Fermented Foods Teacher Instructions

What is a fermented food?

Background

Fermented foods are those produced by the outgrowth of microorganisms. "Fermentation" itself is a set of diverse metabolic pathways utilized by some microorganisms. Byproducts of fermentation include acid production (pickles, cheese, yogurt), ethanol production (beer, wine), gas production (bread), and flavor compound production (all products). Fermentation has historically been utilized to increase food safety, extend shelf life, and produce new foods with interesting and desirable sensory characteristics. Fermented foods are often associated with particular regions and ethnicities as methods of preserving the available food supply (think sauerkraut or kimchi). In this lesson, students will learn about the biochemical changes that occur in foods during fermentation and about some examples of culturally significant fermented foods through an interactive powerpoint. Soy is a valuable source of protein in regions where access to animal protein has historically been limited. Subsequently, there are numerous examples of soy-based fermented foods. Students will set up their own fermentations to make natto, a Japanese fermented soy product that is consumed as a breakfast food.

Materials
Soybeans
Pot
Colander
Burner or stove
Natto starter culture
Tupperware containers
Cheesecloth
Ideally, incubator or simulated incubator (see teacher instructions)
Plastic spoons or scoopula
Refrigeration

Day 1
Discussion

- In the previous activity, students evaluated shelf-life changes based on the availability of water.
- Fermentation has been used to extend the shelf life of foods, increase safety (by reducing the potential for pathogen growth), and adding new sensory characteristics and flavor dimensions to food. The byproducts produced by the fermentative organisms are responsible for these attributes.
- See powerpoint for discussion notes. This powerpoint uses the accompanying handout and includes a breakout activity where students take the pH of several food products.

Activity—ferment preparation

- Divide students up into groups (assuming each group has between 2-4 people).
- At the end of the presentation on day 1 of the lesson, have each group begin by soaking ½-1 cup of soybeans in warm water. Let soybeans sit overnight until the following class period.

Day 2
Activity—ferment preparation

- Have students begin by boiling their beans for about 10 minutes.
- While beans are boiling, prepare the starter culture. Natto Bacilli cultures can be purchased commercially for around $10. If you choose to try a wild fermentation, the process is more likely to fail

and/or result in the outgrowth of potential pathogens. To that end, it is NOT recommended that students be permitted to eat their end product since this is a laboratory exercise and not a well-controlled fermentation. In reality, most food science experiments do not result in an end product that the scientists get to eat. This is additionally true if your students are working in a classroom laboratory, which is not food safe. Follow the instructions for preparation of the starter culture, which will involve dissolving some of the dry Bacilli in warm water.

- Drain beans and transfer to a wide, flat Tupperware container.
- Have students add 2-3 Tbs (or as specified in the instructions) of the starter culture to the beans and mix well.
- Cover the container with a damp hand-towel or cheesecloth, then cover with lid (seal if possible).
- This fermentation will work best if stored between 100-115ºF. This can be accomplished in an incubator in a micro lab or in a cooler/ice chest filled with warm water). Let ferment 24 hours, until the following class period.

Days 3-4
Activity—ferment preparation

Students may observe the outcome of the fermentation the following day, or wait another 24 hours after the fermentation has been moved to the refrigerator (this is the point at which it is usually consumed, but NO EATING).

Through each step in processing (soaking, boiling, inoculation, fermentation, aging) ask students to record their observations about how the beans are changing. Have students observe and record changes in sensory qualities that have occurred (slimy, softer). Ask them to postulate what the microorganisms are doing to bring about these changes (what are the microbes eating? what are they pooping out?). As an extension activity, students may also plate dilutions of the initial preparation and final product following fermentation to enumerate the increase in microorganisms.

Questions based on previous exercises can be employed: What macronutrients are relevant to microbial growth? What does the rapid growth of microbes imply about the water availability in the product?