



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
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Nutritional Influence on Illness and Disease

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by Jacqueline Porter

I am a special education teacher in a self-contained classroom for grades 6th - 8th. We currently study the human body in Life Science.

Nutritional intake has a direct influence on health. This correlation can be positive or negative. We all know that good nutrition is the key to good health. What we do not always consider or know is that even if we follow the traditional diet, "eating out of the four basic food groups", it may not be enough.

We have to consider what is in our food. Some things are added and others are deleted while other things are just left alone. Usually we feel content that the government is regulating the food industry and keeping it safe.

Modern technology has changed the production, storage and preparation of food, from the simple farm to market, to a complex system that includes producers, processors, distributors and retailers. This new system has compromised food safety.

For instance, it has been acknowledged that disease caused by foodborne illness causes thousands of deaths and millions of diarrhea illnesses. The Department of Health and Human Services has responded to these events by implementing new expanded performance -- based requirements and standards for sanitation and microbial testing in the food industries. It has also created and implemented programs to educate the public. Everyone involved in the system from beginning with producer and ending with the consumer, must assume responsibility for ensuring that their food is as clean as possible and that it is handled safely.

With my class I plan to examine disease and illness that are nutritionally related, their specific causes and how we can avoid them. We will evaluate studies and come up with topics that we can investigate for a science fair project. My goal is that at the end of this unit we will become healthier because of educated decisions we make toward nutritional value and nutritional safety of the food we eat and prepare.

Curriculum Standards

Throughout this unit a variety of content and performance standard will be used to ensure the students understanding of material covered.

Science for 6th, 7th and 8th

Scientific Inquiry

Content Standard 1.0

Students will:

6th

Develop powers of observation by making quantitative observations.

Use observations and prior knowledge to predict an outcome.

Draw conclusions from observed data, and interpret data in pictures, charts, tables, diagrams and graphs.

Design and conduct scientific investigations, and these will result in a project to be presented in a form such as a science fair.

7th

Develop presentation skills, including verbal and written skills.

Communicate scientific procedures and explanations orally and in writing.

Use technology to gather data in order to enhance the accuracy of analysis in investigations.

8th

Apply safety rules in the laboratory.

Life Science 7th

Content Standard 2.0

Students will:

Identify the systems of the human organism and their functions including control and protection from disease.

Ecology, Environmental Science and Society 7th & 8th

Content Standard 6.0

7th

Students will:

Learn personal responsibility for their own health and safety.
Learn nutrition is essential to good health.

8th

Explore the consequences of pollution on the Earth and the quality of life for all.

What Is Foodborne Disease

Foodborne disease is illness caused by consuming contaminated food or beverages. There are many a variety of foodborne infections caused by many different disease -- causing microbes, or pathogens that can contaminate food. Poisonous chemicals, or other harmful substance can also cause foodborne disease if they are present in foods.

There are more than 250 different foodborne diseases that have been identified. Most of them are caused by a different types of bacteria, viruses, and parasites that can be foodborne. In 1999 CDC reported 76 million gastrointestinal illnesses, 325,000 hospitalizations and 5,000 deaths in United States. (FDA(Science),2001)

There is no one "syndrome" that is foodborne illness. These different diseases have many different symptoms. Nausea, vomiting, abdominal cramps and diarrhea are common symptoms in many foodborne diseases, because, microbe and toxin enters the body through gastrointestinal tract, and often causes the first symptoms there.

Who Is At Risk For Foodborne Disease?

Every individual who consumes contaminated food or beverages is at risk. On a whole our immune systems help fight diseases, but some people's immune systems may be weakened or not fully developed. As a result, their bodies cannot effectively fight illness. Infants and children, pregnant women, the elderly and people with certain diseases have a higher risk.

Infants and Children

Their immune systems are not fully developed, and they produce less acid in their stomach, which makes it easier for harmful microorganisms to get through their digestive system and invade their bodies.

Pregnant Women

Pregnancy, by itself is a period when women's immune system is suppressed. The fetus is at risk because harmful microorganisms can cross the placental membranes and infect the developing child, who does not have a fully developed immune system.

The Elderly

Poor nutrition, lack of protein in diet and poor blood circulation may result in a weakened immune system.

People With Certain Diseases

The immune system of people with certain illnesses such as HIV/AIDS and those on cancer chemotherapy, can be weakened. Thus, their bodies are not able to effectively fight illness. (FDA (Food), 2001)

What Are The Most Common Foodborne Disease?

The most common recognized foodborne infections are those caused by the bacteria. A pathogen is any microorganism that is infectious and causes disease. There are bad bacteria, such as the 12 Most Unwanted Bacteria, that causes foodborne illnesses. They include: Campylobacter, Clostridium botulinum, Clostridium perfringens, Escherichia coli O157:H7, Listeria monocytogenes, Salmonella Enteritidis, Salmonella Typhimurium, Shigella, Staphylococcus aureus, , Vibrio cholerae, Vibrio vulnificus, and Yersinia enterocolitica. The following three are the chief causes foodborne illnesses, Campylobacter, Salmonella and E.Coli O157:H7. (FDA(Food),2001)

Campylobacter

The Campylobacter organism is a group of spiral - shaped bacteria that can cause disease in humans and animals. It causes fever diarrhea and abdominal cramps. Out of all the diarrhea illness it has been identified as the most common. The intestines of healthy birds and most raw poultry meat are the host for these bacteria. The bacterium is fragile. It cannot tolerate drying and can be killed by oxygen. It grows only if there is less than the atmospheric amount of oxygen present. Freezing reduces the number of Campylobacter

bacteria present on raw meat. Eating chicken not fully cooked or juices from raw chicken that has contaminated other food causes the most frequent source of infection. It can also come from raw milk and untreated water. The incubation period is generally 2 -- 5 days after ingestion and the illness lasts up to 7 -- 10 days. (Bellenir, 1985) It is estimated that there are 2 - 4 million cases per year. (Josephson, 1998)

Some people who are infected with *Campylobacter* don't have any symptoms at all. In persons with compromised immune system, *Campylobacter* can spread to the bloodstream and causes a serious life-threatening infection. It can be the cause of Guillain -- Barre syndrome. It is the most common cause of kidney failure in children. *Campylobacteriosis* occurs much more frequently in the summer months than in the winter. Although it doesn't commonly cause death, it has been estimated that 500 persons with *Campylobacter* infections may die each year. (Mead, 1999)

Campylobacter Outbreak

In December of 2001, a total of 75 people had been diagnosis with *Campylobacter jejuni* infection through reports of health care providers reports cases with patients ranging from age 2 - 63. The symptoms included 93% had diarrhea, 92% had abdominal cramps, 76% had fever, 40% had nausea and 23% had grossly bloody diarrhea. No one needed hospitalization. 70 patients reported drinking unpasteurized milk from a local dairy farm, 4 patients did not drink milk, but were mothers of ill children who did and 1 child did not drink milk or come into contact with the other patients.

The supplier of the milk was a Grade A dairy farm with 36 cows. The farm also had a retail store and gave tours to the public including childcare facilities. Tours may explain how that 1 child contracted the illness.

Unpasteurized milk cannot be legally sold to consumers in Wisconsin. The dairy instituted a cow - leasing program. Consumers paid an initial fee to lease part of the cow. Milk could be picked up or delivery was available. Milk from all the leased cows was stored in a bulk tank.

After the outbreak was linked to the dairy farm, investigators tested a sample of milk from the bulk container. The sample tested positive and matched the outbreak strain.

Because of the outbreak, the farm was ordered to ship all milk where it could be processed for pasteurization. Wisconsin state officials are also enforcing regulations that already exist, banning cow - leasing programs. (Harrington, 2002)

Salmonella

The *Salmonella* germ is a microscopic living creature that passes from the feces of people or animals, to other people or other animals. *Salmonella* has been known to cause illness for over 100 years. This bacterium is also widespread in the intestines of birds as well as reptiles and mammals. A variety of food, of animal origin can spread this to humans. *Salmonella* may also be found in the feces of some pets, especially those with diarrhea and people can become infected if they do not wash their hands after contact with these feces.

It causes the illness salmonellosis, which normally is accompanied by fever, diarrhea and abdominal cramps. It can also invade the bloodstream, causing life threatening infections in persons with poor underlying health or weakened immune systems. The incubation period is generally 12 to 72 hours, after eating contaminated food and lasts up to 4 to 7 days. Persons with diarrhea usually recover completely, although it may be several months before their bowel habits are entirely normal. A small number of persons who are infected with

Salmonella, will go on to develop pains in their joints, irritation of the eyes, and painful urination. This is called Reiter's syndrome. It can last for months or years, and can lead to chronic arthritis, which is difficult to treat. (Mead, 1999)

In 1986, during an U.S. Department of Agriculture inspection of beef, chicken and pork, Salmonella was found in 37% of chicken, 12% of pork, and 5% of beef tested. Recent test shows comparable rates. Every year, approximately 40,000 cases of salmonellosis are reported in the United States. Because many milder cases are not diagnosed or reported, the actual number of infections may be twenty or more times greater. Salmonellosis is more common in the summer than winter. (Moeller, 1996)

Salmonella Outbreak

In October 1997, there was an outbreak of Salmonella Serotype Enteritidis in D.C. Nearly 75 people affected attended 7 different events. The same commercial manufacturer in Gaithersburg, Maryland supplied the lasagna for a workshop dinner, nursing home luncheon and dinner for five private homes. Three patients needed to be hospitalized, none died.

The lasagna was implicated because it was the common link to each event. The District of Columbia Bureau of Epidemiology and Disease Control (DCBEDC) tested left over lasagna and discovered it was the source of SE phase type 8. The lasagna was made using fully cooked meat or spinach sauces, mixture of raw eggs, spices, ricotta and mozzarella cheeses. All the lasagna made for the events were made with the same batch of egg - cheese mixture.

The investigation traced the eggs to the farm where they originated. Testing was done in 13 poultry houses and 5 positive samples of SE were found.

The finding of the outbreak led the DCBEDC recommending the manufacturer use pasteurized eggs in egg - containing food. The company voluntarily complied. (Reporter,2000)

E. coli 0157:H7

E. coli 0157:H7 is one of hundreds of strains of the bacterium Escherichia coli. Most strains are harmless and live in the intestines of healthy humans and animals, this strain produces a powerful toxin and can cause severe illness. The combination of letters and numbers in the name of the bacterium refers to the specific markers found on its surface and distinguishes it from other types of E. coli. E. coli 0157:H7 was first recognized as a cause of illness in 1982 during an outbreak of severe bloody diarrhea; the outbreak was traced to contaminated hamburgers. Since then, most infections have come from eating undercooked ground beef. (Bellenir, 1985)

Human illness is the result of consumption of food or water that has been contaminated with microscopic amounts of cow feces. Most illness has been associated with eating undercooked contaminated ground beef. Other known sources of infection are consumption of sprouts, lettuce, salami, unpasteurized milk and juice, and swimming in or drinking sewage - contaminated water. Bacteria in diarrhea stools of infected persons can be passed from one person to another if hygiene or hand washing habits is inadequate. This is particularly likely among toddlers who are not toilet trained. Family members and playmates of these children are at high risk of becoming infected. Young children are at high risk of becoming infected. Young children typically shed the organism if their illness resolves. Older children rarely carry the organism without symptoms. Severe bloody diarrhea and painful abdominal cramps, without much fever are usually symptoms of this illness. The

incubation period is generally 3 to 4 days after ingestion, but may occur anywhere from 1 to 10 days after ingestion, and can last up to 5 to 8 days. (CDC, 2002)

A complication called hemolytic uremic syndrome (HUS) has occurred several weeks after first symptoms in 3% to 5% of cases, particularly children under 5 years of age and the elderly. The symptoms of this severe complication are temporary anemia, profuse bleeding and kidney failure. About one-third of persons with hemolytic uremic syndrome have abnormal kidney function many years later, and a few require long-term dialysis. Another 8% of persons with hemolytic uremic syndrome have other lifelong complications, such as high blood pressure, seizures, blindness, paralysis, and the effect is of having part of their bowel removed. (CDC, 2002)

Escherichia coli 0157:H7 is an emerging cause of food borne illness. An estimated 73,000 cases of infection and 61 deaths occur in the United States each year. (Mead, 1999)

Other toxins and poisonous chemicals can cause foodborne illness. If pesticides are inadvertently added to a food or in food is prepared with naturally poisonous substance, such as poisonous mushrooms people can also become ill. (CDC, 2002)

Escherichia coli 0157:H7 Outbreak

In January of 1993 there was a *E.coli* outbreak associated with Jack in the Box restaurants, located in Washington state. 350 people became ill and 3 children died. (Moeller, 1996)

The source of the outbreak was a batch of contaminated hamburger meat that was purchased by a supplier.

Thoroughly cooking the hamburger would have killed the bacteria, but Jack in the Box used a cooking star that was deemed acceptable in most states. Unfortunately it was not sufficient to kill *E.coli*. Since this *E.coli* outbreak caused Jack in the Box chain has instituted a food safety program.

Although Jack in the Box sales dropped a great deal in 1993 and 1994 they have grown to a total of 1,800 stores. This is attributed to the company's devotion to improve food safety and public awareness. (Howard, 2002)

Mad Cow

Bovine Spongiform Encephalopathy (BSE) also known as Mad Cow disease appeared in the mid 1980's. This disease affects cattle. Affected cows show a variety of signs; anxiety, nervousness and initial hyperactivity only to become lethargic. This disease affects the part of the brain that controls gait, co-ordination and involuntary movement. These specific symptoms and signs led to the name, Mad Cow. Most cows affected were older dairy cows manly from the south of England.

It is believed that the cause of BSE in cattle was transmitted through cattle feed. BSE appeared after manufactures of cattle feed changed the way they prepared the feed that contained sheep carcass, consisting of brain, nervous tissue and other organs. It has been known for at lease 200 years that sheep have been affected by Ovine Spongiform Encephalopathy (OSE), also know as Scarpie. Just as with cattle, sheep affected

with OSE act strangely. They continually bump into their surroundings causing loss of fleece and chunks of flesh.

Although it has not been confirmed that BSE or OSE are transmissible to humans, scientist believe that the similar disease that affects is no coincidence. Creutzfeldt - Jakob disease (CJD) a human Spongiform Encephalopathy is believed to have been transmitted through contaminated beef products. (Josephson, 1998)

Although this disease is rare it strikes 1 - 2 per million and unfortunately always fatal, usually within 1 year. Symptoms in humans range from depression, dementia and eventually loss of physical control of function, including inability to speak, muscle spasms, palsies and paralysis with vision distortions. Most affected are in their late 50's. Incubation period can be 20 years or more. (Ratzan, 1998)

In all three disease OSE, BSE AND CJD are all called Spongiform Encephalopathy or SE because of the spongy like holes that are found in the brains of the affected. Scientist say that although there are good indications that SE is transmissible, they have not been able to identify a transmissible disease agent. (Josephson, 1998)

The fear that took the world by storm; TSE passing from sheep - to - cow - to - human, brought about many changes.

1. British order slaughter and incineration of over 37,000 head of cattle.
2. European countries banned the import of beef.
3. U.S. banned beef from Great Britain.
4. European Union banned orally ingestible medicines that contained animal by products.
5. FDA issued regulation instituting a mammal to ruminant feed ban.

(Josephson and Ratzan, 1998)

How Are Foodborne Disease Diagnosed?

There are many people who become ill and do not seek medical attention. While many that do become ill are not tested. For this reason many foodborne illnesses go undetected. CDC has estimated that for every case of salmonellosis that is actually diagnosed and reported to public health authorities about 38 more occur. (Mead, 1999)

The infections that are diagnosed are usually by specific laboratory test where the causing organism is identified. The three most common causes are identified by culturing stool samples in the lab and identify the bacteria that grow. By examining the stool under a microscope, parasites can be identified. While viruses are too small to see under a microscope, stools are tested for genetic markers that will indicate if specific virus is present. (Mead, 1999)

How Are Foodborne Illness Treated?

Different kinds of foodborne illness they require different treatments. The system that they affects helps determine the treatments. Oral rehydration solutions such as Cerlyte, Pedialyte, or Oralyte should be drunk by people with symptoms of diarrhea or vomiting, because they can lead to dehydration. Anti diarrhea medication can be taken to reduce the duration and severity of diarrhea only if diarrhea and cramps occur, without bloody stools or fever. If these symptoms occur taking anti diarrhea medication can make the illness worse.

A physician should be consulted if diarrhea illness is accompanied by :

- high fever
- blood in the stools
- prolonged vomiting that prevents keeping liquid down
- signs of dehydration, including a decrease in urination, a dry mouth and throat and feeling dizzy when standing up
- if diarrhea last more than 3 days

Doctors do not regularly prescribe antibiotics for foodborne illnesses, unless infections complicate the illness. Many diarrhea illness caused by viruses will improve on their own in 2 to 3 days. Antibiotics have no effect on many viruses, using them can cause more harm than good.

In the past antibiotics have been over- prescribed which has resulted in some bacteria resistant to antibiotics. This is why it is important to use antibiotics only when they are really needed.

Whenever, antibiotics are prescribed it is necessary to complete all the medication and not stopping just because the symptoms have improved. Partial treatment can also cause bacteria to become resistant. (Mead, 1999)

How Does Food Become Contaminated?

There are many ways that food can become contaminated. Food microbes are present in the intestines of healthy animals that we raise as food. Other food can be contaminated during slaughter from having contact with feces or contaminated meat while being processed. Washing or being irrigated with water that has been contaminated can contaminate fruits and vegetables. Shellfish can be contaminated by bacteria that are naturally found in seawater or in sewage that has been dumped into the sea.

Food may also be contaminated in the final processing stage. Infected humans who handle the food may contaminate it. Cross contamination is also possible in the late stages of preparing, juice from other raw agricultural products. Kitchen utensils and surfaces can transfer microbes from food to food by not washing them after each use. Drippings from contaminated raw meat, fish or poultry can also contaminate thoroughly cooked food.

The way food is handled after preparation can also cause contamination. Given moist conditions and availability of nutrients, one bacterium quickly can produce billions in 12 hours. Even lightly contaminated food, left un- refrigerated overnight, can be highly infectious the following day. (Mead, 1999)

What Food Are Most Associated With Foodborne Illness

(chart available in print form)

What can we do to protect control and prevent foodborne illnesses?

Food can become contaminated in many ways or places traveling from farm to table. Therefore, precautions need to be taken by everyone along the route. We as consumers depend on the government to establish rules and regulations for food safety and to also monitor to make sure that they are enforced. Since there is no such thing as a foolproof system and contamination can still happen within our homes, we need to take reasonable steps to further ensure our safety. Following the 4 C's of food safety is the perfect way to begin.

Clean

Bacteria are invisible to the naked eye, it is important to clean everything thoroughly even if it looks clean. Hand washing should be done with hot soapy water. Paper towels should be used once for drying and then thrown away to avoid possible contamination. If cloth hand towels are used they should be changed often. Never use a towel to dry hands that was used to clean liquid from raw meat off counters.

All surfaces should be cleaned before, in between, and after cutting and preparing raw foods. Using paper towels is a good idea, so that you throw away the bacteria with the towel. Throw away cutting boards that are beginning to wear. Cuts and grooves are hard to clean and bacteria can grow.

Rinse all foods under running water. This includes meats before cooking, fruits and vegetables. Use a small vegetable brush to clean rough skin fruits and vegetables. Bacteria can grow in spaces.

Cook

All food should be cooked thoroughly. Heat kills bacteria. Foods that are boiled, baked or fry normally reach temperatures (160°F to 212°F), is sufficient enough to kill most bacteria that cause foodborne illness. Thermometers should be used to check to see if internal temperature of meat is sufficient. (FDA(Food),2001)

The following chart shows sufficient temperature that food should be cooked to kill foodborne illness causing

bacteria.

(chart available in print form)

Combat Cross Contamination

The only way to prevent cross contamination is to avoid contact of raw foods that need to be cooked or food that is eaten raw that haven't been cleaned.

Separate raw food in shopping cart and in your refrigerator.

Use separate cutting boards if possible. One for raw meat products and one for fresh fruits and vegetables.

Don't place cooked food, on plate that previous held raw meat.

Use sealed containers or plastic sealed bags to store raw meat.

Never use or taste sauce that was used to marinate raw meat unless it has been boiled.

(FDA(Food),2001)

Chill

Pathogen bacteria in food can double in number every 30 to 40 minutes, increasing your chance of contracting a foodborne disease. Keep all perishables in refrigerator.

Refrigerate food quickly

Set refrigerator no higher than 40 degrees Fahrenheit and 0 degrees Celsius.

Refrigerate or freeze perishables prepared food, and leftovers within 2 hours.

Marinate food in refrigerator.

Don't pack refrigerator, cold air needs to circulate to keep food safe.

Use coolers full of ice at family outings or barbecues for perishable foods.

Never thaw foods at room temperature. Thaw in refrigerator or immersing in cold water, change water every half hour. (FDA(Food),2001)

This chart gives short but safe times to keep refrigerated food from spoiling. The times are modest as to maintain foods texture and flavor. They would still be safe to eat if kept longer.

(charts available in print form)

Simulated Outbreak

In order to control and prevent outbreaks of foodborne -- disease, CDC has an outbreak response and surveillance unit. Their job is to investigate outbreaks so that they may gain information that will lead to improvements and prevention of similar outbreaks. There are many steps that are taken in this process. To view in depth the procedure for identifying an outbreak and reporting it visit: CDC Outbreak Response and Surveillance Unit <http://www.cdc.gov/ncidod/dbmd/outbreak/>

Lessons

Lesson:

Doing Experiments - Using The Scientific Method

Objective:

Students will learn the scientific method by designing an experiment to answer a question in how to solve a simple everyday problem.

Procedure:

Have students practice developing an experiment by using something simple and interesting. Tell them you want to know how to make a peanut butter and jelly sandwich quick. Tell them that you keep your peanut butter in the refrigerator and your friend keeps theirs in the pantry. Which one should you use if I want to make my sandwich fast. Let the students design and conduct an experiment using the above question. Define steps in experiment:

Problem -- What question are you investigating?

Hypothesis -- What do you think will happen?

Materials -- List the supplies needed to conduct the experiment.

Procedure - List the steps followed to complete the experiment.

Data/ Organization/ Interpretation - What did you see, hear, or smell? You should use a graph, chart and or illustration.

Summary -- Explain the results using science vocabulary.

Further Question -- Good scientist always think of something else they'd like to try!

When they have completed, tell them that they can use the seven steps for all experiments.

Lesson:

Introduction to Bacteria

(This lesson will be on going and last up to one to two weeks with my class)

Objective:

Research how bacteria move, where they live, and how they reproduce

Learn how bacteria can be helpful or harmful

Create a display illustrating what they learned about bacteria.

Materials:

Chart paper

Poster board

Markers

Colored Pencils

Photographs from magazines or the Internet

Print resources

Internet resources

Procedure:

Ask students what they know about bacteria. Record response on chart paper. Put away until the end of lesson.

Explain to students that they will be learning about bacteria. Students will work in teams to answer the following questions from the web sites listed and record them in their bacteria notebook.

Basic Characteristics of Bacteria

Questions

What do bacteria look like?

What are the three basic shapes?

How are bacteria classified?

Where have bacteria been located? (Name as many as you can.)

How many bacteria live on Earth?

How quickly do bacteria reproduce? (Draw a graph or picture.)

What and how do bacteria eat?

Websites:

<http://www.microbe.org/micorbes/bacterium1.asp>

<http://www.bacteriamuseum.org/>

http://whyfiles.org/shorties/count_bact.html

<http://www.ucmp.Berkeley.edu/bacteria/spirochetes.html>

<http://www.amnh.org/nationalcenter/youngernaturaliswards/1998/bacteria.html>

Helpful Bacteria

Questions

Name some helpful bacteria.

How are bacteria helpful to humans? Give examples.

How does bacteria help keep ecosystem healthy?

What do bacteria do that is especially helpful to plants?

Websites:

http://www.microbe.org/microbes/friend_or_foe.asp

http://www.micorbe.org/microbes/at_work.asp

<http://www.micorbeworld.org/mlc/pages/roles.asp>

<http://www.amnh.org/nationalcenter/youngnaturalistawards/1998/bacteria.html>

Harmful Bacteria

Questions

What are pathogenic bacteria?

Where do these harmful bacteria usually live?

Describe how bacteria can cause food poisoning.

Give two examples of bacteria that cause disease. Include their names and how the bacteria spread.

How can these disease be prevented

Websites:

<http://www.bacteriamuseum.org/niches/pbacteria/pathogens.shtml>

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/groupasreptococcal_g.htm

<http://vm.cfsan.fda.gov/~MOW/chap7.html>

<http://hna.ffh.vic.gov.au/phb/hprot/food/fhpp/fpl.html>

<http://www.micorbe.org/microbes/bacteriuml.asp>

3. Have the students display their results of their research on a poster board. Encourage them to be creative and use graphs, pictures, drawings, diagrams, charts and any other ways that interest them.

4. When displays are completed, give each group time to present their display.

5. Display the chart paper with the student's original ideas about bacteria. Add to the chart what the students know now. Compare to see if ideas have changed.

Evaluation:

30 Points - Completion of task.

2 Points (16 questions = 32 possible points) -- For each question answered.

15 Points -- For oral presentation of information learned.

15 Points - For visual display

8 points -- For poster creativeness.

This lesson, Introduction to Bacteria was adapted from Discovery School.com

<http://www.discoveryschool.com>

Teaching Material

All other lessons will come from a program called "Science and Our Food Supply Investigating Food Safety From Farm to Table: Teacher's Guide for Middle Level Science Classrooms".

This kit has three components:

Teacher's Guide
Dr. X and the Quest for Food Safety Video
Food Safety A to Z Reference Guide

The program includes 5 modules with activities and experiments related to each one.

Module 1 -- Understanding Bacteria

Module 2 -- Farm

Module 3 - Processing and Transportation

Module 4 - Retail and Home

Module 5 - Outbreak and Future Technology

To order *Science and Our Food Supply* , go to the FDA/NSTA OnLine Order Form and submit the form electronically by pressing the submit button on the bottom of the form or print and mail it to:

The National Science Teachers Association

Science And Our Food Supply

1840 Wilson Boulevard

Arlington, VA 22201

Fax: 703-522-5413

Teacher Bibliography

Bellenir, Karen and Peter D. Dresser, ed. *Health Reference Series Vol.7, Food and Animal Borne Disease Soucebook* . Detroit: Omnigraphics, Inc.,1985.

This book gives basic information about disease that can be spread to humans through the ingestion of contaminated food or water or by contact with infected animals and insects.

Dack, G.M., M.D. *Food Poisoning* . Chicago; The University of Chicago Press, 1967.

This book includes the discussion of illnesses resulting from ingestion of food containing certain inorganic chemicals, poisons derived from animals and plants and toxic products or infections caused by several species of bacteria.

FDA and NSTA, *Science and Our Food Supply* . New York, JMH Education Marketing Inc., 2001.

This is a teacher guide for middle level Science classrooms. Investigating food safety from farm to table .

"Foodborne Infections". *Center for Disease Control* . 6 Mar. 2002

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/foodborneinfections_g.htm

This article defines foodborne Infection, their causes, the effects they have and how it effects the consumers. It also discuss what role the government plays in detection and prevention of outbreaks.

Josephson, Julian. "Cows for Fear, Is BSE a Threat to Human Health?" *Focus: Environmental Health Perspectives* 106(1998): no 3. 28 June 2002. <http://ehpnet1.niehs.nih.gov/docs/1998/106-3/focus.html>

This article investigates the disease Bovine Spongiform Encephalopathy (BSE) or Mad Cow Disease and discusses how similar it is to Creutzfeldt -- Jakob Disease (CJD) a human spongiform encephalopathy. Raising the questions, Is Mad Cow a threat to humans.

Mead PS, Slustsker L, Dietz V, et al. "Food Related Illness and Death in the United States" . *Emerging Infectious Disease* 5(1999): no 5. 6 Mar. 2002. <http://www.cdc.gov/ncidod/EID/vol5no5/mead.htm>

Multiple surveillance systems and other sources information on foodborne disease on health in the U.S. was compiled and analyzed and presented in this synopsis.

Moller, Dade W. *Environmental Health chapter 6* . Cambridge: Harvard University Press, 1996. *Chapter 6 focuses on contaminants that are commonly found in food, their effects on health, and steps taken in the preservation and handling of food to assure safety.*

Ratzan, Scott ed. *The Mad Cow Crisis* . London: UCL Press Limited, 1998. *This book presents a multi -- disciplinary approach to the crisis, with viewpoints form experts across a variety of fields, in an attempt to comprehend the ramifications of this unique case.*

Teacher and Student Bibliography

Harrington, P. "Outbreak of Campylobacter Jejuni Infections Associated with Drinking Unpasteurized Milk Procured through a Cow - Leasing Program - Wisconsin, 2001". *MMWR Weekly* 51(2002): no 5. 27 June 2002.
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5125a2.htm>

This article discusses the facts surrounding an outbreak of Campylobacter Jejuni Infection in December of 2001 in Wisconsin.

Howard, Scripps. "Jack in the Box chain bounces back". *Seattle Post - Intelligencer* , (2002): 24 June 2002.
http://seattlepi.nwsourc.com/business/75728_fill24.shtml.

This article features how Jack in the Box fast food chain, bounced back after deadly outbreak of food poisoning, Ecoli.

FDA and NSTA, *Food Safety A to Z Reference Guide: Science and Our Food Supply* . New York: JMH Education Marketing Inc., 2001.
User- friendly reference guide, that offers you a wealth of invaluable, up to date safety information. Also included are in depth sections on the steps by step journey food travels from farm to table.

Reporter, R, M.D. "Outbreaks of Salmonella Serotype Enteritidis Infections Associated With Eating Raw or Undercooked Shell Eggs - United States, 1996 -- 1998". *MMWR Weekly* 49(2000) no 4. 28 June 2002.
<http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/mm490a1.htm>

This article discuss the facts surrounding outbreaks of Salmonella Serotype Enteritidis Infection associated with eating raw or undercooked eggs through 1996 --1998.

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