

Microbes: Friend or Foe?



Ages 10 - 14

Lesson Overview:

The purpose of these lessons is to explore microbes and their purpose in food. They will also demonstrate the importance of food safety through plating bacteria from various surfaces.

Learning Outcomes:

Learners will:

- be able to explain why it is important to wash hands before preparing foods
- be able to describe how some bacteria are safe for consumption while others are not
- examine the role microbes play in some foods such as yogurt, mushrooms, and bread

Materials:

Lesson 1: Sampling Surfaces

- Option A
 - loaf of sliced, white bread
 - permanent marker
 - sandwich-sized plastic bags
 - tongs
 - hand soap &/or hand sanitizer
- Option B
 - prepared petri dishes (potato dextrose agar OR tryptic soy agar)
 - cotton swab
 - permanent marker
 - hand soap &/or hand sanitizer
 - Premade kits are available:
 - <https://www.carolina.com/biological-media-kits/tryptic-soy-agar-media-kit/821040.pr?catId=&mCat=&sCat=&ssCat=&question=tryptic+soy+agar+media+kit>
 - https://www.amazon.ca/Nutrient-Dehydrated-Sterile-Dishes-Cotton/dp/B00B799PDG/ref=pd_lpo_2?pd_rd_i=B00B799PDG&psc=1

Lesson 2: Yeast

- an empty plastic bottle
- a balloon
- water
- yeast
- sugar
- ingredients for bread sticks *see recipe*

Lesson 3: Homemade Yogurt

- whole or 2% milk
- plain yogurt (with live, active cultures)
- large saucepan
- whisk
- ladle
- 1-quart mason jar or large glass bowl.
- plastic wrap
- 2 large tea towels
- kitchen thermometer
- Optional: cheese cloth, sous-vide

LESSON

Learning Plan:

Lesson 1: Sampling Surfaces

1. Activating questions:

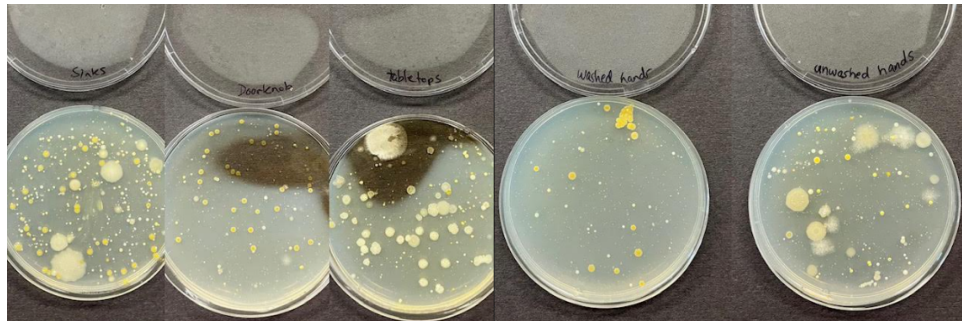
- Why is it important to wash our hands?
- What are some important times in the day when should we wash our hands?
- Why is it important to wash our hands while making food?
- What other things need to be clean in our kitchen?
- How can we tell if something is clean or dirty?
- What is the difference between the words 'clean' and 'sanitary'?

2. Here are two activity options:

- **Option A:** In this experiment, we will grow bacteria using bread as our medium. This can be done as a class or in smaller groups. There will be three samples and should be labelled as CONTROL, UNWASHED HANDS, & WASHED HANDS.
 - **Control:** remove a slice of bread with clean tongs and place in a bag. This is to demonstrate regular mold production with no human interaction.
 - **Unwashed hands:** have learners touch the surface of the bread with their hands and fingers. Place the slice of bread into the labelled plastic bag.
 - **Washed hands:** have students wash their hands following [handwash guidelines](#) (Appendix 1). Then, touch a third piece of bread with their hands and fingers and place into a plastic bag.
 - A summary of the activity can be found at https://www.youtube.com/watch?v=AlOoDe7_RJg



- **Option B:** Sample various surfaces using a swab and petri dish: in this experiment, we will grow bacteria using a petri dish. This can be done as a class or in smaller groups. Ensure to label each petri dish accordingly with a permanent marker.
 - Using a cotton swab, sample various surfaces thoroughly to ensure an accurate sample. Then, take the swab and gently rub the cotton swab along the surface of a prepared petri dish. Place a labelled lid over the dish and keep in a dark, warm space to incubate.
 - A summary of the activity can be found at <https://youtu.be/2VQWx3TnOPA>



3. Discussion questions:

- a. Where did we notice the most/least bacterial growth? Why do you think this is?
- b. Did bacteria grow on washed/sanitized hands? Why do you think this is?
- c. Why was a 'control' included in the experiment?

Optional Extension Activity: count the coliform colonies each day and graph the growth. Place a piece of black construction paper behind the petri dish to make the coliform colonies stand-out and ensure good lighting.

Lesson 2: Yogurt

1. Activating activity:

Place a $\frac{1}{2}$ cup (120 mL) of warm water into a small water bottle. Add in $2\frac{1}{4}$ tsp (or 1 packet) of instant yeast and 1 tsp (5 mL) of sugar to the bottle. Place a deflated balloon on the top of the bottle and allow to rest for 10-15 minutes. The balloon will slowly inflate as carbon dioxide gas is produced.

- What do you notice about the water bottle set-up? What is being produced?
- What makes bread rise?
- What is yeast?

Yeast is a single-celled fungi. They are present in the air and on surfaces all around us. There are many varieties of yeast, like there are different breeds of dogs. The yeast strain we use for bread making is called *Saccharomyces Cerevisiae*.

The yeast become active when dissolved in warm water. However, if the water is too hot, the yeast will die! They also need food – and that’s why we give them some sugar. As the yeast ‘consume’ the sugar, they produce carbon dioxide gas. In the creation of breads, a protein in wheat flour, called gluten, ‘traps’ the carbon dioxide and allows the bread to rise and creates a porous structure known as *the crumb*.

2. **Activity:** Work through the “**Bread Stick Recipe**” (Appendix 2).

- Demonstrate “kneading” or show <https://www.youtube.com/watch?v=ySOj0fFWo1U>

3. Discussion questions:

- Why did we knead the dough?** – *Kneading develops the gluten, a stretchy protein that helps to capture carbon dioxide to create the crumb.*
- What might happen if we used hot water instead of warm?** *The yeast could die*
- Why did we cover and let the breadsticks with a tea towel?** *To allow the dough to rise and soften.*

Lesson 3: Homemade Yogurt

1. Activating questions:

- What do we call products made from cows’ milk? – *Dairy Products*
- What are some dairy products/milk products are you familiar with?
- How do we turn milk products into dairy products?

2. Watch “*Why are there bacteria in my yogurt?*”

<https://www.youtube.com/watch?v=Xs2xGeu6fHc>

3. Create yogurt by following the “**Homemade Yogurt Recipe**” (Appendix 3)

4. Discussion questions:

- What happens when we heat the milk?** – *The heat changes the protein structure so that when cooled, will set as a solid, rather than a liquid.*
- Why do we need add purchased yogurt to make a larger serving of yogurt?** – *We use purchased yogurt, which already has the cultures we need to turn the milk to yogurt. More specifically, we are adding the bacteria Lactobacillus bulgaricus and Streptococcus thermophilus.*
- Why is it important to keep the yogurt warm? What is happening?** – *During this vital step, the bacteria are in ideal conditions to reproduce and multiply. During the multiplication period, the bacteria convert the sugar in milk – called lactose – to lactic*

acid. The presence of lactic acid helps to thicken the yogurt and produces a sour taste. This process is called “fermentation”.

- d. **What is the liquid on top of the yogurt that forms? Is it safe to eat?** – *The watery substance that may appear on the surface of the yogurt is called “whey” and is a protein found in milk. You may stir the liquid back into to yogurt or drain it out, but either way it is safe to eat. This liquid layer can also be found on purchased yogurt or sour cream*

Optional Extension Activity: try our yogurt banana split recipe

https://www.fanlit.org/files/ugd/1692f6_88bf1fa293324a1488250d6432e920e9.pdf

Appendices:

- Appendix 1 – [How to Wash Hands with Soap](#)
- Appendix 2 – Bread Sticks Recipe
- Appendix 3 – Homemade Yogurt Recipe