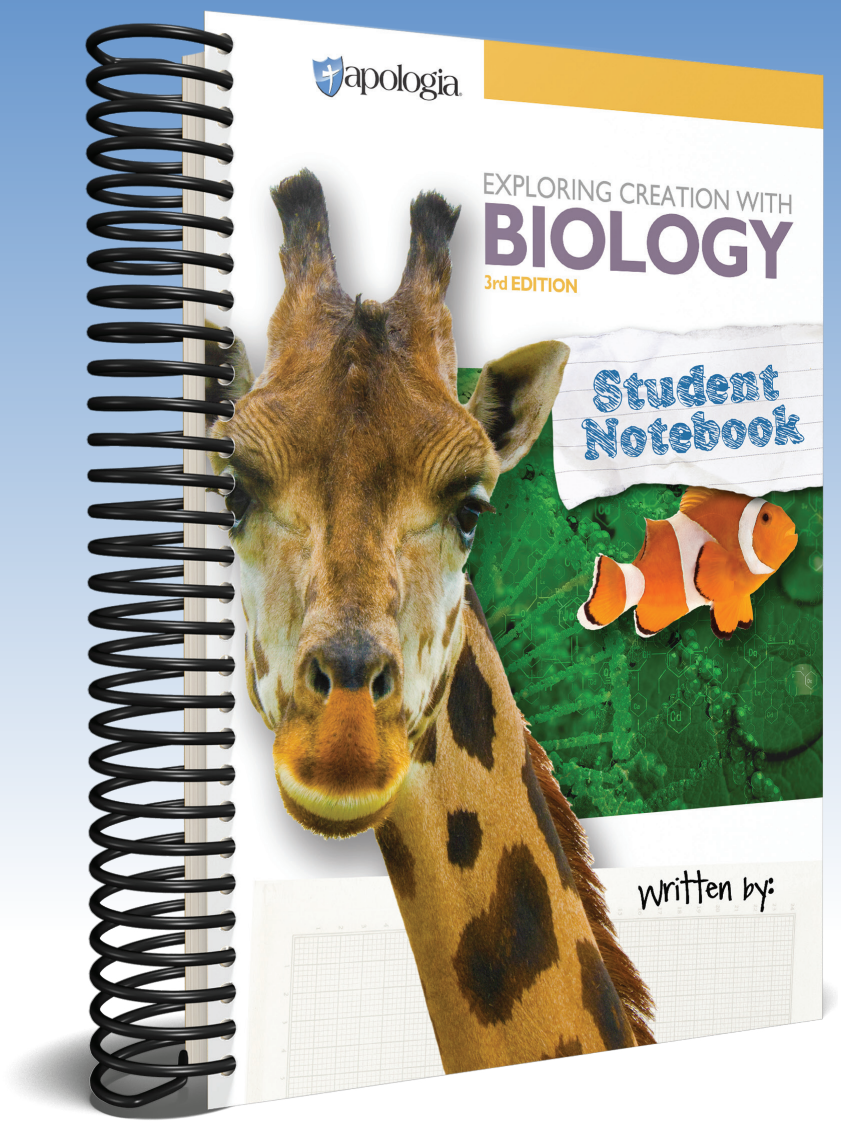

THIS IS THE START OF THE STUDENT NOTEBOOK

THIS IS A PREVIEW. THE NUMBER OF PAGES DISPLAYED IS LIMITED.

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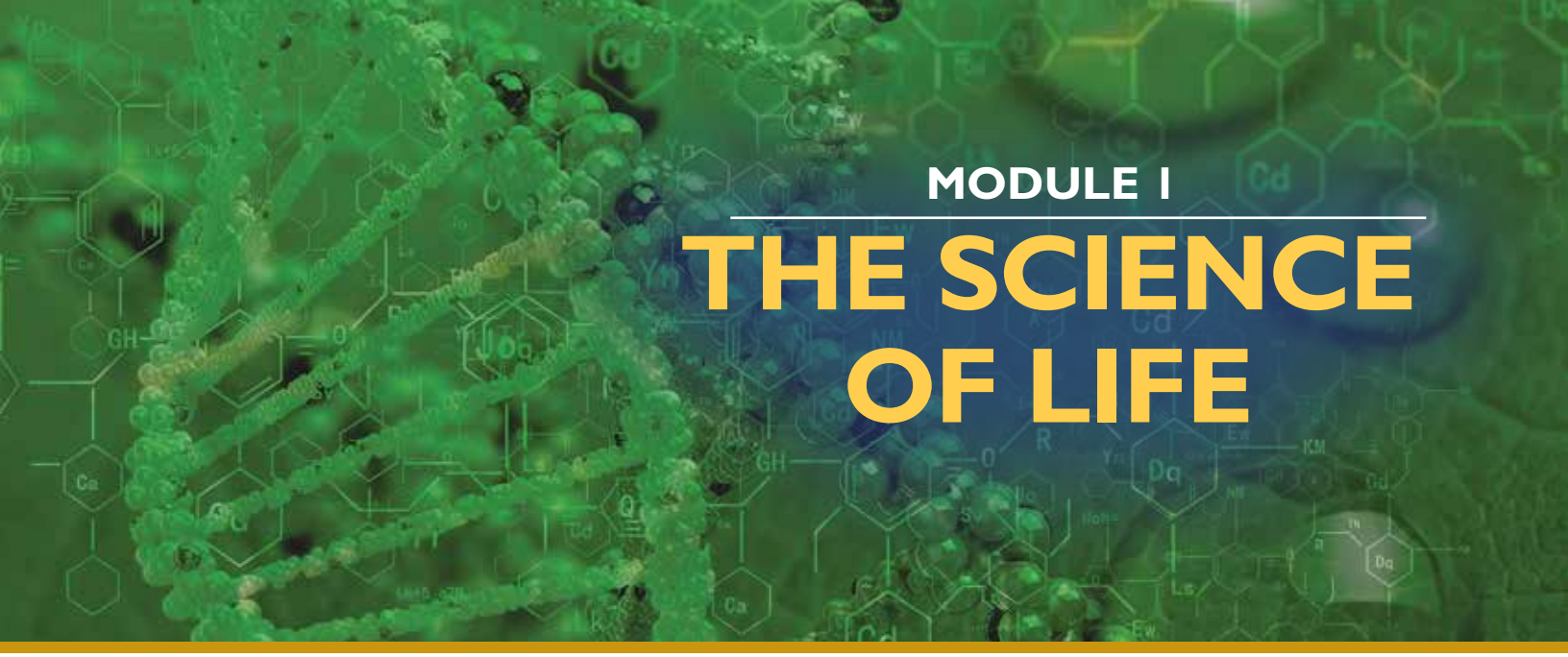
SUGGESTED DAILY SCHEDULE

Week	Day 1	Day 2	Day 3	Day 4	Day 5
1	**MODULE 1** Read pp. vii–x, 1–9 OYO 1.1–1.4	Read pp. 10–15 OYO 1.5–1.6	Read pp. 16–23 OYO 1.7–1.9	Read pp. 24–33 OYO 1.10–1.12	Experiment 1.1
2	Study Guide	Study for the test	**TAKE MODULE 1 TEST**	**MODULE 2** Read pp. 37–40 OYO 2.1–2.2	Read pp. 40–48 OYO 2.3–2.7
3	Read pp. 48–50 Experiment 2.1	Read pp. 50–55 OYO 2.8–2.10	Read pp. 56–62 OYO 2.11–2.12	Read pp. 62–65 Experiment 2.2 OYO 2.13–2.15	Read pp. 66–68 OYO 2.16–2.19
4	Read pp. 69–77 Experiment 2.3 OYO 2.20–2.24	Read pp. 78–79 OYO 2.25–2.26	Study guide	Study for the test	**TAKE MODULE 2 TEST**
5	**MODULE 3** Read pp. 85–90 OYO 3.1–3.3	Read pp. 91–95 OYO 3.4–3.6	Read pp. 95–97 OYO 3.7–3.8	Read pp. 97–104 Experiment 3.1 OYO 3.9–3.10	Read pp. 105–108 OYO 3.11–3.13
6	Read pp. 109–113 OYO 3.14–3.15	Read pp. 113–119 OYO 3.16–3.17	Read pp. 119–125 OYO 3.18–3.20	Read pp. 125–129 Experiment 3.2 OYO 3.21–3.22	Study Guide
7	Study for the test	**TAKE MODULE 3 TEST**	**MODULE 4** Read pp. 137–142 OYO 4.1–4.2	Read pp. 142–145 OYO 4.3–4.4	Read pp.145–154 OYO 4.5–4.6
8	Read pp. 155–157 Experiment 4.1	Read pp. 157-160 OYO 4.7–4.8	Read pp. 150–166 Experiment 4.2	Read pp. 166-169 Experiment 4.3 OYO 4.9–4.10	Read pp. 169–172 OYO 4.11–4.13
9	Study Guide	Study for the test	**TAKE MODULE 4 TEST**	Study for quarterly test 1	**TAKE QUARTERLY TEST 1**
10	**MODULE 5** Read pp. 179–183 OYO 5.1–5.2	Read pp. 184–187 Experiment 5.1 OYO 5.3–5.5	Read pp. 188–192 OYO 5.5–5.8	Read pp. 193–195 OYO 5.9–5.12	Read pp. 196–203 OYO 5.13–5.20



MODULE 1

THE SCIENCE OF LIFE

ON YOUR OWN QUESTIONS

1.1 When trying to convince you of something, people will often insert "Science has proven..." at the beginning of a statement. Can science actually prove something? Why or why not?

1.2 A scientist makes a few observations and develops an explanation for the observations that she has made. At this point, is the explanation a hypothesis, theory, or scientific fact?

1.3 Why is it important for scientists to test only one variable at a time when experimenting?

1.4 Explain the relationship between an independent variable and a dependent variable.

1.5 Describe the impact Pasteur's work had on the scientific community.

1.6 Should scientific laws be considered 100% reliable? Explain.

1.7 List the criteria all living organisms possess.

1.8 A biologist studies an organism and then two of its offspring. They are all identical in every possible way. Do these organisms reproduce sexually or asexually?

1.9 How are unicellular and multicellular organisms alike? How are they different?

1.10 Why is it important that scientist use a common SI system of measurement?

1.11 What is the difference in the way light microscopes and electron microscopes produce images?

1.12 A biologist is studying viruses, which are much smaller than cells. Which type of microscope should the biologist use if she wants to study the internal structure of the virus?

STUDY GUIDE QUESTIONS

1 As we stated in the Student Notes section of your notebook, this first question for each Study Guide module contains the vocabulary words for that module. If you haven't already, it might be helpful to mark this section when you begin a new module. This will give you easy access each time you're introduced to a new vocabulary word in your textbook. That way, you can write out the definitions of new words as you come to them in the reading. Define the following terms:

TERM	DEFINITION
a. Evidence	
b. Observation (include the different types)	
c. Inference	

TERM	DEFINITION
d. Hypothesis	
e. Variable (include the different types)	
f. Experimental group	
g. Control group	
h. Theory	
i. Scientific law	
j. Microorganisms	
k. Abiogenesis	
l. Metabolism	
m. Anabolism	
n. Catabolism	
o. Photosynthesis	
p. Autotrophs	

TERM	DEFINITION
q. Heterotrophs	
r. Herbivores	
s. Carnivores	
t. Omnivores	
u. Homeostasis	
v. Endotherm	
w. Ectotherm	
x. Receptors	
y. Asexual reproduction	
z. Sexual reproduction	
aa. Inheritance	
bb. Mutation	

TERM	DEFINITION
cc. International System of Units	
dd. Compound light microscope	
ee. Transmission electron microscope	
ff. Scanning electron microscope	

2 What are the criteria for life?

3 Why are cells considered the most basic unit of life?

4 An organism has receptors on tentacles that come out of its head. If those tentacles were cut off in an accident, what life function would be most hampered?

5 A parent and two offspring are studied. Although there are many similarities between the parent and the offspring, there are also some differences. Do these organisms reproduce sexually or asexually?

6 What is wrong with the following statement?
"Science has proven that energy must always be conserved."

7 Suggest 2 observations and 2 inferences a biologist might make about the scene below.

8 Briefly explain the scientific method.

9 Why does the story of spontaneous generation illustrate the limitations of science?

10 Where does the wise person place his or her faith: science or the Bible?

11 Why is the theory of abiogenesis just another example of the idea of spontaneous generation?

12 What are some common tools scientists use in the study of biology?

13 Why do scientists use the metric system? Why do they use tables and graphs?

14 What is the difference between a compound light microscope, a transmission electron microscope, and a scanning electron microscope? What is one advantage of a light microscope and one advantage of electron microscopes?

15 Why do scientists have procedures and protocols in the laboratory?

MODULE 2 **DATE:** _____

PAGES: _____

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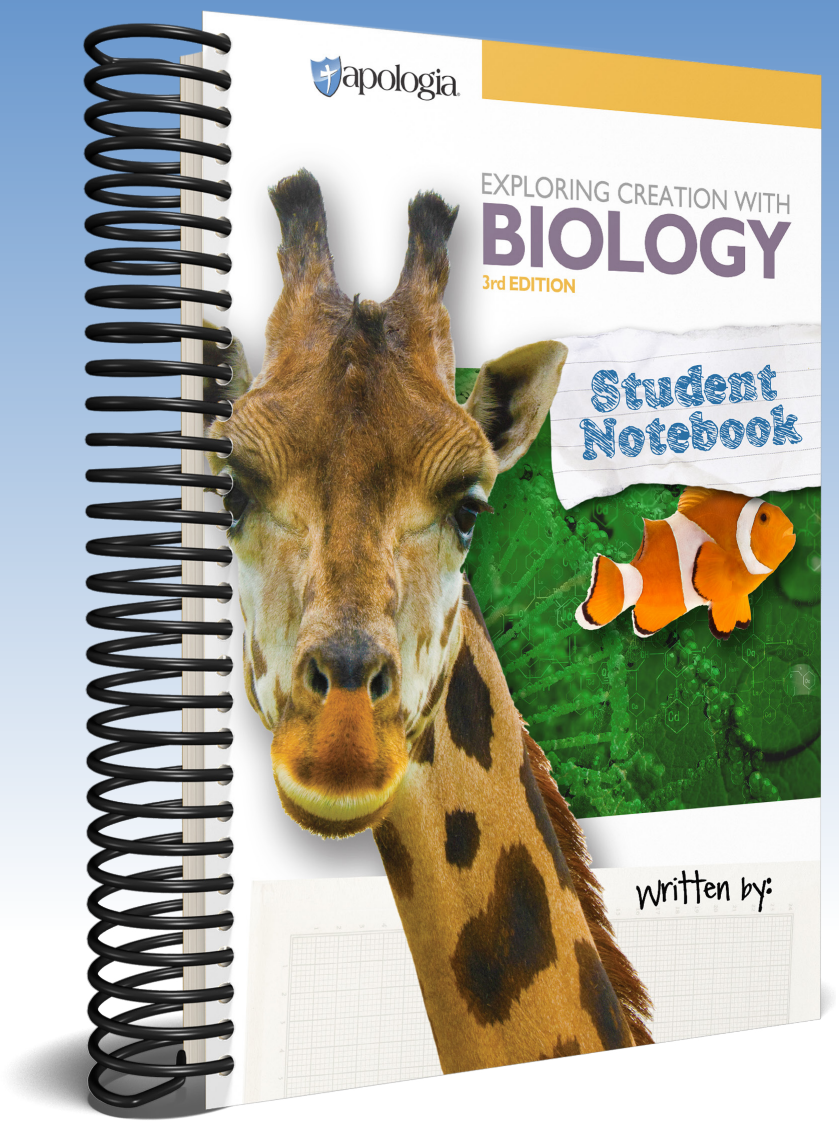

THIS IS THE START OF THE SAMPLE LAB WORKSHEETS

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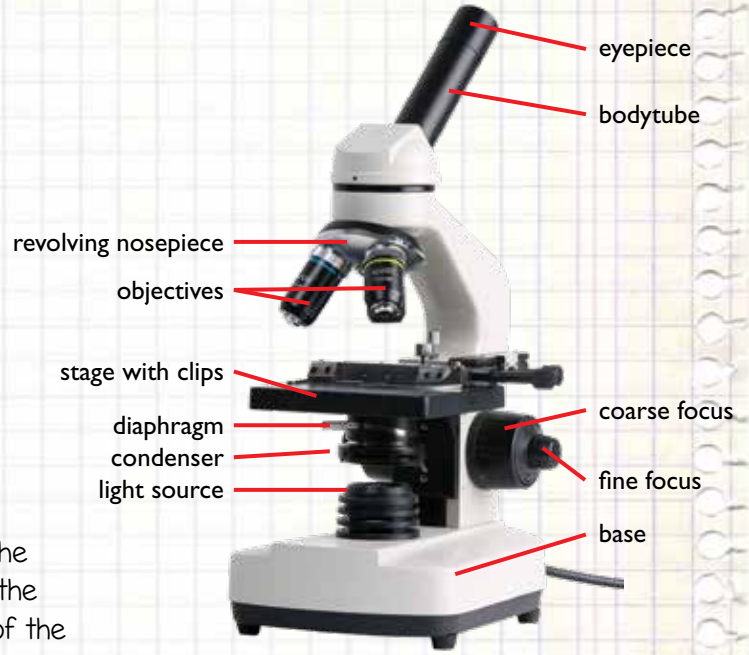
MODULE I

THE SCIENCE OF LIFE

EXPERIMENT 1.1
INTRODUCTION TO THE MICROSCOPE

PURPOSE:
To learn the various parts of the microscope and to learn to use the microscope properly

MATERIALS:
- Microscope
- Lens paper
- Slides
- Coverslips
- Cotton swabs
- Eyedropper
- Water
- Small pieces of brightly colored thread
- Prepared slide: Ranunculus root or Zea mays root
- Methylene blue stain



PROCEDURE:

A. **Learn the parts of the microscope:**

1. Place the microscope on your table with the arm of the microscope nearest you. With the aid of the illustration, locate all the parts of the microscope and become familiar with them.
2. In the data section, label the parts of the microscope listed on the figure at the right as you locate them on your microscope.
   a. The **eyepiece (the ocular)** is what you look through. It usually contains a 10x lens.
   b. The **body tube** starts at the eyepiece and runs to the part that holds the revolving nosepiece.
   c. The **revolving nosepiece** is the disc that holds the lenses (which are called objectives).

d. The **objectives** are metal tubes that contain lenses of varying powers, usually 4x, 10x, and 40x. Some microscopes have a 100x objective as well.
e. The **arm** supports the body and stage and is attached to the base.
f. The **stage with clips** is a platform just below the objectives and above the light source. The clips are used to hold the slide in place.
g. The **diaphragm** regulates the amount of light that passes through the specimen. It is located between the stage and the light source. It might be a disc that has several holes (a disc diaphragm), or it might be a single hole whose diameter can be varied (an iris diaphragm).
h. The **condenser** is also located between the light source and stage. It is a lens system that bends and concentrates the light coming through the specimen.
i. The **coarse focus** is controlled by two large knobs on each side of the microscope. It allows for quick focus, but it does not make the image as sharp as it could be.
j. The **fine focus knobs** are used to produce sharp focus. They are usually smaller and lower than the coarse focus knobs, but in some scopes they are mounted on top of the coarse focus knobs.
k. The **light source** is on the base and provides necessary light for the examination of specimens.
l. The **base** is the heavy structure at the bottom that supports the microscope and makes it steady.

Magnification is an important feature of any microscope. In table 1.1 in the data section, write down the magnifications of the objectives on your microscope. You calculate the total magnification of the scope by multiplying the power of the ocular (usually 10x) by the power of each objective. Thus, if your ocular is 10x and your objectives are 4x, 10x, and 40x, your three magnifications are 40x, 100x, and 400x. In table 1.1, label your three magnifications as low, medium, and high and include the total magnification of each.

B. The letter e slide:

1. Make a wet-mount slide by cutting out a piece of newsprint with a letter e on it. (You can use newspaper, but a magazine works best.) Place the letter on a clean slide right side up and mark the slide on the bottom below the e. Add one drop of water on top of the paper letter. Add the coverslip by sliding it at a 45-degree angle until it touches the water drop, and then drop it onto the slide. If there are air bubbles, gently tap the coverslip with the eraser of your pencil. (You can also use a prepared e slide if you have it.)
2. Look at the slide with the unaided eye (without the microscope). Draw the letter as you see it (Do this is in Figure 2 in the data section. Try to draw it as close to what you see (size and shape) as possible inside the observation circle. Record the magnification and identify what you are drawing.
3. Place your microscope in front of you with the eyepiece toward you and projecting over the arm. Plug it in and turn your light on. If you have a mirror instead of a light, look through the eyepiece and adjust the mirror until you see bright light.
4. Before placing your slide on the stage, turn the revolving nosepiece until the low-power (4x) objective is directly over the opening in the stage. You will feel a slight click as the objective moves into correct position. You should always focus using the low-power objective first before

using a higher-power objective for any slide you are viewing.

5. Using the coarse adjustment knob, lower the stage away from the objective. This allows more room to put the slide onto the stage. Place the slide on the stage so that the sliding spring arm holds it in place.
6. Three adjustments must be made in order to clearly see the letter on the slide. These same adjustments are necessary when viewing any slide:
   a. First, use your hands to move the slide in order to center the object to be viewed (letter e) directly over the stage opening so light can pass through it.
   b. Second, if you have an electric microscope, adjust the light by moving the diaphragm knob so that you can see the letter best. The light may need to be readjusted with each objective—a low-power lens has a larger opening to allow in light than a high-power lens has. This means that more light is required as the power of the lens increases.
   c. Third, focus the object being viewed. Using your coarse adjustment knob, raise the stage while looking through the eyepiece until the letter is visible. Then, with the fine adjustment knob, clear the image until it is sharp for your eye. Do not force the adjustment knobs beyond their stops.

   As you look through the eyepiece, you should see a background white circle of light around your letter. This is called the field of view. You will also notice a dark line extending from the periphery to the center of the field of view. This is a pointer which can be used to point out objects to anyone else looking through the microscope.

7. Draw the letter as it appears under low power (Do this in figure 3 in the data section). Make sure to record the total magnification power used. Describe the position of the image of the letter e through the microscope compared to the position of the letter e as viewed with the naked eye in observation box 1. You should notice two differences between the appearance of your letter when unmagnified compared to what you see using low-power magnification.
8. Move the slide to the left and describe how the image moves in observation box 2.
9. Move the slide away from you and describe how the image moves in observation box 3.
10. Remaining in low power, without touching anything else, rotate the nosepiece until the 10x (medium power) objective clicks into place.
11. In order to see the letter clearly, the same three adjustments used with the low-power lens may be needed:
    a. Move your letter into the center of the field of view, if needed.
    b. Increase the light, if needed.
    c. Focus the lens, but use only the fine adjustment knob.
12. Redraw your letter as it appears under 10x (medium power) in Figure 4 and label the total magnification.
13. Again, remaining in focus, rotate the nosepiece until the 40x (high power) objective clicks into place. Use the same three adjustment steps to see your letter clearly, making certain to use only the fine focus adjustment knob to focus your lens. Never use the coarse focus adjustment knob on high power (40x) since the working distance is so minimal. If you are unable to get a clear image using fine focus, return to 10x and begin the focusing process again.
14. Redraw the letter as it appears under 40x (high power) in Figure 5 and label the total magnification.

15. When you are finished, always rotate your nosepiece to the lowest power objective. This is important so that you do not scratch your lens. When you are at the lowest power, it is safe to remove your slide.

C. Now that you are familiar with the parts of the microscope, you are ready to use it to view thread.

1. Rotate the low-power objective so that it is in line with the eyepiece. Listen for a click to make sure it is in place.
2. Turn your light on. If you have a mirror instead of a light, look through the eyepiece and adjust the mirror until you see bright light.
3. Using the coarse focus, raise the stage (or lower the body tube) until it can move no more. (Never force the knobs.)
4. Place a drop of water on a clean slide and add several short pieces of brightly colored thread.

Add a coverslip. This works best if you hold the coverslip close to the drops of water and then drop it gently. If air bubbles form, tap the coverslip gently with the eraser of your pencil. When you have the slide made, draw what you see with the unaided eye in Figure 6 in the data section, identify your drawing, and note the magnification.

6. Put the slide on the stage and clip it down, making sure the coverslip is over the hole in the stage.
7. Looking in the eyepiece, gently move the stage down (or body tube up) with the coarse focus. If you do not see anything after a couple of revolutions, move your slide a little to make sure the threads are in the center of the hole in the stage. This indicates that the threads are in the field of view.
8. When you have focused as best you can with the coarse focus, fine-tune the image with the fine focus. When you have the image in focus, draw what you see in the microscope in Figure 7, identify your drawing, and note the magnification.
9. Place the threads in the very center of the field of view by moving the slide as you look at it through the microscope. Make sure that the threads are at the center of the field, or you will lose them when you change to a higher magnification.
10. Turn the nosepiece so that the medium-power objective is in place. Until you are very familiar with any microscope, do not turn the nosepiece without checking to make sure it will not hit the slide. Always move the nosepiece slowly, making sure that it does not touch the slide in any way. A lens can easily be damaged if it hits or breaks a slide.
11. Once the medium-power objective is in place, you should use only the fine focus to make the image sharp. Once again, move the slide so that the thread is at the center of the field. When you have the image in focus, draw what you see in the microscope in Figure 8, identify your drawing, and note the magnification.
12. Again, watching to make sure you don't hit the slide, turn the nosepiece so that the high-power objective is in place. You should use only the fine focus to refocus. When you have the image in focus, draw what you see in the microscope in Figure 9 identifying your drawing and noting the magnification.
13. (Optional) If you like, repeat steps 1–12 using a strand of your own hair.

If we wanted to look at the threads at high magnification, why didn't we just start with the high-power objective? If we had tried to bring the threads into focus under high magnification without first looking at them under low and then medium magnification, we almost certainly would have never found them. When you look at the slide at high magnification, you are looking at a very, very tiny portion of

the slide, and it is unlikely that what you are looking for will be there. As a result, you should always start your microscope investigation with the lowest magnification and then work your way up, centering the specimen in the field of view each time before you increase magnification.

D. Now it is time to get your first look at cells!

1. Place the prepared slide of either Ranunculus root or Zea mays root on the microscope and begin the procedure outlined in section B, looking at the cells under low, then medium, and then high magnifications. Draw what you see at each magnification in Figures 10, 11, and 12 in the data section; identify each drawing; and note the magnification.
2. Clean up and return everything to the proper place. To properly clean slides, coverslips, and eyedropper, wash them carefully with soap and water and dry them carefully with paper towels. To properly clean microscope lenses, wipe them carefully with lens paper.
3. Be sure to record any changes you made to your materials or procedure. Sometimes we are required to make changes to procedures that are listed. This can be for many reasons, such as you drew a letter e instead of cutting one out of the newspaper. If you make any changes to the materials or existing procedure, you need to make note of it in your notebook so that others would be able to make the same change if they want to duplicate your experiment. There is space in your notebook to list any changes to the materials or procedure.
4. In the Conclusions section of your notebook, summarize what you learned in this experiment and make connections to the readings in your text. While this might seem simple or even silly in this first experiment, as you progress through this textbook, you will begin to experience science in addition to reading about it in your textbook. It is very important that you can connect the facts presented in your studies to your actual experiences. This is also a good place to discuss what you might consider changing in the future to further text an idea.

CONCLUSIONS:

Summarize what you learned in this experiment and make connections to the text.

Note any changes made to the materials or procedure of this experiment here.

DATA AND OBSERVATIONS:

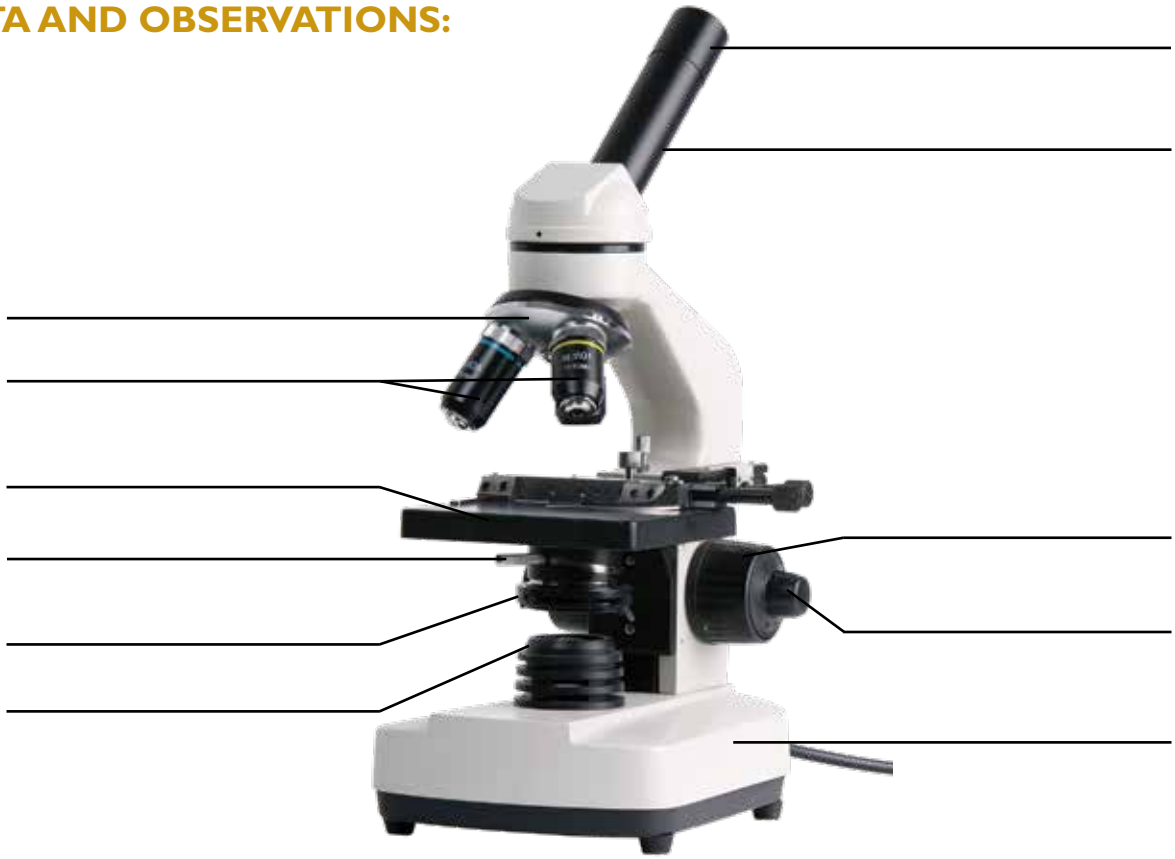


FIGURE 1.18
Microscope
Label the parts of the microscope as you locate them on your microscope.

TABLE 1.1: MICROSCOPIC MAGNIFICATION

Ocular Objective	Nosepiece Objectives	Total Magnification	Magnification Label

Magnification _____

Fig 2: _____

Magnification _____

Fig 3: _____

Magnification _____

Fig 4: _____

Magnification _____

Fig 5: _____

Observation 1:

Observation 2:

Observation 3:

Magnification _____

Fig 6: _____

Magnification _____

Fig 7: _____

Magnification _____

Fig 8: _____

Magnification _____

Fig 9: _____

Magnification _____

Fig 10: _____

Magnification _____

Fig 11: _____

Magnification _____

Fig 12: _____

CONCLUSIONS:

Summarize what you learned in this experiment and make connections to the text.