

Making Sense: The Biology of the Senses

Spring 2008

Week 2: Smell

Adapted from *Human Body Explorations*

Objectives:

- Understand the differences between taste and smell
 - Understand how some smells are linked to particular memories, even when the smell cannot be placed, and figure out what smells evoke the strongest memories for them
 - Understand that smells fade because our smell sensors get used to the scents
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Background Info for Mentors:

The sense of smell (olfaction) is a chemosense, which means it detects the presence of certain chemicals. Smells are transmitted through the air. The odor molecules travel into the nose and up the nasal cavity, where they are detected by olfactory receptors. When an olfactory receptor neuron fires, the impulse is transmitted to the olfactory bulb at the top of the nasal passages. From here, the system connects to the olfactory center in the cerebral cortex for perception and recognition of the odor, and also to the limbic system, which controls the expression of emotions and instinctive behaviors. There are many hundreds of types of olfactory receptors, and with these we can distinguish between more than 10,000 different scents. It is believed that each odorant triggers several types of olfactory receptors, which creates a unique combination of neural impulses that is interpreted as a single scent.

Overview of Lesson:

We will open with a brief discussion on smell, why it's important, and how it relates to taste. The first activity will focus on the relationship between smell and taste. The next activity will introduce the students to the idea that smells can evoke memories. We will wrap up with a quick activity showing them how their sense of smell diminishes as they get used to a particular scent.

Introduction (5 min)

Remind the students of last week's lesson on taste. Tell them that while all the senses are tied together in some way, the other sense that is most strongly tied to the sense of taste is the sense of smell. Ask them if they can think of any examples of times in which the sense of smell is related to taste. For example, you can ask them what food tastes like when you have a stuffy nose.

Explain that we will be doing two activities that look at the sense of smell, and that the first one will focus on distinguishing the sense of taste from smell.

Activity 1: Taste vs. Smell (20 min)

Materials:

- Several different flavors of lollipops
- Stopwatch or clock with second hand
- Data sheet

Procedure for mentors:

1. Instruct the students to close their eyes and pinch their noses shut with their fingers.
2. Select a different flavor of lollipop for each student, unwrap each, and place it into their hands.
3. Tell the students to place the candies in their mouths and open their eyes, but to keep their nose held shut. They should breathe only through their mouths.
4. Ask the students to describe the sensations they are experiencing one at a time, and record their answers, and their guess for the flavor, on the data sheet.

Sample questions:

- Is it sweet? Sour? Somewhere in between?
 - Does it remind you of anything?
5. After 60 seconds, ask the students again to describe the sensations, and make a guess of the flavor. Record these observations.
 6. After recording, tell the students to open their noses and immediately describe any differences in the sensations in their mouths. Record these observations, and ask the students to identify the flavor of the candy.
 7. Tell the students what flavors they had. Are they surprised?

Q: What sensations did you experience in your mouth, and how did they change over time?

A: They should expect to recognize a sensation of sweetness, sourness, or both. After a minute, some students may be able to identify the flavor.

Explanation: When your nose is closed, you are relying on the taste receptors of your tongue alone. These receptors recognize the 5 tastes we discussed last week. After you have sucked on the candy for a while, you may be able to identify the flavor because the flavor molecules may travel through your throat to your nasal passages. These lead to the olfactory bulb, where the olfactory receptors are housed. Once you open your nose, the olfactory bulb isn't blocked anymore, and it's easy to sense the flavor molecules from the candy.

Activity 2: Nose-stalgia (15 min)

Materials:

- 5 or more "nose-stalgia" cans
- Data sheets

Procedure for Mentors:

1. Ask the students what they think of when they smell freshly-baked chocolate chip cookies, Play-doh, or crayons. Explain that it is common for people to associate certain smells with past experiences or emotions, and that in this activity they will explore the connection between smells and memories.
2. Pass around a "nose-stalgia" can containing a mystery scent. Have each student record the number on the can.
3. When the students get the can, they should remove the lid and hold the open can a short distance from their noses. Then they can waft the scent toward their nose with their free hand.
4. As they get the cans, they should record their observations of the different scents. Some questions to ask to guide them include:
 - What does the scent remind you of - is it a particular person, place, or situation?
 - Does it evoke any specific feeling or memory?
5. Ask the students to describe the scent they are smelling. Can they come up with three adjectives to describe it? *Examples: sweet, sour, strong, flowery, spicy, earthy, etc.* Tell them to think of other smells that it reminds them of.
6. Do they recognize the scent? If so, they should try to name it. If not, they can make a guess.

7. Repeat the process with the remaining nose-stalgia cans.

Q: When smelling a scent that stimulated a memory or evoked an emotional response, was the scent always one with which you were familiar? What do you think accounts for this?

A: Each student should find some scents familiar and some unfamiliar. Generally, an unfamiliar scent will elicit neither an emotional response nor a memory. A familiar scent may elicit memories of times or places associated with that scent because they connect to the parts of the brain that deal with memories.

Side Activity (to do if time allows): How quickly do smells fade?

From: http://familyfun.go.com/parenting/learn/activities/feature/famf010101_famfsense1/famf010101_famfsense2.html

Materials:

Same as for Nose-stalgia, plus stopwatches

Procedure:

Using the nose-stalgia canisters, have the students test to see how long they are able to detect a scent. You can time them with the stopwatch.

Q: Why do smells fade quickly?

A: When you first inhale the scents around you, such as if you are in a forest and smelling pine needles and musty leaves, you smell everything at first. But after a while, strong scents begin to fade. That's because smell sensors get used to the scents and stop sending new signals to your brain. This helps you become aware of newer smells, like the odor of a skunk.

Tidbits to Share:

- The average human can detect the presence of some molecules at a concentration of less than 1 part in 20 billion, but dogs can detect the presence of certain molecules at a concentrations of 1 part in 200 trillion!
- Your nose can smell directionally, telling you where an odor originates.
- Your sense of smell is least acute in the morning; our ability to perceive odors increases as the day wears on.