

You Are What You Eat

- Why are there so many corn-derived ingredients in processed foods?
-
- Flavors come from chemicals. Can we discern different flavors in similar products using triangle testing?
- How does mold influence the design of processed foods?



Math & Science Connections

Common Core Standards

CCSS.Math.Practice.MP6

Attend to Precision

Students will choose an appropriate format and create a graph that will effectively represent their data, with correctly labeled axes to accurately communicate their results.

Next Generation Science Standards

Structure and Property of Matter

MS-PSI-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Cross-cutting Concepts

1. Patterns – Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

2. Cause and Effect: Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

So seriously, what exactly are we eating? Let's do some deeper investigation and find out...

They say, "You are what you eat." If that's true, then most Americans are nothing but a bunch of walkin' and talkin' sacks of corn! OK, maybe that's just a *bit* of an exaggeration – but not by much. You may or may not realize it, but thousands of the processed foods many of us eat on a daily basis contain lots of ingredients derived from the commodity crops of corn and/or soybeans. Let's do some sleuthing and see what's really in some of our food. Later on, we'll learn more about why corn and soy show up so frequently on ingredient lists.

We'll also do some exploration into the world of mold. Inhibiting mold is one of the motivations behind the formulations of many of the processed foods that we eat today. But is food that won't mold a good thing or bad thing? Hope you don't lose your appetite!

Images: Wikimedia Commons



Let's Be Grocery Sleuths!

Let's look a little deeper into the ingredients of some common grocery items and see if we can solve a few mysteries....

This activity works best with a little bit of advance planning. Ask students to bring in empty food containers from grocery items that they have at home: snack food bags, soda bottles, the box from a microwave meal, condiment bottles, cans of soup, etc. You can bring things too!

Create an imaginary grocery store in the classroom, and ask students to work together in small groups, or individually, to do a little shopping. You can direct them to choose items for a day's worth of meals for a family, or have students pick out a set number of items that are of particular interest to them. Then have them read

and classify the ingredients listed on the labels for each item. You can let them look things up on the Internet or use the abridged list included here. (If students use the Internet, remind them to consider if a source website may be biased; for example, one anti-GMO website lists ingredients such as brown sugar and maple syrup as

Corn is Corn is Corn, by any other name...

being corn-derived, which, of course, makes no sense.) A good extension activity is to have interested students research some of the ingredients on the list, describe its use(s) and by what chemical or mechanical process it is derived from corn.

Students may want to use an organizer to record their findings. Consider creating large charts labeled "Corn" and "No Corn" for the class to display product lists from their final results. Maybe your class would like glue the labels on large sheets of bulletin board paper and

decorate graffiti boards dedicated to Corn. Some students may want to create pie charts or graphs, while others may want to create a corn/no corn flashcard guessing game. See what unique ways the kids can come up with to communicate their results!

Corn-derived Ingredients

Alpha tocopherol

Ascorbic acid

Baking powder

Calcium stearate

Caramel

Cellulose

Citric Acid

Citrus cloud emulsion

Corn flour

Corn oil

Cornstarch

Corn syrup

Dextrin

Dextrose (glucose)

Diglycerides

Ethylene

Ethyl acetate

Ethyl lactate

Fibersol-2

Fructose

Fumaric acid

Gluten

Golden Syrup

High fructose corn syrup

Inositol

Invert sugar

Malt

Maltodextrin

Margarine

Monoglycerides

Monosodium glutamate

(MSG)

Polydextrose

Saccharin

Semolina

Sorbic Acid

Sorbitol

Starch

Sucrose

Treacle

Vanilla extract

White vinegar

Xanthan gum

Xylitol

Zein

One of These Things is Not Like the Other

Sensory Evaluation – Lesson Plan

Adopted from FOOD FIGHT! Curriculum (2005), which was developed as part of The Science Behind Our Food NSF GK-12 program at the University of Georgia in collaboration with the College of Agricultural and Environmental Sciences and the Department of Food Science and Technology. Curriculum authors: Amy Rowley and Jeremy Peacock.

Summary

In this classroom activity, students will explore the principles of sensory evaluation as they conduct and analyze a cola triangle test—a test used to determine whether there is a sensory difference between two products.

Primary Learning Outcomes:

Students will be able to define the term *triangle test* and explain its use.

Students will be able to calculate percentages based on a data set.

Students will be able to explain the importance of sensory evaluation in food science.

Materials and Equipment:

For Teacher Preparation:

(Per class of 30 students)

***other cola products will work in addition to brands listed: RC, Check Cola, store brands, etc.)*

1. 120, 5-oz. Plastic cups
2. 2-L Bottle of Pepsi®
3. 2, 2-L Bottles of Coca-Cola®
4. Gallon of drinking water
5. Saltine® crackers
6. Paper towels
7. 12-oz. Can of Sprite® *(For Optional Extension)*
8. Blindfold *(For Optional Extension)*

Per Student:

1. *One of These Things is Not Like the Other* student handout
2. 5-oz. Cup of Sample A
3. 5-oz. Cup of Sample B
4. 5-oz. Cup of Sample C
5. 5-oz. Cup of water
6. 2 Saltine® crackers
7. Paper towel

Procedures:

Teacher Preparation:

Use the attached template to prepare a *One of These Things is Not Like the Other* student handout for each student. For each student, label 4 cups “A,” “B,” “C,” and “water,” respectively. Remove all labels and markings from the soft drink bottle. Label the 2-L bottle of Pepsi® “A.” Label one 2-L bottle of Coca-Cola® “B” and the second “C.” Fill each cup roughly half full with the appropriate sample.

Introduction:

Sensory evaluation, an important area of food science, is a tool used to analyze and interpret human sensory responses to food products based on the five senses: sight, sound, smell, taste, and touch. Sensory evaluation is used to improve existing food products or to determine consumer acceptability of new food products. Several types of sensory tests are used. A triangle test is a difference test that is used to determine whether there is a sensory difference between two products. For example, do consumers detect a difference between generic and name brand food items? During a triangle test, panelists are presented with three samples and asked to identify the sample they believe to be different from the other two. Data is compiled from a number of panelists and analyzed to determine whether there is a detectable difference between the products. A detectable difference is often considered to be one in which fifty percent or more of panelists are able to correctly distinguish the odd sample from the other two. However, food companies and researchers may adjust these levels according to their particular interests or needs.

Explain to students that they will be sampling three cola beverages: two are the same and one is different. Their task is to identify the odd cola sample.

Activity:

Provide each student with the materials listed above. Ask students to sample each of the three colas. Advise them to pay close attention to the color and flavor of each sample. Ask students to indicate the odd sample on the *One of These Things is Not Like the Other* student handout. Students should use the water and crackers to cleanse their palates between samples.

Optional Extensions:

1. Ask one or two students to step out of the classroom. As the class watches, pour, for each student sent out of the room, two cups of Coca-Cola® and one cup of Sprite®. Appoint a student to escort each student, one at a time, back into the classroom, blindfolded. Ask the student(s) to sample each of the three samples and identify the odd sample. In a blind sensory test, many individuals find it difficult to detect a difference between Coca-Cola® and Sprite®.

2. Add another cola brand to the blind samples – preferably one that is considered generic. Have students determine how the test design must change to allow for testing of three variables instead of two.

Conclusion:

Reveal to students the odd sample. As a class, compile the following data on the board: the number of students that were able to detect the odd sample, the number of male students that were able to detect the odd sample, and the number of female students that were able to detect the odd sample. Discuss with students any difficulties experienced in determining the odd sample. Have students answer the post-laboratory questions found on the *One of These Things is Not Like the Other* student handout.

Assessment:

Assessment should be based on completion of the *One of These Things is Not Like the Other* student handout.

Reference:

• Meilgaard, M., Civille G.V., and Carr B.T. 1991. *Sensory Evaluation Techniques*. CRC Press. Boca Raton, Florida.

One of These Things is Not Like the Other

Sensory Evaluation – Student Handout

Introduction:

Sensory evaluation, an important area of food science, is a tool used to analyze and interpret human sensory responses to food products based on the five senses: sight, sound, smell, taste, and touch. Sensory evaluation is used to improve existing food products or to determine if consumers will accept new food products.

A **triangle test** is used to determine whether there is a sensory difference between two products. For example, do consumers detect a difference between generic and name- brand food items? During a triangle test, panelists are presented with three samples and asked to identify the sample they believe to be different from the other two. Data is compiled from a number of panelists and analyzed to determine whether there is a detectable difference between the products. In this assignment, a detectable difference is assumed to be one in which fifty percent or more of panelists are able to correctly distinguish the odd sample from the other two.

In this activity, you will be sampling three cola beverages: two are the same and one is different. Your task is to identify the odd cola sample.

Materials:

1. 3 Cola samples (A, B, and C)
2. Cup of water
3. Saltine® crackers
4. Paper Towel

Cola Triangle Test:

Sample each of the three cola beverages from A to C. Two samples are identical; one is different. Select the sample that is different and indicate by placing an “X” next to the letter of the odd sample.

Sample	Mark Odd Sample “X”	Comments
A	_____	_____
B	_____	_____
C	_____	_____

Calculations:

1. What percentage of students in the class was able to distinguish the odd sample?
2. What percentage of male students was able to distinguish the odd sample?
3. What percentage of female students was able to distinguish the odd sample?

Post-Laboratory Questions:

1. Assume that in this sensory evaluation a detectable difference among samples is one in which fifty percent or more panelists are able to distinguish the odd sample from the other two. Based on the class data, is there a detectable difference among the samples?
2. Describe three factors that might account for the differences detected between the cola samples?
3. Why can some students detect differences between the samples while other students cannot?
4. What measures could have been taken in this experiment to improve the reliability of the results?

To Mold, or Not To Mold, That is the Question...

OK, maybe that's not *exactly* the way Shakespeare put it. But other than in the case of some exotic cheeses, people usually don't want to eat moldy food. But should our food mold eventually? What if it doesn't – is that good or bad, or does it depend on what kind of food you're talking about?

What is your first reaction to finding mold on your food: Disgust? Loss of appetite? Curiosity? Nothing at all – you just eat it anyway? People may have different reactions to moldy food, but the process of food molding is a very specific reaction – a chemical reaction.

Mold is a type a fungus. A fungus isn't like a plant, because it doesn't contain any chlorophyll, so it can't make its own food from sunlight and water. Fungi and molds have to find foods to eat to allow them to grow. Sometimes that food happens to be ours!

Mold spores are very tiny and float around in the air. They are around us all of the time. When these spores fall onto damp food, or other suitable materials, they grow into mold. Food doesn't have to be sitting out in the open to mold, however. It can mold inside a container or even in the refrigerator.

Although most of us find it gross and disappointing to find mold on our food, mold is performing an important and necessary function. Its job is to decompose organic materials to allow nutrients to return to the soil, and then the soil can provide nutrients to other living things. Decomposers are literally nature's way of recycling!

Different molds grow on different kinds of foods, and can be many different textures and colors. Some molds are very fuzzy while others are slimy. Molds can be white, gray, blue, green, yellow, orange, black...pretty much just about any color you can think of!

Many natural foods, such as fruits, vegetables and meats, will mold relatively quickly. Many processed foods take



Image: Jennifer Sheffield

Three different hamburgers (one fast food, one from the school cafeteria and one from a farmer's market) left out in our classroom so students could observe and compare how they decompose. The above image is after three weeks had elapsed.

Continued

just a bit longer...if they ever even mold at all. Some processed foods contain preservatives (additives to prevent food spoilage while maintaining the flavor) to keep them from molding as quickly. Foods can also be dehydrated and/or heavily salted to prevent mold. The practice of drying and salting meats for long-term storage has been around for centuries. Another technique is to store foods in oil.

Experimenting with food mold can be extremely interesting. Does white bread or whole-wheat mold faster? Does it matter if food is in a container or left out in the open? What effect does temperature have on mold rates? Sunlight? Do fast food hamburgers mold at different rates? Which fruits mold the fastest or the slowest?

What moldering questions do you have?

Things to Think About:

1. What are some of the pros and cons of salty foods?
2. Many processed foods are designed to resist mold. Why is this helpful?
3. Many people around the world do not have access to electricity for refrigeration. How might this affect some of their food decisions? What other factors might come into play?
4. Food is decomposed in your body by the acids and bacteria in your digestive system. Do you think there is any correlation between how easily foods can be digested and how quickly they mold, or not? Does “healthy” food mold faster than unhealthy food? Explain.
5. Does “healthy” food mold faster than unhealthy food? Explain.

Lab Ideas:

Design and set up an experiment to observe mold. What questions do you have? Are you interested in mold rates of similar foods, i.e.: hamburgers from different fast food restaurants or different kinds of breads, fruits or vegetables? What about how different variables such as exposure to light, temperature or moisture levels affect mold rates? Will mold grow differently on food when it's openly exposed to air or kept in a Ziploc bag?

Design an experiment and try it out – don't forget to record your results!



Further Resources

Read What To Eat (2007) by renowned nutritionist and food expert, Marion Nestle. She explains the facts and fiction behind the confusion and myths about a myriad food items in every section of the supermarket, to help consumers make wise and healthy choices about what to eat.

Watch Morgan Spurlock's documentary film, "Super Size Me" and follow the filmmaker's physical and psychological journey as he only eats food from the fast food chain McDonalds, three meals a day, for a 30-day period.

"Forks Over Knives" is a documentary film that explores the medical connection between our food habits and degenerative health issues, with a focus on the benefits of a plant-based diet.

The documentary, "King Corn," follows a pair of recent college graduates who decide to grow one acre of their own corn and follow it to market. This film explores various uses of corn such as animal feed and to make high fructose corn syrup, basically corn's role in making food cheaper and somewhat healthier. Includes an interview with Earl Butz, former U.S. Secretary of Agriculture, who was one of the original proponents of industrial farming.