

Lesson Plan for Microbiology (Week 2)

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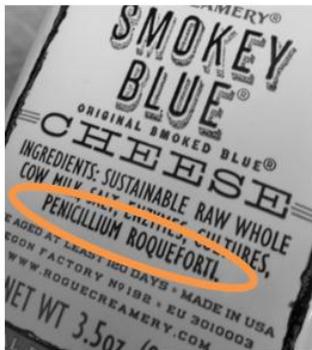
What good are microbes, anyway?

How microorganisms are used in cooking, science, and engineering

Introduction and Background Info

In the previous lesson, we learned all about two types of microbes: bacteria and fungi. We learned that bacteria, although normally too small to see, can be found practically anywhere on the planet. We then conducted a simple experiment to determine where bacteria can be found around the classroom. In this lesson, we will analyze the results from last week's experiment and learn more about how microbes are used by the food industry and by scientists and engineers.

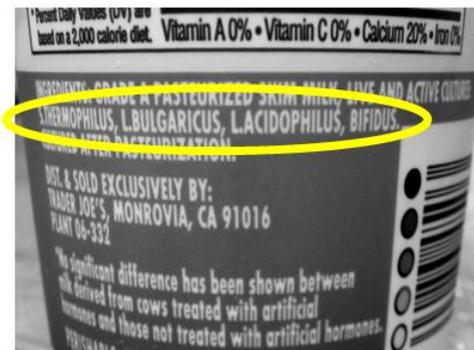
Microbes are used to make a number of foods. For example, bacteria are used to make foods like yogurt and soy sauce. Fungi is also used in many foods. A special, edible mold is used in blue cheese to give a unique flavor. Yeast (a fungus) is used in *many* bake goods like bread, bagels, and donuts.



BLUE CHEESE
contains bacteria called
Penicillium roqueforti



Yeast is used in many
baked goods like **bread**



YOGURT
contains bacteria such as
L. Bulgaricus and *L. acidophilus*

Microbes are also used by scientists and engineers. Some microbes make important medicines. Penicillin, which you might have taken if you've ever gotten Strep Throat, comes from a type of fungus!

Scientists and engineers can also alter microbes in the lab to give the microbes special abilities. For example, some microbes can produce gas that will power your car! Other microbes can break down undesirable materials in the environment, like plastics in landfills or oil spilled in the ocean.

Sometimes scientists even just research microbes like yeast to understand how they work. This is useful because microbes are fairly simple organisms that can teach us a lot about how our own bodies work and how to fix things when we get sick or injured.

Student Objectives

- Students will review what microbes are and the types of microbes (bacteria and fungi).
- Students will analyze the results from last week's activity to learn where bacteria can be found.
- Students will learn how bacteria and fungi are in cooking, science, and engineering.
- Students will conduct a simple experiment to see what happens when yeast grow. This demonstrates the usefulness of yeast (a fungus) in baking.

Topics (review from week 1)

Microbiology: The study of microscopic organisms (a.k.a. microbes) like bacteria and fungi.

Bacteria: single-celled organisms that can be found everywhere on Earth. In the human body, there are about 10 times more bacterial cells than human cells!

Fungi: Eukaryotic (cells have a nucleus) organisms that are more like animals and plants than bacteria. Fungi include mushrooms, truffles, smuts, molds, and yeasts.

Overview of Lesson Process

- Review microbes as a class – what are they and where can they be found?
- Explain to the students how microbes are used in cooking, science, and engineering.
- Set up this week's activity to give the yeast plenty of time to grow.
- As the yeast grow, show the students their agar plates from the previous week. Have the students analyze the results – where was the most bacteria found? The least? Does all the bacteria look the same? If microscopes are available, slides will also be prepared for the students to look at.
- Return to this week's experiment. By now, the balloon should have started to inflate, and bubbles should be visible in the yeast mixture. Explain to the students that the yeast, a living thing, consumes sugar and produces CO₂) and how this is useful for baking things like bread and donuts.

Procedures

1. Combine sugar, yeast, and warm water (105 – 115 F) and stir or swirl until yeast and sugar dissolve.
2. (Optional) mentors can set up one additional bottle *without sugar* as a class demonstration.
3. Stretch out the balloon by blowing it up a few times then attach it to the mouth of the bottle.
4. Make sure balloon is secure and sealed, then set the bottle aside.
5. Analyze bacterial growth while the yeast grows...
6. After several minutes, the balloon will stand upright and eventually begin to inflate. Bubbles should be visible forming in the yeast mixture (CO₂ gas production).

Materials (per group)

	Estimated Cost
Approx. 2 teaspoons dry active yeast (or one packet)	4oz jar \$8
Approx. 2 tablespoons sugar	small box \$1
Approx. 1 cup of warm water	hot tap water \$0
1 large rubber balloon	10 balloons \$2
1 small empty water bottle	supplied by mentors \$0
	Total \$11

Resources

The science of bread: yeast-air balloons <http://www.exploratorium.edu/cooking/bread/activity-yeast.html>
Yeast science: can yeast inflate a balloon? http://www.education.com/activity/article/Yeast_Balloons/

Microbiology Worksheet

Microbes around the Classroom

Last week you tested for bacteria around the classroom by taking samples and growing them. Now look at what grew and answer these questions:

If the bacteria are normally too small to see, why can you see them here?

What does the bacteria look like? Does all the bacteria look the same?

Where can you find **the most** bacteria?

Where can you find **the least** bacteria?

Microbes in Cooking

Microbes can be very useful, especially to cooks! Bacteria and fungi are found in all kinds of food like yogurt, cheese, and soy sauce. One type of fungus, called yeast, is important for making lots of yummy baked goods like bread, bagels, and donuts.



Growing Yeast

In today's experiment, we will give yeast a nice warm environment (warm water) and some food (sugar). This is similar to what bakers do to yeast when they make bread.

Set up the experiment with your group, then answer the following questions:

What happens to the balloon as the yeast grow?

Why does this happens? Discuss this with your group and mentor.

What would happen if we didn't give the yeast any food (sugar)?

Microbes in Science and Engineering

Microbes are also used by scientists and engineers. Some microbes make important medicines. Penicillin comes from a type of fungus. If you've ever had Strep Throat, you might have taken Penicillin. Scientists and engineers can also alter microbes in the lab to give the microbes special abilities. For example, some microbes can produce gas that will power your car! *Microbes may be small, but they're really useful!*