W 889

Food Science Project Area Guide
Beginner

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BASICS OF FOOD SCIENCE
ACTIVITY #1: THE BASICS

Project Outcome Addressed

- Define Food Science.

Words to Know:

- Food Science

THINGS TO LEARN

What is Food Science?

You might think that studying **food science** is to study food nutrition for your body or to learn to become a chef. Surprisingly, food science is neither of these subjects! Nutrition and culinary arts are their own subjects. Food science is different, but what could it be?

In your own words describe what you think food science might be:

_____

_____

_____

_____

Use a QR code reader on a mobile device, if you have printed out these activity sheets, or *click* on the QR below if you are using a computer. Once you are there, watch the video, made by the Institute of Food Technologists (IFT), called, "A World Without Food Science."

Once you have finished watching the video, answer the following questions:

Record three things that you learned for the first time.

1._____

2._____

3._____

What are two opinions that you have about food science after watching the video?

1._____

2._____

What is one question you have after watching the video?

_____

_____

Now find a credible source to answer your own question using a website that ends in ".edu," ".org," or ".gov."

Check your answer! You can find the definition of food science using the following QR code:

Record the true definition of Food Science:

_____

_____

_____

_____

_____

List two differences between the true definition and the one you made up at the beginning of this activity

1._____

2._____

If you thought that food science was something else that is not included in the true definition, record what you thought it was and find out the name of the field that is responsible for that kind of study below:

_____

_____

If you found out something new about food science after watching the video and looking up the true definition that you did not think of before, explain what you learned and if you thought that either 1) someone other than a food scientist did the work or 2) you never thought about it before.

_____

_____

THINGS YOU CAN TRY

Here are some additional videos explaining what a food scientist does.

In this video, two food scientist students explain their research on ice cream and candy.

This video clip is an interview with a food scientist who works for the government.

In this video, you can learn a lot about food processing:

1-2 YEARS IN PROJECT

ACTIVITY #2: CAREERS IN FOOD SCIENCE

Project Outcomes Addressed

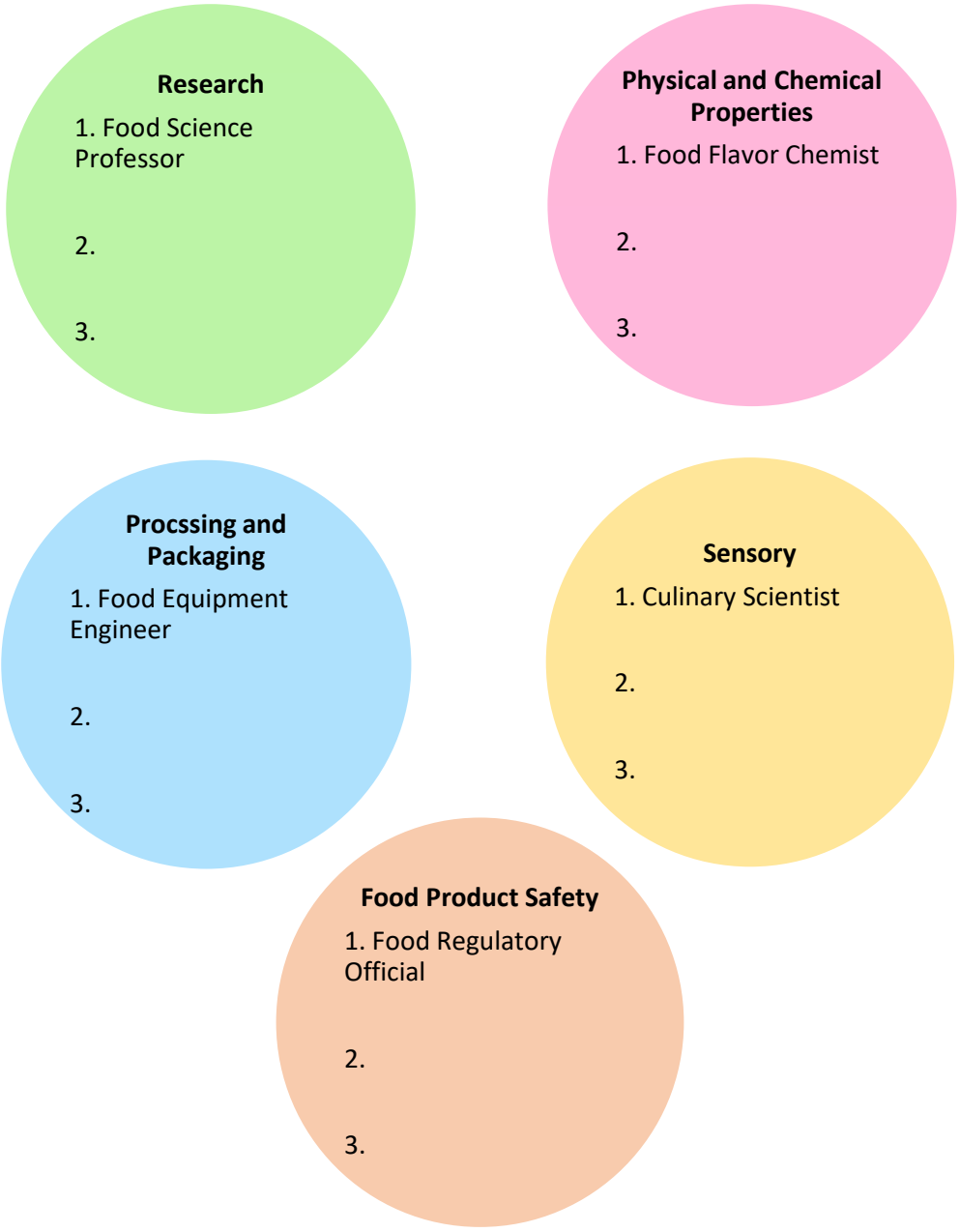
- Research a specific career in food science.

THINGS TO LEARN

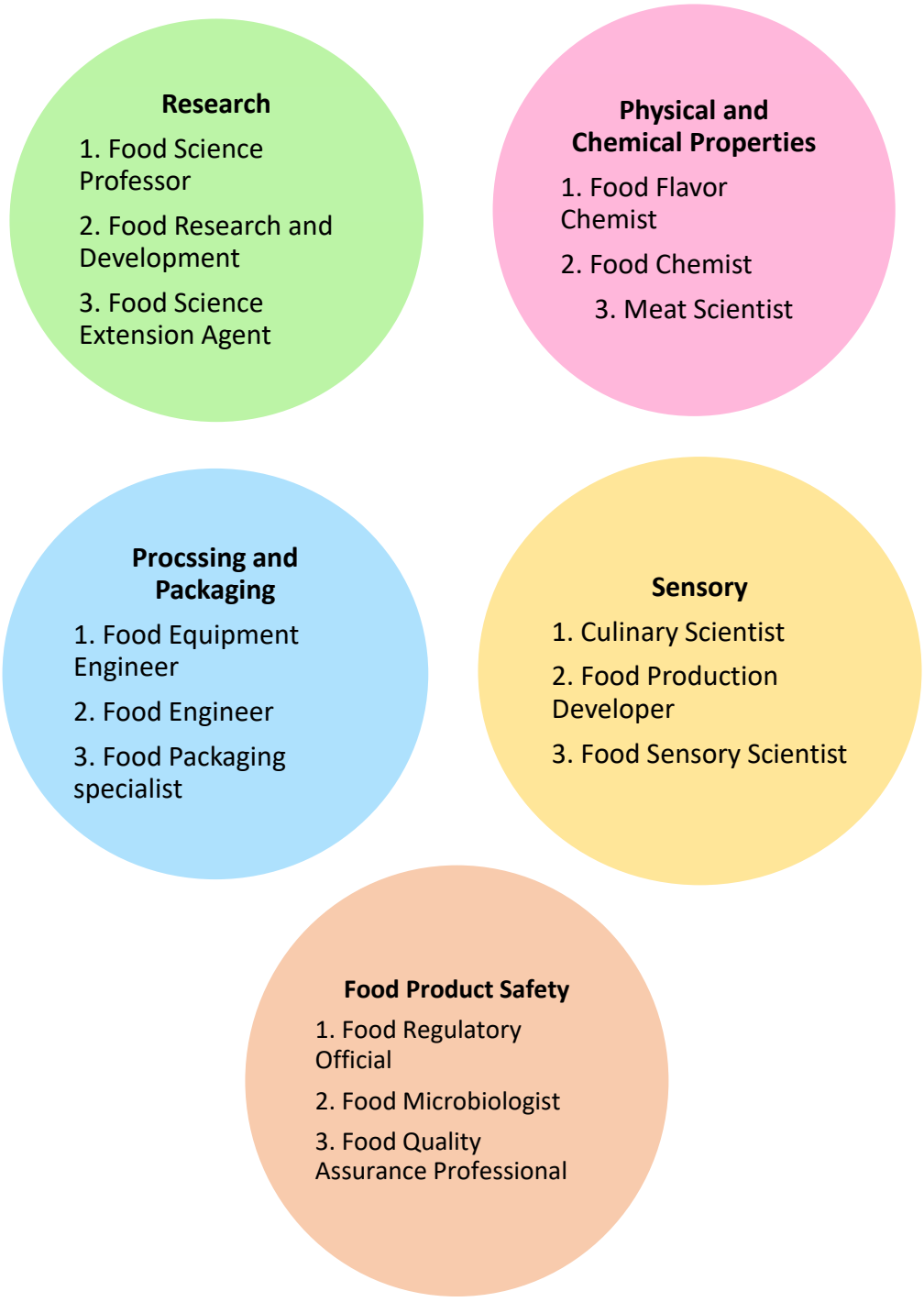
Now that you know what food science is, you can learn about some of the many careers that exist in the field of food science. Food science is an applied science that uses many principles from traditional sciences like biology, physics and chemistry to understand the foods that we eat. Food science careers can be placed into several groups like processing and packaging, sensory perception, food product safety, physical and chemical properties, and research. Many other fields in science also include research, but it is necessary in food science because we continue to learn more about the microscopic building blocks that make up our foods and give us energy and nutrients.

Below are several food science careers. Match each one of them with a category in the diagram below. The first one in each group is done for you. Around each colored circle, write three skills that might be necessary for a career within each discipline.

1. Culinary Scientist
2. Food Processing Engineer
3. Food Researcher and Developer
4. Food Equipment Engineer
5. Food Product Developer
6. Food Science Professor
7. Food Packaging Engineer
8. Food Sensory Scientist
9. Food Chemist
10. Food Microbiologist
11. Food Flavor Chemist
12. Food Quality Assurance Professional
13. Meat Scientist
14. Food Science Extension Agent
15. Food Regulatory Official


Research
1. Food Science Professor
2.
3.
Physical and Chemical Properties
1. Food Flavor Chemist
2.
3.
Procssing and Packaging
1. Food Equipment Engineer
2.
3.
Sensory
1. Culinary Scientist
2.
3.
Food Product Safety
1. Food Regulatory Official
2.
3.

Your bubbles might look like the one below, but you may have come up with other ways to organize them as well.



THINGS YOU CAN TRY

Prepare a job listing for a food science career you would like to explore. Choose one of the 15 food science careers listed in the previous exercise on page 1 of this activity. Below, you can see an example of a job listing for a Quality Control Manager for Vegetable Soup Company.

Sample Job Posting

Quality Control Manager, Full-Time – Vegetable Soup Company

Job Description: Working as a Quality Control Manager Monday through Friday beginning at 7:30 a.m. with scheduled Saturday work every 6 weeks. Employee will be working in both corporate offices with travel to area processing plants

Responsibilities include, but are not limited to:

- Establish measurement standards for all products based on industry norms for food safety.
- With production staff, develop systems to maintain the safety and quality of all foods.
- Research standard food safety testing protocols and implement the testing necessary to follow the protocol.
- Work with outside lab when needed to complete tests
- Complete shelf-life studies of all new products
- Conduct sensory and microbiological tests on finished lots of product on a random basis to measure quality after production
- Conduct quality tests on incoming raw materials according to industry standard protocols.
- Manage & run production of food items, in the short term, including scheduling production runs, ordering ingredients, packaging and supervising production shifts.

Education: Applicant should have at least a bachelor's in food science or experience in food science industry (3-5 years) with a bachelor's in agriculture or another science field.

Requirements: Industry experience or Food Science Degree

Salary: $40,000 including benefits (health insurance, 401k, annual leave, sick hours)

Contact: Send a cover letter and resume to johndoe@vegetablesoup.com

When preparing your job listing, use the following format and answer each of the questions listed in the sections below in complete sentences.

- Job Description
    - What department does that food scientist work in? (for example: research and development, processing, food safety, quality assurance, regulatory affairs or human resources)?
    - Do they work in a lab, plant, office or educational facility?
    - What types of tasks do they do on a daily basis?
- Responsibilities
    - What are three responsibilities that they have as a part of his or her job?
- Requirements
    - What skills do they need to do his or her job well?
    - How many years of experience do they need?
    - What education, training or certifications are required or desired?
- Job Type
    - Do they work part-time or full-time?
- Education
    - What is their level of required education?
- Starting Salary Range
    - What is the beginning salary?

1-2 YEARS IN PROJECT

FOOD MICROBIOLOGY

ACTIVITY #3: FOOD MICROBIOLOGY: PATHOGEN & SPOILAGE ORGANISMS

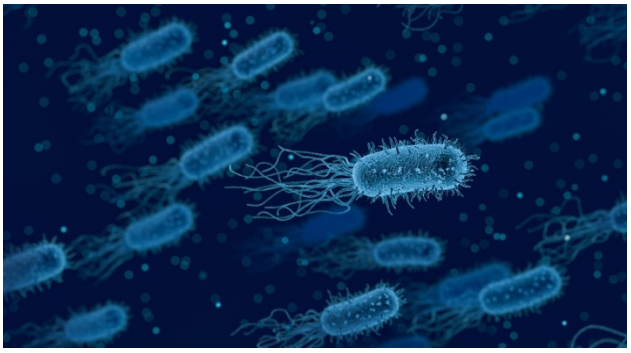
Project Outcomes Addressed

- Define bacteria, viruses, protozoa and fungi.
- Compare and contrast the differences between bacteria, viruses, protozoa and fungi.
- Identify the three main shapes of bacteria.

Words to know:

- Microorganisms
- Bacteria
- Viruses
- Protozoa
- Fungi
- Spoilage
- Toxins

THINGS TO LEARN



Microscopic organisms are all around us, and they live, eat and reproduce just like we do. Sometimes we call them *microorganisms*. Microorganisms are the tiniest forms of life that we know about. They are so small that you need a powerful microscope to see them.

Some of these microorganisms are bad and can make us very sick or cause our foods to be spoiled. Have you ever eaten food and gotten very sick the next day? Sometimes this is because microorganisms that can make you sick have been in your food. Microorganisms can be placed into four groups: *bacteria, viruses, protozoa*, and *fungi*.

Some bacteria, viruses and protozoa can make us sick when we eat them; however, not all of them can. Actually, only a small number can make your sick, but they live everywhere around us, sometimes even in our food. Bacteria are living microscopic organisms, usually made up of one single cell. Viruses are also living microscopic organisms, but they are smaller than bacteria. Unlike bacteria, viruses must have a host body to survive. Protozoans are a living organism, but they are neither plants nor animals. Protozoans can live on land and in water. Like bacteria and viruses, fungi are living organisms, but they are made up of multiple cells. These multiple cells will sometimes create food *spoilage*, such as black or green fuzz on your sandwich bread. Most bacteria, viruses, protozoa and fungi can be killed with high heat. This is one of the reasons that we cook our food.

Bacteria and fungi are both capable of producing *toxins*, poisonous substances that can also cause us to become very sick. These toxins are rarely destroyed with cooking, so it is important to keep the microorganisms that can produce these toxins out of our foods or kill them quickly to keep them from producing toxins.

You might be surprised to hear that not all microorganisms are bad! Some are good and can be used to make fermented foods like cheese, bread, yogurt, pickles, sauerkraut, sour cream and soy sauce. The good microorganisms can be found in the bacteria and fungi groups. Although there are also some good viruses, they are not used to produce food products but are instead used to kill bad bacteria.

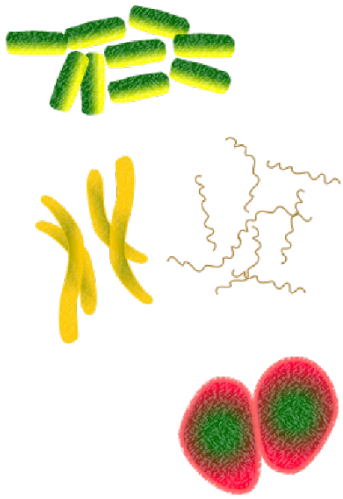
Define Bacteria: _____

_____

_____

_____

_____



Check out some cool pictures of bacteria:

Different bacteria have different shapes. There are three main shapes of bacteria. Watch the following video to learn the shapes of bacteria:

Can you think of another candy or food item that resembles the shape of each major shape of bacteria?

Bacilli: _____

Cocci: _____

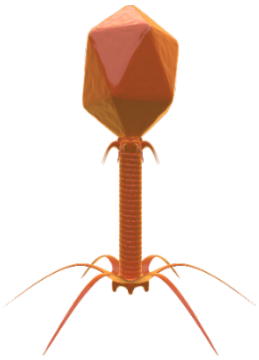
Spirilla (Spiral): _____

Define Virus: _____

_____

_____

_____



Check out some cool pictures of viruses:

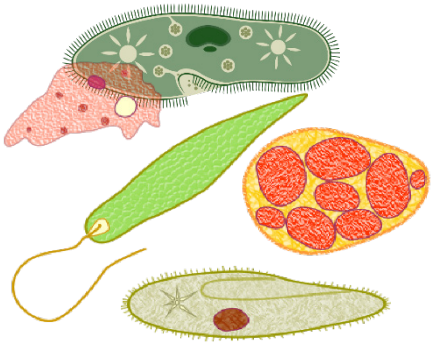
Define Protozoa: _____

_____

_____

_____

_____



Check out some cool pictures of protozoa:

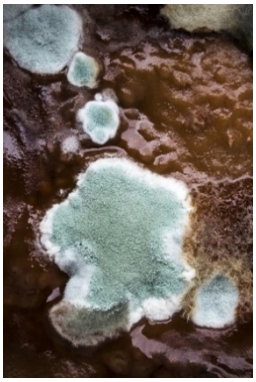
Define Fungi: _____

_____

_____

_____

_____



Check out some cool photos of fungi:

Check your answers against the definitions below to see how you did!

Bacteria: Bacteria are single-celled microorganisms with cell walls but no organelles or organized nucleus. Bacteria can cause disease in most life forms, including plants, animals, insects, and fungi.

Virus: A virus is a tiny infectious agent that can only reproduce inside a living cell of another organism. Viruses can infect all living things, including animals, plants, insects, and bacteria.

Protozoa: Protozoa are microscopic, one-celled organisms that can be free-living or parasitic in nature. They can multiply in humans, helping them to survive, sometimes causing serious sickness from a single organism.

Fungi: Fungi are a group of spore-producing, single-celled or multicellular organisms feeding on organic matter, including molds, yeast, mushrooms, and toadstools.

THINGS YOU CAN TRY

For this exercise, see if you can tell the differences between bacteria, viruses, protozoa and fungi by filling in this comparison table. Put an "X" in each box that is true. Leave the other boxes blank.

Characteristics	Bacteria	Virus	Protozoa	Fungi
Can reproduce by itself				
Is a eukaryote				
Can make you sick				
Causes food spoilage				
Can be spread in food or beverages				
Can produce toxins or poisons				
Rank these from smallest to largest				
Can be unicellular				

Check your answers on the next page to see how you did!

Answers:

Characteristic	Bacteria	Virus	Protozoa	Fungi
Can reproduce by itself	x		x	x
Is a eukaryote			x	x
Can cause disease	x	X	x	x
Causes food spoilage	x			x
Can be spread in food or beverages	x	X	x	x
Can produce toxins or poisons	x			x
Rank these from smallest to largest	2	1	3	4
Can be unicellular	x	X	x	

You can review answers by visiting *Encyclopedia Britannica Kids* at kids.britannica.com and searching for *bacteria, virus, protozoa*, and *fungi*.

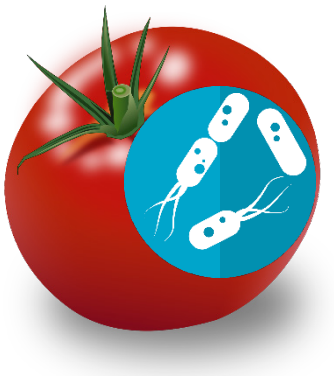
FOOD MICROBIOLOGY
ACTIVITY #4: LIFE FOR MICROORGANISMS

Project Outcome Addressed

- Identify conditions that are favorable for pathogen and spoilage organism growth in food.

Words to Know:

- Bacterium
- Requirements for life



THINGS TO LEARN

One of the basic things all humans need to live is food, but you need more than food to live. Can you think of other basic things you need to survive?

_____

_____

What would happen to you if the temperature on Earth was as hot all day and as cold all night as Mars?

_____

_____

What would happen to you if you tried to live in the ocean with no air or oxygen tank?

_____

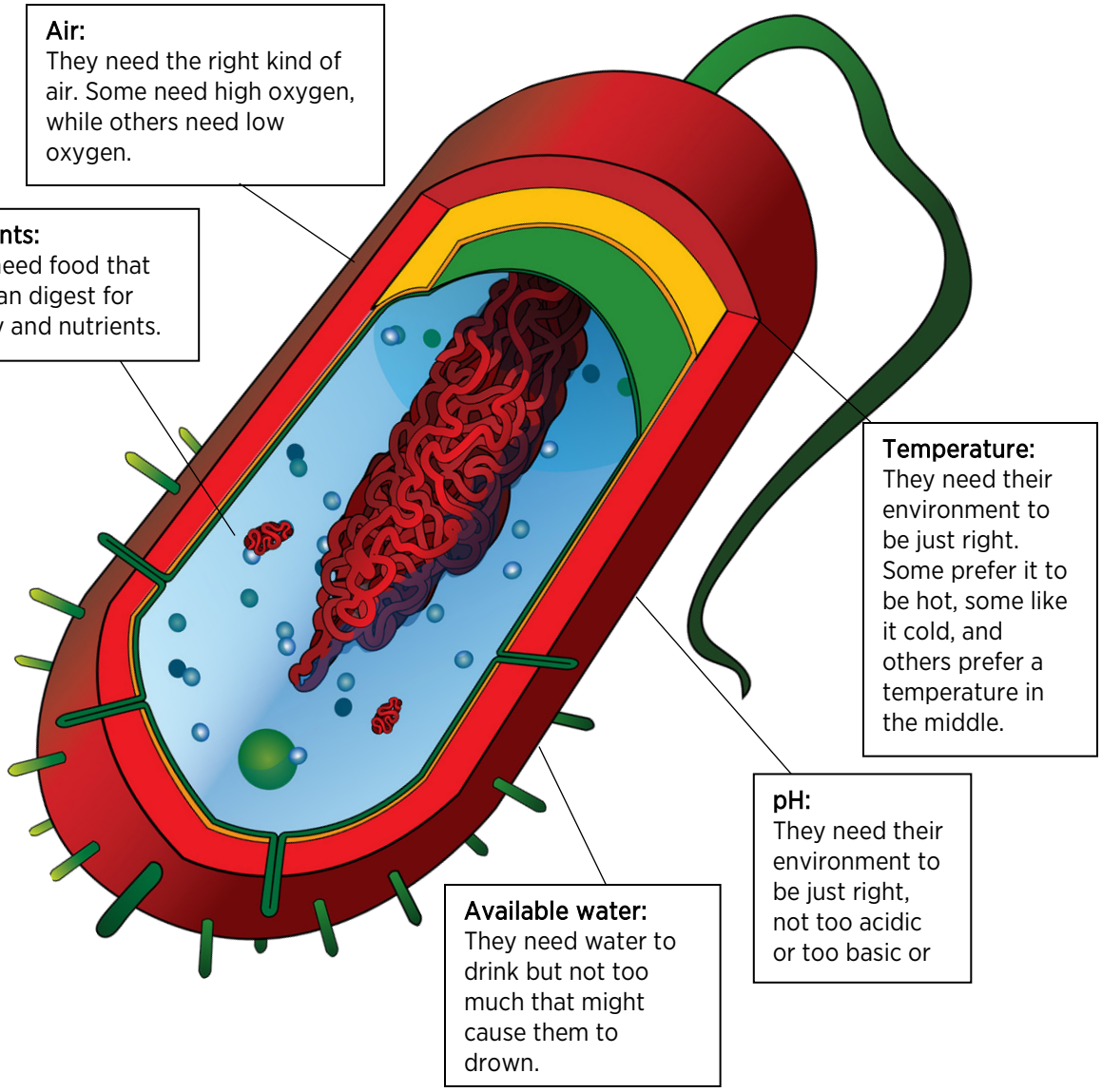
_____

What would happen if you had no food?

_____

_____

Microorganisms are very much like us. Below is an illustration of a bacillus-shaped or rod-shaped *bacterium*. Its shape is similar to a Mike & Ike candy. Surrounding it are five *requirements* that a microorganism needs for life. These requirements for life are universal, meaning that they apply to bacteria, protozoa, fungi, plants and animals, like you. But within each of these categories, there is some variation. For example, one creature may be able to live where it is very hot, but another may only be able to live where it is very cold. But each one has a temperature requirement, a range of temperatures where it is comfortable and happy. Check out what a microorganism needs!



THINGS YOU CAN TRY

We also have the same requirements as microorganisms! Can you think about how these things might affect you?

pH:

Available water:

Air:

Nutrients:

Temperature:

You can also go to the following website to know more about how microorganisms interact with our food:

Write a letter to a family member or neighbor telling them three things you learned for the first time from the website above, two personal opinions you have now that you have studied food safety, and one question you have about food safety within the home.

FOOD MICROBIOLOGY
ACTIVITY #5: FOOD PRESERVATION AND SAFETY

Project Outcome Addressed

- List different methods used for food preservation.

Words to Know:

- Preservatives
- Preservation
- Pathogens
- Shelf-life
- Autodegradation

THINGS TO LEARN

To begin this activity, we will start with an easy ongoing experiment.

For this experiment, go to the grocery store and purchase two loaves of bread. These loaves will not be edible at the end of the experiment.

1. **Choose a loaf from the fresh-baked section, being careful to read the label. Select a bread that does not have any chemical *preservatives* on the ingredients list.** Some preservatives that might be listed include calcium propionate, sodium benzoate and potassium sorbate. These preservatives are naturally occurring acids that are found in foods, and they are added to bread to inhibit mold. All agents used as preservatives must have their function explained in the ingredients list; for example, "a mold inhibitor" or "to retard spoilage."

What is the preservative listed in the ingredients list on the right?

---

*If you are feeling crafty, you could make a loaf of handmade bread for this experiment instead of using a fresh loaf from the grocery store. Make sure to put it in a bag or wrap it in plastic to keep it from drying out during the experiment.

2. **Choose a loaf of sandwich bread from the bread aisle, being careful to read the label. Select a loaf that does include a chemical preservative.** Remember that all agents used as preservatives must have their function explained.

Which preservative(s) is used in the loaf of sandwich bread?

_____

When you have purchased your loaves of bread for the experiment, bring them home and leave them on your kitchen counter. Inspect them for mold every day. Write down the number of days the bread was on the counter before you first saw mold.

How many days passed before the loaf without preservatives showed signs of mold?

_____

How many days passed before the loaf with preservatives showed signs of mold?

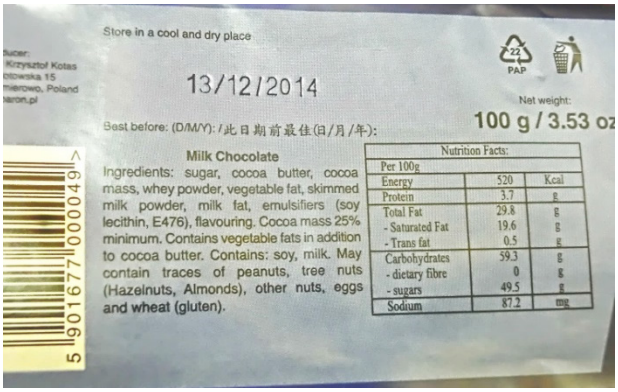
_____

Explain why the longest-lasting loaf did not mold as quickly:

_____

_____

Have you ever wondered what "expiration," "sell by," "use by," or "best by" dates are?



Watch the following video to learn more about what they mean. Listen carefully to why manufacturers add them to their packaging.

Do expiration, sell by, use by or best by dates refer to the **SAFETY** of a food or the **QUALITY** of a food? (circle one)

Does the government require expiration, sell by, use by or best by dates to be printed on all food labels? _____

Safety; No (only baby food)

What is the one type of food that is an exception to your previous answer?

_____

In your own words, try to describe the purpose of a best-by date?

_____

_____

_____

Why might a company put an expiration date on their foods?

_____

_____

_____

Food *preservation* is the term that we give the techniques employed to make food last longer. Another term used in food science to explain how long a food lasts is *"shelf life."* The shelf life of a food is affected by two things:

1. Microbial spoilage organisms that can make our food rot. Think about the mold that covers your bread.
2. The natural enzymes present in the food that cause it to start to break itself down, also known as *"autodegradation"* or self-degradation. Think about how fast a banana turns from yellow to brown or overripe without the help of microorganisms.

Which do you think is more desirable, a short or a long shelf life? Why?

_____

_____

Many of the foods we eat come from all over the world, such as bananas from Brazil, vanilla from Madagascar, avocados from Mexico, and strawberries from California. We have to make sure that our food can be delicious, desirable and healthy after it travels hundreds and sometimes even thousands of miles. The bananas you see in the grocery store are picked while they are still underripe and green like you can see in the photo above. That way they are firmer and bruise less easily during their long journey to your grocery store.

What is one of your favorite foods?

_____

Do an internet search to learn about where your favorite food originated. For example, the black walnut is from North America. Where does your favorite food come from?

_____

If spoilage organisms are responsible for causing our foods to spoil and reducing their quality, what can we do to stop them?

We have learned that microorganisms, such as bacteria, need many of the same things that we do and are attracted to our food because microorganisms need nutrients. Also, many foods are grown outside where they touch soil, insects and animals, and are watered with rain. Therefore, our foods naturally have microorganisms on them before they are cleaned and cooked. Since we share the same food, we must race to win the prize and keep the food for ourselves. The only way we can do that is to eat all of it at one time or preserve it for a later time in a way that will make it unusable as food to microorganisms.

Do you remember what bacteria need to live? Think back to Activity #5. Make a list of the five things bacteria need to survive.

1. _____
2. _____
3. _____
4. _____
5. _____

Keeping those five things in mind, what are some things we can do to make our foods safer to eat for a longer period of time?

_____

_____

_____

_____

If we can change at least one of those factors like available water, pH, air or temperature, we can keep the food for ourselves and not share it with microorganisms that can make us sick or spoil our foods.

Watch this video to learn more about ways that we can preserve our foods!

THINGS YOU CAN TRY

There are many ways that we preserve food. Below is a list of 10 different food preservation techniques. To each list, add two more foods that are preserved by each of these methods.

Canning

1. green beans
2.
3.

Salting

1. codfish
2.
3.

Refrigerating

1. milk
2.
3.

Pickling

1. eggs
2.
3.

Freezing

1. ice cream
2.
3.

Sugaring

1. strawberry jam
2.
3.

Smoking

1. bacon
2.
3.

Fermenting

1. cheese
2.
3.

Chemical Preservatives

1. bread
2.
3.

Dehydrating

1. apricots
2.
3.

If you want to learn more about food preservation, there are many videos that you can watch. Try to answer the questions below the links to test your knowledge!

Watch this video:

Why might you freeze blackberries on a sheet without touching? What life requirements are being altered so that microbes cannot grow in the meat? Hint: What is different about the freezer than your countertop? Think back to the requirements for life in activity #5.

_____

_____

Watch this video:

Why might this method not meet modern safety standards? Hint: How long does it take them to smoke the meat at a warm temperature? What life requirements are being altered so that microbes cannot grow in the meat? Hint: What happens to the meat when it has been smoked?

_____

_____

Watch these videos:

What do you think the sugar does to the lime peel and the strawberry fruits? What life requirements are being altered so that microbes cannot grow in the fruit? Hint: What happens to all of the water from the fruits?

_____

_____

Watch this video:

An unusual and outdated form of meat preservation, potting meat is rarely done these days. What life requirements are being altered so that microbes cannot grow in the meat? Hint: What steps does he take after the initial cooking step before putting them into the pots.

_____

_____

Why might you add more salt?

_____

_____

Why might you reheat the meat after it was put in the pots?

_____

_____

Why might you make sure there are no air pockets in the pots?

_____

_____

Why might you cover the warm meat with butter or another fat?

_____

_____

Why might you want to store this in the refrigerator?

_____

_____

FOOD LAWS & REGULATIONS
ACTIVITY #6: REGULATION OF FOOD SAFETY AND SANITATION

Project Outcome Addressed

- Define the following food science terms: quality assurance, HARPC and food law.

Words to Know:

- FDA
- USDA
- HARPC
- Food Law
- FSMA
- Quality Assurance

THINGS TO LEARN

Our food is the perfect place for microorganisms, both spoilage and pathogenic, to grow and multiply. Controlling their growth and improving food safety is important. There are a couple of government regulatory agencies responsible for keeping our food safe. These are 1) the United States Food and Drug Administration (**FDA**) and 2) the United States Department of Agriculture (**USDA**). They define quality characteristics for food products. For example, you can find the requirements for milk at the following website:

Define **Food Law**: _____

_____

_____

_____

_____

You can watch a video of a news story in Wisconsin on the regulation of raw milk cheese:

Although there are no laws that refer to home cooking, there are laws that apply to restaurants and large food production facilities. The laws that regulate food production and processing in large companies are very important for enforcing food safety standards. A new food safety regulation called the Food Safety Modernization Act (**FSMA**) was enacted in 2011. Here is a video about FSMA:

FSMA is responsible for focusing on preventing food-borne illness rather than responding to it when it happens. Within this law, there is a provision called HARPC. Do an internet search to determine what **HARPC** is. Try this website if you have trouble:

Define HARPC: _____

_____

What are the eight steps of HARPC that a food processing or producing company would need to follow?

1. _____
2. _____
3. _____
4. _____

5. _____

6. _____

7. _____

8. _____

One way that these governmental departments regulate food quality is to enforce *quality assurance*. They can do this by requiring companies to label their foods in a specific way — truthfully, accurately and completely. They can also perform routine inspections of production and processing facilities. These inspections evaluate if the company is producing food in a manner that is both healthy and safe.

Define **Quality Assurance**:

_____

_____

_____

_____

You can watch this video about food labeling:

The FDA and USDA have a long list of all the ingredients that are allowed in food and another long list of all the food ingredients that are not allowed in food.

THINGS YOU CAN TRY

Quality Assurance takes many people designing and watching carefully to make sure that all the proper steps are followed. Think about how many steps are required in the making of ice cream treats.

Watch this video on how ice cream sandwiches are made:

What step is taken to kill the bacteria in this product?

_____

_____

_____

After that step, what do they do to keep new bacteria from growing? Think back to our activity on the requirements for life: pH, time, texture, temperature, antimicrobials, salts, atmospheric oxygen, nutrients, UV light and available water. Hint: It is in the name of the food.

_____

_____

_____

FOOD LAWS & REGULATIONS
ACTIVITY #7: USDA vs. FDA

Project Outcome Addressed

- Compare and contrast the roles of the USDA and FDA in keeping our food supply safe.

THINGS TO LEARN

Remember the government regulatory agencies that are responsible for keeping our food safe are called 1) the United States Food and Drug Administration (FDA) and 2) the United States Department of Agriculture (USDA). Each of these agencies has the responsibility to control certain food groups so that all foods are overseen for quality and safety. They are responsible for enforcing laws and regulations that are related to food processing and production of different food items from catfish and chickens to Twinkies and canned beans. Because there are so many food products, it takes two large agencies to approve and regulate each product that companies want to produce. However, it is not always clear if the FDA or the USDA is responsible for regulation of a certain food product.

North Carolina State University has prepared a helpful document called "Principal Food Safety Regulatory Organizations" to simplify the categories of foods that the FDA and USDA are responsible for. You can find out at the following link:

You can also see the specific laws and their codes that give responsibility to each agency. The Code of Federal Regulations, or CFR, is where all the food laws in the United States can be found.

THINGS YOU CAN TRY

After looking at the document labeled “Principal Food Safety Regulatory Organizations,” try to match each one of the food product types listed in the word bank below with the appropriate regulatory department.

If you are unsure, do a quick Google search. Put the item under the question followed by “regulation” into the search bar to see what you can find.

milk and milk products	catfish	eggs in the shell	processed foods without meat	nutrition facts labeling
game meat	seafood	egg products	processed foods with meat	dietary supplements
organic certification	meat	poultry		

FDA	USDA

Check your answers on the next page!

Answers:

	
milk and milk products	poultry
eggs in the shell	egg products
processed foods without meat	processed foods with meat
seafood	catfish
nutrition facts labeling	organic certification
dietary supplements	meat
game meat	

Personal Reflection:

Why do you think the FDA and USDA split the job of keeping our food safe?

_____

_____

_____

_____

To Share with Others:

Create a digital brochure that describes the different roles and regulated foods of the FDA and the USDA. Upload your brochure to your digital 4-H portfolio website!

FOOD CHEMISTRY

ACTIVITY #8: THE MAJOR COMPONENTS OF FOOD

Project Outcomes Addressed

- Define the five major components of a food's composition (lipids, proteins, etc.).
- Research the major vitamins and minerals in foods.

Words to know:

- Calories
- Macronutrients
- Micronutrients
- Vitamins
- Minerals

THINGS TO LEARN

We all eat, and we all feel hungry when we do not eat. Why do you think that we need to eat?

_____

_____

_____

We eat food because we need energy to move around and even sleep! Did you know that you burn about ½ a *calorie per hour* for every pound you weigh while you are asleep? That means that if you weighed 80 pounds and you sleep for eight hours, you burn about 320 calories while you are asleep! That is like one serving of Kraft macaroni and cheese!

What are two things that your body needs energy for?

1. _____

2. _____

If your body gets energy from the food that you eat, what is it about food that gives you energy? Check out this video about *macronutrients*, the important things found in food that the body needs a lot of to survive. Remember that the prefix “macro” means large.

Then, check out the following video and website about *micronutrients*, the important *vitamins* and *minerals* that our bodies need small amounts of but cannot make for themselves. Remember that the prefix “micro” means small.

According to the video, what are the two types of vitamins?

_____

Do vitamins or minerals contain carbon in their makeup?

_____

THINGS YOU CAN TRY

After learning about macro and micronutrients, you can put some of your knowledge to the test!

On the next pages, you will find five text boxes titled after each major group of foods. Included in each text box is an example of a food that has a large proportion of that nutrient and a justification for why that food can be placed in that category.

Below is a word bank that includes several different food products. Place each of the foods from the word bank into the macro or micronutrient category that best represents the food. Some of these foods can be used twice, and a few of them have multiple answers.

avocados	carrots	fish	meat	rice
bread	celery	fruits	nuts & seeds	whole grains
broccoli	eggs	fruits & seeds	pasta	

Macronutrients:

Water:

Mushrooms — most mushrooms have more than 90 percent water.

Carbohydrates:

Potatoes — Carbohydrates account for at least 90 percent of the calories found in potatoes (16.83 grams of carbohydrate per every 100 grams of potato).

Lipids (or fats):

Olives — Lipids or fats account for more than 90 percent of the calories found in green olives (15.2 grams of lipids per every 100 grams of olives).

Proteins:

Soybeans — Proteins account for nearly 40 percent of the calories found in soybeans (16.6 grams of protein per every 100 grams of soybeans).

Micronutrients:

Vitamins and Minerals: Dark leafy greens — Many vitamins like A, C, E and K can be found in much higher concentrations in dark leafy greens.	

Now it is your turn!

Choose one of the foods from the word bank on page 37 and describe why you categorized it in the box you selected on page 35, following the example of the explanations already listed in each box. For calculations, **carbohydrates have 4 calories per gram**, **proteins have 4 calories per gram**, and **fats or lipids have 9 calories per gram**. Water, vitamins and minerals are considered to have zero calories.

I think that _____ (type of food) belongs in the _____ box

because _____

_____

_____

For fun:

Describe which box you might put supreme pizza and why:

_____

_____

_____

_____

_____

Go to the following website to learn what foods are high in what vitamins and minerals. Then fill in the list below.

Vitamin A
Food: _____

Vitamin C
Food: _____

Vitamin B12
Food: _____

Vitamin B9 (folic acid)
Food: _____

Vitamin K
Food: _____

Vitamin D
Food: _____

Mineral — calcium
Food: _____

Mineral — iodine
Food: _____

Mineral — potassium
Food: _____

Mineral — sodium
Food: _____

Mineral — iron
Food: _____

Mineral — magnesium
Food: _____

FOOD CHEMISTRY
ACVITIY #9: pH and FOOD

Project Outcome Addressed

- Define pH.

Words to know:

- pH
- Acid
- Base
- Acidified foods
- Alkaline
- Neutral pH

THINGS TO LEARN

The study of food chemistry explains how food interacts with our bodies and provides us with the nutrients that we require to live. It also explores how food molecules interact with each other. This activity will explore two important phenomena that occur in molecular interactions within food. The first is called *pH*. As unusual at it seems, it is correct for the "p" to be lowercase followed by an uppercase "H." We use the pH scale to measure many substances and solutions, but it can also be applied to foods. pH is a measure or scale of how *acidic* or how *basic* a substance or food is.

Can you think of something that is very acidic? Hint: one acidic thing helps you digest your food.

_____

Can you think of a food that is very acidic? Hint: many acidic foods taste SOUR.

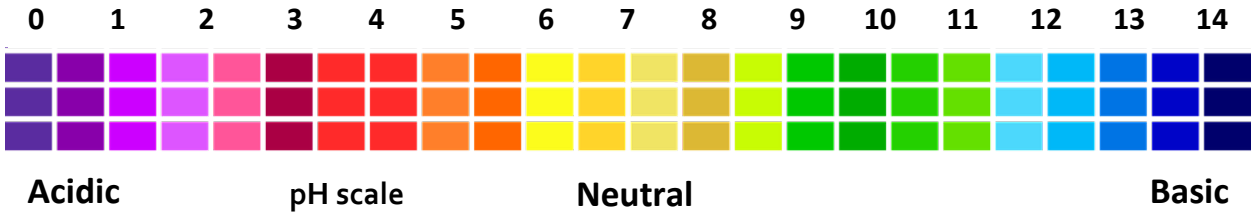
_____

The pH scale ranges from 0 to 14. On this scale, 0 is the MOST acidic, and 14 is the LEAST acidic. You would also be correct if you said that 0 is the LEAST basic and 14 is the MOST basic because acids and bases are opposites.

What do you think a 7 represents on the pH scale?

_____

If you thought that it represented a middle point between acidic and basic, you would be right! We consider a 7 on the pH scale to be NEUTRAL. That means that it is neither acidic nor basic because the molecules that make it an acid or a base are in equal proportions.



Go to the following website to learn more about pH. Near the bottom of the page under the "activities" section, take the quiz to test your knowledge from what you learned! You can take the quiz as many times as you like.

Fun facts:

1. Most foods are between a 2.0 and 7.5.

   Would you consider most of our foods to be acidic or basic? _____
   Go to the following website to see the pH of many common foods:

2. We call foods with a pH BELOW 4.6 (like 3.2 or 2.1) HIGH acid foods.

   Would you say that a food with a pH of 2.6 is a LOW or HIGH acid food? _____

3. We call foods with a pH ABOVE 4.6 (like 5.2 or 7.6) LOW acid foods.

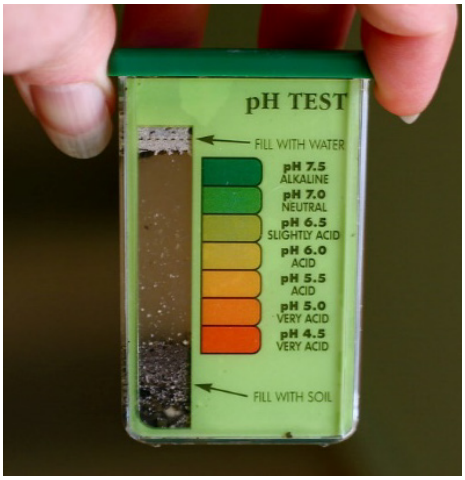
   Why do you think that we call them LOW and HIGH acid foods? _____

   _____

4. Remember in Activity #5 that we use canning to preserve food. We use different techniques for foods with a HIGH acid content (low pH) versus a LOW acid (higher pH) content because certain dangerous pathogens are more sensitive to low pH values in some foods. We often add acid to low-acid foods before canning. These foods are called *acidified foods*.

5. Sometimes we call things that are basic *alkaline*.
   Is an imaginary food with a pH value of 9.5 acidic or alkaline? _____

6. Some molecules are sensitive to acid or basic conditions, and they CHANGE COLOR when exposed to solutions of specific pH values. In the picture on the right you can see a kit that can show you how acidic your soil is for gardening. The kit includes some capsules that are mixed with soil and water. The resulting color can be seen in the clear window on the left, and the color color-coded key on the right corresponds to the pH scale. These capsules are filled with a pH-sensitive substance. When the pH-sensitive substance is mixed into an acidic solution, it turns bright red like you can see in the key. It turns dark green when mixed into a more neutral solution.



There are some pH-sensitive molecules in certain foods that we eat!

THINGS YOU CAN TRY

Like the paper strips described above, you can make your very own pH indicator at home using some very simple household ingredients!

Make sure to ask an adult for permission to use a knife. This experiment requires adult supervision.

Follow the instructions in the video:

The required ingredients are:

Purple or "red cabbage"	Knife and cutting board	Strainer or sieve
Water (preferably distilled)	A blender	As many clear cups as test solutions
Safety glasses and gloves		

Possible solutions to test:

apple juice	lemon juice	vinegar	Any other household ingredients
baking powder	Sprite		
bleach	sugar water		

Answer the questions posed in the video:

Which solution is the most basic?

_____

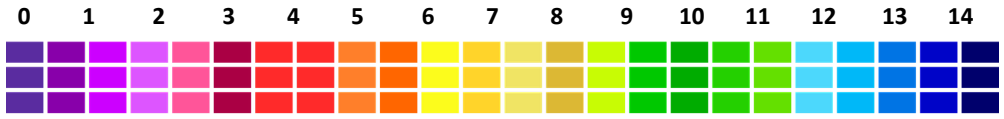
Which solution is the most acidic?

_____

Video your experiment and explain your results to your 4-H Club!

Using the pH scale in the box below and the list of foods and their pH value found in the link below, create your own pH scale with some foods listed in order based on their pH values. You can check foods here:

My food pH scale



Acidic **Neutral** **Basic**

FOOD SENSORY SCIENCE
ACTIVITY #10: WHAT IS FLAVOR?

Project Outcome Addressed

- Define flavor.

Words to know:

- Flavor
- Senses

THINGS TO LEARN

Everyone eats. Many people like certain foods a lot and do not like some other foods as much.

Why do you think that is?

_____

_____

What is your favorite food?

_____

On the lines below, write a haiku about the *flavor* of your favorite food. A haiku is a short Japanese poem that reminds you of an experience. It is written in three lines. The first and last line both have five syllables, while the middle line has seven syllables. For example,

Fresh ripe cantaloupe
honey sweet, fragrant, floral
tender and juicy

_____

_____

_____

You might have said that you like the flavor of your favorite food. But what is flavor? Flavor is a complicated interaction of each of our five primary *senses*.

THINGS YOU CAN TRY

Do you remember the five senses? In each box, write one of the senses and draw a picture of one place on the body where it can be sensed.

In the next several activities we will unpack how each of these senses play a role in perceiving the qualities of a food and how they contribute to our sense of flavor.

Try to predict why each of your senses might contribute to your perception of food.

Give some examples of foods that might trigger each of the five senses that you have listed and drawn above. The experience can be perceived during chewing, swallowing, choosing, scooping, cutting or any other step that takes place in the eating process. For example, oranges may be perceived in each of the five senses: 1) you look at the bag of oranges to choose the oranges that you want, 2) you can feel the bumpy skin of the orange on your hand 3) you can smell the orange as you breathe while you are cutting or peeling the orange, 4) you can hear the orange slices crunch and gush under your teeth as you bite down, and 5) you can taste the orange slice as it is moved around on your tongue.

FOOD SENSORY SCIENCE
ACTIVITY #11: FLAVOR AND SMELL

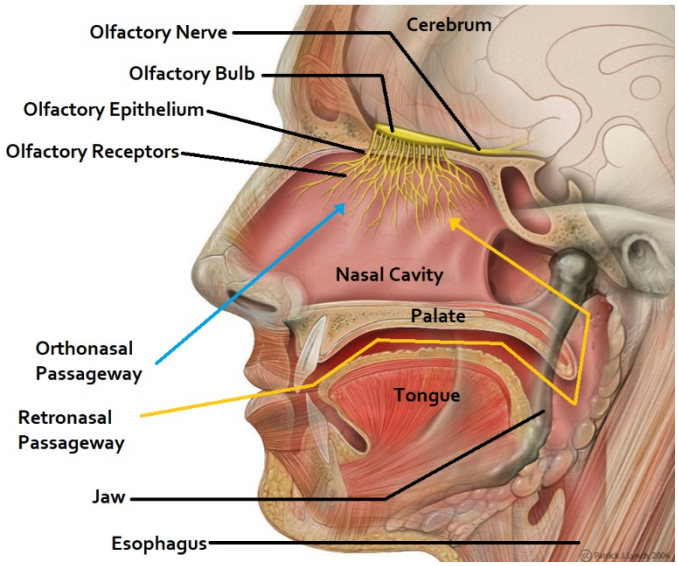
Project Outcome Addressed

- Understand how the five senses contribute to flavor perception: Smell

Words to know:

- Orthonasal Smell
- Retronasal Smell
- Anosmia

THINGS TO LEARN



In studying the perception of flavor, let us explore smell first because it is the most important factor of flavor. Smell is sensed in the nasal cavity (nose). There are two types of smell — one that is taken in through the nostrils called *orthonasal*. This is the type of smell that you use when you smell an orange when you peel it. An easy way to remember this term is smells that come through the orthonasal passageway come from outside the mouth or head.

The other type of smell is taken in from the back of the mouth up through the retronasal passage which is the connection between your nasal cavity and your throat; this one is called *retronasal*. The retronasal passage is also responsible for allowing you to drain congestion when you have a head cold. Retronasal smelling takes place when you put foods in your mouth like Skittles or jelly beans. An easy way to remember this term is that smells that come through the retronasal passageway come from the reverse, or the inside of the mouth or head.

Watch this short TED talk that explains how we smell:

Why do you think dogs can smell so much better than humans?

_____

_____

What does the word *anosmia* mean?

_____

_____

How might anosmia affect your ability to perceive flavor?

_____

_____

THINGS YOU CAN TRY

Try this fun experiment by yourself or with a friend. Read the instructions before beginning.

1. Take a flavored candy like Skittles or jelly beans and do not look at the color that you choose from the bag.
2. Plug your nose and carefully place the candy in your mouth and chew it.
3. Try to guess the color of the candy. You will find that both Skittles and jelly beans have the same taste on your tongue but are only recognizable if you are able to breathe, allowing air in your breath to carry odor molecules up through your retronasal passageway to be detected in your nasal cavity.

Draw and label the retronasal passageway. Label the olfactory epithelium, olfactory receptors, olfactory bulb, olfactory nerve, nasal cavity, orthonasal passageway, retronasal passageway, and tongue. You can use arrows to point at specific structures.

Explain the two types of smelling in your own words.

_____

_____

_____

FOOD SENSORY SCIENCE
ACTIVITY #12: FLAVOR AND TASTE

Project Outcomes Addressed

- Understand how the five senses contribute to flavor perception: Taste
- Identify the five major tastes.

Words to know:

- Taste
- Sweet
- Sour
- Salty
- Bitter
- Umami

THINGS TO LEARN

The next important aspect of flavor is *taste*. Remember the haiku you wrote back in Activity # 11? Maybe in your haiku you said that you liked the "taste" of that certain food. But what really is taste?

Taste is the second-most important factor of flavor. It is primarily sensed on the tongue. It is responsible for the taste that you could perceive when you chewed the Skittles or jelly beans with your nose plugged in Activity #12.

Watch this video about taste. As you watch, listen closely to identify the five basic tastes.

What are the five basic tastes?

1. _____
2. _____
3. _____
4. _____
5. _____

Of the five basic tastes, which do you like best? _____

List a few foods that can be characterized by that type of taste:

1. _____

2. _____

3. _____

Draw a line to match each of the images below with one of the basic tastes that we can sense.

Bitter Umami (Savory) Salty Sour Sweet

THINGS YOU CAN TRY

Under each of the five tastes, list two foods that are not listed above that have a lot of that major taste.

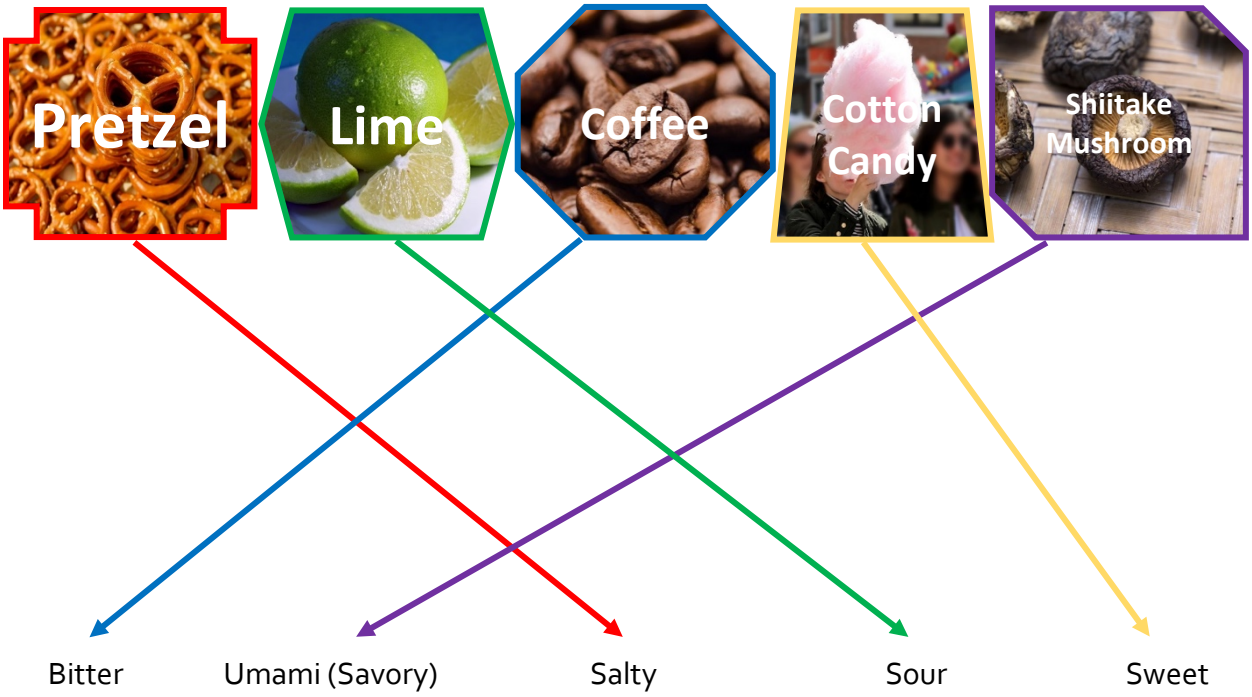
_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

Now, watch the following video about how both taste and smell combine in the perception of flavor.

Great description of taste and smell and flavor until the 1:51 mark.

Check your answers:



FOOD SENSORY SCIENCE
ACTIVITY #13: FLAVOR — SIGHT, SOUND & TOUCH

Project Outcome Addressed

- Understand how the five senses contribute to flavor perception: Sight, Sound, Touch or Feel.

Words to know:

- Sight
- Sound
- Touch
- Texture

THINGS TO LEARN

So far, we have explored how smell and taste affect the flavor that we perceive. Next, we will explore the remaining three senses — **sight**, **sound** and **touch**, or feel. Sight includes characteristics like color but is also involved in the perception of texture.

Look up the definition of *texture*: _____

_____

_____

In the context of food, texture is a complex perception of visual, audible and feeling sensations. For example, the gummy bears look smooth and firm; the potato chips look greasy, rough and rigid; and the honey looks smooth, sticky and thick. Each of these foods has a distinct sound when it is chewed or stirred. And they feel very different when you touch them, move them around in your mouth, or chew them.



THINGS YOU CAN TRY

Which senses do these attributes fit?

Below is a word bank of several words that describe various attributes of various foods. Together they could be combined to describe the complex concept of flavor. Place each one into one of the labeled boxes. Taste and smell have been combined because of the difficulty in distinguishing such sensations.

Crunchy	Sweet	Tender	Tender
Spicy	Aromatic	Fruity	Fishy
Salty	Cold	Juicy	Cheesy
Chocolate	Chewy	Greasy	Crackle
Brittle	Garlic	Smooth	Sticky
Sour	Fluffy	Steaming	Sizzling
Crispy	Gummy	Rough	Shiny
Bitter	Fizzy	Gooey	Grainy

Sound	Taste and Smell	Touch or Feel	Sight

Explain why you categorized the attribute “gooey” the way that you did.

_____

_____

What might a gooey look like? How might you know that it is gooey?

_____

_____

What might a gooey food sound like? How might you know that it is gooey?

_____

_____

What might a gooey food feel like? How might you know that it is gooey?

_____

_____

Because the attributes of a food are so complex and intertwined, we usually use the word “flavor” to describe the overall experience when eating a food. Certainly, we still describe various attributes more specifically, like the taste, texture or smell of a food, but the next time you think about the flavor of a food, try to think about how the many complex sensory attributes of a food work together to create a distinct experience for each food that we eat.

Try this experiment with Sprite and food coloring.

Take Sprite or another clear soda and put two drops of food coloring in a soda-filled glass and stir until combined. Try making several glasses, such as green, red, orange and purple. Serve the glasses to a friend or family member and ask them to identify what flavor each glass is without telling them the true flavor.

What flavor do your participants think green soda tastes like? _____

What flavor do they think red soda tastes like? _____

What flavor do they think purple soda tastes like? _____

What flavor do they think blue soda tastes like? _____

What conclusions can you draw from this experiment?

FOOD SENSORY SCIENCE
ACTIVITY #14: THE CHANGING SENSORY PROPERTIES OF FOODS

Project Outcome Addressed

- Identify changes in foods with processing.

Words to know:

- Processing
- Sensory

THINGS TO LEARN

The sensory properties of foods can change drastically with processing. **Processing**, in terms of food, is any process that is done to alter a food — cutting, cooking, freezing, peeling and many others. Think about a potato.

What is a potato like when it is unprocessed?

_____

_____

If you said it was hard, crunchy, cold and raw, you would be right. Uncooked potatoes have very different sensory qualities than those of cooked potatoes. And even cooked potatoes can be very different!

Do an internet search to find several different ways that you can process or prepare potatoes.

_____

_____

_____

French fries are made from potatoes; so are mashed potatoes.

Do an internet search for a recipe to make French fries and a recipe to make mashed potatoes.

What are the different processing steps that are required to make French fries from potatoes and mashed potatoes from potatoes?

French Fries	Mashed Potatoes
_____	_____
_____	_____
_____	_____

In terms of flavor and the five senses, compare and contrast the flavor of French fries and mashed potatoes.

	French fries	Similarities	Mashed Potatoes
taste			
sight			
smell			
touch or feel			
sound			

THINGS YOU CAN TRY

Try to determine how much the *sensory* qualities of popcorn change with various combinations of ingredients and cooking techniques.

Try making popcorn in several different ways. Find a recipe for homemade kettle corn, oil-popped popcorn and air-popped popcorn.

Once the popcorn is made, try adding various combinations of seasonings, making sure to leave at least some of the popcorn without added ingredients. Then compare the flavor attributes of each of the combinations. When comparing the various products you have made, make sure to notice any differences in flavor — smell, taste, appearance, sound and feel.

The sensory properties of popcorn prepared several different ways.

Toppings	Popcorn Cook Method # 1	Popcorn Cook Method # 2
Plain		
Salt		
Butter		
Salt and Butter		
Sugar		

Remember your answer at the beginning of the activities on flavor — your favorite food — in Activity #11. With all your new understanding of the sensory attributes of foods, explain the sensory impact of your favorite food in terms of each of the five senses.

Smell — What do you smell when you eat your favorite food?

_____

_____

Taste — Which of the five major tastes do you experience when you eat the food?

_____

_____

Sight — What does your favorite food look like?

_____

_____

Touch or feel — What does your favorite food feel like?

_____

_____

Sound — What does your favorite food sound like?

_____

_____

1-2 YEARS IN PROJECT

FOOD SCIENCE, SAFETY and SANITATION IN THE KITCHEN ACTIVITY #15: FOOD SAFETY BEGINS WITH HANDWASHING

Project Outcome Addressed

- Understand the basic principles in handwashing techniques.

Words to know:

- Contamination

THINGS TO LEARN

Has someone ever told you to go wash your hands — after you use the restroom, after playing outside, after you play with the dog or cat, before you help make a salad, before you touch a baby, or before eating a snack? Handwashing is an important part of basic hygiene. It is the first line of defense in protecting the body against pathogenic organisms. Remember, pathogens are those microorganisms that can make us sick. When you wash your hands properly, you can remove many pathogens and reduce your risk of spreading disease to other people or making yourself sick.

We pick up pathogens and other bacteria on our hands when we touch things in the world around us. Some things like raw meat, feces, wild animals and pets, outdoor sources of water, bathroom surfaces, the bottoms of your shoes, your own skin, and the bodily excretions from someone who is sick are generally considered to be *contaminated* with pathogenic organisms. When contaminated things touch clean things, the contamination is transferred. We contaminate things with our hands all day long. Therefore, it is important to wash your hands regularly to reduce contamination and the spread of pathogens.

Why do you think handwashing might be important in food safety?

_____

_____

Why do you think handwashing might be more important in keeping ready-to-eat food safe? Hint: Ready-to-eat food *does not* require any additional processing steps, such as washing, peeling or cooking.

_____

_____

_____

The reason handwashing is so important when it comes to food safety is because we often touch food during harvest, storage, preparation and even consumption. Contaminated hands can contaminate your food with pathogens! Due to the nature of food — you eat it, and it goes into your body — you can easily contract a disease by eating pathogens. Eating is recognized as one of the routes by which we can become infected. Therefore, it is important to wash your hands regularly between food preparation tasks.

Keep this in mind: If you need to separate ingredients, their cutting boards, and their knives to reduce cross-contamination, you need to wash your hands after you touch the contaminated items. For example, if you are preparing a roasted chicken and a salad, be very careful to wash your hands after you touch the raw chicken and before you touch the salad ingredients.

Think of another food preparation example where you would need to wash your hands:

_____

_____

_____

THINGS YOU CAN TRY

Try this fun handwashing experiment:

Print out and try the first two experiments (Soapy Solutions and There's More Than Meets the Eye) found at the following web address:

After challenging your handwashing technique, watch this video on how to wash your hands properly and try your handwashing experiments again:

Make sure to print the worksheets and attach them and your observations and conclusions to this activity. After looking at the results from your initial handwashing experiments, watching the video on how to properly wash your hands, and trying the handwashing experiments again, compare your handwashing results:

What parts of your hands were still covered in paint or cinnamon oil before you watched the video?

_____

What parts of your hands did you learn how to wash when you watched the video on handwashing?

_____

Were you able to wash your hands more thoroughly after watching the video? _____

Were you even able to wash your hands more thoroughly with the blindfold on? _____

Compose a poem that includes each of the parts that you need to wash when you wash your hands:

_____

_____

_____

_____

_____

_____

_____

_____

Next, try keeping a journal of everything that you touch during the day on a sheet of ruled paper.

Include the things you have touched that are considered contaminated and label them with a "C." Make sure to label each item after you touch a contaminated one as "contaminated" before you wash your hands.

In the case below, after you touch the cat or dog, everything that you touch until you wash your hands (including the cupboard handles, cereal, milk, bowl and spoon from which you eat) should be labeled as contaminated until you wash your hands and stop spreading the contamination.

Once you have washed your hands, reset your categorization to "uncontaminated" until you touch another contaminated object. You can label things that are clean as "U" for uncontaminated.

Check out the example on the next page.

Category	Items Touched
U	Cellphone
U	Clothes
U	Hairbrush
U	Toothbrush and toothpaste
C	Tissue to blow your nose
C	Restroom door handle, toilet paper, toilet flusher, pants or skirt, door handle
C	Bathroom sink
	Washed hands
C	Pet dog or cat
C	Pantry or cupboard handle and cereal box
C	Cupboard handle and bowl, drawer pull and spoon
C	Refrigerator door handle
C	Milk bottle
C	Kitchen sink
	Washed hands
U	Lunchbox
U	Refrigerator
U	Packed lunch
U	Backpack

U = Uncontaminated; C = Contaminated

ACTIVITY #16: THE FOUR CORE CONCEPTS OF FOOD SAFETY

Project Outcomes Addressed

- Recognize four core concepts of food safety (cook, clean, chill, separate).
- Identify the proper internal temperature for cooking raw commodities.
- Identify the temperature "Danger Zone."

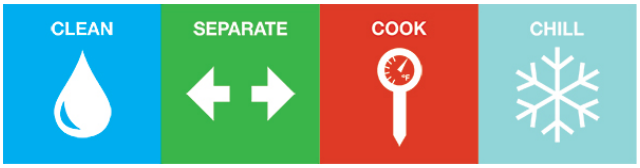
Words to know:

- Clean
- Separate
- Cook
- Chill
- Temperature Danger Zone

THINGS TO LEARN

We know that food safety is a big deal and there are laws and regulations put in place by the United States government that protect our food supply. We also know that there are some life requirements that we can remove or adjust to control the growth of pathogenic and spoilage microorganisms to improve food safety and extend the shelf life of food. But how do we keep our food safe at home when we just need a simple snack or a nutritious dinner?

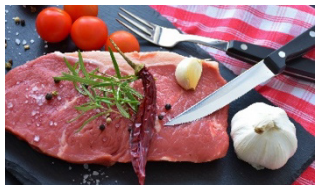
There are four easy steps to preparing food safely.



Remember that the United States government does not regulate home cooking but does regulate standards in companies that sell food like restaurants and processing facilities. The following website explains how food safety can be achieved from the farm all the way to your stomach.

Food Safety Chain of Prevention:

Label each photo with the appropriate step:

_____ _____ _____ _____

Understand how to implement each of the four steps:

Explore this website:

Watch this video:

What are two ways to thaw properly?

1. _____
2. _____

_____

Explore this website:

Watch this video:

What are two ways to separate and prevent cross-contamination?

1. _____

2. _____

_____

Explore this website:

Watch this video:

What are two ways that we can clean well?

1. _____

2. _____

_____

Explore this website:

Watch this video:

What two things are necessary to ensure that foods are cooked thoroughly? Hint: Both start with the letter "T."

1. _____

2. _____

Using the information found at this website, fill out the following table:

In the right column, rank the foods in the word bank in order from the lowest temperature (number 1) to the highest temperature (number 7) required to ensure food safety. In the left column, write down the proper minimum heating temperatures corresponding to the foods you listed on the right.

beef	chicken	fish	leftovers
casseroles	egg dishes	ground meats	

Temperatures ranked from coldest to hottest:	Foods ranked from coldest to hottest:
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.

What is the minimum HOT cooking temperature to ensure food is cooked safely? _____

What is the minimum COLD cooling temperature to ensure food is stored safely? _____

Why do you think that there is a large gap between these temperatures?

_____

_____

That's right! Bacteria can grow at temperatures above 40 F and below 140 F. That is why we call this the "Temperature Danger Zone."

THINGS YOU CAN TRY

Write a song explaining the temperature danger zone:

_____

_____

_____

_____

_____

_____

_____

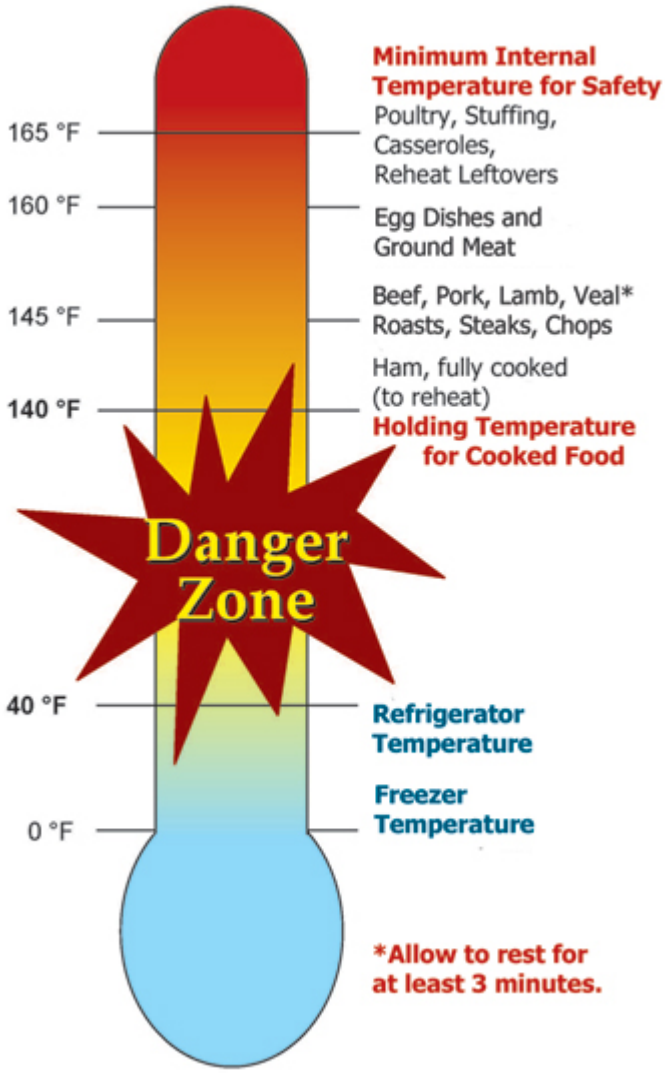
_____

_____

_____

_____

_____



Watch this video about how some kids were detectives at school — figuring out where the food-borne illness came from!

Try this Food Detectives game using Microsoft Edge Web Browser:

Take this home food safety survey! How well do you fight bacteria?

You can try this Bacteria Catcher Game!

You could also be a detective at a picnic! Catch Tom's mistakes! Make sure to label each one with the appropriate food safety step that he did not follow correctly.

Download this cool poster with the ten LEAST WANTED bacteria:

Attach all documents and printouts to this activity.

For more fun, check out this video game: outbreaksquad.org

ACTIVITY #17: THAWING FOODS SAFELY

Project Outcome Addressed

- Understand the principles of thawing foods.

Words to know:

- Thaw

THINGS TO LEARN

You know the four steps of food safety: Cook, Clean, Chill and Separate. But how do you thaw and reheat foods properly? Thawing foods safely is important because foods do not thaw evenly throughout. If you *thaw* some steaks like the ones on the right, the center of the steaks will remain frozen much longer than the edges of the steaks. This happens because heat is applied from the outside in, so the surface is always thawed first. This effect is even more noticeable when the steaks are frozen in a stack. If not thawed properly, the steaks in the middle will be completely frozen.

What would you do to the steaks to allow them to thaw more evenly?

_____

_____

If you said that you would separate them so that the pile was not so thick, you would be correct! It is important to thaw foods evenly because any parts of the foods that remain in the danger zone waiting for the center to thaw are excellent feeding and breeding grounds for pathogenic and spoilage microorganisms. If you leave a roast in your kitchen sink to thaw overnight, the surface of that roast may be covered in enough pathogens to make you sick. It is extremely risky to prepare foods that are so highly contaminated.

Although many bacteria are destroyed with high heat, remember that some can produce toxins that are not destroyed by heat. Toxin-producing organisms can take advantage of a thawing food as you wait for the center of the food product to thaw. Even if the microorganisms are killed during the cooking process, the toxins they leave behind can still cause people to get very sick.

What are some ways that people thaw food?

_____

_____

To learn about a few safe ways to thaw food, watch the following video:

What do you think are some advantages of thawing foods in the refrigerator?

_____

What do you think are some disadvantages of thawing foods in the refrigerator?

_____

What do you think are some advantages of thawing foods in the microwave?

_____

What do you think are some disadvantages of thawing foods in the microwave?

_____

For extra help answering these questions, try watching this video:

THINGS YOU CAN TRY

Try a frozen T-shirt experiment to demonstrate ways to thaw foods!
*This will not damage your T-shirt.

Items needed:

4 T-shirts
Water
4 plastic bags
1 water-tight zippered bag
At least 2 dishes to collect the water that might come out of a thawing T-shirt
A thermometer
A pen
A piece of paper

Directions:

Fold each T-shirt into an identical, small shape such that each one has several layers of fabric in the center. Then soak the T-shirt until it is thoroughly wet. Place each one into a plastic bag and put them in the freezer to freeze overnight. The plastic bag will keep the shirts from sticking to other things in the freezer. The next day:

1. Place one of the T-shirts in the refrigerator to thaw. Like frozen foods, you should place the shirt into a bowl so that the water does not leak out as it thaws and potentially contaminate another food.
2. Place the second T-shirt on the countertop to thaw.
3. Put the third T-shirt in a water-tight bag and thaw it in cool water like the steaks in the video above.
4. Put the fourth T-shirt in the microwave on a plate to thaw like the steaks in the video above. Try using 50 percent or 70 percent power, flipping the shirt every one or two minutes like you would a piece of meat.

Now, record the surface temperature of T-shirts in the following format. *You can add more rows if you need.

When measuring the temperature of the T-shirts, try to wrap any loose T-shirt material around the stem of the thermometer to get an accurate reading. Continue taking measurements until the T-shirt is fully flexible and thawed.

	T-shirt #1		T-shirt #2		T-shirt #3		T-shirt #4
Time 0		Time 0		Time 0		Time 0	
2 hours		1 hr		15 min		1 min	
4 hrs		1 hr 30 min		30 min		2 min	
6 hrs		2 hrs		45 min		3 min	
8 hrs		2 hrs, 30 min		1 hr		4 min	
10 hrs		3 hrs		1 hr, 30 min		5 min	
12 hrs							

Based on your understanding and experience, choose the method of thawing that you think is best.

Write a letter to one of your family members, such as a parent, grandparent, aunt or uncle, explaining why you would recommend this method of thawing. In that letter, list all the advantages and disadvantages associated with that method and explain how it can be used to keep your food safe.

ACTIVITY #18: COOLING FOODS SAFELY

Project Outcome Addressed

- Understand the principles of cooling foods safely.

Words to know:

- Chill

THINGS TO LEARN

You now know how to thaw foods, but how do you properly cool foods?

Just like a big stack of frozen steaks does not thaw evenly and the center takes longer to thaw than the surface, hot food does not cool evenly. The surface of hot food cools fastest, and the center remains hot for a much longer time, leaving it vulnerable to the growth of pathogenic microorganisms! It is important to *chill* foods properly to reduce the risk of food-borne illness!

Which do you think would take longer to cool? A hot soup in a small, uncovered glass bowl or a hot lasagna stored in a large plastic container with a lid? Explain your answer.

_____

_____

_____

If you said that the bowl of soup was much smaller, you would be right. If you said that the lasagna is much denser and less watery, you would be right. If you said that the glass bowl would transfer heat better than the plastic dish, you would also be right. And if you said that the container that is uncovered will allow the food to cool faster, you would also be right. There are four factors that influence the speed of cooling in foods:

1. The size of the portion — smaller and thinner portions cool faster.
2. The density of the food — watery foods cool faster (denser foods should be put in smaller portions).
3. The type of container the food is stored in — glass and metal containers cool faster.
4. If the food is covered — uncovered food cools faster.

Watch this video on how to cool foods properly:

For a fact sheet on how to cool and thaw foods, go to the following website:

THINGS YOU CAN TRY

Print out and try the sixth (Cooling Counts) and seventh (Yeast Balloon Blow-Up) experiments described at the following web address:

Make sure to print the worksheets and attach them and your written observations and conclusions to this activity.

ACTIVITY #19: FOOD REHEATING AND PREPARATION SAFETY

Project Outcomes Addressed

- Understand the principles of reheating foods.
- Identify proper sanitation practices within a kitchen.

Words to know:

- Celsius
- Fahrenheit

THINGS TO LEARN

Now that you know how to thaw and chill foods properly, how can you reheat foods safely? It is not that different from cooking it the first time. Watch this video:

You can use this formula to convert *Celsius* to *Fahrenheit*:

$$\frac{°\text{C}\ x\ 9}{5} + 32 = °\text{F}$$

Based upon the above video, what temperature, in Fahrenheit, should your food be heated to?

_____

That's right! 165 F is the proper temperature to heat all leftovers, including lasagna, chicken tenders, tomato soup, macaroni and cheese, and even broccoli. That temperature is hot enough to kill food pathogens.

How many times should you reheat food? _____

Why do you think you should not reheat food more than once?

_____

_____

THINGS YOU CAN TRY

Go to the following website to see a neat list of food safety and sanitation techniques associated with handling food leftovers:

Now that you know so much about food safety and sanitation, it is time to put your knowledge to the test!

Necessary Items:

Internet access
Device that can access the internet
Pen
Paper

Directions:

Only watch the FIRST TWO MINUTES of the video below.

Write down every mistake that you see Katie make. Make sure to describe her mistake in detail.

Propose how Katie might have avoided each one of the mistakes.

Record your observations on a separate sheet of paper. Make sure that you attach it to this activity.

You can watch the first two minutes as many times as you wish, but only proceed to the end when you are ready.

After you have finished watching the entire video, answer the following questions:

Identify three times that Katie should have washed her hands.

1._____

2._____

3._____

What are two things that you learned about food preparation safety while watching the video?

1._____

2._____

What is one question you have after watching the video?

_____

_____

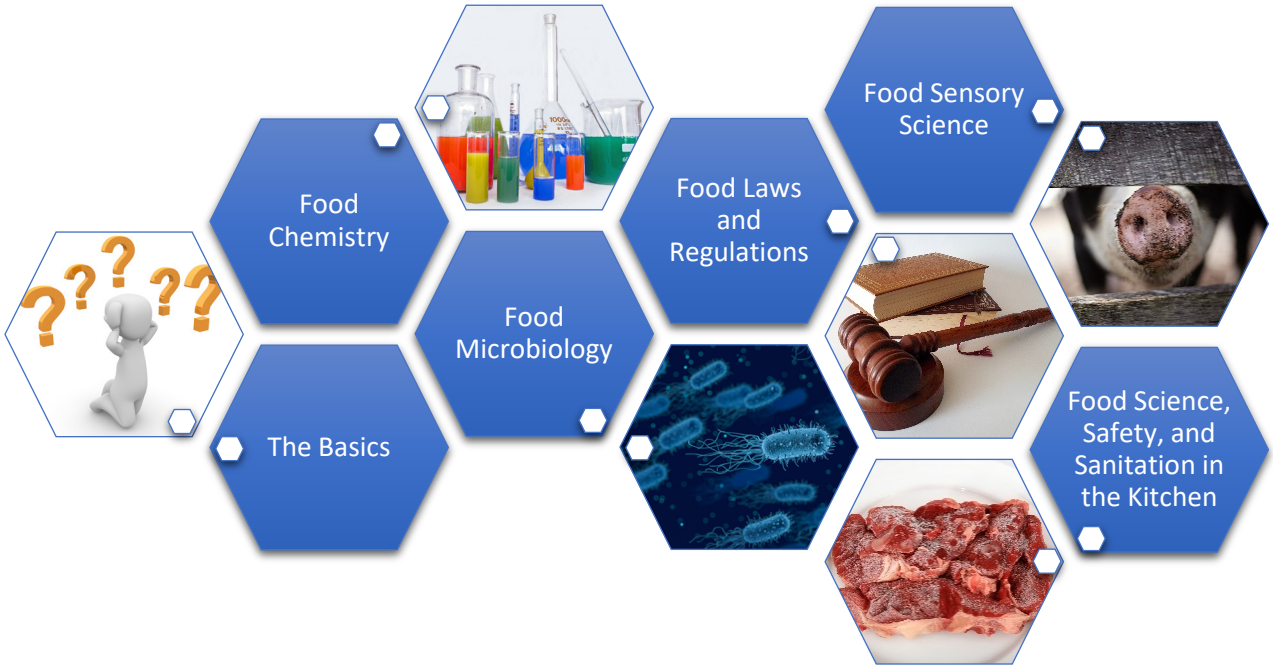
How will you find a correct answer to your question?

BASICS OF FOOD SCIENCE
ACTIVITY #20: CAPSTONE PROJECT

Project Outcome Addressed

- Research the skills and education needed to be a food scientist.

Congratulations! You have made it to the end of the beginning level of the 4-H Food Science Project Area. You have learned so much about food science, from the basics all the way to application. Along the way you have learned about food microbiology; laws and regulations; food chemistry; food sensory science; and food science, safety and sanitation in the kitchen. You have even explored various careers in food science.



Near the beginning of this project (back in Activity #2), you explored a food science career of your choice before you knew much about food science.

For your final activity, you will explore a food science career of your choice in depth. Based on your interests in food science, choose a food science career that is different from the one you explored in Activity #2. Below is a list of several food science careers. You can choose one of these or another one that you can find.

Culinary Scientist
Food Processing Engineer
Food Researcher and Developer
Food Equipment Engineer
Food Product Developer
Food Science Professor
Food Packaging Engineer
Food Sensory Scientist
Food Chemist
Food Microbiologist
Food Flavor Chemist
Food Quality Assurance Professional
Meat Scientist
Food Science Extension Agent
Food Regulatory Official

Once you have chosen a food science career to explore, make your own video (at least three minutes) to be shared with your local 4-H club in the style of the "Day in the Life of a Food Scientist" videos available through IFT's YouTube channel:

In your video, include the following:

1. An introduction to the profession that you selected.
2. The reason that it is interesting to you.
3. The type of work that such a professional would do.
4. The education qualifications needed to get the job.
5. The types of companies that employ such a professional.
6. The locations of those companies.
7. The salary range of the position.
8. Any other interesting information you found about this food science professional.
9. All sources for the information that you gathered for your video.

Do not forget to share your video with your club, so that each one of you can learn more about the many careers in food science! Upload your final video to your 4-H portfolio website.

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W 889 04/20 20-0161 Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and county governments cooperating. UT Extension provides equal opportunities in programs and employment.