



Bacteria for Breakfast

Grade Level: 3-5

Goal

Students learn the process of turning milk into yogurt by using different bacteria starts and comparing results.

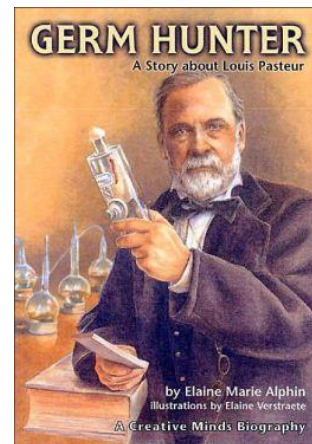
Curriculum Alignment

Find a list of which Common Core State Standards and NC Essential Standards this lesson plan aligns with on the lesson plan page at www.growing-minds.org.

Materials

Book to read

[Germ Hunter: A Story about Louis Pasteur](#) by Elaine Marie Alphin



Supplies for each group

- (2) 8 oz. canning jars with lids (sterilized in boiling water or dishwasher)
- Craft sticks
- Plastic spoons
- Liquid measuring cup and measuring spoons
- Permanent marker

Supplies for the class

- A hot plate
- 1 gallon of whole milk
- Different brands of single serving containers of yogurt to use as starter cultures. Try using several different types of products for comparison; here are some options:
 - products with live and/or active cultures
 - products that are heat pasteurized and do not contain live or active cultures
 - products that have flavoring or coloring agents added
 - products with added stabilizers, such as gelatin

- Large double boiler (or heavy pot) with lid
- Candy thermometer with a range of 100-200°F
- A Styrofoam cooler (acts as an incubator)
- Hot tap water to incubate the jars

Lesson

Do you know that there is good bacteria and bad bacteria?

All of the dairy foods we eat come from milk— ice cream, butter, sour cream, cheese and yogurt. Most of the yogurt made in the United States is made from cow's milk, but any type of milk can be used. In other



Bacteria for Breakfast

Grade Level: 3-5

countries, yogurt is made from the milk of water buffalo, sheep, goats, horses or yak. Had any yak yogurt lately?

Yogurt is a thick, custard- or pudding-like food that is made with the help of microorganisms called bacteria that grow in milk. Don't worry; these are not the kind of bacteria that can make you sick. The bacteria in yogurt can actually help you digest your food and keep you healthy. Yogurt also has other healthy ingredients in it like calcium, phosphorus, potassium, and riboflavin.

You find yogurt and other dairy products in the grocery store. But before there were grocery stores, people raised their own animals and made their own yogurt or cheese. Today you will learn how easy it is to turn milk into yogurt.

In this activity you will be creating an environment that encourages bacteria to grow. Since you don't want any old bacteria to grow (just the good yogurt kind) your group will be heating milk to kill any naturally occurring bacteria and then adding a "starter." Your starter will be a scoop of already made yogurt that contains the good bacteria you need grow in the rest of the milk. Each group will use two different starters in order to see what variables make a difference in successful yogurt making.

Procedure

You will need to start early enough in the day to insure that you have the 3 hours necessary for incubation in step #8.

1. You will heat the milk to 185–195°F in a double boiler, keeping the pot covered to reduce evaporation. You can also use a heavy-bottomed pot, but stir frequently to prevent the milk from sticking to the bottom. Review the dangers of touching the hot plate and hot pans before beginning lesson.
2. Once the milk is hot enough, remove it from the hot plate and place the covered pot in a pan of clean, cool water until the stirred milk is very close to 130°F.
3. While the milk is cooling, have the students prepare their yogurt starters. Ask the students what a starter is and define for them if unknown. They can use craft sticks to taste the starters.
4. Have them make predictions and record them in the first two columns of the Yogurt Predictions and Observations Table.
5. Have students prepare their experiment. They will decide who will do each step and initial the boxes on their student page.
6. Have each group arrange their two (one for each starter) pre-sterilized canning jars and loosen the lids.



Bacteria for Breakfast

Grade Level: 3-5

7. Each group of students will open the yogurt products they will use as a starter (use at least two different types of yogurt such as organic, no sugar, live cultures, with fruit, or goat) and stir with a clean spoon to be sure it is mixed evenly.
8. Students will add one tablespoon of each starter to each jar and label the jar with the brand name using a permanent marker. Have them fill in the first two columns of the Yogurt Predications and Observations Table.
9. After the milk cools to 130°F, it will still be warm to the touch. Again, reinforce safety. Students will carefully pour it into the canning jars filling the jars almost full, with about 1/2 inch from the top. Cover immediately with the sterile lids.
10. Students will place filled canning jars in the cooler (or incubator), add enough 122°F water so that jars are surrounded, but the water is well below the lid rims. Discuss with your students what an incubator is and its purpose.
11. Do not disturb the yogurt and it will be finished in 3 hours, provided the temperature does not drop below 104°F. Refrigerate overnight.
12. The next day, students will open and examine each yogurt. Did the product gel? Is it firm or runny? Does it smell good or bad?
13. Once the yogurt is complete, have students taste it. They should then fill in the rest of their Yogurt Predications and Observations Table and answer the questions.
14. As a class, share your results and discuss why results differed.

Teacher Tips:

- Sanitize all cleaning surfaces and equipment. Have jars sterilized prior to starting.
- Make sure children thoroughly wash their hands.
- Be aware of children with allergies.
- Provide soy yogurt and soy milk for children who are lactose intolerant.
- Have fresh fruit or honey to add to the yogurt when done (for student tasting).

Extension ideas:

- Have the class test the effects of preservatives.
- Have the class test whether the amount of starter used in the culture makes a better product. Is it better to use more or less? Does it take a longer or shorter time?
- Have the class test which kind of milk works best. Try using whole, 2%, and skim milk. Also try using alternative products to cows' milk: can you use goat milk, Lactaid, or soy milk?
- Invite a farmer in to your classroom to discuss raising cows for milk.



Bacteria for Breakfast

Grade Level: 3-5

Yogurt Problem Solver Table

Below each listed problem you observe is are possible reasons and solutions for that problem.

Problem: water separation of curds and whey	
Incubation time too long, forms too much acid	Shorten incubation time and refrigerate yogurt as soon as it becomes firm.
Insufficient heat treatment of milk	Either milk was not heated to 200°F or it was not held at 200°F as directed for thin or firm yogurt. Heat treatment changes the milk proteins so that the yogurt is firmer and whey does not separate so easily from curds.
Problem: yogurt does not become firm	
Culture inactive	Commercial, unflavored yogurt used for starter must be fresh and contain live culture.
Incubation temperature too high or low	Temperature must be between 108 -112° F for yogurt culture to grow properly. Temperatures above 115° F cause separation or curdling and can destroy the active yogurt culture, while temperatures below 100°F stop the growth.
Other substances may interfere (such as detergent)	Wash and thoroughly rinse all yogurt-making equipment and container(s) before making yogurt.
Problem: off flavors	
Milk that is off-flavored	Use fresh milk with a good flavor and fresh dry milk powder.
Bacteria that cause off-flavors can grow along with the yogurt culture.	To prevent the presence of unwanted bacteria, use a fresh, active yogurt culture, thoroughly wash and rinse all yogurt-making equipment and container(s), hold container(s) in hot water while preparing yogurt and keep container covered during incubation.