**Cells & Their Environment**

**CH3.4 Diffusion & Osmosis**

* All cells must respond to their environment to maintain stable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ conditions

|  |  |
| --- | --- |
| Objectives | Vocabulary |
| * **Relate** concentration gradients, diffusion, and equilibrium. * **Predict** the direction of water movement into and out of cells. * **Describe** the importance of ion channels in passive transport. * **Identify** the role of carrier proteins in facilitated diffusion. | Passive transport  Concentration gradient  Equilibrium  Diffusion  Osmosis  Hypertonic solution  Hypotonic solution  Isotonic solution  Ion channel  Carrier protein  Facilitated diffusion |

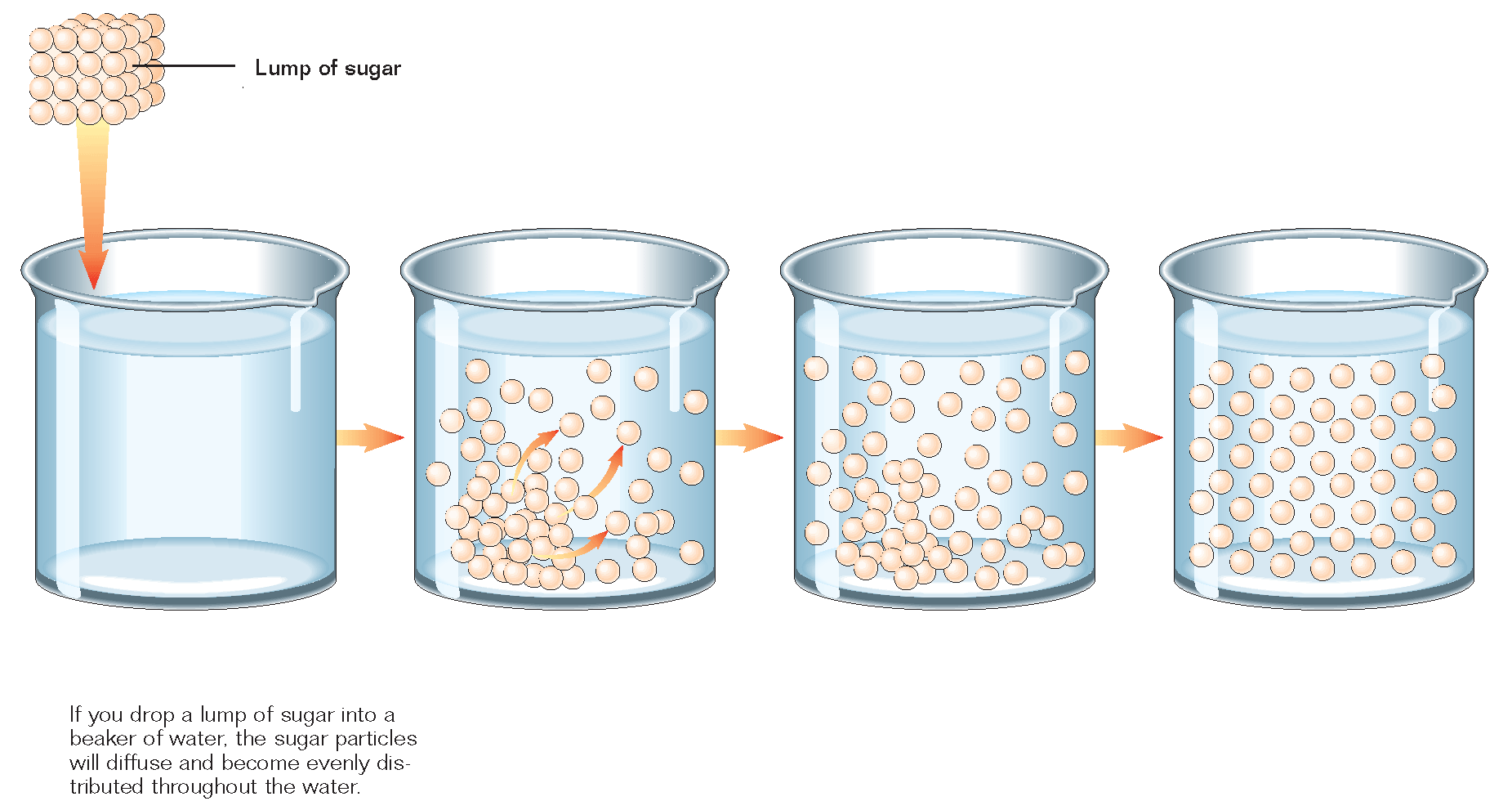
* One way cells maintain homeostasis is to control the movement of substances across their cell \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + When this process does not use energy, it is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_ transport
  + When this process does use energy, it is called \_\_\_\_\_\_\_\_\_\_\_ transport

**Diffusion**

* One type of passive transport is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* It is the result of the \_\_\_\_\_\_\_\_\_\_\_\_ motion of particles, which was first observed by Robert \_\_\_\_\_\_
  + Using a microscope, he observed pollen grains in water
  + He noticed that the grains were moving in little \_\_\_\_\_\_\_\_\_\_\_, like they were being struck by invisible objects
  + The invisible objects were \_\_\_\_\_\_\_\_\_ particles
* The random motion of particles is similar to balls bouncing in a closed room
* If a door is opened, balls will randomly bounce off of each other moving from an area of \_\_\_\_\_\_\_\_\_\_\_ concentration to an area of \_\_\_\_\_\_\_\_\_\_concentration



* This difference in concentration is called a concentration \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* It is natural to move \_\_\_\_\_\_\_\_ the gradient, following the \_\_\_\_\_\_ to \_\_\_\_\_\_\_ pattern
* This is similar to swimming with the flow of a river…it requires no \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The particles continue to follow the gradient until they are \_\_\_\_\_\_\_\_\_\_\_\_\_ distributed
* At this point, they have reached \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* They still continue to randomly move, which is \_\_\_\_\_\_\_\_\_\_\_\_, but there will be no net change in concentration, representing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Sometimes particles in a solution, called \_\_\_\_\_\_\_\_\_\_\_\_, diffuse across a semi-permeable membrane

-This process is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

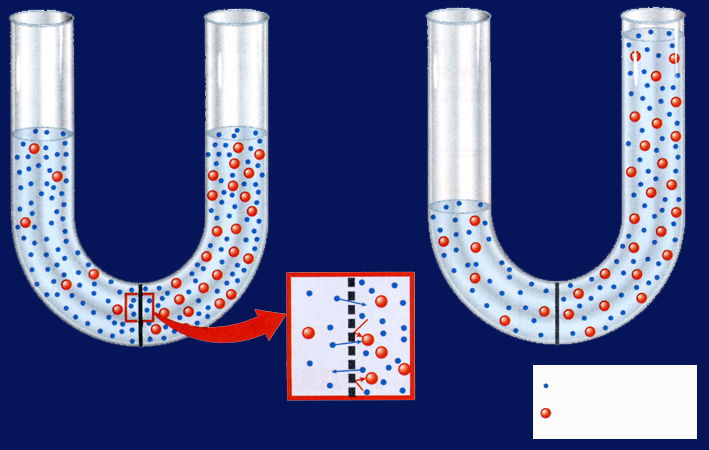
-Kidneys usually carryout dialysis, by filtering \_\_\_\_\_\_\_\_\_\_\_ out of our blood

-If kidney failure occurs, a patient will receive dialysis treatment with a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Only certain substances can diffuse through the cell membrane due to its lipid bilayer structure
* Review…
  + The phosphate heads are \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + The fatty acid tails are \_\_\_\_\_\_\_\_\_\_\_\_\_
* Since “like dissolves like,” the polar heads will repel \_\_\_\_\_\_\_\_\_\_\_\_\_\_ substances and the nonpolar tails will repel \_\_\_\_\_\_\_\_\_\_\_\_\_ substances
* Only \_\_\_\_\_\_\_substances will diffuse through the cell membrane

**Osmosis**

* Another type of passive transport is \_\_\_\_\_\_\_\_\_\_
* It is specifically the diffusion of \_\_\_\_\_\_\_\_\_\_\_ across the cell membrane
* Even though water is \_\_\_\_\_\_\_\_\_\_, it is \_\_\_\_\_\_\_\_\_\_\_ enough to pass through the nonpolar tails



Before Osmosis

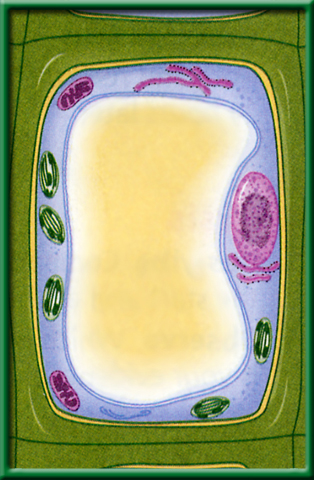
* On which side of the membrane are there more sugar molecules?

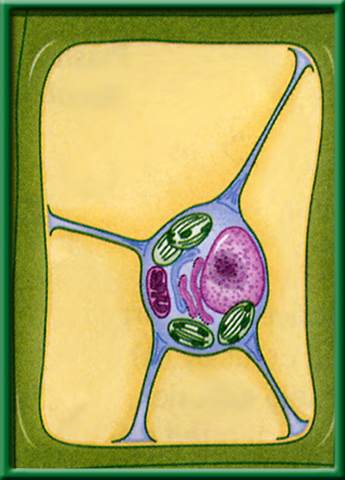
*\_\_\_\_\_\_\_\_\_\_\_*

* *Sugar molecules are too \_\_\_\_\_\_\_ to pass the membrane*

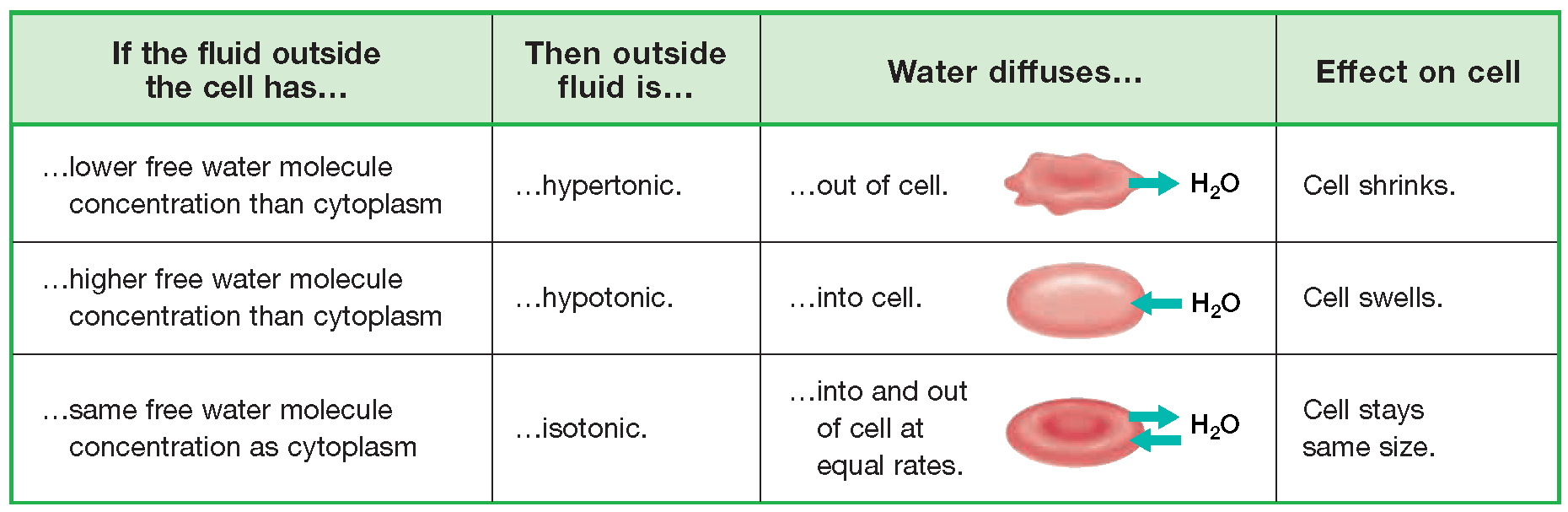
After Osmosis

* Water has moved to the \_\_\_\_\_\_\_\_\_ so that there is an equal concentration on both sides
* There are three types of solutions that will affect how water diffuses into or out of the cell
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solution
    - Hypo- means \_\_\_\_\_\_\_\_\_solute, so a hypotonic solution contains a lower concentration of particles than are found inside the cell, more water
    - These particles cannot move across the membrane
    - Only water can move
    - So where is there a higher concentration of water, outside or inside the cell?
    - Where does this water want to diffuse?
    - This will cause the cell to \_\_\_\_\_\_\_\_\_\_\_
    - In plant cells, this increases \_\_\_\_\_\_\_\_\_ pressure
    - When plant cells are full with water, they stand \_\_\_\_\_\_\_\_\_\_
    - But if there is too much pressure, plant cells can become \_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Animal cells lack a strong cell wall
    - What do you think will happen to them if they swell too much?
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solution
    - Hyper- means \_\_\_\_\_\_\_\_\_, so a hypertonic solution contains a higher concentration of particles than are found inside the cell
    - So where is there a higher concentration of water?
    - Where does the water want to diffuse?
    - This will cause the cell to \_\_\_\_\_\_\_\_\_\_\_
    - Because of this, plant cells decrease in turgor pressure and \_\_\_\_\_\_\_\_\_
    - When the cell membrane pulls away from the cell wall of a plant cell it is said to be \_\_\_\_\_\_\_\_\_\_
    - This process is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



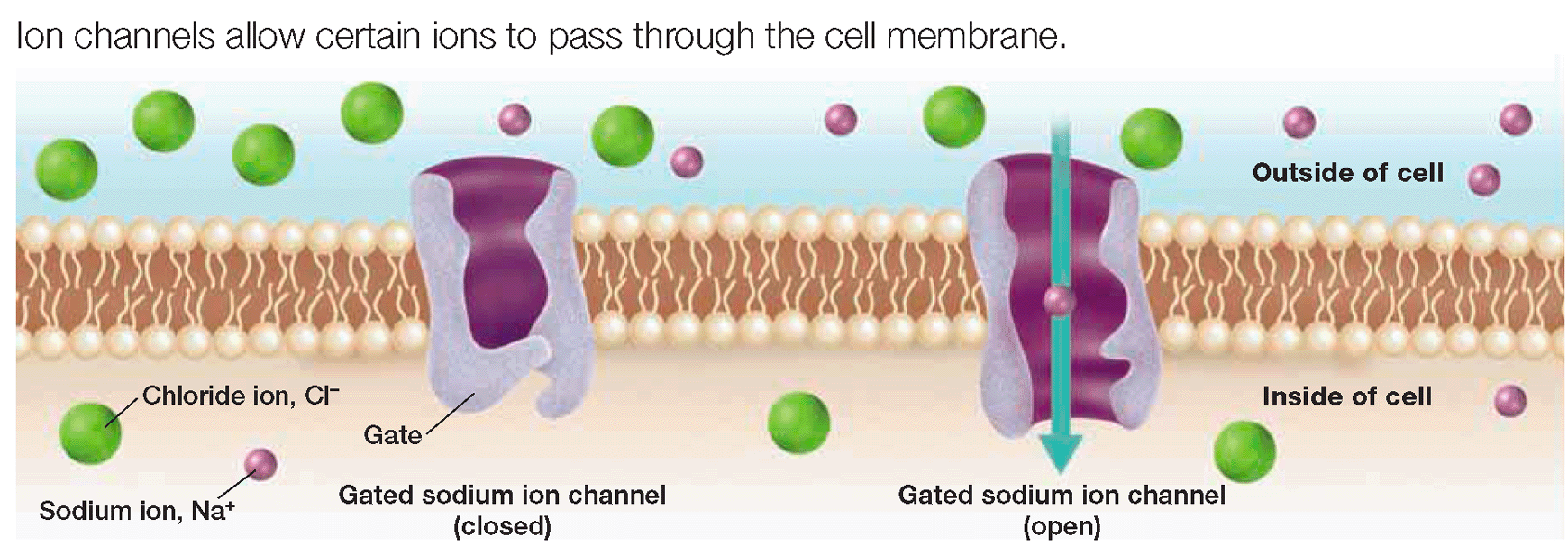


* + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solution
    - Iso- means \_\_\_\_\_\_\_\_\_, so an isotonic solution contains the same concentration of particles that are found inside the cell
    - So water will diffuse\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into and out of the cell because it is in dynamic equilibrium



**Diffusion Through Ion Channels**

* Ions have \_\_\_\_\_\_\_\_\_\_\_\_, so they are attracted by \_\_\_\_\_\_\_\_\_\_\_\_ molecules but repelled by \_\_\_\_\_\_\_\_\_\_\_ molecules
  + Therefore they can’t pass through the \_\_\_\_\_\_\_\_\_\_
* An **ion channel** is a transport protein with a \_\_\_\_\_\_\_\_ pore or opening through which ions can pass.

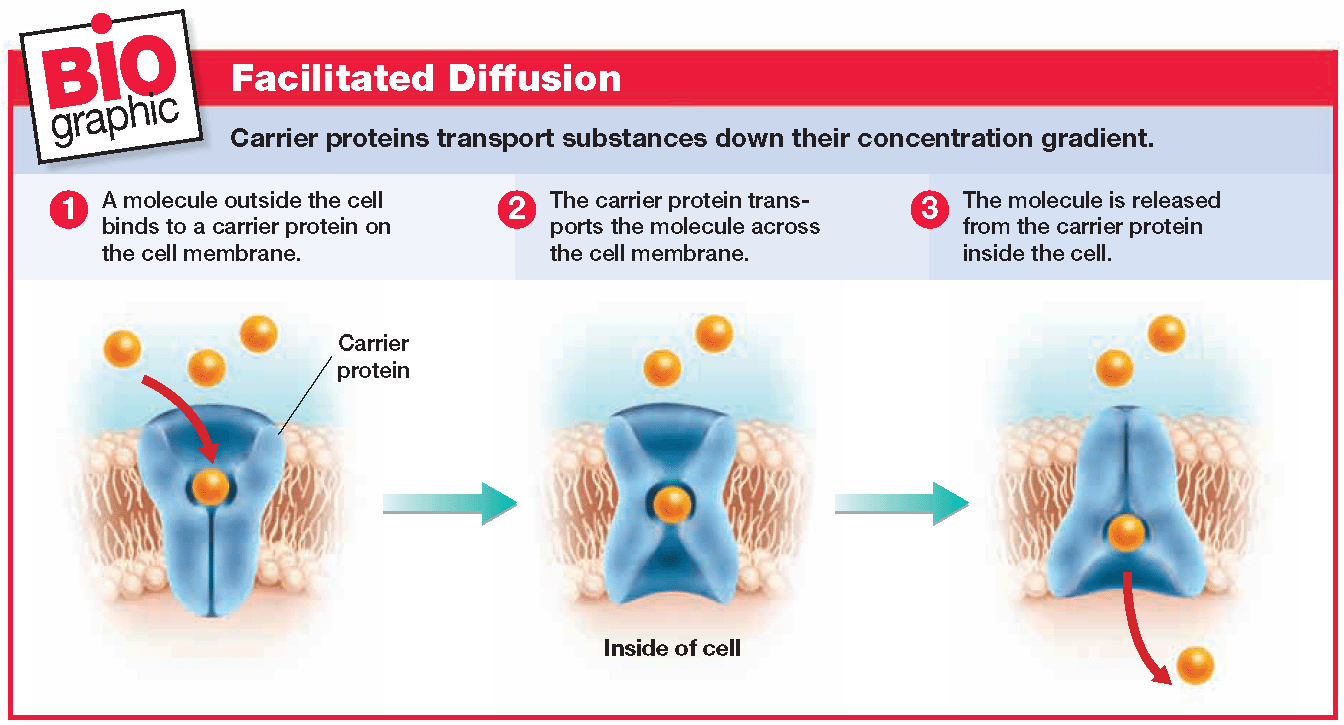


**Electrical Charge & Ion Transport**

* The movement of a charged particle across the cell membrane is also influenced by the particle’s \_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_ electrical charge.
* The inside of the cell is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_...
  + So a positive particle will diffuse \_\_\_\_\_\_\_\_\_\_\_ the cell
  + And a negative particle will diffuse \_\_\_\_\_\_\_\_\_\_\_ of the cell

**Facilitated Diffusion**

* Some substances need help or \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to move across the membrane
  + They still move “down” the concentration gradient so this process does not need \_\_\_\_\_\_\_\_\_\_\_\_
* Facilitated diffusion uses transport proteins called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **proteins,** that…
  + \_\_\_\_\_\_\_\_\_\_\_ to a specific substance
  + \_\_\_\_\_\_\_\_\_\_\_\_ it across
  + and \_\_\_\_\_\_\_\_\_\_\_\_\_ it on the other side.
* Used to move larger substances like\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_ across the membrane



1. What does it mean when particles move “down” a concentration gradient?
2. Which type of solution makes cells shrink?
3. Is the pore of an ion channel polar or nonpolar?
4. What is the charge inside a cell?
5. What kind of transport proteins are involved in facilitated diffusion?

**CH3.5 Active Transport, Endocytosis, & Exocytosis**

|  |  |
| --- | --- |
| Objectives | Vocabulary |
| * **Compare** active transport with passive transport. * **Describe** the importance of the sodium-potassium pump. * **Distinguish** between endocytosis and exocytosis. * **Identify** three ways that receptor proteins can change the activity of a cell. | Active transport  Endocytosis  Exocytosis  Phagocytosis  Pinocytosis |

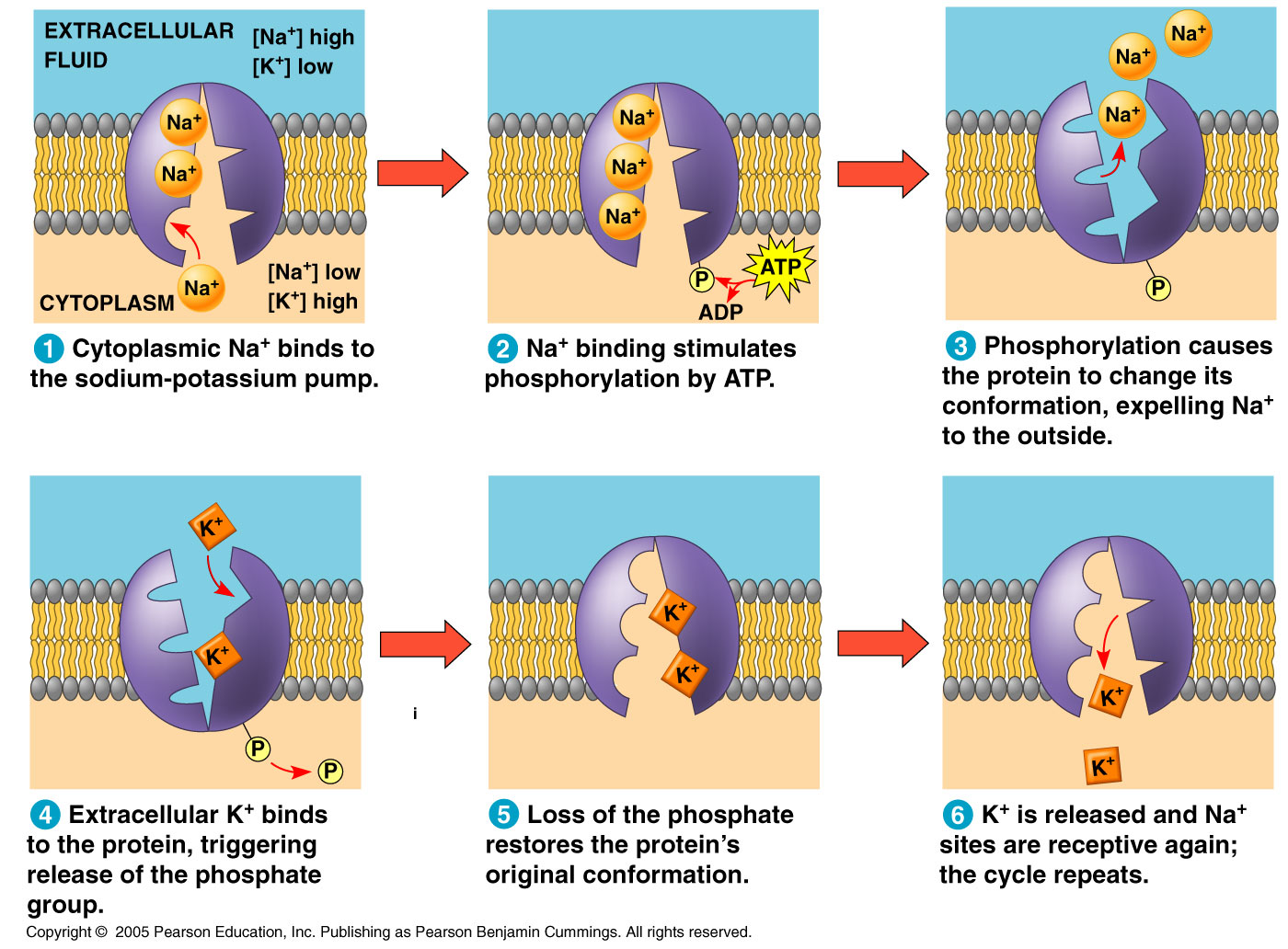
* Many important cellular substances have a lower concentration outside the cell than inside the cell
* If a cell could only move substances with passive transport, where would these substances

**Movement Against a Concentration Gradient**

* To move certain substances into the cell, they must have a way to move substances \_\_\_\_\_\_\_\_\_ the concentration gradient…
  + That is from a \_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_ concentration
  + This type of transport requires \_\_\_\_\_\_\_\_\_\_\_\_ so it is called \_\_\_\_\_\_\_\_\_\_\_\_\_ transport
  + It is similar to how you need energy to swim \_\_\_\_\_\_\_\_\_\_\_ the flow of a river
* Most often, the energy needed for active transport is supplied directly or indirectly by \_\_\_\_\_\_\_\_\_.
* Some active transport processes use \_\_\_\_\_\_\_\_\_\_ proteins, like those used in facilitated diffusion

So let’s review…

* A carrier protein…
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to a substance
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ it across the membrane
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ it on the other side
* However, in active transport, carrier proteins move substances from a \_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_ concentration, acting like a membrane \_\_\_\_\_\_\_\_\_\_
* One of the most important membrane pumps in animal cells is a carrier protein called the \_\_\_\_\_\_\_\_\_\_\_ - \_\_\_\_\_\_\_\_\_\_ **pump.**
* In a complete cycle, the sodium-potassium pump transports \_\_\_\_\_\_\_\_\_\_ sodium ions, Na+, \_\_\_\_\_\_ of a cell and two potassium ions, K+, \_\_\_\_\_ the cell.

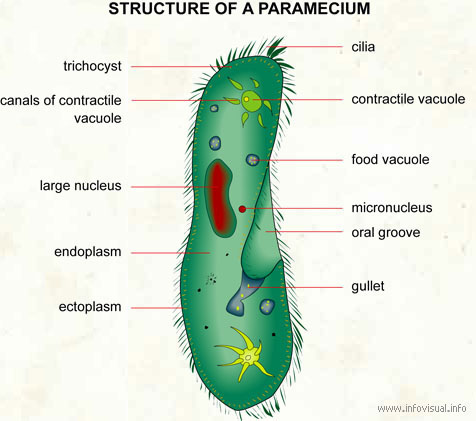


Step 1: \_\_\_\_\_\_\_\_\_ sodium ions and a \_\_\_\_\_\_\_\_\_\_ group from ATP bind to the pump

Step 2: The pump changes \_\_\_\_\_\_\_\_ and transports sodium ions \_\_\_\_\_\_\_\_ of the cell

Step 3: Two \_\_\_\_\_\_\_\_\_\_\_\_\_\_ ions bind to the pump and are transported \_\_\_\_\_\_\_\_\_ the cell

Step 4: The phosphate group is \_\_\_\_\_\_\_\_\_\_\_\_ back inside the cell



* Some simpler organisms have a different “pump” called a

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ vacuole

* It expands and contracts to

\_\_\_\_\_\_\_\_\_ water out of the cell

* This is important because it lives in a watery environment, which

would be a \_\_\_\_\_\_\_\_\_\_\_\_\_ solution

**Movement In Vessicles**

* Many substances, such as \_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, are too \_\_\_\_\_\_\_\_\_\_ to be transported by carrier proteins.
* These substances are moved across the cell membrane by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* The movement of a substance into a cell by a vesicle is called **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **Think “en” is like “in”**
* The movement of a substance by a vesicle to the outside of a cell is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.**
  + **Think “ex” is like exit**

**Endocytosis**

* The cell membrane forms a \_\_\_\_\_\_\_\_\_ around a substance, then \_\_\_\_\_\_\_\_ off to form a vesicle that transports materials, like \_\_\_\_\_\_\_\_, into the cell

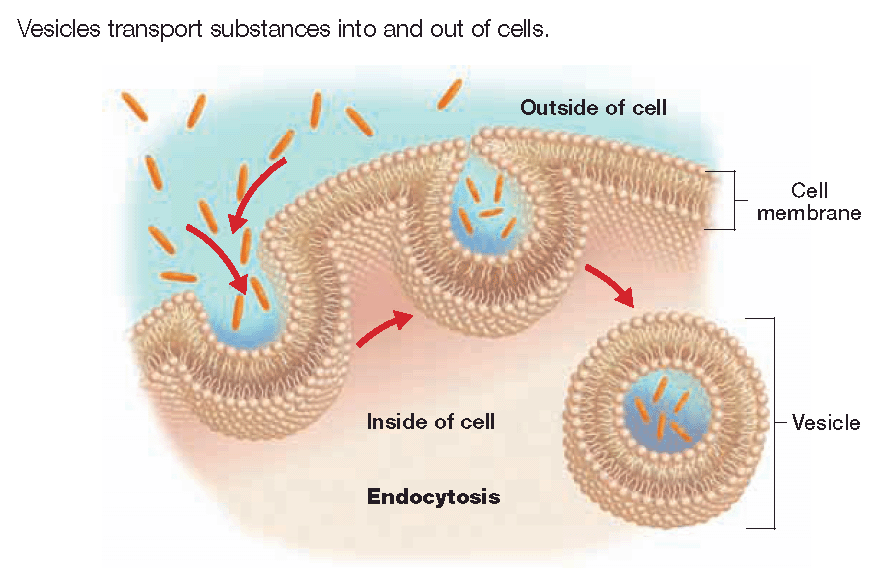
There are two types of endocytosis

* + Phagocytosis = engulfing

\_\_\_\_\_\_\_\_\_\_ particles like food

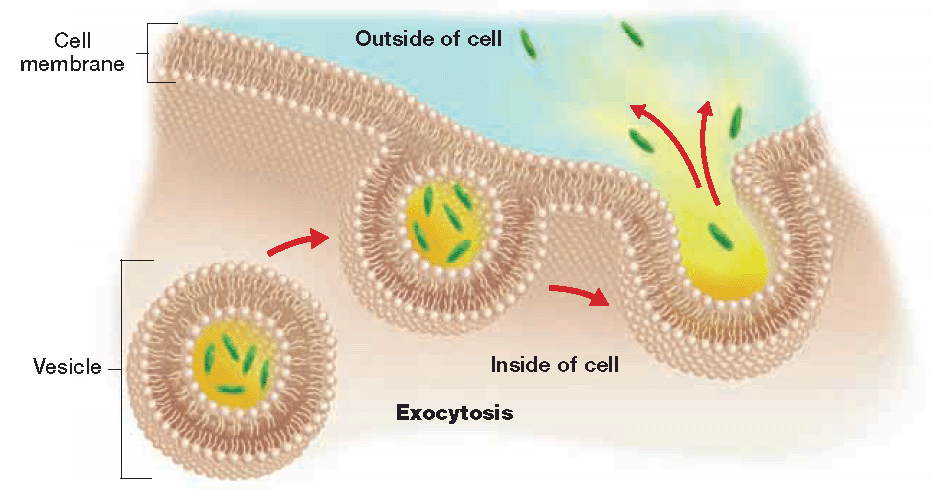
* + Pinocytosis = engulfing

\_\_\_\_\_\_\_\_\_\_\_\_ particles



* The vesicle \_\_\_\_\_\_\_\_\_ to the cell membrane, which \_\_\_\_\_\_\_\_\_\_ up to release items like \_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_ made by the cell

**Exocytosis**

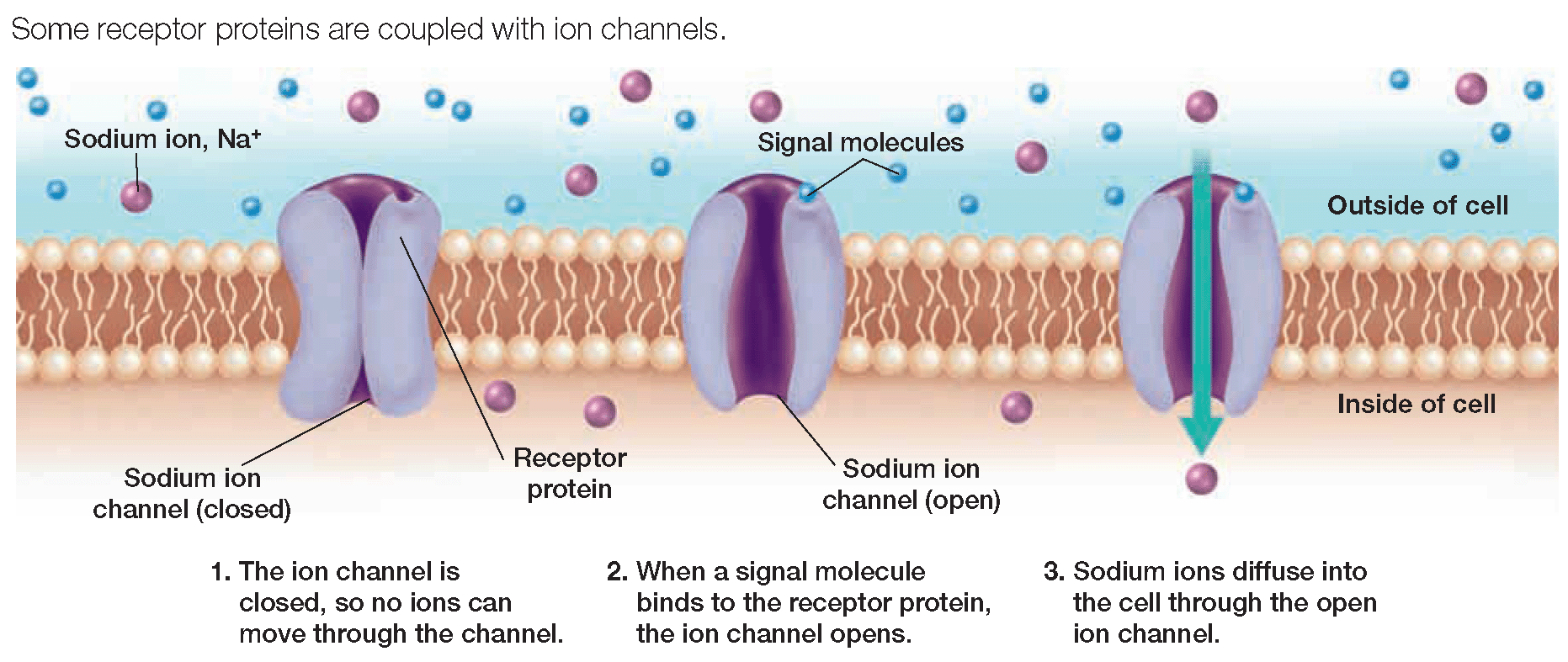


**Membrane Receptor Proteins**

* Cells must \_\_\_\_\_\_\_\_\_\_\_\_\_\_ with each other to coordinate your growth, metabolism, and other activities
* To do so, some cells release \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ that carry information or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to nearby cells
* Cells can receive the messages because the cell membrane contains specialized proteins, called \_\_\_\_\_\_\_\_\_\_\_\_\_\_ proteins, that bind to these signal molecules.
* **When signal molecules bind to receptor proteins, they may cause three different changes in the cell…**
  + Changes in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Triggering the formation of a \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Activating \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

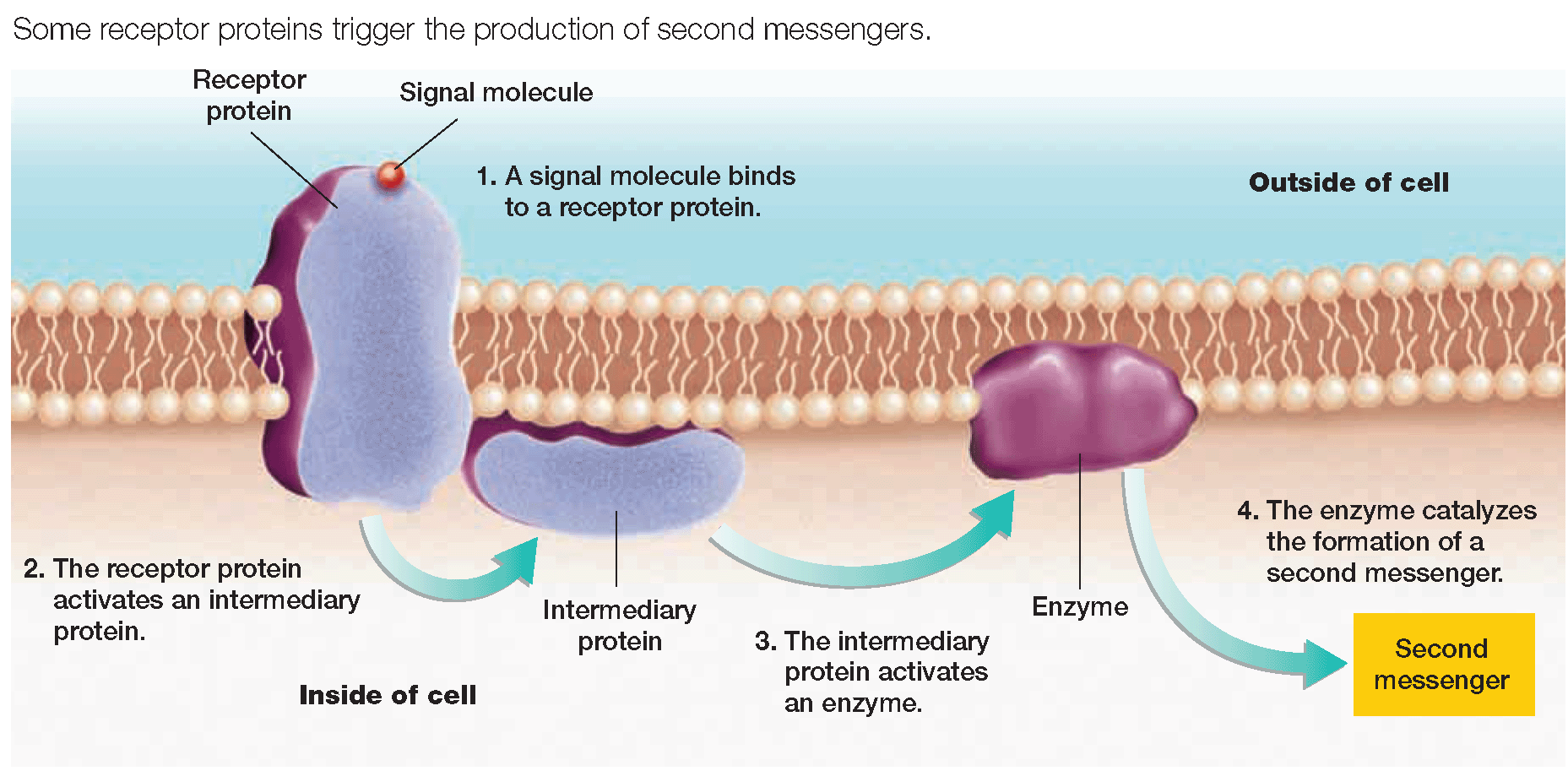
**Changes in Permeability**

* The binding of a signal molecule to the receptor protein causes an ion channel to \_\_\_\_\_\_\_\_\_\_, allowing specific ions to cross the cell membrane.



**Second Messengers**

* The original \_\_\_\_\_\_\_\_\_\_\_\_\_ molecule triggers the production of a second messenger, which may trigger a series of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reactions in the cell



**Enzyme Action**

When a signal molecule binds to the receptor protein, the receptor protein may act as an

\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,

speeding up chemical reactions inside the cell.

* Many \_\_\_\_\_\_\_\_\_\_ affect the binding of signal molecules to receptor proteins, affecting the function of the cell
  + Examples…
    - The illegal drug heroin \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a signal molecule and binds to receptor proteins
    - Prescribed drugs called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ prevent or block signal molecules from binding to receptor proteins in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells, which \_\_\_\_\_\_\_\_\_ down the heart rate of patients with rapid heart beats

1. Which molecule provides energy for active transport to occur?
   1. Chlorophyll
   2. ATP
   3. Carbon dioxide
   4. Signal molecule
2. In the sodium potassium pump, which substances get released inside of the cell?
   1. Sodium ions
   2. Potassium ions
   3. Phosphate groups
   4. Both B and C
3. Which substance would a cell take in through endocytosis?
   1. Sodium ions
   2. polysaccharides
   3. Amino acids
   4. monosaccharides
4. What type of membrane protein interacts with signal molecules?
   1. Cell surface marker
   2. Receptor protein
   3. Transport protein
   4. enzymes
5. Which type of transport may occur in dead cells…passive or active?