TRB 6:5 -- Activity 5 -- Good Guys or Bad Guys

Summary

Students will complete a variety of activities to learn about both positive and negative effects of microorganisms.

Materials

Activity A: Decay and Decomposition
- quart Ziploc bag for each team of two
- clear tape
- markers
- decay buffet (including grass, vegetable peelings, straw, dry leaves, etc.)
- water spray/mist bottle
- food handler's gloves
- magnifying glasses

Activity B: Microbes in My Food
- grocery store newspaper advertisement
- bread wrapper
- label from a box of cereal
- beef jerky package label
- yogurt container
- package from dried fruit
- copies of Microbe Grocery List (see Attachments below.)
- Food Preservation Techniques (see Attachments below.)

Additional Resources:
- Bottle Biology
  Kendall Hunt Publishing (www.kendallhunt.com)

Background for Teachers

Yes, it's true; decomposition is a fundamental process on which all life depends. We'd all be knee deep in garbage without it. Bacteria, fungi, and other microscopic organisms that live in the soil, air, and water are responsible for turning once living plants, animals and other organisms into nutrients that can be used again and again. Think of them as nature's recyclers. These tiny creatures have the ability to produce special enzymes that allow them to break down dead plant and animals and use them as food. No job is too big because they enlist the help of friends and family. As they eat, they grow and multiply at an amazing rate. In just 4 hours, one bacterial cell can grow to a colony of 5,096. At day's end there are millions and billions of them working together. Why, in 1 teaspoon of soil, there are more bacteria and fungi than all the people on Earth!

Some microorganisms are harmful and cause disease while others are benevolent, neutral, or even helpful. Some help us to produce certain foods, break down toxins in our environment, while others can kill us. For example: Protozoa cause amebic dysentery, fungi cause athlete's foot and ring-worm, bacteria cause pneumonia, legionnaire's disease, strep throat, tetanus and other diseases. Contaminants in food like E. coli or Salmonella can also make us very sick. The second activity in this lesson will focus on helpful and harmful microorganisms.

Molds:

Molds are probably the best known of the microorganisms (see bread mold activity in previous lesson). They are widely distributed in nature and grow under a variety of conditions in which air and moisture are present. They are members of the kingdom fungi. Nearly everyone has seen mold

growth on damp clothing and old shoes. The mold we see with the naked eye is actually a colony of millions of mold cells growing together. Molds vary in appearance. Some are fluffy and filament-like; others are moist and glossy; still others are slimy.
Molds are made up of more than one cell. They appear flat, fuzzy, and shapeless. Mold cells form a "fruiting body." The fruiting body produces the spores, which detach and are carried by air cur-rents and deposited to start new mold colonies whenever conditions are favorable. Mold spores are quite abundant in the air. So any food allowed to stand in the open soon becomes contaminated with mold if adequate moisture is present. Some types of molds are also psychrophiles (grow in cool temperatures) and can cause spoilage of refrigerated foods.
Molds (and other microorganisms) are important to the food industry. Among their many contributions are the flavor and color they add to cheeses and the making of soy sauce. They also play a role in making chemicals such as citric and lactic acid and many enzymes. Sour cream, butter-milk, yogurt, and hard cheeses (cheddar, Swiss, jack, feta, etc.) are all cultured with a bacteria. Other cheeses such as blue and Roquefort are cultured by fungi. Processed cheeses, like American cheese, are not cultured with microorganisms.
Some ice cream contains a thickener made from seaweed. Seaweed, or algae, is everywhere in our food today. Chunks of it float around in Korean soups, paper-thin sheets of it are wrapped around Japanese rice balls, and it lies hidden in the alginates and carrageenans in hamburgers, yogurt and ice cream. Seaweed-based food additives are now so commonly used in prepared and fast food that virtually everybody in Europe and North America eats some processed seaweed every day.
Sometimes microorganisms spoil food. Most students will have seen rotten, spoiled, or moldy food in their refrigerators. Food that is spoiled by bacteria may not be seen with the naked eye, but the food will taste bad and can make you sick. Molds are more visible. The best known use of molds is in the drug industry, where they help produce such antibiotics as penicillin.
The old adage for dealing with questionable food is the best advice, "When in doubt...throw it out!"

Intended Learning Outcomes

1- Use science process and thinking skills
3- Understand science concepts and principles
4- Communicate effectively using science language and reasoning
5- Demonstrate awareness of social and historical aspects of science

Instructional Procedures

Activity A: Decay and Decomposition

Invitation to Learn

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Ask students to describe the most disgusting thing they have ever pulled out of their refrigerators. Ask them why foods decay and see if molds or bacteria are mentioned. Ask students if they ever eat molds or bacteria. Explain to them that in this activity they will see how microorganisms are both helpful and harmful to the food industry.

Instructional Procedures:

Divide the class into pairs.

Provide each pair of students with a locking plastic quart bag and ask them to write their names on some tape and then stick the tape on the bag.

Set up a "Decay Buffet" of items noted in the list of materials to be placed in the bags. The ingredient ratio of 2-parts dry (brown or the carbon containing ingredients) to 1-part wet (green or nitrogen containing ingredients) is VERY IMPORTANT.

Students should place one small piece of each item at the "Decay Buffet" into their bags. Have them cut up items if necessary. *Stress that they not add any meat or dairy product to their bags*

because potentially harmful bacteria could grow.

One student can place the items in the bag and the other student can record the exact contents. The recorder should also note his/her partner's predictions as to what will happen to each item over time. Will the item rot? Smell yucky? Remain the same?

7. *Optional*

: You may want the students to switch roles and create a second compost bag with a list of contents and predictions.

Ask the students to add about 1/2 cup of soil to their bags and to lightly mist the contents with a plant mister. (Adding a teaspoon of water and mixing the contents will work the same way.)

Have the students blow into the bags (to inflate slightly) and carefully seal the bags.

Once the bags are sealed, leave them for 2-8 weeks. You may decide to keep the bags together, or place them in various locations with differing conditions. (If you let the students choose their compost bag's location, be sure to have everyone register their locations on a class master list or you may be unpleasantly surprised when a missing bag finally makes its presence known.)

Have students create compost bag journals. Ask them to observe their bags periodically and record what they see happening inside. Do they see fuzzy masses? Remind students that they are not to open the bags until the designated date.

On the designated date, have the students take their bags outside. Distribute plastic gloves to the students to wear while sorting through the contents of their bags with their partners. They may need magnifying glasses to "see" the original items. *Caution: students with known allergies to mold or fungus should not participate!* Bags do not need to be opened to observe mold growths and decay.

Record any items still identifiable and in their present state. Provide misters or water bowls so items can be cleaned off for closer observation and identification.

Are any items missing? Check the list and note the items missing.

How did the results compare with the predictions?

Define and discuss the process of decomposition or decay.

You may want to ask your students some questions:

What are some things you have thrown away over the past couple of days? What happens to these things? Do they disappear? Decompose? Remain in the same form forever?

Will placing the bags in various conditions have an effect on what occurs in the bags?

Can you think of any other types of compost containers that would get the decomposition job done?

"Bottle Biology" published by Kendall/Hunt Publishing, includes plans for making compost tumblers, the "Decomposition Column," out of 2-liter bottles. Pickling bottles "vats," making your own microscope, and other great science projects are included in this book. See Additional Resources under the Materials section for ordering information.

Making compost can be very educational whether you are studying soils, plant growth, gardening, microbiology, or just trying to reduce waste.

Activity B: Microbes in My Food

Instructional Procedures:

Arrange the students in pairs.

Provide each pair with a grocery store advertisement and the "Microbe Grocery List" found under Attachments in the Materials section.

Instruct them to find all the foods in the ad that have a relationship to microorganisms, and write them down. Remember foods like spaghetti sauce may contain mushrooms, and foods containing dough have yeast.

Ask each group to share with the class the food products they found in their ad. Did they miss

any? Did other groups find the same products? Can these foods be spoiled by other microbes and make us sick?

Explain to students that virtually all foods can spoil or be contaminated. That is why you find food additives, or inhibitors, or preservatives in food, to keep them fresher or viable longer.

Read the labels of the food items listed in the materials list.

Ask the following questions:

Can you identify an ingredient that might be a food additive or preservative? (*Sometimes sugar, salt, or vinegar is added to a product to inhibit the growth of microorganisms, a chemical preservative may be added to do the same thing but will have little effect on the flavor of the food. For example, jelly is so sweet that few additives need to be added to preserve freshness; the sugar acts as a "natural" preservative, the same with pickles and vinegar.*)

Is the food preservative the same from item to item? (*No, because some food additives or inhibitors only work on certain microbes, see the Food Preservation Techniques Information page listed in the Materials section.*)

Extensions

Activity A: Stomach Microorganisms:

Why Can a Cow Eat Grass? video available from Utah Agriculture in the Classroom http://extension.usu.edu/aitc/

Activity B: Stomach Microorganisms

Bibliography

This lesson is part of the Sixth Grade Science Teacher Resource Book (TRB3) http://www.usoe.org/curr/science/core/6th/TRB6/. The TRB3 is designed to be your textbook in teaching science curriculum to your students. This book covers all the objectives of each standard and benchmark. If taught efficiently, a student should do well on the End-of-Level (CRT) tests. The TRB3 is designed for teachers who know very little about science, as well as for teachers who have a broad understanding of science.

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