Thinking About Biology An Introductory Laboratory Manual 5th edition Bres Solutions Manual

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Exercise 2—Windows to a Microscopic World

Preparation Notes

1. **Supply lists are based on a class size of 24 students. In situations where class size varies, adjust supplies accordingly.**

2. **Asterisks (*) next to materials or supplies indicate a nonstandard or special order item. Specific details for obtaining these items can be found in the "Ordering Information" section for each exercise.**

3. **The times listed to complete activities are conservative estimates of the time required. In our community college classes (with three hours of lab per week), we're usually able to complete all the activities in an exercise and still have time for short quizzes, introductory remarks, and summarizing important concepts at the end of the class period.**

Materials and Supplies

Equipment	Quantity
dissecting microscopes	12
compound microscopes	24
glass stacking dishes, medium (*)	14
disposable pipettes	14
blank microscope slides	1 box
blank depression microscope slides	1 box
microscope cover slips	1 box
lens paper booklets	8
blunt metal probes	14
squirt bottles (*)	8
long gripping tongs (*)	1

Living Materials	Quantity
large brown planaria (*)	16
daphnia (*)	50
snails (*)	9
aquarium with fish, snails, and algae	1
box of slides with algal colonies	1

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Chemicals	Quantity
dropper bottles, iodine or methylene blue	16
dropper bottles, physiological saline	16
dropper bottles, methyl cellulose (*)	8
squirt bottles, pond water	8

Microscope Slides, Prepared	Quantity
letter "e" with large letter e (*)	25

Miscellaneous Supplies	Quantity
individually wrapped toothpicks (*)	25
clean, shiny pennies of the old design (showing the Lincoln Memorial on the back)	12
aquarium tank	1

Preparation Instructions

1. **Activity 6:** Mix up the stock solutions and place them in the appropriate containers.

2. **Activity 7:** Set up a filtered aquarium with fish, aquatic plants, and snails. Fish are needed for nutrient cycling to the algae and provide a nice atmosphere in the classroom.

Cover the bottom of the tank with gravel. An undergravel filter works best, but a side-mounted filter is adequate for a small number of organisms.

To maximize algal growth, the tank should have an overhead light or be placed near a window. Algae growth is best if aquaria are set up with the glass slides **at least 60 days** before they'll be needed in the classroom.

Arrange open boxes containing blank microscope slides on the gravel across the bottom of the tank. In the boxes, slides should not be stacked and should be arranged for maximal light exposure.

The slides will eventually develop a colony of algae and various pond organisms. These slides will be removed during Activity 7 and examined by the students.

Covered, portable plastic aquaria are available and work quite well for use at satellite locations. Fish, snails, and slide boxes covered with algae can be easily transferred from permanent aquaria for use at other locations.

Setup Instructions

1. No special setup is needed for most activities. Items should be placed in the classroom in convenient locations for easy access by students.

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2. **Activities 2 and 6:** Rotate the jars of planaria and daphnia between sections so stressed animals can recover.

   Metal probes must be thoroughly cleaned before use with living material.

3. **Activity 7:** Place the long tongs next to the aquarium for easy removal of slide boxes.

Ordering Information (*)

1. Long tongs—Fisher, #15-207, 21 inches long
2. Large brown planaria—Wards, #87-W-2500
3. *Daphnia magna*—Wards, #87-W-5210
4. Mystery snails—Wards, #87-W-412
5. Letter "e" slides—Triarch, #6-Z1-1
6. Methyl cellulose (ProtoSlo®)—Carolina Biological, #P7-88-5141
7. Aquarium, covered, portable—Carolina Biological, #P7-67-4337C
8. Glass stacking dishes, medium—Carolina Biological, #74-1004, 4 1/2 inches diameter
9. Squirt bottles—Fisher, #03-409-16, 500 ml
10. Aquarium starter kit—Carolina Biological, #P7-L-1256, 20 gallons

Suggestions for Specific Activities

1. **Activity 2:** Planaria observations

   When placing the planaria in the glass dish for viewing, try to keep the pond water concentrated in the center of the dish. When liquid is concentrated in the center, it prevents the planaria from moving up the sides of the petri plate.

   When viewing planaria, experiment with light from different directions and various illumination levels to get a good view of various body parts. Start on low power and zoom up for a closer look.

   Don't stain living material. This will kill the organisms.

   Planaria should be returned to the stock container when Activity 2 has been completed. If planaria are left on the microscope stage with the light on for too long, they'll overheat and die.

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2. **Activity 6:** Cheek cell wet mount

   Cheek cells on the **unstained** slide can be viewed only in **very dim** light. Students frequently think that there are no cells on their slide, but usually a scraping yields many cells for observation.

3. **Activity 6:** Daphnia observations

   The daphnia will be viewed with **depression** slides. The depression slides should be kept separate from the other blank slides. For easier cleanup, ask your students to return the slides to the appropriate box.

   When using a depression slide, a cover slip isn't necessary. If a student should lower the lens into the water, ask him or her to dry it thoroughly with lens paper.

   A small drop of methyl cellulose (ProtoSlo®) is helpful to slow the daphnia's movements and make observations easier.

   If you have the ability to project from a dissecting microscope onto a screen in the classroom, that's really helpful. If you have computer access in the classroom, there are several excellent YouTube Websites of daphnia viewed through the microscope, even some of the daphnia giving birth.

4. **Activity 7:** Aquarium experiment

   In the aquaria, you will place plastic boxes of microscope slides (see Preparation Instructions). Because it's impractical to have everyone stick an arm into the tank and scrape the glass wall, these will substitute.

   Use the long tongs to carefully lift a plastic slide box out of the tank. Each group can have a slide. Dry off the **back** side of the slide (the side with least algal growth) before placing it on the microscope stage.

   If a video microscope is available, the entire class can view an exceptionally good slide. Aquarium slides can be viewed with both the dissecting and compound microscopes for comparison.

   To avoid potential contamination issues, don't replace slides in the aquarium after they've been viewed on the microscope.

Approximate Time to Complete Activities

Activities 1 and 2	45 minutes
Activities 3 and 5	45 minutes
Activity 6	30 minutes
Activity 7	30 minutes

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Answer Key to Questions

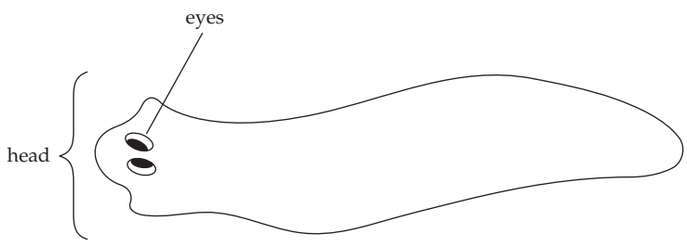
Activity 1

4. Yes, you should see Lincoln in the memorial.

Activity 2

3. The worms crawl most of the time, but are capable of swimming.

4. Refer to the labeled drawing of a planaria below.



Labeled Drawing of Planaria

5. The worm goes around or tries to evade the probe.

6. The worm will pull away or avoid the probe.

7. The worm will move away from the probe.

8. The planaria can feel the probe in any location, although the most sensitive response is obtained by touching it in the head area.

Activity 3

4. The pointer rotates when the ocular lens is rotated.

6. You'll feel a click when the lens is in position.

8. Refer to the completed magnification table.

Length of Objective Lens	Magnification of Objective Lens	Magnification of Ocular Lens (Eyepiece)	Total Magnification of Specimen
short	4×	10	40
medium	10×	10	100
long	40×	10	400

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12. When you move the level in one direction, the light gets brighter. When you move the level in the opposite direction, the light dims.

Activity 4

Refer to the completed diagram in **Figure 2-5.**

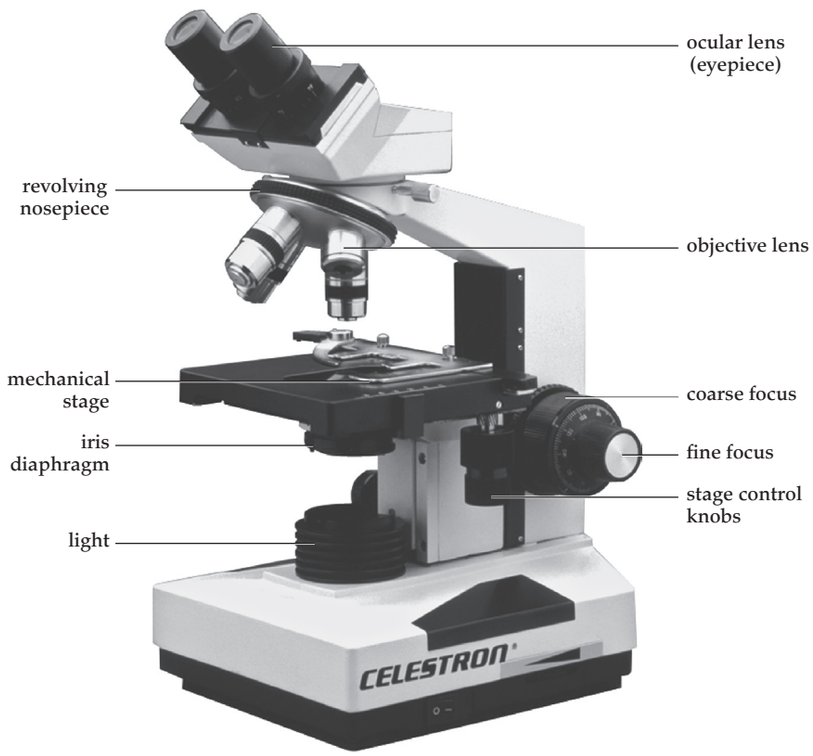


Figure 2-5 Parts of the Compound Microscope
Celestron International

Activity 5

Comprehension Check

1. Adjust the iris diaphragm (open it more).

2. Objective lens = 4.
Ocular lens = 10.
Total magnification (4 × 10) = 40.

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3. Letter e diagram:



4. Upside down and backward.

5. To the right.
Toward you.
To the left and toward you.

8. Yes.
No.
The letter "e" will probably need adjustment.
The illumination level will probably need adjustment.
Larger and more details are visible.

9. No.

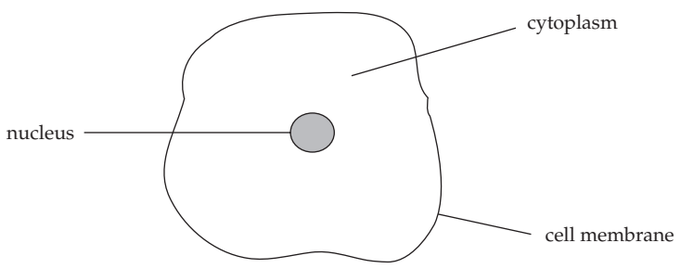
10. Smaller. When the field of view decreases, less of the letter "e" is visible at one time. As you increase the magnification, you see less of the specimen.

11. 400×
Total magnification = 40 × 10 (ocular) = 400.

Activity 6

Human Epithelial Cells

7. Refer to the following completed diagram of one human cheek cell:



Labeled Drawing of Cheek Cell

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9. Examples include a Pap smear, which removes epithelial cells from the cervix, removal of cheek cells for DNA analysis, and skin cells with abnormal appearances in various body locations.

10. Yes. The cytoplasm, nucleus, and nucleolus are seen more clearly.

Daphnia—An Aquatic Organism

3. Refer to the completed diagram of a daphnia in **Figure 2-6** below:

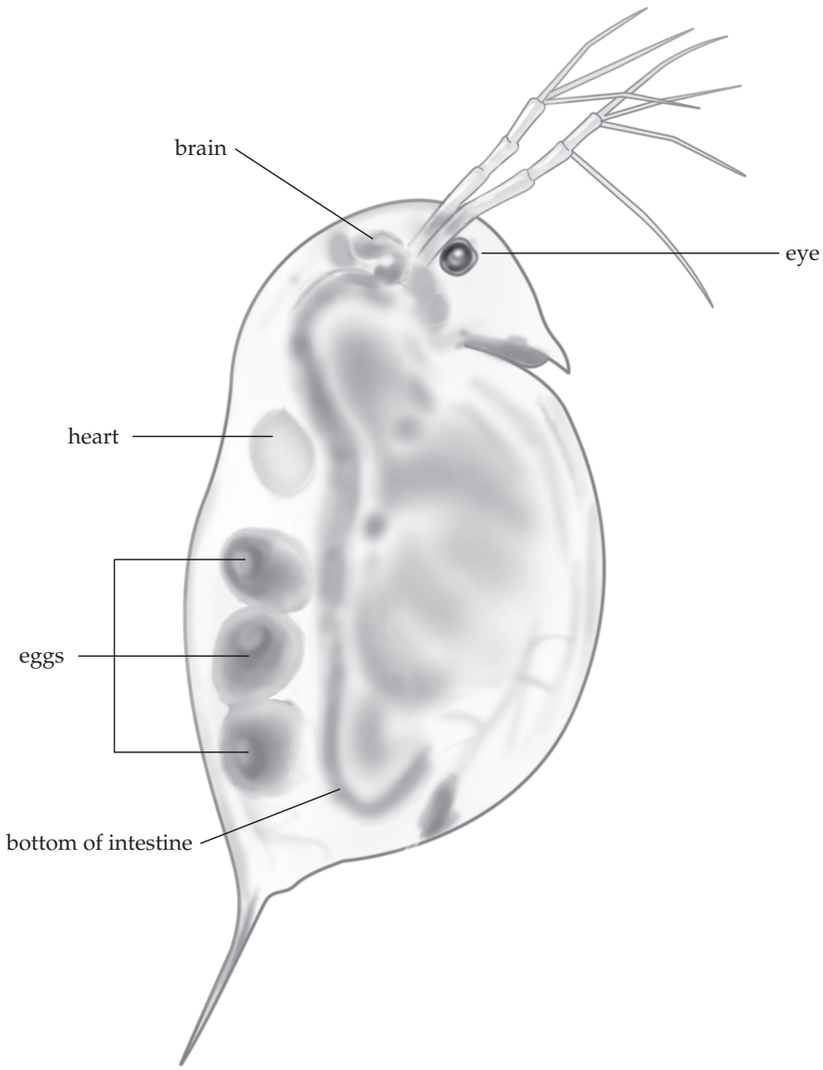


Figure 2-6 Labeled Drawing of Daphnia

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Activity 7

2. Sample hypothesis: The snails are eating something on the glass.

3. Because the focus of this exercise is the microscope, the observation plan should make some reference to observing organisms on the glass by using the compound microscope.

   Make reference to **Figure 2-7** for examples of organisms that can typically be found on aquarium glass. Several different types of organisms are easily seen by students, including: green algae, diatoms, euglenoids, *Vorticella,* and *Stentor.*

Comprehension Check

1. Answers will vary depending on the original hypothesis.

2. Answers will vary depending on the observed results. If chlorophyll was visible, students should conclude that observed organisms were producers (or could perform photosynthesis).

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