



# Plant Chemicals for Medicine, Protection & Poison

Grade Level(s): 3-5

Author(s): Tulpehaking Nature Center

Course(s) and School(s)/School District: Abbott Marshlands

## Overview/Summary:

Resources in the Abbott Marshlands are rich and varied. This has been true for thousands of years, due in large part to the unique tidal nature of the area. Much evidence of the use of these resources by Native Americans and Colonists has been uncovered and is displayed in the Tulpehaking Nature Center and the NJ State Museum in Trenton. This lesson uses the Abbott Marshlands and the Nature Center to teach students about the native plants there, their uses as medicines, poisons, and protection, and the relationship to medicines in current use today, specifically aspirin. Students learn about the plant resources in the marsh, walk through the marsh to identify 3 plants, draw, label, and describe them in a field notebook, conduct computer research on these plants, possibly test a plant for chemical content, and share results in group discussion.

## Standards/CPIs and 21<sup>st</sup> Century Themes:

### NGSS:

**2-LS4-1.** Make observations of plants and animals to compare the diversity of life in different habitats.

LS4.D: Biodiversity and Humans

**2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.** PS1.A. Structure and Properties of Matter.

**2-PS1-2.** Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

### CCS Connections: ELA/Literacy W.2.7; W.2.8

### CPIs:

**5.1.P.B.1.** Observe, question, predict, and investigate materials, objects, phenomena during indoor and outdoor classroom activities and during any longer-term investigations.

**5.1.P.B.2.** Use basic science terms and topic-related science vocabulary.

**5.1.4.B.2.** Measure, gather, evaluate, and share evidence using tools and technologies.

**5.1.P.C.1.** Communicate with other children and adults to share observations, pursue questions, and make predictions and/or conclusions.

**5.1.P.D.1.** Represent observations and work through drawing, recording data, and "writing."

- 5.1.4.D.3. Demonstrate how to safely use tools, instruments, and supplies.
- 5.2.P.A.1. Observe, manipulate, sort, and describe objects and materials in the classroom and outdoor environment based on size, shape, color, texture, and weight.
- 5.2.2.A.1. Sort and describe objects based on the materials of which they are made and their physical properties.
- 5.3.P.A.1. Investigate and compare the basic physical characteristics of plants, humans, and other animals.

Essential Questions:

- Can I observe, describe, and identify at least 3 plants in the Abbott Marshlands that were used by Native Americans and Colonists for medicine?
- Can I accurately draw the leaves and stems of these plants and label the drawings? - Can I count all plants of a given species in a given area, identify on a map of the marsh where this area is, and describe their habitat?
- Can I say which part of a given plant was used medicinally and how it was prepared?
- Can I hypothesize how Native Americans and Colonists learned about the medicinal properties of these plants and how they shared this knowledge?
- Can I test given plants for sugar, acid, starch, and/or pH?
- Can I learn about the relationship between these plants' uses as medicines and as poisons?
- Can I learn about the use of these plants by animals and Native Americans for protection?
- Can I research on a computer facts about at least 3 plants found in the Abbott Marshlands that were used as medicines by Native Americans and Colonists?
- Can I research salacin, explore its relationship to aspirin, and write a paragraph about it?
- Can I share my knowledge of Native Americans' and Colonists' use of marsh plants as medicines and/or for protection with a group?

Enduring Understandings:

- Many different plants populate a marsh. Some plants growing in the Abbott Marshlands were used as medicines by Native Americans and Colonists who used them as medicines.
- The relationship between plants used as medicine or protection and plants used as poison is often in dose and/or parts of the plants used.

Student Learning Outcomes:

*Students will ...*

- learn about plant parts, growth patterns, and habitats.
- learn how to draw and label in a field notebook.
- learn about Native Americans' use of the Abbott Marshlands.
- identify, draw, label, count and describe 3 species of plants that were used as medicines by Native Americans and Colonists while on a walk through the Abbott

Marsh. Include their habitats and mark where they were found on a map of the Marsh.

- research these 3 plants on a computer.
- optional: test a given plant for sugar, acid, starch, and/or pH.
- research salicin and aspirin and write a paragraph about them.
- share their knowledge of these 3 plants with a group.

Teaching and Learning Activities (Including Differentiation Strategies) with Timeline:

Lesson 1: 1 hr. (can be extended as desired) – classroom discussion/activities

1. Ask, “How do you think the Native Americans living in our area treated common illnesses such as headaches or cuts?” (local herbs, plants; ceremonies/rituals)
2. “How do you think they learned about these treatments?” (trial and error, observations of animals, shamans/medicine men and women, customs)
3. “Do you think we have any of these resources in the area today?” (yes, plants are here in abundance)
4. We have a preserved area of land near here where Native Americans lived and worked thousands of years ago, and where we can observe plants these peoples used as medicines. Locate the Abbott Marshlands on a map of the area. Discuss why Native Americans would have been drawn to the area and what they did there. Show/discuss archeological evidence of early habitation. Show Tulpehaking Nature Center and Abbott Marshlands websites.
5. We will visit the Abbott Marshlands and the Tulpehaking Nature Center there to see some of these archeological artifacts and view these plants in their native habitats. We will also learn about their use by Native Americans and Colonists, while we are there and after we return to our classroom.
6. Divide students into Discovery Groups. Each group will locate 3 plants growing in the Marsh and record them in their field notebooks. They will work together back in the classroom to research these 3 and share their findings with another group.
7. Give students the plant chart of 12 local plants used by Native Americans. Have students learn names, shapes of leaves, and uses. Explain visit to Tulpehaking Nature Center and walk through Abbott Marshlands to locate plants and record them in their field notebooks. EMPHASIZE no touching. Give map of walk area.

Explore the following topics, as appropriate:

1. What is a medicine? How have peoples of other cultures used medicines? What medicines do students’ families use? What is a synthetic medicine? How does it differ from a natural one? Where do our medicines come from?
2. What is a habitat? How does it influence a plant’s growth, predators, and possible uses people make of it? Practice describing varied habitats.
3. Learn plant identification techniques (size and shapes of leaves, stems, size and growth patterns of plant, habitats, appearance in different seasons, uses by animals). Practice drawing and labeling parts of plants of differing shapes, using terms such as stem, leaf arrangements, veins, flowers/fruits. Introduce scientific practice of careful use of field notebooks. Teach drawing, labeling, estimating size, describing in drawing and words the habitat (light, water, soil conditions), and noting any evidence of predators. Include a count of the number of the species seen at the location, and mark it on the trail map. Give each student his or her own notebook.

Lesson 2 – 2 hrs. - Field Trip to Tulpehaking Nature Center and Marsh

1. In Tulpehaking Nature Center, show map of area. Orient students and explain route around Spring Lake or Watson Woods. Give plant ID chart. Discuss essential importance of not touching any plant and animal seen. Emphasize use of field notebooks for recording the 3 plants each student will locate and record. Remind students to note the plants' growth patterns and habitat. Animals seen can also be recorded.
2. Walk together to far end of Spring Lake. (**Modify for Watson Woods area**). Stop in open area just before bridge and have students share what they have observed. Include plants, habitats, and animals. Point out willow, purple loosestrife, milkweed, and oak. Have everyone enter willow leaves into their notebooks. (This can be every group's first plant.)
3. Discuss poison ivy while here. The rash occurs when the urushiol in the plant attaches to the skin protein of a human. (Native Americans may have rubbed leaves on the rash, or eaten young leaves that were cooked, to build resistance. We have no evidence that these worked.) Ask students to note if they see evidence of an herbivore eating this plant. (Many plant secondary chemicals are designed to protect the plant from herbivores because plants can't move to protect themselves. However, some animals have developed adaptations: milkweed eaten by caterpillars accumulates in the adult butterfly and causes it to be distasteful to predators.) Some animals can eat plants that would cause harm when eaten by people. (Deer can eat mayapple leaves. Birds can eat poison ivy berries that are rich in fats and, therefore, a useful food especially in fall and winter.)
4. Have Discovery Groups locate and record 1 other plant. Assist in locating these, as needed.
5. Continue walk across bridge and to beaver point, if time permits. If not, return via grassy trail (3<sup>rd</sup> left). Have Discovery Groups stop along this part of trail and record one or two more plants.

Lesson 3 – 1 hr. to several days, as appropriate. Researching/writing/sharing about plants seen in Marsh; follow-up activities as appropriate

1. Students share field notes with members of their Discovery Group.
2. Students research on computers and with other available materials their group's 3 plants. Every student should research the willow. Outline needed information: plant shape & size, leaf shape & size, habitat, number in immediate area, uses made by Native Americans, and predators.
3. Share findings with another group.
4. Emphasize medicinal uses of plants by Native Americans. Discuss the parts of the plants that were used (fruit/flower, leaf, bark, root), how the plants were prepared for use (ground, steamed, boiled, mixed with other materials), and how they were used (drunk, eaten, breathed in, rubbed on). Include consideration of how Native Americans shared knowledge about what plants, particular parts of plants, seasonal use, and amount would be useful and what would be harmful.
5. Explore briefly how drugs are discovered today. (In pharmaceutical laboratories, chemists learn about diseases and then try to target the chemicals they can make to have a particular effect. In the field, explorers visit remote areas to note local populations' medicines and area plants and gather samples to study the chemistry involved.)

6. Discuss with whole class their willow research. Include Native Americans' use of salacin, from willow bark, as remedy for headaches and pain. (Much information is readily available on the web about salacin and aspirin.)
7. Students write a paragraph of informational text comparing the natural substance salacin with aspirin.

Have students do the following, where appropriate.

1. Test for chemicals in plants. Use mortar and pestle to mash leaf; place leaf material in small container and add a capful of ethanol rubbing alcohol, to extract the plant chemicals. (The green color is due to extracted chlorophyll.) The teacher should provide the leaves! Be sure to wash hands carefully after handling all materials.
  - a. Use iodine to test for starch. Use first on wet cracker.
  - b. Use diabetic test strip to test for sugar. Use first on sugary beverage, such as sodas.
  - c. Use Litmus paper to test for acidity. Use first on apple or orange juice.
  - d. For willow (and milkweed), if the extract is acidic, there are likely to be salacins present. If it is basic, there are likely alkaloids present. What is aspirin, where does it come from, how is it made, and why do people take it?
2. Research the effect of these chemicals on people.
3. Look up chemicals on websites and see how chemical shapes differ.
4. Ask why plants produce these special chemicals. (Plant secondary chemicals serve to reduce the effect of herbivores. This is chemical warfare!)
5. Research how people saved and passed on observations and information of medical effectiveness of various plants. (Chinese, Greeks, Persians, and others have very ancient herbals – books, with drawings and written uses. In other parts of the world the efficacy of plants was part of the oral tradition, passed on from a shaman or medicine man or woman. In medieval times, herb gardens in monasteries served as modern drug stores, with monks' knowledge of what plant healed what sickness essential to a community's health.)

Vocabulary:

Chemical – a substance having a particular composition, characteristics, etc. Sugars, starch, and proteins are chemicals produced by all organisms.

Ethnobotany – the study of plants used by people of a given culture. (Native Americans have a long history of use of indigenous plants. Other cultures also had great familiarity with their plants and how they could be used in the treatment of human ailments – and also for dyes, food, art.)

Food chain – Transfer of food energy and nutrients from plants, the photosynthetic primary producers, to herbivores and then to carnivores.

Habitat – the place where organisms live, characterized by factors that permit control and growth there. Factors include light, water, temperature, and soil.

Herbivore – an animal that eats plants. Examples include rabbits, beaver, caterpillar, and monarch butterfly.

Medicine – any substance that is used to treat disease, promote healing, and relieve pain. These may be taken as teas, applied as poultices, or inhaled as steam.

Plant secondary chemicals – unique, “special” materials produced by a single plant or related species. A number appear on the medical plant list. These are in contrast to chemicals such as typical sugars, starches, and proteins made by all plants.

**Bibliography:**

Foster, S. and J.A. Duke. (1990). Eastern Central Medicinal Plants. Peterson Field Guides. Houghton Mifflin.

Still, Cecil. (1998). Botany and Healing: Medicinal Plants of New Jersey and the Region. New Brunswick, NJ: Rutgers University Press.

- Introduction has an overview of history of medicinal botany. It notes that there is little information about plants used specifically by the Lenape.

**Other Resources:**

<http://botanical.com> - Available on Amazon, this is an excellent resource for this unit. A good reference source with many links

<http://www.nybg.org/baci/herbarium.imaging/> - looks at herbarium specimens of plants.

Medicinal plant information is on an accompanying pdf file. Illustrations are reproduced with appropriate permission as noted.

**Informal Summative Assessment:**

Rubric

4	3	2	1	0
Student locates, draws, labels, researches, and shares information on 4 or more plants found in Abbott Marshlands.	Student locates, draws, labels, researches, and shares information on 3 or more plants found in Abbott Marshlands.	Student locates, draws, labels, researches, and shares information on 2 or more plants found in Abbott Marshlands.	Student locates, draws, labels, researches, and shares information on 1 or more plant found in Abbott Marshlands.	Student is unable to locate, draw, label, research and verbally share information about any plant found in Abbott Marshlands.
Student is able to conduct extended research on salacin and willow on the web. Student is able to write a substantial paragraph	Student is able to conduct research on salacin and willow on the web. Student is able to write a cogent paragraph about the	Student is able to conduct minimal research on salacin and willow. Student is able to write a short paragraph about the	Student is able to conduct minimal research on salacin and willow on the web. Student is unable to write a paragraph about the	Student is unable to research salacin and willow on web. Student is unable to write paragraph about salacin and willow research.

about the research.	research.	research.	research.	
Student does 4 additional activities related to plants of the Abbott Marsh.	Student does 3 additional activities related to plants of the Abbott Marsh.	Student does 2 additional activities related to plants of the Abbott Marsh.	Student does 1 additional activity related to plants of the Abbott Marsh.	Student does no additional activities.

Supplies and/or Equipment Needed:

- Field notebooks, writing tools
- Computers
- *Optional:* iodine, diabetic sugar test strips, litmus (pH) paper, saltines, sugar, water, apple and orange juice.
- *Optional:* selected plant leaves, mortar and pestle, rubbing alcohol, small plastic containers.

Student and Teacher Reflection:

Analysis of student performance and learning (both group and individual).

What were the results of the assessments?

To what degree did the results match the expectations for student learning and performance?

What worked well, what didn't work as well as anticipated?

What, if any, modifications should be made for the next time this unit is taught?

What needs to be done now to help the students who have not yet mastered the objectives and to extend the learning of those that have?

What have we learned that will improve our own planning and classroom practice in the future?

Appendix with plant illustrations and other materials is in a separate file.