Bay Area Scientists in Schools Presentation Plan

Lesson Name Microbe-Body
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Grade Level 4th
Standards Connection(s) Life Science (microorganisms)

Abstract:
Microorganisms are extremely important to our lives. They are everywhere and can be good or bad for the human being. Good microbes are involved in the production of food (cheese, bread, wine, beer etc), help plants grow, cycle nutrients in the environment and they even help us digest the food we eat. Bad microbes can make the plants, animals and human being sick.

Today we are going to use a microscope to see yeast, an example of a microbe. Yeast can “eat” different type of sugars to produce energy and live. They like some type of sugars better than others and they produce gas as a “waste” product. We will see how much gas yeast produce as they “eat” different types of sugars.

Our goal for this experiment is to expose the students to the world of microorganisms and teach them their importance in the environment and in our body. We will talk about food digestion and use yeast as an example (even though yeast is not in the human gut) for energy production.

Vocabulary/Definitions:
- Microscopic = too small to be seen with your bare eyes
- Microscope = Instrument used to see microorganisms
- Microbe = a microscopic organism, such as bacteria or yeast.
- Bacteria = a very simple type of microbe (some live in your intestine)
- Yeast = a more complex type of microbe (some are used to make bread, beer, and cheese)
- Digestion = the breakdown of food and its incorporation into the body (some of this is done in our body by microbes)

Materials:
- 2 zippered, plastic bags per group (3-4 students)
- 1 teaspoon of rapid rise yeast extract per bag
- Warm water
- Sharpies
- Paper cups
- Paper towels
- Sugars: regular sugar cane sugar, Splenda, sweet ‘n Low (saccharin), Equal (aspartame), soda or any types of juice
**Classroom Set-up:**
Groups of 10 students, access to warm water

Each group will have 4 plastic bags; one for the control (water and yeast) and three for the different types of sugar. Two – three students from each sub group will be in charge of each bag.

Before experiment:
   Have 3 separate paper cups per group, each containing one of the following:
   1. 1 teaspoon of sugar, artificial sweetener or (for the juice use half a cup)
   2. half a cup of warm water
   3. 1 teaspoon of rapid rise yeast extract
   4. Also prepare 4 bags before the experiment for station 3
      a. 1 with sugar
      b. 1 with artificial sweetener
      c. 1 with juice
      d. 1 control
   5. Prepare microscope and slide of yeast
   6. Copy pictures of human digestive system

**Classroom Visit**

1. **Personal Introduction:** 5 Minutes
   Who are you? What do you want to share with students and why? How will you connect this with students’ interests?

   Brief description of where we come from and what we do as a graduate student.

2. **Topic Introduction:** 10 Minutes
   What are microbes? What they do and how they look?

   Introduce vocabulary and give brief introduction about what microbes are, where they live, what they do and talk about yeast as an example.

   Create a hypothesis, e.g. What type of sugar will the yeast “eat” faster?

   Introduce the concepts of digestion and energy production:

   1. **Microbes** are very small, single cell, organisms that we are unable to see with the naked eye. We use an instrument called microscope that magnifies the image of microbes in order to be able to see them and study them.
2. Microbes are everywhere. There are "good" microbes, which are those that help us, and other animals, to digest the food, and others that help plants to grow healthy. There are also "bad" microbes like those that cause us to get sick (stomachache, common cold). This is why it is important to study which microbes are good, and which ones are bad.

3. Microbes, called bacteria, are involved in digestion (*there are good bacteria and bad bacteria). The good bacteria that live in your intestines (mainly in the large intestine) that make certain vitamins (like folic acid and biotin), and digest things like lipids, carbohydrates and proteins.

4. In our experiment we will use yeast as an example of a microbes. We will see how these microbes can use different types of sugars to obtain energy to live and produce gas as a waste product.

2. **Learning Experience(s):**

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<th>30 Minutes</th>
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<td>Experiment:</td>
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<tr>
<td>1. Sub divide the class in three groups (~10 students per group).</td>
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<td>2. Each group will have 4 plastic bags; one for the control (water and yeast) and three for the different types of sugar. Two – three students from each sub group will be in charge of each bag.</td>
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<td>3. The student will add the sugar, followed by the water and at the same time they will add the yeast extract.</td>
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<td>4. De-gas the bags by “squeezing” all the air out and then close the bag.</td>
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<td>5. Mix the contents</td>
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While we are waiting to see the gas develop
- We have 3 stations of teachers (rotate groups of 3-4 students 5 minutes at each station

   **Station 1: Microscope Viewing of Yeast**
   1. Students look at yeast through microscope
   2. Microscopes magnify pictures so we can see very small things
   3. Explain that yeast is an example of a microbe but they don’t live in our intestine (Bacteria live in the intestines)
   4. They are very complex microbes that can do all sorts of things (make bread, beer, and cheese)

   **Station 2: Digestion**
   1. Point out areas in the body where microbes are working (stomach, mouth, teeth)
      a. There are microbes in your stomach and intestine that help you digest your food (breakdown your food into small particles)
   2. “Good vs. Bad Microbes Game”
      a. Have six items on the table (yogurt, bread, cheese, moldy fruit, picture of a virus, fake teeth with microbes on them)
b. Organize into good and bad microbes  
   c. Identify why each was grouped into good and bad (ie. What makes microbes on your teeth bad?)—good microbes in your body help digest food, such as yogurt and bread.

**Station 3: Looking at Gas Formation in the Bags**

1. Show students prepared bags with gas in them  
   i. Most gas = sugar bag, then Artificial sweeteners, then Water Control  
2. Ask students which bag they think will have most gas in it  
3. Explain that artificial sweeteners contain simple, easily broken down sugars in small amounts so they form gas fastest (artificial sweeteners cannot but still taste sweet (100-1000x sweeter than sugar)  
4. ...But, the factories that make artificial sweeteners add simple sugars to their packets as well (to make them taste less sweet, dilute the sweet taste)  
5. Therefore artificial sweeteners should form less gas over time (because they have less sugar than regular cane sugar)

**3. Wrap-up: Sharing Experiences and Building Connections**  
   5 Minutes

1. Ask them what they learned  
2. Talk about applications for microbes: clean up of pollution, making other food (cheese, wine, beer etc), nutrient cycling

**4. Close: How can kids learn more? Thanks and good-bye! Clean-up.**  
   2 Minutes

TOTAL 50 – 60 Minutes

**Follow-up – After Presentation**

Suggest students write a letter explaining “How we learned about microbes...”  
We will like to have feedback from the students and the teachers about our performance and the learning experience.

**Mold Terrarium: What Grows on Leftover Food?** (from Exploratorium) This activity shows you how to make a mold terrarium using a jar and leftover food. Learners explore mold, an "icky but necessary" thing that helps living matter rot, return to the soil, and provide nutrients for other plants. If you use a variety of food scraps, with preservatives and without, you'll see the different kinds of mold and be able to compare the rate of growth on various foods. Note: don't put meat or fish in your mold terrarium--after a few days, these would start to smell very, very bad.

[http://www.exploratorium.edu/science_explorer/mold.html](http://www.exploratorium.edu/science_explorer/mold.html)

Just How Small is an Atom? video on TED-Ed by Johnathan Bergmann and animated by Andrew Park. Just how small are atoms? And what’s inside them? The answers turn out to be astounding, even for those who think they know. This fast-paced animation uses spectacular metaphors (imagine a blueberry the size of a football stadium!) to give a visceral sense of the building blocks that make our world. [http://ed.ted.com/lessons/just-how-small-is-an-atom](http://ed.ted.com/lessons/just-how-small-is-an-atom)

Reading Connections:

- Invisible Allies: Microbes that Shape Our Lives by Jeanette Farrell – “In the course of her eye-opening narrative, Dr. Farrell relates the historical significance of using microbes to preserve foods, our long-standing ambivalence about the microbes that live on and in us, and our growing understanding of their importance.” [http://www.amazon.com/Invisible-Allies-Microbes-Ribbon-Nonfiction/dp/0374336083](http://www.amazon.com/Invisible-Allies-Microbes-Ribbon-Nonfiction/dp/0374336083)