Every instructor of microbiology must be concerned about laboratory safety. This is because the microbiology laboratory represents a unique environment in which accidents can and do occur. In general the hazards associated with a microbiology laboratory fall into the following categories: (1) laboratory acquired infections, (2) chemical, (3) laboratory equipment, (4) fire, and (5) handling of animals.

Laboratory Acquired Infections

This represents perhaps the greatest hazard to those working in the microbiology laboratory. Students may come into contact with potentially dangerous pathogenic agents. When working with infectious agents or biologicals (blood, urine, etc.) the following regulations should be strictly adhered to:

1. At the start and end of each laboratory session, each student must clean their assigned bench-top area with a disinfectant solution.

2. No direct mouth pipetting. Always use a rubber bulb or automatic pipettor.

3. Wear a laboratory coat, gloves, etc., when working with biological specimens to avoid skin contact.

4. If you have cuts or abrasions on the skin of your hands, cover with bandages and wear rubber gloves.

5. Do not eat, drink or smoke in the laboratory.

6. To avoid infection keep fingers, pencils and such out of your mouth.

7. Disinfect immediately all biological spills with disinfectant solution.

8. Always flame the inoculation needle or loop before setting it down.

9. Hot inoculation needles or loops should never be plunged into specimens or cultures. This may create a dangerous aerosol. Always cool inoculation loops by holding them in the air for 10 to 15 seconds or by touching portions of uninoculated media.

10. Always sterilize all discards.

11. Place test tube racks with cultures and other materials away from the edges of the work bench.

12. Do not place coats, hats or other personal articles on the work bench surface. They should be kept in lockers or on coat hangers.

13. Always wash your hands before leaving the lab and whenever you spill culture or unknown material on them.

14. Microorganisms in wet mounts or hanging-drop preparations are still alive and should be placed in a disinfectant tray.

Chemical Hazards

The most common dangers from chemicals are skin burns, fires, explosions and toxic fumes. Splattering of dangerous chemicals can easily cause extensive damage to vital organs such as the eyes or skin as well as clothing. To avoid these dangers the following precautions should be followed:

1. Store all flammable solvents in a safety cabinet. Keep open flames such as that of a bunsen burner away from the cabinet.

2. Never pipet strong acids, caustic
materials or strong oxidizing agents by mouth.

3. Wear protective eye glasses when working with caustic chemicals.

4. Use the laboratory hood when working with chemicals that generate odoriferous, corrosive or toxic fumes.

5. If a chemical is spilled, clean it up immediately.

6. Know the location of the safety shower and how to use it.

7. Slowly pour acids into water. Water should never be added to acids because it will quickly generate heat.

8. Read warning labels on reagent bottles.

9. Keep bunsen burners and hot plates away from flammable liquids.

10. Never grasp reagent bottles by the neck. Instead hold it securely in both hands around the bottom.

11. When pouring reagents into a drain, always flush with a large amount of water.

Laboratory Equipment

With an increase in equipment usage seen in the microbiological laboratory, students are being exposed to a greater degree of electrical and mechanical hazards. Basically there are two types of electrical injuries. They are (1) electrical shock and (2) electrical burns.

Students must also learn to use laboratory equipment in such a manner as to avoid accidental infections. This can occur when using such instruments as a blender, centrifuge or hypodermic syringe where infectious aerosols can be set up. The following procedure should be followed to avoid or minimize accidents due to laboratory equipment:

1. Properly ground all electrical equipment and check grounding every six months.

2. Before centrifuging carefully inspect all glass centrifuge tubes for cracks. If any are found discard them. If a tube should break while centrifuging, stop the machine, carefully remove all pieces of broken glass from the rubber cushion and disinfect the area.

3. Never pick up broken glassware with your bare hands. First disinfect and then use janitorial equipment to clean up the area.

4. Always stand to one side when opening the door of an autoclave. Some residual steam may still be in the instrument and it may cause a skin burn.

5. Always wear rubber gloves when removing broken ampoules or tubes from a deep-freeze.

6. Never touch electrical equipment with wet hands.

7. Special precautions should be taken when using the hypodermic needle and syringe. Some areas in which accidents may occur are: (1) separation of the needle from the syringe during injection, (2) accidentally injecting oneself, and (3) aerosols can form when the needle is withdrawn from a vial.

8. Keep hands, necklaces, ties, etc., away from moving parts of equipment.

9. If spillage occurs on electrical equipment, immediately turn off the instrument and dry it. Disinfect if needed.

10. Never touch a person receiving an electric shock! First turn off the circuit breaker and only then give aid.

11. If electric cords or equipment starts to sizzle, crackle, or smoke when turned on, immediately unplug the instrument.
12. Know where the circuit breakers are located in the laboratory.

13. Mix broth cultures in such a manner as to avoid wetting the plug or cap.

14. Keep all flammable liquids away from electrical contacts.

15. Before using an autoclave carefully examine pressure gauges, safety relief valve and discharge line.

**Fire Hazard**

Preservation of human life is the first priority in cases of fire. Procedures such as the following for the handling of fires should be established and practice drills carried out.

1. Know where fire extinguishers, fire blanket and sand bucket are located and how to use them.

2. Check all fire equipment and test it at regularly scheduled intervals.

3. Know where the alarm systems are in the building.

4. In case of fire evaluate the situation quickly. If you can put it out readily and easily, do so. Otherwise sound the alarm system.

**Laboratory Animals**

Proper methods should be followed when working with animals in the laboratory. Improper procedures can result in pain to the animals as well as bites and puncture wounds to the handlers. Always adhere to the following procedures:

1. Devices for holding animals are available and should be used.

2. Always wear gloves when handling animals.

3. Use animal cages designed to minimize exposure to both animals and students.

4. Immediately treat all puncture wounds. This type of injury may be relatively painless, but microorganisms can be introduced into the body via the animal's saliva or from the surface of its skin.

**Conclusion**

Educators have the responsibility to warn students of the dangers that may exist in a microbiology laboratory. By adopting these procedures and presenting them in the form of a "Laboratory Safety Manual" the instructor informs students of these hazards and hopefully thereby a reduction in such accidents will occur. It is suggested that each student should be required to read the safety manual and pass an examination over its contents.

The responsibility on the part of the instructor does not end with the teaching or enforcement of safety procedures. He or she must serve as a role model, to protect both present and future students from illness, injury and even death.

**References**


Editor's Note: I hope the publication of this article marks the beginning of a series on safety in the biological laboratory. I look forward to receiving additional articles on animal care, hazardous waste disposal, radiation safety, and handling of toxic materials.