CABBAGE TODAY, SAUERKRAUT TOMORROW!

By Susanne Johnston, Germantown Academy, Ft. Washington, PA

Purpose: To demonstrate how bacteria naturally present on cabbage can change it into the common fermented food called sauerkraut.

Background: Do you think your food is bacteria-free? Well, think again! It isn't and it's a good thing! Without naturally occurring bacteria on cabbage, we wouldn't have foods like sauerkraut and kimchee to tingle our taste buds. But cabbage doesn't just magically turn into sauerkraut in the field. What conditions are required for the change to occur?

Many foods are products of natural fermentation. Yogurt, cheese and sauerkraut are just a few. Often a series of natural microbes breaks down complex compounds like sugar into simple substances like carbon dioxide and alcohol, and changes one food into another. Some bacteria produce acid in air free environments as they grow. The acid and alcohol are toxic to food-spoiling microbes and can act as natural preservatives.

Different foods like cabbage, cucumbers, and grapes host different microbes. The microbes found naturally on cabbage produce a variety of acids and alcohols in air-free environments. Sauerkraut's flavor is the result of these chemicals. Salt draws water and sugars from the cabbage. The microbes use the sugars to make acids. With the right saltiness and temperature, the bacteria change the color, consistency, smell and flavor of the cabbage. Sometimes these fermented foods are seasoned. For example, kimchee is fermented cabbage seasoned with garlic, red peppers, and ginger.

Materials: Head of cabbage, shredder, bowl, salt, plate, 1-gallon freezer bag, water, and pH meter.

Procedure:

1. Carefully examine the head of cabbage looking for any organisms. Trim the cabbage head, removing any damaged leaves.

2. Shred the cabbage and place it in a large bowl. Liberally sprinkle the cabbage surface with 3 teaspoons of salt. Compress the mixture slightly. Cover the cabbage with a clean plate. Weigh the plate down with a zippered, plastic 1-gallon freezer bag filled with water. Cover the bowl, plate and freezer bag with cheesecloth to prevent insects from contaminating the mixture. Please in a warm, dry place. The temperature should be consistent at approximately 21 C.

3. Stir the cabbage/salt mixture each day. If the water has scum on top, skim it off. Observe changes in odor, color, texture and pH on days 2, 7 and 14. Write your observations in a chart. Graph your results. Be sure the plate remains weighted to compress the cabbage and maintain as much of an air-free environment within the bowl as possible.

Questions:

1. After you check the pH of the cabbage, taste one of the other fermented foods. How would you describe its taste?

   What is its pH ____________? How does it compare with the pH of the cabbage?

2. Why did the flavor of the cabbage change?

3. What are the bacteria using for food?

4. What does the bacteria give off?

5. Why is the bacteria by-product a natural preservative?

6. Will mold grow on the sauerkraut?

7. How can refrigeration or some other method of preservation prevent mold from growing?

8. What is the name of the process called that took place here?

Expansion:

What factors could you manipulate to alter your results? What role did the salt play? Did the type of salt, such as pickling versus table salt, make a difference? What is you had used sugar, instead? What if you left the cabbage-salt mixture exposed to air?

Design a new experiment based on data you gathered or questions you asked during this investigation. Use the model for lab write-ups we have used in the past. Don't forget to include a control. What variables are important? How many trials have you included? What will you measure? How can you show your results in a graph?