

**Food For Thought**  
*By Barbara C. Kengor*  
*Pittsburgh Gifted Center*

**Index:**

- **Overview**
- **Rationale**
- **Objectives**
- **Strategies**
- **Classroom Activities**
- **Annotated Bibliography/Resources**
- **Appendices-Standards**

**Overview**

This curriculum, *Food for Thought*, is designed to use food as the primary material in a variety of science experiments and activities. Since food and food products are very accessible, somewhat inexpensive, and well known to elementary level students; they are an excellent medium for science experiments and demonstrations. The use of food is a practical and fun way to approach science. The science content of the experiments and activities covers general topics in chemistry, biology, and earth science.

**Rationale**

I teach third grade science at the Pittsburgh Gifted Center. Our science department has developed a scope and sequence plan for the students in our program that teaches the scientific method for problem solving. We teach six steps to the experiment process: identify the problem/ask a question; research the problem/understand related vocabulary; develop a testable hypothesis; follow a set of experiment procedures; collect data in an organized format; and review the data to state a conclusion. Along with these steps, we concentrate on teaching the process skills of time management, creativity, higher level thinking and interaction. The content of the discipline is not the primary focus, but rather a vehicle, used to teach the skills needed by a scientist. For this curriculum I chose food as an area of study. Food can be an example of a concept, a material used in an experimental procedure, or a topic of study, in and of itself. Using food is also a way to relate science to everyday experiences. I found that each food has a company, a foundation, an organization or an association to promote the consumption of the product. There are lesson plans, information sheets, games, activities and even contests for most food products. The lesson plans offered by these groups range from pre-school to the high school level and encompass all disciplines. I also found that there are books and movies that relate to every food that I deal with in this unit. Because of the myriad of information and abundance of ideas for using food as a topic for education, I chose six foods to research and work with in the science classroom. As I searched for information about teaching with food I began to find out many little known facts and interesting details about basic foods. I tried to include these as part of this document along with the essential information to be taught to students.

Food has been thought of in scientific terms for many years. “In its most basic form, food is a group of chemicals; chemicals that have come together to produce a special taste and to look a certain way.” (*Try it with Food*, p.4). In his book, *Movable Feasts*, Gregory McNamee writes “Food involves science as well as art, and science can produce some oddities indeed” The science of food study can be interpreted many ways. This curriculum explores six foods and uses them to illustrate science concepts. Each food has a history and a cultural aspect to it. Each food has component parts to review and each food is able to be used in hands-on classroom work. The foods to be used in the classroom activities are chocolate, corn, apples, milk, cookies and sandwiches.

### Chocolate

Chocolate is thought to have originated with the Mayan Indians who lived in the Yucatan Peninsula. They used the crushed cocoa beans to make drinks and cakes. The name chocolate comes from the native word for “bitter water”. The conquistadors brought the chocolate drink back to Spain where the Spanish added sugar to make the drink more palatable. Eventually chocolate drinking spread across Europe, but due to the high cost, it was usually enjoyed by nobility only. A man named Nicholas Sanders is said to have been the first to add milk to the chocolate drink. In London, chocolate drinking houses were established for the well-off to go to and have a chocolate drink. It was during this time that a cocoa press was invented that crushed the cocoa bean into a powder. The crushing process extracted the cocoa butter from the bean which made for a less fatty drink. Manufacturers then found a use for the cocoa butter. If it was mixed with sugar and cocoa nibs, it produced a chocolate that could be eaten. European chocolate factories began producing edible chocolate during the Industrial Revolution; as many new machines were invented that made the process an easy one. Milton Hershey is credited with starting the chocolate industry in the United States after he purchased a German chocolate making machine in 1893. The chocolate bar that we still eat today was the first mass produced product at the Hershey plant. Since then, the name Hershey has been linked to many products, not the least of which is the *Hershey’s Kiss*. Other companies also started making chocolate confections at this time and the eating of chocolate overtook the drinking of chocolate. Also, chocolate products became affordable for most people and chocolate consumption soared. Today, Americans eat an average of 12 pounds of chocolate per person per year. (*Americans Love Affair with Chocolate*). Chocolate is a viable teaching tool for young students in several areas. It can be used to teach about the senses. Chocolate experts use all five senses to rate chocolate. The better the chocolate, the faster it melts in the hand because of the cocoa butter, which has a melting point of 93.2 degrees. Good chocolate should make a loud snapping noise when broken. Good chocolate should have a glossy look to it and a deep cocoa aroma. Interestingly, chocolate tasters do not eat the chocolate they rate, but rather allow a piece to melt on the tongue in order to determine the quality of taste. Chocolate can also be used to demonstrate physical and chemical changes. The physical changes happen when beans are crushed into powder, when powdered chocolate is added to liquids, and when chocolate is melted and poured into molds to cool. The chemical changes happen when chocolate is heated to rid it of impurities or when other compounds are added to the product to change its taste or smell. The many uses of chocolate make it

adaptable to a variety of classroom activities and creative endeavors. One unusual use of chocolate was as stage blood in the shower scene of the Alfred Hitchcock movie, *Psycho*; since the movie was filmed in black and white.

## Corn

Corn or maize was actually a food that started as a wild grass called teosinte. Through cultivation techniques, developed by the indigenous peoples of the Americas, edible corn developed. This was a long process and the first ears of corn were small; a few inches long with about eight rows of kernels. By the time Christopher Columbus came in contact with Native Americans, corn was an important part of the diet of most native peoples. Corn is actually a tall leafy grass. Each corn stalk has a tassel on the top where the flowers grow. The pollen from the flowers travels down the corn silk of each ear and begins the formation of the kernels. Corn can be classified into different types: sweet corn, popping corn, flint corn, flour corn and dent corn. The type of corn relates to the use of the kernel. Each kernel of corn has three parts. The seed coat, which is actually two layers known as the pericarp and testa, is the first layer. The endosperm, which is basically starch, is next. The innermost part is the embryo. The embryo of a seed is really a miniature plant from which the normal plant begins to grow. Corn can be made into many other products and over the years, new processes have been invented to use corn. In the 1800's a process for starch extraction produced cornstarch which was introduced as a substitute for wheat flour, but did not have the same consistency in breads. Cornstarch began to be used primarily as a thickening agent. The process for converting cornstarch into corn syrup came next and has evolved into a large industry. Corn syrups are found in many products today and are produced in processing plants across the country called wet corn mills. These mills turn out many corn products along with corn syrup. They produce corn oil, soap stock and animal feed, just to name a few. In 1987, the National Corn Growers Association issued a statement that said: "Anything made from a barrel of petroleum can be made from a bushel of corn." There are new corn products being developed every day. A new tire called a *bioTRED* has been advertised that uses a starch-based compound. Many biodegradable products are made from corn, such as disposable cups and trash bags. The National Corn Growers Association also provides lesson plan ideas and information about all aspects of corn. The lessons are both multidisciplinary and content specific. Corn is an excellent food to use in teaching science because all of the uses of corn have not been exhausted as of yet and ongoing experiments, involving alternate energy sources and eco-friendly products, are being done at the present time. One interesting item, that illustrates the place of corn in some areas of our country, is the existence of a Corn Palace located in South Dakota. The first palace was built so that the early settlers could show off the crops that they had grown by decorating the outside of the building with them. Today, after being rebuilt twice, the Corn Palace still stands and it is free to the public for tours. The exterior of the building is decorated with murals made of bushels of corn, oats, wheat, straw and grasses. Besides tours the building is used as a meeting place and entertainment center

## Apples

Apples have always had a special place in history. From ancient times apples have been associated with many human virtues and emotions. The pleasurable and romantic notions that surround the apple led to its first being eaten as a dessert. It is believed that the first dessert apples were grown in 1800 B.C. in the mountains near Kazakhstan in Eurasia. By 79 A.D. twenty varieties of apples could be identified. The apple is given credit for being the object that inspired Sir Isaac Newton to explore gravity and the laws of motion. In 1955, J. T. Stinson, the head of the Missouri State Fruit Experiment Station told us that “An apple a day keeps the doctor away”, due to the many nutrients contained in the fruit. Today, there are over 7,500 known varieties of apples found in the world. The apple is actually a member of the rose family. The smallest apple is the size of a cherry and the largest is comparable to a grapefruit. About 2,500 varieties are grown in the United States and apple growing is more than just planting a few trees. The science of fruit growing is called pomology and much of it has to do with apples. In science class, students can learn about the parts of the apples and apply that knowledge to other trees and plants. Dissecting apples, to test for maturity and to identify parts, helps to teach students about starch and sugar conversions. Every apple has six parts: skin, flesh, core, seeds, stem and leaves. The skin that covers the apple is there to protect the inner parts. The juicy part of the apple is the flesh that contains the water in the apple. The apple core, the center part, is made up of the seed pockets which hold the seeds. The seeds look like black dots inside the core. The stem connects the apple to the tree and also carries water and food from the tree to the apple. The leaves of the apple make the food which enables the apple to grow. It takes the energy from fifty leaves to form one apple. Apples need to take in oxygen just as people do in order to stay alive. This means that in order to store apples the container must have a controlled atmosphere. In CA (controlled atmosphere) storage the oxygen level is reduced, along with the temperature, while the humidity is increased. This keeps the apples from ripening, as it helps them retain moisture. In the classroom, apples can be used to study water loss and the drying process through various activities. Early settlers made dolls from apples and there are images of some very interesting dolls on several websites dedicated to them. Apples have also been a part of American folklore through the story of Johnny Appleseed; who actually was a real person named John Chapman. He was the owner of apple growing nurseries in Ohio, Pennsylvania, Kentucky, Illinois and Indiana who gave away apple seeds to American pioneers. He was a very successful man who lived a very simple life. He wore no shoes because his feet were misshapen and he wore second hand clothes because he chose to do so. He was a vegetarian who carried only a stew pot with him instead of the gun or knife that most men of the time sported. John did not just scatter seeds as he traveled but methodically selected sites for planting and instructed local people on the care of young trees. Johnny Appleseed is buried in Fort Wayne, Indiana. His gravestone reads that “He lived for Others” and while that memorial stands for him, his body is actually in an unknown grave near a riverbank that has never been located.

## Milk

Milk and the milk products from cows will round out the foods to be explored in the unit. Historians believe that the ancestor of the modern cow was called an auroch. Aurochs lived on the wide plains of Asia, Europe and North Africa. They were eventually domesticated and the raising of cows for their food products spread throughout Eurasia and India. The first cows came to the United States in 1611, for use in the Jamestown colony. Cow's milk became a staple of the American diet early in our history. However, one problem with milk has always been keeping it safe for human consumption. Most of the history of milk deals with this aspect. In the 1830's the distilleries found a way to get rid of the slop that resulted from grinding bushels of corn and rye to make alcoholic beverages. They fed the slop to the cows, milked the cows, and sold the milk to consumers. People called it swill-milk. This milk was consumed in many large cities and was blamed for high infant mortality rates. The concern about the purity of milk led scientists to search for solutions. When researchers began to make the connection between germs and disease, milk was again in the spotlight. Louis Pasteur is the name most recognized when talking about milk. He discovered why milk turns sour by recognizing that milk contains tiny living organisms. He developed a method to kill the organisms and still keep the milk flavor. His process was named "pasteurization" in his honor. He never applied for a patent for his process, but rather he shared his information with all who could use it. Today making milk involves pasteurization, clarification, separation, homogenization and the addition of vitamins A and D because they are lost in the separation process. In the classroom, milk and milk products can serve as illustrations of the changing states of matter. Comparing the properties of milk with the properties of other liquids can be the basis for experimentation. Today there are many kinds of milk to choose from and chocolate milk is a cafeteria favorite among students. Chocolate milk is actually 93% milk, 6.3% sugar, .65% cocoa powder and .05% carrageenan. Carrageenan is an extract of algae or moss that is used as a thickening agent in place of gelatin from animal bones. In general, milk is a very popular drink throughout the United States. In fact, fourteen states (including Pennsylvania) claim milk as their official drink!

## Cookies

The word "cookie" comes from the Dutch word koekje that means "little cake". In fact, cookies were first made to be used as test cakes. They were made of small amounts of cake batter which was placed in the oven to test the temperature. Before these cookies, ancient peoples actually did eat cookie-style cakes. Persia was well known for its sweet concoctions because they were one of the first countries to use sugar cane. Explorers ate a type of cookie called hardtack which was baked and could last for many months while at sea. During the Industrial Revolution the making of various kinds of sweet biscuits grew into a major manufacturing endeavor. The first cookies were brought to the United States by English and Dutch immigrants and were simple butter cookies, often called tea cakes. Cookies became widespread and many varieties were developed across the country. In 1902, the National Biscuit Company began making Animal Crackers in small boxes with a string handle so that they could be hung on Christmas trees as treats. In 1912, that same company, better known as Nabisco, created the Oreo. They claim that the Oreo is the best selling cookie in the United States today. No one is sure where the Oreo

got its name. One theory is that the cookie's name is a combination of "re" in cream between the two "o's" in chocolate. In 1917, the Girl Scout Cookie had its start as a service project and by 1922 the cookies began to be sold to the public. These were basic sugar cookies, baked by the girls and their mothers. They were packaged in wax paper and sold for about 30 cents a dozen. The chocolate chip cookie was invented by Ruth Graves Wakefield in 1930. She was a dietitian and food lecturer who ran an inn where she also baked for her guests. The inn was situated on a toll road and it took on the name of the Toll House Inn. One day while baking, Mrs. Wakefield ran out of baker's chocolate and instead used the pieces of a semi-sweet chocolate bar that was given to her by Andrew Nestle. The cookies were a hit with the guests. The Nestle Company began packaging the chocolate pieces and even put Mrs. Wakefield's recipe on the bag. The Nestle Toll House Cookie (better known as the chocolate chip cookie) was born. During the Gulf War the desert camouflage pattern on soldiers' uniforms was nicknamed "chocolate chip" because it resembled the cookie. In 2001, Pennsylvania declared the chocolate chip cookie the official cookie of the Commonwealth. The science of cookies deals with both the physical and chemical changes that take place when ingredients are heated. In baking, energy is absorbed by the batter as it changes. Heat is used to bring about a chemical reaction. Different temperatures, held for different time periods, bring about different changes. That is why recipes provide both the oven temperature and the length of baking time. Cookie science is also way to reinforce the scientific method relating to variables. Changes in ingredients, how they are mixed, their temperature and how each individual ingredient reacts with another, all may have a bearing on the final outcome of the cookie.

### Sandwiches

Bread is the defining ingredient of a sandwich. A sandwich is described a food item between bread. Bread was initially used as a utensil for a table setting. It was used to get food to the mouth and to sop up juices and meat sauces. These first kinds of bread were called trenchers and were used until the fork became the acceptable way to get food to the mouth. John Montagu, the fourth Earl of Sandwich, is credited with inventing the sandwich. One story describes Montagu as a compulsive gambler who would not leave the table to eat. He instructed his servant to bring him meat tucked between two pieces of bread. When others at the table watched him eating and winning, they saw his creation as a good luck charm. They began to request "the same as Sandwich" and the word "sandwich" was coined. Today "sandwich" is used as both a noun, naming a certain food product and a verb that means to put in between. Elizabeth Leslie introduced the ham sandwich to America in 1840. When sliced bread became available to the public in the 1900's the popularity of sandwiches increased tremendously. The peanut butter and jelly sandwich was created by the soldiers during World War II from the meal packages they were given, called c-rations. When the war was over and the soldiers came home, the sandwich continued to grow in popularity. In England there is a British Sandwich Association which gives "Sammie" awards each year to manufacturers of sandwiches. The British Sandwich Association defines a sandwich as: "Any form of bread with a filling, generally assembled cold - to include traditional wedge sandwiches, as well as filled rolls, baguettes, pita, bloomers, wraps, bagels and the like, but not burgers and

other products assembled and consumed hot.” The idea of the sandwich is used in many classrooms. There are lessons for sequencing, organization, frog dissection and geological layering that refer to and use the sandwich as the vehicle to teach a concept.

### **Objectives**

The objectives of the unit are merged with the general science outcomes for third graders at the gifted center.

The student will be able to

- follow the steps of the scientific method in order to conduct an experiment with food
- use accountable talk to discuss outcomes of experimentation.
- discuss the origin, cultural ties, and present day uses of the foods presented in the unit
- use food and food products as part of hands-on experiences in the classroom
- interact with peers to develop solutions to problems
- develop real world connections for material covered in the science classroom

### **Strategies**

The basic strategy in this unit is to give students a better understanding of selected science content and concepts by utilizing a practical and familiar material: food. This is accomplished by allowing students to research the origin and cultural history of the food. Reading and discussion are two strategies that deepen knowledge about the food we eat. Recipe study helps student sharpen measuring skills along with sequencing. Hands-on work with food, as a model of science theory, deepens understanding of the content. Using food in place of a chemical in an experiment allows students to recreate experiments at home and helps them transfer classroom information to the real world setting.

### **Classroom Activities:**

#### **Chocolate Refrigerators**

Use five different brands or types of chocolate, both milk and dark for this observation. All of the chocolate should be the same size and temperature. Provide the wrappers or a copy of the ingredients for each piece of chocolate. Have each student select a chocolate type that they think will melt the quickest when held in their palm. Each student should read over the ingredients and form a hypothesis. (Example: **If** I hold the Hershey’s milk chocolate nugget in my palm **then** it will melt the quickest **because** it contains the most calories from fat.) Now have the students test their hypotheses by placing the candy piece in their palm and closing their fist, but not pressing against the chocolate. Students should watch their time by using a stopwatch or timer and note when the candy first starts to soften and then again when it can be smashed in the palm. When the candy has melted to the smashed stage have the students wash up and record their

answers. Ask them how their results might be different if they tried to melt the chocolate in their mouth rather than in their hand. Repeat the experiment using mouths instead of palms and have the students record and compare the results. Students who are allergic or who do not like chocolate can partner with another and record the other person's results. Now ask the class how they could prevent chocolate from melting. Challenge them to design a refrigerator to keep chocolate from melting when placed in direct sunlight. For this activity the students must use a Hershey's kiss, unwrapped. Each student will be given a small candy box (available from *Party City* stores or *Oriental Trading Company*) Provide the students with the following materials: tin foil, bubble wrap, black construction paper, paper towels, and plastic wrap, felt squares, tape and any other materials that may be available. Discuss the term insulation. Ask students what they know about keeping warm in winter and cool in summer. Have the students use the materials that they wish to insulate the inside of the box in order to keep the chocolate cool. Students may decorate the outside of the box in anyway that they wish. After the refrigerators are complete, place one Hershey's Kiss in the center of each box, close the flap and secure it. Place the boxes in a sunny spot for one hour. Have the students participate in a discussion about the materials that they chose and how they were used to assemble the refrigerator. After one hour open the boxes to see how the insulation worked. Discuss what worked the best and why.

#### Corn to Popcorn

Lead students in a discussion about popcorn. Develop a KWL chart about popcorn. (What we know, What we want to know, What we learned). Explain that corn pops because it contains water. In fact almost 15% of each kernel is water. When a kernel is heated above the boiling point of water (212 degrees Fahrenheit), the water turns to steam. Pressure builds in the kernel until it explodes and actually turns itself inside out. Field questions from students as to what they might want to learn about how popcorn pops and take suggestions for experiments. One question to formulate should be "Does the amount of water in the kernel affect the popping process?" Have students formulate hypotheses about what would happen if water was added to, or removed from, the kernel before popping. Now, give each student 30 kernels of corn: 10 that have been soaked overnight in water and then dried with a paper towel, 10 that have been pierced with a pin so that some water might have escaped, 10 that have been taken directly from the popcorn bag. Have students observe the kernels for any outward signs of change. Collect the soaked kernels and note the total number. Pop those kernels having the students note the time of the first pop, the intensity of popping (how loud and how close together pops are heard) and the time it takes to finish the popping process. Remove the popcorn from the popper and count the popped and unpopped kernels. Repeat this process for the pierced kernels and the unaltered kernels and keep a record of the results. Make a data chart with the class and determine an answer to the original question. Complete the KWL chart with what was learned about popcorn. Ask the students to discuss the practical applications of this experiment as far as storing popcorn is concerned; how it is related to microwave popcorn and are there any additional experiments that might be done at home.

### Apple Mummies

Have the students research the art of mummification by visiting several websites. There are many good sites to choose from and they can be found in the bibliography section of this curriculum. Explain that the Egyptians preserved the organs of the dead by removing all of the liquid from them. Tell the class that they are going to make their own mummy from an apple. Provide a small apple for each group of four students. A variety of apples can be supplied and the students can choose the type of apple that they want to mummify. Discuss how some apples may be juicier than others. Talk about how the sweetness or tartness of the apple may indicate how much liquid it contains. Ask students if they think that the liquid in a sour apple might react differently in the mummification process than the liquid in a sweet apple. Discuss what the students learned about mummies from their research. Focus on natron, the chemical mix, used by the Egyptians to dry out the organs of the corpse. Natron was found naturally in the land of Egypt. Natron is made up of sodium carbonate, sodium bicarbonate, sodium chloride and sodium sulfate. Make a mixture of modern Natron for each group of four by combining one cup of baking soda, one cup of all fabric powdered bleach and a half cup of salt. Have each group cut the apple in four pieces and remove the seeds. Weigh each slice and record the information. Place each apple slice into its own plastic cup. Cover the slice completely with natron and set the cups in a dark, dry place for one week. After a week have the students pour off the natron and observe the apple slice. It should be shriveled and dry. If the apples are not completely dry, mix up some fresh natron and repeat the process for another week. Explain that the ancient Egyptians left the natron on the body for 30 to 40 days. When the apples are completely dry have the students weigh them again and record the difference between the fresh apple slice and the dried slice. Next have the students wrap them in strips of white cloth. ( A cut up sheet can be used in place of linen or, if the budget allows, water activated plaster gauze can be used) Students can add enough wrapping to give the apple mummy a body-like shape. The ancient Egyptians used a hot resin material to keep the linen strips in place. Students can use a hot glue gun with the teachers help or regular school glue. (This would not be needed if gauze is used) Have the students make a funerary mask for the apple mummy. Use a small circle of stiff cardboard and glue it onto the bandages. When the mummies are completed give each student a small candy favor box. (These are little white boxes with a flap type closing used for wedding favors) Have the student decorate the “sarcophagus” with hieroglyphics or Egyptian gods. Provide some books for them to use and have them visit more websites to see examples. As an extension activity the students could write the life story of their apple mummy. Also the class could make a pyramid and “entomb” their mummies with a ceremony.

### Moldable Milk

Discuss chemical reactions with the class. Explain that chemical reactions happen when mixtures combine and take on new properties. Chemical changes in the molecules of the mixture regroup to make a new material. Use the example of baking soda mixed with vinegar to show a chemical reaction. Explain that the acid in the vinegar reacts with the

chemicals in the baking soda and forms something else. The bubbles are the carbon dioxide escaping the new mixture. Ask students what might happen if they add vinegar to milk. Have them write out their predictions in hypothesis form, using this sentence: **If I add vinegar to milk, then \_\_\_\_\_ (describe the reaction) because \_\_\_\_\_.**

Have the students work in groups of four. Provide each group with 2 bowls, a strainer or a square of wire mesh, 1 cup of skim milk and 1 tablespoon of vinegar. Direct the students to combine the milk and vinegar in the bowl and add a few drops of food coloring. Observe any changes or reactions. Have each group bring their bowl to be warmed in the microwave for one minute. After all of the bowls are warmed, have each group strain their mixture by pouring it through the strainer or mesh, allowing the liquid to drip into the empty bowl. Have students notice the smell; it is an indication of a reaction. Explain to the class that they have made curds and whey. Curds are the milk solids and whey is the liquid that is left. Ask the students how many have ever eaten cottage cheese and explain that what we call cottage cheese is really curds and whey. The curds are the lumps and the whey is the liquid. Provide some samples of cottage cheese for students to taste if they wish. There are many brands with fruit added that young eaters might enjoy. Ask the students to refer back to their hypotheses and decide if the experiment result supported or did not support their prediction. Let the group divide up the curds into four blobs. Give them time to mold blobs into designs or shapes. After the shapes dry they will become hard and can be displayed in the classroom as food art.

### Cookie Mining

Mining is the process by which we take minerals from the earth. We use these products in many ways. One example is coal, which is used for energy and power. When miners and mining companies take minerals from the land they are responsible for reclaiming the area. In fact, they are required under the law to restore the land to its original condition, or a better condition, after they excavate it. The reclaimed land can be used for farming or recreation. Lakes and reservoirs can even be made on the reclaimed areas. Reclaiming the land preserves the environment for wildlife and sometimes businesses and schools are built on reclaimed sections. Reclamation is not an easy process and must be thought out and planned for, before mining begins. Tell students that they are going to be miners in a company and each company will be given a plot of land to mine. Their objective is to get as much coal as possible out of the “mine” and then reclaim the land around it. Give each mining company a tray with a large, soft cookie containing “minerals”. Each company should get a different type of cookie. Suggested cookies are chocolate chip, chocolate chunk, oatmeal raisin, white chocolate Macadamia Nut. (Sam’s Club has these packaged together and reasonably priced.) Have the miners weigh the cookie and record the weight. Next, have them brainstorm a reclamation plan for when their mining is complete. Give each company tools to use. The tools can be toothpicks, coffee stirrers, straws, ice cream sample spoons (Ask for some at Coldstone Creamery or Baskin Robbins), or any other small poking devices. Miners should observe the cookie and figure out where the largest deposits are found. Explain to the students that removing the minerals in tact makes them worth more so miners need to be careful as the work. Give each mining company time to remove as many mineral samples as the can. They should separate the minerals (nuts, chips and raisins). Depending upon the

types of cookies used the teacher can establish a value for each mineral and the worth of the size and condition of the specimen. The teacher can determine which item in the cookie can represent the coal. Each group should weigh the mineral samples and record that weight. Lastly, give each group time to work on their reclamation plan. They can use their creativity during this process and should be provided with any small materials that many add to their reclamation designs. (miniature trees, water, small Legos, etc.)

### Sedimentary Rock Sandwiches

Introduce students to the three types of rocks; sedimentary, igneous and metamorphic. Discuss the formation of each type of rock and show the students rock samples or pictures of various rocks. Explain that today the class will make a sedimentary rock, which is the most common rock on the earth's surface. Sedimentary rock is formed from layers of sediment that have been pressed together over time. The layers of sedimentary rock can be made up of sand, shells, animal remains, pebbles, silt or clay. Ask students if they have ever seen rock layers on the sides of highways when construction has cut into hillsides. Provide each student with the following to build a sedimentary rock sandwich:

- Rye bread for sandstone
- Jam or jelly for limestone
- Whole wheat for shale
- Chunky peanut butter or apple butter mixed with raisins for conglomerate
- White bread for white sandstone
- Plastic knife
- Paper plate

Have the students build the sandwich starting with the white bread (white sandstone).

Spread the peanut butter/apple butter over the bread (conglomerate)

Next layer the whole wheat bread. (shale)

On the whole wheat bread, spread the jelly/jam (limestone)

Top it off with rye bread. (sandstone)

Use the plastic knife to cut each in half, exposing all of the layers.

Show the class pictures of real sedimentary rock layers and have them compare their sandwiches to the real thing. Have students note that many times the rock layers are not flat and horizontal the way the layers in their sandwiches are. Rock layers are often bent and sometimes broken. Discuss which layer is the oldest and how long it might take for layering like this to take place. Have the students take the two halves of the sandwich and gently push them together. Note what happens. This same thing happens in nature when earthquakes occur and this is how mountains and faults are formed. Give the students time to think about other geological happenings that they know of and relate them to the movement of their sandwich halves. When finished allow students to eat their rock sandwiches.

## Annotated Bibliography for Teachers

Allison, Linda and David Katz. *Gee, Wiz.* Little Brown and Company, New York, NY. 1983.

This book combines science and art activities which can inspire many experiments using food.

Amos, Wally. *The Cookie Never Crumbles.* St Martin's Press. New York. NY. 2001  
The story of the Famous Amos Cookie Company with references to the history of cookie making in the United States.

Beckett, Stephen. *The Science of Chocolate.* The Royal Society of Chemistry. Cambridge. UK. 2000.

This book presents a detailed history of chocolate making with an emphasis on the science of the process. It provide examples of experiments to conduct with chocolate.

Berthold-Bond, Annie. *The Green Kitchen Handbook.* Harper Perrenial. New York. NY. 1997

This book discusses the USDA guidelines and then adapts them to design guidelines that address environmental concerns. It explains the meaning or organic, reviews pesticide use and looks at sustainable agriculture.

Browning, Frank. *Apples.* North Point Press. Chicago, Ill. 1999.

This book covers all aspect of growing apples as well as the history of the fruit. It is very comprehensive.

Critser, Greg. *Fat Land.* Houghton Mifflin, New York, NY. 2003.

This book chronicles the story of the modern food industry and ties into the present day obesity problem in the United States. It is good background material for the teacher.

Fussell, Betty. *The Story of Corn.* University of New Mexico Press, New Mexico. 2004

This is a complete history of corn that is extremely detailed and a good resource book

Galperin, Anne. *Nutrition.* Chelsea House Publishers. New York, NY. 1978,

This book provides simple explanations of the nutrients found in food, their chemical make-up and function in the human body.

McNamee, Gregory. *Moveable Feasts.* Praeger Publishers, Westport. Conn. 2007.

This book looks at the food we all enjoy and how it came to our country. Over twenty food items are reviewed.

Mecuri, Becky. *American Sandwich.* Gibbs Smith. Layton, Utah. 1990

The history of the sandwich and recipes for many sandwiches are found in this comprehensive book.

Schmid, Ron. *The Untold Story of Milk*, Little, Brown and Company, New York, NY. 2003.

This book explains how milk is processed from the cow to the consumer and discusses the problems in the process

Schwarcz, Joe. *Let Them Eat Flax*. ECW Press. Toronto, Ont. Canada. 2005

This book explores the many scientific studies that have been done with and related to food in recent years.

Van Cleave, Janice. *203 Icy, Freezing, Frosty Cool and Weird Experiments*. John Wiley and Sons. New York, NY. 1999.

This is a book of experiments many of which use food as a material in the procedure.

### **Annotated Bibliography for Students**

Aliki, *Corn is Maize*, Harper Trophy. New York. 1982.

A short and easy to read book about corn and its origins in the United States.

Breckenridge, Julie. *Simple Experiments with Everyday Materials*. Sterling Publishing Company. New York, NY. 1993

This book uses food products in some experiments to illustrate simple concepts in science.

Churchill E. Richard. *Amazing Science Experiments with Everyday Materials*. Sterling Publishing Co., New York, NY. 1991.

This book contains directions for over 100 experiments, many using food as the primary material.

Gilbin, James Cross. *Milk-The Fight for Purity*. Thomas Y. Crowell. New York. 1986.

This book traces the attempts to make and keep milk suitable for consumption.

Hauser, Jill Frankel. *Super Science Concoctions*. Williamson Publishing Company. Charlotte, Vermont. 1997

This book provides directions on how to use food products to teach children about liquids and their properties.

Kenda, Margaret and Phyllis Williams. *Cooking Wizardry for Kids*. Barrons. NY. 1990.

This is a cookbook for kids that also provides many interesting facts about food.

Lord, John Vernon. *The Giant Jam Sandwich*. Houghton Mifflin Press. New York NY. 1975.

A creative fiction book good as a discussion started about the topic of sandwiches.

Ross, Catherine and Susan Wallace. *The Amazing Milk Book*. Addison Wesley Publishing Co. New York, 1991.

This book contains information about milk along with activities and experiments using milk.

Storey Gills, Jennifer. *An Apple a Day-20 Apple Projects for Kids*, Storey Communications, Philadelphia, PA. 1993.

This is a great idea book for activities and crafts that use apples.

Tocci, Salvatore. *Experiments with Food*. Scholastic Press. New York, NY. 2007.

A primary book that uses food that is easily found in most kitchens as the basis for simple experimentation.

Vilicich-Slomon, Tina. *Creepy Cookies*. Random House. New York. NY. 1996

A book of creative ways to make cookies to represent other things.

## Websites

*All about Chocolate.* <http://www.fieldmuseum.org/Chocolate/about.html>

The history of chocolate and resources for teaching about chocolate

*American Coal Foundation*

<http://www.teachcoal.org/news/index.html>

A good source for information on mining.

*Egyptian Mummies*

<http://www.nationalgeographic.com/ngkids/9906/mummies/>

Photos, diagrams and information about mummification.

*Got Milk?* <http://www.gotmilk.com/>

An creative interactive website dealing with milk

*Hersheys.* <http://www.hersheys.com/>

The history of the chocolate company and the story of how chocolate is made.

*Midwest Apple Improvement Association.*

<http://www.hort.purdue.edu/newcrop/maia/history.html>

This site explains the history of the apple beginning in ancient times.

*Mummies of Ancient Egypt.*

<http://www.si.umich.edu/CHICO/mummy/>

A basic information site about mummies.

*Mummification*

<http://www.ancientegypt.co.uk/mummies/home.html>

An interactive site concerning the mummification process

*National Corn Growers Association.* [www.ncga.com/](http://www.ncga.com/)

The site provides a curriculum for teachers at all grade levels

*The Great Corn Adventure.* <http://www.urbanext.uiuc.edu/corn/>

An interactive site for students to learn about corn

*The History of Cookies.* <http://whatscookingamerica.net/History/CookieHistory.htm>

A comprehensive, historical time line of the cookie.

*The History of Sandwiches.*

<http://whatscookingamerica.net/History/SandwichHistory.htm>

A comprehensive, historical time line of sandwiches.

*The Story of Milk.* <http://www.moomilk.com/tour.htm>

An lower elementary website dealing with how milk comes from the cow to the consumer

*Washington Apples.* <http://www.bestapples.com/kids/eye.shtml>

The kid's section of this website provides basic information about apples.

## Standards

### Communication Standards:

- **#1.** All students use effective research and information management skills, locating primary and secondary sources of information with traditional and emerging library technologies.
- **#2.** All Students read and use a variety of methods to make sense of various complex texts.
- **#4.** All students write for a variety of purposes, including to narrate, inform, and persuade in all subjects.

### Arts and Humanities Standards:

- **#3.** All students relate various works from the visual and performing arts and literature to the historical and cultural context within which they were created.

### Science and Technology Standards:

- **#1.** All students explain how scientific principles of chemical, physical and biological phenomena have developed and relate them to real world situations.
- **#4.** All students explain the relationships among science, technology and society.
- Environmental and Ecology Standards:
- **#3.** All Students think critically and generate potential solutions to environmental issues.

