

## Measuring Your Taste Threshold

Young Scientist Program

Anatomy & Physiology Teaching Team

Adapted from sciencebuddies.org

Katherine M. Holzem

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### Abstract

This project is so good you can taste it! You'll find out how sensitive your tongue is for three different types of taste: sweet, sour and salty.

### Objective

The goal of this project is to determine your threshold of taste for sweetness, sourness and saltiness. You will determine what is the lowest concentration of a solution that still has perceptible taste for salt, sugar and vinegar.

### Terms and Concepts

To do this project, you should do research that enables you to understand the following terms and concepts:

- Taste perception
- Taste bud
- Interactions between smell and taste
- Weber-Fechner law
- Stevens' power law

### Introduction

Our neural system for taste is remarkably sensitive. Not only can we sense compounds at extremely low concentrations, we can also discriminate between compounds that are closely related. For some molecules, we can distinguish between different stereoisomers—molecules that are made of exactly the same atoms, but are mirror images of one another (Dodd & Castellucci, 1991). The artificial sweetener aspartame is an example. It tastes sweet, but its stereoisomer does not. Our noses are similarly sensitive: one stereoisomer of carvone smells of spearmint while its mirror image smells of caraway (Dodd & Castellucci, 1991).

In this experiment, you will determine your own taste thresholds for sweet, sour and salty solutions. You will start with a 10% solution, and use the process of *serial dilution* to make a series of solutions, each 10-fold weaker than the preceding one (i.e., 1%, 0.1%, 0.001%, etc.) If done properly, this is an extremely accurate method.

### Materials and Equipment:

- Salt (sodium chloride)
- Granulated sugar (sucrose)

- Vinegar
- Water (preferably distilled)
- Stirring rod or spoon
- Gram balance, such as the [Fast Weigh MS-500-BLK Digital Pocket Scale, 500 by 0.1 G](#), available from Amazon.com
- 100 mL graduated cylinder
- 10 mL graduated cylinder
- Cotton swabs
- Paper cups
- Paper towels

### Experimental Procedure

1. Make a data table in your lab notebook like the one below. Use as many columns as you need to determine your taste threshold for each substance. You may want to leave more space or make a separate data table for additional observations that you make during the experiment (e.g., testing different areas of your tongue).

Substance	10%	1%	0.1%	0.01%
Sucrose				
Sodium chloride				
Vinegar				

2. Measure 90 ml of distilled water and pour it into a paper cup. Add 10 g of granulated sugar. Stir until dissolved. This gives you a 10% (weight/weight, or w/w) sucrose solution.
3. Rinse your mouth with plain tap water and wipe your tongue dry with a clean paper towel.
4. Dip a clean cotton swab into the 10% sugar solution and smear it all around your tongue. If you can taste the sweetness, put a + in your data table for 10% sucrose. Note any other observations that you make.
5. Now measure out 10 ml of the 10% sucrose solution and pour it into a clean paper cup. Add 90 ml of distilled water and stir. (Note: use a clean stirrer, or else thoroughly rinse and dry the previous stirrer, so that you don't carry over concentrated solution into the dilute solution.) This will give you a 1% sugar solution.
6. Again rinse your mouth with plain tap water and wipe your tongue dry with a clean paper towel.
7. Now dip a clean cotton swab into the 1% sugar solution and smear it all around your tongue. If you can taste the sweetness, put a + in your data table for 1% sucrose. Note any other observations that you make.
8. Continue making serial dilutions, rinsing and drying your tongue, and testing each new solution with the cotton swab procedure. Record the results in your lab notebook. The lowest concentration at which you can still taste the sweetness is your approximate taste threshold.
9. Repeat the experiment with salt (sodium chloride) and vinegar (main ingredient: acetic acid). To make a 10% (volume/volume, or v/v) solution of vinegar, use 2 ml of vinegar and 18 ml of water.

### Questions

1. Were your thresholds the same for all three tastes? Can you think of reasonable explanations for your results?

2. Do sugar solutions that are 10-fold more concentrated taste 10× as sweet? Same question for salt and vinegar solutions.
3. Some textbooks will tell you that certain areas of the tongue are more sensitive to certain tastes, for example, the the tip of the tongue is more sensitive to sweetness. From your observations while doing this experiment, did you find that certain areas of your tongue are more sensitive to a particular taste (sweet/sour/salty)? If you did, draw a diagram to show the areas with the lowest threshold for each taste.

### Variations

- Is there a difference in taste threshold for iodized vs. non-iodized salt?
- Do background research to find out how many molecules are in 10 g of salt. Calculate the number of salt molecules that were contained in the lowest-concentration solution which you could taste. If you assume that the cotton swab holds 0.1 ml, how many salt molecules were available on the cotton swab for you to detect? Do the same for sugar, and, if you are really enterprising, for vinegar.
- In this experiment you used 10-fold serial dilutions to establish your threshold of taste. Design an experiment to determine your threshold with higher precision.
- Recruit enough volunteers in different age groups to take this threshold of taste test so that you can test the hypothesis that taste threshold changes predictably with age. Do your results support the hypothesis?

### Credits

Andrew Olson, Ph.D., Science Buddies DiBari, 1998. "Taste Lab," Troy High School Labs Online, Troy, NY [http://www.troy.k12.ny.us/old%20sites/thbiology/labs\\_online/home\\_labs/taste\\_lab\\_home.html](http://www.troy.k12.ny.us/old%20sites/thbiology/labs_online/home_labs/taste_lab_home.html).

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Kandel E., J.H. Schwarz and T.M. Jessell. *Principles of Neuroscience: Third Edition*. Norwalk, CT: Appleton & Lange.

Science Buddies. "Measuring Your Taste Threshold". [http://www.sciencebuddies.org/science-fair-projects/project\\_ideas/HumBio\\_p013.shtml#summary](http://www.sciencebuddies.org/science-fair-projects/project_ideas/HumBio_p013.shtml#summary)

### Bibliography

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Jacob, T., 2003. "Taste—A Brief Tutorial by Tim Jacob," School of Biosciences, Cardiff University [accessed January 19, 2006] <http://www.cf.ac.uk/biosi/staff/jacob/teaching/sensory/taste.html>.

Here's an interesting news article about an electronic chemosensor: Unattributed news release, 1998. "Researchers Taste Success with Electronic Tongue," College of Engineering, University of Texas at Austin [accessed December 1, 2011] <http://www.engr.utexas.edu/news/releases/4572>.