Microscopes, Osmosis, & Cell Parts

Part 2 of the Notes

Introduction to Microscopes!

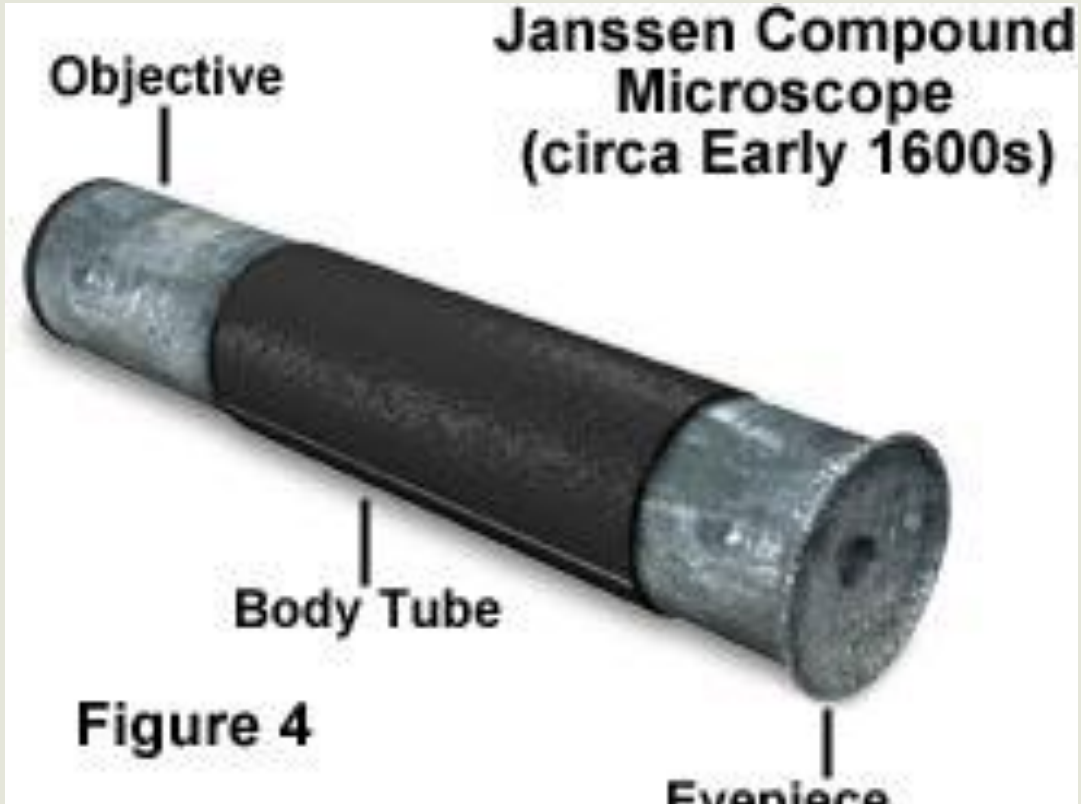
When Your Lab Partner Does Something For Once!

Most Life is Unseen

- We only see “the visible”.
- Most Life, though, is “Invisible” to the naked eye.
- Most life on earth is too small to be seen.

First Compound Microscope

- Developed at the beginning of the 1600's, by the Janssen brothers and Galileo
- Problem: images were blurred.



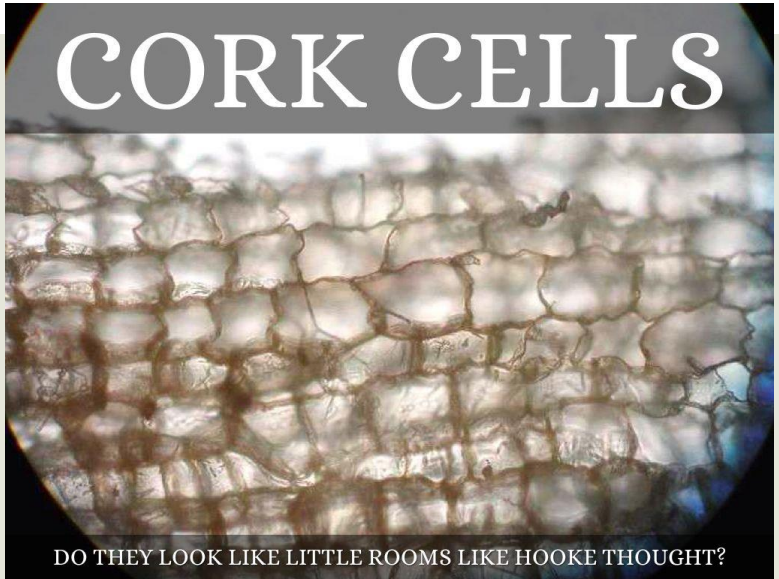
Robert Hooke

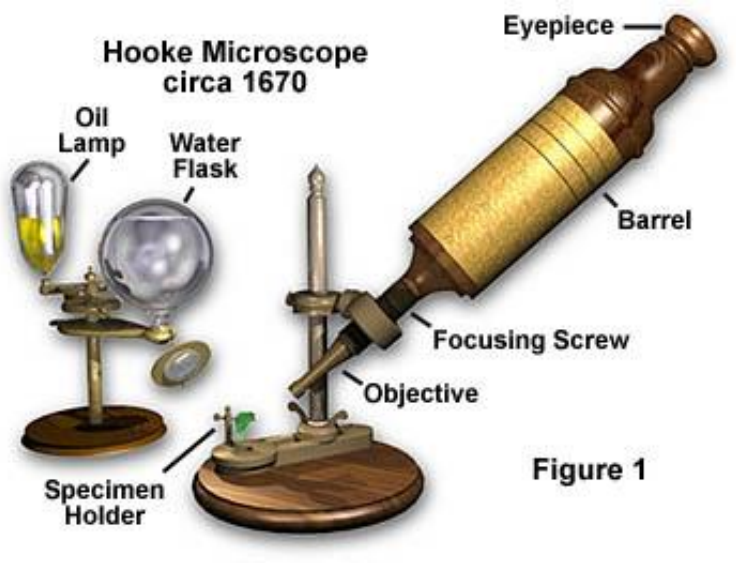
The Father of Microscopy

- **Hooke improved microscopes big time!**
- **Still wasn't very good. Only up to 30X magnification. All images had red and blue halos around them. Still blury. Not Cool!**
- **Coined the term 'cell' after observing pieces of cork under his lenses and comparing them to cells (rooms) of a monastery.**

Born : 1635

Died: 1703





Antonie Van Leeuwenhoek *(Lee-ooo-ven-hoook)*

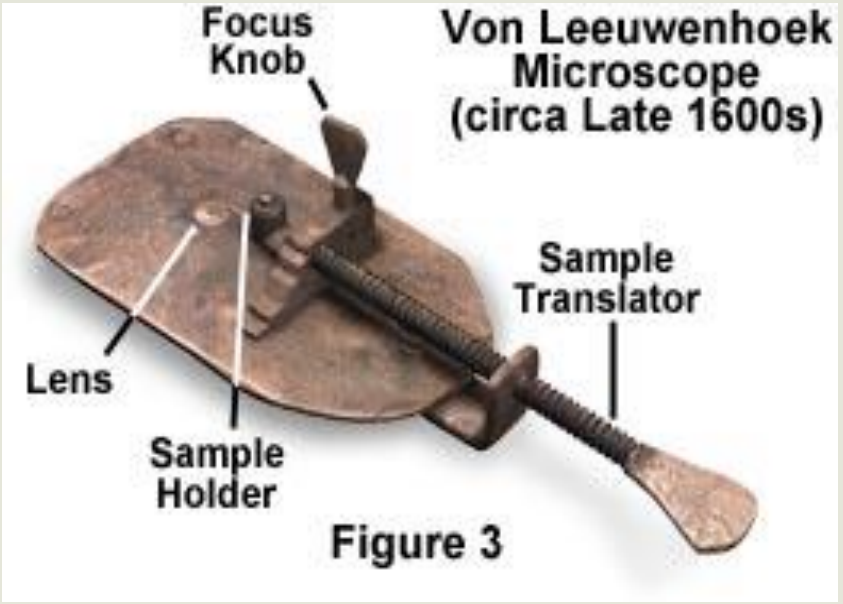
Born : 1632

Died: 1723

- **The Father of Microbiology and a super interesting guy.**
- **He was inspired by the work of Robert Hooke**
- **He made his own lenses which were superior to anything that existed in the world at that time.**
- **The first human to see bacteria, and spermatozoa (ie. sperm).**
- **He Said, "I saw 'little animals' in a drop of lake water."**
- **His lenses were so finely made that the things he saw would not be seen for another 100 years.**
- **He was NOT educated in science. He sold yarn for a living.**

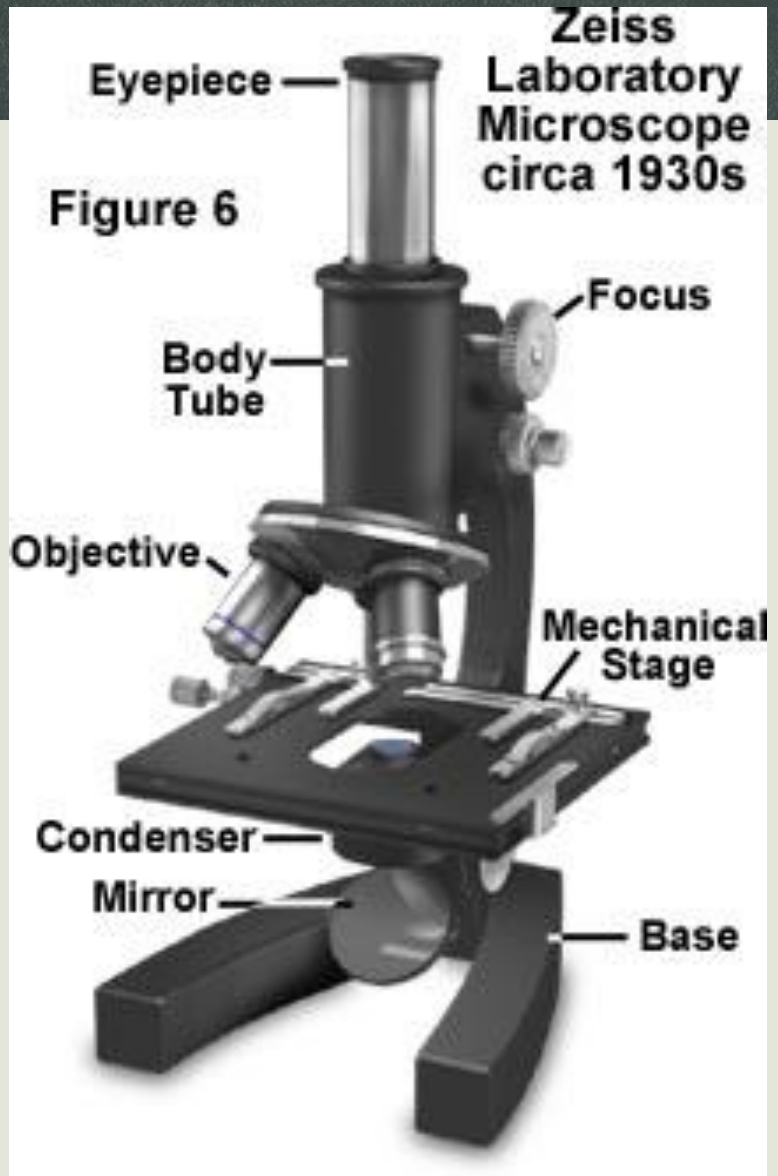
Leeowenhoek's Microscope.

- **Pros**: It allowed him to see bacteria and cells. Clarity was outstanding. The images were crystal clear.
- **Problem**: not enough magnification (only up to 200X)



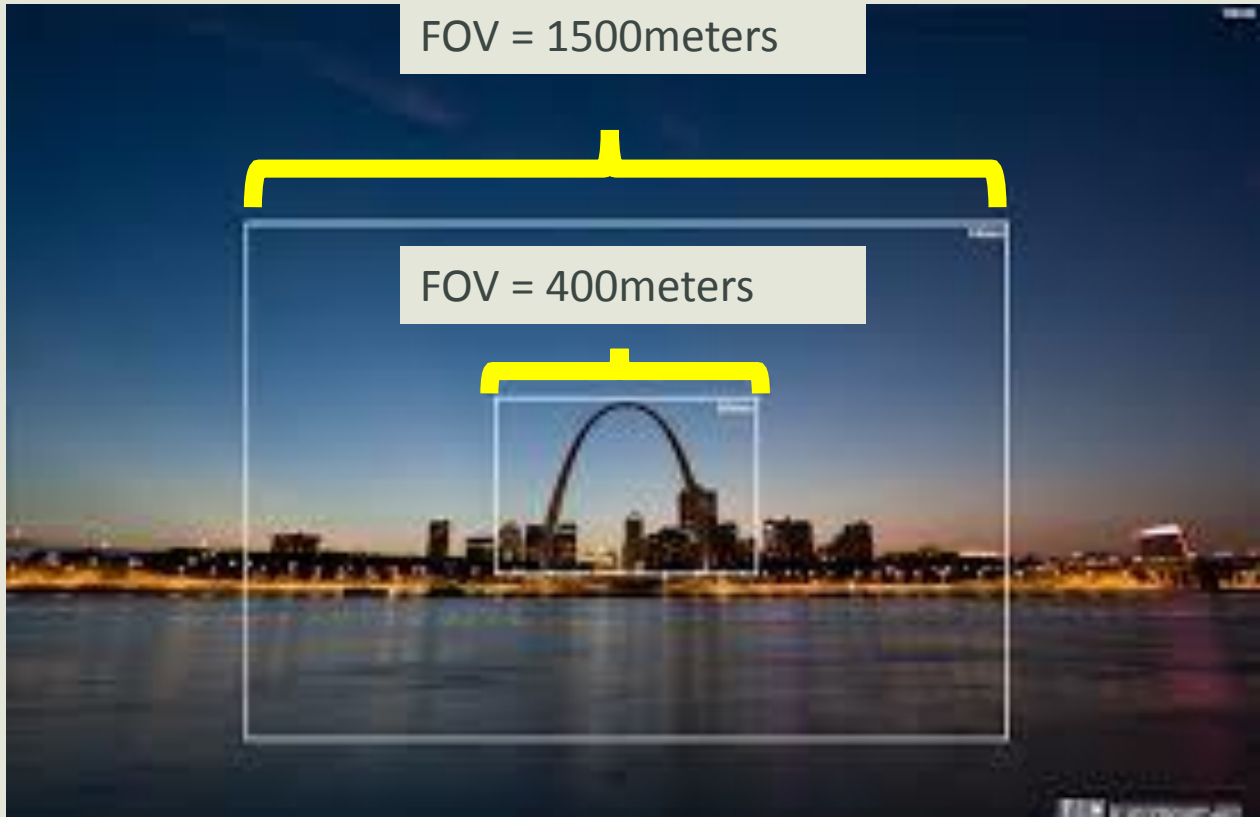
Modern Compound Microscope

- 1900s, started using iron instead of brass (cheaper)
- Only one eyepiece (monocular)
- Outside light source reflected onto mirror (no electricity)
- Very functional
- Still used today



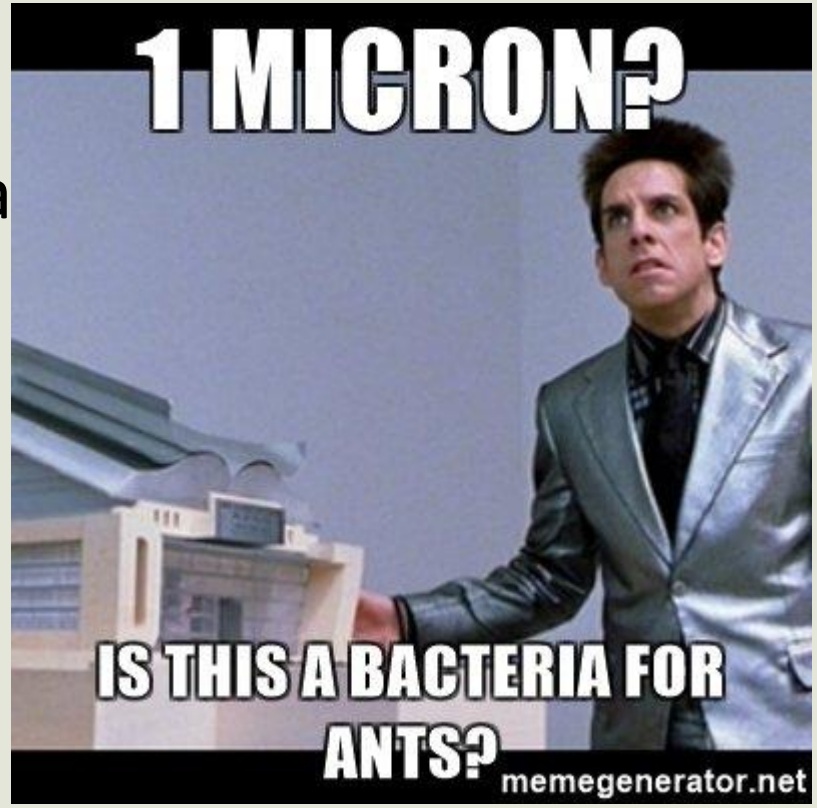
Field of View (FOV)

- Field of View (FOV) is how much of an image you can see.
- What does zooming into an image do to the FOV?



A New Unit of Measurement (µm)

- What is the smallest unit of measurement that you can think of?
- Perhaps you are thinking of a millimeter.
- A millimeter is pretty small, but not small enough to measure things like the length of a bacteria or a cell.
- We need even smaller units than a millimeter.
- Introducing…. The Micrometer (µm)…also called a micron.
- Split 1mm into 1000 sections and each section is called 1 µm.
- That is really small!

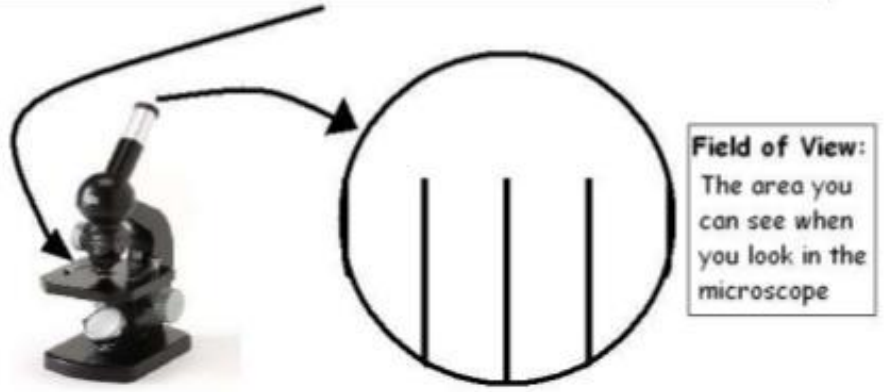


Cool Stats! MindBlowing!

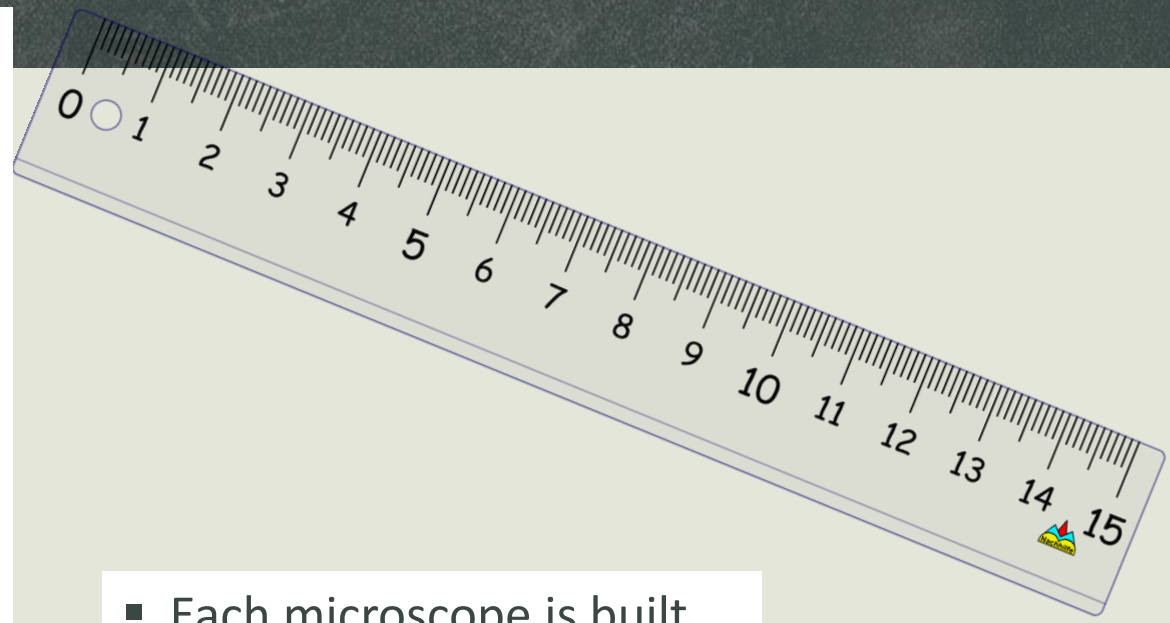
- Amoebas and Paramecia range between 250 µm and 750 µm.
- Plant and Animal Cells range between 10 µm and 100 µm .
- Bacteria can range from 0.2 µm to 10 µm in length.

How To Determine the Field of View of a Microscope?

Field of View (FOV)



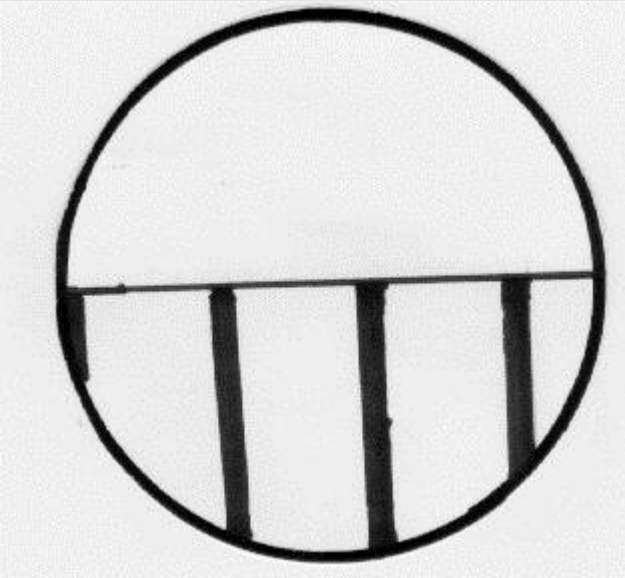
- To **MEASURE** FOV,
  1. Set the microscope to a low, medium, or high magnification by rotating the nosepiece
  2. Place a clear plastic ruler on the stage
  3. Focus the ruler until you see the field of view
  4. Measure the diameter of the filed of view in millimeters

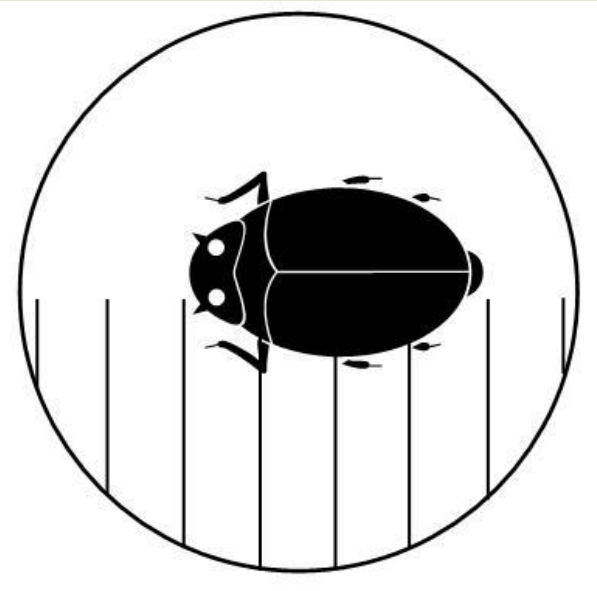


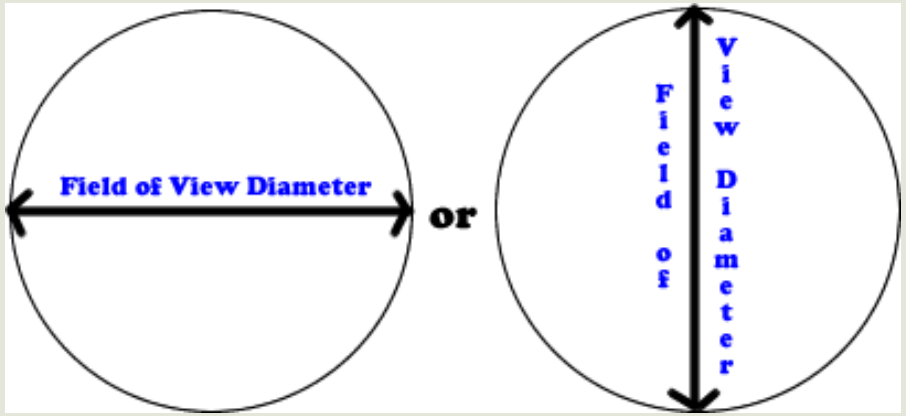
- Each microscope is built differently so the field of view will vary between different microscopes.

- Convert mm into µm (micrometers.) Recall that 1mm = 1000 µm

What is the field of view of the following microscopes on low power?







If you zoom in using medium and high power lens, your field of view changes.

When you zoom in from a low powered lens to a medium powered lens, does your FOV increase or decrease?

When you zoom in from a medium powered lens to a high powered lens, does your FOV increase or decrease?

Can we use a ruler to measure the FOV at medium and high magnification?

No! You would be so zoomed into the ruler, you would have a hard time finding the ruler markings. Solution….Math!

Question 1

How Long is this Amoeba on Medium Power?

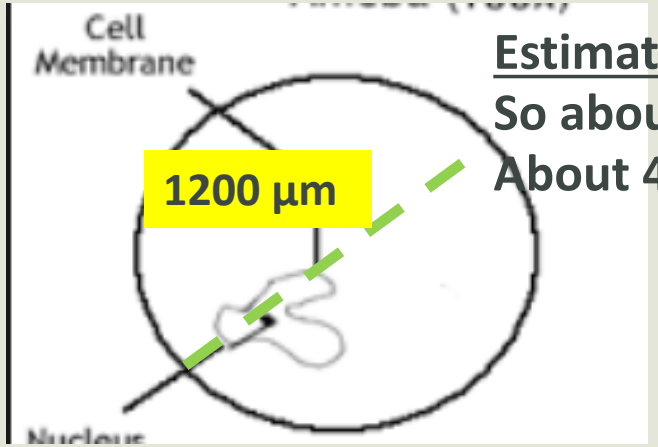
Occular Lens: 10X

Low Power Objective Lens: 4X

Medium Power Objective Lens: 10X

Low Power FOV = 3000 um

Medium Power FOV = ?????



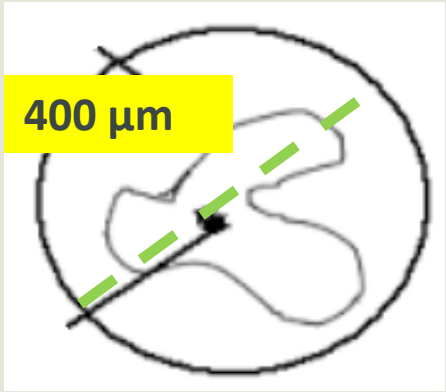
Estimation: About 1/3 of the FOV.
So about 1/3 of 1200um
About 400um long

$$\frac{\text{Magnification (Low Power)}}{\text{Magnification (Medium Power)}} = \frac{\text{FOV (Medium Power)}}{\text{FOV (Low Power)}}$$

Question 2

How Long is this same Amoeba, but nowon High Power?

Occular Lens: 10X
Low Power Objective Lens: 4X
High Power Objective Lens: 40X
Low Power FOV = 4000 um
High Power FOV = ?????

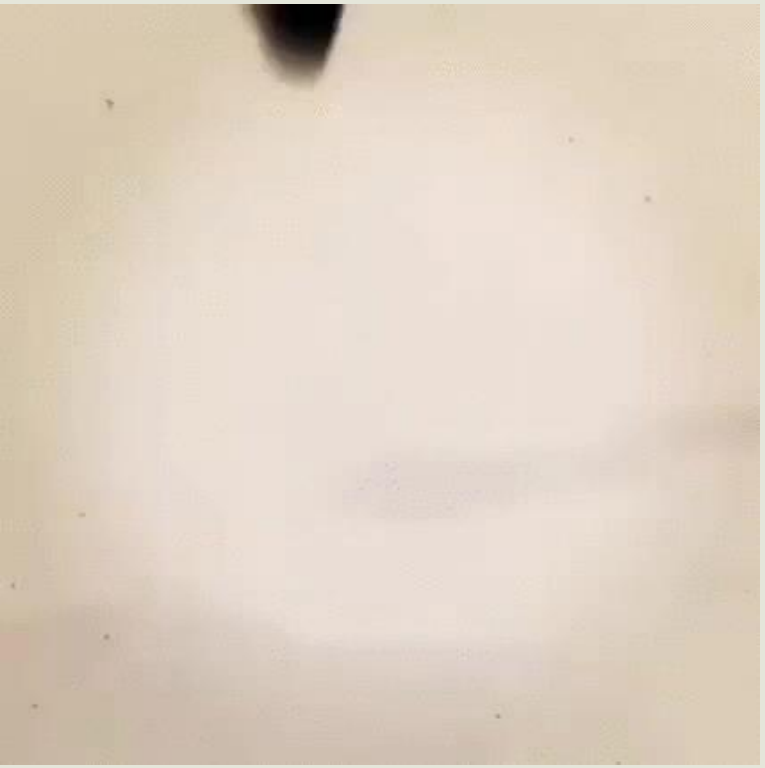


Estimation: About the full FOV. So about 400 um long.

$$\frac{\text{Magnification (Low Power)}}{\text{Magnification (High Power)}} = \frac{\text{FOV (High Power)}}{\text{FOV (Low Power)}}$$

Diffusion vs Osmosis

Diffusion



Diffusion is when highly concentrated fluids (liquids and gases) spread out in a space to areas of low concentration.

Think of how the spell of fart can spread through a room from its highly concentrated source.

Diffusion Of Gasses across a cell membrane.

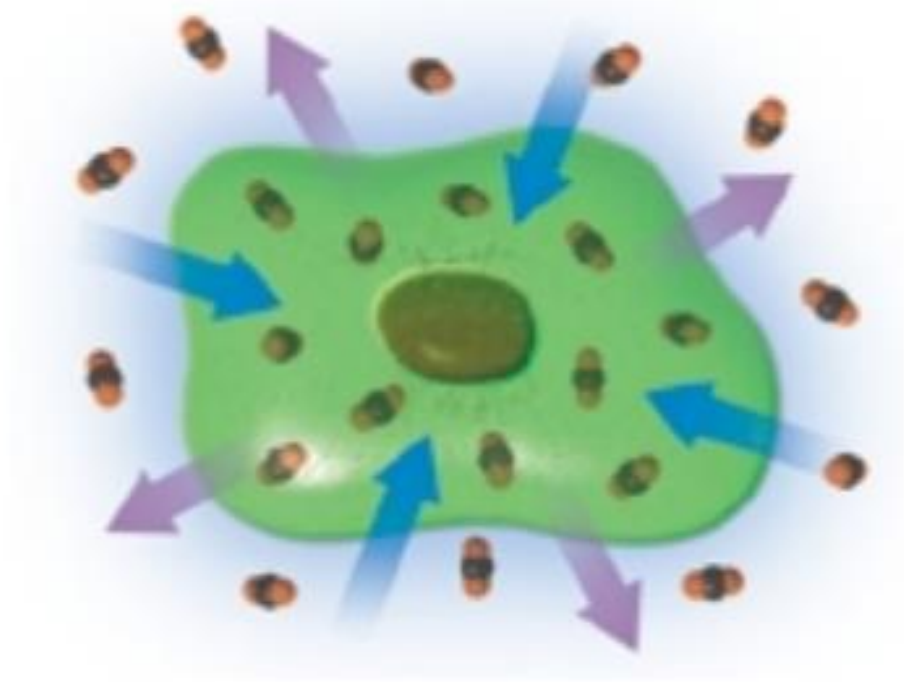


Figure 2.13A An equal concentration of carbon dioxide particles on both sides of the cell membrane. The particles move into and out of the cell at an equal rate.

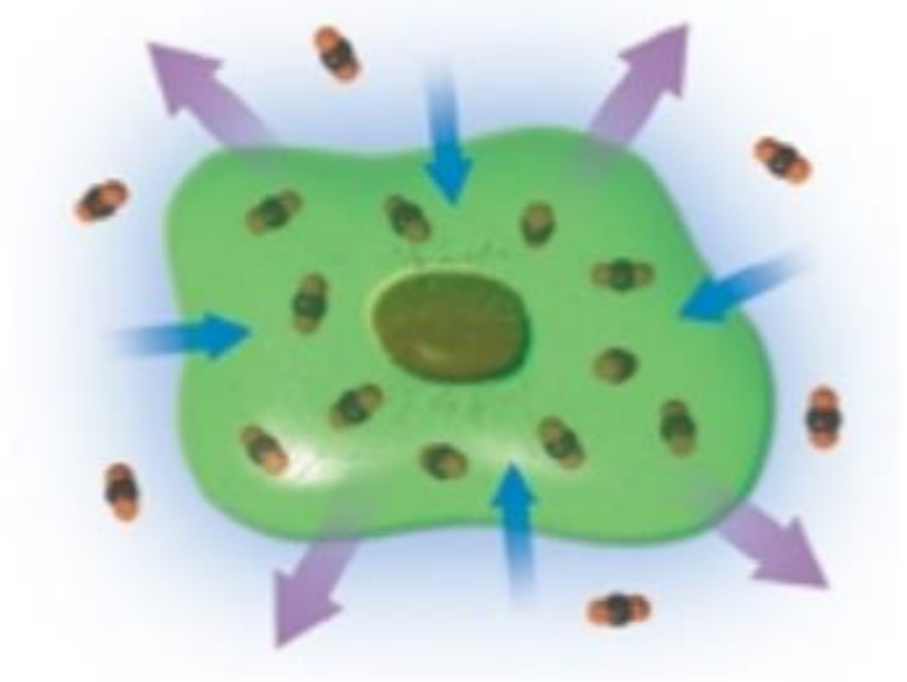
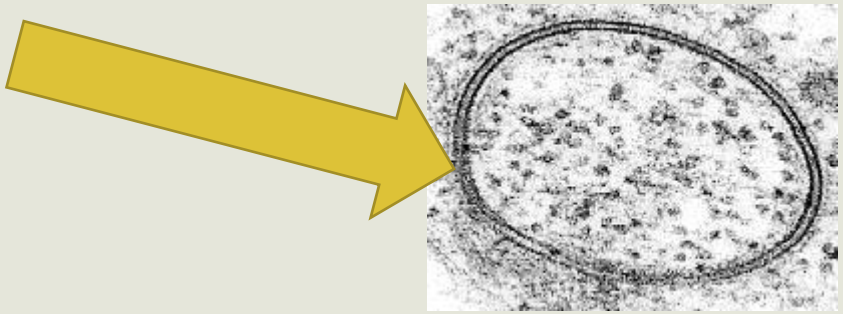


Figure 2.13B A greater concentration of carbon dioxide particles inside the cell. The particles move out of the cell at a greater rate than they move into the cell.

Osmosis

- **Osmosis is like diffusion, but it happens only when WATER moves across a barrier called a semi-permeable membrane.**
- **Osmosis is the movement of water across a semi-permeable membrane (also called a selectively-permeable membrane).**
- **This membrane can be anything that contains microscopic holes in it.**
- **Examples of semi-permeable membrane include cheese-cloth, egg skin, and cell membranes (the thin border that surrounds a cell)**



Hypertonic, Hypotonic, & Isotonic Solutions

- Hyper means “Lots”.
- Hypo means “few”.
- Hypertonic means the side that has more solute (salt, sugar, fats, proteins)
- Hypotonic refers to the side that has less solute (see above)
- Isotonic refers to both sides having equal amounts of solute.
- Water always moves to the HYPERtonic Side….cuz….cuz…cuz…that’s where the party is at!
- There is so much action and excitement going on in the hypertonic side that water desperately wants to join in.

Water Movement In Osmosis

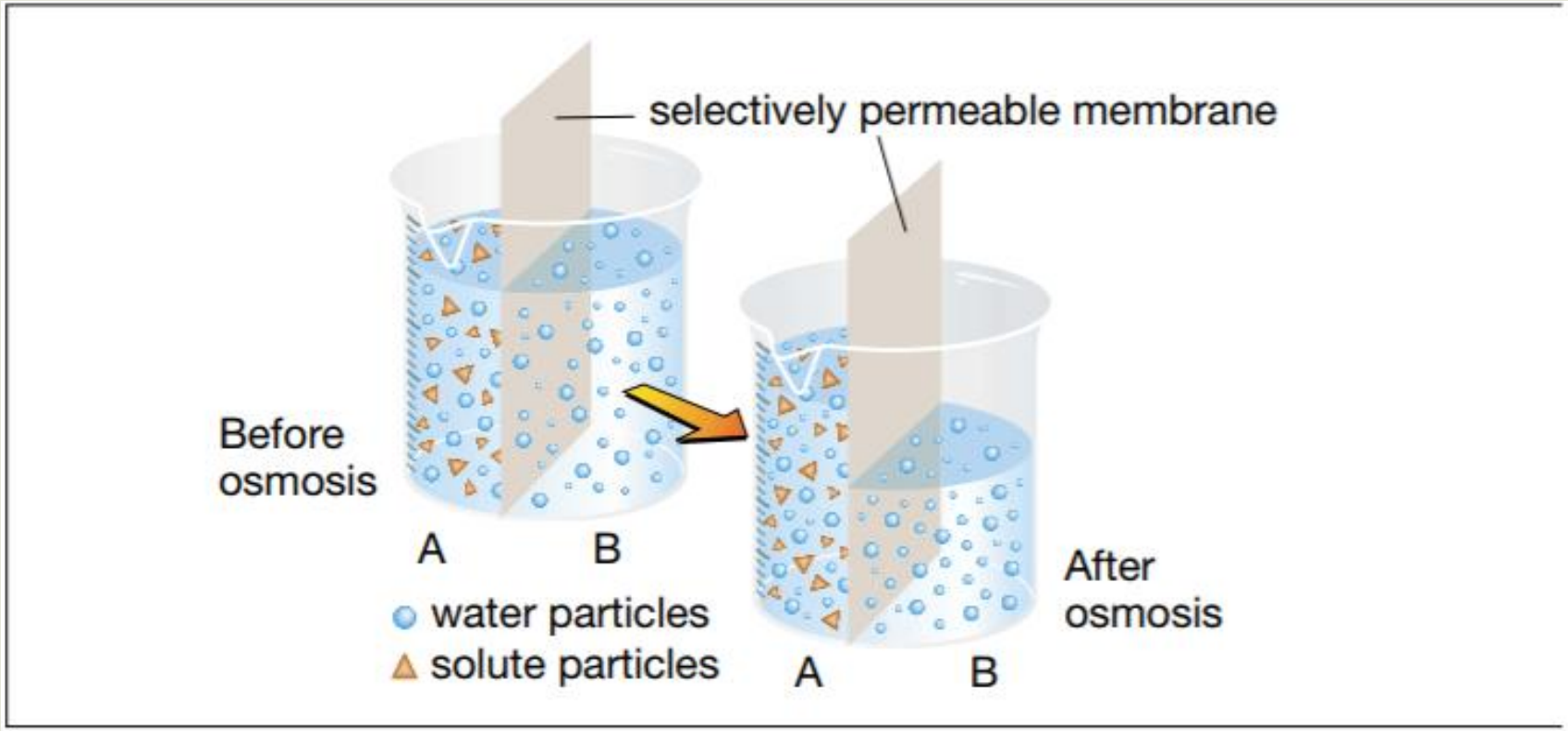
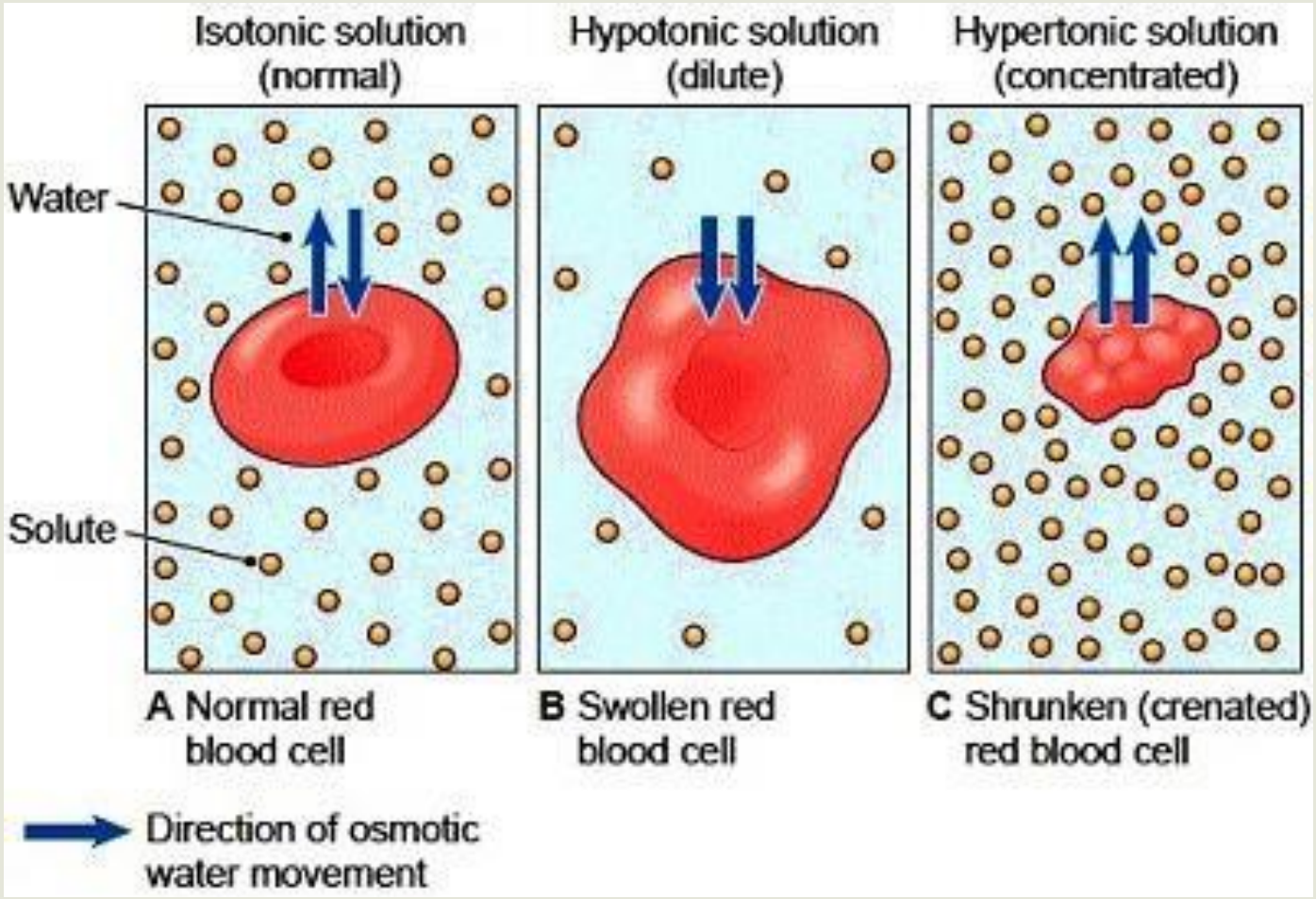
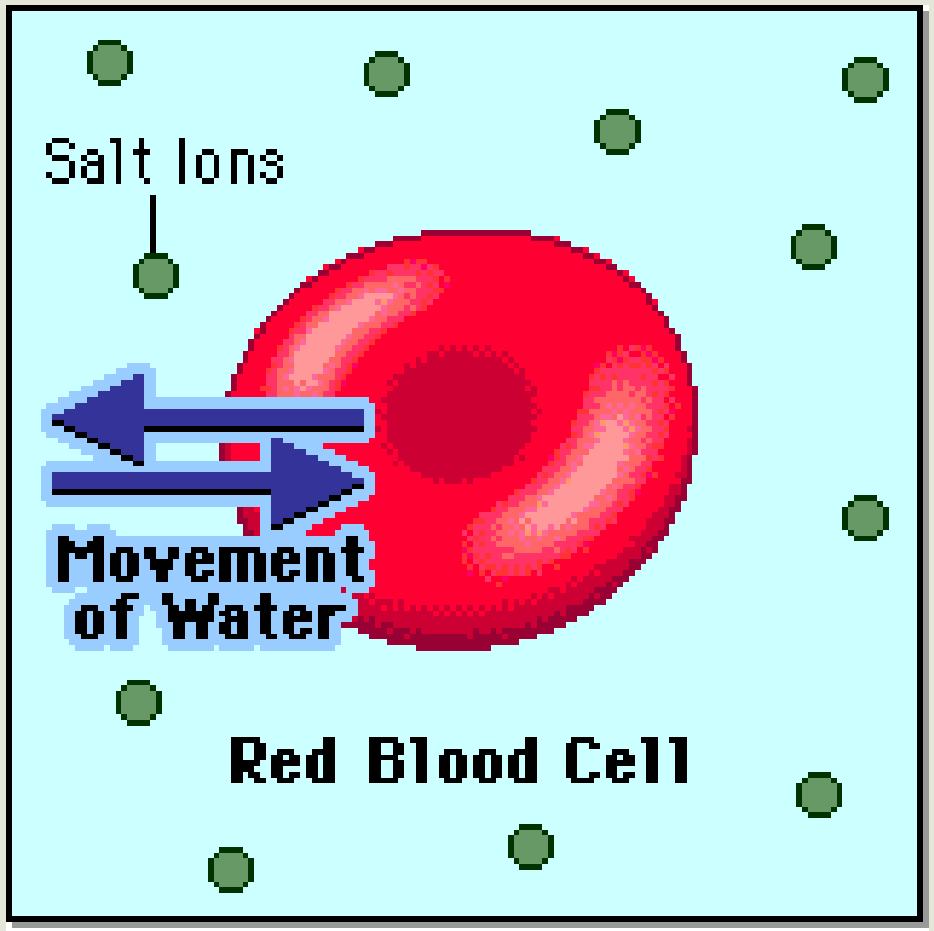


Figure 2.15 Water moves by osmosis from side B to side A inside the beaker. In this simplified diagram, which side represents a carrot stick and which side represents a glass of water?

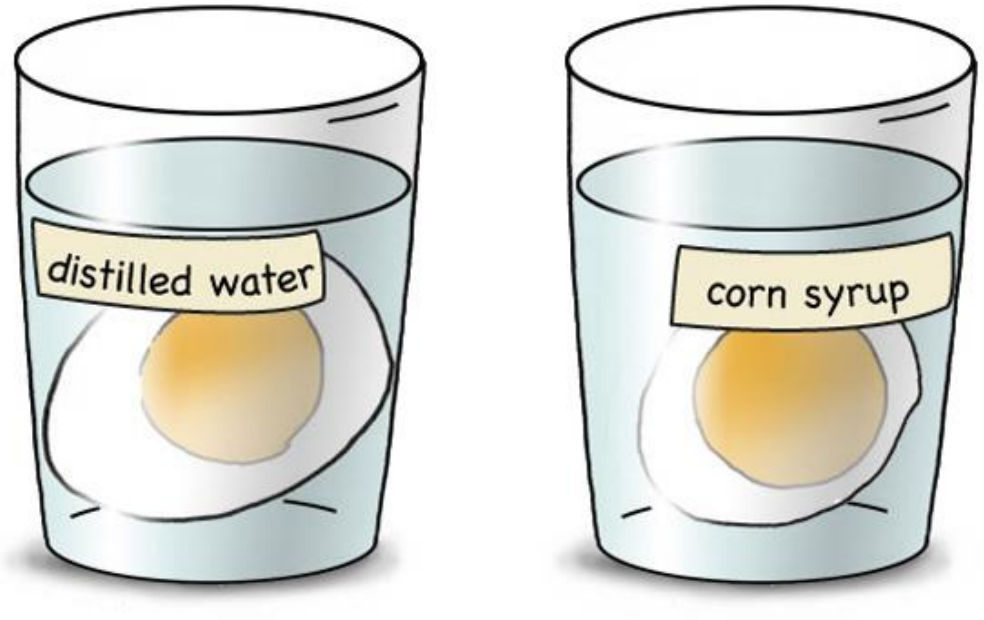
Water Movement In Osmosis



Explain what is happening in each segment of the animation below.

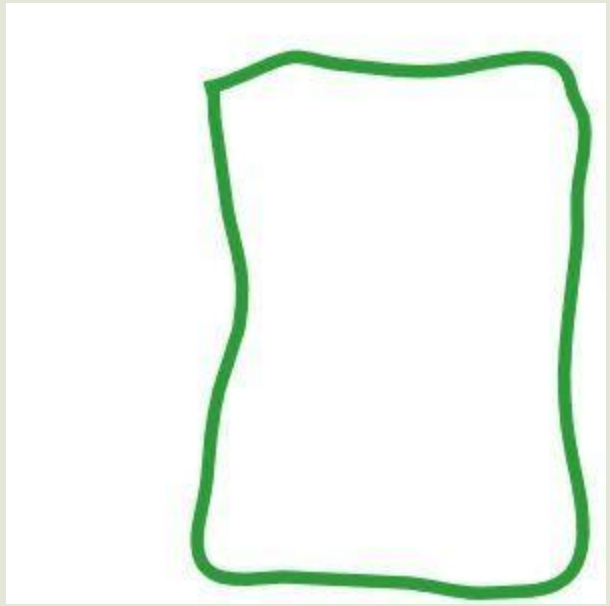


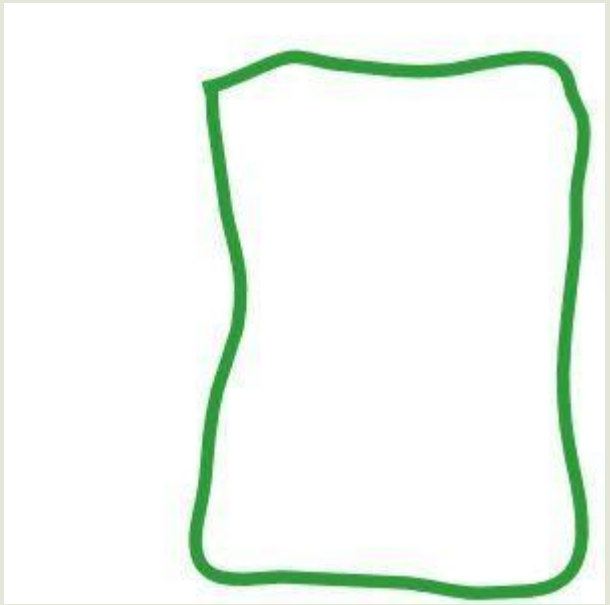
Predict what will happen to each egg? Match them to the after shots to the right. Explain why using hypertonic and hypotonic in your vocabulary.

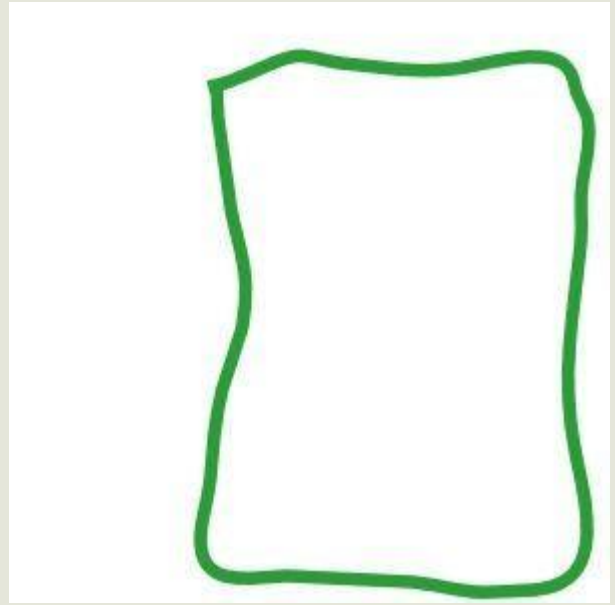


What will happen if the slug touches the salt? Why?

Draw and label a Hypertonic Cell, a Hypotonic Cell, and an Isotonic Cell







Plant vs Animal Cells

What Differences Do You Notice Between a Plant Cell (left) and an Animal Cell (right)?

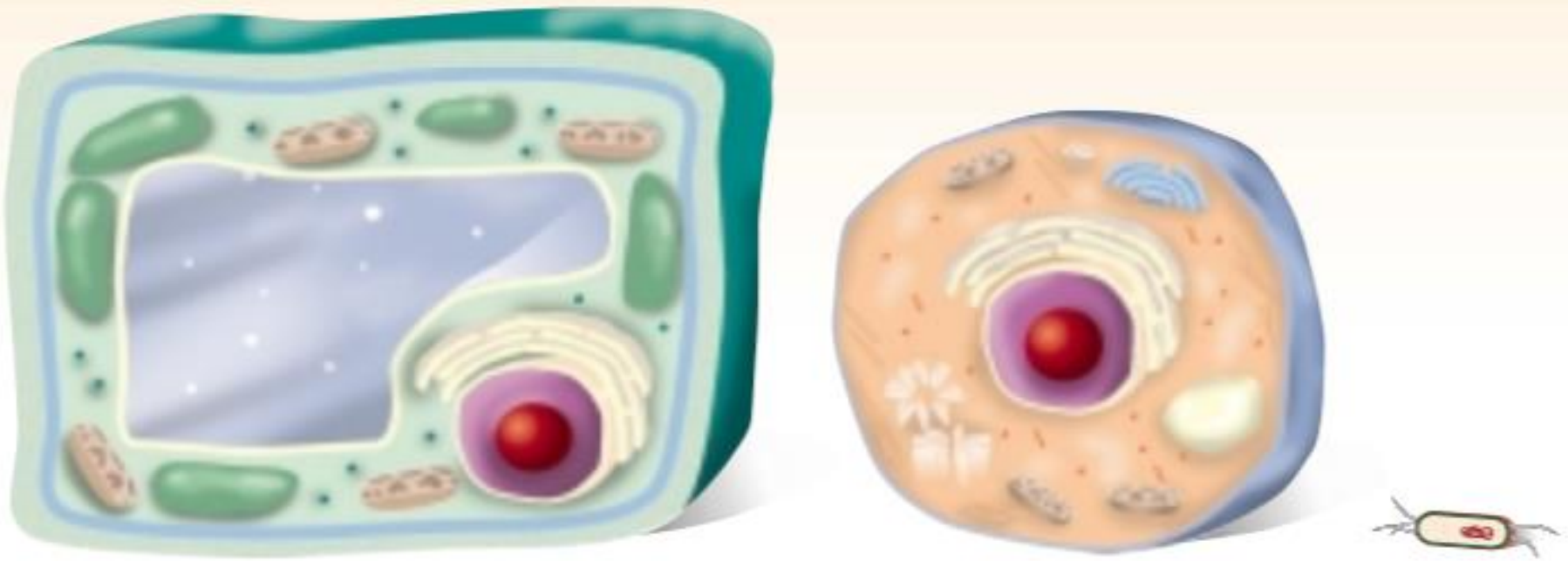
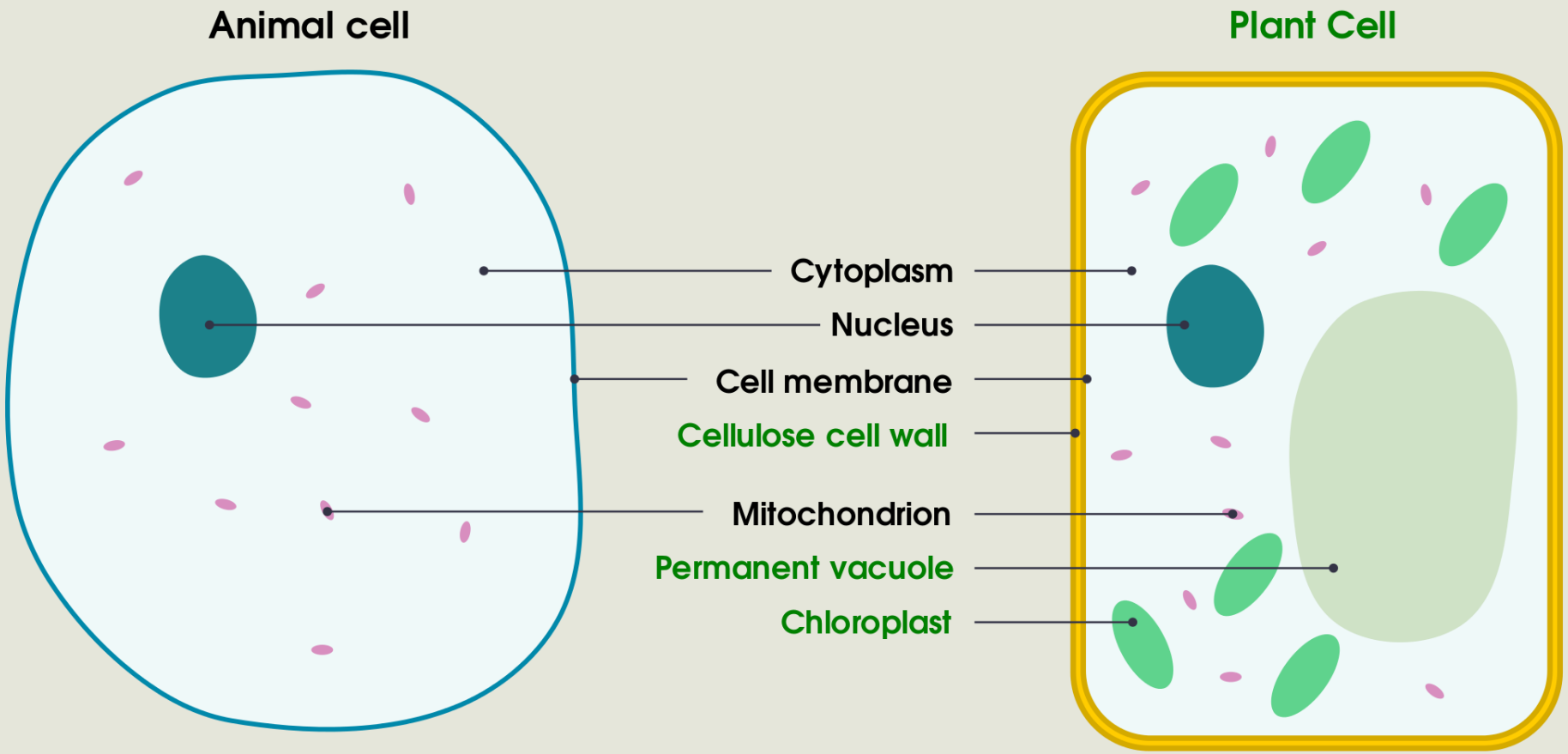


Figure 2.10 Relative sizes of a plant cell, animal cell, and bacterial cell

Circle The Organelles* That Are UNIQUE only to Plants



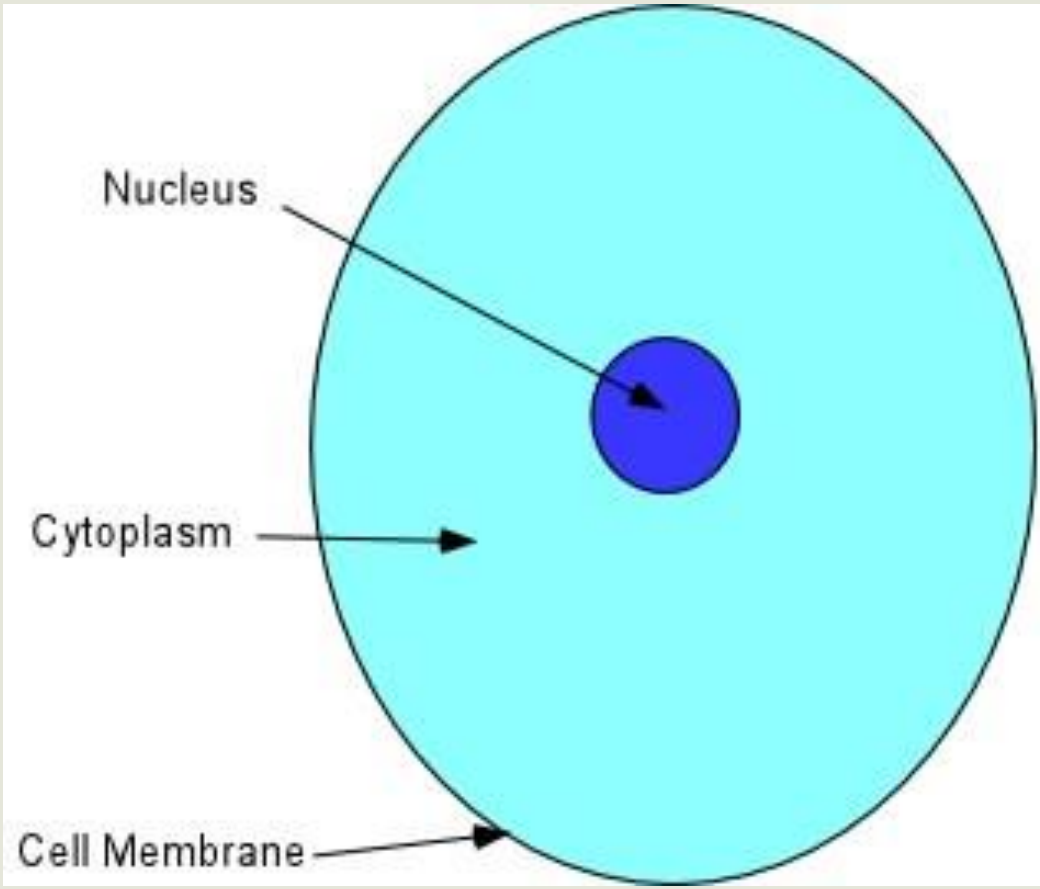
Organelles are 'little, tiny' organs found inside of a living cell. They carry out specific functions inside of the cell.

Cytoplasm, Cell Membrane, and Nucleus (Plants & Animals)

Nucleus: The brain of the cell. All of the DNA (code for life) can be found inside of the nucleus. Almost all plant and animal cells contain a nucleus. **Red blood cells** are an exception so that they can make more room to carry oxygen.

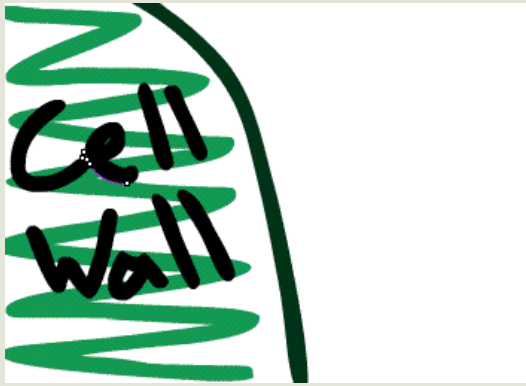
Cytoplasm: is the liquid-gel portion of the cell. It helps transport nutrients through the cell and gases like oxygen and CO2 into and out of the cell.

Cell Membrane: The fortress around the cell. It is thin & flexible and has microscopic holes to allow gases, nutrients and wastes to move into and out of a cell.



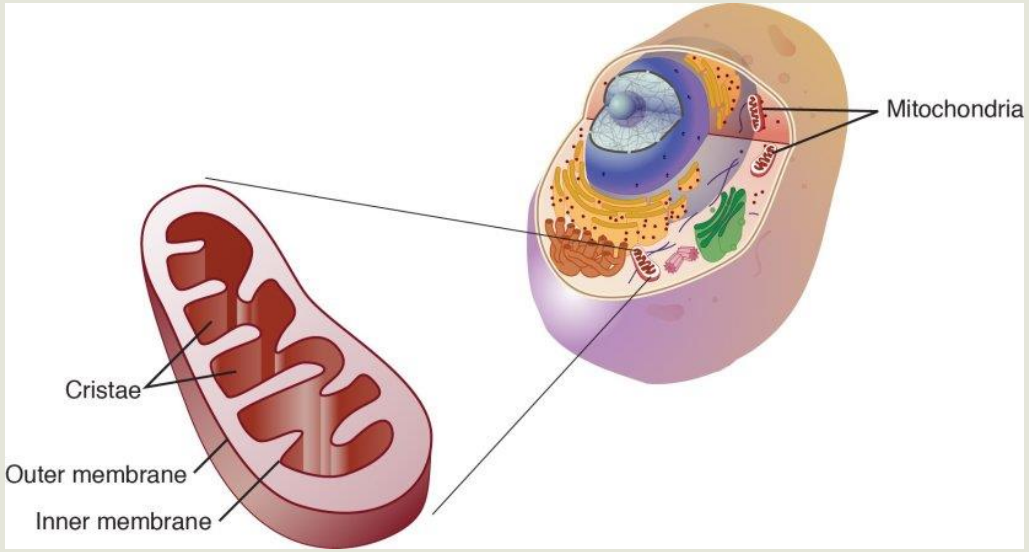
Cell Wall (Only in Plant Cells)

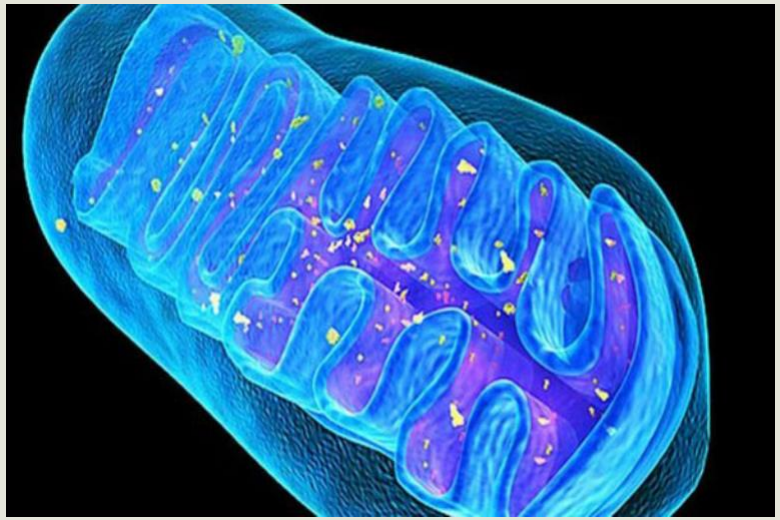
- Cell Walls surround each Plant Cell.
- Plants do not have bones, so they need another way to be strong so that the can stand up with support.
- Meet the cell wall. Cell walls are super thick and are made of a carbohydrate called **Cellulose**. Cell walls act like the bones of the plant. They are hard and crunchy. They protect the cell.
- They also contain tiny microscopic holes to allow certain materials to enter and leave.
- Every time you eat celery or lettuce, the crunch comes from your teeth breaking open the cell walls.



Mitochondria (Plants and Animals)

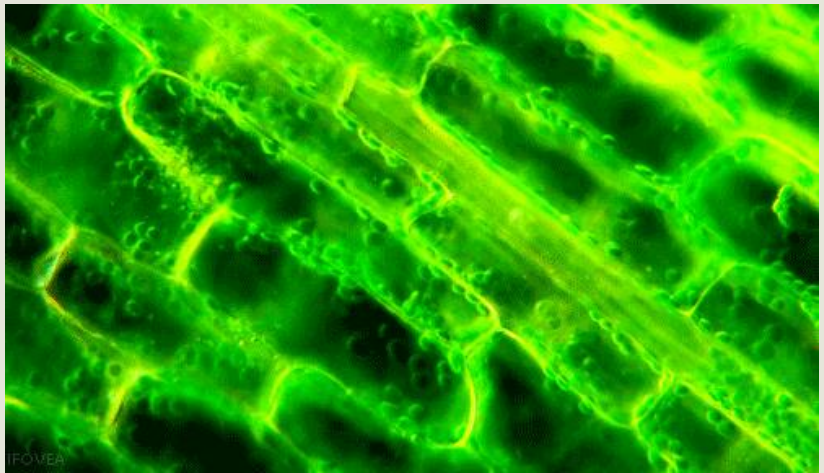
- The powerhouse of the cell!
- What does that even mean?
- The carbohydrates (sugars) that you eat get converted into energy here. The more mitochondria that you have, the more energy you can produce with your muscles. In which body part do you think birds hold most of their mitochondria?

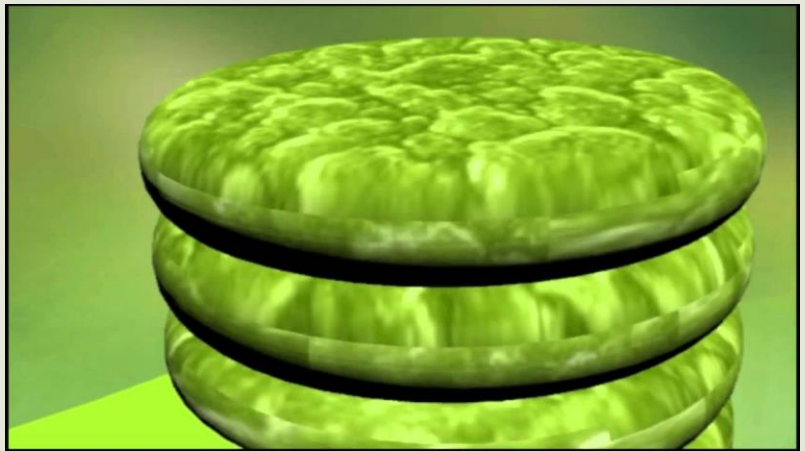




Chloroplasts (Plants Only)

- Chloro- means green.
- Chloroplasts contain a green pigment called **chlorophyll** that converts sunlight, water, and CO2 into sugar (carbohydrates).
- All the carbohydrates (sugars) in the world are made by chloroplasts. Without chloroplasts, we would have no ice cream, no bread, no fruits, no pancakes, no rice, and no sour candy. ☹
- Chloroplasts are the sugar making factories that also make plants green.

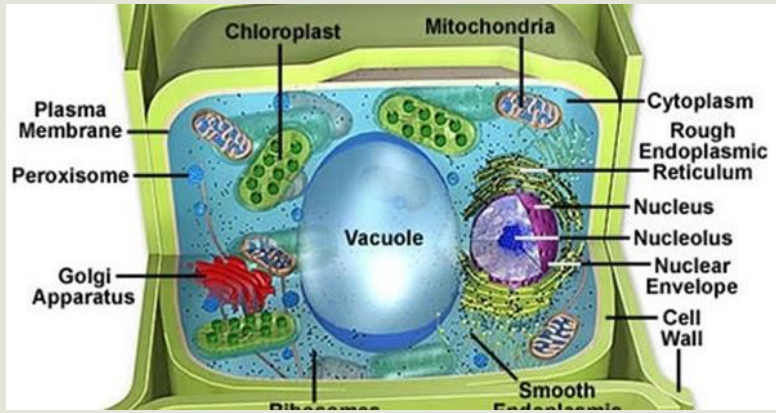


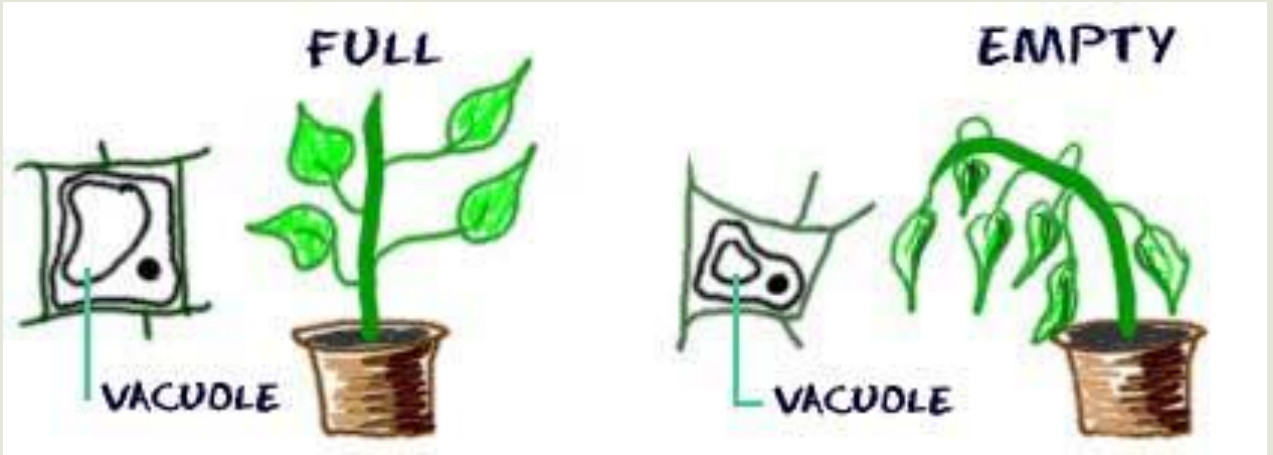


This Stuff……So Far!

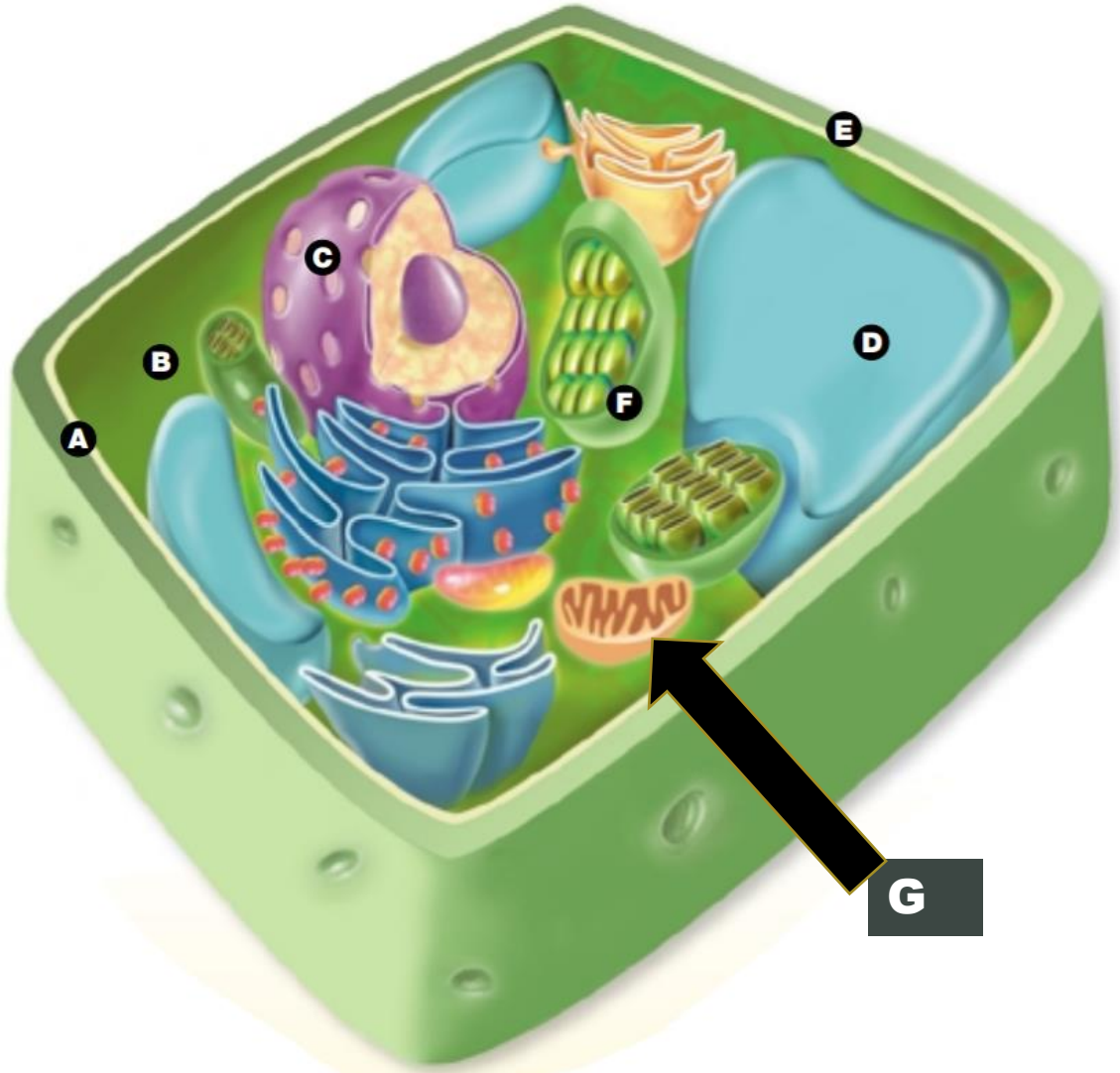
Vacuoles (Mainly in Plants)

- Some animal cells have vacuoles, but they are tiny and more numerous.
- Plant Cells have 1 large Vacuole in the center.
- It stores waste and water.
- It expands like a balloon inside of the cell when it fills up with water and it increases the pressure inside of the cell to keep the cell fully plump.
- When vacuoles drain and are not refilled, the plant cells shrivel up and the plant wilts (See animation to the right.)





Label the parts. Is it an Animal Cell or a Plant Cell?



A =

B=

C=

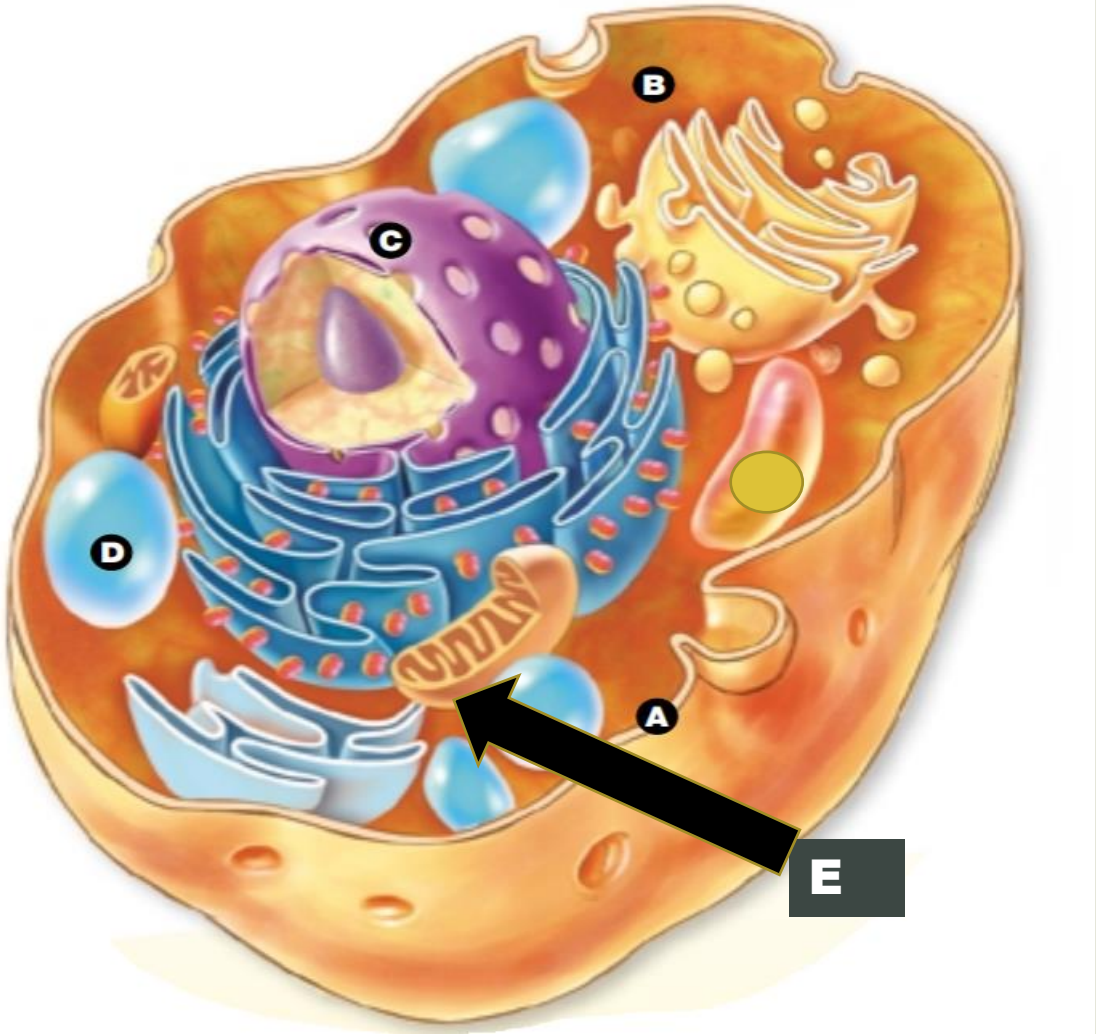
D=

E=

F=

G=

Label the parts. Is it an Animal Cell or a Plant Cell?



A =

B=

C=

D=

E=

Y’all Crushed It!!!