
# Medicinal Plants: Merging Science and Folklore

**Grade Level:** 6, 7, 8
**Where taught:** Classroom or Laboratory (with working sinks and drains)
**# Students:** maximum of 30 students
**Time required for presentation:** 60-90 minutes (2 Days)
**Topics Covered:**
Medicinal Properties of Plants, Plant Selection, and Terrain Mapping – Earth Science
Inhibitory Properties and Chemical Characteristics of Plant Compounds – Physical Science
Properties of Microorganisms and Mechanisms of Attack by Antimicrobials – Life Science

**Georgia Performance Standards:** S(6,7,8)CS1, S(6,7,8)CS2, S(6,7,8)CS3, S(6,7,8)CS6, S(6,7,8)CS7, S(6,7,8)CS8, S(6,7,8)CS9, (S6E5h), (S6E6), (S7L2a), (S7L2b), (S7L4c), (S8P1b), (S8P1c), (S8P1e).

The Medicinal Plants: Merging Science and Folklore module is geared towards preparing Georgia's middle school science teachers to integrate inquiry-based, hands-on research modules in the classroom. Specifically, the module is focused in the areas of earth science, life science, and physical science, three areas that are particularly suitable for incorporating teaching strategies that stimulate student interest in science. The module was developed in order to introduce students to the excitement of scientific exploration, and to enhance students' understanding of and appreciation for the ways that scientific inquiry impacts their lives, as well as the need for scientifically rigorous experimentation to evaluate claims made in the name of science. The module bridges the gap between earth science, life science, and physical science: students will learn important content information on topics related to biology (characteristics of plants and microbes), geology (natural environments that promote growth of selected plants) and chemistry (properties of antimicrobial agents).

This teaching module consists of two visits during which students are engaged in a number of hands-on activities. Ideally, the two days are to be taught in a one week period. For instance, the Bio-Bus Fellows would see each class for a 60-90 minute session on two days of the same week.

**Preparation for Day 1 Classroom Activities (Teacher's responsibility).**
Introduction topic: The medicinal properties of various plants, such as willow bark (aspirin), foxglove (digitalis) and yew (Taxol), and the role of folklore in the discovery of these properties.
Assignment: After interviewing parents, grandparents, or other family members, or by doing independent research at the library or on the Internet, each student group will select 4 plants for investigation. They will be encouraged to choose at least one plant from their own environment so that they can create a simple topographic map of where their plant is found (including such details as the composition, soil drainage properties, etc.). Students will submit a written assignment identifying the plants selected by their group (including their scientific names and the reasoning behind their inclusion for testing), along with a sample of each plant. The teachers will


soak the plants in isopropyl alcohol for 2-4 days. The compounds eluted with the alcohol solution will form the crude extract, and the extract will be fractionated, via cotton ball filtration.

**Day 1.**
Introduction topic: the inhibitory properties of selected plant compounds, their chemical characteristics, and the technology used to purify them.
Experimental design: To separate the compounds of the crude plant extract, students will perform acetone-based paper chromatography. Distinct bands of individual compounds will be viewed under ultraviolet light. The separated compounds will be cut out of the filter paper as small squares, and dried in preparation for their analysis for antimicrobial activity. Additionally, the crude extract will be applied to small squares of filter paper, and analyzed.
Introduction topic: properties of microorganisms, including those that can cause infection and disease in humans.
Experimental design: To test their extracts for antimicrobial activity, students will apply selected non-pathogenic bacteria and non-pathogenic yeast to individual agarose plates using sterile cotton-tipped applicators. Each plate will be divided into 4 quadrants: 1 quadrant will contain a filter disk containing a known antimicrobial compound (such as ampicillin) as a positive control and the other three will contain the filters with the dried plant extracts (previously prepared). Plates containing the filter disks will be allowed to incubate at room temperature overnight.

**Day 2.**
Introduction topic: Mechanisms of attack by antimicrobials.
Experimental design: Students will observe and analyze their agarose plates from the previous day, measuring the diameter of any "zones of inhibition" where the compound on the filter disk has diffused out onto the plate and prevented microbial growth. Students will record their measurements in their notebooks, and prepare an analysis of their results. In our experience with this experimental protocol, we find that at least one in four plant extracts exhibits significant antimicrobial activity. Thus, we believe that most student groups will have results they can evaluate. We will be prepared, however, to help students consider how scientists learn from negative results as well as positive ones.

**The Bio-Bus Program will supply all the needed material. However, teachers are required to implement Preparation for Day 1 Classroom Activities, prior to the visit, in order to prepare students for the module.**