Friends of the Island Fox

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Grade Level: 3 - 7

Time: Two 30 min. class periods

Objective: Students will 1) know that invisible molecules are the origin of scents, 2) understand that water binds with scent molecules to concentrate smells, 3) collect, compile and examine scientific data.

Method: Students conduct an experiment and collect quantitative and qualitative data regarding the sense of smell. They examine the data and test hypothesis.

Materials: Metal spoon, aerosol scent, eraser, pencils, damp cotton balls, small plastic containers, three kinds of dry ingredients (ie. coffee, powdered spices, baby powder, pencil shavings, dried onions).

CA Standards:
Science: 3.1e,h, 3.5c,d,e; 4.6c,d,e,f; 5.3b,5.6g,h; 6.7c,e; 7.7c;
Math: 4 Statistics 1.0; 6 Statistics 1.1, 1.2, 1.4;

EEI: Not Applicable

Sniff This !

The Channel Island fox relies on its sense of smell to locate food and to find out information about other island foxes. The fox's sense of smell is much more sensitive than a human's because it has a design element that increases its ability to chemically attract molecules of scent - a wet nose.

Background: The island fox is only 12 inches tall and spends much of its time alone. To find food on the Channel Islands, the fox uses its eyes and ears, but also its highly sensitive nose. The island fox can smell ripe fruit high in a tree. Using smell it can find a hidden bird nest or locate a deer mouse trail.

Smell is also important for communication. Island foxes mark their territory with urine and scat. A quick sniff informs an island fox about a neighbor fox. By smell alone it knows the sex, age, and possibly the identity of another island fox. Scent also determines the boundary line between two island fox territories.

To smell an odor, molecules must be shed off of an item into the air. Wind, plant transpiration, evaporation, fire, even shaking a dusty rag, all release molecules into the air. When these molecules come in contact with special receptor cells (olfactory sensing cells) in the nose, information is sent to the brain through nerves and a smell is detected.

Part of having a highly affective nose, lies in having a good system for gathering scent molecules and bringing them in contact with the nasal passage.

A few molecules of scent floating through the air can easily be missed. But scent molecules are attracted to water. When multiple scent molecules bind with a water droplet, the smell becomes concentrated. Examples of this chemical attraction at work are steam rising from a bowl of soup or a cup of coffee and the intensity of smells after it rains. It is easier to smell scents in a damp rain forest than in dry forest.

Humans have a relatively dry nose. The island fox, however, has

a wet nose that helps to concentrate scents and therefore enhances the fox's ability to smell.

Procedure:

1. Ask students how they use their sense of smell. Why is it important to them? Explain that the island fox depends on the sense of smell to locate food and to read scent information left by other island foxes.
2. Explain that in order for something to have a smell, molecules from that item must be shed into the air or into water. The molecules travel through the air and come in contact with special sensing cells in our nose. Wave a spoon or other hard metal object through the air. Can anyone smell it? Did molecules come off of the spoon and float through the air? Yes, but not enough for people to identify it. Have everyone close their eyes and spray an aerosol scent into the air. Have the students reopen their eyes. How many can smell the scent? How many can see it?
3. Molecules of scent are too small for us to see, but we know they are there because we can smell them. Many items are fairly hard in composition and they do not shed enough molecules for people to smell. Have a student take out an eraser. If the eraser is just sitting on the desk, does it give off a strong smell? No. Ask the students to think about their experiences with erasers. When are you most likely to smell the eraser? When you are using it and rubbing off little pieces. Some of the pieces are so small they are molecules that find their way into the air and up into the nose.
4. A few molecules floating in the air can be easy for a nose to miss. One way to gather molecules in the air together is with water. The molecules are attracted to the water like a magnet. Evaporating water molecules or those rising in steam are great for concentrating scent molecules and intensifying scent. The more molecules that find their way to your nose, the stronger something will smell. Ask students if they can think of examples where steam or evaporating water made something smell stronger? The island fox has a much better sense of smell than humans. What might be special about a fox or a dog's nose that would help it gather more scent molecules than a human nose? It is wet.
5. Arrange the class in small groups. Each student should have their own **Student *Sniff This!* Data Sheet**. For Round A, each group will have three small containers with dry ingredients, numbered 1 - 3. Keep lids on the containers, but make small holes in the lids so that the ingredients can be tested without opening the containers. Explain that everyone is going to participate in a series of experiments. One at a time, students will slightly shake a container, then take a sniff. After they sniff the container, they write their answers on the data sheet for the corresponding number on the data sheet. Then the student passes the container to the next student. Emphasize that this is a scientific experiment. There are no right or wrong answers. It is important that each student record their own data and not discuss their answers with others.

6. Filling out the Data:
    - WEAK to STRONG Scale: Focus on is the scent WEAK or you can just barely smell it or STRONG it is easy to smell right away. This is not a measurement of good or bad, but of intensity.
    - FOOD or NON-FOOD: Does the scent smell like something you could eat?
    - "What does it smell like?": Urge students that they do not have to know what the item in the container is. There are no right or wrong answers. Encourage them to write down anything that comes to their mind when they smell the scent. Adjectives or descriptive words are just as important as guesses of the substance.
7. Once everyone has completed Round A, ask students to recall how the island fox's nose was different. For Round B, each student should also have one damp cotton ball. Have them dampen just under their nose on the upper lip. Now repeat the experiment, answering the questions for Round B.
8. After the data is collected, survey the students for their general feeling about what they experienced. How did Food smells compare to Non-food smells? Was there a difference in their ability to smell when their nose was wet?
9. You now have three data sets: The WEAK to STRONG measurement and the FOOD or NON-FOOD are quantitative (measured in numbers), while the question "What does it smell like to you?" provides qualitative data (word descriptions). Collect the data sheets.
10. Assign six tabulation teams, one for each scent and round. Each team will determine the mode for the scale part of the data and create a bar graph for the FOOD or NON-FOOD. They will write down each written response regarding "What does it smell like" on a piece of paper. In this way they can put the similar answers together and create categories for the responses. Have them look for patterns in the answers and find the dominate perception.
11. Compare the mode responses for Round A and Round B for each Scent. Was the scent considered to be stronger in Round B? If yes, then a wet nose helped people have a better sense of smell. If no, then it did not.
12. Compare the FOOD or NON-FOOD graphs for Round A and Round B for each Scent. Did answers change in Round B or did participants have the same ability to determine a food smell with or without a wet nose? Did a wet nose help people have a better ability to determine what was and what wasn't a food scent?
13. Compare the qualitative statements for Round A and Round B for each Scent. Did the basic feelings toward the smell change from Round A to Round B? Were people more likely to know what the scent was specifically with or without a wet nose?

Assessment:

14. Looking at the evidence the class collected, what would students conclude about having a wet nose like an island fox? Did the evidence prove or disprove the hypothesis: A wet nose improves the sense of smell?

Additions:

- Smelling things with a “wet nose” can be especially interesting outside in nature. Try taking students outside and see what scents they find to be heightened by having a wet nose.
- Combine with *The Nose Knows* and *Your Parents’ Nose* for an Olfactory Lab.

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