ARCTIC MARINE SCIENCE CURRICULUM

MODULE 2

ECOSYSTEM PRINCIPLES

LAB MANUAL

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Prepared for:
Fisheries and Oceans Canada
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Nunavut Department of Education
Yukon Department of Education

Prepared by:
AIMM North Heritage Tourism Consulting
with
Prairie Sea Services, Bufo Incorporated and Adrian Schimnowski

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LAB 1 - FOOD CHAIN FIELD WORK

OVERVIEW

This lab will guide you through the observation and organization required to produce food chain diagrams for your community. Part A of this lab is for terrestrial organisms and Part B is for aquatic organisms.

PURPOSE

To make field observations of different areas of your community.
To collect data that you can use to generate food chain diagrams.

MATERIALS

- Collection nets of various mesh sizes
- Meter sticks and string
- Hard covered notebook
- Containers for both insect and aquatic organisms
- Wooden pegs or stakes

PROCEDURE

Part A: Terrestrial Organisms

Your teacher will give you the location for your observations.

1. Using the meter stick, the wooden pegs and string mark off 1 square meter of grassland.
2. Observe, count and sketch all organisms within this square meter area. Do not harm or disturb any of the organisms you observe. Your teacher may ask you to focus on a particular sized organism for this activity.
3. After you have observed this area for a specified time, move the measured area to another location and repeat the procedure.

Part B: Aquatic Organisms

Your teacher will give you the location for your observations.

1. Collect water samples from your community seashore, or from any nearby watershed, lake, river etc. using nets and collection containers.
2. Use the data sheets provided on the following page for your observations, counting and recording.
3. All counting and recording should be observed by pouring the samples into a shallow, flat-bottomed container.

ANALYSIS

1. After you have completed the data collection, draw a sketch of each organism on a file card.

2. Use the file card pictures to produce what you think is a reasonable food chain with the organisms you have observed. Draw the food chain in the space below.

CONCLUSION

Write a conclusion for each of the parts that you completed.

WATER SAMPLING DATA SHEET

School Name: _____

Teacher name: _____

Student names: _____

Date: _____

Time: _____

Location (town): _____

Type of water system: _____

Latitude: _____ Longitude: _____

Brief description of weather:

_____

_____

Outside / ambient temperature: _____

Water temperature: _____

Water depth: _____

Method of collection: _____

Comments:

LAB 2 - THE COMPOUND MICROSCOPE

PURPOSE

To learn the structure and basic use of the compound microscope.

MATERIALS

- Compound microscope
- Newsprint
- Slides and cover slips
- Scissors

NOTE: The compound microscope is a delicate instrument and can easily be damaged. Always carry it carefully with both hands, one under the base and the other holding the arm.

OVERVIEW

The microscope is a biologist's basic tool. It has been developed to help explore the world of living things too small to be seen with the naked eye. Early microscopes had only one lens and were difficult to use. The biggest problem was magnification. The more powerful the lens needed for greater magnification, meant the closer the viewer's eye had to be to the lens. At very high magnification, the lens almost touched the eye. The early microscope user had to be very steady.

A major advance in microscopes came with the invention of the compound microscope. It has two sets of lenses, which magnify objects much greater than a single lens.

PART A: STRUCTURE OF THE MICROSCOPE

The compound microscope has four basic parts: the lens system, the focusing system, the stage, and the lighting system.

The Lens System

One of the two sets of lenses is the objective lenses. They work similarly to the lens of the early, simple microscope. The objective lenses make the initial or primary magnification. They are located in the nosepiece of the microscope.

Inscribed on each objective is the magnification or power of that lens. This tells the number of times the lens magnifies the image. For example, if you are looking at a strand of hair with a 4X (four-power) lens, the hair will appear four times its actual size. Your microscope probably has at least two objective lenses. Some microscopes have as many as four objectives. Rotate the lenses in the nosepiece until they click into position. The objective lens in use is always the one directly under the body tube.

Usual powers for objective lenses are:

4X	The scanning lens.
10X	The low power lens.
40X	The high power lens.
100X	The oil immersion lens. *NOTE*: This lens should not be used without special instructions from your teacher.

The second kind of lens in the microscope is the ocular – sometimes called the eyepiece. This lens is located at the top of the body tube. The ocular serves as a small telescope, magnifying the image made by the objective lens. This enlargement is called the secondary magnification. The magnification of the ocular may be 5X, 10X, 15X, or 20X. The most common power used in microscopes is the 10X ocular. Examine the ocular of your microscope. Do not remove it from the body tube. If the power is not stamped on the top portion of the ocular, you should assume that it is 10X.

The total magnification of the microscope is determined by multiplying the primary magnification (from the objective) by the secondary magnification (from the ocular). For example, if the objective lens is 10X and the ocular is 5X, the total magnification is: 10X x 5X = 50X.

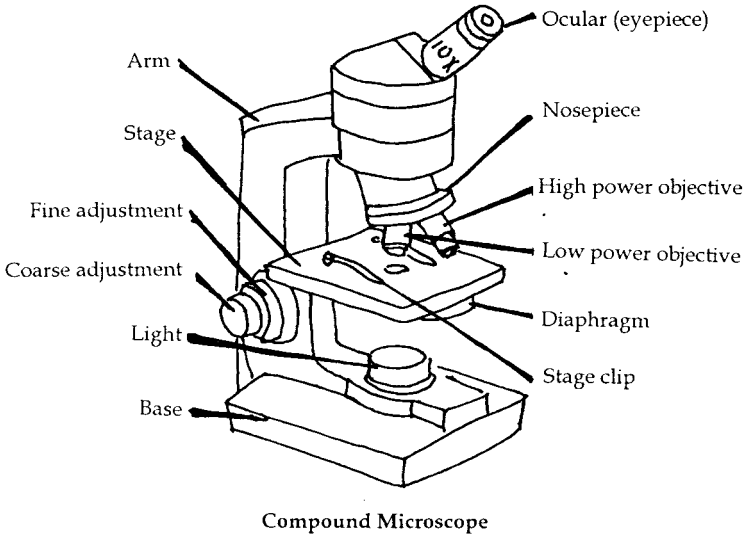

Figure 1: Components of the Compound Microscope

The Stage

A specimen to be viewed through the microscope is mounted on a glass slide and covered with a cover slip. The slide rests on the stage, the flat surface beneath the body tube. Stage clips hold the slide in place. Also, they help in making slight adjustments in the slide's position by holding the slide steady.

The stage should always be kept in a horizontal position. If you tilt the stage, the specimen will slip to the bottom edge of the slide. Even with commercially prepared slides, the stage should be kept horizontal. A commercial slide can be ruined as the cover slip slowly slips downward on a tilted stage.

Both the slide and the stage are extremely smooth. Water between them acts like glue and causes the slide to stick to the stage. If water gets on the stage, STOP, and dry both the stage and the bottom of the slide with a paper towel before proceeding.

The Lighting System

For you to see the specimen, light must pass through it and the lenses to your eye. The lighting system is located under the stage of the microscope. There are three different types of lighting systems.

The simplest system uses a concave mirror to focus a beam of light on the slide. Tilt the curved surface of the mirror to face a light source: room lights, windows, or a desk lamp. Another lighting system uses a lens under the stage to focus the light. If there is a sub stage lens and a mirror on your microscope, use the flat side of the mirror to reflect light through this lens.

A third lighting system uses a sub stage light instead of a mirror. If your microscope has a light, turn it on only when you are actually looking at the specimen. The light gets hot and can easily destroy your specimen.

Under the stage you will also find the diaphragm. It is used to adjust the amount of light that passes through the specimen. The diaphragm works like the aperture on a camera. Practice opening and closing the diaphragm while looking through the eyepiece. Notice how the amount of light increases and decreases.

The Focusing System

In order to bring the image of the specimen into proper focus, it is necessary to change the distance between the slide and the objective lens. This can be done in one of two ways, depending upon the microscope you are using. Either the lenses can be moved or the stage upon which the slide rests can be moved. Two knobs control the focus. The coarse adjustment knob is for coarse focusing, and the fine adjustment knob is for fine focusing. Locate these on your microscope. Turn the coarse adjustment knob.

QUESTIONS – PART A

1. What is the power of each objective lens of your microscope?

2. Note the length of each lens. Is the higher power lens longer or shorter than the lower power lens?

3. Calculate the total magnification for each lens combination on your microscope. Show your calculation in the same form as in the example on the previous page.

4. Calculate the total magnification for the lens system in use on the microscope illustrated in *Figure 1*.

5. Do the lenses move up and down or does the stage move up and down?

PART B: USING THE MICROSCOPE

Put the low power objective in place. Look through the ocular and adjust the light so that you see a uniformly bright field of view. The field of view, also called the field, is the area you see through the lens. If you see specks of dirt in the field, clean your lenses with lens tissue. Now prepare a slide to view under the microscope. Cut a lowercase "e" from a newspaper and place it in the center of a clean slide. Put a drop of water on top of the letter. Next, place the edge of a cover slip against the water, and with a pencil gently lower the cover slip over the "e." Placing the cover slip in this manner prevents bubbles from forming. Be sure that the bottom of the slide is dry. This type of slide is called a wet mount. Place the slide under the stage clips, so that the "e" is right side up. You are now ready to focus on the "e."

Caution: If the lens is dirty or you get water on it, gently wipe it with lens tissue. Never use facial tissues. Lenses are made of soft glass and scratch easily.

Caution: Be sure that the objective does not touch the slide-both the lens and slide can be damaged. Do not look through the eyepiece while lowering the objective toward the stage. It is difficult to judge through the eyepiece how far the objective is moving.

Caution: Never use the coarse adjustment knob in high power. The objective is very close to the slide in high power, and coarse adjustment could cause the objective to hit the slide.

Focusing always begins with the lower power (10X) objective. First, click the low power objective into position in the nosepiece. Then, looking at the side of the microscope, turn the coarse adjustment knob until the objective is as close as possible to the slide without touching it. Now look through the ocular and turn the coarse adjustment knob in the direction that will move the objective away from the stage. The "e" will come into approximate focus. To sharpen the focus, turn the fine adjustment knob back and forth. Are you surprised that the borders of the letter "e" are far from perfect? Note the position of the letter through the microscope. The letter on the slide is right side up.

Now, look at the "e" under high power. First, under low power, center the "e" in the field of view. Switch to high power by turning the nosepiece until the high power objective clicks into place. Sharpen the focus by turning the fine adjustment knob. If you cannot find the "e" under high power, try this. Look through the ocular and move the slide slightly. If this does not bring the "e" into view, move the slide in other directions.

When you are finished using the microscope, remove the slide from the stage. Rinse the slide and cover slip with water. Dry the slide with a paper towel and not lens tissue. Glass cover slips should be air dried to prevent breakage. Return both to their proper places. Finally, be sure the microscope is on low power and put it away. Remember to carry the microscope carefully, with one hand under the base and the other holding the arm.

QUESTIONS – PART B

1. Is the position of the letter viewed through the microscope the same as it is on the stage?

2. Draw the letter "e" as it appears through the microscope.

3. While looking through the microscope, move the slide to the right. Which way does the letter appear to move when viewed through the microscope? Draw it.

4. Push the slide away from you on the stage. Which direction does the letter appear to move when viewed through the microscope?

5. Summarize what you have just learned about apparent movement under the microscope.

6. Draw the part of the "e" that you see under high power.

ANALYSIS

1. What are the two kinds of lenses on a compound microscope? What does each do?

2. How do you increase the amount of light that passes through the specimen? How do you decrease the amount of light?

3. How do you determine the magnification of a microscope?

4. What is the relationship between movement on the stage and movement seen through the lenses?

5. Describe the procedure for focusing a microscope using coarse and fine adjustments.