FUN WITH FOMITES

Fomites?! What are fomites? They are inanimate objects that can carry disease-causing organisms. Your cutting board, kitchen sink, and even that pen you keep putting in your mouth are all fomites. But can you do anything to affect the number of organisms on a fomite?

Goal

To investigate strategies for reducing bacteria on object surfaces.

Activity Time

2 45-minute sessions

Time to Get Ready

30 to 120 minutes

What You Need

Have the following for the entire group:

1 sink with running water
1 heat-proof container (optional)
1 stove or hot plate (optional)
1 set oven mitts/pot holders (optional)
1 laboratory refrigerator (optional)
1 set of Easy-Gel™ medium per group or 2.5 g nutrient agar

Have the following for each team of 3:

1 16-oz soft-drink bottle with screw cap
1 unopened box of cotton swabs
9 sterile nutrient petri plates
1 bar of soap
1 roll of paper towels
1 roll of cellophane tape
1 permanent marking pen
3 safety glasses
3 lab coats
disinfectants such as 70% alcohol solution, 10% bleach solution, liquid soap, Lysol®, hot water, household cleaners

Getting Ready

- Prepare disinfectant solution of 70% alcohol for each group by mixing 7 parts alcohol to 3 parts water in a large container. Subdivide the alcohol solution into smaller bottles. If using bleach as a disinfectant, mix 1 part bleach to 9 parts water in a large bucket, milk jug, or 2-L bottle. Subdivide this solution into 16-oz bottles.
- Be sure to use fresh, unopened boxes of cotton swabs for this activity. Commercial cotton swabs are sold sterile. Once the package is opened, microbes may find their way onto the swabs.
- Prepare petri plates as per the instructions on the Easy-Gel™ medium. Without lifting, slide the plates to a safe place where they will not be disturbed. Easy-Gel™ medium may be purchased from Microbiology Laboratories, L.L.C., 206 Lincoln Ave., Goshen, IN, 46526-3219, (219) 533-3351.
- If using another type of nutrient agar, follow the directions on the agar container. If none exist, add 2.5 g nutrient agar to 97.5 mL warm water in a heat-proof container. Place on a hot plate. Stir constantly and bring to a boil. After liquid appears clear, pour approximately 10 mL of agar into each plate. Without lifting, slide the plates to a safe place where they will not be disturbed. Makes 10 plates.
- Two days before the group meets, make a sample plate. Swab a coin with all sides of a cotton swab. Open a petri plate and streak the surface with the end of the swab that touched the coin. Close the plate, label it, and tape it closed. Allow the plate to sit undisturbed at room temperature until the group meeting.
- Be sure to check on the participants' petri plates each day. Some plates look best after 24 hours, others after 48 hours. If microbial colonies are very heavy, place the plate in a plastic bag and store in a laboratory refrigerator until the second session. Remove the plates 30 minutes before the activity is to start.

Useful Information

It is hard to think of anything as sterile. That includes us. At birth, microbes immediately begin colonizing our bodies as they do every object in the world. They float around until they come in contact with a surface that provides food and shelter. Most are harmless, but some are pathogenic or disease-causing. For this reason, we want to control the number of microbes around us. The odds of becoming infected increase with the number of microbes on surrounding objects.

You are most likely to find microbes in and on dark, moist objects in contact with food, dirt, or vegetation. Bathrooms, hair brushes, refrigerators, kitchen sinks, and cutting boards often have lots of microbes. But door knobs and walls have few because they are nutrient-poor and dry. There are many ways to control microbe populations. Public sanitation and good hygiene control microbes before they enter our bodies. Vaccines and antibiotics control them once they enter our bodies.

In order to study microbes, they must be grown. This can be done several ways. One is to grow them on glass or plastic petri plates containing agar and a nutrient medium. Agar is a product made from algae. It solidifies the medium under certain conditions. A medium has the food, vitamins, and salts that help microbes grow. Each microbial cell reproduces to form a colony of millions of cells. We actually can see the colony with the naked eye. The individual cells are far too small to see without magnification. In natural environments, microbial colonies rarely form like those on a petri plate. The concentration and kinds of nutrients in nature are not suited to such extensive growth. The colony's shape, size, and color may indicate the organism that produced the colony.

Suggestions to Modify the Activity for Those Who Are Exceptional

Specific modifications for this activity are found here. For common considerations when modifying activities for exceptional participants, see page V of the **Introduction**.

Blind or Visually Impaired

- Label petri plates 1 to 4 with braille or large print. Notches can be made with dabs of glue to number the plates.
- Refer to the sections **Introducing the Activity** and **Useful Information** for well-defined questions and references for participants with visual impairments.
- Focus group discussions on specific observations, such as those that relate to color, texture, size, and moisture. Individuals who are blind have a good understanding of color and will appreciate the detailed observations. Using our other senses for clarification with observations such as "Agar looks, feels and moves like Jell-O™."

Deaf or Hard-of-Hearing

- See the ***General Modifications*** for *Blind or Visually Impaired* listed in the **Introduction**, page V.

Mobility Impaired

- See the ***General Modifications*** for *Mobility Impaired* listed in the **Introduction**, page V.

Physically Impaired

- See the ***General Modifications*** for *Physically Impaired* listed in the **Introduction**, page V.

Cognitively Impaired

- See the ***General Modifications*** for *Cognitively Impaired* listed in the **Introduction**, page V.

For More Information

AskERIC Lesson Plan: Bacteria. *http://ericir.syr.edu/Virtual/Lessons/Science/Biological/BIO0007.html.* This site is created as an online resource for Newton's Apple, a national science program. It provides lesson plans for teachers on various topics of biology.

Blair, B. & Bowen, W. (1996). Microbiology: It need not involve great expense & effort. *The American Biology Teacher, 58*(7), 418-419.

Germ free products. (September 9, 1997). *Japan now*, 3-4.

Glausiusz, J. (1997). The good bugs on our tongues. *Discover, 18*(10), 32-33.

Microwave your dishcloth to kill harmful germs. (October 15, 1997). *Times Community Newspapers*, 11.

Molasses recruits bacteria for cleanup. (1996). *Science News, 150*(19), 301.

Seppa, N. (1997). Salmonella plays the good-guy role. *Science News, 152*(20), 319.

Strauss, E. (1997). Mob action. *Science News, 152*(8), 124-125.

Winik, L.W. (February 8, 1998). Before the next epidemic strikes. *Parade Magazine*, 6-9.

How to Start the Activity

- Show a coin to the participants. Pass it among them. Ask them if they see anything on the coin and if it looks dirty. Show the participants the petri plate that you streaked from the coin. Explain that microbes collected from the coin multiplied in the plate to create the colonies they see now.
- Explain that a fomite is an inanimate object that can carry disease-causing organisms. Have the participants brainstorm about where fomites are in the room, i.e., sink, water fountain, table top, pens, pencils, keyboards.
- Have them rank the fomites from those likely to have the most to those likely to have the least microbe populations. Rank them again from those predicted to respond best to disinfecting to those predicted to respond least to disinfecting.

Let's Make a Hypothesis

Discuss the following questions to help guide the participants to make hypotheses.

- How could you show that objects other than a coin have microbes on them?
- If you clean an object, what do you think would happen to the number and kinds of microbes on it?
- What is the best way to clean things?
- How would you design an experiment to show that you have reduced the microbes on an object?

What the Data Mean

Generally, the successive streaks on the petri dish will have increasingly fewer bacterial colonies on them for both the clean and unclean surfaces. However, the streaks from the cleaned surfaces should show less bacterial growth.

FUN WITH FOMITES

Questions to Think About

We're always cleaning things and washing our hands. Usually, it doesn't even look like we're washing away anything. Why do we clean things? What types of things support the greatest amount of microbial growth? What is the best way to get rid of microbial growth? How can you find answers to these questions?

Safety Notes

- Food, drinks, and gum are not allowed.
- Wash hands before and after each session.
- Hair should be tied back to minimize contamination of sterile materials.
- If water containing microbes is spilled onto a person, wash with soap and water. If spilled onto equipment, swab with disinfectant and paper towels.
- DO NOT allow participants to collect microbes from their bodies. There is a small but present risk of collecting a microbe than can cause illness. Growing such a microbe in large numbers on a petri plate can be a risk.
- After microbes are placed on the petri plates, the plates MUST be taped shut. After the final session, kill all microbes on the petri plates by flooding each with bleach. Soak for an hour and place the plates in a plastic bag. Throw in the trash.
- When working with alcohol or bleach, use safety glasses and lab coats.
- When working with bleach or bleach solutions, BE CAREFUL not to spill it on yourself or clothing. Flush spills with liberal amounts of water.
- When in doubt about the presence of microbes, sterilize equipment by boiling for 20 minutes or by flooding with alcohol.

What to Do

Day 1 of the activity

1. Fomites are inanimate objects that can carry disease-causing organisms. Your cutting board, kitchen sink, and even your pen are all fomites. In this activity, you will look at microbes from fomites. Then you will check for microbes again after disinfecting the area. Wash your hands. Clean your work area by dabbing, not pouring, disinfectant solution onto a paper towel and swabbing your area.

2. Choose an object in the room and swab it with all sides of a cotton swab by turning and twisting the swab as you move it across the object's surface. See Figure 1. Swabbing a coin. Open the lid of a petri plate, and GENTLY make four streaks on the plate's surface as shown in Figure 2. Use firm, but GENTLE pressure and do not retrace your previous streaks. Your streaks should make only very slight impressions in the agar. Close the plate. Label it with the objects' name, your initials, and the numbers 1 to 4 next to each of the streaks in the order that they were made. Without covering the plate's surface, seal it with two pieces of tape.

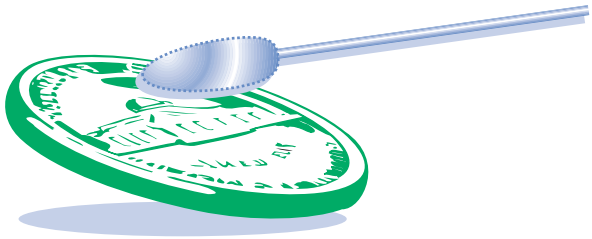

Figure 1. Swabbing a coin.

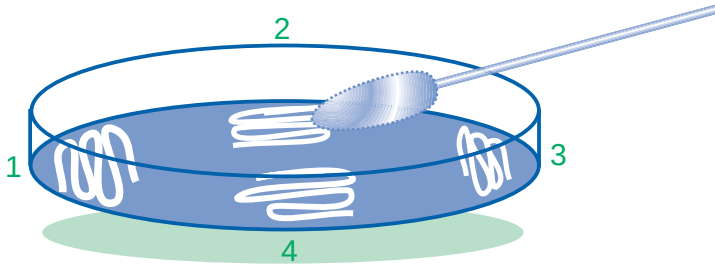

Figure 2. Streaking technique for petri plates. Make 4 separate streaks.

3. Clean half of the object you swabbed with water. Using the same process, re-swab the cleaned area for microbes. Open the lid of a new petri plate and GENTLY make 4 streaks on the plate's surface with the end of the swab that touched the object as you did previously. Close the plate. Label it with the object's name, control, your initials, and the numbers 1 to 4 in the order that the streaks were made. Seal the plate with tape.

4. Use one of the disinfectants to clean the other half of the object you swabbed. Using the same process, re-swab the area for microbes. Open the lid of a new petri plate, and GENTLY make 4 streaks on the plate's surface with the end of the swab that touched the object as you did previously. Close the plate. Label it with the object's name, the disinfectant you used, your initials, and the numbers 1 to 4 in the order that the streaks were made. Seal the plate with tape.

5. Soak the cotton swabs in disinfectant. Throw the cotton swabs in the trash at the end of the activity. Give the petri plates to your facilitator to incubate at room temperature until the next session. Clean your work area with disinfectant solution. Wash your hands.

Day 2 or 3 of the activity

6. Get your initial petri plate from your facilitator. Do not open it. What do you observe? Which streaks have more microbes? Do you see a pattern in the amount of microbes in each streak? At what point were there too few microbes to grow a colony on your plate?

7. Get your other petri plates from your facilitator. Do not open them. What do you observe? How do the streaks compare to those in your first plate? Construct a table that compares the plates from your group before and after cleaning the objects. Be sure to indicate whether microbes grew in each streak.

8. Return the petri plates to your facilitator. Clean your work area with disinfectant solution. Wash your hands.

9. Compare your results with those of other groups. What questions come from your results? To what other topics is this activity related? How does this activity relate to your life? How does cleaning influence the populations of microbes? Could your lab technique have affected your results?

10. How can you learn more about microbes? What factors could you change to alter microbial populations? Could you design an experiment to test a new hypothesis? What would you use for a control? What procedure would you use? How many variables would you include? How many trials would you include? Could you show your results on a graph?

What Did You Find Out By Doing the Activity?

Before doing "Fun with Fomites," did you know:

- how people get diseases?
- what microbes need to survive on surfaces?
- how microbes go from one object to another?
- any products that can be used to reduce or eliminate harmful microbes from surfaces?

From this activity, did you discover:

- how microbes can multiply?
- how diseases can be caused by harmful microbes on surfaces?
- how effective products are at disinfecting?
- what happens if harmful microbes become resistant to disinfectants?
- some objects in your house that could be choice surfaces for harmful microbes?
- how to reduce the number of harmful microbes?