



Microorganisms Safety Guide

Bacteria are ubiquitous, and live within the human gut, and in every corner of our environment. We come in contact with bacteria on a daily basis. Hand washing is 99.9% effective at decontaminating us from bacteria that might reside on the skin. Therefore, when the proper safety precautions are taken, colonies of microorganisms can be safely isolated from homes, yards, gardens, etc. The majority of microorganisms are non-pathogenic, but bacterial cultures or petri plates that contain any type of bacterial colonies should be treated with general safety precautions.

Here are [Nine Safe Practices for the Microbiology Laboratory](http://www.carolina.com/teacher-resources/Interactive/nine-safe-practices-for-the-microbiology-lab/tr11085.tr) (<http://www.carolina.com/teacher-resources/Interactive/nine-safe-practices-for-the-microbiology-lab/tr11085.tr>) that you should follow when working with microorganisms (James, 2008):

1. **Treat all microorganisms as potential pathogens.** While the majority of microorganisms are not pathogenic to humans and have never been shown to cause illness, under unusual circumstances a few microorganisms that are not normally pathogenic can act as pathogens. Treat all microorganisms—especially unknown cultures—as if they were pathogenic. A student who has a compromised immune system or has had a recent extended illness should talk with his or her instructor before working in the microbiology laboratory.
2. **Sterilize equipment and materials.** All materials, media, tubes, plates, loops, needles, pipettes, and other items used for culturing microorganisms should be sterilized by autoclaving. Otherwise, use commercially sterilized products. Understand the operation and safe use of all equipment and materials needed for the laboratory.
3. **Disinfect work areas before and after use.** Use a disinfectant, such as a 10% bleach or 70% ethanol solution, to wipe down benches and work areas both before and after working with cultures. Also be aware of the possible dangers of the disinfectant, as 70% ethanol can catch fire around open flame or high heat sources. Bleach, if spilled, can ruin your clothing. Either alcohol or bleach can be dangerous if splashed in the eyes. You should know where the nearest eyewash station and sink are located.
4. **Wash your hands.** Use a disinfectant soap to wash your hands before and after working with microorganisms. Non-disinfectant soap will remove surface bacteria and can be used if disinfectant soap is not available. Gloves may be worn as extra protection.
5. **Never pipette by mouth.** Use pipette bulbs or pipetting devices for the aspiration and dispensing of liquid cultures.
6. **Do not eat or drink in the lab, nor store food in areas where microorganisms are stored.** Never eat or drink in the laboratory while working with microorganisms. Keep your fingers out of your mouth, and wash your hands before and after the laboratory activity. Cover any cuts on your hands with a bandage. Gloves may be worn as extra protection.
7. **Label everything clearly.** All cultures, chemicals, disinfectants, and media should be clearly and securely labeled with their names and dates. If they are hazardous, label them with proper warning and hazard information.
8. **Autoclave or disinfect all waste material.** All items to be discarded after a class, such as culture tubes, culture plates, swabs, toothpicks, wipes, disposable transfer needles, and gloves, should be placed in a biohazard autoclave bag and autoclaved 30 to 40 minutes at 121° C at 20 pounds of pressure. If no autoclave is available and you are not working with pathogens, the materials can be covered with a 10% bleach solution and allowed to soak for at least 1 to 2 hours.
9. **Clean up spills with care.** Cover any spills or broken culture tubes with a 70% ethanol or 10% bleach solution; then cover with paper towels. After allowing the spill to sit with the disinfectant for a short time, carefully clean up and place the materials in a biohazard autoclave bag to be autoclaved. Wash the area again with disinfectant. Never pick up glass fragments with your fingers or stick your fingers into the culture itself; instead, use a brush and dustpan. If working with animal or plant pathogens, keep the area clear and notify your instructor.

General Lab Safety

Culturing microorganisms is a popular science project, but you should be aware that there are many potential hazards when working with microorganisms. Potential safety hazards can be avoided with the appropriate precautions. As with other types of experiments, when working with microbiological agents you will need to be aware of standard laboratory safety procedures, protective wear, and chemical safety.

Safety in the lab is everyone's responsibility. Before starting any experiment, you should understand the entire procedure that you will be following. You need to make sure that you have the proper equipment, and that you know how to use it. When you are trying an unfamiliar procedure for the first time, it is a good idea to practice at least one "dry run" without your solutions. That way, you can make sure that you have all the materials you will need at hand, and that your workflow will proceed smoothly. You will greatly reduce the risk of an accident by carefully planning ahead.

Note on Clean-up and Disposal

When you are completely done with your experiment, you will need to decontaminate any plates you used. More than likely, you will not have access to an autoclave for sterilization. Another way to decontaminate your experimental materials is to use disinfectants. The best disinfectant is household bleach at 10% strength. You can make a 10% bleach solution by mixing one part of regular laundry bleach (e.g. Clorox®) with 9 parts of water. Other general common household cleaning reagents are also effective at decontaminating bacteria, and can be used. Decontaminate plates by carefully opening, and pouring a generous amount of disinfectant (i.e., 10% bleach) onto the agar surface. Leave the plates to soak for at least an hour. The sterilized, decontaminated plates, can then be disposed of in your regular household garbage, but ONLY after sterilization, as described, is complete.

A Special Case: Projects Involving Unknown Microorganisms

Another category of concern is studies involving unknown microorganisms. In science fair projects, these studies typically involve collecting and culturing microorganisms from the environment (e.g. household surfaces, skin, soil). These studies present a challenge because the identity, concentration, and pathogenicity of the cultured agents are unknown. Research with unknown microorganisms can be treated as a low-risk study under the following conditions:

1. "The organism is cultured in a plastic petri dish (or other standard non-breakable container) and sealed. Other acceptable containment apparatus include Petrifilm™ and doubled heavy duty (2-ply) sealed bags.
2. The experiment involves only procedures in which the petri dish remains sealed throughout the experiment (e.g. counting presence of organisms or colonies).
3. The sealed petri dish is disposed of in the appropriate manner under the supervision of the designated supervisor." (Science Service, 2006)

If a culture of an unknown organism is opened for identification, sub-culturing, or isolation, it must be treated as a moderate-risk study and be carried out in a professional research setting under the supervision of a competent scientist who understands the risks associated with working with the microorganisms involved.

Microbiology Safety Resources

As a responsible scientist, you should understand the properties of every chemical that you use in the lab and in your experiment. We encourage you to research safety issues BEFORE doing your experiment! Here are some great safety resources:

- James, Daniel E., 2008. [Nine Safe Practices for the Microbiology Laboratory](http://www.carolina.com/teacher-resources/Interactive/nine-safe-practices-for-the-microbiology-lab/tr11085.tr) (http://www.carolina.com/teacher-resources/Interactive/nine-safe-practices-for-the-microbiology-lab/tr11085.tr) Carolina Biological Supply, Burlington, NC.
- SGM, 2002. [Microbiology On-line: Safety](http://www.microbiologyonline.org.uk/teachers/safety-information) (http://www.microbiologyonline.org.uk/teachers/safety-information), Society for General Microbiology (SGM), UK.
- CDC, 2007. [Biosafety in Microbiological and Biomedical Laboratories \(BMBL\) 5th Edition](http://www.cdc.gov/biosafety/publications/bmb15/) (http://www.cdc.gov/biosafety/publications/bmb15/), Centers for Disease Control and Prevention, Office of Health and Safety (CDC).

Credits

Source

Science Service. (2006). *ISEF rules: Potentially hazardous biological agents*. Retrieved October 30, 2006, from Science Service: <http://www.societyforscience.org/Page.aspx?pid=319> (http://www.societyforscience.org/Page.aspx?pid=319)

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