Introduction Biology Laboratory

Learning Objectives

1. Learn the ways that botanists identify and name plants
2. Use the names for identifying plants on in the lab
3. Learn how to make a microscope slide
4. Learn about osmosis through an experiment

Introduction

Botany is the study of plants. Botany is one part of the larger field of biology. It includes the study of the different parts of a single plant or a group of plants. Scientists who study plants are called botanists (1). Botany can help us understand many different things about plants including how they are different from one another.

For Mi'kmaq people, many plants are understood based on their purposes as medicines or from their use in ceremony or traditions. Mi'kmaq people are very familiar with different properties of plants in Nova Scotia. Today we learn about plants and botany from a scientific perspective and Mi'kmaq perspective. Later in the camp we will learn even more about the Mi'kmaq perspective from an Elder or Knowledge Keeper.

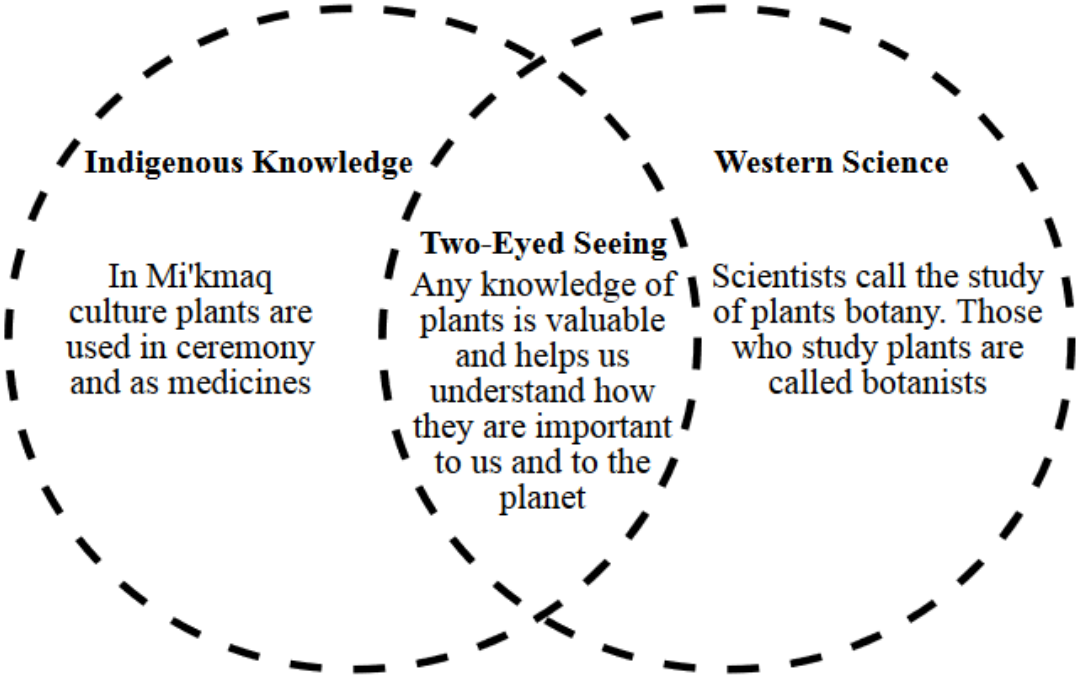

Figure 1: Two-Eyed Seeing Diagram

Laboratory (Lab) Safety Rules

- Wear safety glasses at all times
- Lab coats **MUST** be worn at all times
- No food or drinks consumed in the lab
- No running or horseplay
- Report all accidents to a camp counsellor
- No open toed shoes or high heels
- Tie back long hair

Questions and Answers about Botany

Why is Botany Important?

Studying Botany is important for understanding the environment. It can impact medicines, foods, and building materials. Understanding botany can help us protect parks, forests, and wilderness areas. We also depend on botany and knowledge of plants to help solve pollution problems. (1)

How do you become a botanist?

For someone to become a botanist, they must take a university degree in biology. Some of the university classes will be on plants and environmental sciences. Botanists might work to protect the environment or they might become researchers. Some things that botanists might study include: (1)

- Plant Anatomy (the different parts of plants)
- Plant Genetics (how characteristics of plants are inherited)
- Cytology (The study of plant cells)
- Ecology (How plants, animals, and the environment interact)
- Biochemistry (the study of how chemicals work in living things)
- Plant Taxonomy (identifying and naming plants)
- Microbiology (the study of microscopic living things)

You can also learn about botany from a Mi'kmaq perspective. Many Elders and Knowledge Keepers know lots about plants. They know about how they can be used for many purposes. We will learn more about Mi'kmaq knowledge of plants in another activity.

How do Botanists Name Plants?

All plants have two names which are referred to as their "binomial" names. "Bi" means two and "nomial" means name. The first name that a plant has is called the "genus". This is a name that is given to a group of plants that are similar. The second name is called the specific name. This name is unique to one kind of plant. This way of naming is similar to how people have first names unique to them and last names that are the same as their family. We will learn some of the binominal names for plants today. Many of these names come from Latin or Greek words.

Activity 1: Identifying Plants

In this activity we will learn some of the ways that botanists identify plants. We will examine some of the plants traditionally used by Mi'kmaq people.

What we will need for our activity:

- Plant specimens, including some traditional plants
- A pen or pencil

What we will do, step by step:

Step 1: Introduction to plant identification

Listen to the camp counselor explain how plants are identified and named by botanists

With the camp counselors, review leaf arrangement, leaf shape, and flower cluster on the next two pages.

Step 2: Introduction to Traditional Plants

Listen to the camp counselor explain some of the traditional plants samples that will be used in the lab.

With camp counsellors review the traditional plants in table 1. Fill in the Mi'kmaq name of each plant or ask We will learn more about these plants and others later in the camp from an Elder or Knowledge Keeper.

Leaf Arrangement

Use the types of leaf arrangements below to describe the position of the leaves on the stem

Alternate

The leaves alternate positions along the stem

Opposite

The leaves are arranged directly across from each other on the stem

Whorled

Three or more leaves are attached at a node on the stem

Sub- Opposite

The leaves are not arranged directly across from each other but are not far enough apart to be considered alternate

Leaf Shape

Use the types of leaf shapes to describe the leaves on your specimen

Lanceolate

Spatulate

Orbicular

Oblanceolate

Linear

Ovate

Reniform

Obovate

Inflorescence Flowers
Cluster Types

Simple Umbel

The flower stems are in a cluster and about equal length

Compound Umbel

Branches of simple Umbel

Simple cyme

A cluster of three flowers where the oldest is in the middle

Compound cyme

Branches of simple cyme

Raceme

The main stock has multiple stems with flowers on the ends

Panicle

Similar to a raceme with more branching

Corymb

The stocks near the bottom are longer than the flower stems near the top

Spike

There is no stem between the main branch and the flower

Head or capitulum

The flower is at the top of the main stem

Solitary

The flower has an individual stem coming from the main stem.

Table 1. Understanding the Sacred Mi'kmaq Medicines from a Scientific and Indigenous Perspective

Name	**Indigenous Description**	**Scientific Description**
Common Name: Sage Mi'kmaq Name: _____ Binomial Name*: Salvia apiana*	• Sage is a commonly used in smudging ceremonies. • There are many different varieties of sage. Mi'kmaq people traditionally used sage that was native to the Atlantic Provinces. There are now other types of sage that are used by Indigenous people. • Sage is often used for cleansing and protection.	• The leaves are oblong. • The colour of sage ranges from grey to green with a nearly white underneath due to the many short soft hairs.
Common Name: Sweet Grass Mi'kmaq Name:_____ Binomial Name:*Hierochloe odorata*	• Sweet grass is also often used in smudging and in ceremony. It can be found growing in marshy areas where salt and freshwater meet. • Sweet grass is often braided in three to represent love, kindness, and honesty. The braid is thought of as the hair of mother earth.	• The base of the leaf, just below the soil surface, is broad and white. The underside of the leaf is shiny. • The leaf shape is linear.

Common Name: Cedar Mi'kmaq Name:_____ Binomial Name*: Thuja occidentalis*	• Cedar is frequently used to line the floors of a sweat lodge. • Cedar is used in smudging and in ceremony.	• Cedars trees are tall with thick ridged or square-cracked bark, and broad, level branches (2).
Common Name: Tobacco Mi'kmaq Name: _____ Binominal Name: *Nicotiana rustica*	• Tobacco is one of the most important sacred medicines • Tobacco is used to make an offering and to give thanks when we pray.	• The tobacco plant has pink flowers. • The leaf shape is oblovate. • Some species are native to Canada, however many are non-native (not from here) (2).

Step 3: Practice identifying the plants

With the group, answer the questions below about the sacred Mi'kmaq medicines.

1. Describe the leaf shape and colour of Sweet Grass.

2. What is the leaf shape and leaf arrangement of tobacco?

3. What is the leaf shape and leaf arrangement for cedar?

4.What is the leaf shape, leaf arrangement, and flower cluster type for sage?

Step 4: Observe the plants

Review the different plants provided by the camp counselor. Choose two plants that you like the most.

Step 5: Identify the plants like a botanist

Identify the leaf arrangement, flowers cluster type, and leaf shape for the plants that you chose using the diagrams on the previous pages.

Fill out Table 2 with a detailed description of each plant

If possible, record the common name, Mi'kmaq name, and binominal name if known.

Table 2. Plant Identification Table

Plant Name	**Leaf Arrangement**	**Leaf Shape**	**Flower Cluster**	**Other Identifying Factors (Colors, where it is found, etc.)**

Step 6: Plant Guessing Game

Now that we have identified some plants, we will play a game with what we have found. Use the follow steps for the plant guessing game:

a) Find a partner
b) Tell your partner the leaf arrangement, flower cluster, and leaf shape of one of the plants you choose
c) Have your partner examine the plants and guess which plant you are describing
d) Switch and let your partner describe a plant to you

Activity 2: Plant Cells and Osmosis

In this activity, we will learn how botanists view plants under the microscope. We will also learn about what osmosis is and how is effects what environments plants can live in.

What is Osmosis?

Plants need to store water in their cells to survive. In the plant, water needs to move. For water to move, it needs to pass through membranes. These membranes are part of the cells and only let some molecules through. Osmosis is the movement of water across a membrane to an areas where there is a high concentration of solutes (3). Solutes can be salt, sugar, or other molecules dissolved in a solvent (water). For example, when we add sugar to strawberries, water leaves the cells of the strawberries and moves towards the sugar. Another example is when you put raisins in water, they swell. This is because there is lot of solutes in the raisin but not a lot of water.

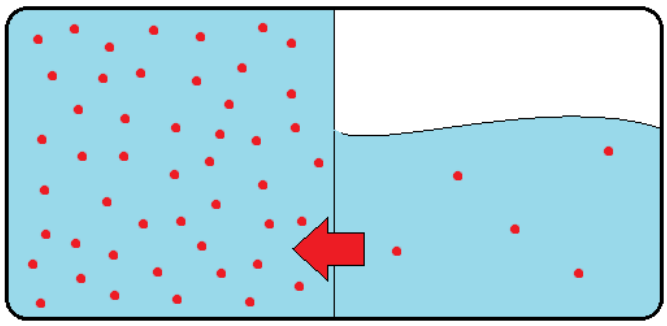

Figure 4. Visual Representation of Osmosis

What we will need

- Glass slides
- Cover slips
- Distilled water
- Saltwater
- Fresh water
- A piece of red onion
- Tweezers

What we will do

Step 1: Make a Hypothesis

As a group make a hypothesis (guess) about what will happen if saltwater, distilled water, or fresh water is added to a plant.

Answer the following questions with everyone at the biology lab:

1. If we put a plant in saltwater, how will the water move? (Inside or outside of the plant or neither)

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2. If we put a plant in fresh water, how will the water move? (Inside or outside of the plant or neither)

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3. If we put a plant in distilled water (water with no solutes), how will the water move? (Inside or outside of the plant or neither)

Step 2: Test the hypothesis

Use the following directions to test your hypothesis. You will prepare a microscope slide, which is a used to view things under the microscope. This will help you see how the water has moved in the cell.

a) Choose which of your hypothesis you want to test (saltwater, fresh water, or distilled water)
b) Take a microscope slide and ad a few drops of the water you chose to the slide
c) Pull off a small, thin piece from an onion
d) Place the piece of onion on the microscope slide on top of the water
e) Add 1-2 drops of liquid iodine on top of the onion on the microscope slide

f) Carefully place the coverslip on top of the water, onion, and iodine. Your slide should be prepared as (in the order) shown below

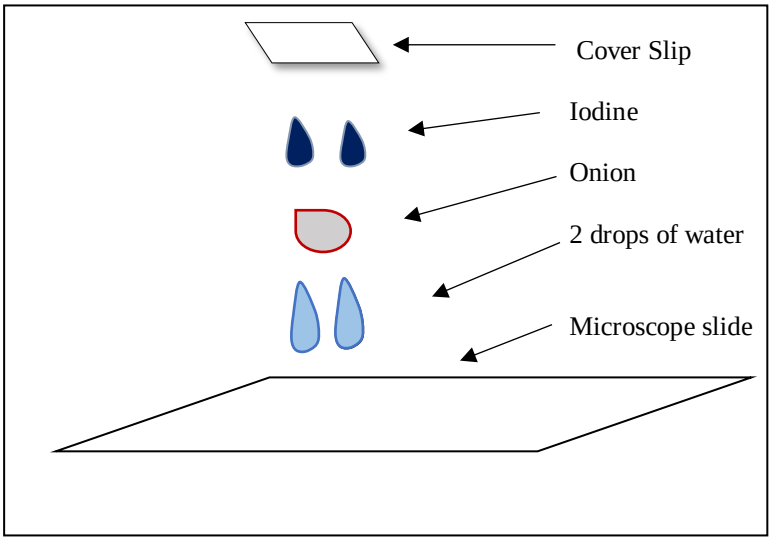
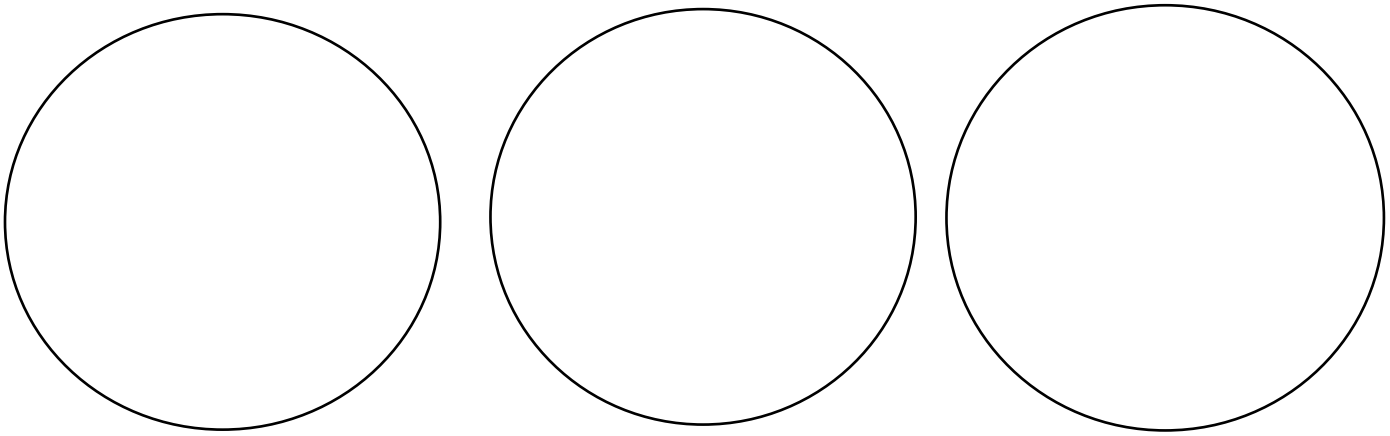


Figure 1: How to prepare a microscope slide for an onion

Step 3: Observe and Record

- The microscopes will be already set up for viewing the slides. The camp counselor will direct you on how to view the microscope slides
- Look at the results of the microscope slides with saltwater, distilled water and fresh water. Refer to appendix 1 for more information about how to use the microscope.
- Draw what you see in the images below.



Distilled Water Saltwater Fresh Water

Step 4: Results

- As a group, compare the hypothesis made for saltwater, distilled water, and fresh water with results.
- Answer the following questions

1. In which of the variables (salt, fresh or distilled) did the onion cell shrink?

2. In which of the variables (salt, fresh or distilled) did the onion cell expand?

3. Which of the variables did not change (salt, fresh, or distilled)?

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All unreferenced stories, Mi'kmaq words, or Indigenous knowledge was provided by the Elders/Knowledge Keepers listed above.

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References

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2. Evert RF, Eichhorn SE, Raven PH. Raven Biology of plants. New York: W.H. Freeman and Company Publishers; 2013.

3. Staughton J. What is Osmosis: Definition, Diagram, Examples and Explanation [Internet]. Science ABC. Science ABC; 2019 [cited 2019Jun11]. Available from: https://www.scienceabc.com/pure-sciences/what-is-osmosis-definition-biology

Appendix 1. How to use the microscope

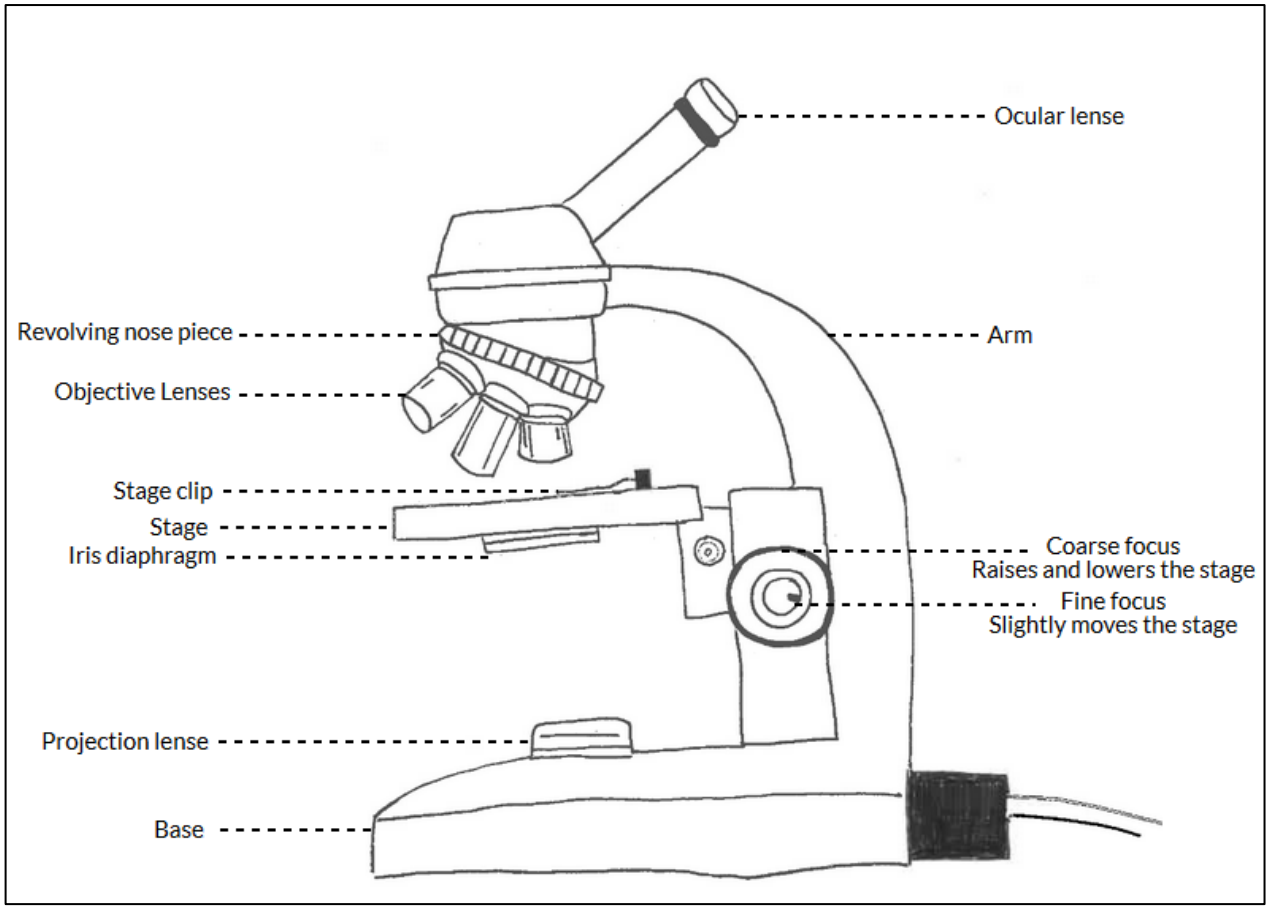

Figure 1. Parts of a Microscope

Microscope Procedure:

1. Plug in the microscope and turn on the light.

2. Make sure you know where the following are located on your microscope:
    a. Coarse focus knob
    b. Fine focus knob
    c. Controls to move the slide
    d. Light adjustment knob

3. Check your microscope is on the lowest power objective before you start.

4. Plug in the microscope and turn on the light.

5. Place the slide on the stage and use the lowest power objective lens to slowly turn the coarse focus knob until you start to see the specimen on the slide come into. You may need to move the slide around in order to see your specimen.

6. Use the fine focus knob to bring your specimen into perfect focus. If you are sharing your microscope with other students, each student will use the fine focus knob to focus the specimen best for their eyes.

7. Once you have your slide in focus on the lowest magnification level, you can switch to the next highest objective lens. You may need to re-focus slightly with the fine focus knob.

8. Repeat this focusing process until you have reached the objective lens you want to use to inspect your specimen.

9. If the image of your slide seems too dark or bright to see anything, try adjusting the light intensity.