

Investigation Five – Good Guys or Bad Guys

**Standard
V**

**Objective
3**

Standard 05:

Students will understand that microorganisms range from simple to complex, are found almost everywhere, and are both helpful and harmful.

Objective 3:

Identify positive and negative effects of microorganisms and how science has developed positive use for some microorganisms and overcome the negative effects of others.

Intended Learning Outcome

- 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

Background Information

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 ringworm, 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 currents 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, buttermilk, 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 floated around in Korean soups, paper-thin sheets of it are wrapped around Japanese rick 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 you 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!”

Invitation to Learn

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.