Are You a Supertaster?

Standard(s):

Grade 7 7.1.1.2.3 Generate a scientific conclusion from an investigation clearly distinguishing between results (evidence) and conclusions (explanation).

Grade 7 7.4.3.2.3 Recognize that variation exists in every population and describe how a variation can help or hinder an organism's ability to survive.

Grade 10 9.1.1.1.2 Understand that scientists conduct investigations for a variety of reasons, including: to discover new aspects of the natural world, to explain observed phenomena, to test the conclusions of prior investigations, or to test the predictions of current theories.

Grade 10 9.4.3.3.4 Explain why genetic variation within a population is essential for evolution to occur.

Objective:

- Students will collect data on variation in human taste abilities as denoted by the number of fungiform papillae found on the tongue.
- Students will discover if they are a nontaster, taster, or supertaster.
- Students will analyze why variation in human taste has evolved.
- Students will discuss potential evolutionary advantages and disadvantages to being a supertaster.

Type of Activity: Lab

Duration: 50-55 minutes

Timing in relation to Nobel Conference:

__x__ pre-conference activity
_____ during conference activity
_____ post-conference activity

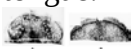
Tie to Nobel Conference:

Speaker: Linda Bartoshuk, Professor of Community Dentistry and Behavioral Science at the University of Florida, Gainsville
Bartoshuk is an internationally known researcher specializing in the chemical senses of taste and

smell. Her research explores the genetic variations in taste perception and how taste perception affects overall health.

Teacher Tips:

Tiny structures called taste buds enable us to taste. Taste buds are located on the tongue on structures called fungiform papillae. They are part of all the pink tissue in your tongue. The photographs below depict variation in the number of fungiform papillae on the human tongue.

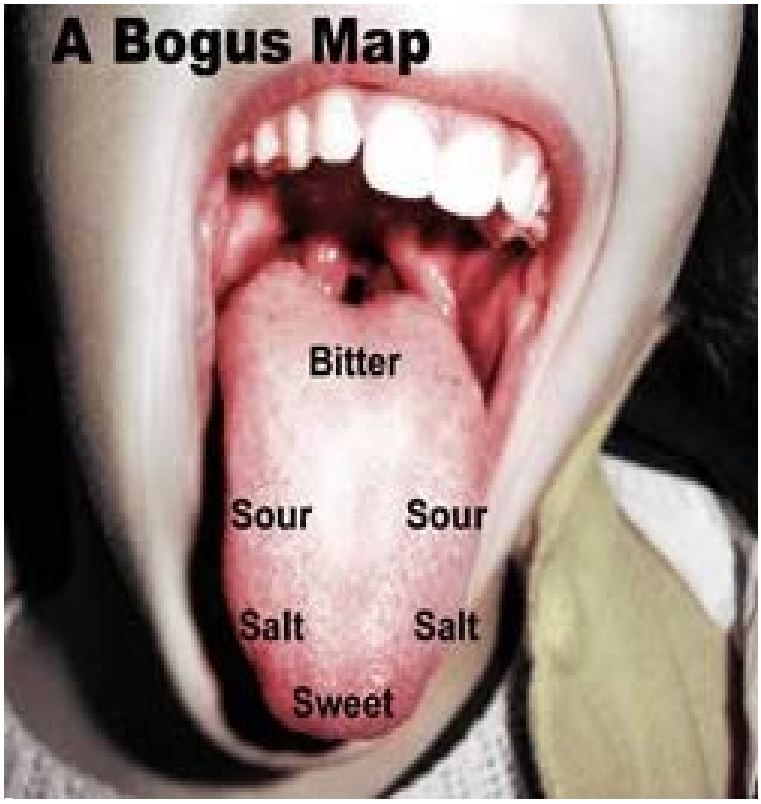


A=taster, B=supertaster

Generally, supertasters will have a strong aversion to foods like raw broccoli, grapefruit juice, and dark chocolate.

Recommended Prior Knowledge for Students:

- Students should have a very basic understanding of why/how we taste. A simple explanation of the information above will be adequate. Along with this explanation, the common misconception of the tongue map (see the picture below) should be addressed.
- Concepts, Connections, and Terms
- How does a person taste?
- What about the tongue allows people to taste?
- Do all people have the same sense of taste?
- What is the evolutionary significance of taste variation in humans?
- What are fungiform papillae?
- Common misconception-tongue map and taste areas



Materials:

- Blue food coloring (1 drop per student) **OR** blue/purple sour balls (1 per student)
  **May be helpful to have both on hand in case a student cannot or does not want to eat the sour ball.*
- 2 paper towels or napkins per group
- 2 cotton swabs per group (food coloring only)
- 2 sticky notebook hole reinforcement circles per student
  **May also use a hole-punch to make 1/4 inch circles or have students use a circle from a sheet of notebook paper*
- 1 flashlight for 2 sets of partners (4 students) to share
- 1 magnifying glass for each set of partners
- Mirrors would be helpful as well
- Digital cameras work great (take a picture of the tongue, zoom in, and count only the larger, whitish bumps).

Description of Activity:

In this experiment, students will dye the tongue tissue to help them identify the number of fungiform papillae within a given area. Once the tongue is dyed, the reinforcement circle is placed on the tongue to isolate a uniform sample of tongue tissue. Students then count the number of fungiform papillae to determine whether or not they are a supertaster.

In other studies, a person who has 10-30 fungiform papillae inside a standard reinforcement circle is considered average and called a "Taster." Usually, about 50% of any group are Tasters. People with more than 30 fungiform papillae found inside the circle are called "Supertasters," and about 25% of any group are Supertasters. Individuals with fewer than 10 fungiform papillae are known as "Non-Tasters" and also comprise about 25% of the population.

Procedure:

Prior to conducting the lab, have students complete the following survey **OR** provide the following foods and conduct a taste test:

1.	Do you like raw broccoli?	Can't stand it	It's OK	Love it
2.	Do you like regular grapefruit juice?	Can't stand it	It's OK	Love it
3.	Do you like dark chocolate?	Can't stand it	It's OK	Love it

Note: The taste test option would be an excellent motivator and would also provide consistency in what exactly is being tasted (i.e. type of broccoli, grapefruit juice, etc).

Students should compare their individual results with the outcome of the lab.

Lab Procedure:

1. With your partner, stick out your tongue at each other. See those pink bumps—that are sort of hard to see? Each bump is a fungiform papillae, and each has 1-15 taste buds on it. We want to be able to see the fungiform papillae really well, so you're going to dye your tongue and it will really make the pink bumps stand out from the colored background. Scientists often use dyes to help them see structures.

**Teacher Note: May substitute a dark-colored sour candy for food coloring (suckers, jolly ranchers, sour balls). If candy is used, there is no need for cotton swabs in the materials list. Candy may work better for this activity because not only will it be a motivation for the students, it will also stimulate the fungiform papillae to stand out.*

2. Dry your tongue by wiping it with a paper towel (not necessary if using candy).

3. Put one drop of the food coloring on the cotton swab and paint your tongue OR suck on the candy until your tongue has been colored.

4. Move your tongue around in your mouth to make sure your whole tongue is colored.

5. Pat-dry your tongue, using a paper towel or napkin—1 or 2 light pats is enough. Don't scrub! Removing excessive dye will be helpful.

6. Place 1 reinforcement circle in the center of the tip of your tongue. It is important for participants to be consistent in where they place the circle.

8. With the use of a hand lens, have your partner shine the flashlight on your tongue and count

the number of larger, less colored bumps within the circle. If there are too many to count, estimate. Count half the circular sample, and multiply by two.

******This is a very important step. If you are unsure about what you are supposed to be counting, ask for help!***

9. Record your data in a labeled data table and repeat the experiment with the other partner.

10. Determine whether you and your partner are nontasters, tasters, or supertasters and record in your table. Your teacher will give you the parameters to make this determination once you have provided your data.

11. Graph the class data, showing the number of students who are nontasters, tasters, and supertasters. If available, graph multiple class data to obtain a larger sample size. (y=# of students, x=type of taster)

12. Compare the initial survey or taste test with the results of the lab and make a correlation between an individual's likes and dislikes for bitter foods and whether or not they are a supertaster.

Modified from ScienceNetLinks.com

Assessment:

1. Explain whether there is variation of fungiform papillae within this population of students.

2. Is there a correlation between the data collected in the initial student survey/taste test and the results of this lab? Explain.

3. Explain a potential relationship between the number of fungiform papillae and a person's health.

See the following resources:

June 2010 article from CNN: http://www.cnn.com/2010/HEALTH/06/16/salt.taste/index.html
MSNBC: http://bodyodd.msnbc.msn.com/_news/2010/05/11/4380014-being-a-supertaster-is-no-piece-of-cake

*Research other sources!

4. Explain potential evolutionary advantages and disadvantages between being a nontaster and a supertaster.

See the following resources:

Website: Ask Linda Bartoshuk!
http://www.pbs.org/safarchive/3_ask/archive/qna/3294_peppers.html

Science News Online: http://www.sciencenews.org/pages/sn_arc97/7_12_97/bob1.htm

http://www.nutritionatc.hawaii.edu/HO/1998/19.htm

Yale-(Another Bartoshuk resource) http://ysm.research.yale.edu//article.jsp?articleID=77

Extensions:

1. The BBC offers a five-question survey to determine whether individuals are non-tasters, tasters or supertasters. Students could take this survey and compare these results with the results from their lab investigation. Are the results the same? Why might they be different? http://www.bbc.co.uk/science/humanbody/body/interactives/supertaster/

2. PTC (phenyl thiocarbamide) genetic taste test - there is a single gene which codes for a protein found in our tongues. PTC will bind with the protein if it present and a person will taste it. If the protein is not present, PTC will not bind and a person cannot taste it. Being able to taste PTC is a dominant trait.

Students could compare their results of the PTC test to the lab investigation results and see if they think there is a relationship. (Some have attempted to find a relationship between ability to taste PTC and Bartoshuk's supertaster, taster, non-taster designations, but they do not seem to be directly correlated.)