Lab 3- Cell Biology

CELL THEORY

- The Cell Theory states the following:

1. **All living organisms are composed of one or more cells**
2. **Cells are the fundamental units which possess all the characteristics of living things**
3. **New cells can only come into existence by the division of previously existing cells**

METRIC SYSTEM

- When we look at cells under the microscope, our usual measurements fail to work. In science, the metric system is used to measure objects and, as you will see, is vastly superior to our antiquated English system of measurement. Here are the basic units:

Length: meter (m)
centimeter (cm) = 10^{-2} m or 1/100 m
millimeter (mm) = 10^{-3} m or 1/1,000 m
micrometer (μm)= 10^{-6} m or 1/1,000,000 m
nanometer (nm)= 10^{-9} m or 1/1,000,000,000 m

Volume liter (L)
milliliter (ml) = 10^{-3} L

Temperature 100°Centigrade (C) = water boiling
0° C = water freezing

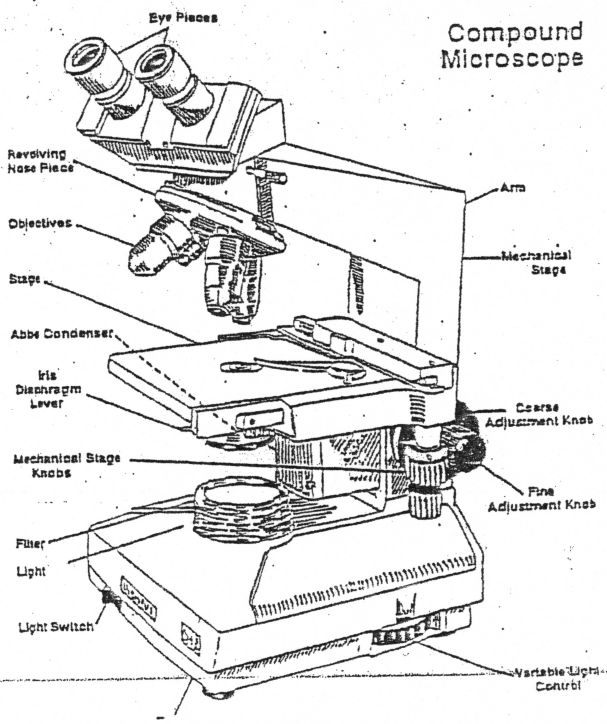
Questions:

670 nm = _____ μm; 0.224 m = _____ mm; 0.023 L = _____ ml; 750 ml = _____ L

USING THE MICROSCOPE

- Features of compound microscope:

(1) eyepieces (10X magnification)
(2) revolving nosepiece
(3) objectives (4X, 10X, 40X and 100X)
(4) arm
(5) stage with calipers
(6) condenser with iris diaphragm
(7) coarse and fine focus knobs
(8) mechanical stage knobs
(9) light switch
(10) variable light control
(11) base



Steps for using the compound microscope.

Finding and focusing on a subject:

1. Carry the microscope with both hands, one on the base and the other on the back.
2. Plug it in and turn the light on. If the light intensity is adjustable set it to 8.
3. Place your slide on the stage and secure with the slide clamp. Center the subject over the light coming through the stage using the stage control knobs. Make sure the condenser is all the way up.
4. Put the 4X (scanning) objective in place. Make sure it clicks.
5. Look through the oculars and adjust the focus by turning first the coarse and then the fine adjustment knobs.
6. Most microscopes have one fixed and one adjustable ocular. Focus first looking through the eye with the FIXED ocular using the main focus knobs. Then adjust the focus of the other eye using only the ocular adjustment for that eye by turning it.
7. Center the subject in the field of view using the stage control knobs.
8. Turn the nosepiece until the 10X (low power) objective clicks into place.
9. Focus using ONLY the fine adjustment knob.
10. Center the subject again using the stage control knobs.
11. Repeat steps 7-9 for the 40X (high power) objective.

Putting the microscope away:

1. Turn off the light and unplug the microscope.
2. Remove the slide and clean the stage of any water or oil
3. Turn the coarse focus knob to put the stage all the way down.
4. Put the 4X objective in place.
5. Center the ends of the slide clamp so it is not sticking too far out either side.
6. Wrap the cord around the base and carefully replace the microscope in the cabinet.

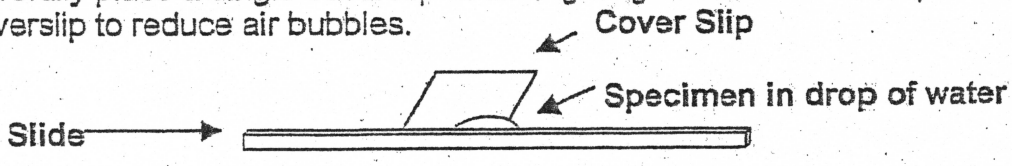
- **Magnification:**

Eye Piece		Objective lens		Total Magnification
10	X	_____ (scanning)	=	_____
10	X	_____ (low power)	=	_____
10	X	_____ (high power)	=	_____
10	X	_____ (oil immersion)	=	_____

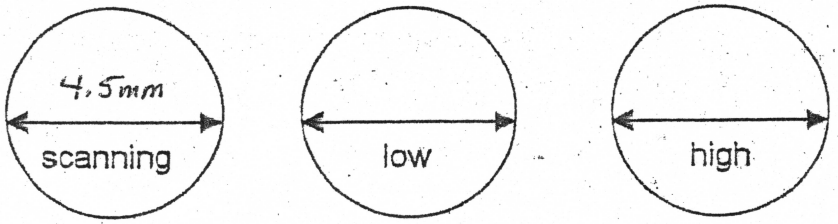
Wet Mount Exercise

Procedure:

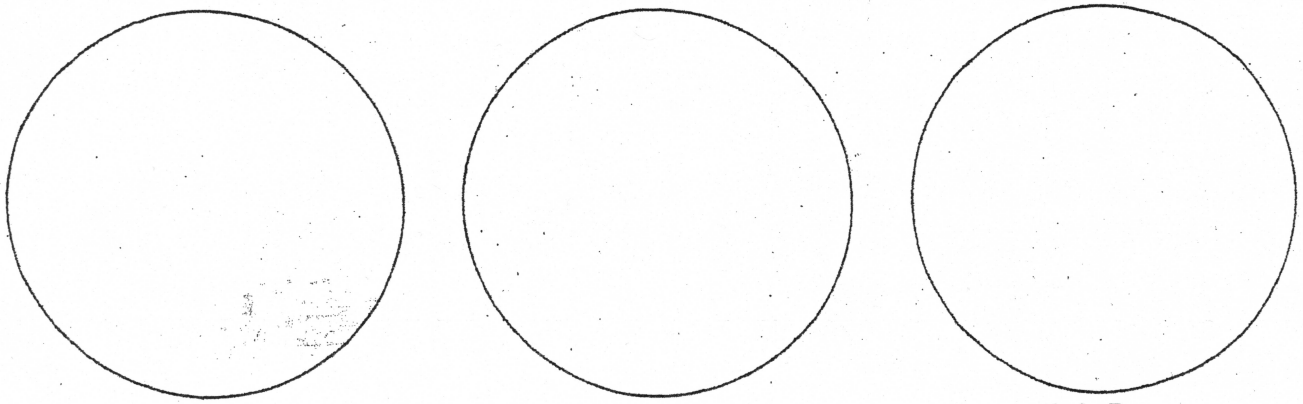
1. Place a drop of water on the center of a microscope slide.
2. Pull out a single hair from your head and place the bulb end (or root) in the drop of water.
3. Carefully place a single coverslip at an angle against the water droplet. Then drop the coverslip to reduce air bubbles.



- **Measurement:** The fields of view and approximate distances across for scanning, low, and high power are as follows:



- **Drawing:** Using the space below, draw your root hair at all three magnifications (not oil immersion). Determine the length of your specimen at each magnification and place this number under the measurement bar that you draw under the specimen.



ANIMAL CELLS

Human Cheek Cell Exercise

Procedure:

1. Take the flat end of a toothpick and scrape the lining of your cheek inside your mouth. Spread the sample on a drop of water you have already placed on a microscope slide.

2. Place a coverslip on top and carefully add one or two drops of methylene blue dye to the edge of your coverslip. Allow the dye to diffuse across as you examine under the microscope.

3. Draw a typical cheek cell that has been stained with dye and label the following: **cell membrane, cytoplasm,** and **nucleus.** Include a scale bar in your drawing.

Questions:

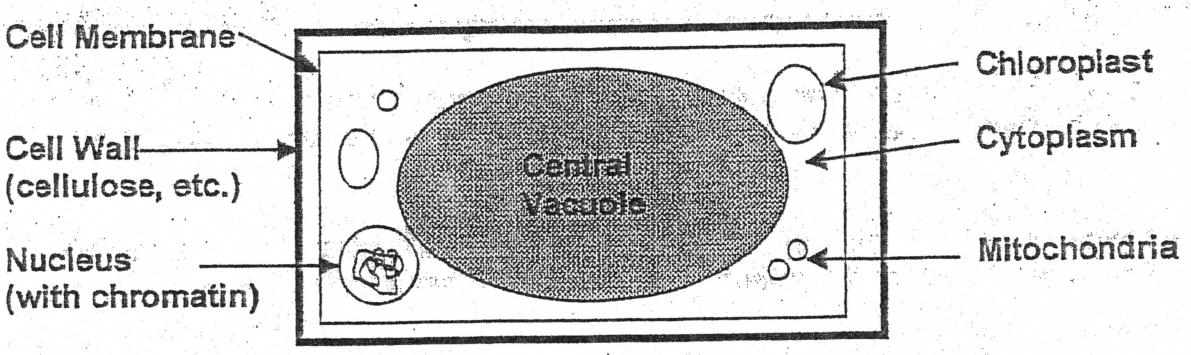
1. **Why do you think animal cells, such as your cheek cells, are generally smaller than plant cells? [hint: think about the differences between plant and animal cells]**

2. **Describe the endosymbiont theory explaining the possible origin of mitochondria, plastids (chloroplasts and other plastids in plants), centrioles (in animals), and flagella found in eukaryotic organisms.**

PLANT CELLS

- Plant cells can be differentiated from animal cells by these characteristics:

(1) **Cell Wall** (composed primarily of cellulose, a structural polysaccharide)
(2) **Central Vacuole** (at maturity may make up to 90% of cell volume)
(3) **Chloroplasts and other plastids** (organelles involved in photosynthesis, etc.)



Plant Cell Exercises

Procedures:

1. Make a wet mount of an *Elodea* (*Annacharis canadensis* in aquarium trade) leaf. View the leaf under the microscope (<u>always</u> begin under scanning power).

2. Search for any cellular organelles that you can find. Draw several cells under high power (400X) as carefully as you can. Identify and label the following: **cell wall, cytoplasm,** and **chloroplasts.** Include a scale bar below your drawing.

3. Next, make a wet mount of an onion skin, being sure to obtain as thin a section as possible.

4. Once you have several cells in focus under low power, add a drop of methylene blue to the edge of the coverslip. The stain should make the <u>nucleus</u> quite visible. Draw an onion cell at low or high power. Label the following structures: **cell wall, cytoplasm, central vacuole, nucleus,** and **nucleolus.** Include a scale bar in your drawing.

Questions:

1. **What is the length of an average *Elodea* cell? _____**

2. **What advantage do plants have with a rigid cell wall?**

3. **Where is the anthocyanin (red) pigment located within the onion cell?**

Protistan Cells

Procedure:

1. Place a drop of water from one of the protistan sample jars or pond water and place it on a depression slide.
2. Add one or two drops of Proto-Slo to the sample drop. This makes the water more viscous to slow down the swimming action of the protists.
3. Cover the depression with a cover slip and search for protists under scanning power. Increase to high power (40X objective) if possible.
4. Make detailed drawings of at least two different protists and attempt to identify them using the guided provided by your instructor.

If you are unable to find good examples of protists from these sources use the prepared slides provided.

Bacterial Cells

Procedure:

1. Obtain a prepared bacterial slide. Pick one on which you can see smudges of pink or purple with your naked eye. These are areas containing stained bacteria.
2. Examine the bacteria using the oil immersion objective and draw examples of each of the three different bacterial types. To use oil immersion proceed as normal from scanning power to high power then turn the 40X objective out of the way and place a drop of immersion oil on the slide. Then slowly rotate the 100X objective into the oil drop.
3. **DO NOT** accidentally put one of the other objectives into the oil it will ruin them! You may have problems finding your subject with the 100X objective but **DO NOT** go back to the 40X objective without first cleaning the oil off the slide.
4. Be sure to carefully clean up all oil using gauze patches and the lens cleaning solution. Be extra careful not to get the oil on other objectives.