How do we experience food?

1) Big group activity:

Ask the students- How do we experience food? If they are confused by this question, ask them which sense or senses do we use?
Someone should say taste.
Tell them that today we are going to learn a little more about how we taste. We will learn about the role of saliva in tasting. In order to learn about it, we are going to experiments on ourselves.
Ask them how else we experience food?
All senses can be explored. After this exploration tell the students that we will also learn about how smell affects how we "taste".

2) Experiment One: Do we need saliva to taste our food?

Supplies:
Tongue picture
Paper towels
Q-tips
Bits of cookie, pretzels, pirate booty in baggie for each explorer
1 cup of water/explorer
For the brave there will also be coffee powder, cinnamon, curry powder, cocoa powder, salt, mustard powder

Vocabulary: saliva, dissolve, receptor

Ask your explorers if they know "how" we taste. If they want to explore- go with them. If they don't know and just want an answer here is one.
Saliva dissolves our food the takes it to our taste **receptors**.

Look at the picture provided with your explorers to follow the path flavor molecules take. If they are interested in the details, feel free to go through figure. Otherwise, I think it is enough to say the tastebuds are in the little bumps on our tongue and inside these are the taste receptors.
You can ask- How many different types of tastes are their? It may be fun to list them. You can tell them there are only five.
Bitter, Salty, Sweet, Sour, Umami (glutamate such as in MSG- we have this to try-Accent)

OK- let's see if it is really true that we need saliva. Tell them we are going to taste a variety of different foods with and without the help of our saliva.

Have them paste the "taste" table in their lab notebooks. Before each food item, have the explorer rub their tongue dry with a paper towel. Then have them place the larger food item on their tongue OR using a q-tip rub some powder on their tongue. Ask them if they can taste it. Try at least 3 foods. Between each tasting have the students rinse with water and dry their tongue.

Repeat the exercise with the students holding their nose.

Ask the students at the end of the exercise what things are important to taste. Explore their answer. Did they just say saliva? Did they say saliva AND smell? This is a nice lead in to the second activity.

For your interest see 2006 Nature article on mammalian taste.
http://www.nature.com/nature/journal/v444/n7117/full/nature05401.html

3) Can you tell the difference between an apple and potato without your nose?

Supplies:
cut up potato
cut up apple
lifesavers

1) Have students close their eyes to mix up the pieces. Have them hold their nose and eat them. Can they tell the difference? Have them repeat without holding their nose.

2) Tell the explorer they are next going to try to guess the flavor of a lifesaver. With their nose held and eyes shut you will hand them a lifesaver. Ask them immediately what the flavor is. Have them such for a minute and then ask them if they can now guess the flavor. If they are able to eventually guess what it is, ask them why. We don't know "why" from the experiment, but what is happening is that molecules are making it up their nose through their throat!

One small change can make an entirely different smell!

The next two pages are optional. It is neat that just the handedness of the molecule can make an entirely different smell but may be difficult to understand. It may be enough to mention that humans can distinguish approximately 10,000 smells and compare it to 5 tastes!

Smell the Difference

Even though the same atoms combine to make mirror molecules, the left-handed and right-handed versions can have very different properties, such as smell. With a few items from around your house (and your parents permission), you will be able to smell the difference between some stereoisomers.

Part 1

Items needed:

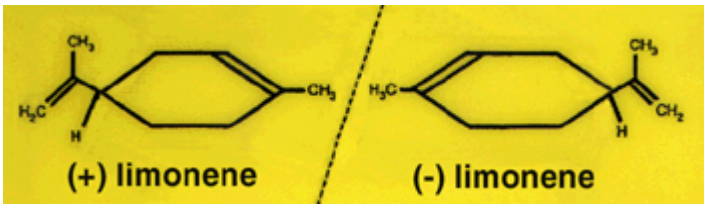
- 1 orange (or orange peel)
- 1 lemon (or lemon peel)
- 1 grater
- 2 small bowls

Procedure:

1. Grate a small amount of orange peel into one bowl.
2. Grate a small amount of lemon peel into the other bowl.
3. Smell the difference!

What's going on?

Orange and lemon peel both contain a molecule called limonene. However, the limonene molecule in orange peel has a different structure than the limonene in lemon peel. The different structures have different smells.



Orange **Lemon**

The types of limonene in oranges and lemons are mirror molecules. The molecule in the orange is "left-handed," and the one in the lemon is the "right-handed" version.

Part 2

Items needed:

- caraway seeds

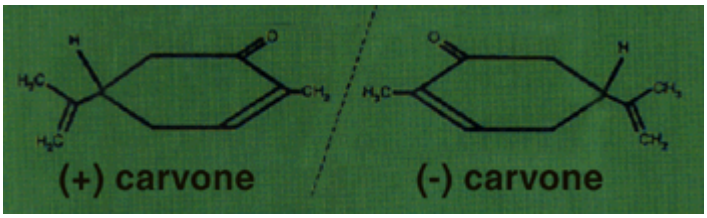
- mint leaves (fresh or dried)
- 2 small bowls
- 2 spoons

Procedure:

1. With one of the spoons, crush the caraway seeds in a bowl.
2. With the other spoon, crush the mint leaves in the other bowl.
3. Smell the difference!

What's going on?

Mint and caraway both contain a molecule called carvone. Look at the picture of the carvone molecules in mint and caraway. Do they look the same?



Mint **Caraway**

Mint and caraway are mirror molecules. Mint is the "left-handed" version and caraway is the "right-handed" version.

How does a molecule's handedness affect smell?

When you grated the orange and lemon peels and crushed the mint and caraway, you released molecules into the air. The nerve-ending receptors in your nose absorbed the molecules and sent an impulse to your brain. Your brain then interpreted the smell.

Molecules with different shapes fit into different receptors. A receptor shaped like a right glove, for example, would interact only with a right-handed molecule.

Can you see wich "nerve receptors" (gloves) these lemon, caraway, orange,