

Mapping Your Tongue

Overview: The tongue has an ingenious design. Receptors responsible for getting information are separate and compartmentalized. So, different areas on the tongue actually have receptors for different types of tastes. This helps us to separate and enjoy the distinct flavors. In this experiment, you will be locating the receptors for sweet, sour, salty, and bitter on the tongue's surface.

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Suggested Time 30-45 minutes

Materials cotton swabs (4)

- cups (5)
- black tea (1 bag)
- red vinegar
- sugar
- salt
- microwave
- water
- spoons
- partner
- blindfold

Experiment

1. Review the instructions on their worksheets and then break the students into their lab groups.
2. Hand each group their materials and give them time to perform their experiment and write down their observations.
3. Label the first cup as "bitter." Put 3 ounces of water into it. Add teabag and have an adult help you to heat the water in the microwave. This will make your bitter cup. Let it sit for 5 minutes. While it is steeping, you can prepare the other cups.
4. Fill the remaining cups with 2 ounces of water each. Label each and prepare them as follows:
 - a. For the sweet cup, add two teaspoons to the warm water in one of the cups. Stir until well dissolved.
 - b. For the sour cup, add 2 ounces of red vinegar to another cup and stir well.
 - c. For the salty cup, put two teaspoons of salt into the final cup. Stir until dissolved.
 - d. The last step in cup preparation is to discard the tea bag that has been steeping in the first cup.
5. Now, put the blindfold on your partner and have them stick out their tongue. Dip the first swab into the tea. Using the diagram as a guide, swab each area one at a time: A, B, C, and D. Ask your partner to identify the flavors as *sweet*, *sour*, *salty*, *bitter*, or *can't tell* as you swab each individual area. Record your partner's response for each area.

6. Your partner should rinse out their mouth with water after testing the bitter tea. Then test each of the remaining solutions, one at a time in the same manner.

Mapping Your Tongue Data Table

Liquid Type	Tongue Location A	Tongue Location B	Tongue Location C	Tongue Location D
bitter				
sweet				
sour				
salty				

Reading

Humans can identify thousands of distinct tastes, but we only have four types of taste receptors. When you take a bite of something flavorful, the enzymes in your saliva start to dissolve it immediately. This solution of flavor and saliva goes to your taste buds and is then interpreted by your brain as sweet, sour, salty, or bitter.

The taste buds are located on the little bumps all over your tongue (those are called papillae). The taste buds have taste receptors which bind to the structure of certain molecules: sweet receptors recognize hydroxyl groups (OH) in sugars, sour receptors find acids (H⁺, such as the citric acid in a lemon), salt receptors respond to metal ions (like Na⁺ in table salt), and bitter receptors are triggered by alkaloids. These are bases which contain nitrogen. It's interesting to note the location of the bitter taste buds – they are on the back of the tongue. Since many poisons are alkaloids, their bitter taste may actually trigger vomiting.

Anyone who's had a stuffy nose can tell you that smell plays a big role in our ability to taste. This makes sense because we know that we can only really taste the four distinct true flavors of sweet, sour, salty, and bitter. Our nose works in partnership with our tongue to allow us to identify more complex flavors.

Exercises

1. How many different types of taste receptors do we have? What are they?
2. Can you still taste food when you have a stuffy nose?
3. Which taste receptors recognize the hydroxyl group?

Answers to Exercises: Mapping Your Tongue

1. How many different types of taste receptors do we have? What are they? (Four: sweet, salt, bitter, and sour.)
2. Can you still taste food when you have a stuffy nose? (We can only taste the four distinct true flavors of sweet, sour, salty, and bitter. Our nose works with our tongue to allow us to identify more complex flavors.)
3. Which taste receptors recognize the hydroxyl group? (sweet)