

### [The Science of Food Web Log](#)

This web log (blog) serves as a forum for news, views and discussion about all things related to the science of food: food chemistry, microbiology, engineering, process technology, and nutrition. Also discussed are issues related to food safety, GMO foods, organic foods, health and wellness, and news about what's going on in the PSU Food Science Department.

### **Curricula and learning sets**

#### [Food Science Teacher Resources](#)

Whether you're a teacher looking for class materials or a student interested in looking behind the scenes at how food is developed and processed, check out these curriculum guides and accompanying resources. Institute of Food Technologists

[Teachers Resource Guide - The Science and Scientists Behind the Food](#) Connect your students to this dynamic real world application of chemistry, biology and physics. IFT and Discovery Education.

#### [Food Safety Lessons for Middle School Students](#)

These lessons were designed to complement the Newspapers in Education (NIE) Supplement called Food Safety: From Farm to Table. The supplement is available as a PDF on this website in two alternative formats for your use. The centerpiece of the supplement is also here as a single PDF for your use.

#### [Bring Food Science into Your Middle and High School Classrooms](#)

A curriculum used to engage students in inquiry-based science - The Food and Drug Administration (FDA) in collaboration with the National Science Teachers Association (NSTA)

#### [Fun Food Stuff](#)

Science projects teachers can do with their students, at minimal cost, to illustrate some of the principles of biotechnology and of science experimentation in general.

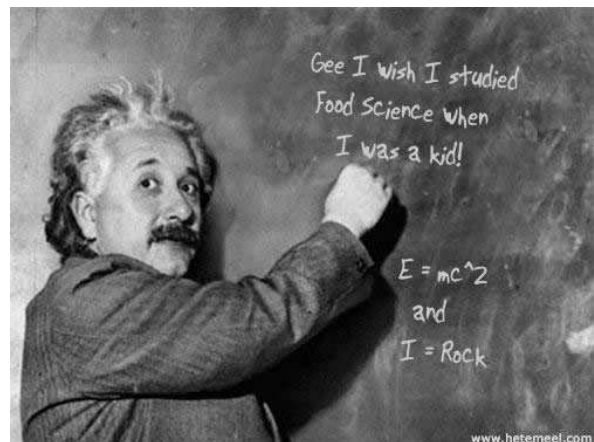
#### [Food and Science](#)

Volume IV in a series of Food Nutrition and Science Curriculum projects developed for the Utah State Board of Education.

#### [School Sciences and Food](#)

Experiments and projects to assist teachers in developing their own programs for secondary school children. Institute of Food Science and Technology.

#### [FDA Food Safety Resources for Kids, Teens, & Educators](#)



Games coloring books, songs, quizzes, puzzles and more that teach principles of safe handling of foods.

### [Food Science Lesson Plans for K-12 students](#)

National Science Foundation GK-12 Fellows Program, University of Maine.

### *Resources for teachers*

### [Ever Wondered About Food?](#)

From BBC2's Ever Wondered? Series. A look at the science, history and artistic aspects of the food in your cupboard with a British perspective.

### [Marketplace for the Mind](#)

As you explore this site you will find the Agricultural Resource Library full of information on quality, non-biased references, books, lesson plans and teaching tools that are aligned to Pennsylvania's Science & Technology and Environment & Ecology teaching standards. The library can be searched in a multitude of convenient ways.

### [4-H Leaders' and Teachers' Guides Food and Nutrition](#)

Program and curricula guides developed by the USDA's Cooperative Extension Service to support youth education and programs.

### [National Chemistry Week 2000: Journal of Chemical Education Resources in Food Chemistry](#), J. Chem. Educ. 2000, 77, 1256.

Food chemistry information and activities at the college, high school, and elementary school levels (many of these are listed below).

### [Chocolate: A Marvelous Natural Product of Chemistry](#)

Chocolate is a natural product as ubiquitous as television. Of course, it is eaten, but it is also found in air fresheners, marking pens, flavoring in a multitude of products including soda pop, and as an aroma in "chocolate-dyed" T-shirts.

Journal of Chemical Education August 2004 Vol. 81 No. 8 p. 1131

### [Artificial Sweeteners - No-calorie sugar substitutes provide options for enjoying the sweet life](#)

"Most days my coffee is accompanied by packets of artificial sweetener instead of spoonfuls of sucrose--the compound we call sugar. But what exactly are the no-calorie sugar substitutes that help me keep my figure while satisfying my sweet tooth?..."

### [Foods under the Microscope](#)

A collection of sub-microscopic images of common foods that visually illustrates why some foods have properties such as elasticity, firmness, and grittiness.

### [The Accidental Scientist - Science of Cooking](#)

Learn about the science behind candy, bread, eggs, pickles, meat and seasonings from the Exploratorium Science Museum in San Francisco.

[Where Candy Comes From](#) - Resource guide  
Ag in the Classroom

### Simple experiments and activities young kids can do for school or science fair projects

#### [Smell the Difference - Mirror Molecules](#)

Even though the same atoms combine to make mirror molecules, the left-handed and right-handed versions can have very different properties, such as smell. With a few items from around your house, you will be able to smell the difference between some stereoisomers like lemon and orange, or mint and caraway.

National Museum of American History

#### ["Finding the Speed of Light with Marshmallows - A Take-Home Lab](#)

Requires a microwave oven, a microwave-safe casserole dish, a bag of marshmallows, and a ruler.

#### [Burning Calories - The Energy in Food](#)

How to make a simple calorimeter for measuring the energy content of food.

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How to make a simple calorimeter for measuring the energy content of food.

University of Southern California

#### [Testing Foods for Glucose and Starch](#)

Students practice safe laboratory methods while learning how to interpret results of chemical tests. They determine the foods to test and interpret and record their results. Based on the amount of glucose or starch present in the food, both tests will provide varying results. This gives students the chance to make decisions about results and helps them understand that scientists must repeat tests to confirm results.

#### [Countertop Chemistry](#)

Chemistry Activities that use chemicals you can find at the grocery or the hardware store.

NC State University.

#### [Edible/Inedible Experiments Archive](#)

Science should be fun....and science should be edible! Food batteries, cabbage juice pH indicator, generating light by chewing, and more!

#### [How Stuff Works - Foods](#)

Beer, coffee, antioxidants, food preservation, etc.

#### [Food Chemistry Experiments](#)

A to Z Home's Cool Homeschooling Web Site

Students learn how to lower the freezing point of water and how ice cream forms as a solution freezes.

#### [Plastic Bag Ice Cream](#)

Illinois Farm Bureau - Ag ZipLocks & You - 10 plastic bag activities for kids  
And this "[HowToon](#)" on homemade icecream making

#### [Lab Dad](#)

Laboratory experiments for young people to do at home, as well as a reference for science teachers. Most of the labs are intended for grades 7-12, but many can easily be done by younger scientists.

[Introductory Electrochemistry for Kids - Food for Thought, and Human Potential.](#) J. Chem. Educ. 1998, 75, 178.

A simple, inexpensive experiment using fruit, a voltmeter, and wires made of various metals allows children to discover many electrochemical principles including: circuits, series connections, the chemical nature of batteries, electrodes, and potential/voltage

#### [Microwave Ovens What is the science behind microwave cooking?](#)

Newtons Apple

#### [Making Ginger Ale at Home](#)

#### [Making Root Beer at Home](#)

David B. Fankhauser, Ph.D. Professor of Biology and Chemistry U.C. Clermont College  
Batavia OH 45103

#### [Food Preservation](#)

Grade 3-5 lessons to help students understand how various food preservation techniques help to slow down the spoiling of food by microscopic organisms

### **Experiments, demonstrations, and resources for beginning food scientists**

[An Alternative Procedure for Carbohydrate Analysis of Bananas.](#) Cheaper and easier the use of commercially available glucose test strips for home diabetic care is described as a new approach for determining the glucose concentrations in a ripening banana

[Food Scientists - The Naked Scientist.](#) White bread and the wonder of enzymes, extract DNA from Kiwi fruit using just simple kitchen items, the power of cornflour, etc.

#### [Food Science experiments for K-12 students.](#)

Hydrogen bond formation, pH and titratable acidity, rancidity of foods, enzymatic denaturation of proteins, color changes in chlorophyll, etc.

#### [Catalysis Enzymes in Pineapple](#)

In this experiment, students investigate methods for altering the functioning of an enzyme catalyst.

### [In a Jam and Out of Juice](#)

Use of enzymes in jam and juice processing. One of a series of biotechnology guides from Unilever Inc.

### [Practical Fermentation - A Guide for Schools and Colleges](#)

Food fermentation experiments from the Unilever biotechnology guide series.

### [Proteins - Student Guide](#)

Food protein experiments. Unilever biotechnology guide series.

### [Extracting the Pea \[DNA\]](#)

A crude but effective way to extract DNA from peas. Unilever biotechnology guide series.

### [Molecular Biology: First Steps—How to Extract DNA in your Kitchen](#)

Another DNA extraction site. Extract DNA from fruits, vegetables, meats ... just about anything that used to be alive using chemicals that are probably already in your house.

### [Fermented Soft Drinks](#)

Directions for making traditional fermented beverages. Unilever biotechnology guide series.

### [Remarkable Rennet](#)

Experiments with the milk clotting enzyme. Unilever biotechnology guide series.

### [Prove It!](#)

The science behind bread making. Unilever biotechnology guide series.

### [Clarifying Apple Juice](#)

Using pectinase to clarify apple juice. Unilever biotechnology guide series.

### [Finding Science in Ice Cream - An Experiment for Secondary School Classrooms](#)

As the hot weather approaches and students' minds begin to drift from the rigors of the school classroom or laboratory, a fun afternoon might be spent making ice cream and in so doing, introducing several aspects of the science and technology "behind the scenes". This web site is a classroom experiment for school teachers on ice cream making.

### [Anthocyanins: A Colorful Class of Compounds](#). J. Chem. Educ. 1997, 74, 1176A.

The red colors of leaves in the fall, and the colors of radish skins, and some cabbages result from pigments known as anthocyanins. This activity makes use of the fact that these substances are also acid-base indicators.

### [Tick Tock, a Vitamin C Clock](#) J. Chem. Educ. 2002, 79, 40A.

This Activity can be used to explore reaction kinetics, and in particular the effect of reactant concentrations on the apparent rate of a reaction. It can also be used in a discussion of redox chemistry, the descriptive chemistry of iodine, and the chemistry of vitamin C.

[Fizzy Drinks: Stoichiometry You Can Taste](#). J. Chem. Educ. 2000, 77, 1608A.

Students create their own Fizzie-style carbonated beverage. They find that using too much baking soda or too much citric acid ruins the taste. In the final steps, they use stoichiometry to calculate the correct mix of these two ingredients.

[Cabbage Patch Chemistry](#). J. Chem. Educ. 2000, 77, 1432A.

Students make sauerkraut and also investigate the effect of changing one variable in the sauerkraut-making process.

[Put an Enzyme to Work](#).

This is a simple experiment using pineapple and gelatin to show how enzymes work.

[Soup or Salad - Investigating the Action of Enzymes in Fruit on Gelatin](#). J. Chem. Educ. 1999, 76, 624A.

Students observe gelatin samples treated with substances that may or may not have an enzymatic effect on the protein in the gelatin. Substances used are fresh pineapple, canned pineapple, fresh pineapple that has been frozen and microwaved, and meat tenderizer.

[Apple Fool! An Introduction to Artificial Flavors](#). J. Chem. Educ. 2003, 80, 408A.

Students investigate flavorings by making artificial "cooked apples" from a mixture of crackers, sugar, cream of tartar, and water, as is done for the filling in recipes for Mock Apple Pie.

[Flat As a Pancake? Exploring Rising in Baked Goods](#). J. Chem. Educ. 2000, 77, 1264A.

Baked goods have a wide range of characteristics. The ingredients and the relative amounts of each along with mixing and baking techniques determine the properties (appearance, texture, taste, and nutritive value) of the product. This activity investigates the action of baking powder.

[The Alginate Demonstration: Polymers, Food Science, and Ion Exchange](#).

A polymer demonstration involving the calcium crosslinking of Sodium alginate.

[Detection of Catalysis by Taste](#). J. Chem. Educ. 1998, 75, 315.

Sensory demonstration of the action of the enzyme  $\beta$ -galactosidase (or lactase) which catalyzes the hydrolysis of lactose into D-glucose and D-galactose.

[The Heat Content of Nuts and Snack Foods](#).

In this experiment, several types of nuts and snack foods are burned in order to determine their heat content per gram.

[Demonstration: Gummy Bear Sacrifice: Energy of Oxidation of Carbohydrates](#)

This demonstration illustrates the vast amount of energy which is available from the oxidation of carbohydrates, such as sugar.

## More advanced experiments, demonstrations, and curricula in food science

### [MIT OpenCourseWare - Kitchen Chemistry](#)

This seminar is designed to be an experimental and hands-on approach to applied chemistry. Cooking may be the oldest and most widespread application of chemistry and recipes may be the oldest practical result of chemical research. We shall do some cooking experiments to illustrate some chemical principles, including extraction, denaturation, and phase changes. Massachusetts Institute of Chemistry.

[Consumer Chemistry and Food Science](#) • Secondary School Chemistry:  
[Determining the Pressure inside an Unopened Carbonated Beverage](#) • [Mentos and the Scientific Method: A Sweet Combination](#) • [Lab Experiment Based on the Vitamin C Clock Reaction](#) • [Vanillin Synthesis from 4-Hydroxybenzaldehyde](#) • [Resveratrol Photoisomerization](#) • [Quantitative Measurement of Trans-Fats by IR Spectroscopy](#).  
Journal of Chemical Education. 2007

### [Mass Transfer of Cooking-Chemical Engineering through Cooking](#)

Mass transfer principles behind events such as [making Kool-Aid](#), and [mixing pancake batter](#), to [brewing coffee](#) are presented. As a child, almost everyone has made Kool-Aid, or at least watched their mother do it; however, not everyone has stopped to wonder why the water turns red and tastes sugary. The reason why is due to a concept called mass transfer. University of Arizona.

[Popping Popcorn Kernels: Expanding Relevance with Linear Thinking](#). Introductory-level chemistry students determine mass changes as the result of popping along with the volume and density of the popcorn flakes produced.

[I Screen, You Screen, We All Screen for Phenolics](#). This Classroom activity employs a colorimetric visualization test that allows a student to simply and rapidly screen grape juice for phenolic content from fresh, bottled, or frozen concentrate samples.

### [Food Science Labs](#)

The food science experiments posted on this site are part of a grant that was funded to incorporate food science into the high school science classes. Many of these experiments were supplied by science teachers throughout the state of Nebraska. Center for Science, Mathematics, & Computer Education

### [Chromatography of Food Dyes:](#)

A Simple Demonstration for Actively Engaging High School Students in the Chemistry of Foods. Journal of Food Science Education.

### [Candy Chromatography](#)

The purpose of this experiment is to separate and identify the FD&C dyes from M&M's or Skittles using paper chromatography.

[Bioanalytical Experiments for the Undergraduate Laboratory](#) - Monitoring Glucose in

Sports Drinks. J. Chem. Educ. 2001, 78, 788.

A solution-based enzyme assay for the analysis of glucose concentrations in sports drinks and fabrication of an enzyme electrode.

[Hot Chili Peppers: Extraction, Cleanup, and Measurement of Capsaicin](#). J. Chem. Educ. 2000, 77, 1630.

[Determination of the Scoville Heat Value for Hot Sauces and Chilies: An HPLC Experiment](#). J. Chem. Educ. 2000, 77, 266.

[Pungency Quantitation of Hot Pepper Sauces Using HPLC](#). J. Chem. Educ. 1999, 76, 240.

Laboratory activities to acquaint students with the active ingredients of hot chili pepper (capsaicin and dihydrocapsaicin) and the extraction, cleanup, and HPLC determination of Scoville heat value (SHV).

[Pungency Assessment in Onions](#).

A common assessment of pungency is made by measuring pyruvate, which is formed as a stable primary compound from the enzymatic decomposition of each of the flavor precursors. Pyruvate is produced in a mole for mole relationship with the flavor precursors

[Integrating Introductory Biology and Chemistry Laboratories: Human Metabolism of Vitamin C and Fruit Juice Analysis—an Example](#)

Three and a half week module called the *Examination of Vitamin C (ascorbic acid), its Sources, Properties, and Metabolism*. Boston University

[Enzymatic Spectrophotometric Reaction Rate Determination of Glucose in Fruit Drinks and Carbonated Beverages](#). J. Chem. Educ. 2000, 77, 1327.

This paper describes an undergraduate analytical chemistry laboratory for the kinetic determination of glucose in fruit drinks and carbonated beverages using glucose oxidase (GOX) and horseradish peroxidase (HRP).

[Determination of Aspartame and Caffeine in Carbonated Beverages Utilizing Electrospray Ionization-Mass Spectrometry](#). J. Chem. Educ. 2000, 77, 1325.

Procedures can be used to quantify the content of caffeine and aspartame in beverages or to understand the capabilities of electrospray ionization.

[Enzyme Kinetics](#)

A laboratory exercise for assaying b-galactosidase enzyme activity - part of a sophomore level core curriculum course required of University of Oregon biology majors.

[The Other Double Helix—The Fascinating Chemistry of Starch](#). J. Chem. Educ. 2000, 77, 988.

The chemistry of starch; the most abundant biomolecule on earth after cellulose and a major part of the diet of all human beings.

[The Arrhenius Law and Storage of Food in a Freezer](#). J. Chem. Educ. 1999, 76, 504.

Application of the Arrhenius law for temperature dependency of chemical reactions

[Showing Properties of Food Foams with Common Dairy Foods](#). J. Chem. Educ. 1997, 74, 1133.

Demonstration of how food properties can be visualized with the aid of simple and inexpensive experiments using dairy products that can be found in any kitchen

[Demonstration of the exponential decay law using beer froth](#)

The volume of beer froth decays exponentially with time. This property is used to demonstrate the exponential decay law in the classroom. The decay constant depends on the type of beer and can be used to differentiate between different beers. Eur. J. Phys. 23 (2002) 21-26

[A Simple Laboratory Exercise in Food Structure/Texture Relationships Using a Flatbed Scanner](#). J. Chem. Educ. 2000, 77, 368.

A demonstration a simple laboratory exercise designed to demonstrate structure/texture relationships in a common food product using a common flatbed scanner..

[Characterization of Organic Illumination Systems. A study on the science of Lifesavers that shoot sparks when you chew them and the glowing pickle phenomenon](#) \*

*\*really!*

[Sauerkraut Fermentation](#).

Bacteriology/Food Science 324 at the University of Wisconsin - Madison.

For more experiments visit the [Journal of Food Science Education](#) (<http://members.ift.org/IFT/Pubs/JFSE>) and the [Journal of Chemical Education](#)

## Food Science on television

[The FoodNetwork](#) featuring

- [“Good Eats”](#) Alton Brown explores the science and origins of food and ingredients and decodes culinary customs. Also visit Alton Browns web site (<http://www.altonbrown.com/>).
- [“Food Unwrapped”](#) Marc Summers explores the secrets behind lunch box treats, soda pop, movie candy, and more.

## Food Science on the radio

[Cooking with Chemistry](#) (link to December 2004 Science Fridays audio file)

Why does French bread have nice, big holes in it? Why can cooked egg yolks sometimes turn green? Why do recipes have a specific order? Don't turn to your cookbook; get out your chemistry text! Science Friday interview with Harold McGee. December 24, 2004

[Science Principles in Cooking](#) (link to November 2002 Science Fridays audio file)  
What does baking soda do? Why does bread have to be kneaded? Why does turkey breast always seem dry? Most of us have no idea, nor have we ever really thought about it. The average cook follows the recipe, using the ingredients and amounts indicated because that's what it says to do! We never realize that cooking involves myriad chemical and physical reactions without which the dish would fail miserably. Science Friday interview with Harold McGee and Peter Barham. November 22, 2002

[Food Science / New Product Development](#) (link to March 2002 Science Fridays audio file)

The commercials say it "tastes just like mom's" -- but there's a difference. Food makers may spend millions of dollars in research and development, looking for just the right crunch, or just the right creaminess, or a way to keep that product tasting fresh when it gets to your table. March 15, 2002

[The Science of Chocolate](#) (link to Science Fridays audio file)

The average American consumes over five pounds of chocolate each year. Chemists and biologists have tried to improve its qualities, either by mixing in new ingredients or by breeding a better cacao bean, the source of the essential chocolate liquor. So pull up a chair, drink a mug of cocoa, and get ready for a mouth-watering mix of food and science!

### **Non-Technical Books on Food Science Available at [Amazon.com](http://Amazon.com)**

["On Food and Cooking: The Science and Lore of the Kitchen" by Harold McGee](#)

["The Curious Cook: More Kitchen Science and Lore" by Harold McGee](#)

["The Science of Cooking" by Peter Barham](#)

["What Einstein Told His Cook: Kitchen Science Explained" by Robert L. Wolke, Marlene Parrish](#)

["How to Play With Your Food" by Penn and Teller](#)

["I'm Just Here for the Food: Food + Heat = Cooking"  
by Alton Brown](#)

### **Activity Books on Food Science for Kids**

[Science Fair Success Using Supermarket Products \(Science Fair Success\) by Salvatore Tocci](#)

["Kitchen Science : A Guide to Knowing the Hows and Whys for Fun and Success in the Kitchen" by Howard Hillman](#)

[Science Chef 100 Fun Food Experiments and Recipes for Kids](#) Grades 5-9

["Science Experiments You Can Eat"](#) - Simple experiments for kids.

["Cooking Wizardry for Kids"](#) For grades 4-6.

[The Magic School Bus Gets Baked in a Cake: A Book About Kitchen Chemistry](#) When the class tries to bake a cake for Ms. Frizzle's birthday, they wind up inside it and have some delicious fun learning all about mixtures and reactions that occur when ingredients are combined. TV tie-in. Ages 4-8.

### **Assorted Other Food Stuff**

[Tours of food processing companies in Pennsylvania](#)

Hands-on Learning Opportunities from the Pennsylvania Department of Agriculture's Market Place for the Mind

[Taste Technologies - The Ketchup Conundrum](#)

Mustard now comes in dozens of varieties. Why has ketchup stayed the same (until recently)?

September 6, 2004