Plant-Inspired Products

Overview: Not only do plants provide products and raw materials for us to use, they have also served as inspiration for many manmade inventions. In this lesson, we will explore some plants that inspired the creation of common household items.

Grade Level/Range: 3rd to 5th Grade

Objective: Students will

- explore the similarities between scientists and inventors
- study the characteristics of plants that have inspired human inventions
- learn to appreciate the knowledge we can obtain through observations of plants and nature

Time: 30 minutes

Materials: Collect examples of some or all of the following plants and the products they inspired:

- gourds — utensils/food storage vessels
- horsetail — scrub brushes
- lamb's ear — bandages
- willow — aspirin
- burdock burs — Velcro®

Background Information

Not only do we obtain a vast array of products directly from plants, they have also served as the inspiration for a number of manmade inventions. Just like scientists, inventors use keen observation skills to identify problems or needs and then develop solutions to fix or fulfill them. The process inventors follow is closely related to basic experimental methods: They must pose a question (hypothesis), research possible solutions, create ways to test their solutions, and then present their results. Sometimes they find these solutions by observing how similar challenges are solved in nature or through the use of natural products, and then they look for ways to replicate natural phenomena through man-made means. The development of Velcro® is a perfect example of a plant-inspired invention.

Velcro®: Velcro® was invented by a man named George de Mestral in the 1940s. He was inspired by the burdock burs (fruit of the burdock plant) that stuck to his pants and his dog's fur after walks in the outdoors. He observed that the burs had small hooks that would get stuck on the rough surface of the fabric of his pants and was impressed by this natural adhesion method. The hooks on the burs are an evolutionary adaptation that aids the plant in dispersal of its seeds. In nature, animals will brush up against the burs, picking them up on their fur. The burs eventually drop off in another location where the seeds can germinate and grow. This allows the plant to propagate itself throughout its habitat, helping to ensure its survival.

George wanted to find a way to imitate this design for human use. He worked with fabric experts to create an adhesive fabric that replicated this phenomenon and developed Velcro®, which works by combining strips of loops with strips of hooks. His journey to replicate nature is recounted on the Velcro® website (https://www.velcro.com/about-us/our-brand/).

Here are a few more plant-inspired inventions to share with your young gardeners:

Gourds. Gourds (*Cucurbita* spp.) have hard shells and this made them suited for very important jobs in early civilizations. Archaeologists have found that gourds appeared early in human civilization and that cultures throughout the world grew different types of gourds and used them for a number of purposes. For instance, before people created pottery storage vessels, they used gourds to store food and water, and to make utensils such as ladles and water dippers.

Ancient people also used gourds to make musical instruments and for decoration. Some of the musical instruments were used in religious ceremonies and traditional celebrations.

As cultures developed the technology of pottery making, they replaced gourds with clay pots, and today we store food and water in plastic and glass containers. But we still use gourds for decorative uses, and even to make birdhouses! For more information on gourds check out our gourd spotlight or visit the American Gourd Society website (https://www.americangourdsociety.org/).

Horsetail. Horsetail (*Equisetum*) is a prehistoric plant that has survived since the time of the dinosaurs. A close relative of the ferns, horsetail reproduces through spores, not seeds. It grows in marshy areas and consists of two different types of vertical, hollow stems. The first stems appear in the spring and are similar in appearance to asparagus topped with a brown cone-like structure that bears the spores. Later in the year, larger stems are produced with stringy, tough leaf-like stems branched at the joints, giving the plants a feathery appearance (like a horse's tail). If planted in a favorable location, horsetail will spread quickly and has the potential to be weedy.

Another name for horsetail is scouring rush, which gives away one of its important uses. Horsetail's very fibrous stems contain silica crystals which make the stems excellent implements for cleaning pots and pans. Historically, people tied bunches of horsetail stems together and used the "pads" to scour dirty dishes. Horsetail was also used by furniture makers to polish their wares. Even though they have been replaced by "SOS Pads" and sandpaper in most places, there are still cultures that use the horsetail for cleaning and polishing.

Lamb's Ear. Lamb's Ear (*Stachys* spp.) is a low-growing plant with fuzzy, whitish-gray leaves that remind people of the ears of lambs. A quickly spreading perennial, lamb's ear's orgins have been traced to the Middle East, specifically Iran and Turkey. In the past, its soft, absorbent leaves were wrapped around wounds to serve as bandages. Replaced by sterilized bandages made from cotton and plastic, lamb's ear is now grown mostly for decorative purposes and is often used in garden designs to create a soft border. It is very easy to propagate by division and makes a great plant for herb and children's gardens.

Willow. The Greeks discovered that chewing on willow (Salix sp.) bark could relieve pain during the fifth century BC, but it was not until the 1800s that scientists uncovered the secret component providing that magic: salicin. A synthetically produced derivative of salicin is used as the active ingredient in aspirin — the number one drug consumed in the world for pain relief. Although aspirin is now man-made, the willow deserves the credit for its inspiration. Salicin was later identified in additional plants including wintergreen, sweet birch, a variety of rose and spiraea plants.

Aspirin is just one example of a medicine derived from plants. Depending on the reference you consult, anywhere from 25 to 50% of medicines today are have their origins in plants, and new ones are still being added. Who knows what cures are waiting to be discovered? This is just one reason why plant and habitat conservation are so important.

Laying the Groundwork

Before beginning the activity, ask students to list ways they interact with plants. Why are plants important to humans? *We use plants in our daily lives for food and shelter. They are an important part of our environment/landscapes and we depend on them for the air we breathe, too. There are a number of plant-derived products we use each day, such as paper and cotton.*

Next, ask, How do people discover new inventions? *They use observation skills to identify problems/needs and develop solutions. They use the experimental methods to pose a question (hypothesis), research possible solutions, create ways to test their solutions, and then present their results.* How does this process compare to the scientific method used by scientists? How are they similar? How are they different? You can make a Venn diagram or class chart to compare.

Exploration

1. Collect examples of as many of the plants listed in the background information as possible (gourds, horsetail, lamb's ear, willow, burdock burs or cockleburs).
2. Break the students into small groups and give each group one of the plant examples.
3. Tell students that each of these plants inspired the invention of a product used in our everyday lives. Give them time to discuss and formulate an idea of what their plant may have inspired.

4. Let each group present their idea (or ideas) of what product the plant sample inspired and also list the characteristics of the plant that brought them to that conclusion. Some of the plant uses will be harder to discover through observation than others so be sure to give positive reinforcement for all conclusions.
5. After each group has had time to present, share examples of the products inspired by each plant. Here are some possible discussion questions: How did the plants help solve a problem or meet a need? How are the man-made products they inspired different than the plants themselves? Do the man-made products offer any benefits? Are there any differences in cost?

Making Connections

Read the book *The Most Magnificent Thing*, by Ashley Spires. What did the girl in the story learn about inventing new things? As a group talk about observation and what it means to be a good observer. Discuss the steps needed beyond observation to lead to a new invention or scientific discovery. Do they think this is an easy process? Why is it important?

Take a trip to your schoolyard or garden. Challenge students to look at the plants they see in a new way and come up with a design for their own nature-inspired invention. Give them the chance to draw and share their idea. Makes sure they explain the challenge or problem their invention will solve.

Branching Out

English and History. Assign students to write a research paper on a famous inventor. Give them time to share their findings with the class. Older students can develop a monologue for their inventor that they present in class — if possible, dressed like the inventor.

Art. Before the development of synthetic dyes, plants were used to add color to textiles and artwork. Investigate plant dyes and give students a chance to create something using these dyes. (The dyes can be used to bring color to cloth, yarn, eggs, paper, etc.). Learn more in the lesson Exploring Plant Dyes (https://kidsgardening.org/lesson-plans-exploring-plant-dyes/).

Link to Standards

This lesson can be used to connect to the following Next Generation Science Standards Performance Expectations:

- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.