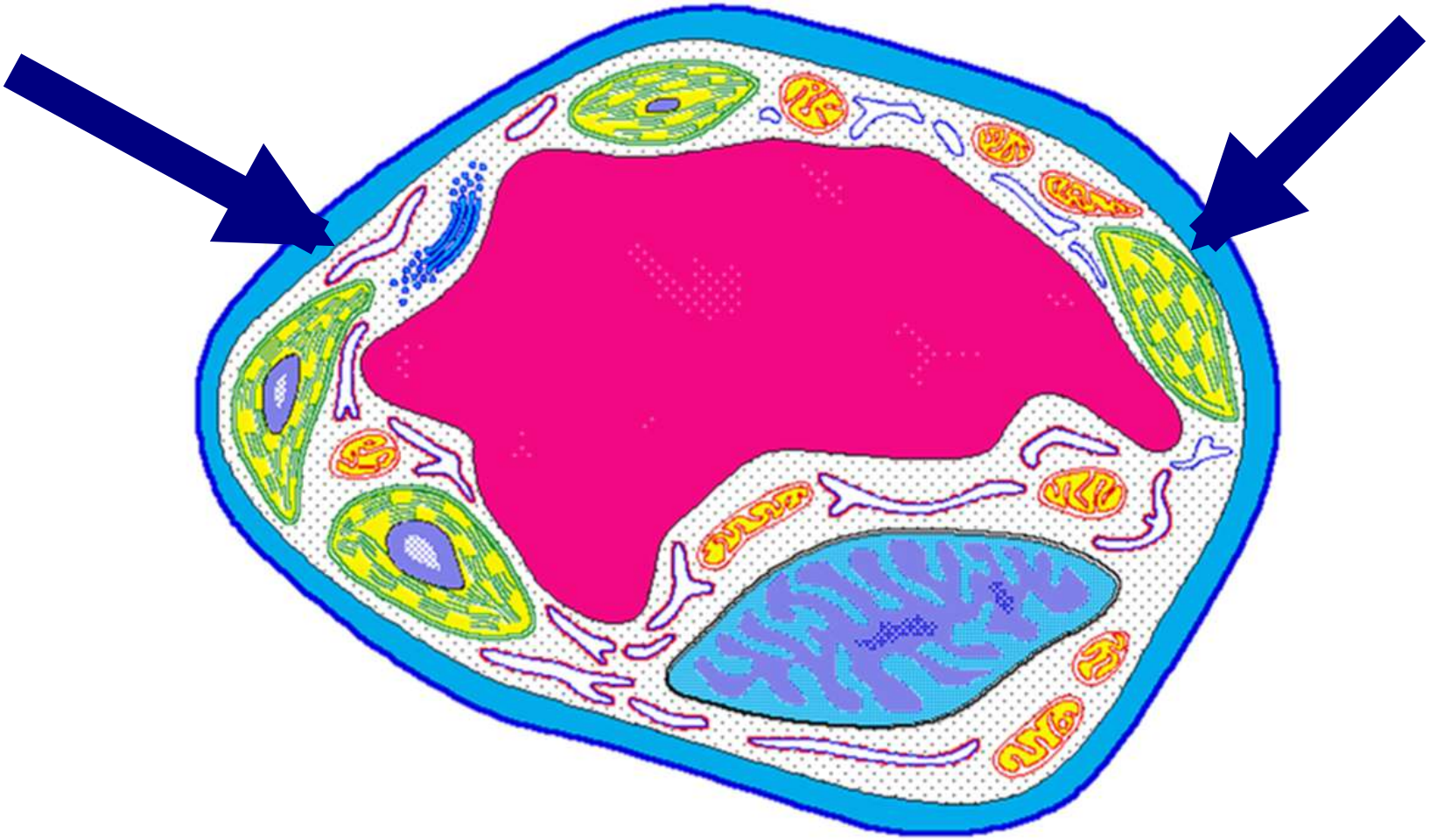
The Processes of the Cell

Essential Question:
What processes are necessary for the survival of a cell, tissue, organ, and organ system?

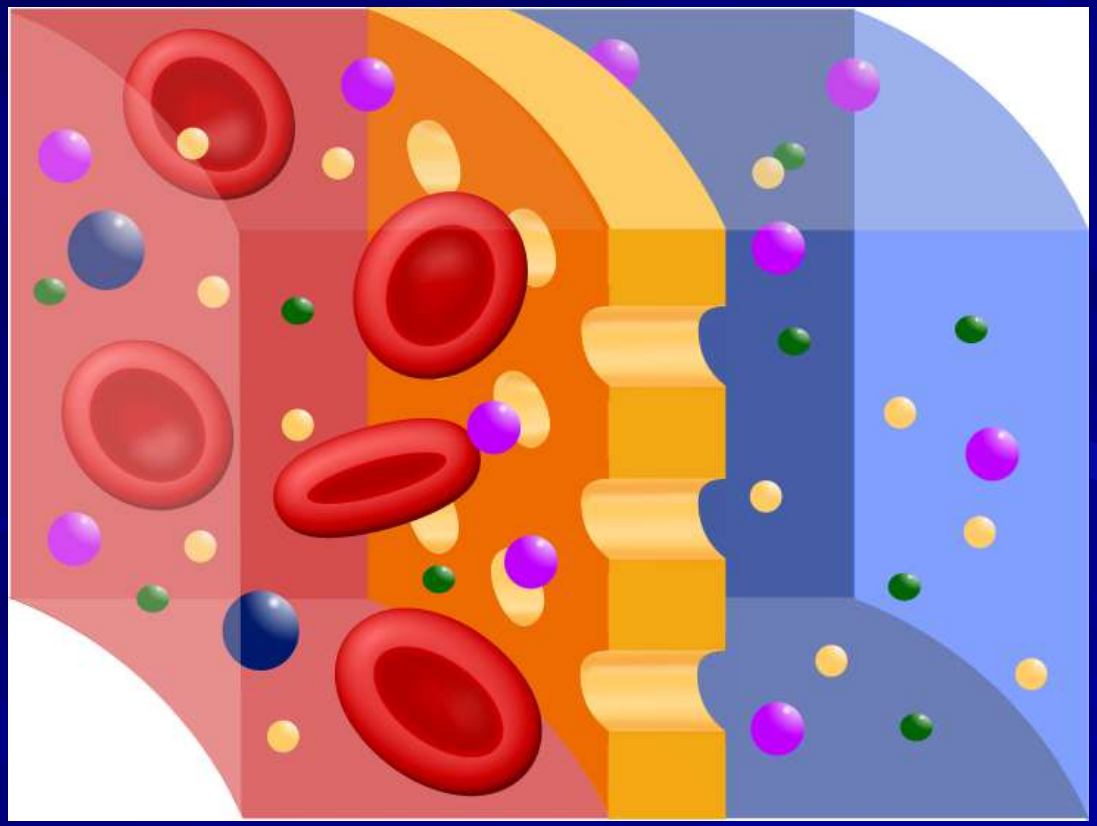
Standard:

S7L2a. Explain that cells take in nutrients in order to grow and divide and to make needed materials.

In our previous unit, we learned that the job of the cell membrane is to allow materials in and out of the cell.



The cell membrane is semi-permeable. This means that it can let some materials pass through while others can not.



Animation of Semi-Permeable

https://www.youtube.com/watch?v=yU4otyMhjHU

Materials must move in and out of a cell in order for it to survive.

Let’s discuss the different ways in which this occurs.

Some materials can move in and out of the cell membrane easily.

Other materials require help or are forced to move in and out of the cell.

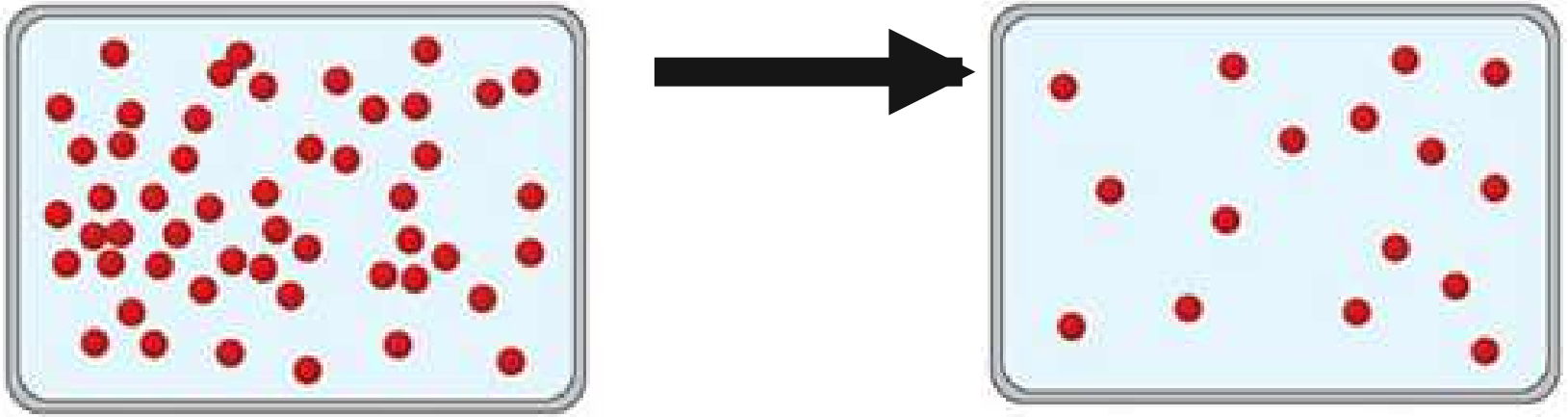
Natural Movement of Particles Demonstration

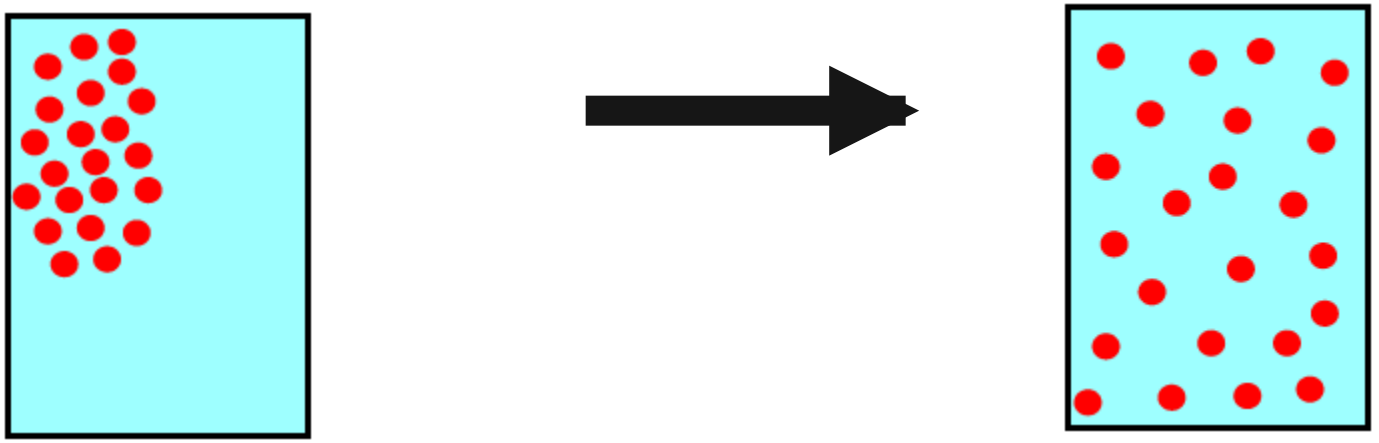
Particles naturally want to move from where they are more crowded to where they are less crowded.

Natural Movement of Particles

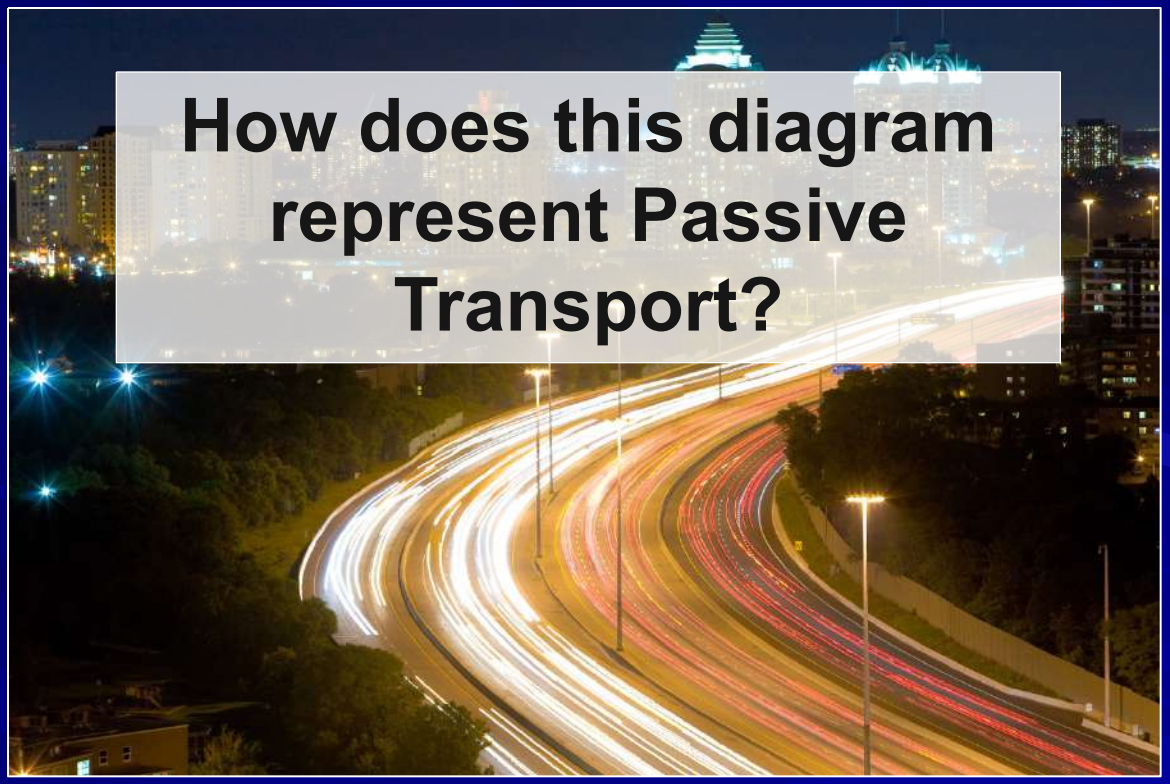
More Crowded
(High Concentration)

Less Crowded
(Low Concentration)





The transport (movement) of substances across cell membranes without the use of energy is called Passive Transport.



Passive Transport

In Passive Transport, substances or particles move from high concentration to low concentration.

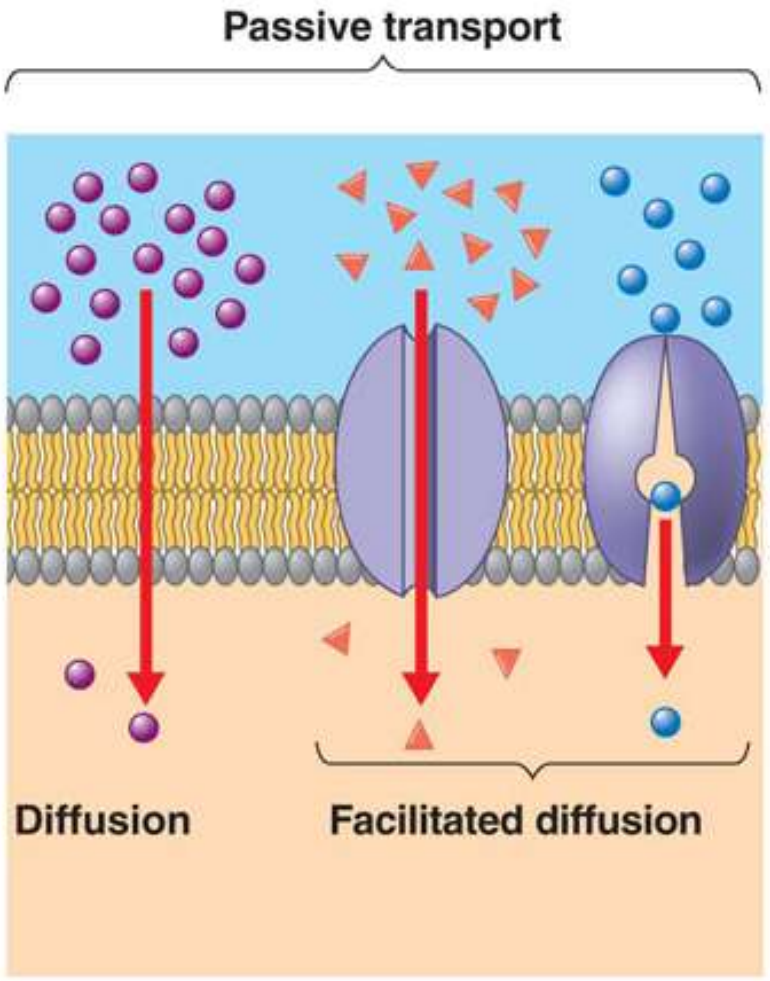
Why do you think energy is not required for passive transport?

Turn to an elbow partner and describe an experience that you could compare to Passive Transport

[ex. Easily moving from a crowded area to a less crowded area]

Passive Transport

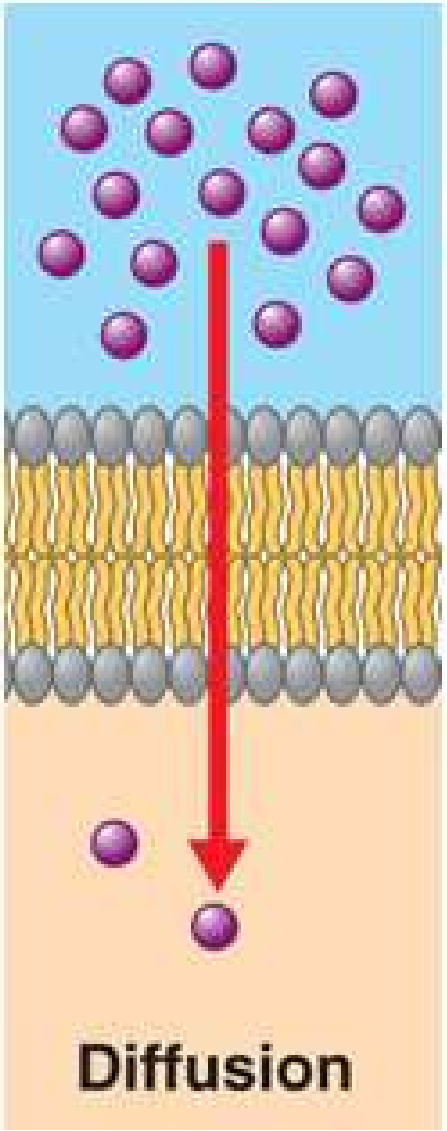
There are different types of Passive Transport.



Diffusion

Small particles such as oxygen and carbon dioxide move easily across the cell membrane from areas of high concentration to low concentration.

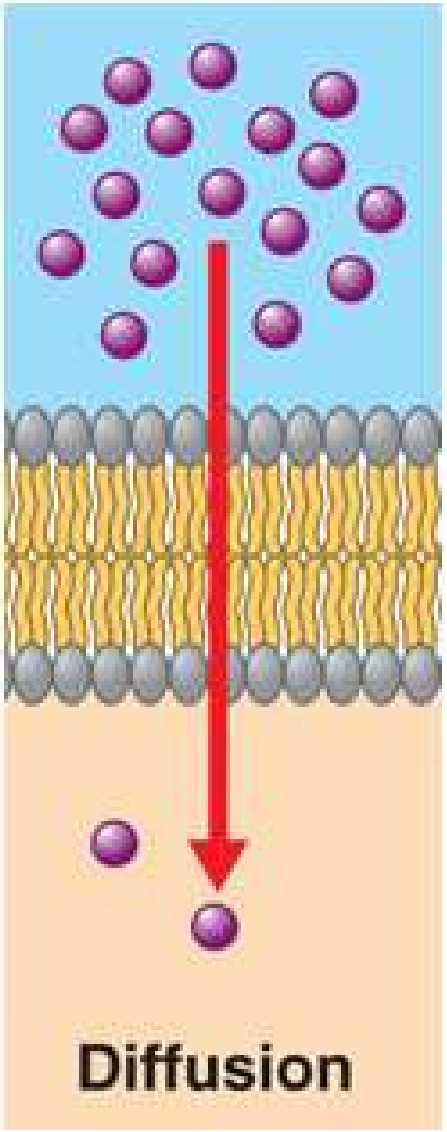
Diffusion is a type of passive transport. Why?



Diffusion

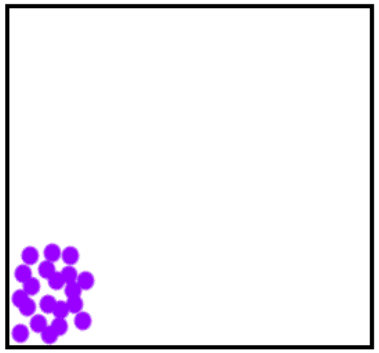
How is diffusion important for Photosynthesis and Cellular Respiration?

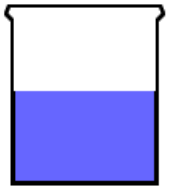
Oxygen and Carbon Dioxide easily diffuse through the cell membrane. Both are necessary for energy production.

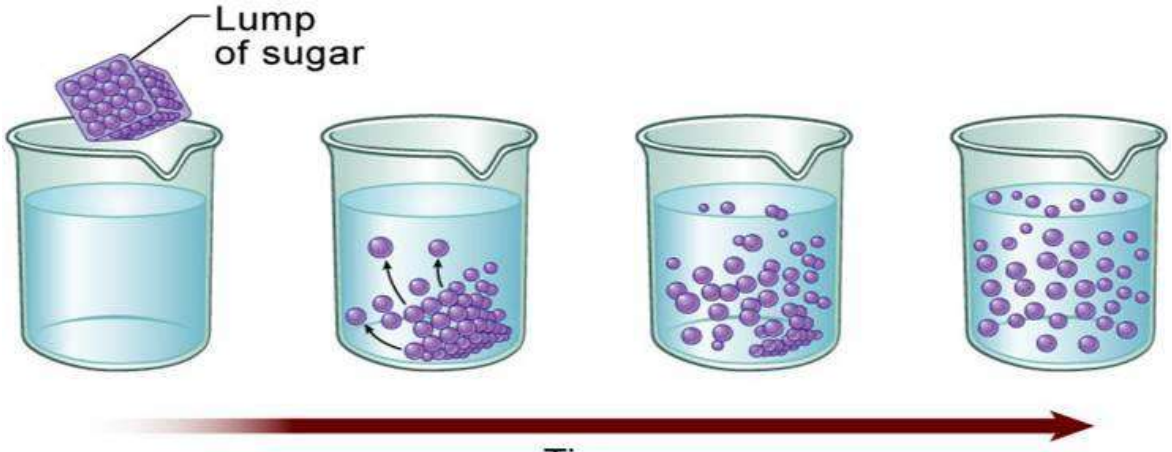


Everyday Examples of Diffusion

Smell of food, perfume, air freshener, and other substances.

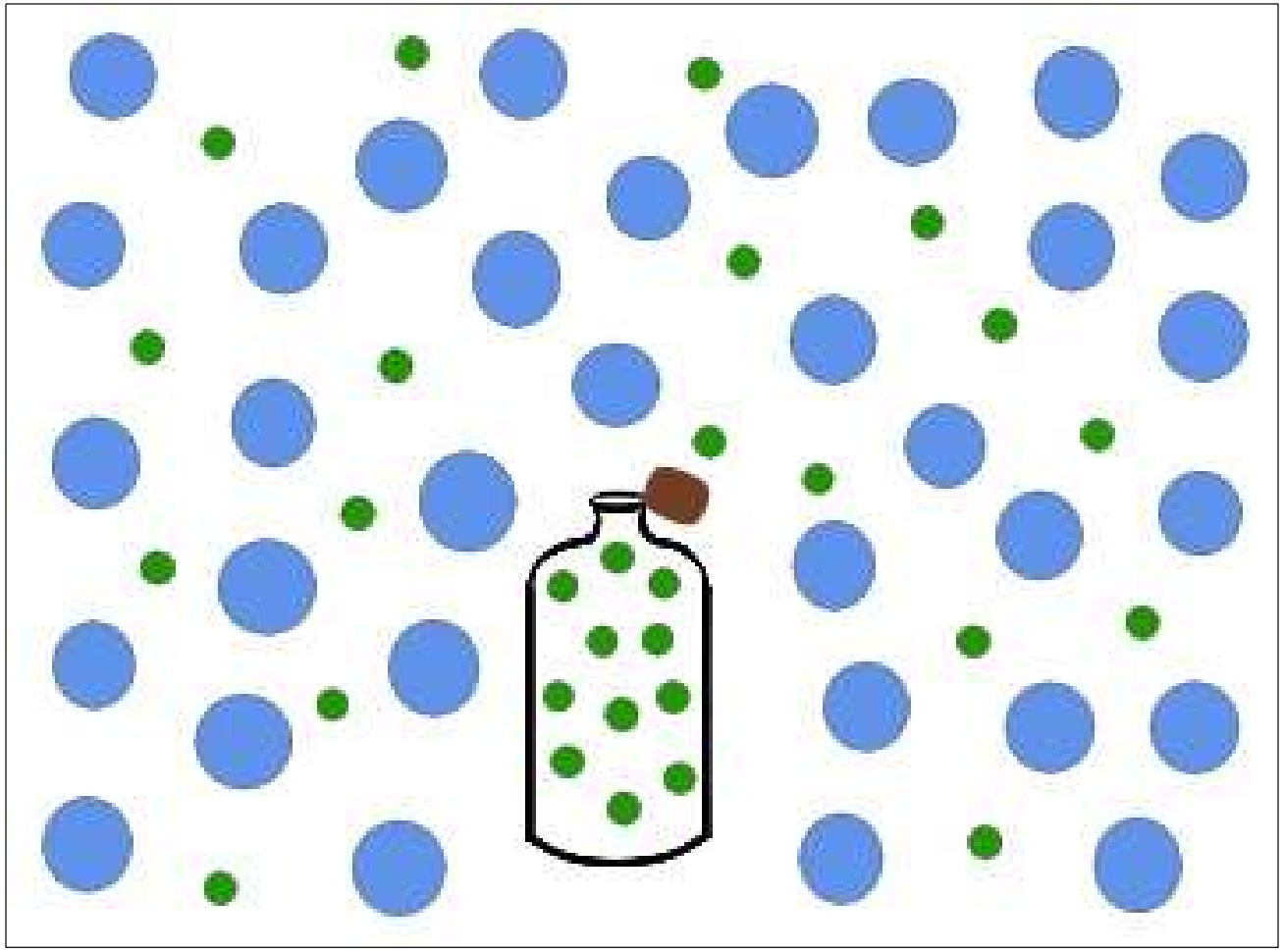






From Patton KT, Thibodeau GA: *Anatomy and physiology*, ed 7, St Louis, 2010, Mosby.

Everyday Examples of Diffusion



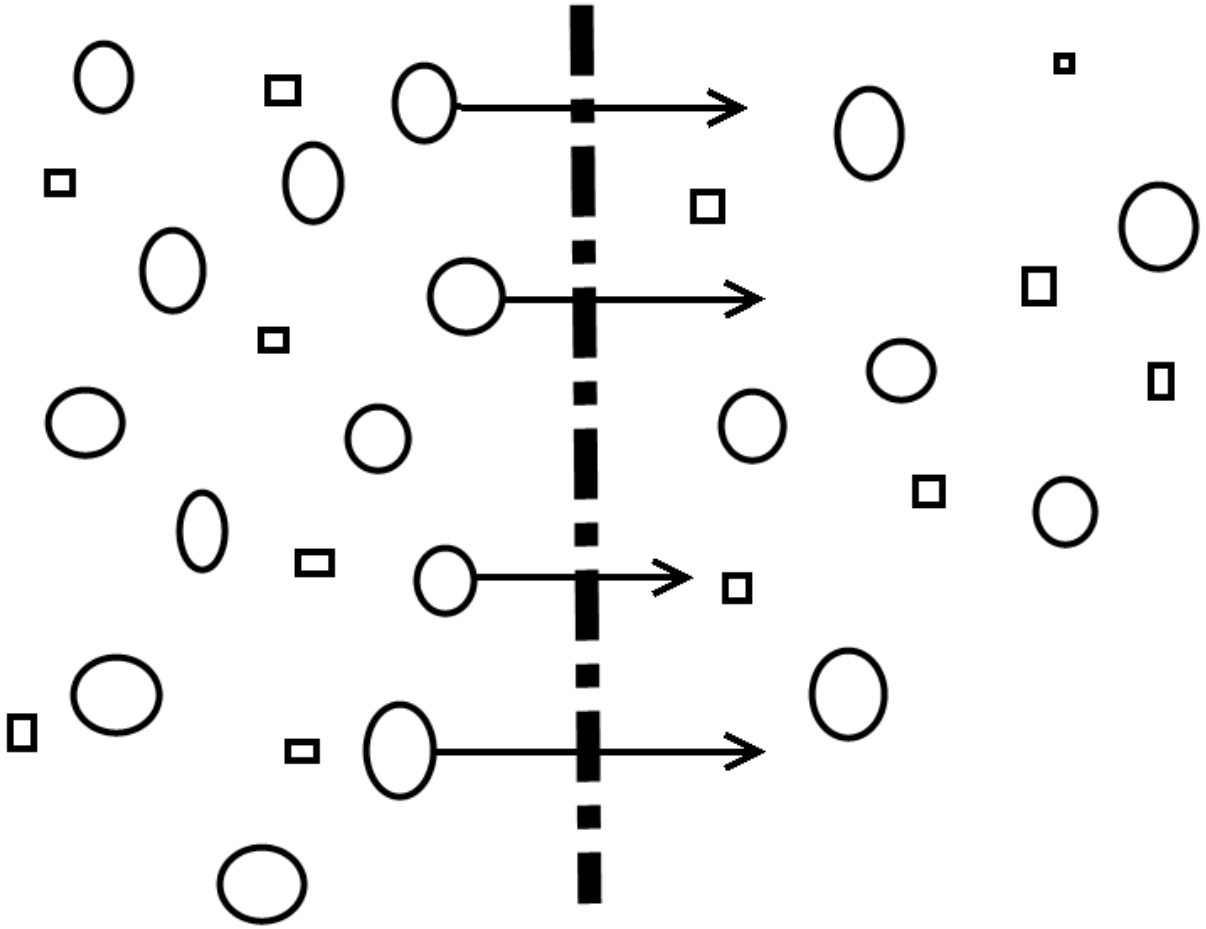
Diffusion Animations

http://www.sumanasinc.com/webcontent/animations/content/diffusion.html [Requires Adobe Plugin]

http://esminfo.prenhall.com/science/BiologyArchive/lectureanimations/closerlook/diffusion.html

http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_diffusion_works.html

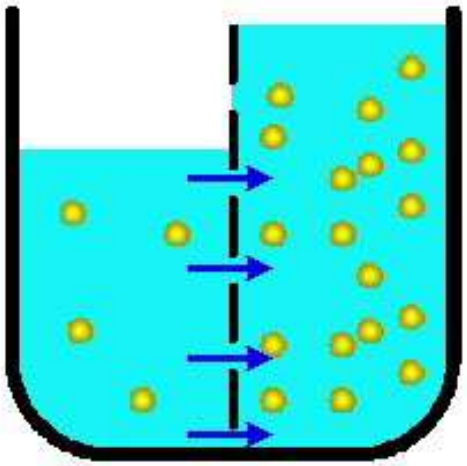
If the diagram below represents a cell membrane and particles, why are there arrows showing the movement of some of the oval objects?



Distributed Summarizing

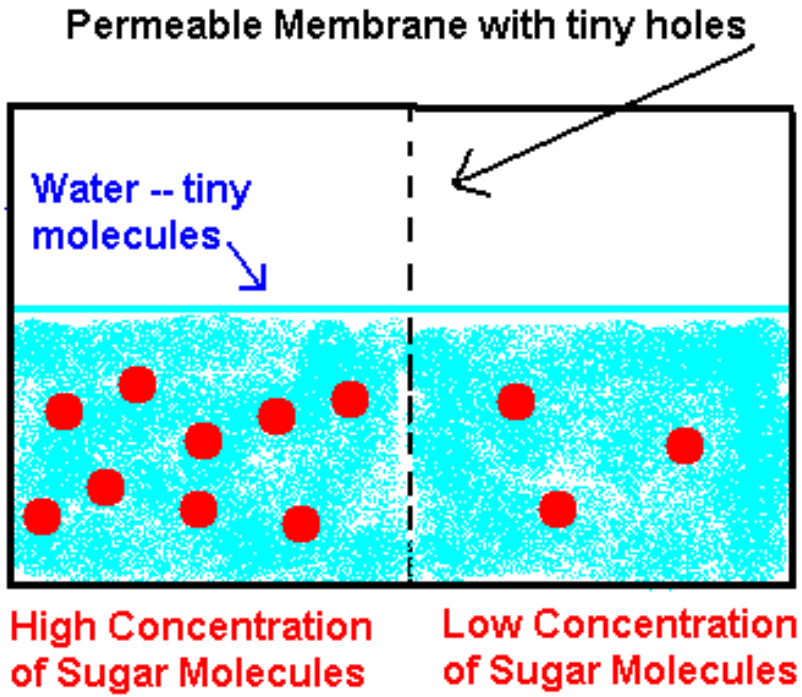
Draw a diagram illustrating particles diffusing across a cell membrane.

Osmosis is the diffusion of water. Water moving from where it is crowded (high concentration) to where it is less crowded (low concentration).

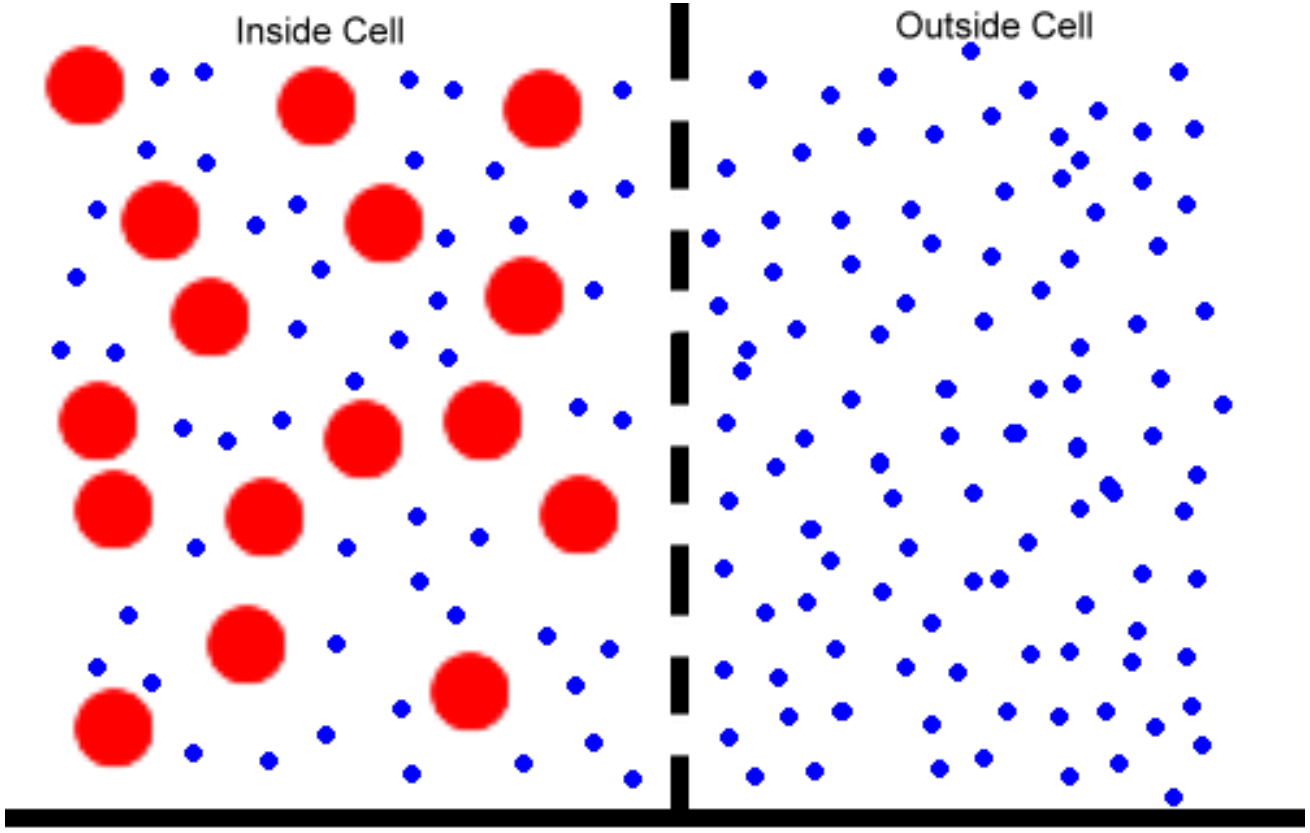


Osmosis

(Water moves by concentration gradient)

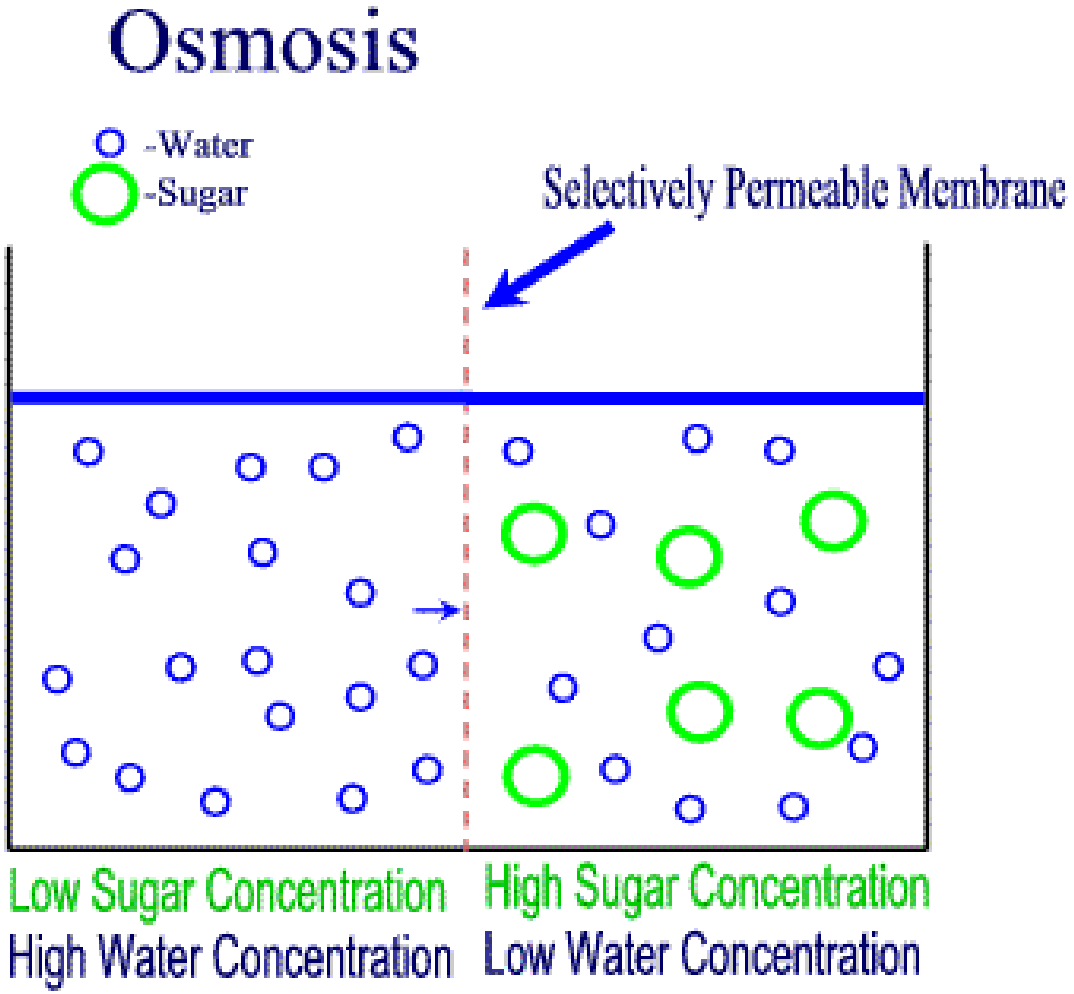


Osmosis
[Diffusion of Water] Illustration



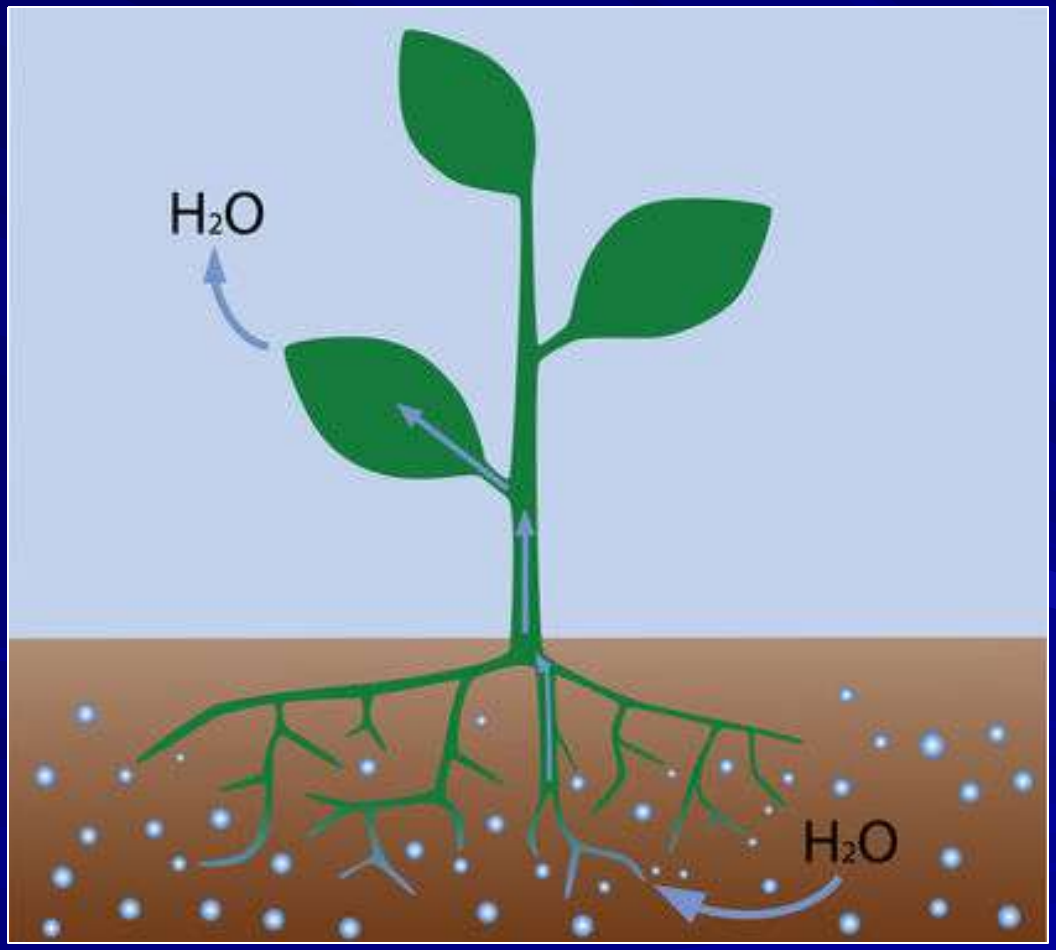
In this example the inside of the cell is loaded with solute particles (the solute particles are shown in red). There are also water molecules inside the cell (shown in blue). Outside the cell are just water molecules.

Osmosis
[Diffusion of Water] Illustration



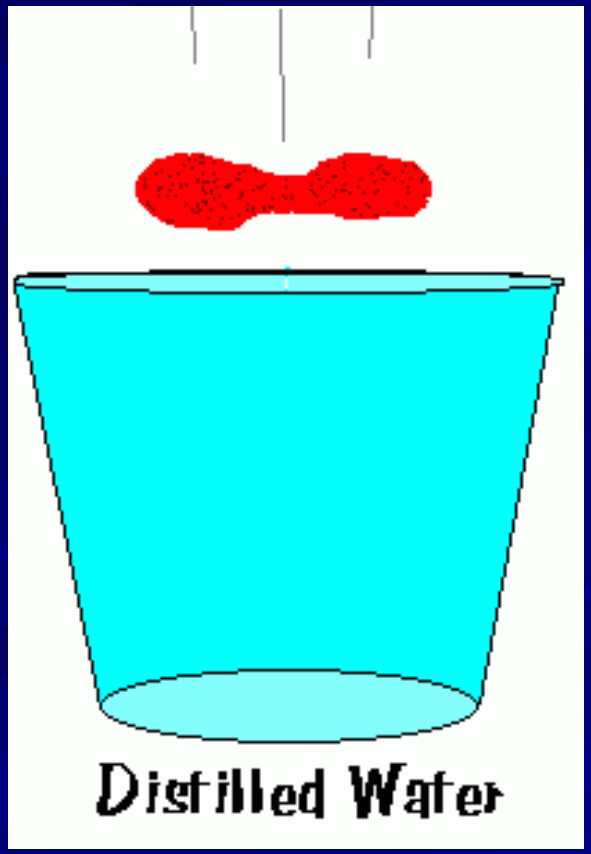
Example of Osmosis

Watering a plant



Pure water diffuses more than any other water mixture because it is more crowded (has a higher concentration) than any other water mixture.

In this picture a red blood cell is put in a glass of distilled water (pure water with no salt or sugar in it).



Because there is a higher concentration of water outside the cell, water enters the cell by OSMOSIS.
The cell bursts and dies.

Video Clip and Animations on Diffusion/Osmosis

http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa_pre_2011/cells/osmosisact.shtml

http://www.stolaf.edu/people/giannini/flashanimat/transport/osmosis.swf

http://www.abpischools.org.uk/page/modules/homeostasis_kidneys/kidneys3.cfm?coSiteNavigation_allTopic=1

Distributed Summarizing:

Identify and Share some other examples of Diffusion/Osmosis.

Activities on Diffusion/Osmosis [see resources]

Egg-cellent Ideas for Osmosis and Diffusion

Diffusion Lab

Egg Osmosis | Egg Osmosis Demo

Gummy Bear Diffusion/Osmosis

Osmosis Vegetable Lab

The Perfect Taters Mystery

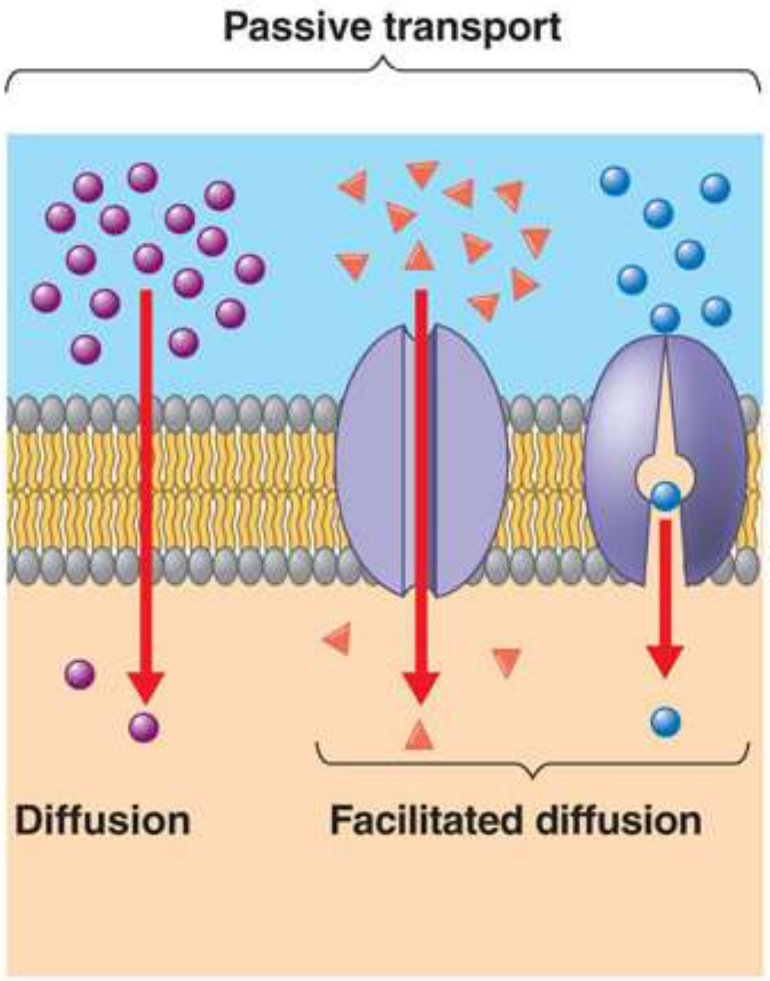
Some materials can move in and out of the cell membrane easily.

Other materials require help or are forced to move in and out of the cell.

Passive Transport

Some particles are not able to diffuse through the tiny openings in the cell membrane.

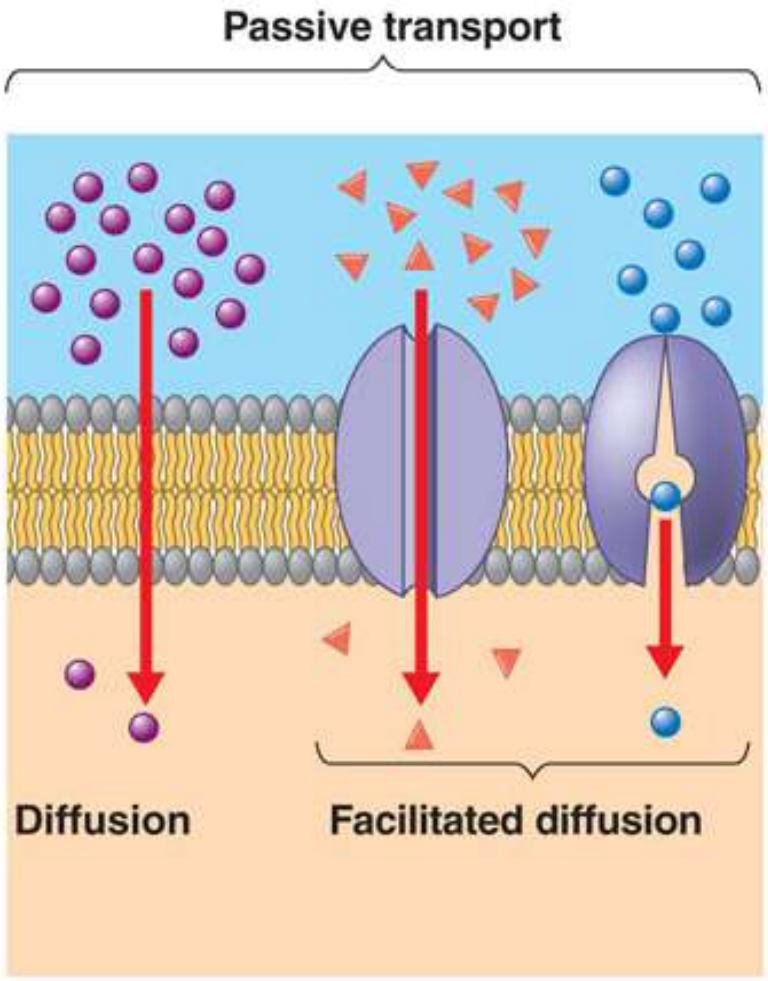
These particles need assistance.



Passive Transport

Some particles have to go through protein channels or doorways [shown as facilitated diffusion in the diagram to the right].

However, energy is not required and the particles still move from high concentration to low concentration.



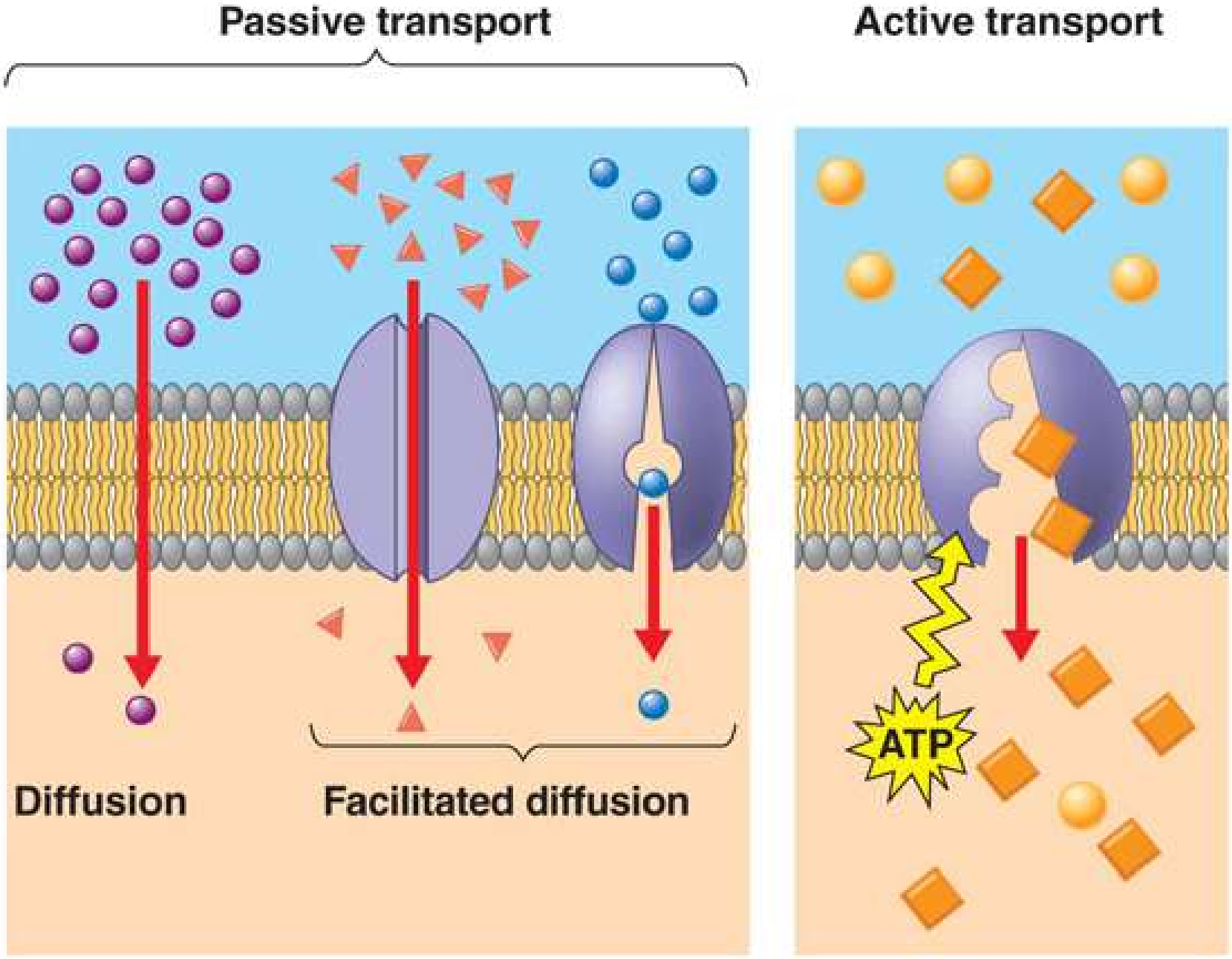
There are some particles that naturally want to diffuse, but cannot be allowed to diffuse.

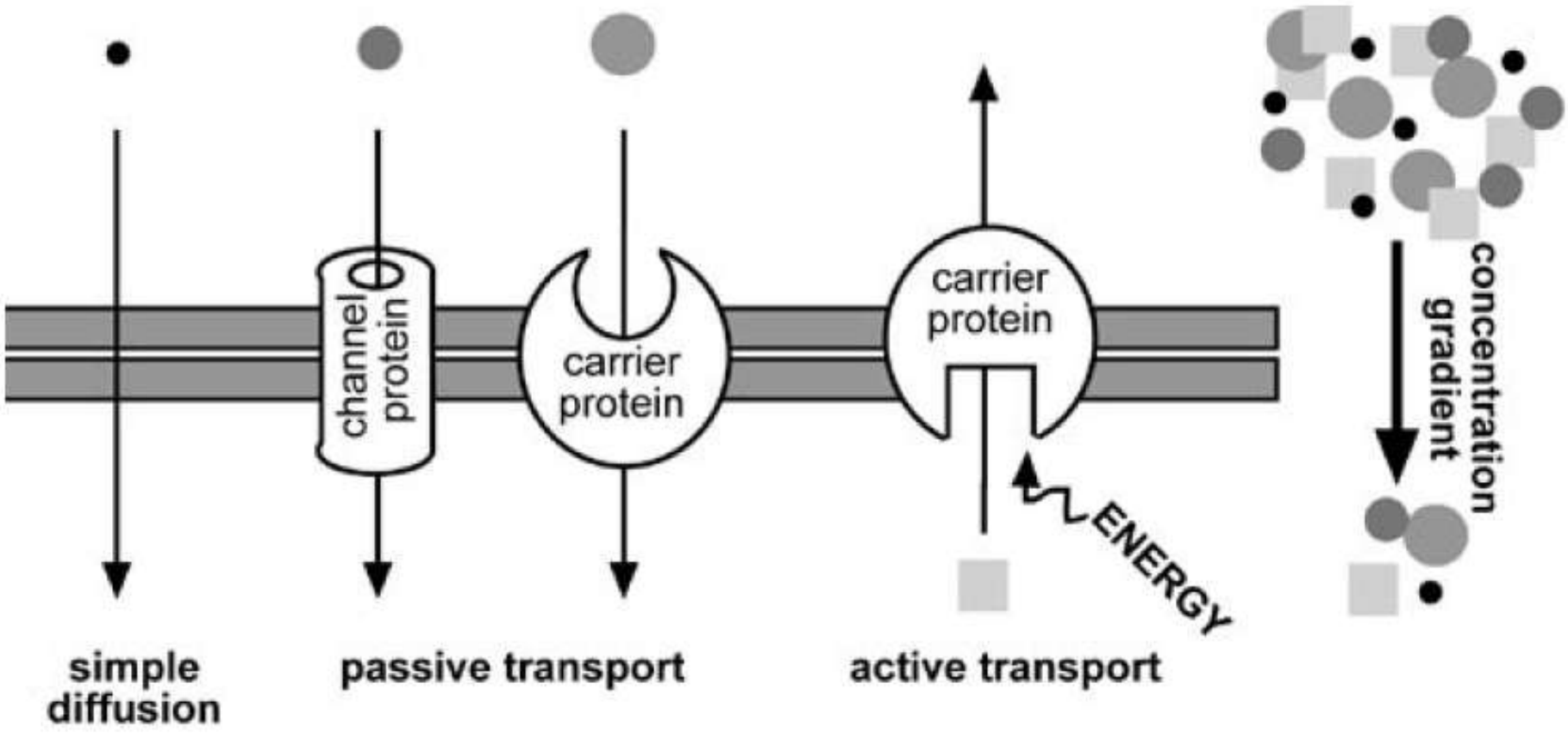
Energy must be used to make the particles stay where they are more crowded.

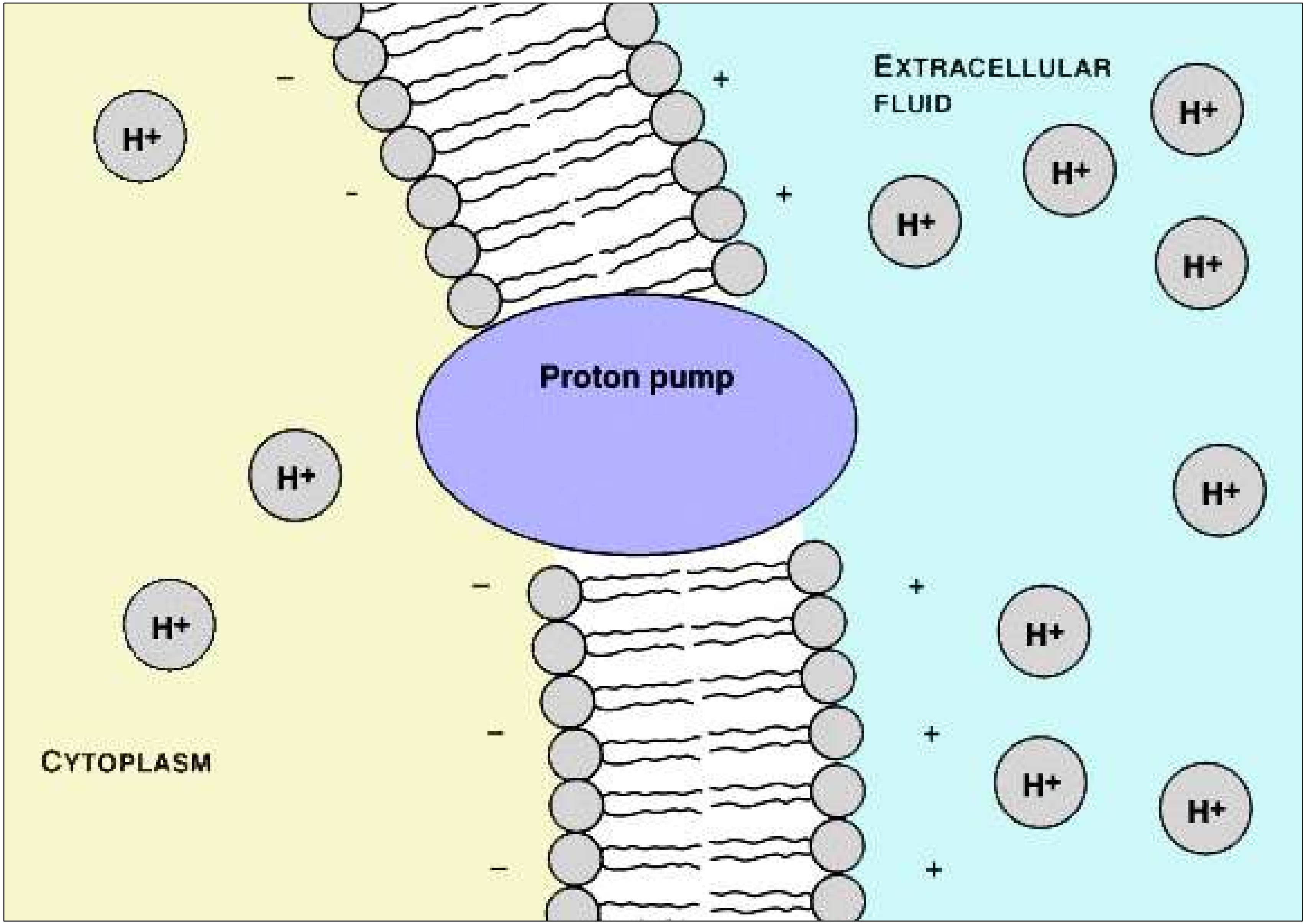
Active transport is different from passive transport because it requires energy. Active transport is necessary to make particles move against their natural tendency.

In active transport, particles move from less crowded (low concentration) to more crowded (high concentration).

Active transport is important in organs such as the kidneys when harmful particles are made to stay in the organ when they naturally want to diffuse


Passive transport
Active transport
Diffusion
Facilitated diffusion
ATP


channel protein
carrier protein
carrier protein
ENERGY
concentration gradient
simple diffusion
passive transport
active transport

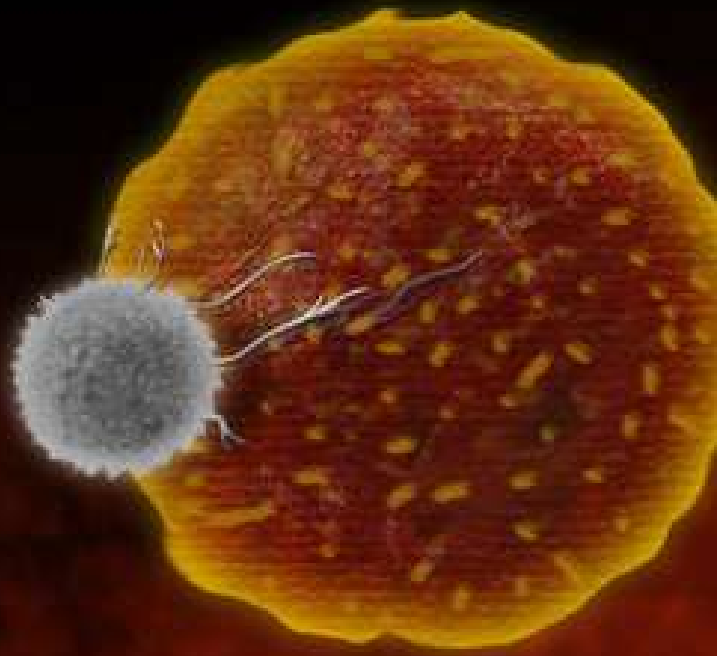

EXTRACELLULAR FLUID
CYTOPLASM
Proton pump
H+
H+
H+
H+
H+
H+
H+
H+
H+
H+
H+
H+

Movement of Particles Activities

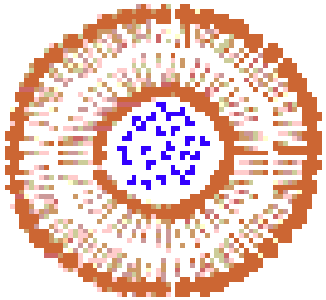
- Cellular Movement of Particles Practice worksheet
- Modeling Cellular Movement of Particles Activity
- Animated Cellular Processes: Passive Transport/Active Transport

If your cell needs a particle and the particle is too big to diffuse through the cell membrane and/or go through a protein channel or doorway, does your cell just go without that particle?

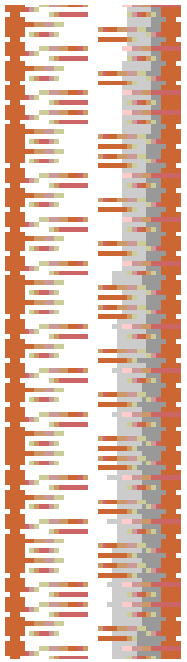
Although some particles are too large to go through the cell membrane, they can still get in or out of the cell through the process of Endocytosis and Exocytosis.



Endocytosis is the process by which the cell membrane envelops (engulfs) material that is too large to pass through the membrane and then pinches off inside the cell.

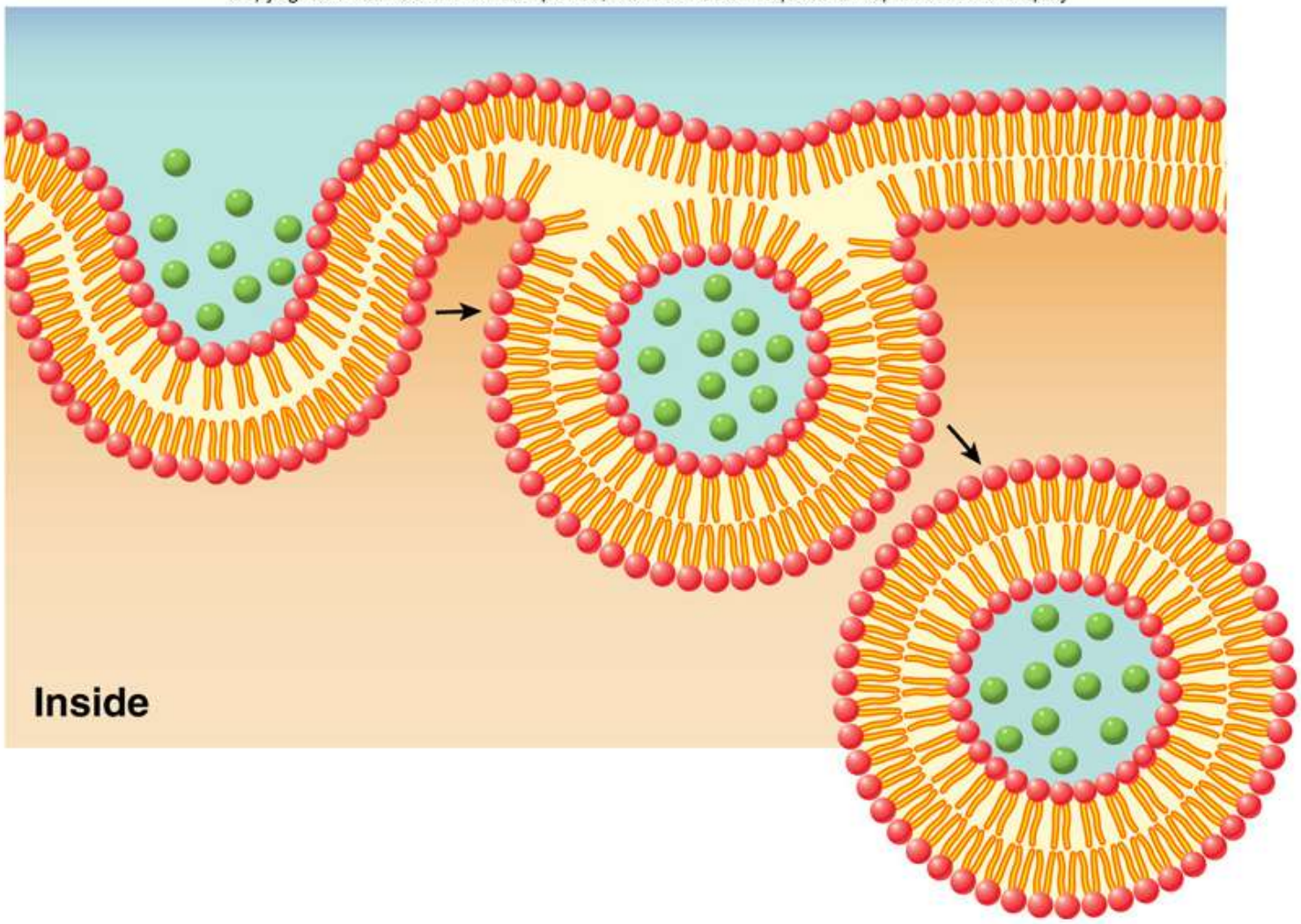


VESICLE



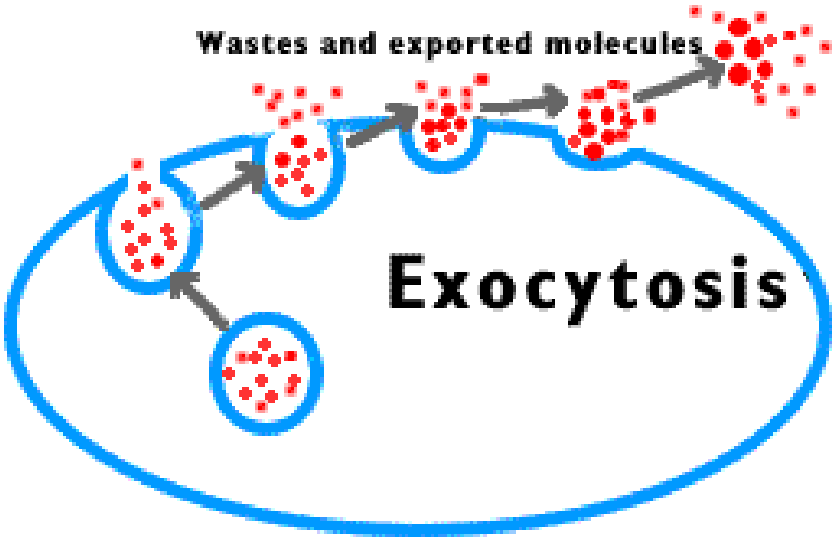
PLASMA MEMBRANE

Endocytosis

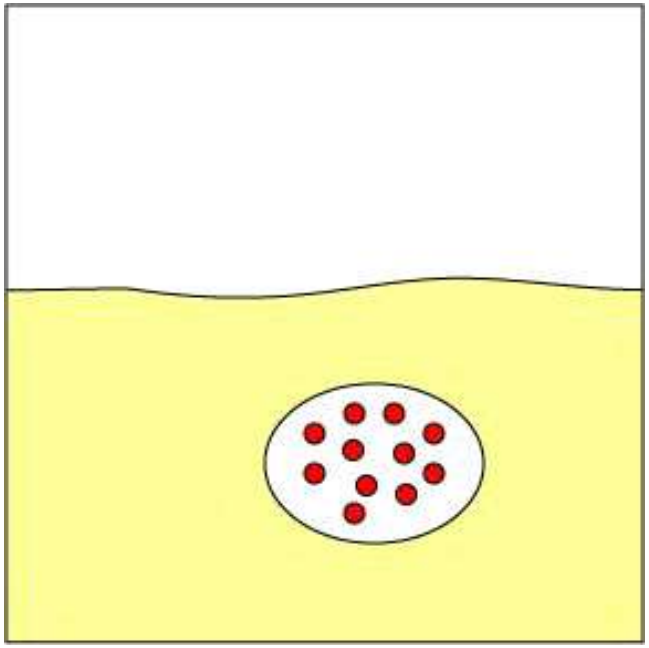


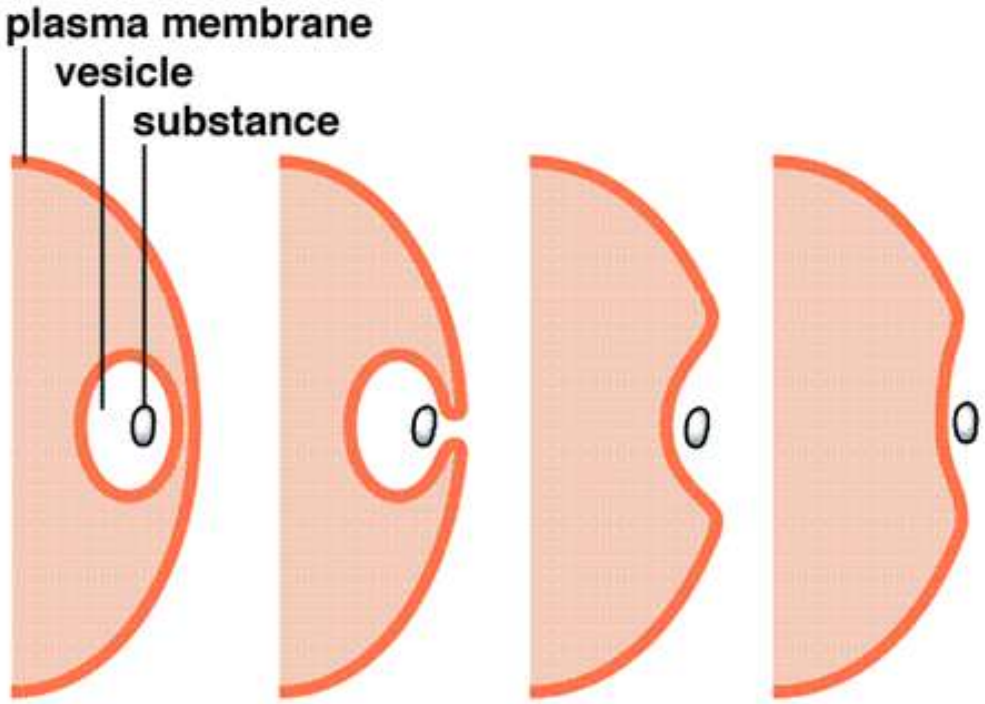
Exocytosis is the process by which the cell membrane removes material that is too large to pass through the membrane.

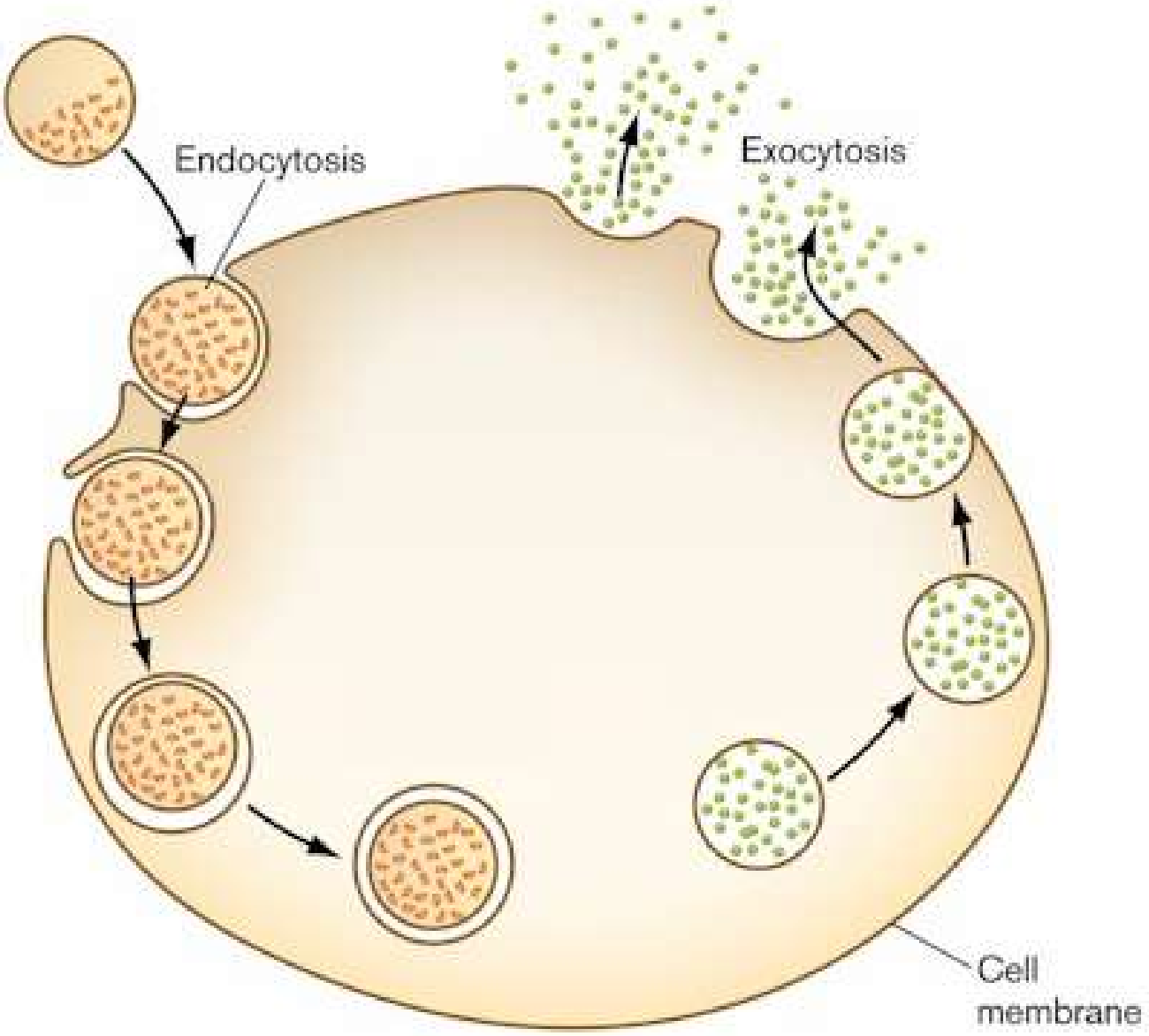
The material is surrounded by a membrane within the cell and then expelled by being pushed out of the cell.



Exocytosis






Endocytosis
Exocytosis
Cell
membrane

Distributed Summarizing

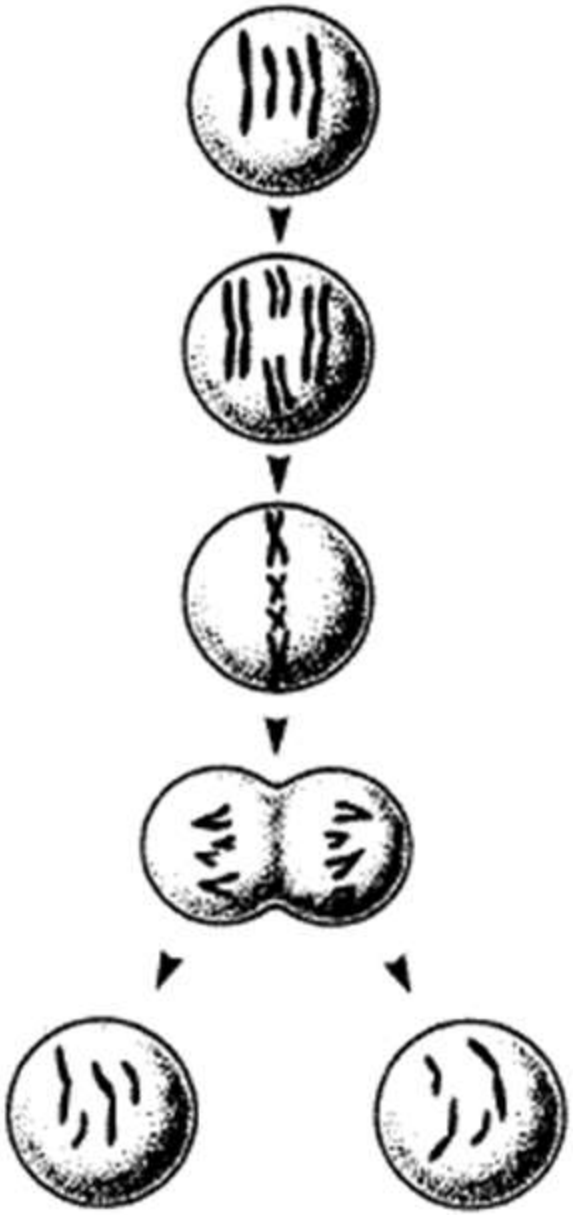
Imagine that you are an oxygen molecule, carbon dioxide molecule, glucose molecule or food particle. Write a short story describing your journey into or out of a cell. Be sure to include which process is needed for your entrance/exit and why. Also, include your purpose for entering or exiting the cell.

We have discussed ways in which cells live and grow by getting the nutrients they need, as well as, removing their wastes.

However, another important process must occur for growth and cell repair.

Think of a time when you got a bad cut. Over time, what happened to the cut?

Organism's grow or cells are replaced through a process called Mitosis.



Cells make more cells or divide through a process called **mitosis** (one cell makes two).

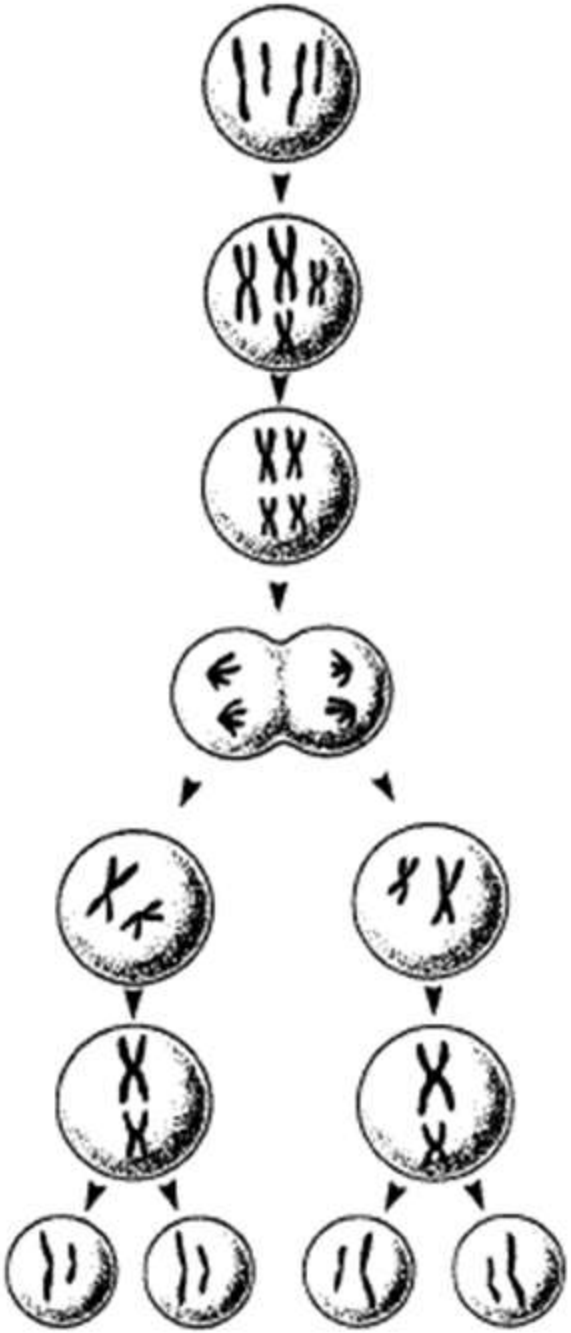
Video Clip of Growth by Cell Division: Mitosis

http://www.youtube.com/watch?v=GO5YN_t1fqw

Mitosis: The Amazing Cell Process that Uses Division to Multiply!

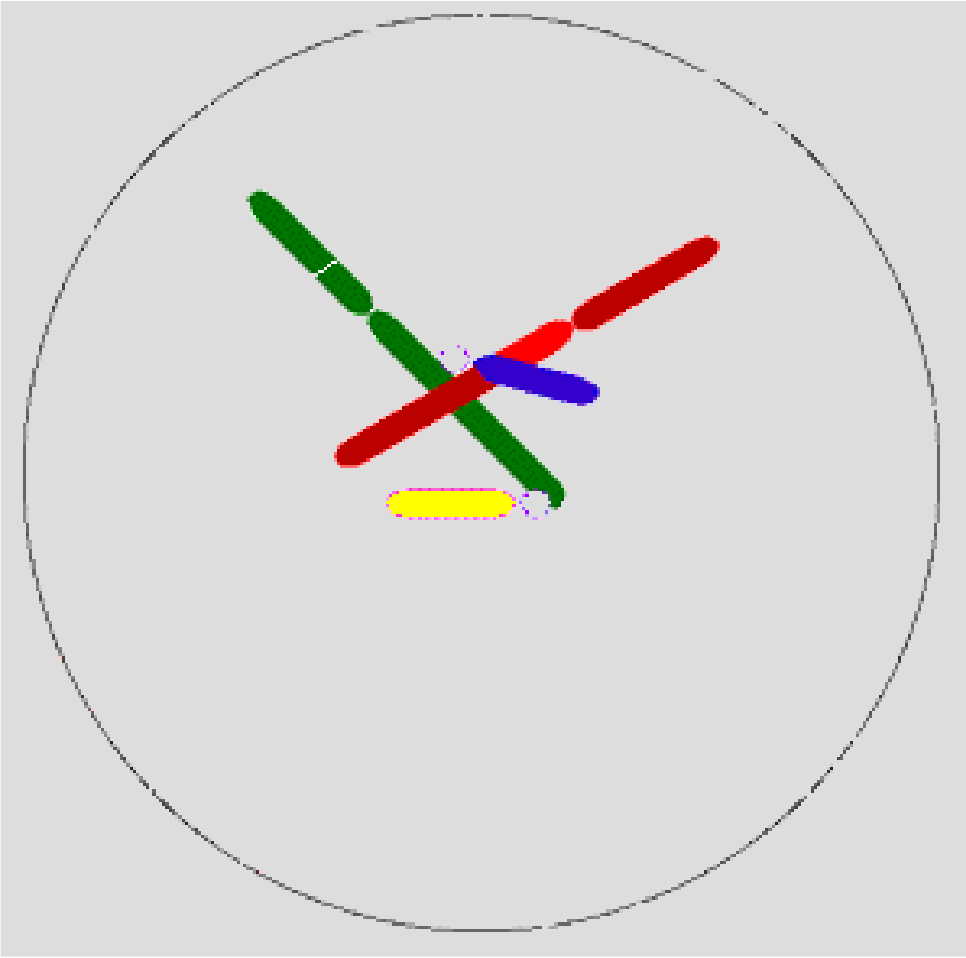
[see resources for handout]

http://www.youtube.com/watch?v=gwcwSZIfKIM



Cells make sex cells to help in the reproduction of multi-cellular organisms through a process called **meiosis** (one makes four).

Meiosis



Meiosis: The Great Divide Video Clip

http://www.youtube.com/watch?v=toWK0flyFIY

[watch first 3 minutes only]

Comparing Mitosis and Meiosis

http://www.pbs.org/wgbh/nova/body/how-cells-divide.html

http://www.bbc.co.uk/schools/gcsebitesize/science/add_edexcel/cells/mitosisact.shtml

Activities to Review Cell Processes

Cell Processes Image Shuffle Activity

Cell Processes QR Code Review

Cell Processes Review Cards [play Kaboom or other review game]

Cell Processes Summarizer

Organization of Living Things: Name _____ Date _____ Period ____

Directions: Match the cell processes with their correct description.

____ 1. Photosynthesis	A. Small particles such as oxygen and carbon dioxide move easily across the cell membrane from areas of high concentration to low concentration.
____ 2. Cellular Respiration	B. Process by which the cell membrane envelops (engulfs) material that is too large to pass through the membrane.
____ 3. Passive Transport	C. Process where food is broken down to release chemical energy. Occurs in the mitochondria.
____ 4. Active Transport	D. Process in which particles move from less crowded (low concentration) to more crowded (high concentration) using energy.
____ 5. Diffusion	E. Water moving from areas of high concentration to low concentration.
____ 6. Osmosis	F. Process where cells make more cells or divide (one cell makes two).
____ 7. Endocytosis	G. Plant cells take in light energy and change it into chemical energy in the form of glucose (food). Occurs in the chloroplasts.
____ 8. Exocytosis	H. Process by which the cell membrane removes material that is too large to pass through the membrane.
____ 9. Mitosis	I. Process where cells make sex cells to help in the reproduction of multi-cellular organisms (one makes four).
____ 10. Meiosis	J. Process in which substances or particles move through the cell membrane, protein channel, or protein doorway from high concentration to low concentration without the use of energy.

Cell Processes Tiered Activity