TRB 6:5 - Activity 1 - Naked to the Eye

Summary

The activities in this lesson will help students understand that microorganisms are found nearly everywhere and vary in appearance and growth habits.

Materials

Activity A: Magnification
- glass slides
- quarter-inch (USS) washers/3 per student
- petroleum Jelly
- toothpicks
- 15 magnifiers (Hand lenses, 1/pair of students)
- microscope (at least one)
- "Microscope" video, "Virtual Microscope" CD, or "Microorganism" CD
- "Magnification Worksheet"
- 15 pipettes

Activity B: Growing Microorganisms
- 4 locking plastic bags
- 4 slices of bread (homemade or bread without preservatives)
- permanent marker or pen
- water spray/mist bottle
- paper towel

Activity C: Pond Life
- quart or pint jars
- eyedroppers, or 1ml pipettes
- slides
- coverslips
- Pond Life identification sheet
- microscopes (If you have a standard microscope with a low power magnification of about 100 times [written 100x] and a high power of 400x you have the most important item of equipment. If you do not have microscopes, a video or CD that allows your students to view the movement, color, appendages, and shape of pond water microbes will suffice).

Additional Resources:

Guide to Microlife, Kenneth G. Rains &Russell. Published by Franklin Watts Danbury, Connecticut, 1996.

Magnificent Microworld Adventures, Mike Wood, Published by AIMS Education Foundation, California, 1995.

Foods of Biblical Times, video shows how the ancient world made cheese, yogurt, wine, etc. Available from Utah Agriculture in the Classroom, www.agclassroom.org/ut.

Microorganism CD's, microscopes, and microbe videos are available from Carolina Biological; www.carolinabiological.com (order a catalog) and other Science Supply vendors.

Materials adapted from materials provided by Utah State University Extension and Utah Agriculture in the Classroom, www.agclassroom.org/ut

Background for Teachers

Microorganisms vary in size. Molds can be seen with only slight magnification and use of an ordinary magnifying glass. Yeasts must be viewed through a microscope that magnifies several hundred

times. Bacteria can best be seen when studied with a more powerful microscope that enlarges 1,000 times.

It helps to understand something about cells when studying microorganisms. All living organisms, large and small, have one thing in common: the cell. This is a tiny living factory capable of converting simple food substances into energy, and creating new cell material, making it possible for the cell to reproduce itself. Many microorganisms are unicellular or single-celled but some are multicellular.

Kingdom Monera

Bacteria make up the largest group of microorganisms. People often think of them as germs that do harm. Actually, only a small number of bacteria types are disease causing. There are thousands of different kinds of bacteria. Since some differ only slightly, they require a highly trained person to identify them. There are also groups that differ greatly in growth habits and appearance, and are quite easily identified.

Bacteria also vary somewhat in size, but average about 1/25,000 inch. In other words, 25,000 bacteria laid side by side would occupy only one inch of space. One cubic inch is big enough to hold nine trillion average-size bacteria; about 3,000 bacteria for every person on earth. Bacteria multiply by binary fission or cell division. Bacteria double every: 1/2 hour at 32 °C; 1 hour at 21 °C; 2 hours at 16 °C; 6 hours at 4 °C; 20 hours at 0 °C; and 60 hours at -2 °C.

Bacteria and other microorganisms need food in order to grow and multiply. They vary in their food needs, but nearly everything we consider as food can also be used as food by some types of bacteria (some bacteria can synthesize or make their own food).

Kingdom Protista

The kingdom Protista contains many species and a greater variety of organisms. Although most protists are unicellular (single-celled), some are multicellular organisms and may be quite large. While some protists get their food from their environments, others make their own food. Protists may live on land or in water. Because they are so diverse, the members of the kingdom Protista are difficult to classify. They are divided into three main groups: animal-like, plant-like, and fungus-like protists.

Animal-like Protists

The animal-like protists are single-celled or colonial organisms called protozoans. They live in fresh and salt water, in the soil, and in the bodies of other organisms. All protozoans get food from their environments. Some absorb nutrients through their cell membranes, whereas others engulf larger particles of food. Most protozoan can move.

Amebas are single-celled organisms that continually change shape and engulf food particles. They are commonly found in freshwater ponds, lakes, and streams. Plasmodium is a protozoan that causes malaria, a serious, sometimes fatal, disease. The spores from this parasite invade the red blood cells of the human host, multiply there, then break out and invade new cells. The destruction of the red blood cells releases toxic cell wastes into the bloodstream. These waste products cause fever, chills, and other symptoms of malaria. Although malaria can be treated with drugs, one method of prevention is to eliminate the Anopheles mosquito. In spite of the widespread use of pesticides in many countries, millions of people, especially in tropical areas are still infected with malaria.

Plant-like Protists

The plantlike protists, commonly called algae, are photosynthetic like plants. Like the protozoa, algae are very diverse. Some are tiny, single-celled organisms with flagella. Others are large, multicellular organisms like seaweed. Like plants, algae have chloroplasts, which contain the photosynthetic pigment chlorophyll.

Another group in this category is called the euglenoids. These single-celled protists have both plant-like and animal like characteristics. Like plants, they contain chloroplasts. However, they do not have cell walls. Like some of the protozoa, euglenoids move by means of flagella. One typical euglenoid is

Euglena, an organism common in pond water.
The Euglena is a single-celled organism having two flagella. The cell has a large, central nucleus and numerous chloroplasts which contain chlorophyll. Chlorophyll gives Euglenas their grass-green color. Euglenas are primarily photosynthetic. However, in the absence of light, they absorb dissolved nutrients from the environment.

Intended Learning Outcomes

1-Use science process and thinking skills
3-Understand science concepts and principles
4-Communicate effectively using science language and reasoning

Instructional Procedures

Activity A: Magnification
Invitation to Learn:
Ask students to make a dot with their pencils on a paper. Ask them how many bacteria they think could fit on the dot. Accept any answer and write it on the board. The answer is between 500-1,000 bacteria. Ask students how we know about organisms this small and discuss why magnification must be used to study the structure of most microorganisms. Scientists also gather information on microorganisms by the effect they have on other things such as illness or decay.
Instructional Procedures:

- Provide each student with a Magnification "m "Worksheet, hand lens, glass slide and three washers.
- Instruct each student to look at the letter "m " with a 3x magnifier and then draw what they see in actual size in the appropriate box on the worksheet.
- Ask the students to apply some petroleum jelly with a toothpick to one side of a washer and place it on the glass slide (they will be able to maneuver the slide better if they apply the washer to one end of the slide). Have them add a few drops of water into the center of the washer using a pipette until the water is almost even with the top of the washer. Instruct them to use this "lens " to view the 1x letter "m " and then draw its actual size in the appropriate box on the worksheet. They should estimate how many times the letter has been magnified. Repeat this same step using two more washers. BE SURE TO ASK THEM TO PREDICT THE MAGNIFICATION OF THIS LAST LENS BEFORE THEY MAKE THAT OBSERVATION.
- If you plan to have students use microscopes in class, discuss the proper use and handling of the microscope (see microscope manual, encyclopedia, web sites noted in the Resources section)
- Observe some microorganisms using either videos, CD's, or by looking at prepared slides at microscope work stations. Discuss the amount of magnification being used to view the specimens.

Activity B: Growing Microorganisms

- Select four slices of bread, preferably from a loaf without preservatives (this will speed your mold growth). Give each piece the following treatment and then place the slice into a "treatment labeled " locking plastic bag. Store the bags in warm, dark place for incubation.
- Wipe an unwashed hand (pretend you are smearing on mayonnaise with your entire hand) on both sides of the slice, then place it into a locking plastic bag.
- Lick one slice on both sides, with your tongue.
- Wipe one slice, on both sides, on the floor.
- WASH YOUR HANDS. Place the slice onto a paper towel. Moisten the slice with water from a spray/mist bottle.

Observe the bread for microorganism growth every other day for the next week. (This may take

longer if you are using bread that contains growth inhibitors, preservatives.) Ask students to record their observations. At the end of 2 weeks review the results and make some class conclusions. Most of the growths on the bread will be fungal.

Activity C: Pond Life

Collect protists from local pond water (or other source noted above) by scooping up (use the lid or your hand) the scum and algae on top of the water. Even in midwinter, protists may be scooped up in debris or vegetation on top or on the bottom of the pond.

Fill the jars 2/3 full with the pond water.

Keep the jars in a well-lit area, preferably one that is reached by moderate sunlight. You don 't want the water to get too hot or you'll kill the creatures. Be careful about direct sunlight. Within 24-48 hours, some protists that were scattered through the jar will become concentrated at the top where they may be found more easily and in greater numbers. Others may become concentrated near the bottom of the jar.

Using an eyedropper, suck-up some pond water from the top or the bottom of the jar, place a drop or two on a slide and then cover the drop with coverslip.

Observe the slide, if no protists are found, make more slides.

Ask students to draw what they observed.

Ask students to compare the similarities and differences of organisms they see growing on the bread and the microorganisms in the pond water. Use the Kingdom and Characteristic Charts to aid in the discussion.

Finally, see if they can identify what they saw using their drawing and the identification key.

The jars should be kept for several weeks. The species that are most numerous one day may be absent the next day, replaced by other species. The protozoa which feed on bacteria may be helped by steeping a small amount of grass or alfalfa hay in warm water. The proportion of hay to water should be enough to produce a color similar to strong green tea. Two tablespoons of hay infusion added to a quart jar, or one tablespoon added to a pint jar should be sufficient to revive your protozoa.

Extensions

Activity A: More Observation Possibilities

This activity is a variation on bread media observations. Wash your hands and then slice two potatoes into four pieces. Give each piece the following treatment and then place the slice into a “treatment labeled ” plastic locking bag. Store the bags in a warm dark place for incubation.

1) Dip one potato piece into a 5% solution of chlorine bleach (5ml in 100ml). Remove the piece with sterilized tweezers and place it into a plastic locking bag.

2) Put fingerprints all over another piece, or pass it around the classroom for everyone to touch (unwashed hands).

3) Ask one student to wash hands and then touch a piece on both sides.

4) Wipe one piece on both sides on the floor.

5) Using a variety (use three potato pieces for this) of “antibacterial” wipes, lotion, and/or hand sanitizer, have a student use one product on his/her hands then touch both sides of the potato.

6) Use the last potato piece as a control, no treatment.

Observe the potatoes for microbial growth every other day for the next week. Ask students to record their observations. At the end of 2 weeks review the results and make some class conclusions. Most of the growths on the potatoes will be fungal.

Activity B: More Observation Possibilities

Obtain sterile agar petri plates and carefully label them with name, date, experiment, and any other pertinent identification information. Do not open the lid until you are ready to inoculate (contaminate) the nutrient agar. Expose the petri dish of agar medium to microorganisms by performing

one or more of the following:
a. Sprinkle some yeast on the medium.
b. Using a cotton swab, rub across mold on cheese then rub on the medium in the petri dish.
c. Using an eye dropper, deposit a drop or two of pond water/ditch water onto the medium in the petri dish.
d. Rub your finger (after washing hand thoroughly) on your face and then rub same finger on medium in petri dish (being careful not to tear the surface of the agar).
e. Place strand of hair on the medium in petri dish.
f. Place a fine layer of soil onto the agar.
Seal the petri dishes with clear tape. Place the petri dishes in a drawer (or other warm dark place) overnight and observe the next day and after 3 and 7 days. This is the incubation period. Have students write what they observed on each petri dish on a piece of paper. After incubation, observe the types of microorganisms that have grown on the surface of the plate. Many microorganisms will have formed visible colonies. A colony is a group of microbial cells resulting from the reproduction of one or more cells that were deposited on the medium surface and grew into a visible collection of cells. Discuss with students what took place in the petri dishes. Create a Venn diagram with your student to compare the microorganisms.

Bibliography

This lesson is part of the Sixth Grade Science Teacher Resource Book (TRB3) http://www.usoe.org/curr/science/core/6th/TRB6/. The TRB3 is designed to be your textbook in teaching science curriculum to your students. This book covers all the objectives of each standard and benchmark. If taught efficiently, a student should do well on the End-of-Level (CRT) tests. The TRB3 is designed for teachers who know very little about science, as well as for teachers who have a broad understanding of science.

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