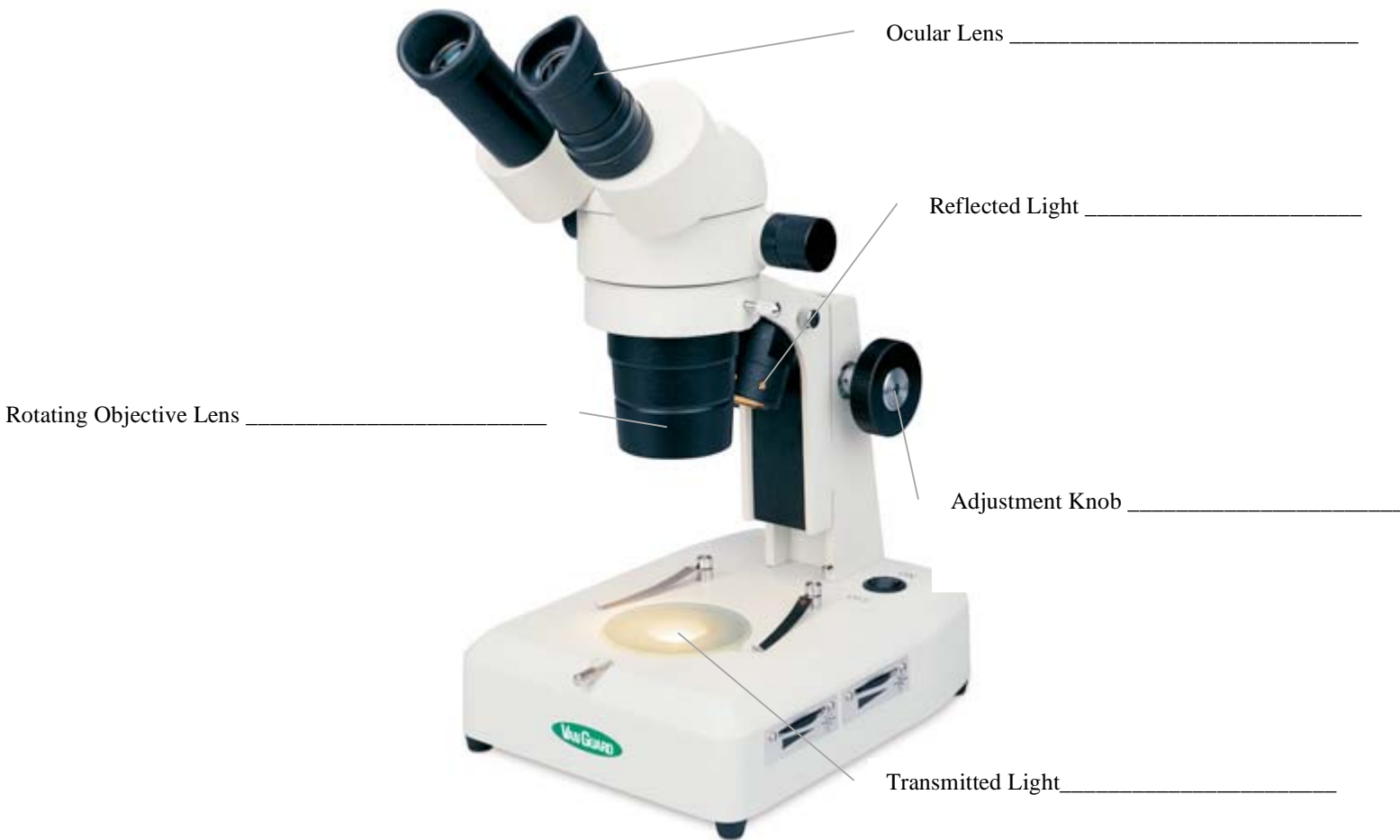


## Becoming an Expert Microscopist

The invention of the microscope was one of the most significant breakthroughs in the field of biology. On average, the smallest object that a human eye can see is about 0.2 mm in size. However, many of the most important basic parts of living things are no larger than 0.02 mm. It was only after the invention of the microscope that scientists could look at those parts.

### **I. Getting to Know the *Dissecting Microscope***

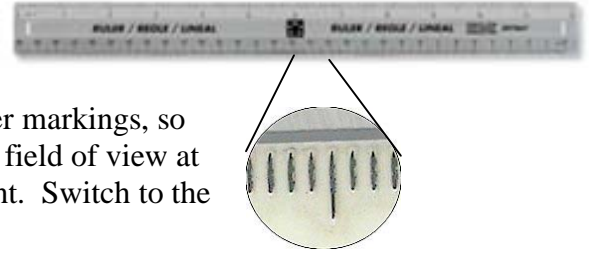
As you complete the activities, use the internet or information on this sheet to fill in the blanks below with the functions of the microscope parts. In each blank, briefly complete the sentence, "This part of the microscope is used to \_\_\_\_\_."



Images can be magnified at in 2 places on the microscope. You can use **the rotating objective lens** to choose either 1x magnification (no magnification) or 2x magnification (object magnified to twice actual size). In either case, the **ocular lens** will magnify the image by 10x (10 times). To figure out how much bigger the image is than the real object (*total magnification*), you multiply the power of the objective lens by the power of the ocular (always 10 on our microscopes). How many times bigger is the image than the real object if you choose the 1x objective? \_\_\_\_\_ How many times bigger is the image than the real object if you choose the 2x objective? \_\_\_\_\_

Place one of the clear plastic rulers under the dissecting microscope and turn on the light source.

Choose the 1x lens on the rotating objectives. Use the **adjustment knob** to focus on the edge with the millimeter markings, so they are in clear view. Read the markings to measure the field of view at 1x (width of the view). Switch to the 2x objective and measure the field of view again.



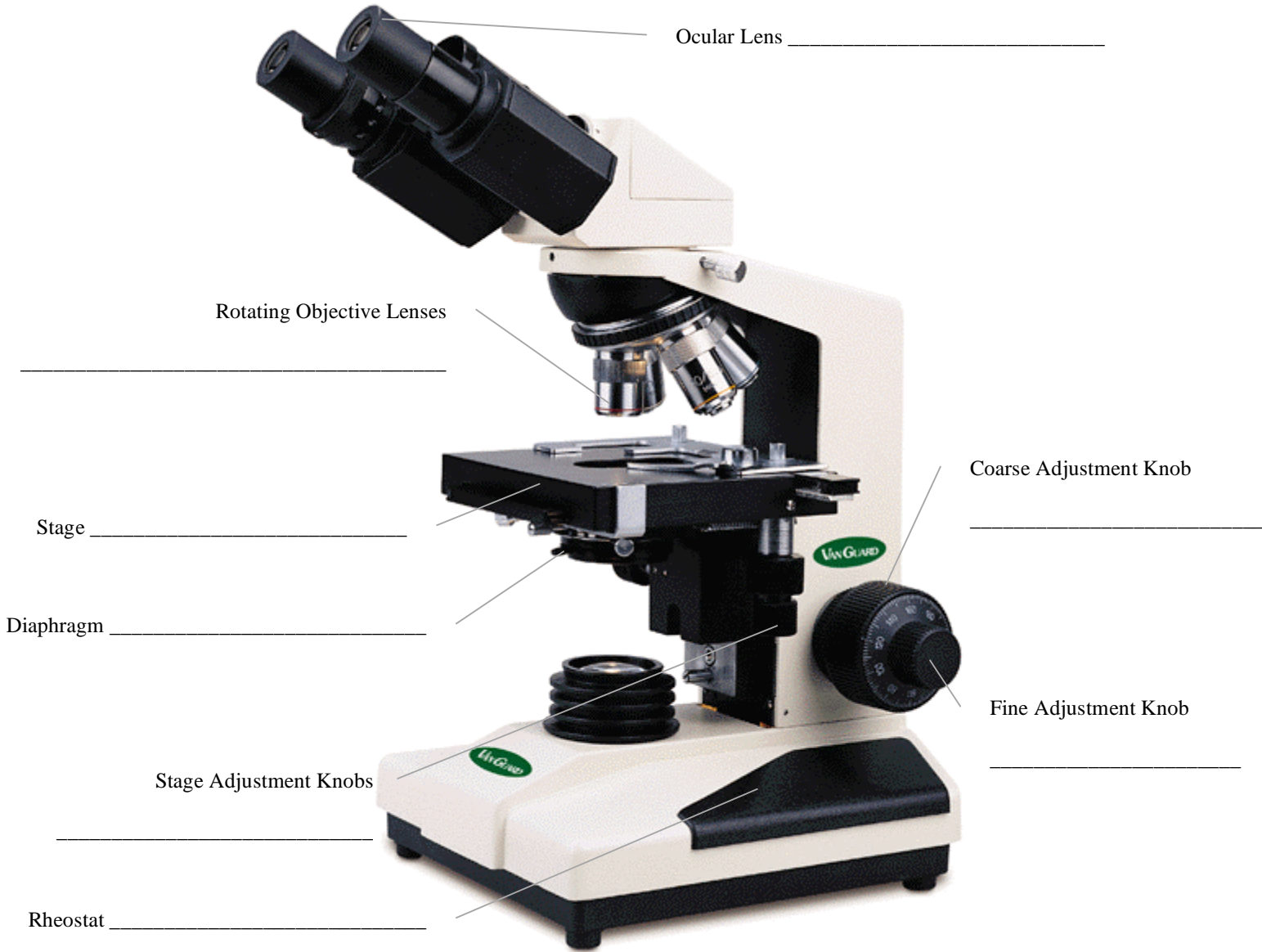
1x Objective Field of View = \_\_\_\_\_ 2x Objective Field of View = \_\_\_\_\_

**Transmitted light** shines up *through* an object and **reflected light** shines down from above an object. Use transmitted light, then reflected light, and then both to look at a guppy under the dissecting microscope. Draw the images below, using colored pencils to show how the views differed. Repeat the experiment with a dollar bill, a coin, a piece of paper, a page in your textbook, or any 2 other objects you have.

Object	Reflected Light	Transmitted Light	Both Lights
Guppy			
_____			
_____			

**II. Getting to know the *Compound Microscope***

As you complete the activities, use the internet or information on this sheet to fill in the blanks below with the functions of the microscope parts. In each blank, briefly complete the sentence, "This part of the microscope is used to \_\_\_\_\_."



On these microscopes, the **rotating objectives** allow you to choose between 4x, 10x, and 40x magnification. Just like on the dissecting scopes, the **ocular lens** magnifies all images by another 10 times. Total magnification is calculated the same way as for the dissecting scopes. How many times bigger is the image than the real object if you choose the 10x objective? \_\_\_\_\_ How many times bigger is the image than the real object if you choose the 40x objective? \_\_\_\_\_

The **stage** is the part that holds the microscope slide or object you're viewing. Use the clear plastic ruler to measure the field of view of each power just like you did on the dissecting microscope. To use the compound microscope:

1. **Always** begin and end with the **4x objective lens (lowest power) pointing down** and the **stage all the way up** (closest to lens)
2. Plug in the microscope and turn on the light
3. Place the slide (or in this case the ruler) on the stage under the lens
  - a. Note that once we start using slides, you never have to move around slides on the stage with your hands. Always use the **stage adjustment knobs** to move the slide forward, backward, left, or right on the stage.
4. Use the **coarse adjustment knob** to focus the markings at lowest power
5. Adjust the **rheostat** (dimmer switch) and the **diaphragm** to set a light level that's most clear and comfortable to your eyes.

4x Objective Field of View = \_\_\_\_\_

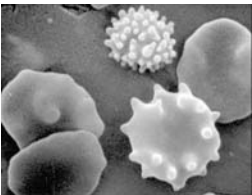
6. Make sure the markings run through the center of your view. *Without changing any other settings*, switch up to the 10x objective lens.
7. The image should still be nearly in focus. Use the **fine adjustment knob** to get the image completely into focus. *Never use the coarse focus knob with the 10x or 40x objectives!*

10x Objective Field of View = \_\_\_\_\_


8. If there is enough room on the stage, repeat steps 6 & 7 to move up to the 40x objective lens.

40x Objective Field of View = \_\_\_\_\_

### III. Making Your Own Slides to View Cells



One of the first scientific theories you will learn about is *Cell Theory*. Cell theory says that all living things (whether bacteria, algae, sea anemones, or humans) are made of cells. Cells always include a *fatty membrane* that separates them from the outside world, but different cells can also have many special features.

**the-o-ry** 

1 popularly, a mere conjecture, or guess

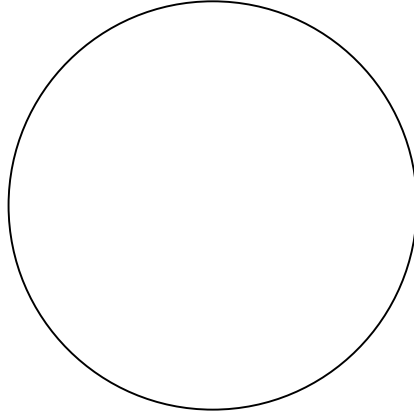
→ 2 in science, a well-substantiated explanation of some aspect of the natural world

Note: The word *theory* has a different meaning in science than in popular culture!

First you will stain and view *your own* cells under the microscope.

1. Gently scrape some cheek cells from the inside of your cheek with a clean, flat toothpick.
2. Spread the scrapings in the middle of a clean slide. Wait until the slide dries.
3. Put a couple drops of *methylene blue* on the cheek scrapings and wait 1-2 minutes. Methylene stains the DNA and gives the whole cell a blue tint.
4. Gently rinse the methylene blue off with a couple drops of water.
5. Add a small drop of water to the scrapings, and add a cover slip as instructed.
6. Follow the steps above to view your cheek cells at 4x, 10x, and 40x powers. Remember to use the stage adjustment knobs (not your hands) to move the slide on the stage.

Draw your cheek cells at high power. Label the **cell membrane**, **nucleus**, and **cytoplasm**.

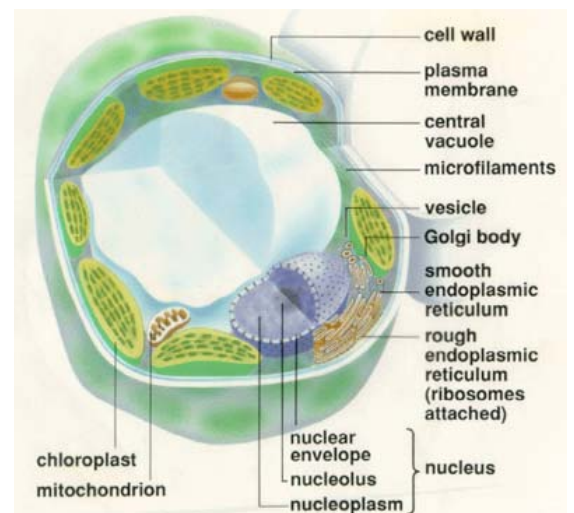
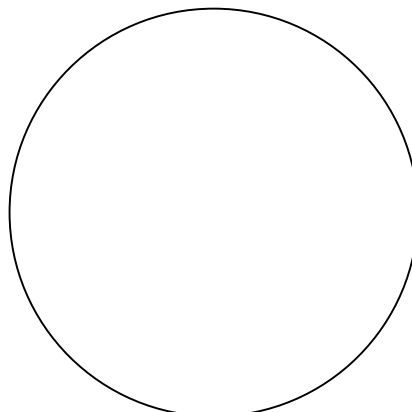


Next you will make a slide to view *plant cells*

Since plants lack bony skeletons, their cells have a stiff and sturdy *cell wall* outside of their membranes that gives them structure. Animals do not have these walls in their cells. The insides of most of the plant cells are almost entirely filled with water (*water vacuole*) which pushes against the cell wall to provide stiffness. Plant cells also often have distinct *chloroplasts* to aid in photosynthesis.

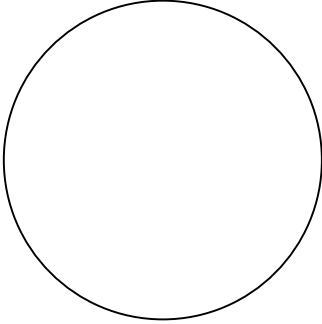
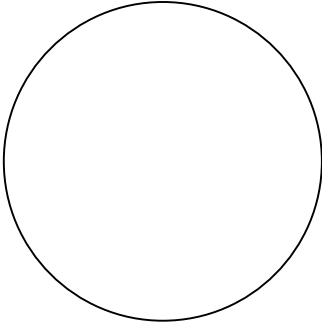
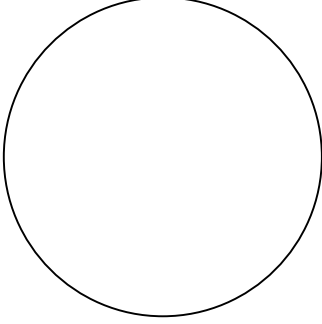
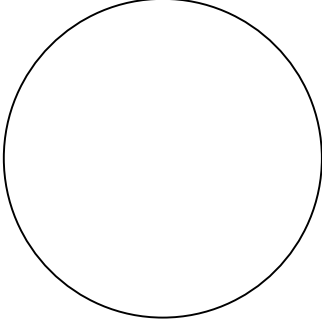
1. Place one *Elodea* leaf on a slide in a drop of water.
2. Add a cover slip and focus on the leaf at 4x, 10x, and 40x as instructed above.
3. Note that at 40x you must move the fine adjustment knob back and forth to see the full thickness of the leaf.

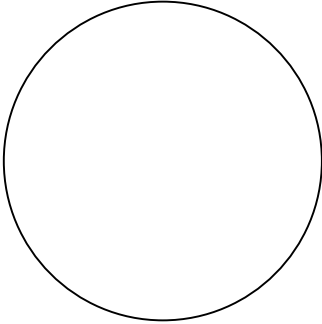
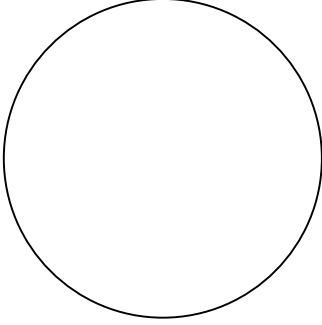
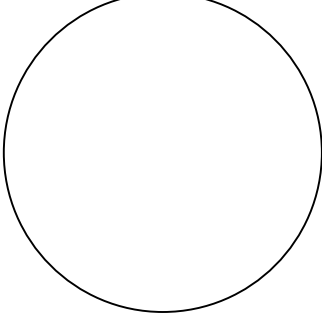
Draw the *Elodea* leaf cells at high power. Label the **cell wall**, **water vacuole**, and **chloroplasts**.



**IV. Searching for Evidence of Cell Types**

You will now make some additional wet slides (*wet mounts*), and also view some slides that are already prepared for you. Draw the cells from each slide at high power. Label the following cell parts *if you think you see them* (hint - only *some* of these things will be visible in each slide): **cell membrane, cytoplasm, nucleus, cell wall, water vacuole, chloroplasts**. Based on your observations, decide as a team whether the cells in each slide are *animal* or *plant* cells.

Slide	Drawing of Cell w/Labels	We think these cells are from (circle one)	What is the <i>evidence</i> for your opinion?
Paramecium Wet Mount		<p>Animals</p> <p>Plants</p>	
Spirogyra Wet Mount		<p>Animals</p> <p>Plants</p>	
Prepared Slide 1		<p>Animals</p> <p>Plants</p>	
Prepared Slide 2		<p>Animals</p> <p>Plants</p>	

Slide	Drawing of Cell w/Labels	We think these cells are from (circle one)	What is the <i>evidence</i> for your opinion?
Prepared Slide 3		<p>Animals</p> <p>Plants</p>	
Prepared Slide 4		<p>Animals</p> <p>Plants</p>	
Prepared Slide 5		<p>Animals</p> <p>Plants</p>	

**Reflection Questions (answer on back):**

1) List 3 things that you think are common problems or difficulties with using a compound microscope to view slides (perhaps problems that came up while your team was doing today’s lab). What techniques did you develop or use in order to most easily bypass these problems and get a clear view of cells?

2) You’re talking to a non-scientist friend over the phone who is looking at pictures of different cells for biology class. Describe to your friend what specifically she should look for in order to tell if the cells are plant or animal cells? What would those features look like in the pictures of cells she has?

