

# Welcome to the **MICROBESWORLD** **ACTIVITIES**

## Background of the development of the *MicrobeWorld Activities*

The *MicrobeWorld Activities* is the product of the Community Outreach Initiative of the Microbial Literacy Collaborative (MLC) and was made possible by generous funding provided by the National Science Foundation with additional funding by the Department of Energy and The Foundation for Microbiology. The MLC is an initiative of the American Society for Microbiology (ASM) to educate the public about the positive aspects of microbes and has three initiatives: Community Outreach, Public Outreach, and Education. The Community Outreach Initiative is related directly to the Public Outreach Initiative which is the four-part video series *Intimate Strangers: Unseen Life on Earth* produced by Baker & Simon Associates in association with Oregon Public Broadcasting. The series focuses on both the positive and negative aspects of microbes and addresses four major areas—evolution, environment, disease, and biotechnology. These issues are further explored in the Education Initiative's distance learning course and textbook and ancillary materials developed for undergraduate education.

The goal of the MLC is to present a more balanced view of microbes, educating the public about their positive aspects as well as their role in disease. The deadly and frightening aspects of microbes have been highly publicized, but the crucial role they play in our daily lives has not been emphasized, especially with the general public. The *MicrobeWorld Activities* complements the four-part video series *Intimate Strangers: Unseen Life on Earth* and is designed so that a science background is not required to implement the activities. All the activities have been field-tested nationally in diverse community outreach audiences, such as church groups, PTO's, Boy and Girl Scouts, 4-H groups, and science and museum centers. The activities have been welcomed for their simplicity, ease of understanding and implementation, and their low-cost, easily found equipment and materials. The use of familiar items from dollar and grocery stores adds to the user-friendly aspect of the activities. The activities are written at the sixth to eighth grade level, but they are easily modified for audiences of all ages.

In addition to developing, writing, and publishing the *MicrobeWorld Activities*, the National Association of Biology Teachers (NABT) has conducted three summer youth leadership training institutes. These institutes provided training and additional background to youth for implementing the activities in their home communities. In the summer of 1998, NABT partnered with ASM and the Association for Science-Technology Centers Incorporated, the Science Museum of Minnesota, and the University of Minnesota, St. Paul to conduct a national training institute for youth from science and museum centers nationwide. In 1999, NABT partnered with ASM and the American Association for the Advancement of Science and The George Washington University to conduct a national and a local institute in Washington, DC. The 37 teams of youth leaders and their adult sponsors from these institutes have implemented the activities in their home communities with groups, such as 4-H, Boy and Girl Scouts, Boys and Girls Clubs, church groups, PTO's, and science and museum centers.

## How the *MicrobeWorld Activities* are set up

Each activity begins with an introductory statement to pique interest and is divided into facilitator and participant pages. The **Facilitator Page** is intended for use by the person presenting the activity. The participant page is intended to be copied and distributed to the participants to use as a guide while doing the activity. The **Facilitator Page** has the following sections:

- **Goal** describes the expected participant outcome.
- **Activity Time** indicates the approximate time to do the activity with participants.
- **Time to Get Ready** indicates the time needed to prepare materials for the activity.
- **What You Need** lists equipment and materials needed for each team of participants.

- **Getting Ready** provides information and tips to prepare to implement the activity.
- **Useful Information** provides easily understood background information about the concepts presented.
- **Suggestions to Modify the Activity for Those Who Are Exceptional** contains information about how to modify the activity for exceptional participants.
- **For More Information** identifies references and readings for further understanding of the information presented.
- **How to Start the Activity** provides suggested ways to introduce the activity to participants, such as demonstrations, discrepant events, and leading questions to stimulate participant interest.
- **Let's Make a Hypothesis** includes questions for discussion that guide the participants as they make hypotheses.
- **What the Data Mean** shows sample data and provides an explanation of the data.

The **Participant Page** has the following sections:

- **Questions to Think About** is an introductory paragraph to guide participants' thinking about the concepts presented in the activity.
- **Safety Notes** provides information and tips for conducting the activity safely.
- **What to Do** is a list of steps for setting up the activity followed by ways to design an investigation resulting from the activity.
- **What Did You Find Out By Doing the Activity?** allows participants to assess their understanding of the concepts before and after doing the activity.

In addition, participants and facilitators are encouraged to access the MLC web site [www.microbeworld.org](http://www.microbeworld.org) to share what they have learned while doing the activity and contact one of the MicrobeMentors with questions or ideas about the activities. The MicrobeWorld Mentors are the youth leaders who participated in the summer training institutes held at the University of Minnesota in St. Paul, MN and The George Washington University and the American Association for Advancement of Science in Washington, DC.

## General considerations for modifying the *MicrobeWorld Activities* for those who are exceptional

In all community outreach efforts to educate the public about microbes, it is essential to accommodate all learning needs where possible. The AAAS *Barrier-Free in Brief* series is an excellent source of information on science/mathematics learning and disability. The four-booklet series is unique, succinct, and reliable. Some of these booklets have addresses of agencies that can provide information about obtaining assistive technology, such as Assistive Listening Devices (ALDs); light probes; and talking thermometers, calculators, and clocks. Anyone or all of the booklets are available FREE from AAAS; Project on Science, Technology, and Disability; 1333 H Street, NW; Washington, DC 20008; (202) 326-6630 (V/TDD); (202) 371-9849 (FAX); [bgoodric@aaas.org](mailto:bgoodric@aaas.org) (E-mail). The following are general modifications that may be used with all of the activities contained within the *MicrobeWorld Activities*. In addition, each activity contained within this guide provides activity-specific suggestions under the heading entitled **Suggestions to Modify the Activity for Those Who Are Exceptional**.

### **Blind or Visually Impaired**

- Produce directions and handouts in large print or braille depending upon the individual participant's language needs. Participants may have access to a braillewriter or will be able to advise the facilitator what font size to use for large print. Eighteen point is recommended usually. Tape-recorded instructions will allow the participant to do the activity independently.
- Use small pieces of tape or dabs of glue to mark measurements on equipment, such as rulers, beakers, and graduated cylinders. This will benefit the participant who does not have access to a braillewriter.
- Place objects for each group in identical areas that are marked clearly with braille or large print. If marking the areas is not feasible, repeat the placement of station areas for each session. This will allow the facilitator to provide consistent, organized steps that will provide a better understanding of the activity's purpose.

- Use different grades of sandpaper, textured tape, and/or yarn to make raised images of diagrams discussed in the activity to emphasize the concept presented.
- Record data and observations on a tape recorder for development of graphs.
- Use available technology to develop graphs. The graphs may be made with materials such as pegs and pegboard for a line graph or with educational counters called cubed manipulatives for a bar graph. Input from group discussions may be transcribed into braille by using a Swail Dot Inverter or done in large print on a computer with voice output.

#### **Deaf or Hard-of-Hearing**

- Discuss language requirements and the language of new concepts with participants. This is also a good time for the interpreter to develop appropriate signs for the new concepts that are introduced to the participant. Although an independent choice, sitting in the front of any discussion area would be beneficial for individuals who depend on lip reading or use a sign language interpreter.
- Emphasize any visuals or hands-on aspects of the activity.
- Keep diagrams that relate to the activity visible at all times to allow for easy reference to any orally missed concepts.

#### **Mobility Impaired**

- Note all the areas where the activity requires group meetings to make certain that there is adequate space at and around the activity area. The circulation route to and from the activity should be no less than 1 meter (36 inches) wide. The turn around space should have a diameter of 1.6 meters (60 inches).
- Provide easy access to all materials and equipment at all workstations. Objects should be within arm's length. If objects are in cupboards and not accessible, collect and prepare the supplies before the activity.
- Provide the participant with a knee space that is 0.7 meters (27 inches) high, 0.8 meters (30 inches) wide, and 0.5 meters (19 inches) deep. The work surface should be 0.75 to 0.9 meters (28 to 34 inches) above the floor.
- Provide an observation area with adequate seating and at a height of 1 meter (36 inches) for comfortable and accessible viewing.

#### **Physically Impaired**

- Ask the participant to describe his abilities before the activity to provide an understanding of what can be done independently and without adaptations.
- Use beans for counting. Their larger size is easier to count and manipulate.
- Adapt measuring instruments for gross and fine motor skills, as necessary. If instruments with handles make it difficult to transfer the liquid or soil, locate an equivalent without a handle. Wrapping an elastic band around the measuring device will give the participant a better grasp. Communicate with the participant regarding the best way to adapt equipment.
- Provide an observation area that has adequate seating with a height of 1 meter (36 inches) for comfortable and accessible viewing.
- Provide loop-handled scissors for individuals with low hand dexterity. The scissors have a loop that allows for an easier grip instead of finger rings found on regular scissors and have "stoppers" that prevent the hand from slipping onto the blade. They are readily available at any school supply store.

#### **Cognitively Impaired**

- Communicate with all team members involved.
- Accommodate the five senses.

## **How the *MicrobeWorld* Activities address assessment and standards**

Today, accountability is a function of informal, as well as formal education. Assessment of what is learned and standards for that learning provide accountability for the processes and content of each learning environment. The *MicrobeWorld* Activities seek to educate the public on what a microbe is and the importance of microbes in our daily lives. In addition, the activities seek to involve the community outreach participants in what an experiment is, how to design an experiment, and how to ask good questions. Each activity has a section entitled **What Did You Find Out By Doing the Activity?** This section contains an activity-specific checklist that assesses the participant's understanding of the

## **How the *MicrobeWorld* Activities relate to the *Intimate Strangers* video series**

The *MicrobeWorld* Activities complement the *Intimate Strangers* video series. The following chart shows the relationship between the series content and the goals of the *MicrobeWorld* Activities.

<b><i>Intimate Strangers:</i> <i>Unseen Life on Earth</i></b>	<b><i>MicrobeWorld</i> Activities</b>
<b>Program One: The Tree of Life</b> As scientists map the human genome, they find the ancient DNA of microbes at the roots of our family tree. This hour follows the quest of scientists to understand how all life on the planet is related. 	<b>Creepy Critters</b> To develop a classification scheme based on the structural features of organisms and then use the scheme to classify newly discovered organisms. <b>Forever and a Day</b> To introduce geological history and a few of the major events that occurred during the Earth's 5 billion years. <b>Mega Multiples of Microbes</b> To visualize large numbers and calculate microbial population growth. <b>Natural Selection</b> To demonstrate that natural selection results in populations different from the original.
<b>Program Two: Keepers of the Biosphere</b> Microbes drive the chemistry of life. They affect the global climate. They do most of the recycling that keeps the world habitable. This hour follows scientists who are exploring our reliance on this invisible world. 	<b>Biosphere in a Bottle</b> To investigate microbes that exist in a column of mud and the role of light in their survival. <b>Bread Box Nightmares</b> To investigate the factors needed for fungi to grow and develop. <b>Can Microbes Tell the Difference?</b> To compare the energy content of various sweeteners by measuring yeast's production of carbon dioxide when using sweeteners as food. <b>Nature's Trash Compactors</b> To observe microorganisms and macroorganisms that contribute to decomposition and determine factors important in decomposition. <b>Now You See it, Now You Don't</b> To investigate the process by which commercial packing peanuts biodegrade.
<b>Program Three: Dangerous Friends and Friendly Enemies</b> Infectious diseases occur when our relationship with microbes changes or when an intruder invades. This hour follows scientists who seek to understand our most personal relationships with this invisible world. 	<b>Caught Red-Handed</b> To evaluate the effectiveness of different hand-washing times, techniques, and materials in reducing the number of microbes. <b>Defend Your Surface</b> To design and test a surface that prevents harmless microbes from sticking to it. <b>Let's Get Small</b> To develop an understanding of the comparative sizes of microbial life, including viruses, protozoa, bacteria, and very small parts of the human body. <b>The Yeast of Our Worries</b> To investigate strategies for reducing microbial growth.
<b>Program Four: Creators of the Future</b> The 21st century challenges us to reclaim our damaged environment and feed a growing population. This hour introduces scientists who are turning to microbes for solutions. 	<b>Cabbage Today, Sauerkraut Soon</b> To demonstrate how bacteria naturally present on cabbage can change it into the common, fermented food sauerkraut. <b>Fun with Fomites</b> To investigate strategies for reducing bacteria on object surfaces. <b>Puddles</b> To discover the abundance and diversity of microbial communities in puddles. <b>Yeast on the Rise</b> To investigate variables that affect the energy and carbon dioxide production of yeast in bread dough.

activity. Each checklist contains questions about what the participant understood about microbes before and after doing the activity. The questions relate to not only the content, but also to what and how information was discovered in the activity and how that information is relevant and applicable to daily life. Two general questions that may be used for assessment for each activity are:

1. Was the activity easy to do and understand?
2. Did your awareness of microorganisms increase as a result of doing this activity?

The activities have been aligned with the *National Science Education Standards (NSES)* developed by the National Research Council and *New Standards™ Student Performance Standards* developed by the National Center on Education and the Economy. Each set of standards has been placed in a matrix. A check mark indicates which activity is aligned with which standard of each document.