Taste intensity & fungiform papillae

The purpose of this lab if to determine your sensitivity to specific bitter tasting substances, and to relate this functional ability to structural properties of your tongue. Genetic variation exists in the ability to taste certain substances (taste stimuli are called "**tastants**"). Chemically-activated receptors exist on the "**taste buds**" in the epithelia of your tongue. Each receptor is activated by specific chemicals, so if one does not have a receptor that binds that chemical, one can't taste it. Your genes code for proteins, some of which are taste receptor proteins. If you lack a gene for that taste protein, your tongue will lack that taste receptor.

You and your partner will test each other's ability to taste bitter substances.

Taste buds are microscopic sensory structures in the epithelia of your tongue. Taste buds are more numerous on the structures known as **fungiform papillae**. In this lab, you will count the number of fungiform papillae on the tip of your tongue, and calculate the density of these papillae.

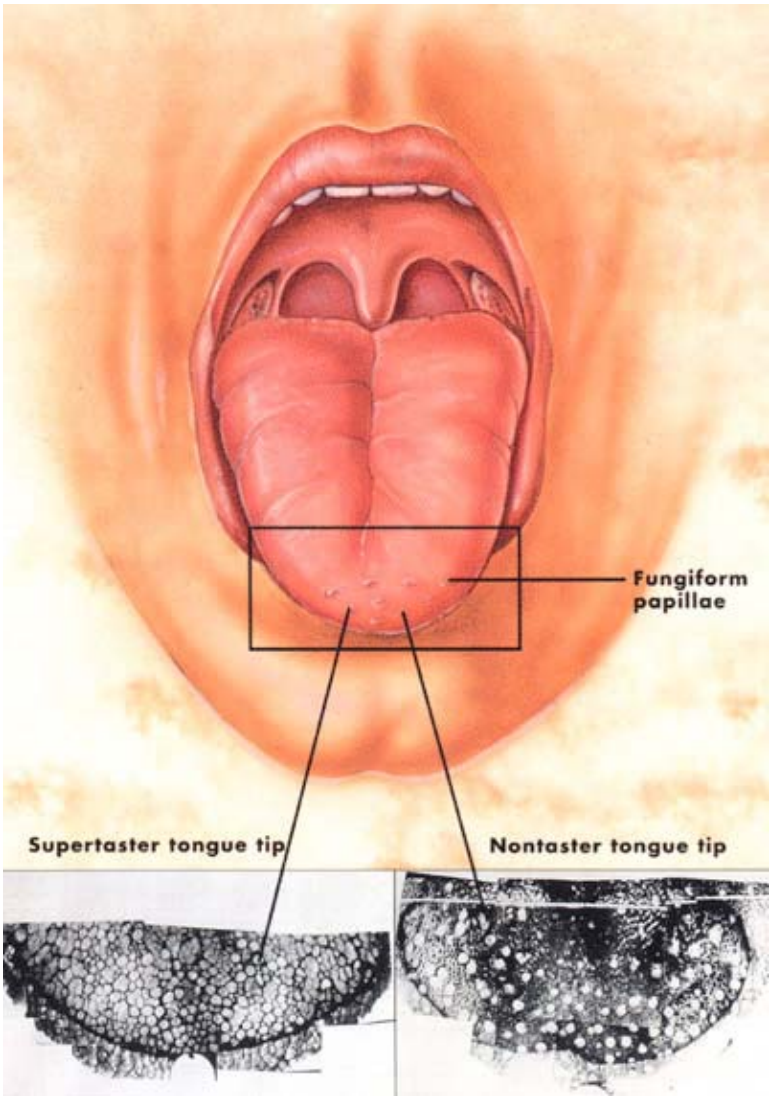
Part I– **Determining taste intensity**

1. Obtain four types of test paper strips–thiourea, PTC, sodium benzoate, and control papers.
2. Take a single piece of Control paper and give it to your partner to place on the tip of their saliva-moistened tongue *for 30 seconds*. Note whether it is "not bitter N", "somewhat bitter S", or "very bitter V".
3. Take a sip of water to wash away any aftertaste.
4. Take a single piece of PTC paper and give it to your partner to place on the tip of their saliva-moistened tongue *for 30 seconds*. Note whether it is "not bitter N", "somewhat bitter S", or "very bitter V".
5. Take a sip of water to wash away any aftertaste.
6. Take a single piece of thiourea paper and give it to your partner to place on the tip of their saliva-moistened tongue *for 30 seconds*. Note whether it is "not bitter N", "somewhat bitter S", or "very bitter V".
7. Take a sip of water to wash away any aftertaste.
8. Take a single piece of sodium benzoate paper and give it to your partner to place on the tip of their saliva-moistened tongue *for 30 seconds*. Note whether it is "not bitter N", "somewhat bitter S", or "very bitter V".
9. Repeat this for the other lab partner.
10. Record your data below and copy the final percentages for each tastant.

Student #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	%N	%S	%V
control																										
PTC																										
Thio																										
SB																										
# pap																										

Part II– **Fungiform papillae density**

1. Place a drop of blue food coloring on the tip of your tongue, and then swallow a couple of times, or rinse with a swig of water and spit.
2. Making your tongue a dry as possible, stick out your tongue and place a paper hole reinforcer on the tip of your tongue in the area shown in the picture.
3. The blue dye should stain the epithelium everywhere except on the fungiform papillae.
4. Using a flashlight and a magnifying glass, count the number of fungiform papillae inside the hole.
5. Determine the number of pink papillae that are within the circle and record it in the table above.



Questions:

1. **What is the function of the control papers?**
2. **Why do some people have receptors for these bitter tasting substances and some do not? In other words, what might the evolutionary benefits be to each condition? (Hint: what types of food taste bitter? What are their nutritional values? Why do plants make bitter tasting chemicals?)**
3. **Report the percentage of students who can taste each tastant. For instance, nearly 100% of students should rate Control paper "N", and 0% should rate it "V". Rank the tastants in degree of "bitterness".**
4. **Make 3 graphs, one for each tastant. Label the abscissa "taste intensity" and put N, S, and V from left to right. Label the ordinate "average # of papillae", and plot the average number of papillae in those students who reported each tastant to be N, S, or V. You should have three data points on your graph.**
5. **Describe the pattern of the points. How does "taste intensity" relate to average # of papillae" for each tastant?**

References:

This exercise was created by James A. Murray (UCA Biology) using these references.
Brain Briefings, Nov 1998, Taste Intensity, http://www.sfn.org/briefings/taste.html
Gadsby, Patricia, Tourist in a Taste Lab, DISCOVER, Vol. 21 No. 7 (July 2000), http://www.discover.com/jul.url
Hunt, Marla June 24, 1998, A question of taste, San Diego Union Tribune

Answers

1. **Using papers with no bitter chemical in them controls for the possibility that the paper itself might taste bad, and for the possibility that sometimes one might imagine a bad taste when it is not there.**
2. **Plants make bitter chemicals to protect themselves from being eaten. The bitter chemicals are often alkaloids (e.g. caffeine, cocaine, morphine) that make animals sick. Animals eat plants to get their nutrients. Often the most nutritional foods (e.g. broccoli) have a bitter taste. Plants tend to protect their most nutritious parts the most. Humans that have more bitter receptors might benefit from avoiding toxins in plants, but humans that have fewer bitter receptors might benefit from eating plants that have a high nutrient contents. Which is favored would depend on the levels of toxins and nutrients in the local environment of those humans.**
3. **NA**
4. **NA**
5. **Often there is a rough correlation between number of papillae and subjective taste intensity.**