Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Unit 3 All Topics

Period: \_\_\_\_\_\_\_\_\_\_ Page: \_\_\_\_\_\_\_\_\_

**Unit 3 Notes: Cell Structure & Transport**

**Topic 1: Cell Theory**

By the end of this topic, you should be able to…

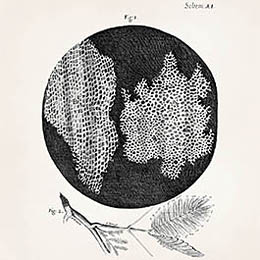
* List the three parts of the cell theory
* Describe the importance of each of the contributors to the cell theory (Virchow, Schleiden, Schwann, Leeuwenhoek, Hooke)
* Relate the invention of the microscope to the development of the cell theory

**The Cell Theory**

There are three components to the cell theory. You must memorize these. Write them below:

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. ****\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

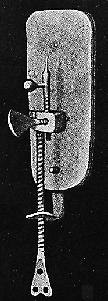
**How did we get the cell theory?**

* What *tool* do we need to see most cells? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* People you should know involved with this tool:
* **Robert Hooke** – he observed fleas and cork; while looking at ­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_, he saw what he called cells. He discovered plant cells (he did not know this) AND coined the term “cell” in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Why did he call the boxes he saw “cells?” \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

🡨 Some of Hooke’s drawings can be seen on either side here! 🡪

* **Anton van Leeuwenhoek** – starting in \_\_\_\_\_\_\_\_\_\_, he began to \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and assemble them together to make \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**More about Anton van Leeuwenhoek**

* Worked on ways to make \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (again, he would grind and reassemble lenses together)
  + Did NOT invent the microscope (it was invented nearly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ before he was born)
* Developed a lens tube with a magnifying power of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* He was the first to see and describe bacteria, yeast, and “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_” (little animals)
  + Observed the animalcules in \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and on his own \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (plaque)
  + His observations are among the first observations ever recorded for bacteria

**Years and Years Without Progress… (“The Gap”)**

* Nothing really drastic happens between the work of Hooke/Leeuwenhoek and our next scientists for close to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

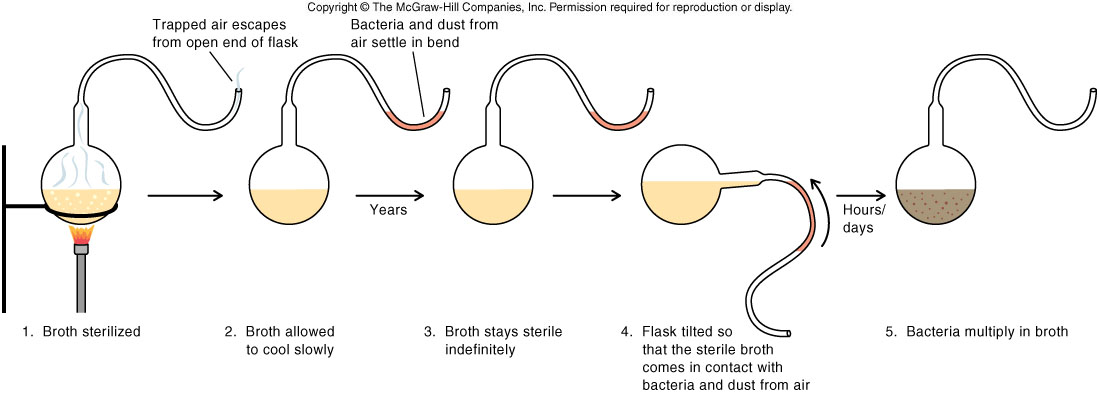
***Why?***

* Likely, because people believed in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and were unwilling to believe anyone telling them otherwise.

***What’s that?***

* The belief that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. *We will revisit this in evolution later this year!*
* Explain this image: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Louis Pasteur**

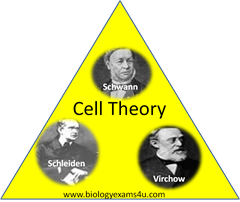
1. Finally put an end to the debate on where living things come from and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ spontaneous generation with his famous experiment: *Living things \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
   * Explain his experiment using the following image: ****

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**1838-1855 (Cell Theory Progress)**

Two German scientists, Matthias Schleiden and Theodor Schwann, continue studying living things.

* **1838** – Matthias \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (botanist, so studies \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) concluded that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **1839** – Theodor \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (physiologist) concluded that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **1855** – Rudolph \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ concluded that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (part 3 of the cell theory)

****

**The 3 Basic Components of the Cell Theory Are Now Complete:**

1. All organisms are composed of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (Schleiden & Schwann)(1838-39)

2. The cell is the basic unit of life in all \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (Schleiden & Schwann)(1838-39)

3. All cells are produced by the division of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells. (Virchow)(1858)

**[[*Language Target for Topic 1: I can identify each of the cell theory contributors and explain their importance in the overall idea of the cell theory.*]]**

*In the following space, create a SIMPLE cell theory timeline that highlights the work (and dates) for each of the following individuals:* Hooke, Leeuwenhoek, Schleiden, Schwann, & Virchow



**Unit 3 Topic 1 Enrichment: The Microscope**

By the end of this topic, you should be able to…

* Label a microscope and explain the function of each part
* Bring a specimen into focus when using a compound light microscope
* Write about the history of the microscope

**History of the Microscope**

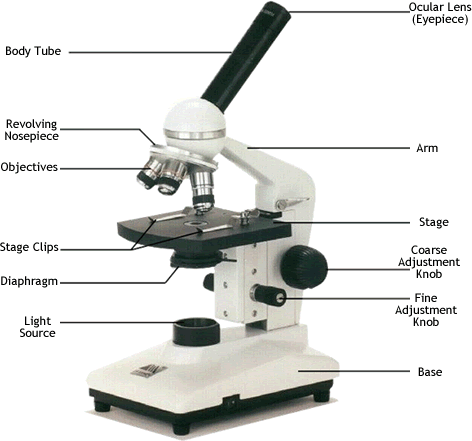
1. The first microscope is believed to have been invented in/around the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   * Zacharias was a spectacle maker that is credited with inventing the first microscope. However, he was born ~1580, so he would have been very young in 1590.
   * It is believed his father, Hans, assisted him in the building of the first microscope.
2. Advancements made by Hooke & Leeuwenhoek:
   * These two made improvements on the microscope by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   * Leeuwenhoek's instruments consisted of simple powerful magnifying glasses, rather than the compound microscopes (microscopes using \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) of the type used today or in Zacharias Jansen's original microscope design.
   * Leeuwenhoek's design is *extremely simple*, using a single lens mounted in a tiny hole in a brass plate (the body of the instrument). The specimen was mounted on a sharp point that sticks up in front of the lens. Its position and focus could be adjusted by turning the two screws. The instrument was only 3-4 inches long, and had to be held up to the eye, requiring good lighting and great patience to use.

**Compound Light Microscope**

1. The scopes we use in class are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ microscopes
   * Have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ one lens
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ lenses are used to build the microscopes (and glasses)
   * These lenses \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ light and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ it in one spot
   * Bending Light: The objective (bottom) convex lens magnifies and focuses (bends) the image inside the body tube and the ocular convex (top) lens of a microscope magnifies it (again).

**Parts of the Microscope: label the following parts & functions**

***Functions:***

* **Ocular Lens:** *the part that you look through; typical magnification = \_\_\_\_\_\_\_x*
* **Body Tube:** *holds what two parts the proper distance apart? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
* **Nosepiece:** *Rotate this to change \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
* **Arm:** *Used to support the microscope; always carry with one arm on this; holds the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
* **Objective Lens**: *Use the nosepiece to switch between objective lenses; when switching between these, what are you changing? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
* **Stage:** *Flat surface used to hold the slide/specimen*
* **Stage clips:** *Always use these; what is their function? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
* **Diaphragm:** *Rotate this to adjust what? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
* **Coarse adjustment knob:** *Never use on high power; what does it do? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

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

* **Fine adjustment knob**: *Use this for focusing; it is the smaller of the 2 knobs… what does it do? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
* **Light source:** *Typically a light, but can be a mirror; projects light upwards*
* **Base:** *Supports microscope; always carry a microscope with one hand on this*

**Magnification**

How do you calculate the total magnification?

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

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

**Using a Microscope**

Provide important notes on microscope use:

1. *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
2. *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
3. *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**How to Prepare a Slide for the Microscope:**

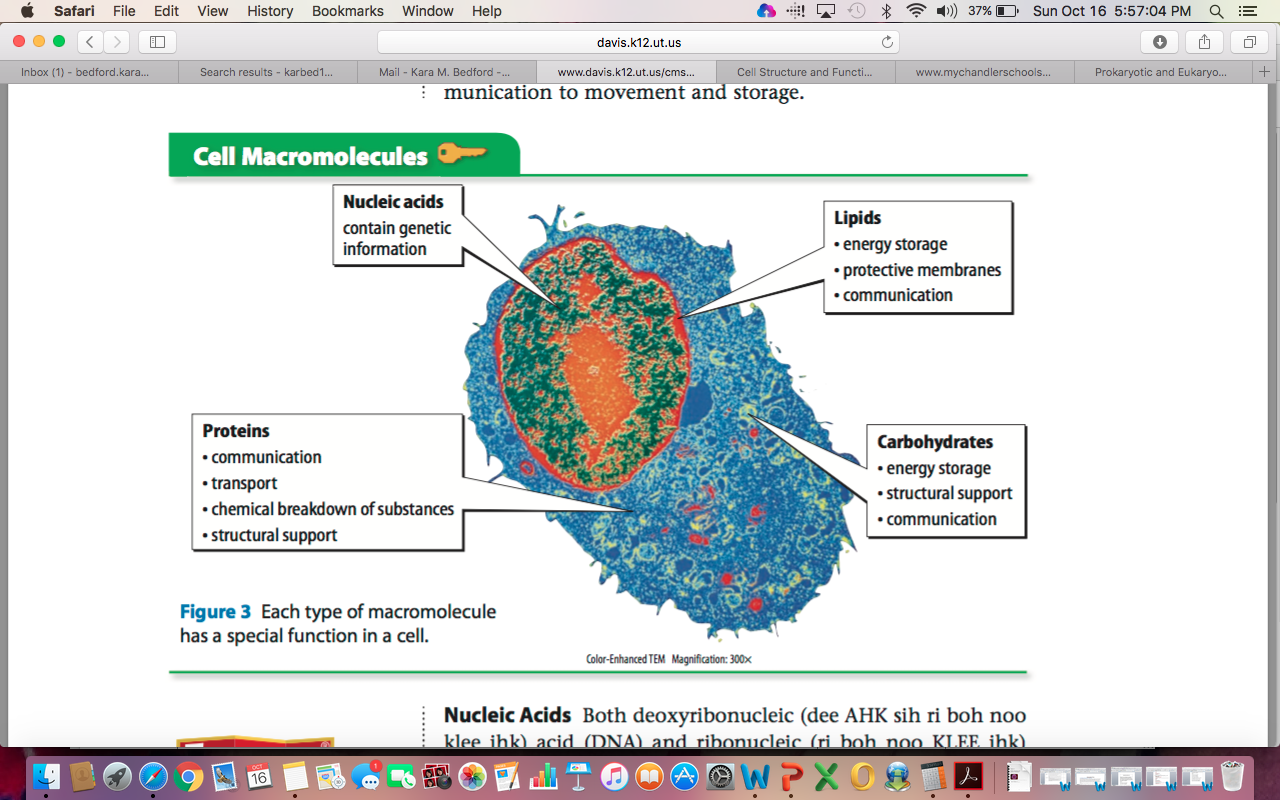
**Unit 3 Topic 2: Cell Types & Structures**

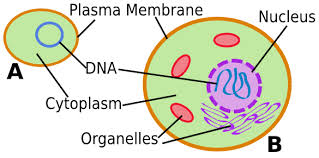
By the end of this topic, you should be able to…

* Discuss similarities and differences between prokaryotic and eukaryotic cells
* Identify a cell as being prokaryotic or eukaryotic based on cellular components
* Explain the function of cellular organelles
* Compare and contrast plant and animal cells
* Explain how cells work together in multicellular organisms

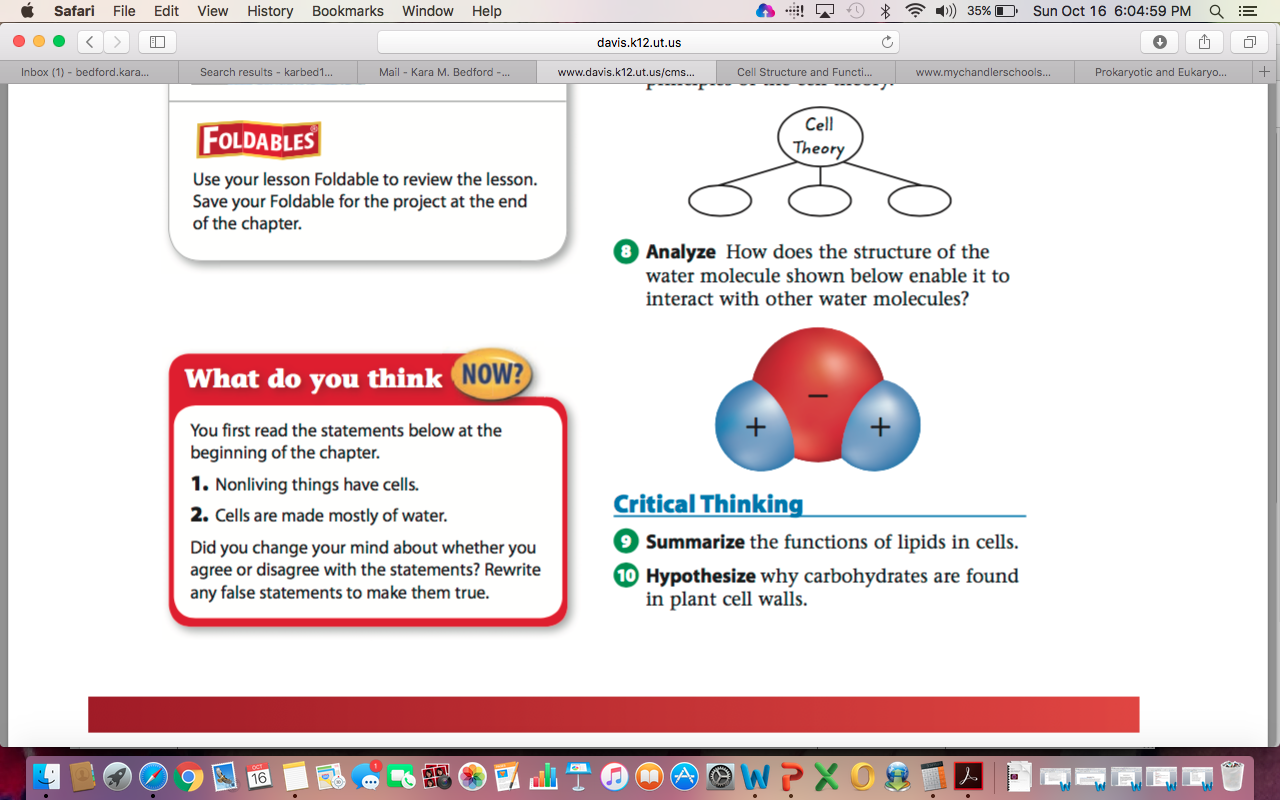
**Things All Cells Have in Common**

* There are MANY types of cells (skin, brain, liver…), but cells are generally classified as either **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ OR \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.
* Some things that ALL CELLS, regardless of type, have in common are:

1. All cells have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Water - nearly \_\_\_\_\_\_\_\_\_\_\_\_\_ of the mass of each cell is water. Water is the most abundant molecule in cells!
3. Macromolecules-
   * Every cell contains a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (nucleic acids)
   * Every cell has hundreds of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with unique functions.
   * Every cell has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that are used for energy storage, cell communication, and protective barriers (cell membrane contains lipids, as does nuclear membrane)
   * Every cell has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, also used in energy storage and used for structural support



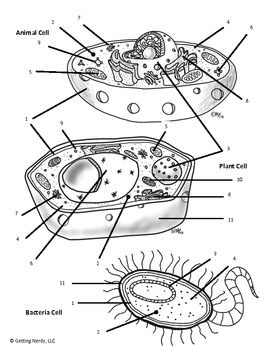
*Review: What is the monomer for…*

* Carbohydrates: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Lipids: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Proteins: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Nucleic acids: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Explain what the phrase “water is polar” means:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*How does this allow water to dissolve so many solutes?* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Describe how invention of the microscope helped scientists understand cells:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Two General Types of Cells**

1. **Pro**karyotic: pro means \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, “kary” refers to “karyon” (kernel)
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kernel (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
   2. Older, simpler, smaller
   3. Example: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. **Eu**karyotic: eu means \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ kernel (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
   2. Evolved more recently, more complex, larger
   3. Examples: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Prokaryotic Cells**

1. NO \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_! DNA is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and located in the cytoplasm (“\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”)
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than eukaryotic cells (no \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organelles)
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than eukaryotic cells (smaller surface area to volume ratio)

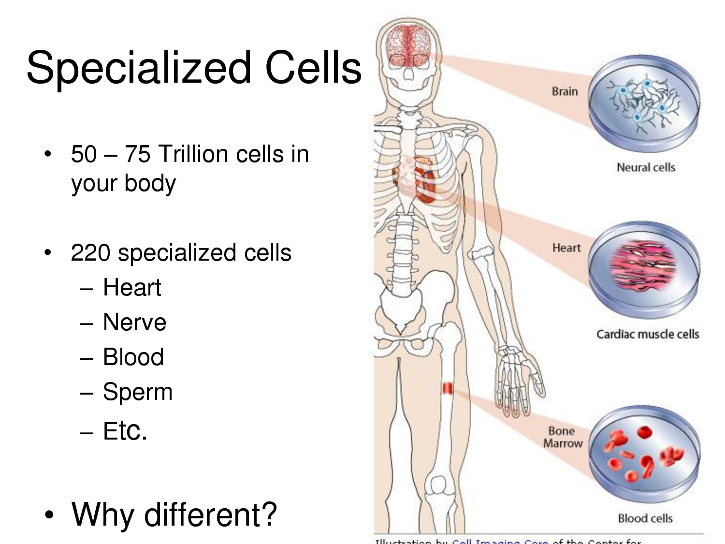
* Size is important because the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (they also get through the cell quicker)

*\*Eukaryotic cells have organelles that assist in moving nutrients/waste\**

* 1. *Do contain ribosomes (site of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)*

1. Surrounded by a cell wall \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the cell membrane

**Eukaryotic Cells**

1. Contain a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in which their genetic material is separated from the rest of the cell.
2. Contain cell parts called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ membranes.
3. Eukaryotic cells are generally \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than prokaryotic cells.
4. ****Organelles (cell parts) carry out specific \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the cell.
5. Many eukaryotic cells are highly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
6. Provide some examples of “specialized” cells.



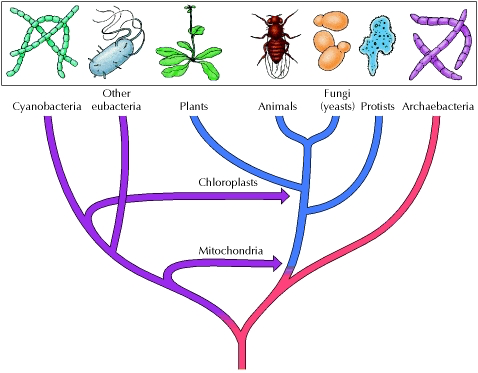
1. Eukaryotic cells can exist either as single-celled organisms or as part of multicellular organelles
2. Human body is made of more than \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of cells! These cells work together to make up five main types of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: epithelial, connective, blood, nervous, and muscle tissue.
   * 1. *Recall: cells of the same organism contain the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, but not all of the genes are activated in every type of specialized cell*
3. Each type of cell is modified to work in the way the organism needs it to (may differ in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
4. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a non-specialized cell that can either replicate itself (produce more stem cells) or differentiate into a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cell.

**Levels of Organization within a Multicellular Eukaryote:**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Evolution of Cells**

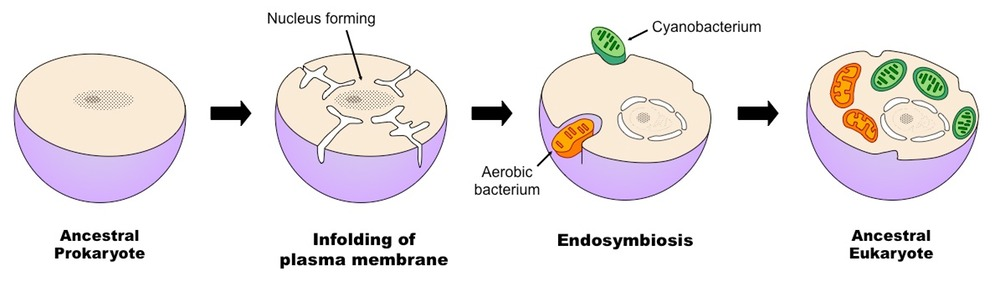
1. Approximately \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years ago: Prokaryotic cells likely appeared on earth
   1. *We will look at how these cells could have developed later in the year (evolution unit)*
      1. *It involves conditions of earth’s early atmosphere (lacked oxygen) and the synthesis of organic molecules*
2. ~3 billion years ago: Photosynthetic bacteria evolved (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ released into atmosphere)
3. Around \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years ago: Eukaryotic cells evolved *(Endosymbiotic theory)*
4. Roughly 1.7 billion years ago: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organisms evolved (plants and animals)



*Looking at the evolutionary tree to the left, what can be inferred? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**Endosymbiotic Theory**

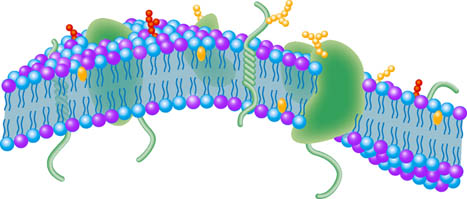
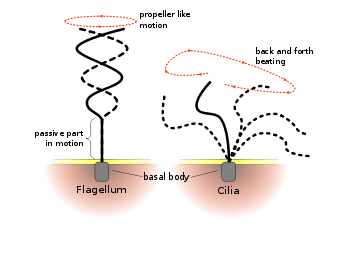
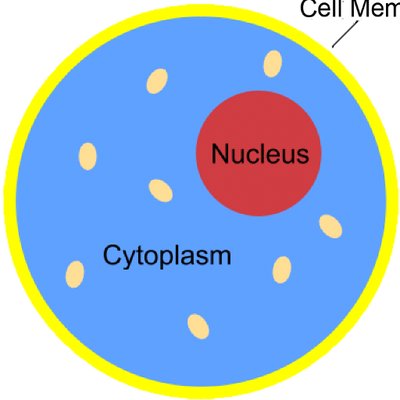
1. Define theory (again): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. The endosymbiont theory explains how scientists believe that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells evolved from prokaryotic cells
3. What is happening?



Essentially, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ engulfs (but does not digest) a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The smaller cell is then living within the larger cell and operating as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

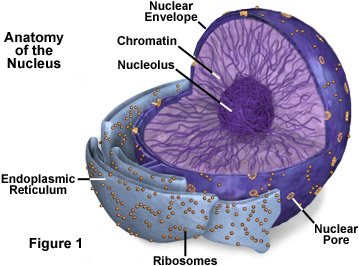
* The Endosymbiotic Theory suggests that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ were once separate prokaryotic organisms that were engulfed but not digested by a larger cell.

**Cell Structures**

1. **Cell Membrane**
   * Also referred to as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ membrane
   * Surrounds the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Is the outermost part of animal cells, but not for plant cells
   * Plays a large roll in cell transport (topic 3 this unit)
   * Controls \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of materials into and out of the cell
   * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (does not allow all things into the cell)
2. **Cilia and Flagella**
   * + Used for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
     + Cilia:
     + Shorter/greater in number
     + Move \_\_\_\_\_\_\_\_\_\_\_\_\_ using sweeping motion
     + Flagella:
     + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and typically one per cell
     + Propels \_\_\_\_\_\_\_\_\_ using whip-like motions
3. **Cytoplasm**
   * + Suspends the organelles
     + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ within the cell membrane
     + Also known as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. **Cytoskeleton**

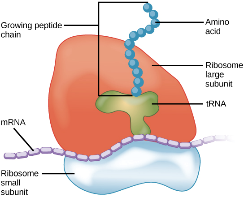
* A structure that maintains the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of cells
* A network of microtubules (thicker) and microfilaments (thinner) that are long protein strands

1. **Nucleus**

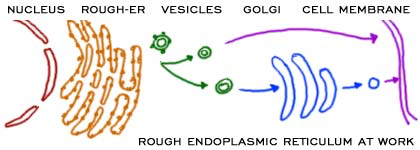
* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the cell, housing the \_\_\_\_\_\_\_\_\_\_ (master copy of a cell’s genetic material)
* The nucleus is surrounded by the nuclear membrane, which has lots of little \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_ exits through these)
* Within the nucleus is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and this is where \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are produced

1. **Ribosome**

* Small particles of RNA and protein scattered throughout the cytoplasm
* This is the site of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (proteins are made here)



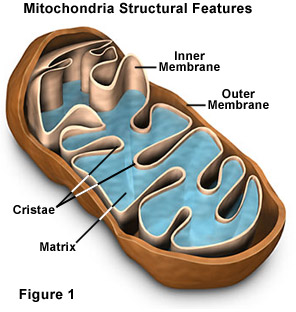
1. **Endoplasmic Reticulum**

* An interconnected network of flattened sacs
* Joins with the outer membrane of the nucleus
* ****Two types:
  + Rough ER: coated in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (makes proteins)
  + Smooth ER: lacks the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on its exterior
* Known as the “highway” or the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ system because it folds and moves proteins
* Sends them to the golgi apparatus/body

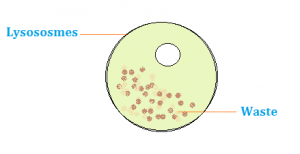
1. **Golgi Apparatus (Body)**

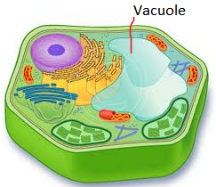
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cellular components (proteins & lipids)
* Made of membrane-bound sacs
* Can produce lysosomes
* Works directly with the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

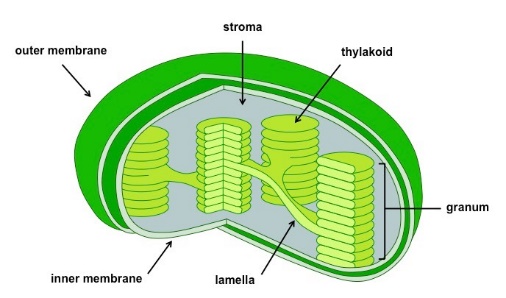
1. **Mitochondria**

* Acts as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the cell
* Produces \_\_\_\_\_\_\_, the energy currency of the cell
* Contains DNA (not unique to an individual though, runs through the family- get it from your mom because it is carried in the female egg)
* Double membrane
* Varies from 1 to 10,000 mitochondria in a single (specialized) cell
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** contain lots of mitochondria.
  + Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **Lysosome**

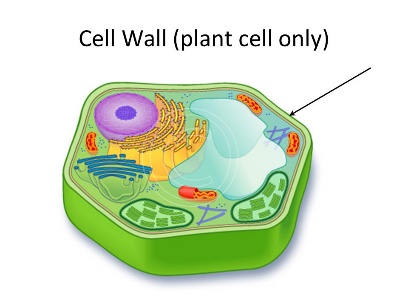
* Membrane-enclosed organelles with lots of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ used to break down \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Lysis = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Functions as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ system of the cell
* Maintain an acidic pH within the lysosome
* Debate as to whether this is only found in animal cells… leaning towards this organelle being found in both animal and plant cells

1. **Vacuole**

* Fluid filled organelle that stores \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Often the largest organelle in plant cells- can take up to \_\_\_\_\_\_\_\_\_\_\_ size of the cell (much smaller in animal cells)

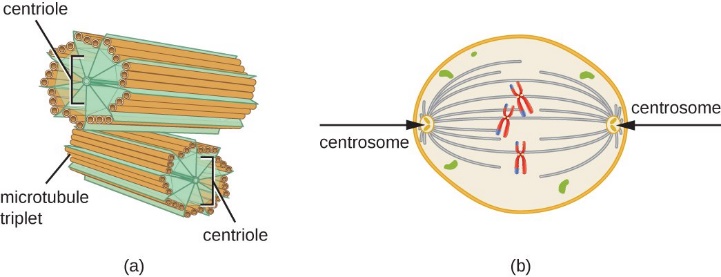
1. **Chloroplast**

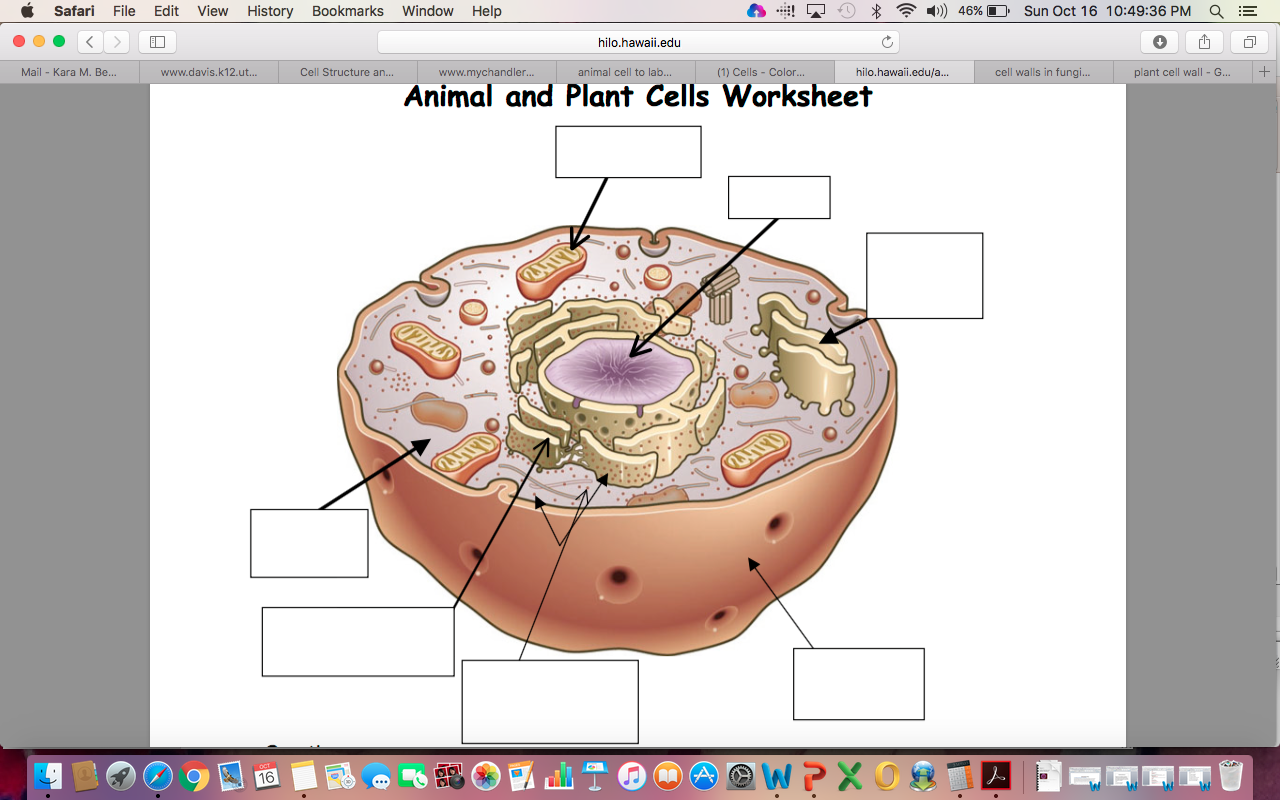
* Found only in plant cells, this is the location of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Converts \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy
* Double membrane
* Contains DNA
* Green in color because it contains the pigment \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

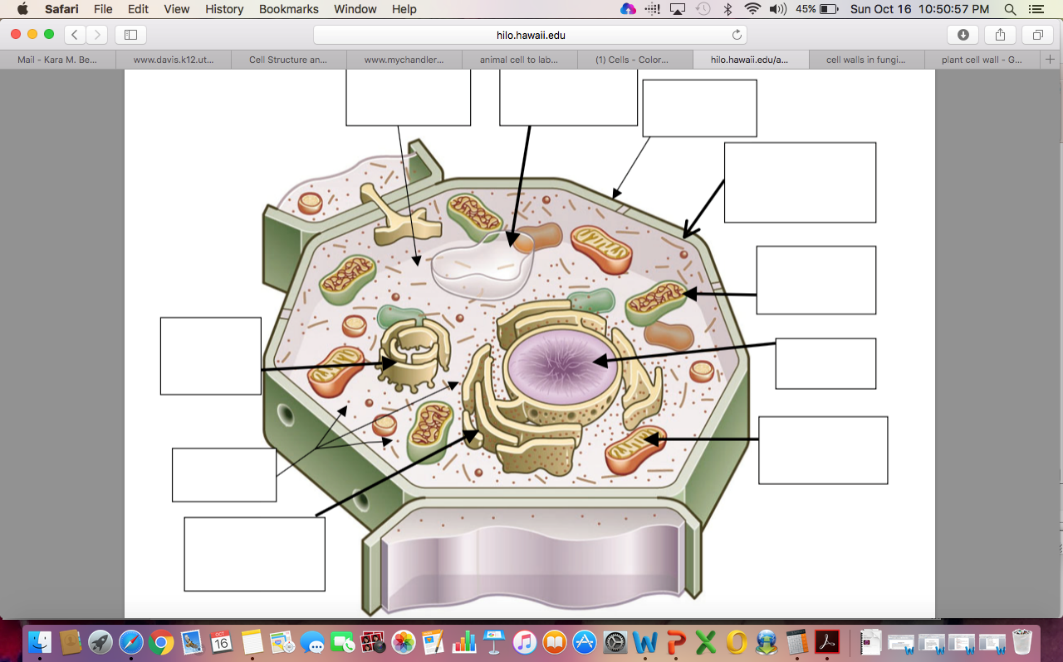
1. **Cell Wall**

* Found in plant cells (and bacteria and fungi), **not** in animal cells
* Located \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the cell membrane
* Leads to plant cells having a square/rectangular shape
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the cell
* Made of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (in plant cells)
  + Remember, this is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!

1. **Centrioles**
   * + Only found in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells- located near the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
     + Assists in cell division. How? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_







**[[*Language Target for Topic 2: I can construct a Venn diagram comparing prokaryotic and eukaryotic cells; I can draw and label the parts of a plant and animal cell, then define each organelle’s function and give an analogy for each; I can sequence the levels of organization of cells in multicellular organisms.*]]**

**PART 1:**

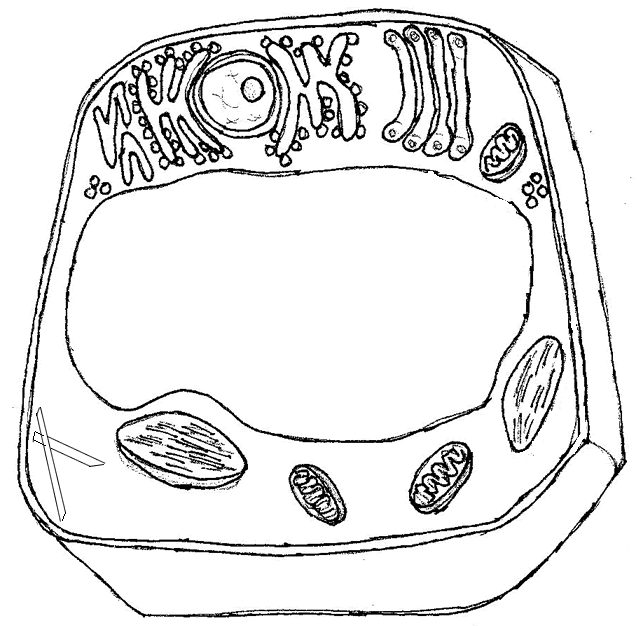
BOTH

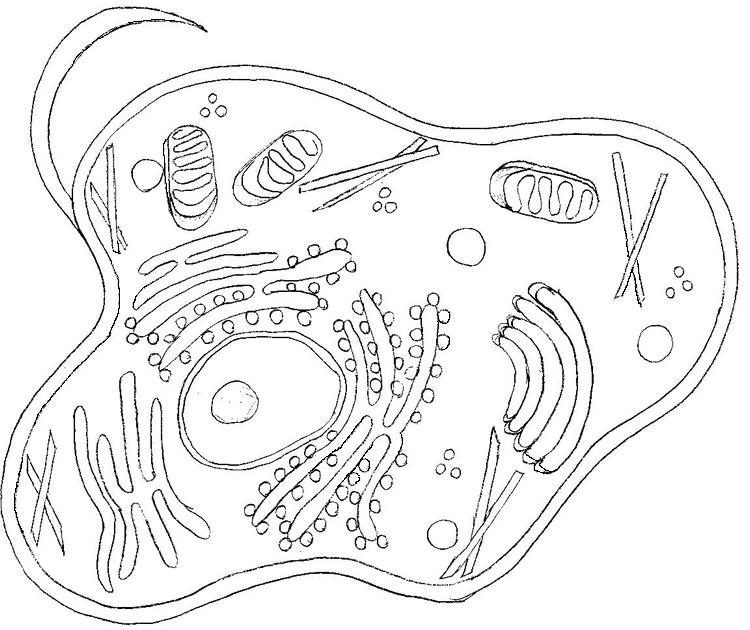
Eukaryotic Cells

Prokaryotic Cells

**PART 3 (here for spacing):** *starting with cell, and ending with organism, sequence the building blocks of life:*

**PART 2:** Label the plant cell and the animal cell. Then color-code the organelles illustrated (ie all mitochondria orange, all nuclei pink, etc). Finally, create a chart identifying the organelles, their function, and an analogy (ie nucleus – brain of cell).



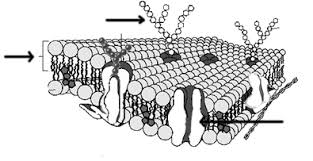
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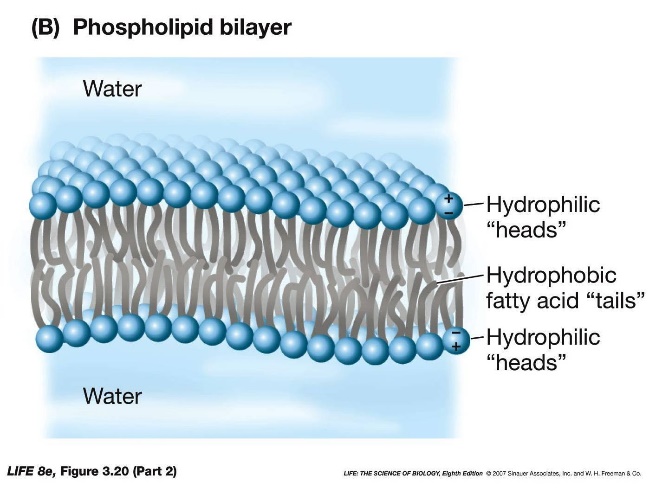
**Unit 3 Topic 3 – Cell Membrane and Transport**

By the end of this topic, you should be able to…

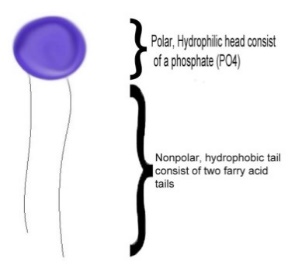
* Label a cell membrane with its components and explain the function of each component (carbohydrates, phospholipid, proteins)
* Explain what “a cell membrane is selectively permeable means”
* Explain why the cell membrane is known as the Fluid Mosaic Model
* Compare and contrast passive transport (diffusion, facilitated diffusion, osmosis) with active transport (endocytosis, exocytosis)
* Discuss the importance of surface area to volume ratio

**The Cell Membrane**

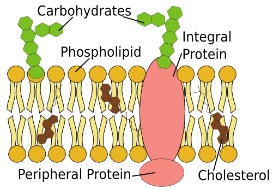
* **Function:** regulate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into and out of the cell
* Parts you need to know:
  + Phospholipid bilayer
  + Carbohydrate Chain
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (integral and peripheral)
  + Cholesterol
    - Label all parts on the diagram.

**Arrangement of the Lipid Bilayer**

1. ***2 sheets of phospholipids*** (a lipid with a head & two tails)

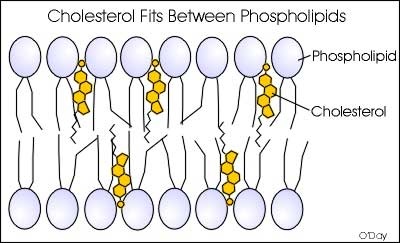
* Head = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + “Hydro”: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + “Philia”: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Arranged on the outsides of the bilayer due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Tails = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + “Hydro”: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + “Phobia”: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Arranged on the inside of the bilayer \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Label the head and tails of the phospholipid above and to the right

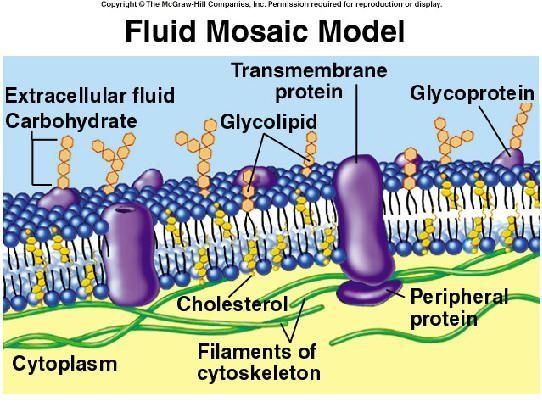
***2. Carbohydrate Chains***

* Attach as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to membrane \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- carbohydrates attached to protein
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- carbohydrates attached to lipid
* Protect the cell
  + These are used for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Differentiate between things that can enter the cell and things that cannot enter the cell

***3. Proteins***

* Allow for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ between cells and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of materials
* *Integral proteins*: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Usually \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (extends the length of the membrane to connect the inside of the cell with the outside)
  + Can act as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for materials to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the cell
* *Peripheral proteins*: attached to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (outside) of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (or other membrane)
  + - Wingmen for other membrane proteins (partner with other proteins- can be used for transport from one part of the cell to another by attaching to these other proteins)

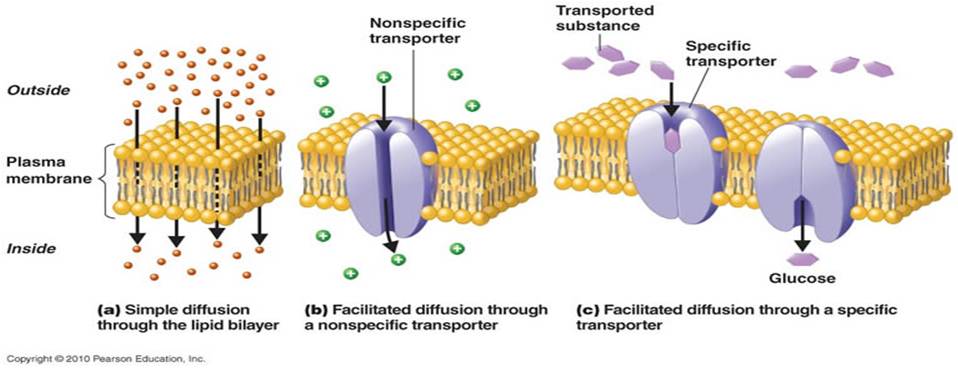
***4. Cholesterol***

* Maintains the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of cell membranes
  + - Without cholesterol, cell membranes would be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Used to maintain fluidity of the cell membrane by preventing crystallization of the tails in the bilayer
* Involved with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(due to closeness with proteins on the cell membrane)

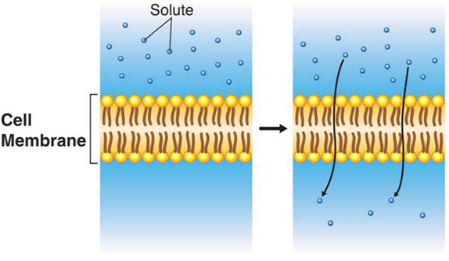
**Fluid Mosaic Model**

* Describes the flexible (fluid) combination of phospholipids, cholesterol, and proteins
  + Separate but \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecules
  + Dynamic and scattered with these different molecules (mosaic-like)
  + This fluid characteristic allows it to be SEMI—PERMEABLE (certain things can \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ freely, but not others)

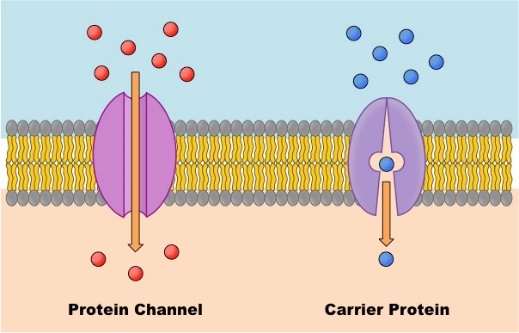


**So, how do things get into and out of cells?**

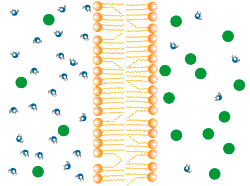
* By moving across a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (moving from one side of the cell to the other)
  + Concentration: mass of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a given volume of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Cell transport
  + ***Passive***: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ required, solutes move \_\_\_\_\_\_\_\_\_ the concentration gradient (from \_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_ concentration)
  + ***Active***: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ required, solutes move \_\_\_\_\_\_ the concentration gradient (from \_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_ concentration)

1. **Simple Diffusion**

* Molecules move from an area of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ concentration to an area of \_\_\_\_\_\_\_\_ concentration
* This means they are moving \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the CONCENTRATION GRADIENT
* ***PASSIVE*** (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ required)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ move through cells using simple diffusion
  + Not all solutes can cross the membrane by simple diffusion.
    - **Why?** The membrane is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, this means only certain solutes (typically small ones) can pass across by simple diffusion
    - The solution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **Facilitated Diffusion**

* Diffusion of certain molecules through a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ membrane, made possible by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* This is for some substances, like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, that are too \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to fit through the cell membrane on their own.
* Still moving \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the CONCENTRATION GRADIENT
* ***PASSIVE*** (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ required)

1. **Osmosis**

* This is the diffusion of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ across a cell membrane
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ process
* WATER molecules move \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the concentration gradient
  + Movement depends on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (hypertonic, isotonic, hypotonic)
  + Vocab Review
    - Solute: the substance that is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in water (ex: sugar, salt, oxygen, calcium, etc)

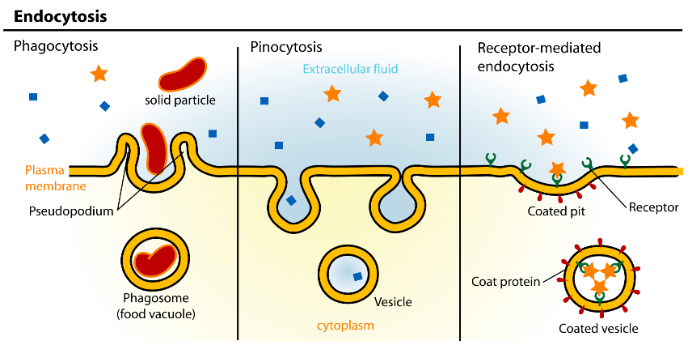
|  |  |  |
| --- | --- | --- |
| **HYPERtonic =** | **HYPOtonic =** | **ISOtonic =** |
| -Solution **outside** the cell has a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solute concentration and lower water concentration than **inside** the cell.  -Water \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the cell  Image result for hypertonic solution | -Solution **outside** the cell has a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solute concentration and higher water concentration than **inside** the cell.  -Water \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the cell  Image result for hypertonic solution | The concentration of solute (and water) is the \_\_\_\_\_\_\_\_\_\_ outside the cell as inside the cell  -Water moves \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in both directions  -No \_\_\_\_\_\_\_ movement  Image result for isotonic solution |

1. **Active Transport**

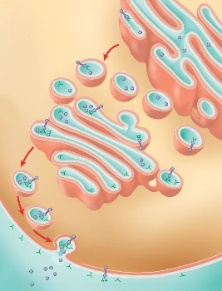
* Movement \_\_\_\_\_\_\_\_ the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + From areas of \_\_\_\_\_\_\_\_\_\_\_ concentration to areas of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ concentration
* ***ACTIVE*** because this requires \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_\_\_\_\_)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are used to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ materials across the membrane
  + Each pump moves \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of molecule

*Endocytosis & Exocytosis (Types of Active Transport)*

|  |  |
| --- | --- |
| **Endocytosis** | **Exocytosis** |
| Endo = | Exo = |
| Cyto = | Cyto = |
| Taking large amounts of material \_\_\_\_\_\_\_\_\_\_\_\_ the cell | Sending large amounts of material \_\_\_\_\_\_\_\_\_\_\_\_ the cell |

***Endocytosis*** – two types:

* **Phagocytosis**: essentially, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (bringing \_\_\_\_\_\_\_\_\_\_\_\_\_\_ into the cell)
  + *Ph sounds like fuh… same start as food (solid)*
* **Pinocytosis**: essentially, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (bringing \_\_\_\_\_\_\_\_\_\_\_\_\_\_ into the cell)
  + *Think pina colada, which is a drink!*
* In either case, the material is brought into the cell through \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that form around the material

***Exocytosis***

* Products of the \_\_\_\_\_\_\_\_\_\_ are packaged into \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and are then sent to and released at the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Surface Area to Volume Ratio – Why Cells need to be small**

* Each part of the cell relies on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. As a cell grows, its volume grows and the cell membrane expands. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Surface area available to pass materials to a unit volume of the cell steadily decreases.
* If the cell grows too big, not enough material can come into the cell to accommodate the larger cell volume.
  + cell must \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into smaller cells with favorable surface area/volume ratios, or cease to function.
* The **important point** is that *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**[[*Language Target for Topic 3: I can diagram and write a detailed description of the fluid mosaic model; I can select the proper mode of movement through the membrane when given examples; I can analyze data to make conclusions as to the impact of surface area to volume ratio on cells and determine what general ratio is best.*]]**

**Part I*:*** *In the space provided, draw and label a small section of the cell membrane. Identify the hydrophobic tails, the hydrophilic heads, the protein channels, the carbohydrate chains, and where cholesterol is.*

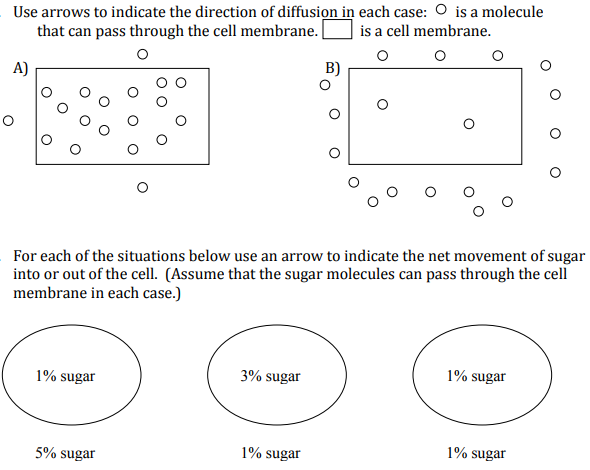
Function of…

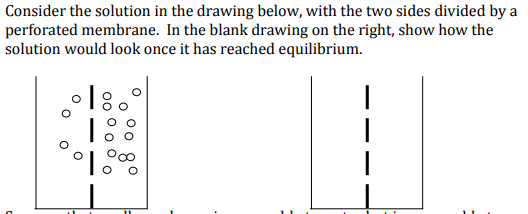
Phospholipid bilayer:

Carbohydrate chain:

Protein channel:

Why is the cell membrane referred to as the fluid mosaic model?

**Part II:**

****

**Part III:** *Use the following instructions and examples to calculate the surface area to volume ratios of the cubes that follow. Then, answer the questions:*

