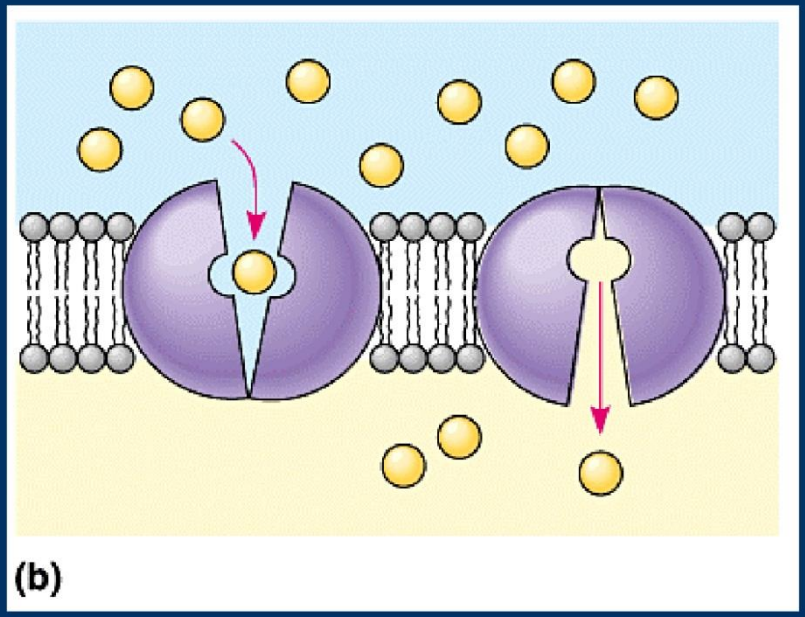
Specific proteins facilitate the passive transport of water and and selected solutes

Facilitate diffusion = diffusion of polar molecules (including H_2O) and ions with the help of transport proteins spanning the membrane

Model # 1: The purple transport protein forms a channel through which water molecules or a specific solute can pass.



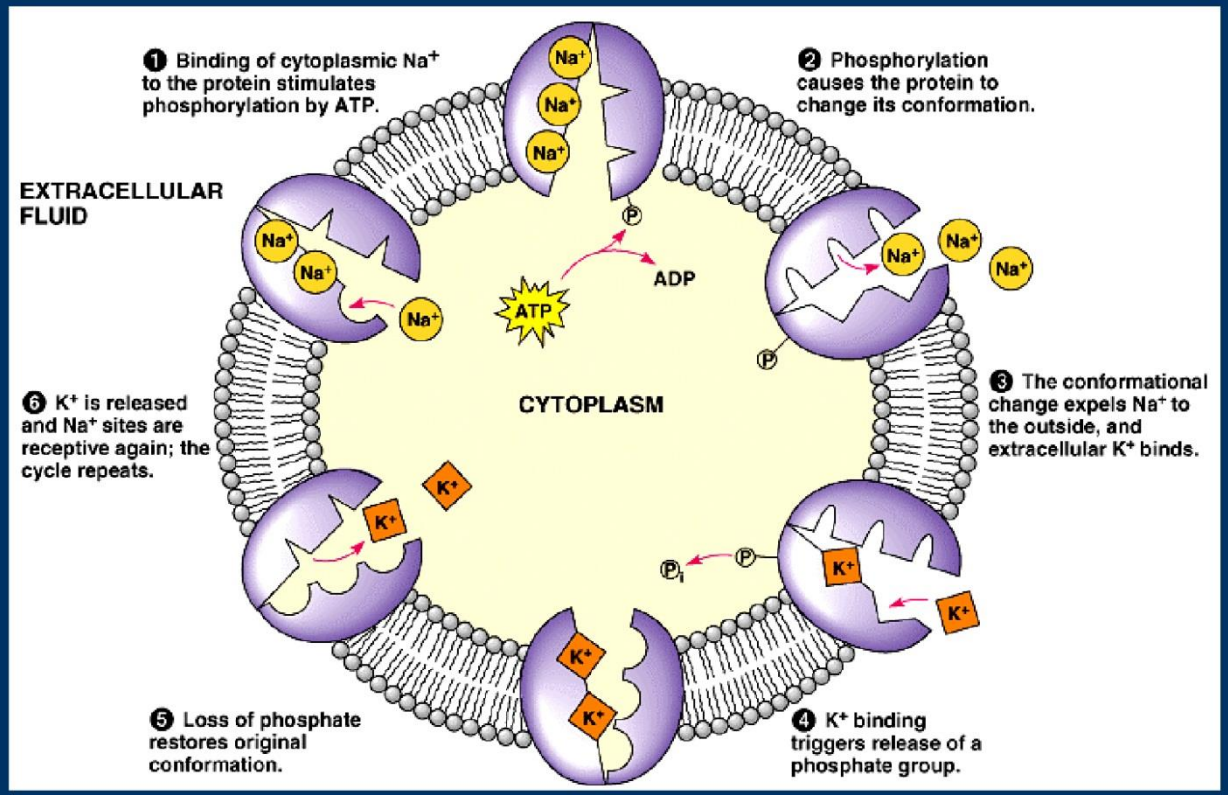
Model # 2: Transport protein alternates between 2 conformations, moving a solute across the membrane as the shape of the protein changes.

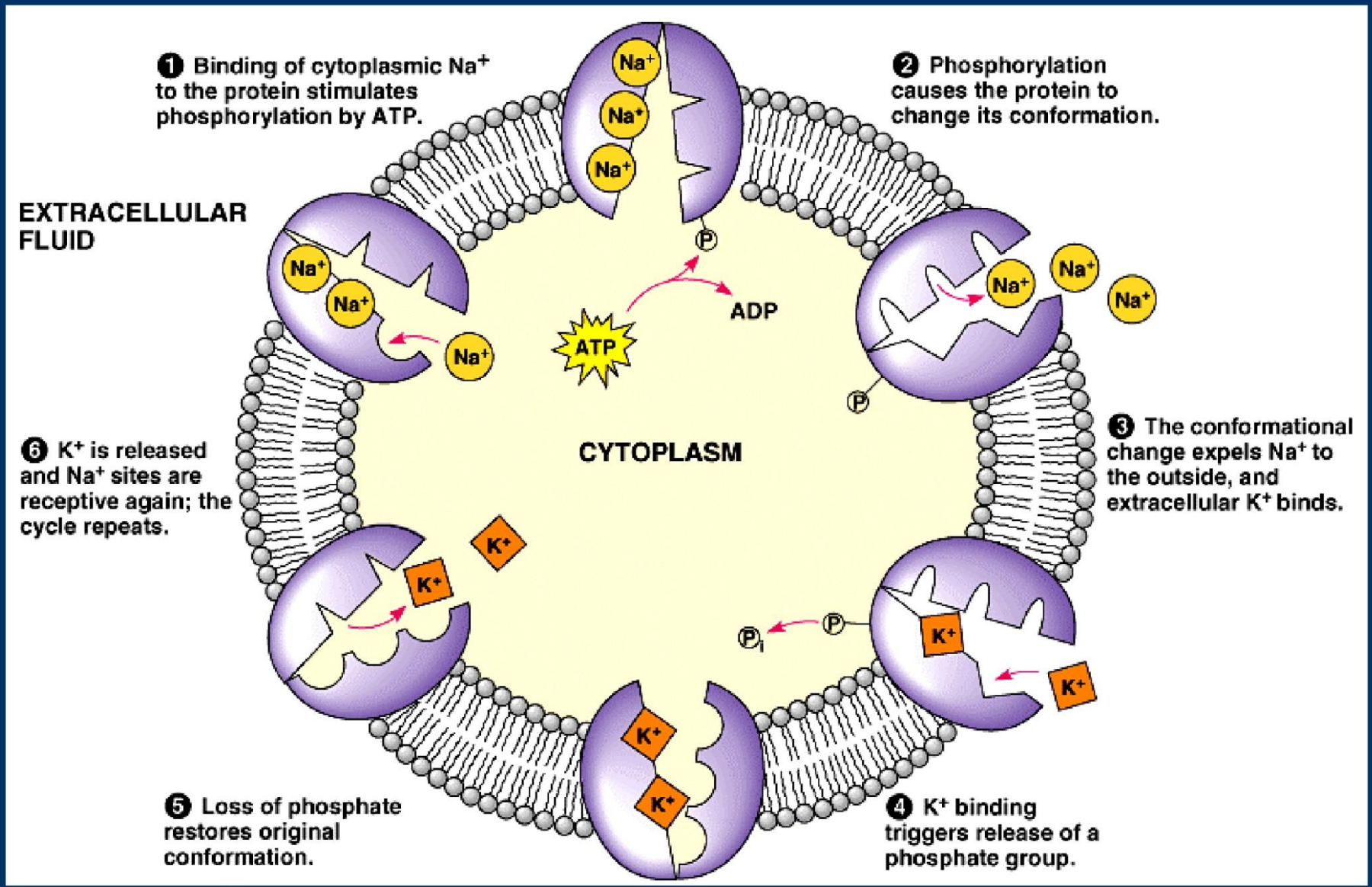


The proteins can transport the solute in either direction, with the net movement being down the concentration gradient of the solute.

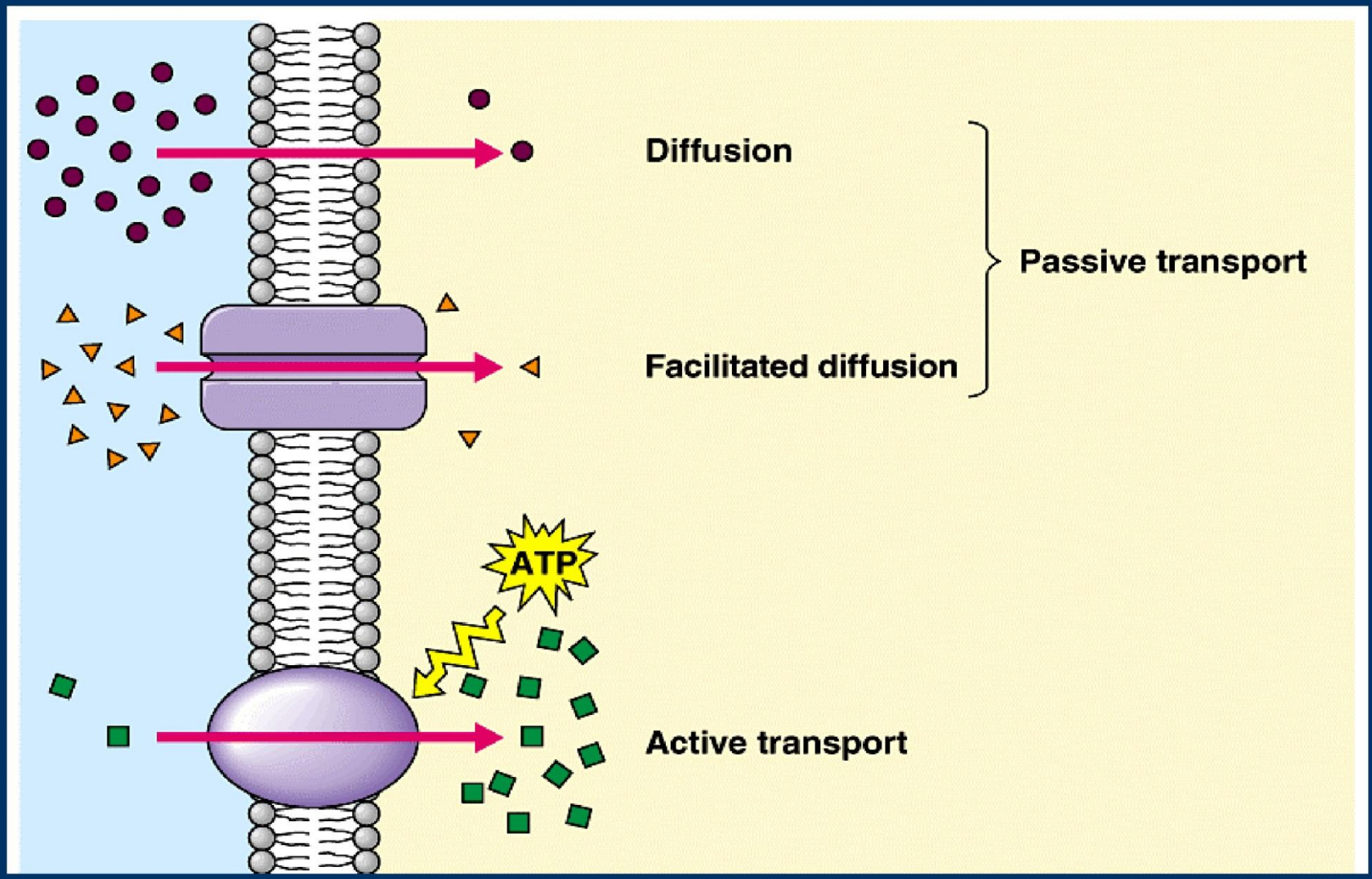
Active transport:

-pumping of solutes against their concentration gradient
-require energy in the form of ATP





The sodium-potassium pump



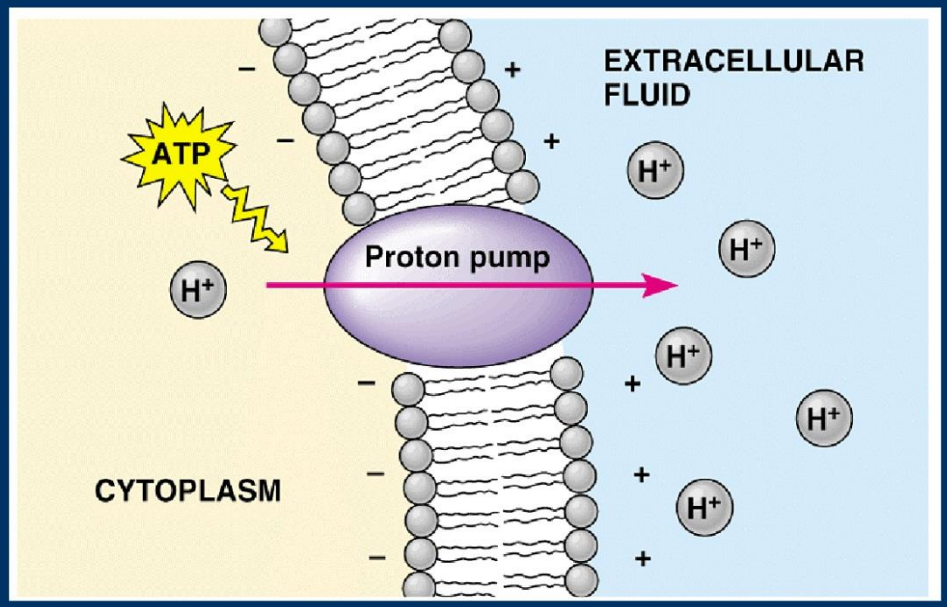
Comparison between passive and active transport

An electrogenic pump = a transport protein that generates voltage across a membrane

sodium-potassium pump

proton pump transport positive charge in the form of hydrogen ions

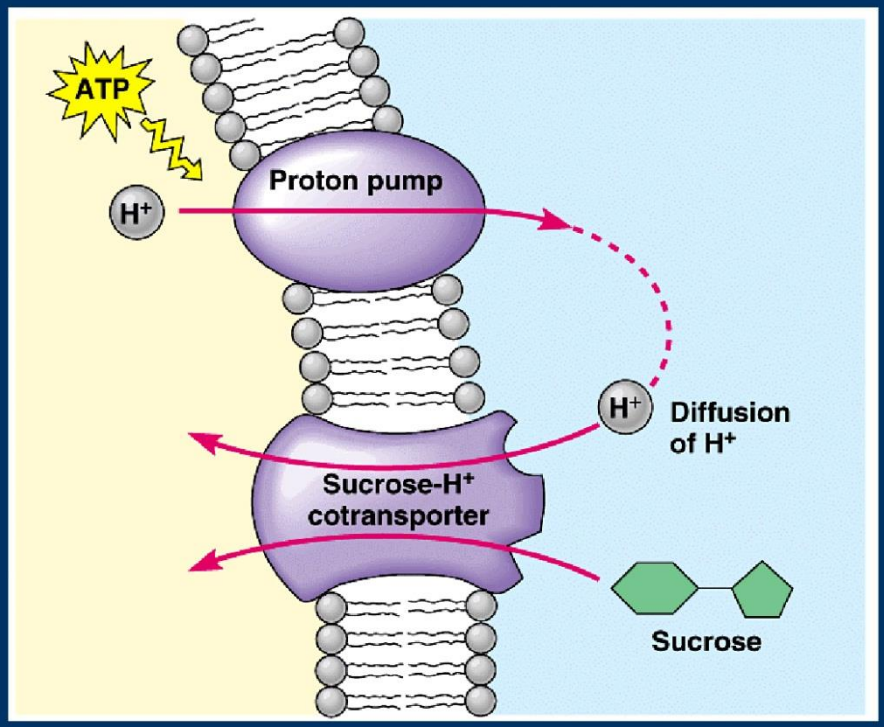
Voltage generated across membranes can be trapped for cellular work such as in cotansport.



Cotransport: a membrane protein couples the transport of 2 solutes

A substance that has been pumped across a membrane can do work as it leaks back by diffusion.

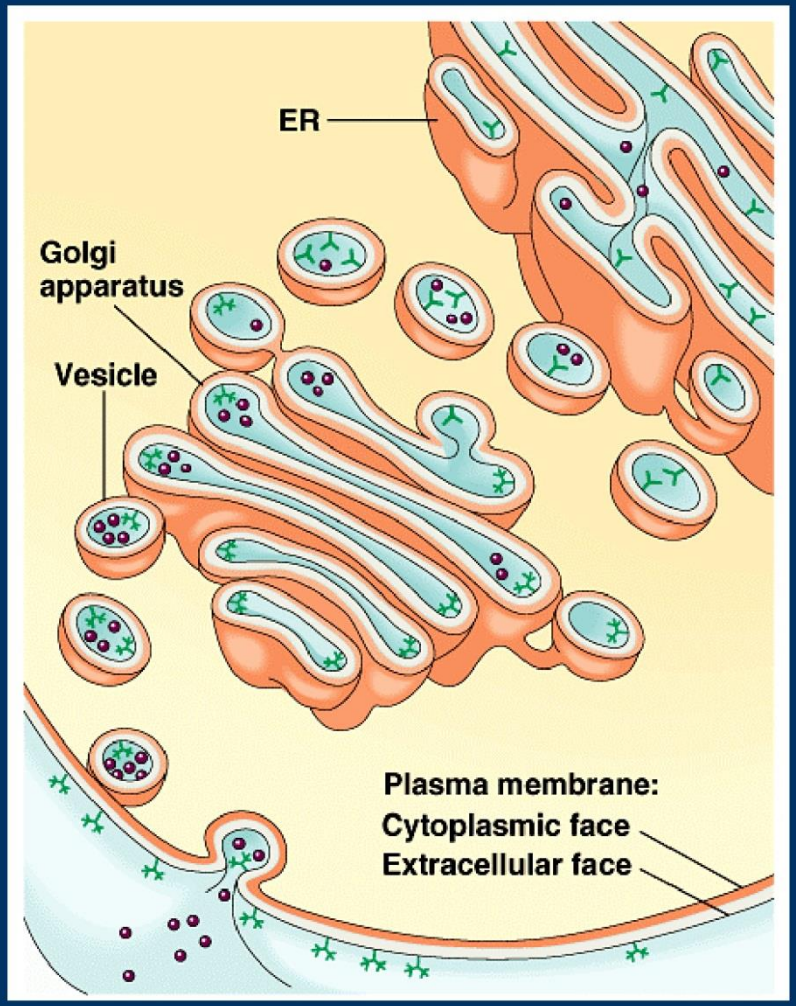
Plant cells uses



hydrogen gradient generated by proton pumps to drive active transport of amino acids, sugar and other nutrients

Exocytosis and endocytosis: transport of large molecules (proteins, polysaccharides)

Exotytosis = secretion of macromolecules from cells by the fusion of vesicles with the plasma membrane.



Endocytosis = the process which cell takes in macromolecules and particulate matter by forming new vesicles from the plasma membrane.

3 types of endocytosis:

phagocytosis = celular eating

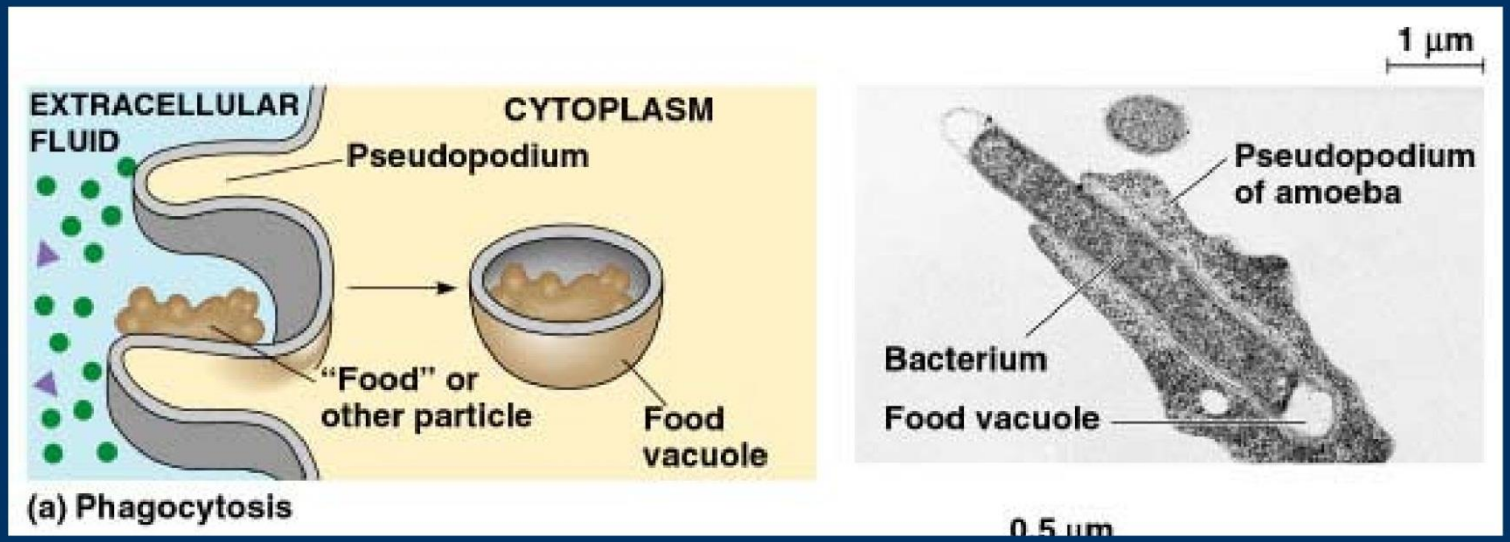
pinocytosis = cellular drinking

receptor-mediated endocytosis

Phagocytosis

The cell engulfs a particle by wrapping pseudopodia around it and packaging it within a vacuole: food vacuole.

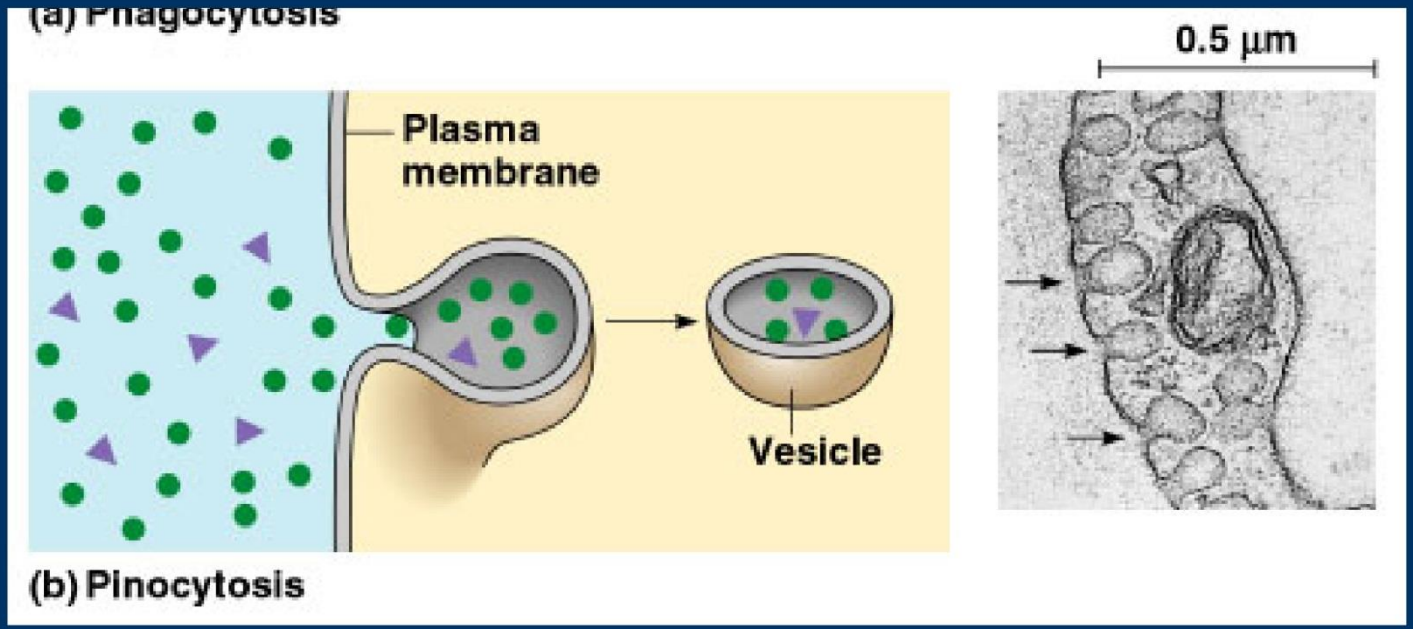
Food vacuole fuses with lysosome to be digested.



Pinocytosis

The cell gulps droplets of extracellular fluid into tiny vesicles.

Pinocytosis is unspecific in the substances it transports.



Receptor-mediated endocytosis

Specific receptor proteins embedded in the membrane bind to the ligands.

e.g. transport of cholesterol into the cells.