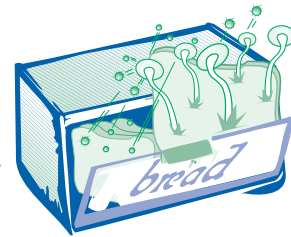


BREAD BOX NIGHTMARES



Have you ever opened a bread bag only to find the bread inside covered with mold? Why does that happen? What is mold? How does it grow?

Goal

To investigate the factors needed for fungi to grow and develop.

Activity Time

14 days

Time to Get Ready

30 minutes

What You Need

Have the following for the entire group:

- 1 hot plate or stove
- 1 stirring rod or spoon
- 1 250-mL beaker or small sauce pan
- 100 g sugar

Have the following for each team of 4:

- 3 50-mL beakers or small cups
- 3 pipettes or eye droppers
- 20 mL prepared sugar solution
- 20 mL lemon juice
- 20 mL tap water
- 4 slices of white bread
- 4 slices of assorted breads such as bakery, rye, or wheat
- 8 zippered, plastic bags
- 1 permanent marking pen

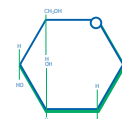
Getting Ready

- Fill the 250-mL beaker or sauce pan with 100 mL of water. Add approximately 100 g of sugar to the water. Heat the mixture until the sugar is dissolved. Allow the solution to cool for 5 minutes.
- For each group, fill 1 50-mL beaker or small cup with 20 mL of tap water, 1 50-mL beaker with 20 mL of lemon juice, and 1 50-mL beaker with the prepared "Sugar Water."
- Set out materials for each group.
- Potato slices can be substituted for bread slices.

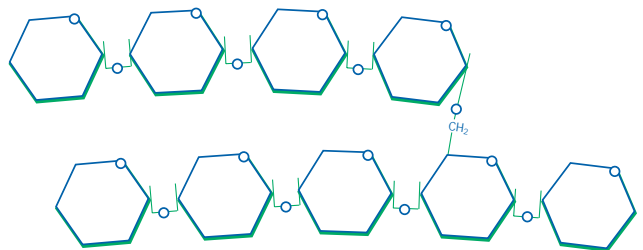
Useful Information

Fungi are decomposers. As such, most release enzymes to digest the food around them. They keep the ecosystem balanced by breaking down dead organisms. They also break down the wastes of living things. To survive, they need moisture, food, warmth, and darkness.

Bread contains large quantities of starch that is a great food source for bread molds. These molds grow not only on breads, but also on fruit. They are generally greenish or black and fuzzy. They digest starch and make glucose. See Figure 1. Glucose is a building block of starch. The glucose is then used by the fungi and bacteria as an energy source.



Glucose



Starch

Figure 1. Glucose and starch molecules. Notice that glucose is a basic unit of the longer starch molecule.

Bread molds produce spores. The spores are stored in cases which are on thin stalks. When the cases break, hundreds of spores are released into the air. If the spores land on a suitable place, they produce more mold. See Figure 2.

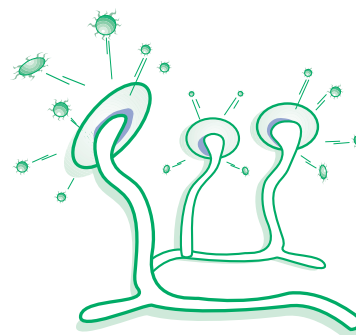


Figure 2. Releasing spores



Suggestions to Modify the Activity for Those Who Are Exceptional

Specific modifications for this activity are found here. For common considerations when modifying activities for exceptional participants, see page V of the **Introduction**.

Blind or Visually Impaired

- Allow the participants to touch and smell the different types of bread. Sensory stimulation is beneficial to the participant achieving a better understanding of the activity. Discuss the distinct characteristics of the bread, such as texture and density. References to common experiences such as, "Have you ever opened a container of homemade spaghetti sauce? What did you find?" are important to understanding the basic concept. These sensory prompts will allow the participants to think independently and develop their own hypotheses.
- Build a tactile model of the glucose and/or the sporangium. See the **Introduction** for suggested materials.
- Construct a bar graph showing the progression of mold growth with educational counters called cubed manipulatives.

Deaf or Hard-of-Hearing

- See the **General Modifications** for *Blind or Visually Impaired* listed in the **Introduction**, page V.

Mobility Impaired

- See the **General Modifications** for *Mobility Impaired* listed in the **Introduction**, page V.

Physically Impaired

- See the **General Modifications** for *Physically Impaired* listed in the **Introduction**, page V.

Cognitively Impaired

- See the **General Modifications** for *Cognitively Impaired* listed in the **Introduction**, page V.

How to Start the Activity

- As an introduction, the poem "Sarah Cynthia Sylvia Stout Would Not Take the Garbage Out!" by Shel Silverstein may be used to generate discussions about garbage and fungi growth. See Figure 3.
- Set out 4 pieces of bread. Have the participants examine them closely.



Let's Make a Hypothesis

Discuss the following questions to help guide the participants to make hypotheses.

- Is anything growing on this bread?
- How could you encourage something to grow on the bread?
- Would it matter what type of bread you used?

For More Information

Access Excellence. Teaching Ideas. Fungus among us. <http://www.gene.com/ae/atg/released/0347-TishTaylor/description.html>

This site is dedicated to teachers and provides lesson plans, resources, and an activities exchange for biology curriculum.

Hawke, C. (1997). Focus on *Listeria*: A foodborne bacterium. *Pasteur Perspectives*, (3), 1-2.

Kessler, J.H. (Ed.). (1992). Through thick or thin. *WonderScience*, 6(4).

Yoon, C.K. (1998). Newly found fungus tied to vanishing frog species. *The New York Times*, CXLVII(51,202).

What the Data Mean

What helps mold grow on bread?

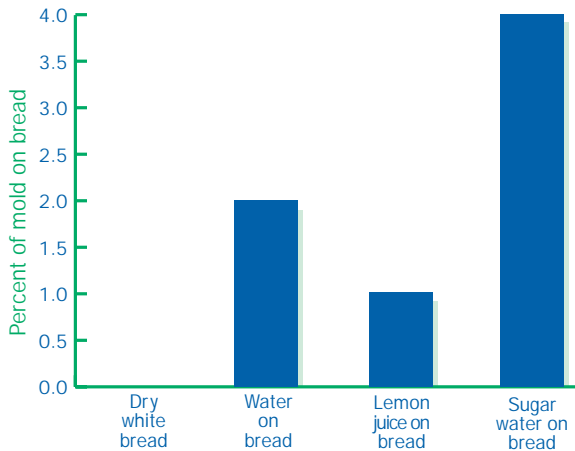
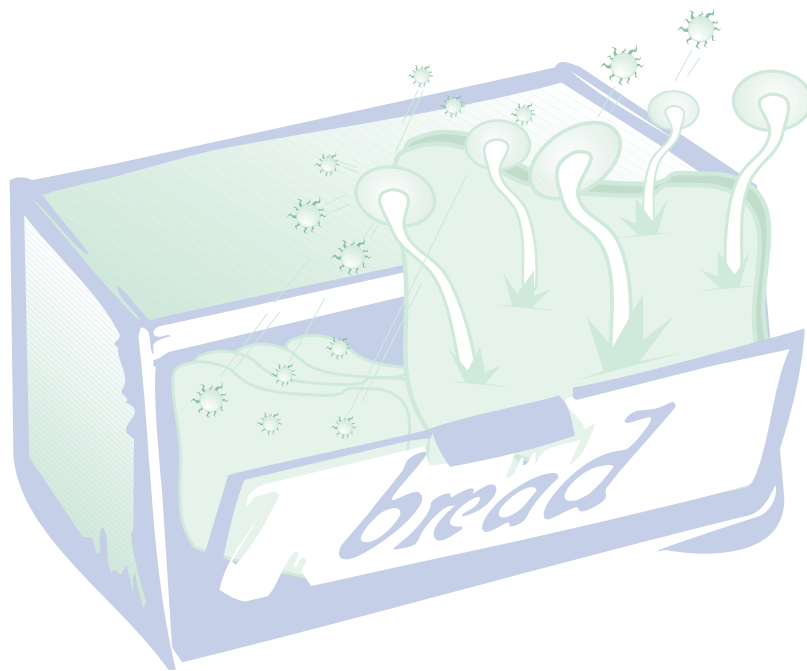
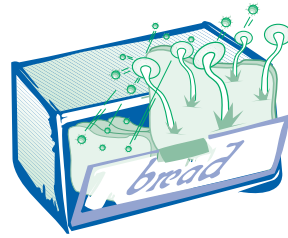


Figure 4. This graph shows that sugar water encourages growth of mold on bread.



BREAD BOX NIGHTMARES



Questions to Think About

Have you ever been asked to clean out the refrigerator? Have you ever opened a container of homemade spaghetti sauce or some other food that's been in the refrigerator too long? Sometimes you open a container of food, and what do you find? Fungi! You might say this food is "moldy." Mold is a type of fungi. Is it living? If it is, what does it need to grow?

Safety Notes

- Wash hands before and after the activity.
- Do not eat materials from the activity.
- Make sure the bags are sealed tightly, and do not open them once the fungus begins to grow.
- Throw all materials away at the completion of the activity.
- Food, drinks, and gum are not allowed.
- Use caution when working with glass beakers.
- Use caution when working with hot plates and hot liquids.

What to Do

1. Label 1 zippered, plastic bag as "Dry White Bread," 1 as "Water on White Bread," 1 as "Lemon Juice on White Bread," and 1 as "Sugar Water on White Bread." Put your group name on all 4 bags. Place a slice of dry white bread in the bag marked "Dry Bread" and seal it. Sprinkle 20 drops of water on another slice of white bread. Be sure not to overmoisten the bread. It should only be damp. Place the slice of bread in the bag marked "Water" and seal it. Sprinkle 20 drops of lemon juice on another slice of white bread. Place it in the bag marked "Lemon Juice" and seal it. Sprinkle 20 drops of sugar water on the last slice of white bread. Place the slice of bread in the bag marked "Sugar Water" and seal it.
2. Repeat the steps above, but use a different type of bread in the other 4 bags. Be sure to label the bags so you will know what is in them.
3. Place all 8 bags in a dark, warm (30°C) place. Check on them daily for 2 weeks. Record your results on a chart. Construct a graph of the results. Can you see evidence of a decomposer at work on the bread? What would happen to the bread if you left it indefinitely? You may want to try this and see what happens.

4. What questions come from your results? To what other topics is this activity related? What did you learn from this activity? How does this activity relate to your life? What did your graph show?

5. How can you learn more about the requirements of fungi? What procedures would you use? What would you measure? What if you used another kind of bread? What if you sprinkled other liquids on the bread? What if you altered the temperatures? What if you left them exposed to light? What if you changed the amount of liquid sprinkled on the bread? What if the bread had preservatives in it? Could you design an experiment to test a new hypothesis or question?

6. Design a new experiment based on data you gathered or questions you asked during this investigation. Develop a hypothesis that can be tested in a controlled experiment. Write a procedure in a numbered list. What is your control? What variables are important? How many trials have you included? What will you measure? How can you show your results in a graph?

What Did You Find Out By Doing the Activity?

Before doing "Bread Box Nightmares," did you know:

- what mold is?
- what it needs to grow?
- that not all molds look alike?
- where mold can grow besides food surfaces?

From this activity, did you discover:

- what different molds look like?
- how mold grows?
- how preservatives affect mold growth?
- how to determine the effect of light and temperature on mold growth?
- other places molds can grow such as the shower, trees, or between your toes?

