

# OH MY — P A P I L L A E !

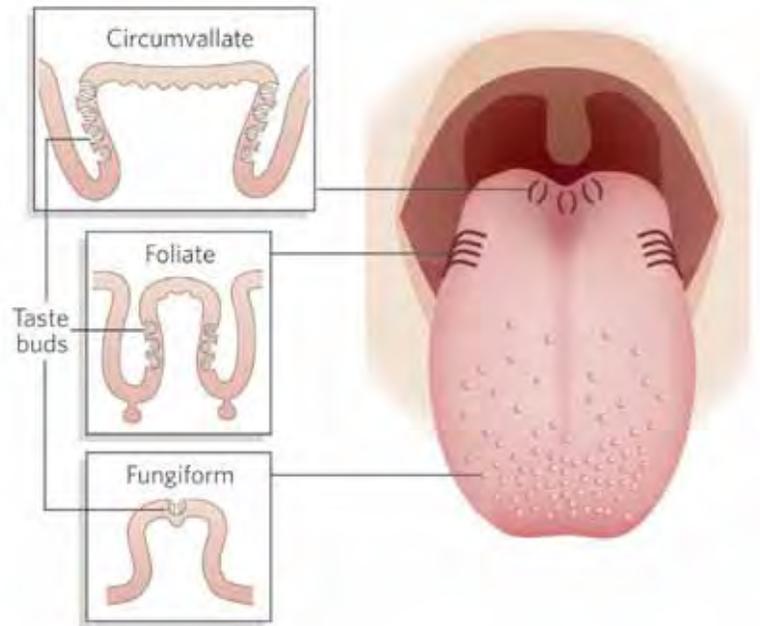
## Background

### *Taste*

There are five basic tastes. They are: sweet, sour, salty, bitter, and umami. The Japanese word “umami” translates as “pleasant to the taste, agreeable, good, mild, savory, delicious.” Umami is also described as “meaty.” Sources of the taste include monosodium glutamate (MSG), broth, and shiitake mushrooms.

Taste begins when taste molecules in food enter a pore at the top of the taste bud. Taste buds are located throughout the mouth, including on the soft palates and larynx. Contrary to what is published in many textbooks, all taste buds respond to all five basic tastes. Taste buds can't be seen without a microscope. Those “bumps” that you can see on the tongue are called papillae. Three out of the four types of papillae contain taste buds. The locations of the papillae that contain taste buds are shown in the figure on the right.

Once in the taste pore, taste molecules bind to hair-like cilia that project from the top of taste cells that are located in the taste bud. Each taste bud contains 30-50 taste receptor cells (TRCs). After the tastants bind to the cell, the next step, taste transduction, is somewhat different for each of the basic tastes. The chemicals that produce salty and sour tastes act directly through ion channels, whereas those responsible for sweet, umami, and bitter tastes bind to surface receptors that trigger a series of signals to the cells' interiors that ultimately results in the opening and closing of ion channels. The opening of the ion channels increases the concentration of positive ions inside taste cells. This depolarization causes the taste cells to release tiny packets of chemical signals called neurotransmitters, which prompt neurons connected to the taste cells to relay electrical messages to the brain.



*(Chandrashekar et al. 2006)*

### *References*

Chandrashekar, J, Hoon, MA, Ryba, NJ, Zuker, CS. 2006. The receptors and cells for mammalian taste. *Nature* 444: 288-294.

Lawless, HT and Heymann, H. 1998. *Sensory Evaluation of Food: Principles and Practices*. New York: Chapman & Hall.

# OH MY — PAPILLAE!

## Administrator's Guide

*The following demonstration was prepared by Sarah Smith-Simpson.*

**Grade levels:** 3-8

**Estimated Preparation Time:** 5 minutes

**Estimated Activity Time:** 10 minutes

**Standard Addressed:** Content Standard C (Behavior of Organisms)

Multicellular animals have nervous systems that generate behavior. Nervous systems are formed from specialized cells that conduct signals rapidly through the long cell extensions that make up nerves. The nerve cells communicate with each other by secreting specific excitatory and inhibitory molecules. In sense organs, specialized cells detect light, sound, and specific chemicals, and enable animals to monitor what is going on in the world around them.



### **References:**

Chandrashekar, J, Hoon, MA, Ryba, NJ, Zuker, CS. 2006. The receptors and cells for mammalian taste. *Nature* 444: 288-294.

### **Objectives:**

- To introduce sensory science to students
- To have students voluntarily participate in a sensory test

### **Materials:**

- Food coloring
- Mirrors

### **Procedures:**

1. Students can voluntarily participate, but should not be forced to participate because all sensory tests that include human subjects must be conducted on a voluntary basis.
2. To make the papillae visible, have students put a few drops of blue food coloring on their tongue, and they will see that a bunch of little pale bumps—mostly fungiform papillae—stand out on a blue background.

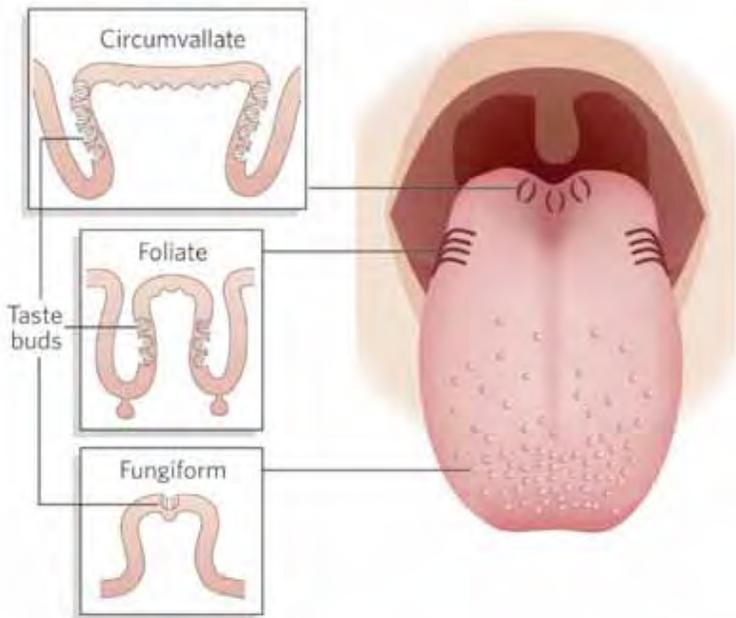
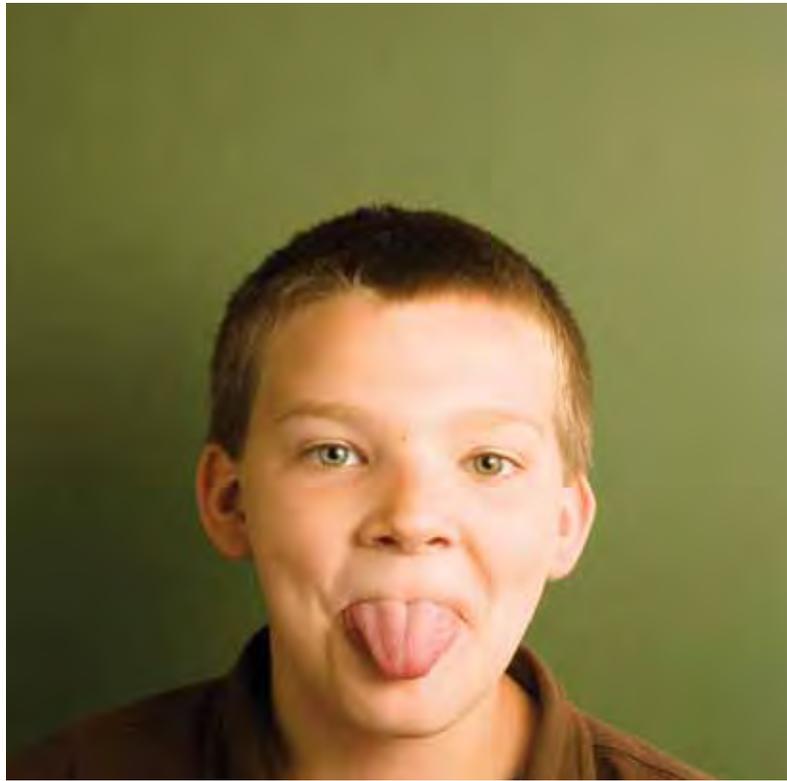
# OH MY — PAPILLAE!

## Student Handout

**Background:** Taste buds can't be seen without a microscope. Those "bumps" that you can see on the tongue are called papillae. Three out of the four types of papillae contain taste buds. The four types of papillae are:

- Filiform (no taste buds)
- Fungiform
- Foliate
- Circumvallate

**Objectives:** To investigate the anatomy of taste



Chandrashekar, J, Hoon, MA, Ryba, NJ, Zuker, CS. 2006. The receptors and cells for mammalian taste. Nature 444: 288-294.

### **Procedures:**

1. To make the papillae visible, put a few drops of blue food coloring on your tongue and you'll see that a bunch of little pale bumps—mostly fungiform papillae—stand out on a blue background.

### **Conclusion Questions:**

1. How many kinds of papillae can you see?