

BIOLOGY for AP[®] COURSES

Chapter 5 STRUCTURE AND FUNCTION OF PLASMA MEMBRANES

PowerPoint Image Slide Show

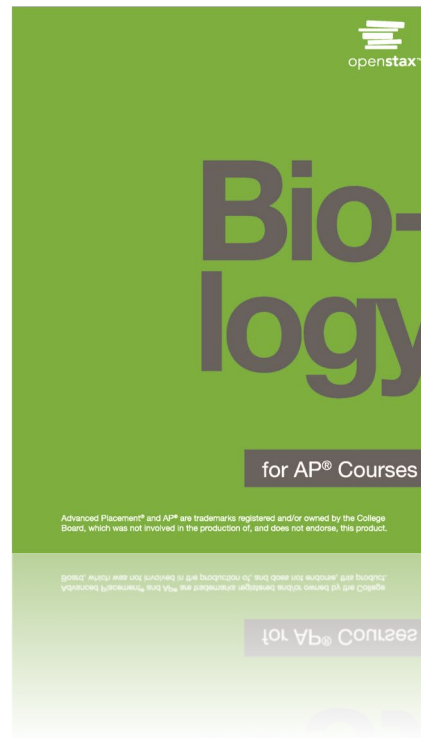


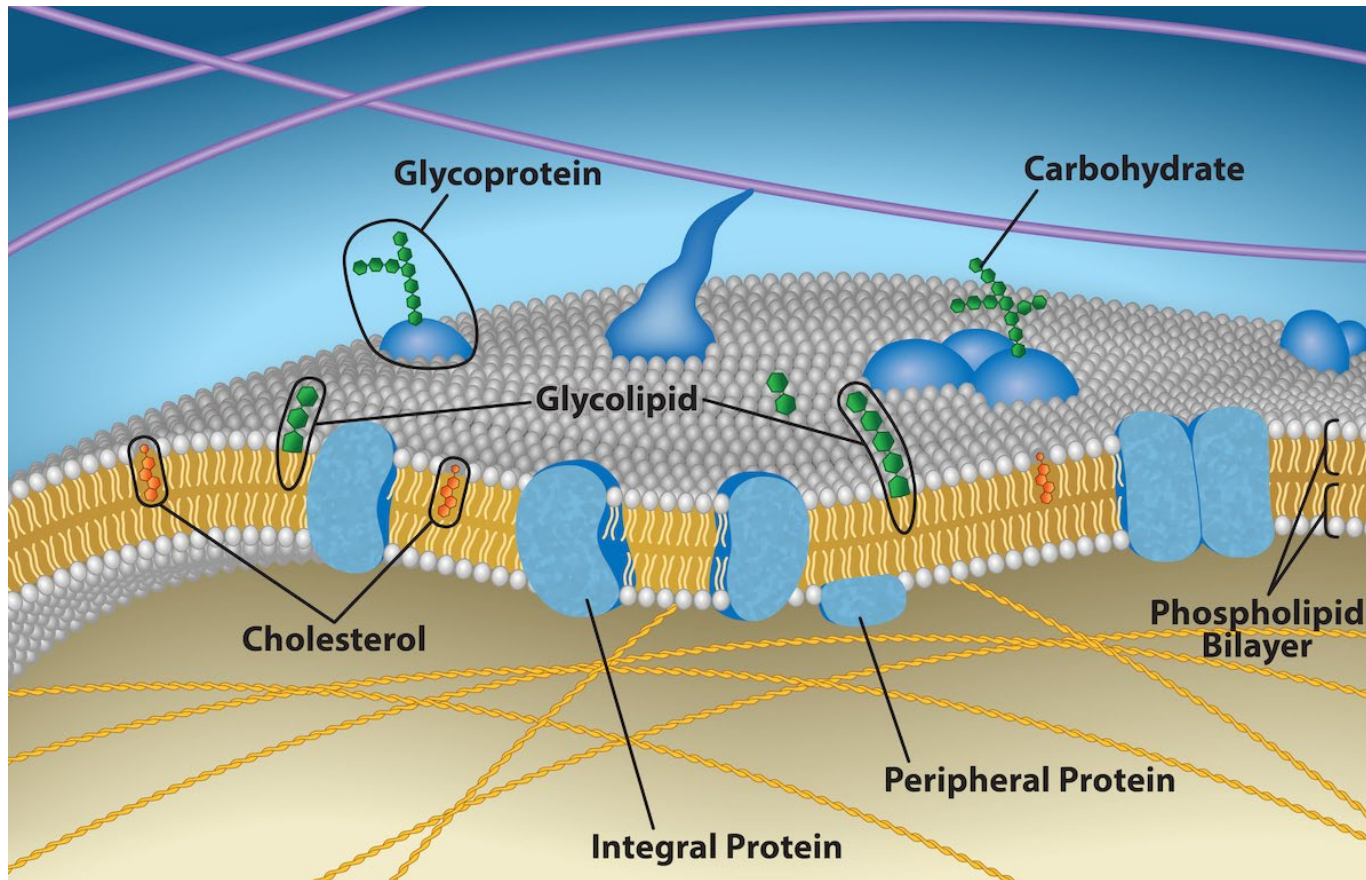
FIGURE 5.1



Despite its seeming hustle and bustle, Grand Central Station functions with a high level of organization: People and objects move from one location to another, they cross or are contained within certain boundaries, and they provide a constant flow as part of larger activity. Analogously, a plasma membrane's functions involve movement within the cell and across boundaries in the process of intracellular and intercellular activities.

(credit: modification of work by Randy Le'Moine)

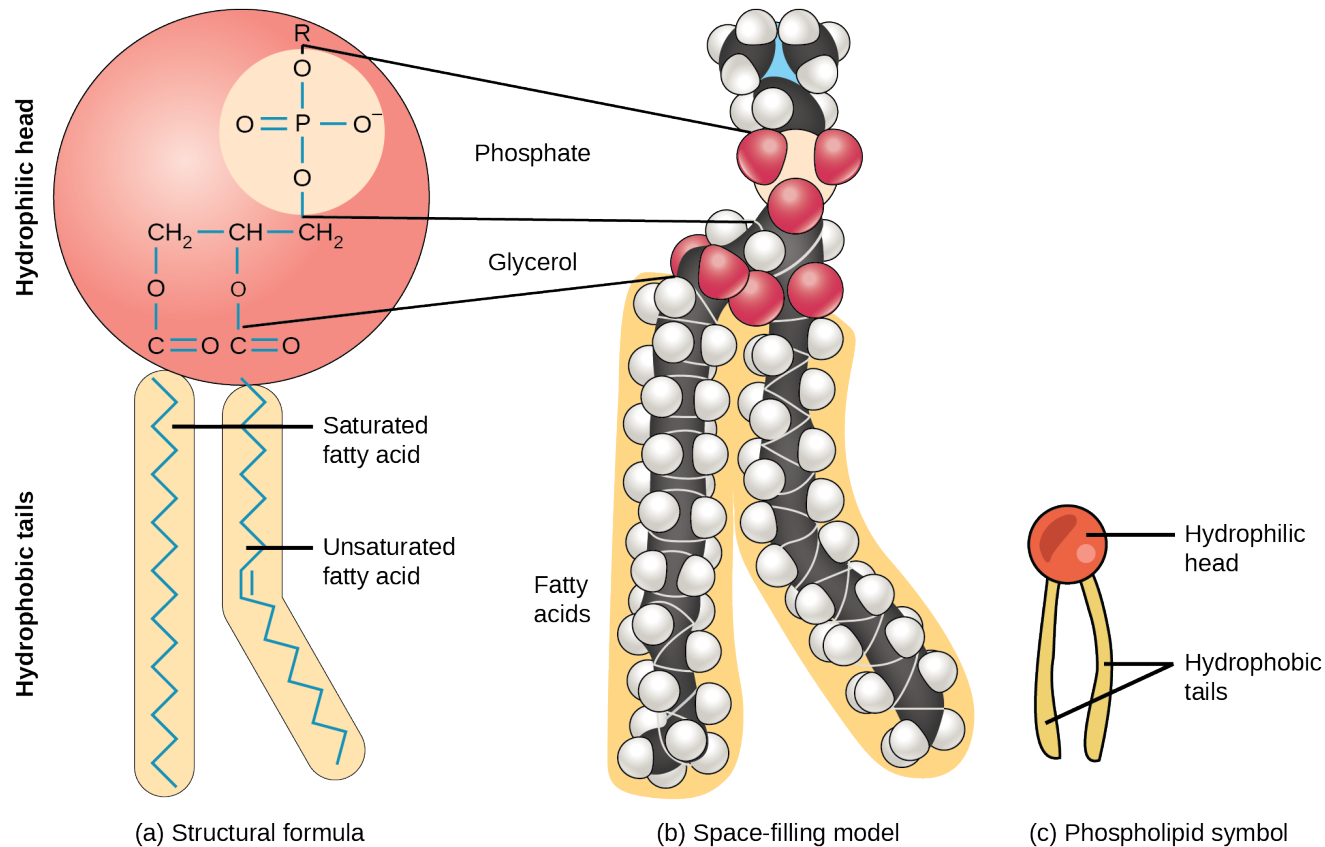
FIGURE 5.2



The plasma membrane fluid mosaic model describes the plasma membrane as a fluid combination of phospholipids, cholesterol, and proteins. Carbohydrates attached to lipids (glycolipids) and to proteins (glycoproteins) extend from the membrane's outward-facing surface.

(credit: Rao, A., Ryan, K., Fletcher, S., Hawkins, A. and Tag, A. Department of Biology, Texas A&M University)

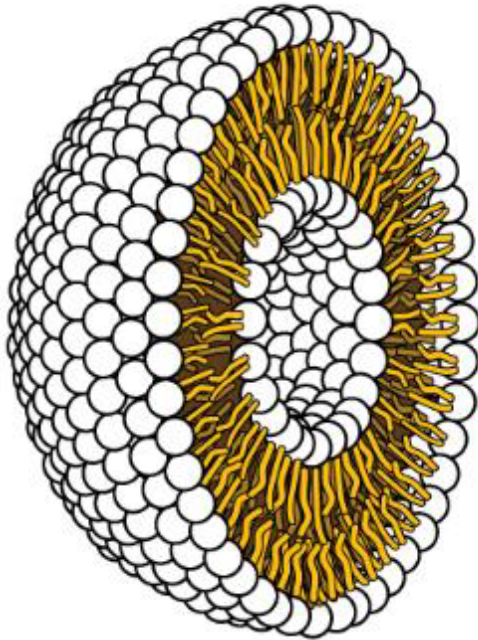
FIGURE 5.3



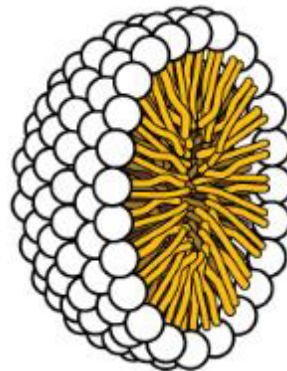
A hydrophilic head and two hydrophobic tails comprise this phospholipid molecule. The hydrophilic head group consists of a phosphate-containing group attached to a glycerol molecule. The hydrophobic tails, each containing either a saturated or an unsaturated fatty acid, are long hydrocarbon chains.

FIGURE 5.4

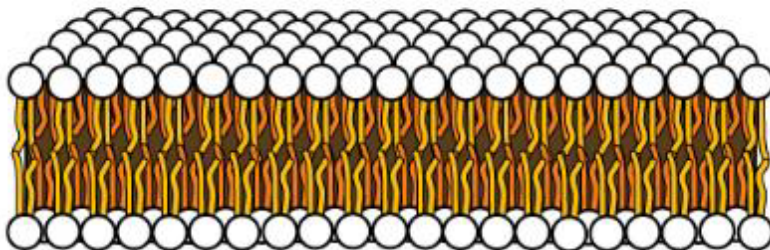
Lipid-bilayer sphere



Single-layer lipid sphere



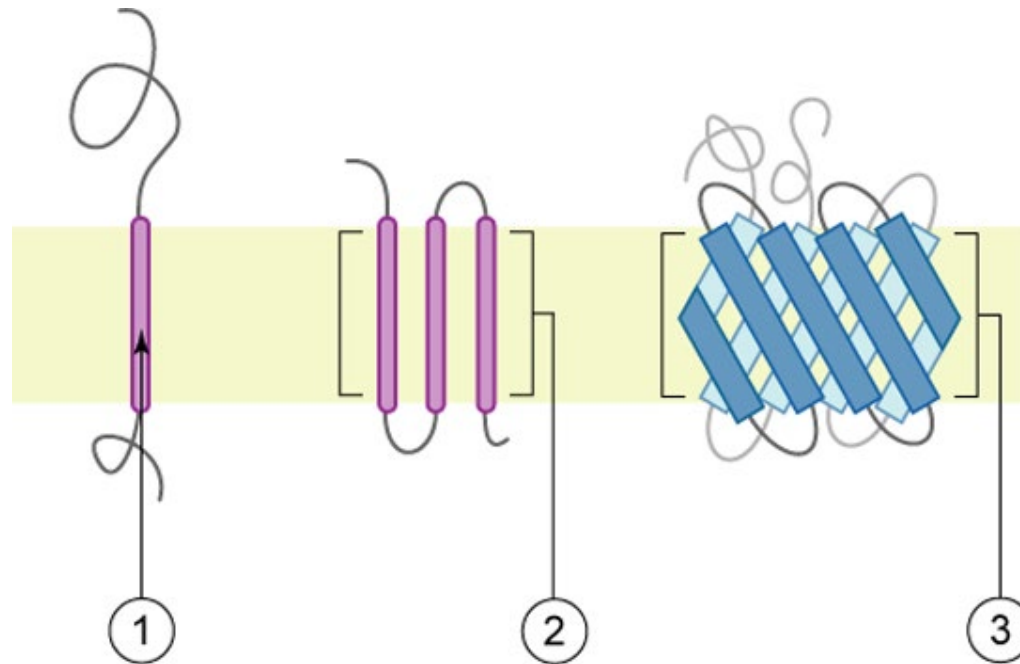
Lipid-bilayer sheet



In an aqueous solution, phospholipids tend to arrange themselves with their polar heads facing outward and their hydrophobic tails facing inward.

(credit: modification of work by Mariana Ruiz Villareal)

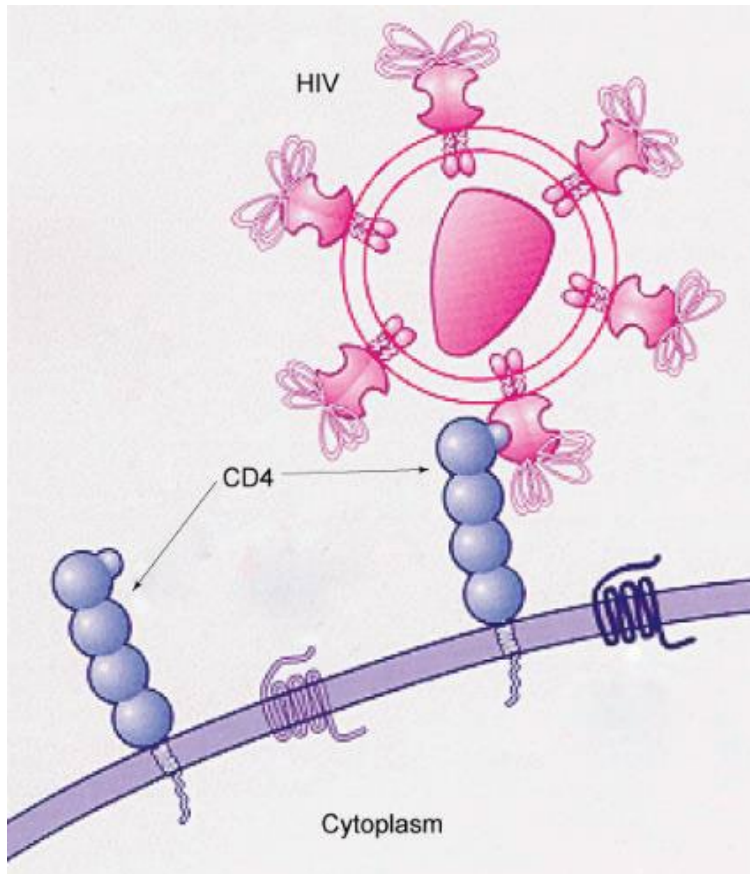
FIGURE 5.5



Integral membranes proteins may have one or more alpha-helices that span the membrane (examples 1 and 2), or they may have beta-sheets that span the membrane (example 3).

(credit: "Foobar"/Wikimedia Commons)

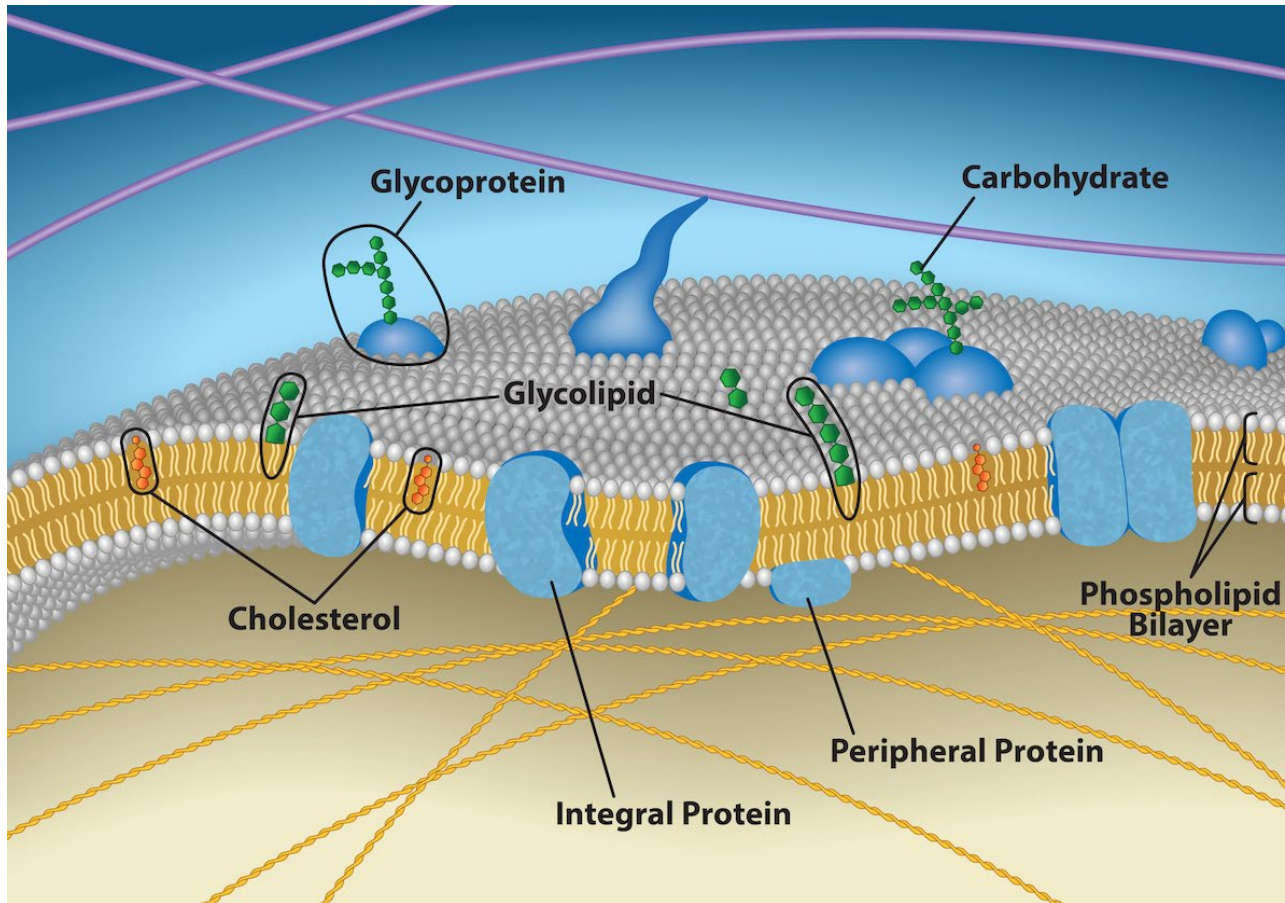
FIGURE 5.6



HIV binds to the CD4 receptor, a glycoprotein on the surfaces of T cells.

(credit: modification of work by NIH, NIAID)

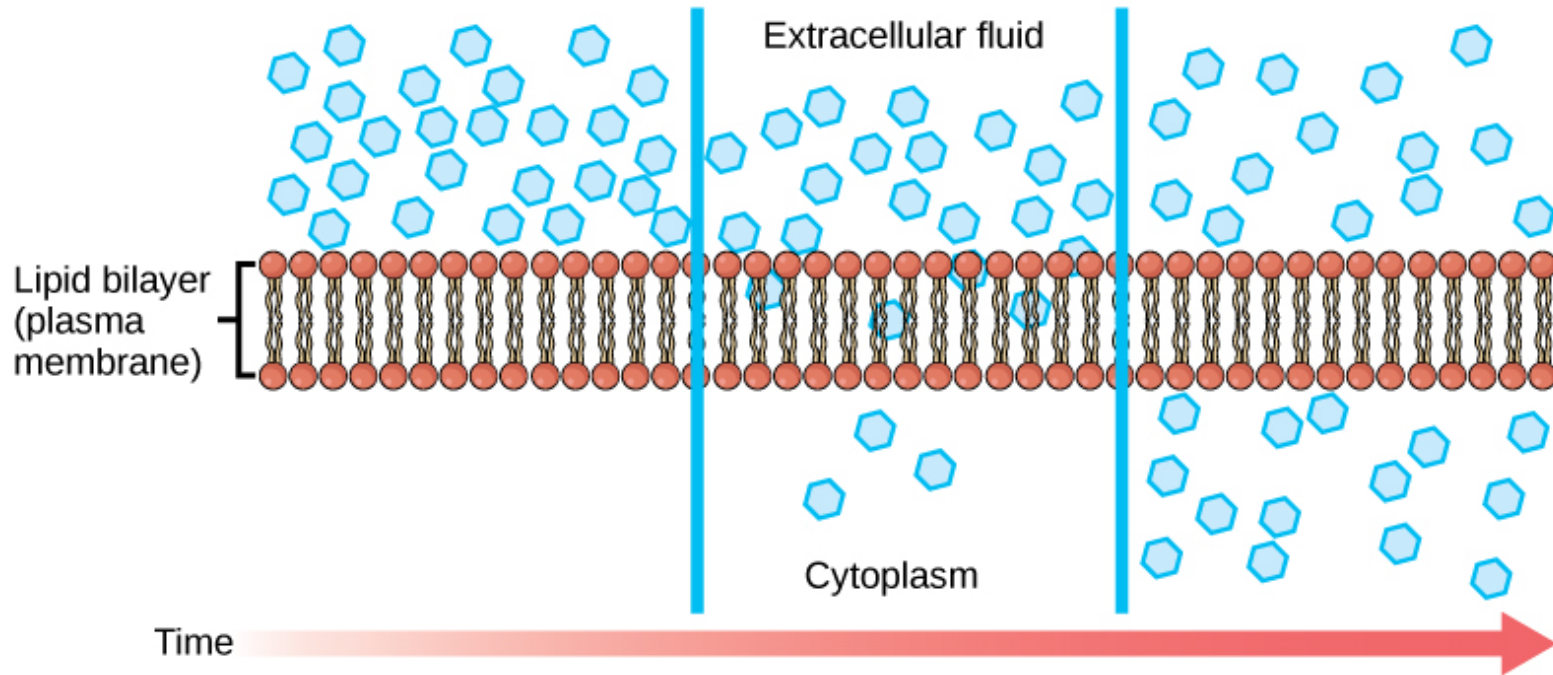
FIGURE 5.7



The exterior surface of the plasma membrane is not identical to the interior surface of the same membrane.

(credit: Rao, A., Ryan, K., Fletcher, S., Hawkins, A. and Tag, A. Department of Biology, Texas A&M University)

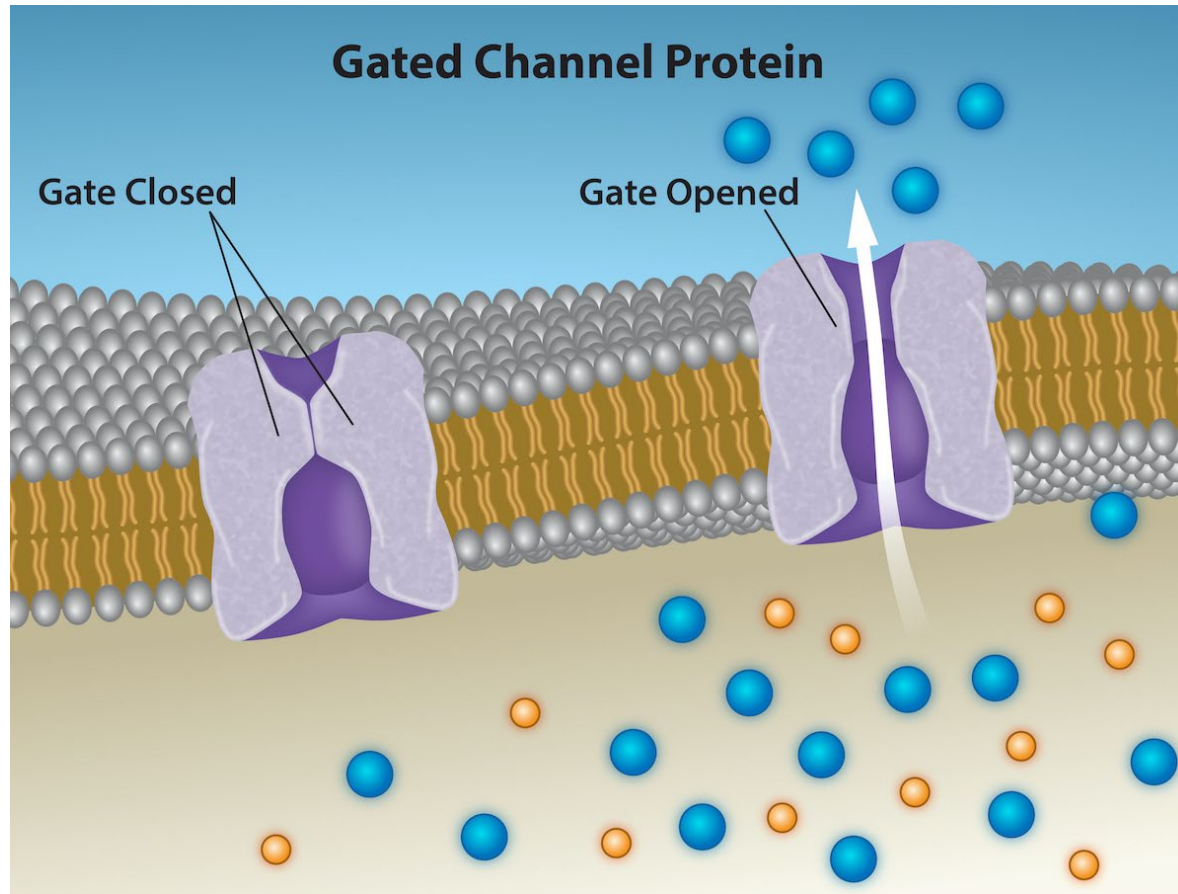
FIGURE 5.8



Diffusion through a permeable membrane moves a substance from an area of high concentration (extracellular fluid, in this case) down its concentration gradient (into the cytoplasm).

(credit: modification of work by Mariana Ruiz Villareal)

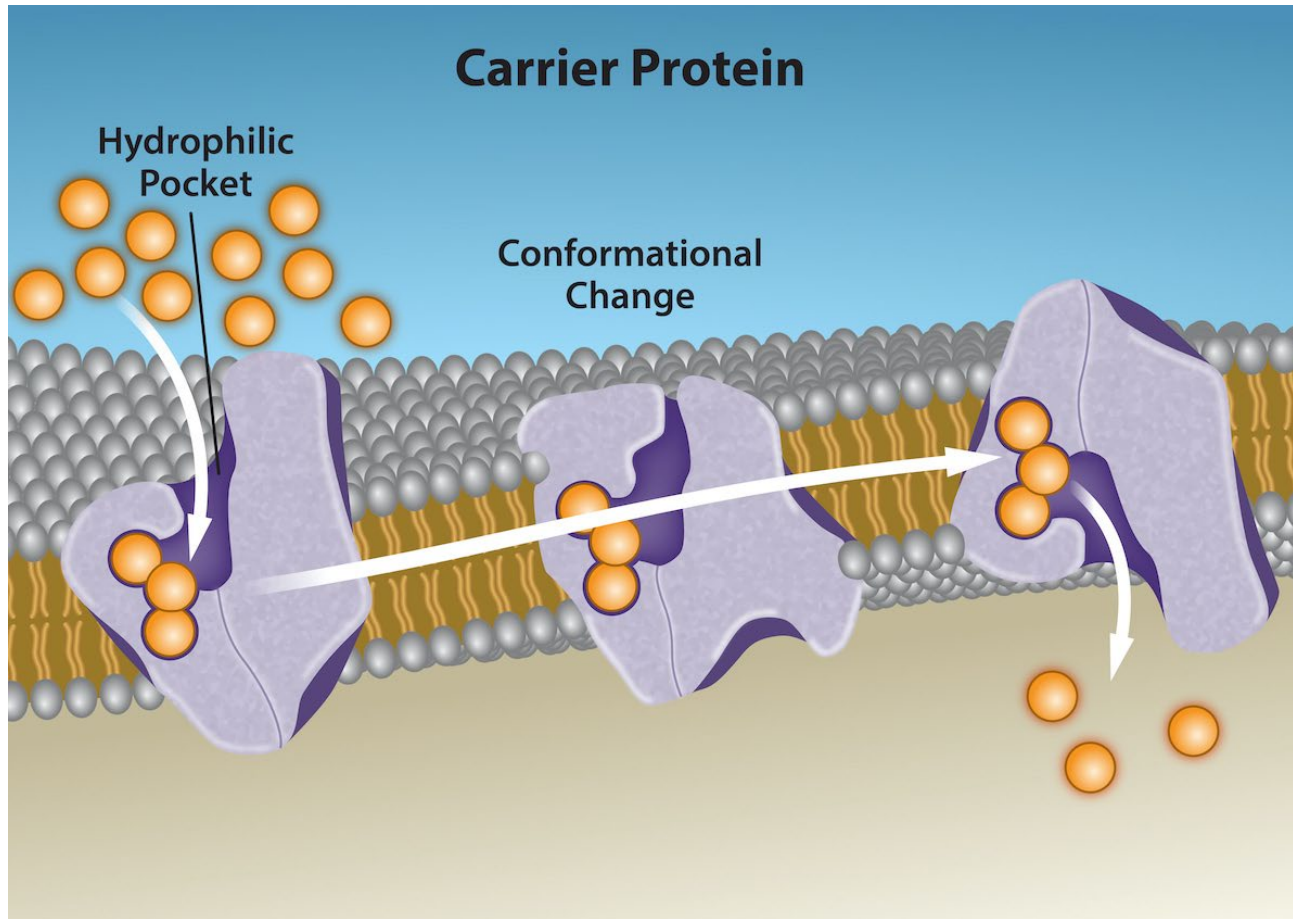
FIGURE 5.9



Ion channel proteins are gated. When they are closed, no ions can pass through them. However, when a channel opens, select ions diffuse through the channel. Channel proteins are highly specific, letting only a specific ion or subset of ions pass.

(credit: Rao, A., Ryan, K., Tag, A. and Fletcher, S. Department of Biology, Texas A&M University)

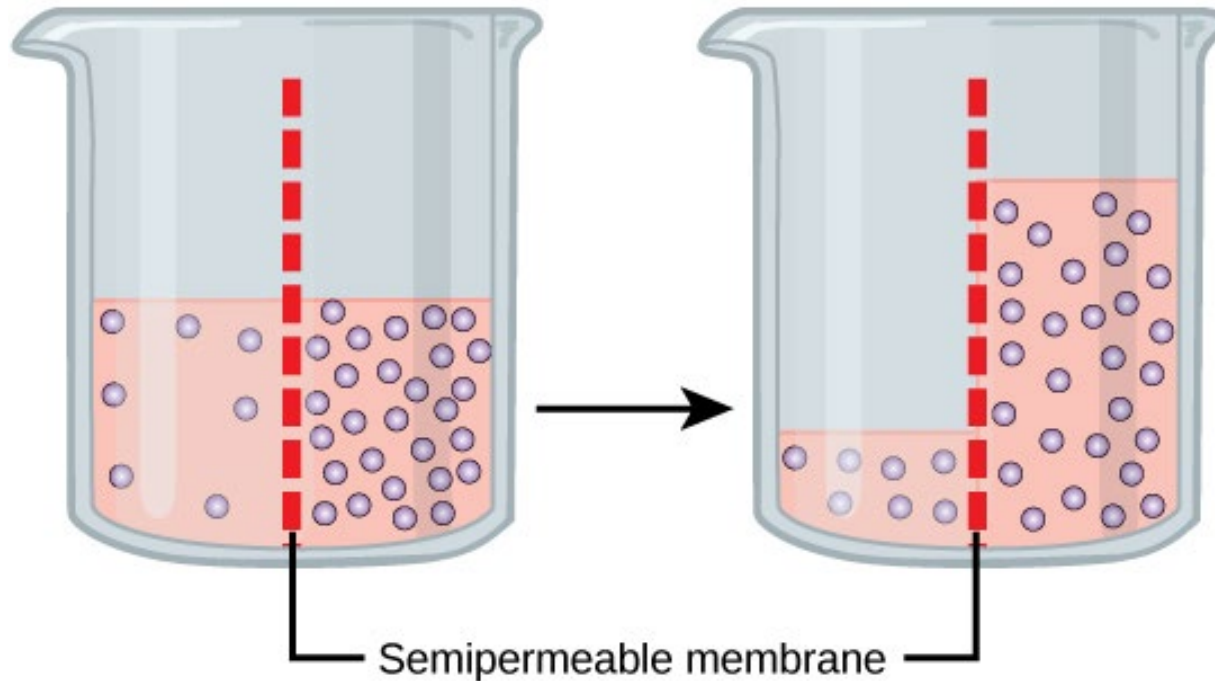
FIGURE 5.10



Some substances are able to move down their concentration gradient across the plasma membrane with the aid of carrier proteins. Carrier proteins change shape as they move molecules across the membrane.

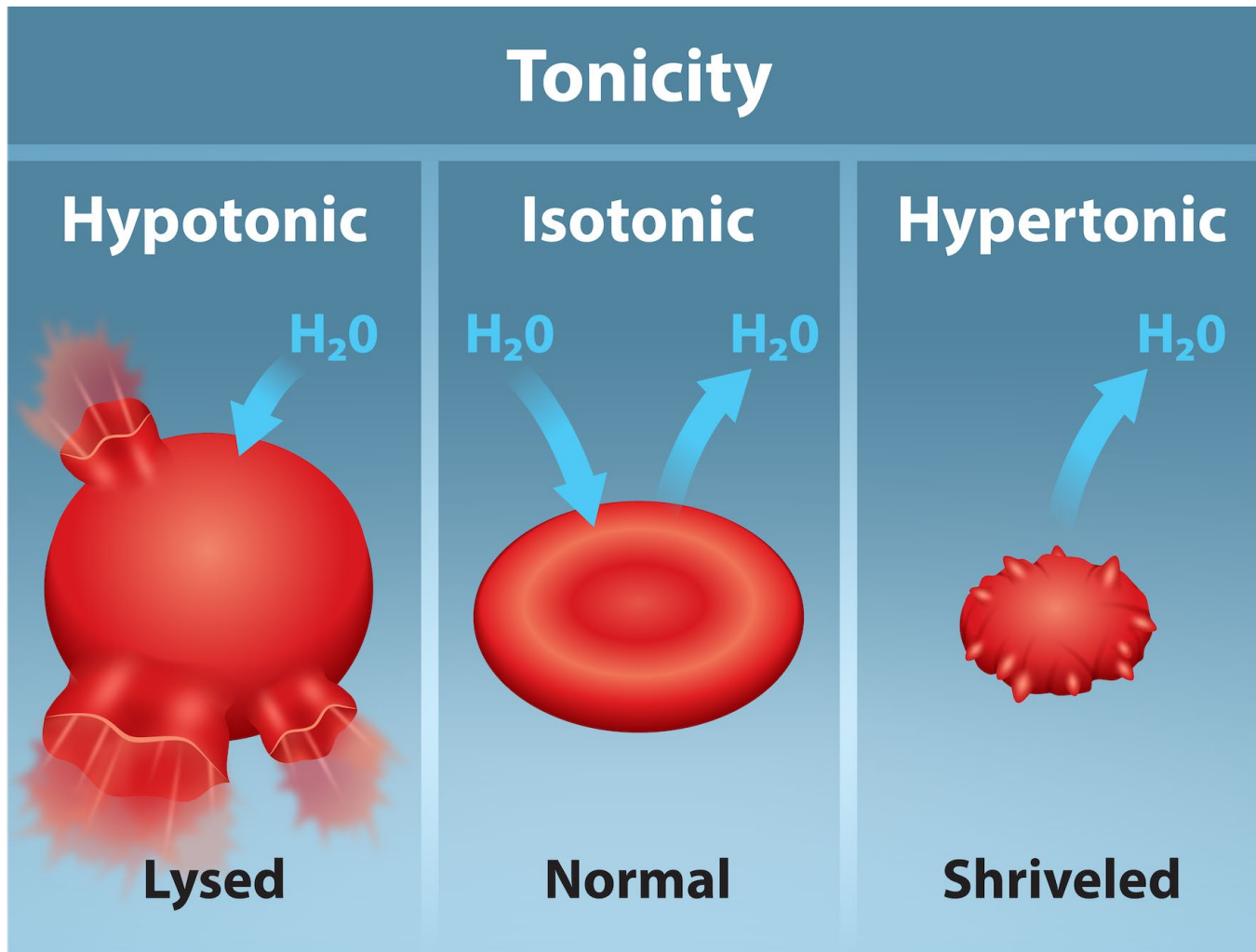
(credit: modification of work by Mariana Ruiz Villareal)

FIGURE 5.11



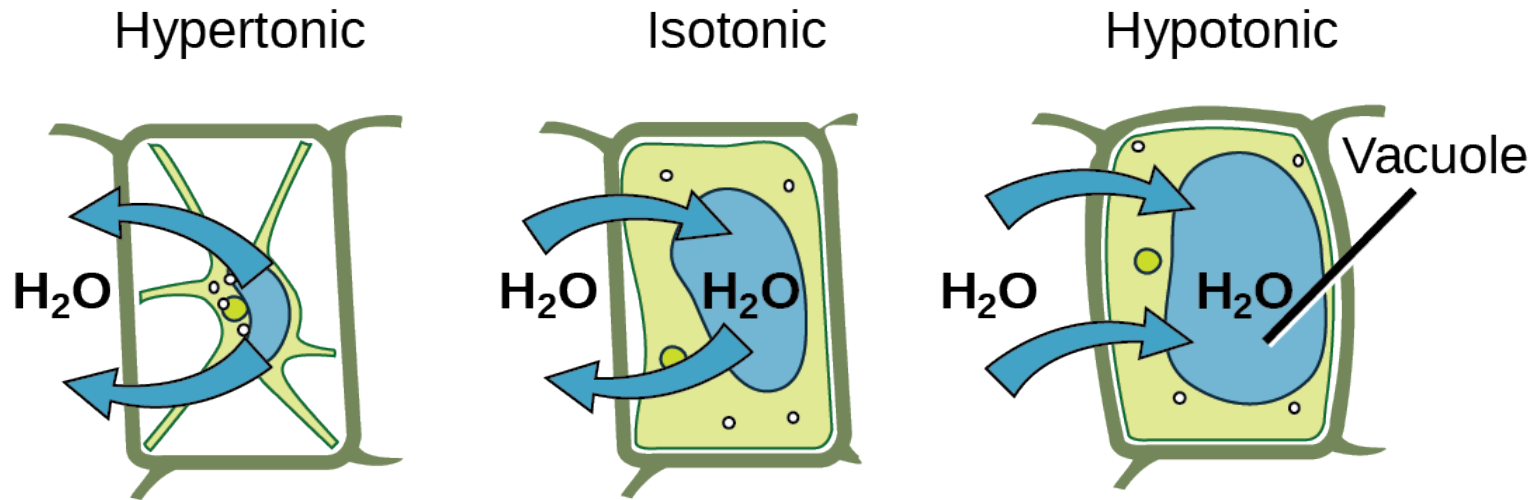
In osmosis, water always moves from an area of higher water concentration to one of lower concentration. In the diagram shown, the solute cannot pass through the selectively permeable membrane, but the water can.

FIGURE 5.12



(credit: Tag, A., Rao, A., Hawkins, A and Fletcher, S. Department of Biology, Texas A&M University)

FIGURE 5.13



The turgor pressure within a plant cell depends on the tonicity of the solution that it is bathed in.

(credit: modification of work by Mariana Ruiz Villareal)

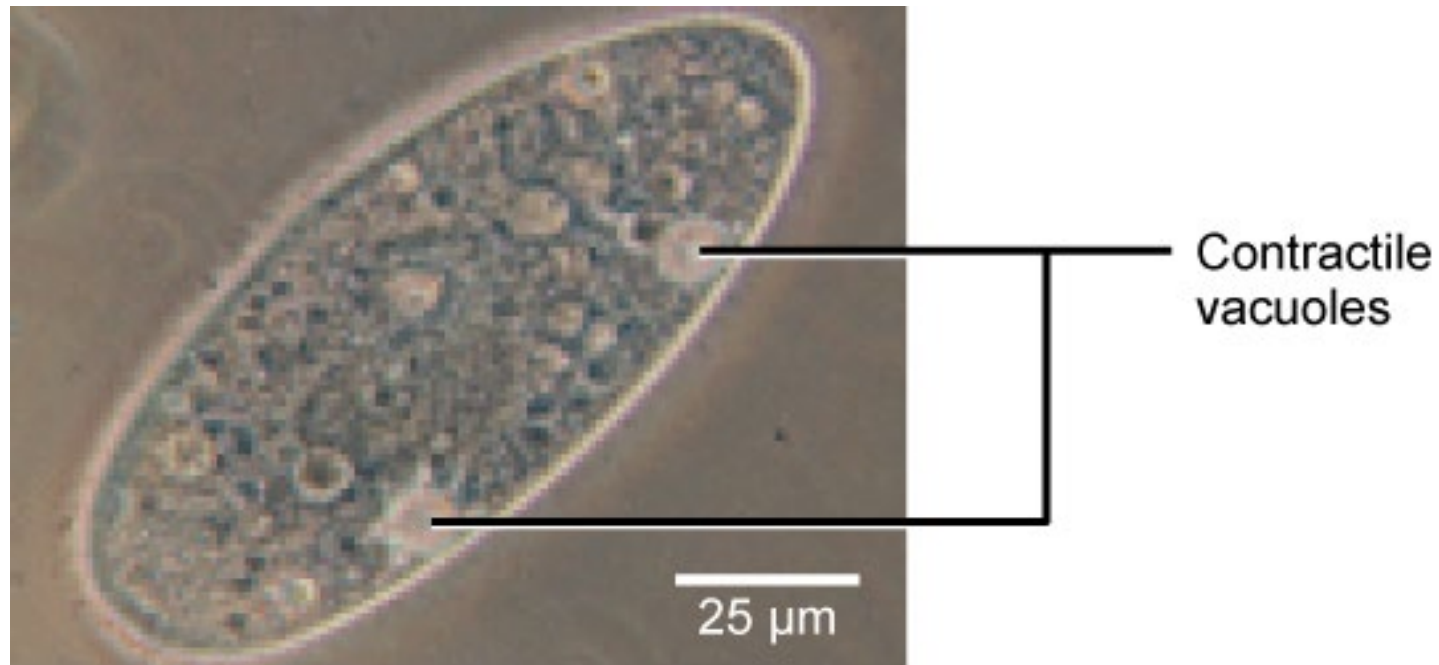
FIGURE 5.14



Without adequate water, the plant on the left has lost turgor pressure, visible in its wilting; the turgor pressure is restored by watering it (right).

(credit: Victor M. Vicente Selvas)

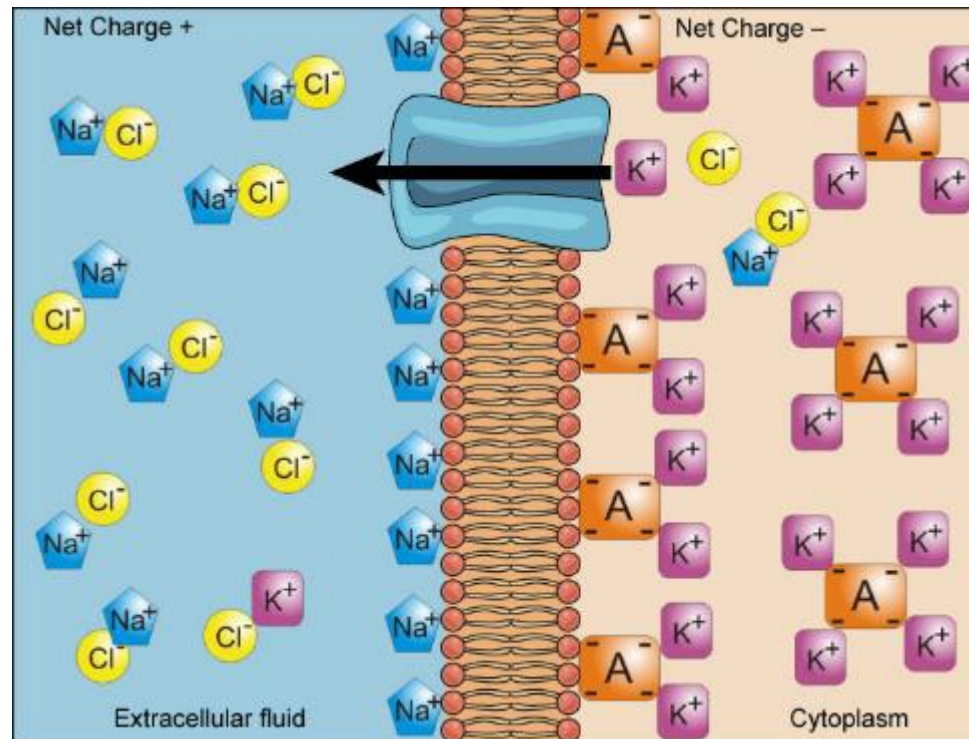
FIGURE 5.15



A paramecium's contractile vacuole, here visualized using bright field light microscopy at 480x magnification, continuously pumps water out of the organism's body to keep it from bursting in a hypotonic medium.

(credit: modification of work by NIH; scale-bar data from Matt Russell)

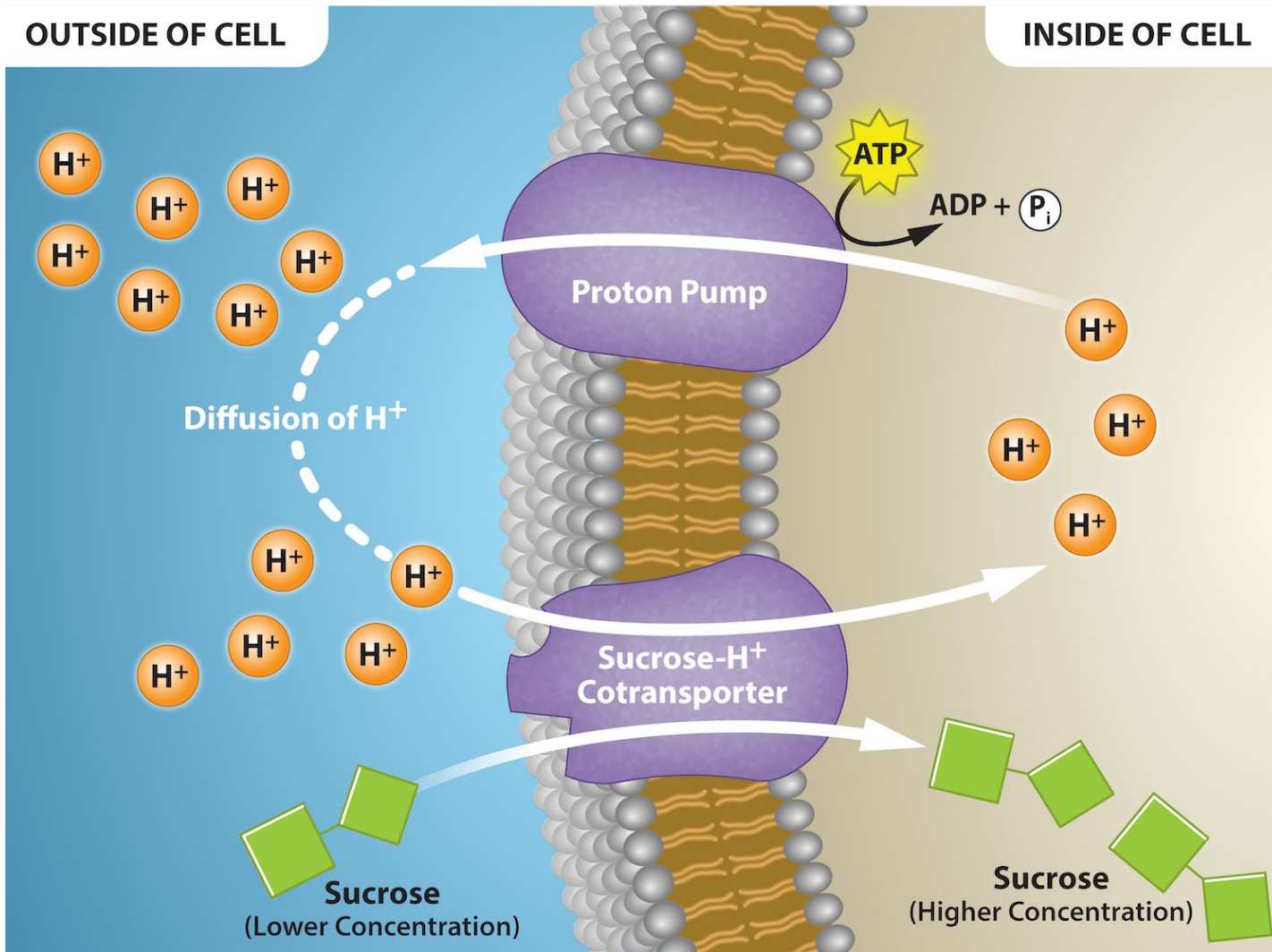
FIGURE 5.16



Electrochemical gradients arise from the combined effects of concentration gradients and electrical gradients. Structures labeled A represent proteins.

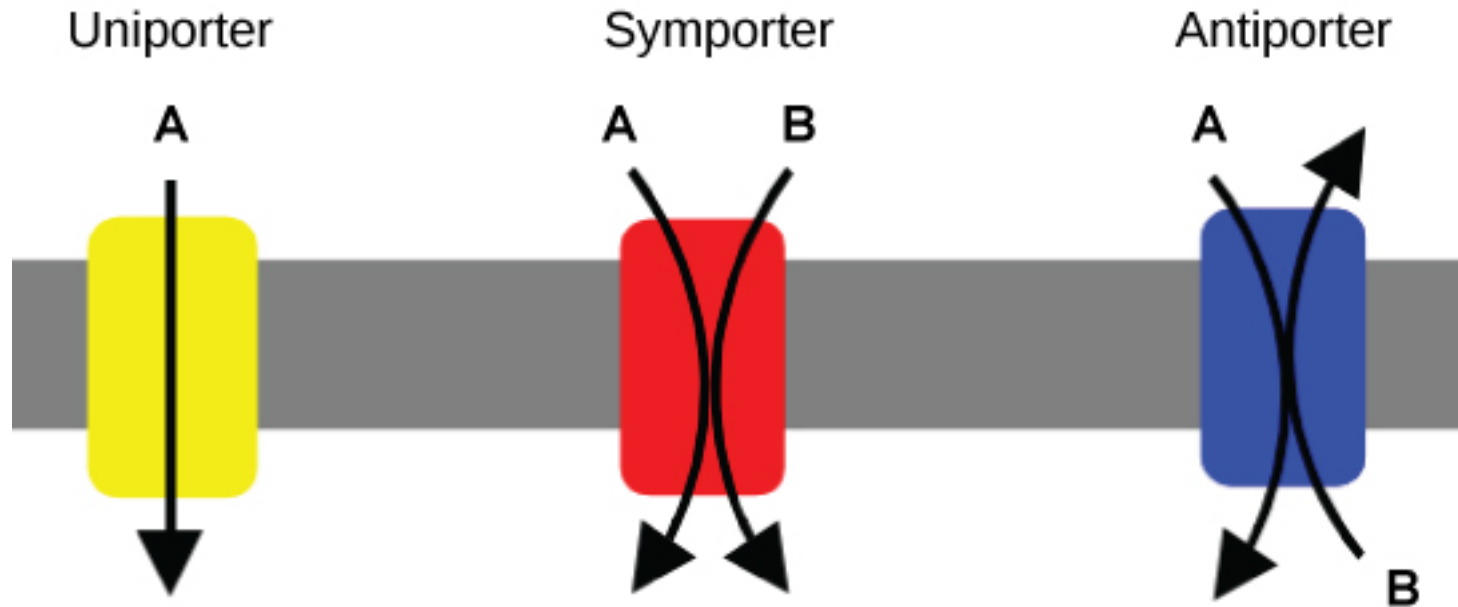
(credit: "Synaptitude"/Wikimedia Commons)

FIGURE 5.17



(credit: Rao, A. Tag, A. and Ryan, K. Department of Biology, Texas A&M University)

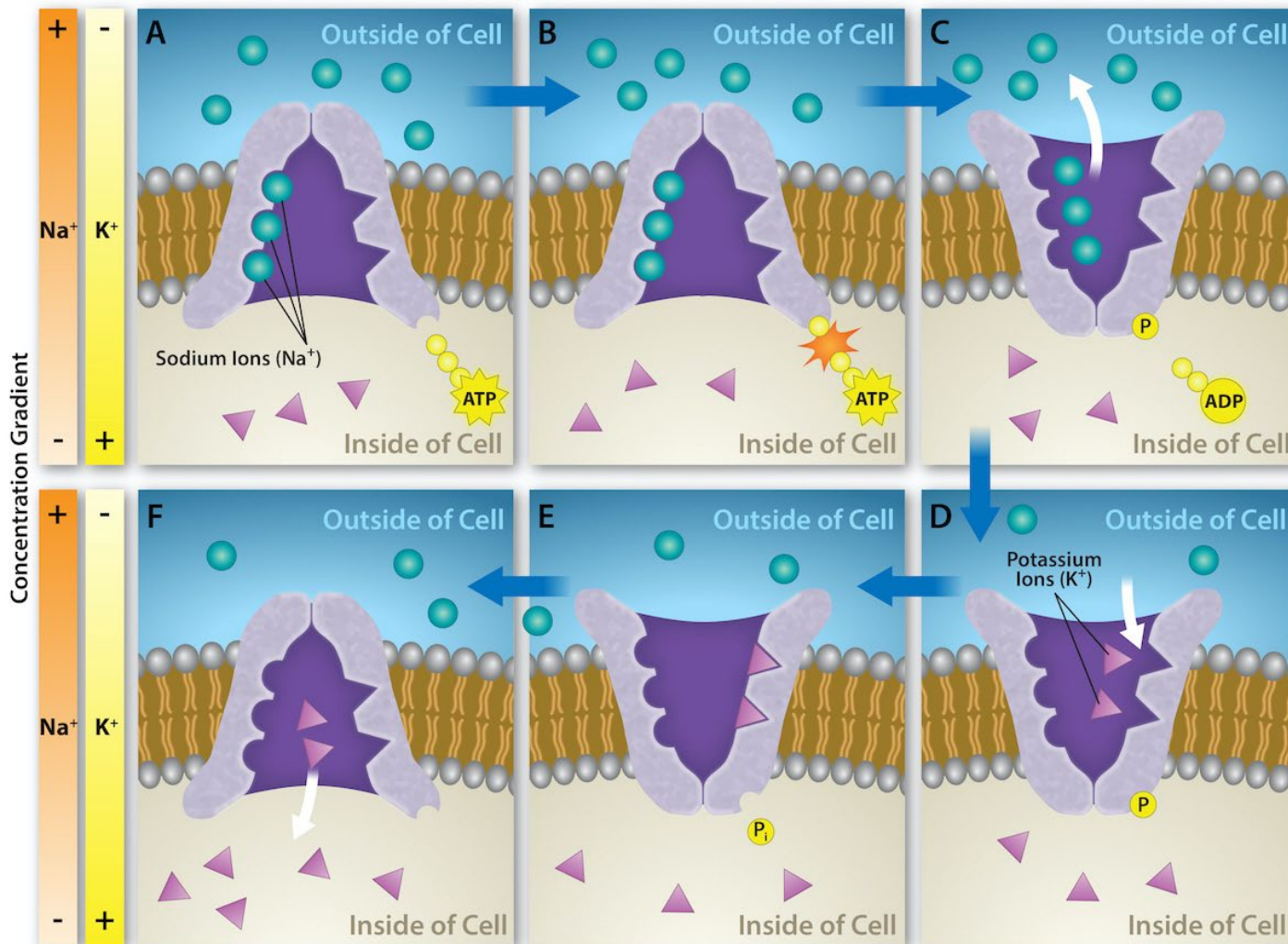
FIGURE 5.18



A uniporter carries one molecule or ion. A symporter carries two different molecules or ions, both in the same direction. An antiporter also carries two different molecules or ions, but in different directions.

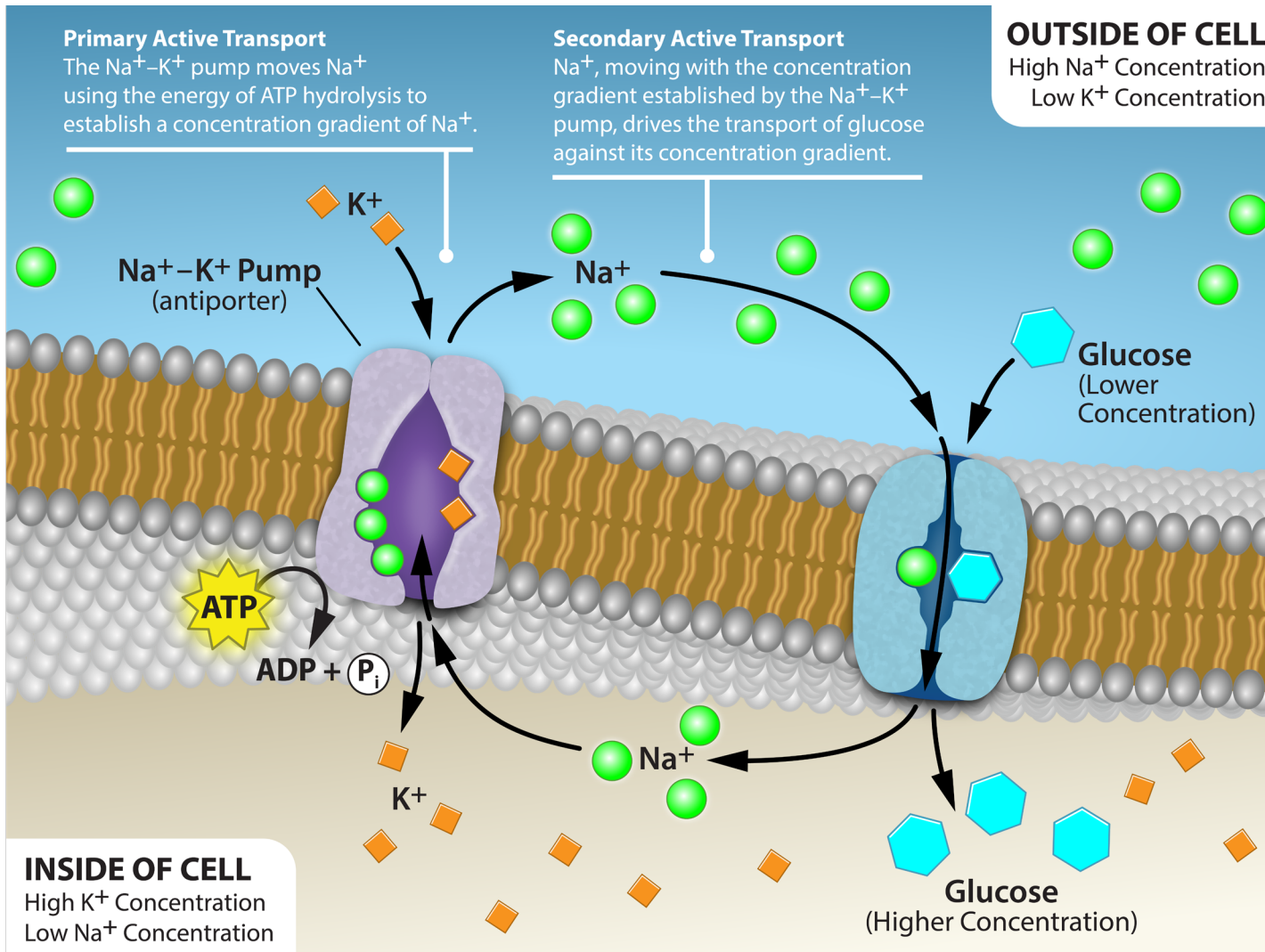
(credit: modification of work by “Lupask”/Wikimedia Commons)

FIGURE 5.19



(credit: Rao, A. Tag, A. and Ryan, K. Department of Biology, Texas A&M University)

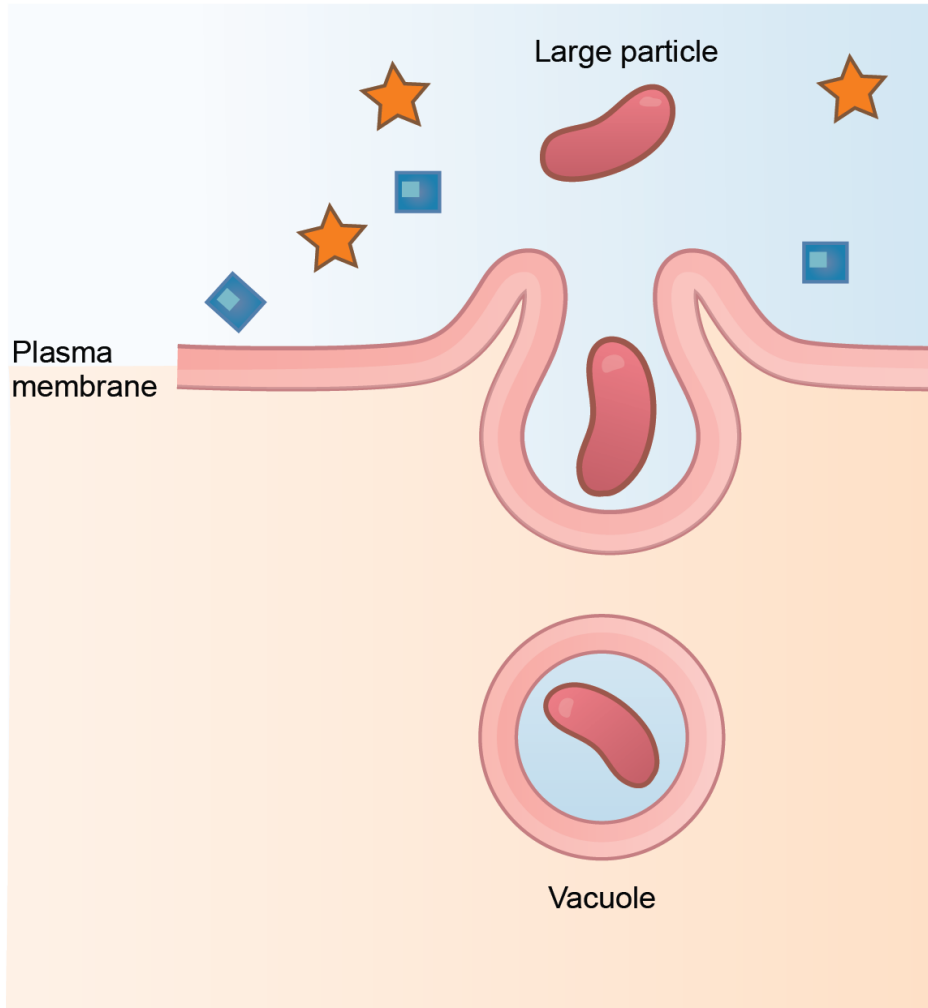
FIGURE 5.20



(credit: Rao, A. Tag, A. and Ryan, K. Department of Biology, Texas A&M University)

FIGURE 5.21

Phagocytosis

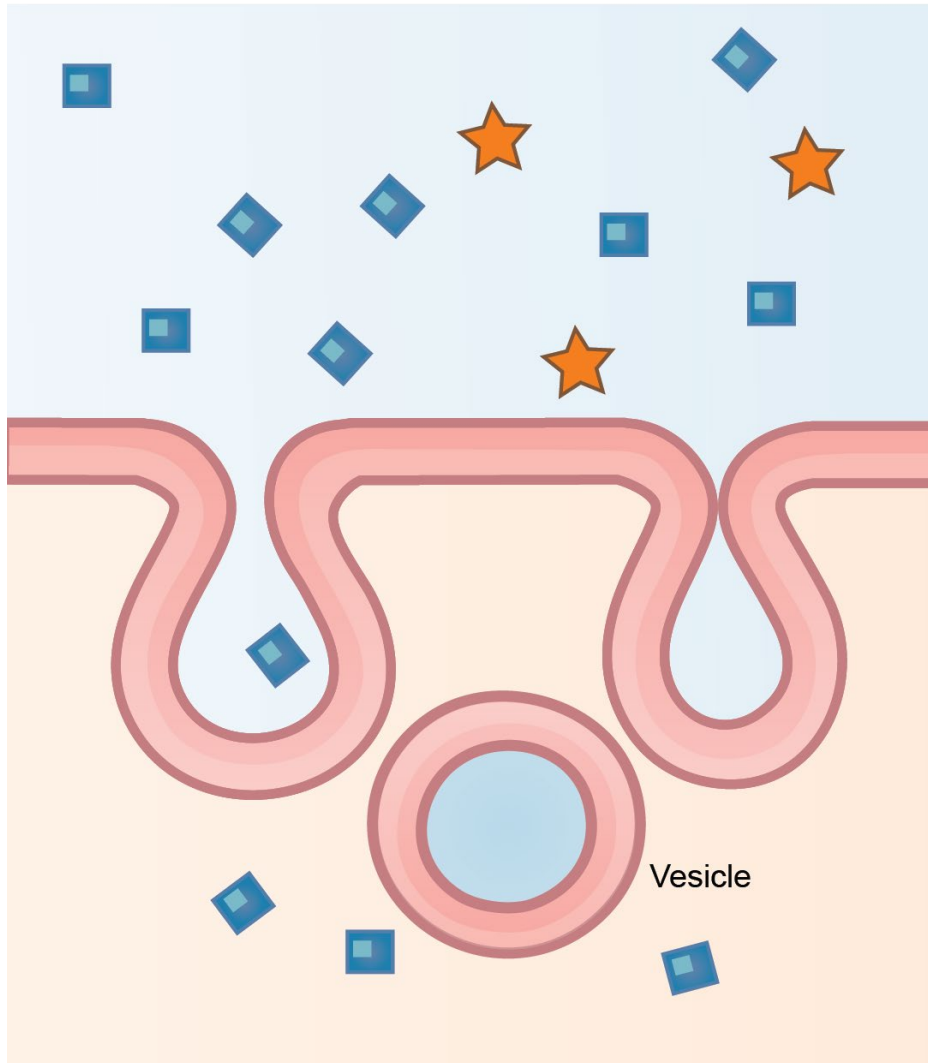


In phagocytosis, the cell membrane surrounds the particle and engulfs it.

(credit: modification of work by Mariana Ruiz Villareal)

FIGURE 5.22

Pinocytosis

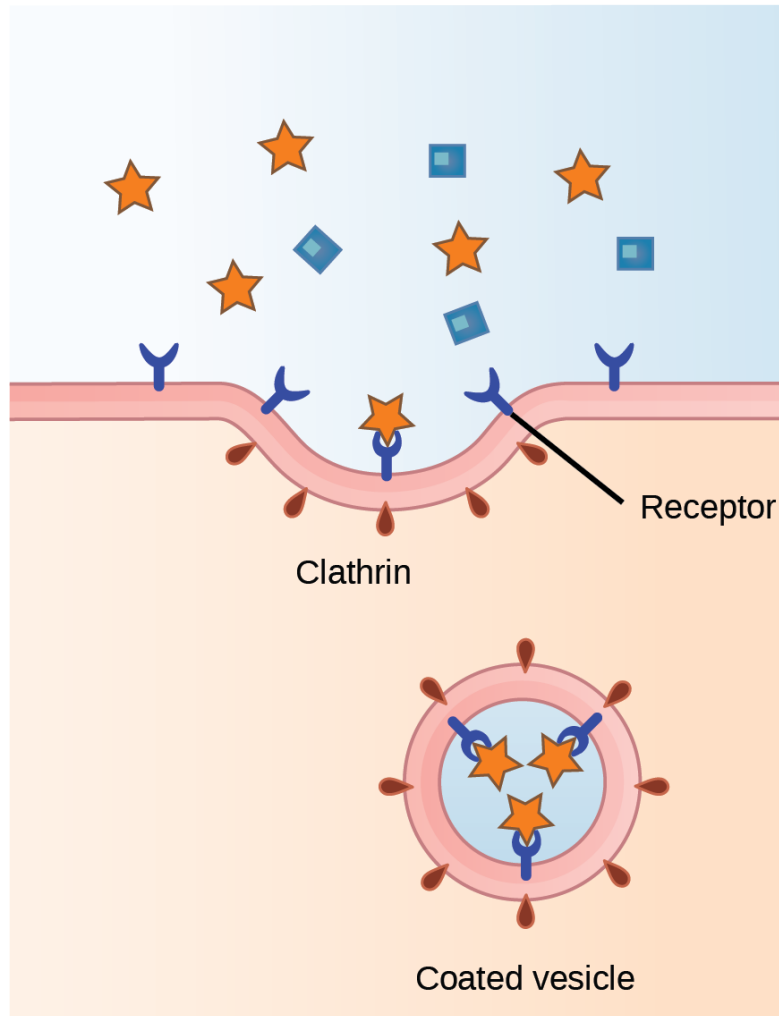


In pinocytosis, the cell membrane invaginates, surrounds a small volume of fluid, and pinches off.

(credit: modification of work by Mariana Ruiz Villareal)

FIGURE 5.23

Receptor-mediated endocytosis

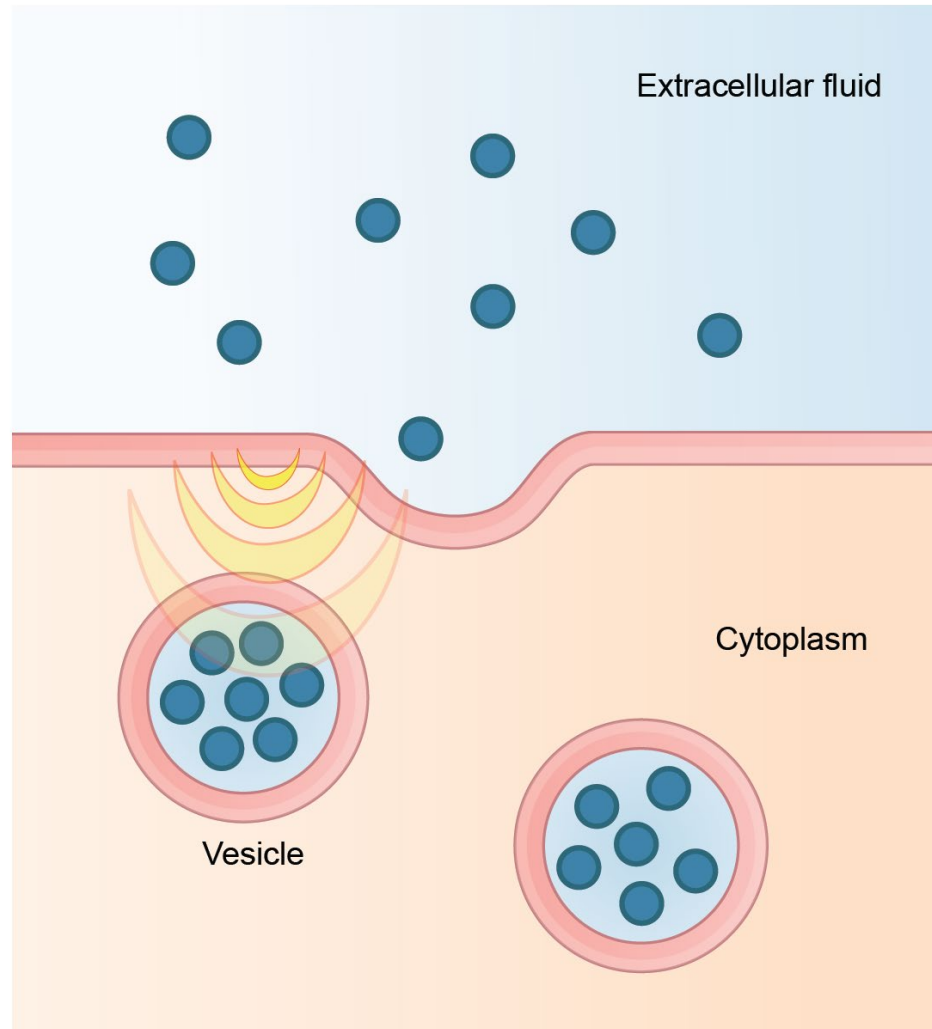


In receptor-mediated endocytosis, the cell's uptake of substances targets a single type of substance that binds to the receptor on the cell membrane's external surface.

(credit: modification of work by Mariana Ruiz Villareal)

FIGURE 5.24

Exocytosis



In exocytosis, vesicles containing substances fuse with the plasma membrane. The contents then release to the cell's exterior.

(credit: modification of work by Mariana Ruiz Villareal)