Growing a Knowing Nose

Overview: Students explore a variety of plant-derived aromatic substances, reflect on the memories and feelings they evoke, and describe them. Next, as they try to taste without using their sense of smell, they begin to grasp the importance of this remarkable adaptation. They also learn that scents provide plants with a way to communicate, aid in reproduction and seed dispersal, and protect themselves.

Grade Level/Range: 3rd- 5th Grade

Objective:
Students will learn that:

- Plants give off many different distinctive scents.
- People's sense of smell and sense of taste are connected.
- Many plant scents aid the plant in its survival.

Time: 1 hour

Materials:

- Small bottles or plastic containers with lids. If clear, cover the containers with paper to hide what they contain.
- Cotton balls
- Different plant-derived aromatic substances for each container. Try vanilla; herbs (basil, cilantro, dill, etc.); rose water or other flower inspired perfumes; cinnamon; cocoa powder; lemon juice or peel; garlic; etc.

Background Information:

Nothing arouses our "taste buds" like our sense of smell. In fact, scientists believe that 75 percent of what we perceive as taste actually comes from the aromas we take in! And no surprise; after all, we only perceive four flavors (salty, sweet, sour, and bitter; some add a fifth, called umami), but our brains perceive more than 30,000 smell sensations! Most of us can actually recognize about five to ten thousand!

The scent of food makes it, well, worth eating! When that pizza comes, we revel in the smell before it even gets close. But that's just part of it. When we take a bite, odor molecules also go straight from our mouths to a place deep within our nasal cavity. In both cases, aromatic signals travel to an area of the brain associated with memories and emotions.

Odors actually come from families of volatile chemicals too numerous to mention. So to make the task of describing smells manageable, food and wine connoisseurs describe them by using analogies to flowers, fruits, herbs, spices, other foods (e.g., yeast), and nonfood substances (e.g., smoke).

Beyond the "how" each scent is produced and perceived, is the "why" plants developed the scent-producing chemicals — and it's just as interesting and important to the plants' survival. Plants use these chemicals as a way to communicate and protect themselves.

For example, the scents given off by flowers help attract pollinators to them. Pollinators play an important role in seed production and the survival of the plant species. Flowers that release scent during the day tend to be pollinated by bees and butterflies. Flowers that

release more scent at night attract pollinating bats and moths. Some plants have are very specialized flowers. For example, some flowers have developed a scent that mimics rotting meat, which attracts the flies that pollinate those flowers.

Scientist have also discovered that plants give off an odor when under stress. The smell released by freshly cut grass is a commonly used example. Recent studies have observed that some plants give off a special scent when under attack by insects, which draws birds to them for an insect feast, helping both plant and bird.

Scent can provide other means of protection for a plant. For example, some plant leaves produce an odor that is displeasing to animals, which prevents them from grazing on the leaves. Since the leaves contain the plants' food factories, scents that repel animals aid in the plants' survival by keeping them from looking like an all-you-can-eat salad bar for hungry animals.

Circling back to fruit, a "suitcase" of edible fruit is one strategy plants use to disperse seeds throughout their environment. When an animal eats a seed-filled fruit, the animal may move on to a new location — with the fruit and seed still in its digestive system. At this new locale, the animal may excrete the seeds in its droppings, thus not only dispersing the seeds, but also accompanying them with a nice supply of fertilizer.

So chemicals that enhance the flavor of fruit increase the likelihood that the fruit will be eaten and the seeds dispersed. Incredibly, plants keep their fruit unpalatable (think sour, under-ripe apple) until the seeds are mature. The scent and flavor of ripe fruit therefore, can help the plant increase its numbers and the overall chance of survival of the species.

Advanced Preparation:

If your small bottles or plastic containers are clear, cover the containers with paper to hide what they contain. Poke a hole in the lid of each jar and mark the jar with a letter.

Gather different plant-derived aromatic substances for each container. Examples include vanilla; herbs (basil, cilantro, dill, etc); rose water or other flower-inspired perfumes; cinnamon; cocoa powder; lemon juice or peel; garlic; etc.

For liquid scents, put drops of the liquid on cotton wads and insert into your bottles. For solids, place under cotton balls.

Laying the Groundwork:

Ask students to brainstorm different plant-derived scents in their environment. If possible, go out to your garden or schoolyard and conduct a Nose Scavenger Hunt. Write down as many different scents as the students can find.

Exploration:

1. Line up the aromatic containers on a table or counter. As students go from bottle to bottle with a notebook in hand, and direct them to carefully smell each one and then write these things in their notebooks for each one: 1) any memory, feeling, or activity the aroma brings to mind, 2) words that describe what they smell, 3) guesses about what they are actually smelling. Nonwriters can discuss their responses with you.

2. Discuss students' experiences and notebook entries. Ask, Which smells did you like most, and why? How do you think the substances taste? Which did you like least? Which were easier (harder) to describe, and why? What conclusions can you draw about our sense of smell?

3. Finally, ask, *Which do you think is more important when we eat: our sense of smell or our sense of taste?* Consider having students

explore this question by sampling slices of two mystery foods: apples and pears. Have partners work together on the challenge. One student should be blindfolded and hold his or her nose. The other should give the taster the slices, one at a time. Ask, *Are the samples the same or different? How can you tell?* (Students may notice texture differences.) *What does each taste like?* Next, students should unplug their noses, taste again, and try to identify the flavors. Ask, *What did you notice about the taste test? What do you think made the difference? What new questions do you have?* Revisit and discuss the initial question.

Making Connections:

Now that students have had a chance to observe different plant-derived scents, help them understand the benefits plants get from producing these odors.

Ask students:

- Why do plants need to attract pollinators?
- Why is it important for plant leaves to be protected?
- How does fruit help a plant with seed dispersal?

Use the background information above to share with them how plant-produced scents can help with pollination, seed dispersal and plant survival.

Branching Out:

Aroma Journal

Challenge students to keep diaries of everything they do for a day that involves a plant-derived aroma. They should write down what they did along with an adjective to describe the smell (e.g., *I woke up and smelled strong coffee. I brushed my teeth and smelled something minty.*).

Smell with Words

Build students' vocabulary by asking them to come up with synonyms for the word smell or odor (e.g., *fragrance, stink, stench*). Next, have them come up with adjectives to describe types of odors (e.g., *gentle, penetrating, putrid, fetid, acrid, sour, garlicky, sweet*).

Aromatic Cultural Cuisine

Many types of aromatic herbs and spices are associated with dishes of a particular region or ethnic group. In fact, the titles of some dishes include the name of the aromatic ingredient (e.g., rosemary bread). Students can research their own region or the ethnicities represented in class in search of dishes that rely upon specific aromatic ingredients. Each young detective should share the name of the dishes they find and the aromatic ingredients that help define them. If practical, try to taste some of these in class, first with just your noses, and then with your mouths, too!

Explore Other Senses:

Sight

Take a color wheel out to the garden and see if you find a match for all the “spokes.” Create annual beds demonstrating different color combinations, such as planting annuals with warm- or cool-colored flowers or using analogous, complementary or monochromatic color schemes. Conduct a color hunt in the garden by matching squares of paint color samples to plants and talk about the wide variety of hues found in nature.

Touch

Plants provide a range of visual textures from fine (generally created by smaller-leaved plants like cosmos or dill) to coarse (usually the larger-leaved plants like hostas). You can also find a variety of tactile

textures, from smooth and soft (lamb's ear) to rough (cucumber leaves). Collect samples of leaves with varying visual and tactile textures to display at a discovery station in the classroom (make sure to avoid poisonous plants.) Give students an opportunity to explore the textures and ask them to make a written description of each one using at least 3 adjectives.

Links to Next Generation Science Standards Performance Expectations:

4-LS1 From Molecules to Organisms: Structures and Processes
- 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.