

## LABORATORY SAFETY GUIDELINES

### 1. Policy For Appropriate Biology Laboratory Usage

It is important for everyone to realize that there is attached responsibility to the Instructor including the students, every time they use the Biology laboratory room during class and experiment sessions.

Biology Laboratory Guidelines and Policies for Students: In using the Biology laboratory facilities, the student:

1. Must follow rules on the use of the laboratory room such as the prohibition of drinking, eating or smoking in the laboratory room.
2. Must not perform any unauthorized experiments.
3. Must conserve gas, water and materials of any kind used in the laboratory.
4. Must observe proper disposal of solid waste and chemical waste used in the experiment.
  - a. The solids must be disposed of by placing them in waste cans, unless they are readily soluble in water.
  - b. The gutter must be used for the disposal of water only.
  - c. Small amounts of corrosive flammable liquids may be flushed down the sink with plenty of water. Larger amounts of such solvent should not be poured off in the sink.
  - d. Table or floor spilled with acids or bases must be washed immediately with plenty of water.
5. Agrees to be careful in handling laboratory apparatuses and equipment.
6. Must be cautious in performing experiments and in handling chemicals. The student must observe the following precautions in performing experiments and in dealing with chemicals:
  - a. Always wear a laboratory gown and goggles when performing experiments.
  - b. Avoid inhaling fumes of any kind. Use a well-ventilated hood if heavy or toxic vapors are being produced.
  - c. Never taste chemicals unless directed by the instructor.
  - d. Do not use mouth suction in filling up pipettes with chemical reagents.
  - e. Use spatula for solid reagents; do not handle them with bare hands.
  - f. Handle concentrated acids with care; avoid spilling them on clothing or any part of the body, especially the eyes. If this should happen, wash the affected area with plenty of water and report it to your instructor.
  - g. Always pour concentrated acid into water. Never pour water into acids.
7. Agrees not to work alone in the laboratory.
8. Informs the instructor of any problems occurring with the use of the equipment.
9. Must turn off water and gas supply and make sure that the working area is clean before leaving the laboratory room.
10. Understands that violation of the abovementioned conditions is subject to corresponding sanctions by the appropriate authorities. Accidents due to negligence of students shall be the sole responsibility of the students concerned.
11. Agrees that the above conditions shall remain for as long as enrolled student uses the Biology facilities.

Biology Laboratory Guidelines and Policies for Instructors:

1. In using the Biology laboratory facilities, the Instructor must follow the following guidelines and policies: When the laboratory is used for instructional/laboratory purposes, the Instructor is responsible for the supervision and conduct of the students during the entire class or laboratory period. During the assigned time, only the enrolled students for the subject should be in the room. The Instructor has the authority to send out anyone who is not a member of

the class.

2. The following becomes the added function of the Instructor during the conduct of
  - The Instructor is responsible for the efficient functioning of the laboratory during regular student usage

- The Instructor should report all defective apparatuses/equipment which were issued before the conduct of laboratory experiments or activities.
- The Instructor is responsible for securing the laboratory when leaving. The entrance and exit to the laboratory must be locked and secured when the laboratory is vacated.
- The Instructor assigned for the scheduled time needs to be present before the students are allowed to enter the laboratory room.
- The Instructor is responsible for maintaining the equipment in the laboratory during the experiment session by reporting problems to the laboratory in-charge.
- The Instructor sees to it that the laboratory and workstations must be left tidy for the next users.

## **II. Basic Rules in the Biology Laboratory Cleanliness, Orderliness and Discipline**

1. Before Experiment:
  - a. Wear your laboratory gown.
  - b. Clean your working area/table, sink, and floor.
  - c. Arrange all stools.
  - d. Set all your personal belongings on the shelves under the working tables.
    - No other things should be placed on top of the working table except when those materials are needed in the experiment.
    - Secure all personal belongings (money, calculators, cellphones etc.) In your pockets.
  - e. Accomplish completely the requisition slip to necessary materials from the stockroom.
    - Double check your list before going to the stockroom counter.
    - Request for additional equipment/chemicals will not be entertained at the stock room.
    - Double check the quantity and condition of the material needed for particular experiment upon issuance at the stockroom counter.
    - Bring out your material from the class locker.
    - Prepare the list and labels of the reagents needed for the experiment.
    - Prepare the apparatuses needed.
    - Get the reagents from the dispensing section.
2. During the Experiment:
  - a. Set all the materials (chemicals, apparatus and others) on the working table.
  - b. Position yourself around the working table where you can visualize and observe the experiment procedures and results.
  - c. Perform the experiment systematically.
  - d. Record significant observation.
  - e. Double check whether you have obtained the required data in the experiment.
3. After the experiment:
  - a. All the leaders must present their note-books/manuals signed by the faculty.
  - b. Leaders collect checked manuals of members and must affix their signatures/date. They must make sure that materials are returned to the stockroom. Wastes and unused reagents must be disposed properly. Glass wares are washed and wiped dry. Working table, or working area is cleaned.
  - c. Class materials must be returned in lockers.
  - d. Faculty must inspect group area.
  - e. Faculty should dismiss the class by group.

### III. Cleaning and Disposal

Always read the MSDS before handling any chemicals. When disposing used chemicals or cleaning apparatus, make sure that:

1. Always refer to Cleaning and Disposal SOP
2. Do not dispose organic substance waste into lab sink
3. Calculate the exact amount of chemical need for pre-treatment. Such chemical will react to neutralize/reduce/oxidize the chemical substance, so it is safer to handle. It is important to make sure that the chemical waste fully react before disposing it.
4. Collect all organic liquid in special container. Mineral oil waste typically dangerous to the environment and should be stored in different container and labelled appropriately
5. Solid waste must be collected separately
6. Use appropriate protective garment when cleaning or disposing chemicals
7. Flush residual chemical from vessel using suitable and non-toxic solvent and dispose the solvent accordingly
8. Do not dry the solvent rinsed equipment in the oven/drying cabinet with heater because the risk of fire ignition
9. Aggressive or corrosive cleaning agent may be used when other cleaning agent have been found ineffective
10. Usage of dichromate-sulphuric acid as cleaning agent is allowed in special cases and make sure that no hazardous reaction will happen upon cleaning with the substance
11. Cleaning with detergent should only be performed after abovementioned pre-cleaning treatment



Figure 1. Example of Lab Sink. Unless stated so,  
**DO NOT DISPOSE ANYTHING INTO THE SINK**

## A. Pre-Disposal Treatment

Chemical	Treatment	Disposal
Sugars and amino acid	Do not require pre treatment	Dispose into sink
Dilute buffer solution	Do not require pre- treatment	Dispose into sink
Low volume of low toxic organic solvent such as ethanol or isopropanol (<100 ml)	Dilute with water to reach concentration <10%	Dispose into sink
Strong Acid and Bases	Added dropwise into excess of ice water, neutralized	Dispose into sink
Anhydride of Carboxylic Acid, Chloride of Carboxylic Acid, Phosphorylchloride, Thionylchloride and Phenylsulfonate	Added dropwise into excess of ice water or solution of 10% Sodium Hydroxide (NaOH), Neutralized	Collect in special container, do not dispose into sink
Alkali metals	Cut into small pieces and add to suitable alcohol under constant stirring, dilute with water	Collect in special container, do not dispose into sink
Thiol, Sulphide	Oxidized with excess of 15% Sodium Hypochlorite	Collect in special container, do not dispose into sink
Bromine, Iodine	Neutralized/Reduced with Sodium Thiosulfate	Dispose into sink
Mercury	Use special adsorbent to collect small pieces of Mercury droplets (e.g. when mercury thermometer is broken)	Collect in special container, do not dispose into sink
Peroxides in small amount	Reduce with Fe, Zn, Sn salt or bisulfite, neutralized	Collect in special container, do not dispose into sink
Dimethylsulfate	Added dropwise into cold ammonia, neutralized	Collect in special container, do not dispose into sink
Cyanide	Oxidized with excess of 15% Sodium Hypochlorite	Collect in special container, do not dispose into sink

## B. Laboratory Animal Waste and Biological Sample

All animal waste (whole or organs) must be double bagged in a heavy-duty, dark colored bag. The bag must be properly sealed to hold its content and to prevent any leakage or odor release. Before sealing and transporting animal waste, ensure no free-flowing liquid is inside the bag. All fluid must be absorbed and disposed separately. Each bag should not exceed 10 kg to ease transport and to avoid bag rupture.

## C. Glassware Safety And Waste

Before working with glassware, review it for imperfection thoroughly, imperfect glassware can be dangerous when used. If defects are found, glassware should be returned immediately to the lab technician to be replaced with new one. Use appropriate gloves when handling glassware and carry it using two hands. When storing glassware, remember to keep it away from the shelf/table edge. Glassware are fragile and breaks easily so extra care and precaution should be taken when handling glassware. When accident happen, consider this following rule:

1. If the glassware is falling, do not try to catch it. The glassware may break in your hand and cause injuries.
2. Wear cut-resistant gloves when handle broken glass whenever possible.
3. Use mechanical means to pick up broken glass pieces
4. Never use bare hands when picking broken glass. Use thongs, tweeters or forceps to collect broken glass pieces
5. Make sure to notify nearby lab mates or any other person so they do not step on broken glasses before you finish cleaning them.
6. Dispose the broken glass in a rigid, puncture resistance container
7. Separate clean glass waste with contaminated broken glass, keep the contaminated glass in separated sealed container



Figure 2. **CORRECT** to handle and transport glassware

## **IV. General Rules and Regulations**

1. Scheduled classes are given priority over other users.
2. Eating, drinking, smoking or chewing tobacco/momma shall strictly be prohibited inside the laboratory.
3. Students who destroy any laboratory apparatus or equipment in the lab shall be held financially responsible. Fines for replacement shall be determined according to the value of the damaged items and shall be assessed by the Laboratory custodian.
4. Appropriate attire is required (laboratory gowns and face masks required).
5. Do not let another person use the apparatuses/equipment assigned to a certain group.
6. The use of Biology laboratory room must be limited to laboratory classes only. The use of such rooms for other purposes requires a permit from the General Services Office.
7. Failure to adhere to Biology laboratory policies and procedures may result in permanent suspension of laboratory privileges.

## V. Clothes and Protective Wear

Shorts, short-sleeved shirts, and dresses do not offer adequate protection when performing laboratory activity and should not be worn unless any exposed skin can be covered by a lab coat. Proper footwear must be used which comprises closed toes and heels. Flip-flops, open-weave shoes, and sandals are not appropriate to use in the lab while performing laboratory activities. Before conducting any activity in the laboratory, all students/staff/guest should wear the following personal protective equipment:

1. Lab coat made of cotton with long sleeves
2. Safety goggles
3. Gloves
4. Closed shoes or protecting work shoes



Figure 3. Wearing Lab Coat Before Entering Laboratory Working Area

Laboratory coats and gloves **SHOULD NOT** be worn outside the lab since it can be contaminated with hazardous chemicals. Contact lenses should not be put on when performing laboratory activity. Gases and vapors can be concentrated under the lenses and will cause permanent eye damage. If chemicals splash into/come in contact with the eyes, it is almost impossible to remove lenses to irrigate the eye due to spontaneous spasms of the eyelids.

As part of general laboratory practice, any form of jewelry is also prohibited to wear when doing activities in the laboratory. When handling certain chemicals, specific protective wear may be required (e.g. Respirator), please consult individual chemical MSDS provided in the lab.

Locate the nearest eyewash station and make sure you know how to operate it. Put on goggles every time you handle chemicals or working with equipment under pressure, particularly when working with a caustic substance, concentrated acids/bases, and substance/process that can generate droplets/vapor/aerosols.



Figure 4. Taking Off and Storing Lab Coat

## VI. First Aid Treatments/Laboratory Safety

### A. Chemicals

For acid in the eye, wash thoroughly with running water; then by means of a cup, wash with 2% sodium bicarbonate solution. Dry with sterile gauze pad and apply several drops of olive oil into the eye. Follow this procedure upon chemical accidents:

1. Rescue injured or poisoned person from the danger zone
2. Pay attention when rescuing the victim, do not cause self-harm during the process
3. The place for first aid should be selected so that immediate transport to the hospital is possible and no further helpers need to enter the danger zone
4. Use appropriate protective garment when helping the victim to ensure that the helper/first aider does not cause self-harm
5. Immediately call the emergency department hospital (M Yunus Hospital). Notify the emergency medical service with complete information about **where it has happened, what has happened, how many people were injured, and which kind of injury** and wait for further inquiry.
6. Organize the transport to the hospital
7. Make a report of any accident that happened in the lab. Make sure that the lab head is notified immediately.
8. Facilitate fresh air supply by opening constraining clothing and immediately removing contaminated clothing.
9. Rinse exposed skin with plenty of water. Use the air shower provided in the lab.
10. If the chemicals have got into contact with eyes, immediately rinse both eyes with water using an eye shower provided in the lab for at least 10 minutes while holding open the eyelid with fingers



Figure 5. Using Laboratory Shower and Eyes Wash

**B. Cuts**

First, wash with water thoroughly; then apply 50% alcohol or tincture of iodine. Bandage with sterile gauze. Do not continue to use iodine in subsequent dressings. Burns will result. Never cover directly with adhesive tape.

**C. Burns**

For acid burns, wash first the affected area with running water and then with saturated sodium bicarbonate solution. Cover for about ten minutes with solid sodium bicarbonate. Wash off, dry with gauze and go to the clinic for further treatment. For heat burns, apply Vaseline or ask for burn ointment from your instructor or laboratory technician.

**D. Liquid splash on the eye –**

Wash immediately with water from an eye wash bottle or eye wash fountain.

**E. Chemical splash on the skin**

Immediately rinse the area with cold water for at least one minute. Notify your instructor of further action.

**F. Fire**

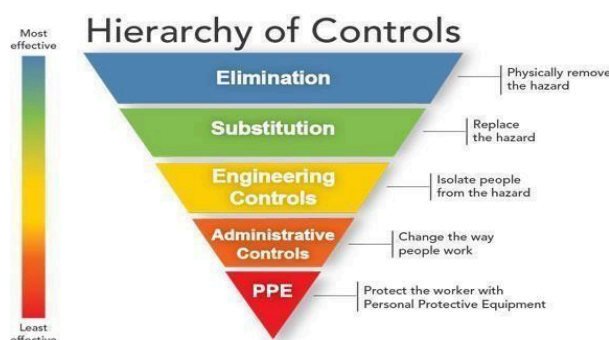
Small fire: First, turn off the gas, then smother the fire with a wet towel. Otherwise, use the fire extinguisher provided for this purpose. Clothing on fire: Smother fire by covering yourself with a jacket or by rolling on the floor. In general, do not use water. This will only hasten the spreading of fire.

## VII. Safety Concerns

### A. Chemical Hazards

Hazardous chemicals can come from any chemical used in the laboratory. It can be cancer-causing agents (carcinogens), toxins, irritants, corrosives, sensitizers, and/or explosives. For teaching laboratory that is used by students, the variation of hazards is usually under control since the procedures are often repetitive (practicums or regular lab works), so that the chemicals used are also often the least hazardous among chemicals following the hierarchy of controls seen in Fig.7

Figure 7. hierarchy of control for hazards



However, the mathematics and natural science education lab is also used for research that sometimes involves uncommon material thus need hazard precautions applied to the handling of the chemicals and procedures. The manual of laboratory regarding chemical hazard should include hazard identification, chemical hygiene plan, information and training, exposure monitoring, and medical consultation and examinations.

Hazard identifications are conducted for safety precautions and measurements. All containers of chemicals that are out of their original (manufactured) containers must be labeled with clear information (name of the chemicals, dates, person in charge, etc) and the hazard symbols/pictograms (Fig.2) of those chemicals are stated in the chemical storage room (in poster form) for easy access.



Figure 8. Chemical Hazard Symbols

Chemical hygiene plan is required for every procedure in the laboratory. This plan must include set of procedure, equipment, personal protective equipment (PPE) and hazard identification. For lab work and practicum, this plan is stated in the practicum handbook. However, for research, this chemical hygiene plan must be provided by the researcher to the head of laboratory or laboratory manager following format in Appendix 1. Every personnel that works in the laboratory must undergo a safety training.

1. Students: Before entering the laboratory for the first time, they must undergo safety information session conducted by the laboratory. The session contains information on hazards, required PPE, and how to handle accidents and laboratory waste.
2. Laboratory manager: Laboratory managers are person in charge of laboratory daily function. The managers are graduated from science laboratory vocational program where they undergo basic training on how to run the lab
3. Researchers: A researcher can be a student or lecturer. Students that already have practicum prior to their research are exempt from safety training but must provide the lab manager with chemical hygiene plan (Appendix 1)

## **B. Biological Hazards**

Biological agents that are commonly known as a threat to public safety are banned from the lab following the control hierarchy. All other biological materials (virus, bacteria, etc.) for culture development must be conducted inside an incubator. All procedures on animals should include all potential hazard information such as allergies, bites, strains, sprains, etc. This information is very useful so that personnel working with animals can be prepared with safety precautions. Procedures using animals must pass the animal ethic commission examiner provided by the Research and Community Service Institution of University of Bengkulu.

## **C. Physical Hazards and Others**

Besides exposures to chemical and biological hazards, all person working in the lab may also expose to physical hazard including injuries while working with apparatus, electric shocks, radiation, noise, fire/heat, compressed gases, trips/slips/falls, etc.

To eliminate these potential physical hazards, any person working in the laboratory must identify the environment before conducting any activity. Firstly, the person must locate first aid equipment, fire extinguisher, eye washers, body showers, etc. Secondly, eliminate all possible accident-causing objects before working in the lab such as slippery floors, sharp objects, source of heat (must be away from any object that is easy to burn), gas cylinders attached properly, all electrical cord must be properly placed, etc. And thirdly, all people working in the lab must have information on emergency contact, may it be local emergency call or phone numbers of lab manager and/or supervisor in hand.

## **D. Accident Handling**

Every accident that happens in the lab must be reported to the Head of The Laboratory or to the Lab Managers following the form in appendix 2. These accidents reports are necessary information for the laboratory management to evaluate and enhance safety measurement in the future and provide a better first aid apparatus in the laboratory.

Accidents concerning chemicals, biological or physical hazards must be handled based on the type of exposure and severity of the accidents. Several accidents can be handled by first aid in the lab, others might need special medical attention.

## **E. Storage Management.**

General storage of chemicals and others are following these guidelines to prevent potential hazards:

1. Separate incompatible material (acids from bases; oxidizers from flammables; reactives from water and air, never stored alphabetically but by hazard categories).
2. Corrosive materials (concentrated acids or concentrated bases) are stored in corrosive cabinets.

3. Store materials below eye level.
4. Heavier container on lower shelves, but never on the floor
5. Labels must be readable and facing front when stored.
6. Evaluation on expired dates
7. Store only small quantities of currently used items in the fume hood.
8. Flammable materials stored in the fume hood.
9. Routinely performed inventory on materials

## **F. Waste management.**

Waste disposal is an important aspect that need attention when managing a laboratory. Several actions are needed when handling chemical/biological/physical waste:

### 1. Waste hazard identification

All waste is defined as hazardous if they have toxic, carcinogenic, or mutagenic effects in humans or animals. A waste may also be considered hazardous if it has an adverse impact on the environment. Identification of waste can be categorized into flammable waste; corrosive waste; reactive waste, and toxic waste. The volume of waste collected in one laboratory can be considered hazard if the amount is too large.

### 2. Storing

Small volumes of waste can be stored in the laboratory. Containers must have a screw top lid and must be compatible with waste material stored in the container. Solid waste such as broken glassware, gloves, paper, etc. can be stored in a cardboard box. Liquid and solid waste must be stored separately and placed at a secure area until disposal. Waste storages must be labeled appropriately (name, volume/amount/date), and frequently dispose with appropriate measures.

### 3. Waste picks up for disposal

Waste disposal for certain chemicals from Mathematics and Natural Science Education Laboratory is done by Laboratory of Medicine, University of Bengkulu. When enough amount of waste generated, laboratory manager responsible for waste management will contact the pickup person and the waste will be pickup for disposal. All containers must be provided with information of type and the amount waste.

### 4. Using sinks, drains, or sewers

Sink drains of the sewer must never be used as a means to dispose of hazardous or other chemical waste. Chemical and waste products should enter the sewer only through actions incidental to the process of experiment, such as container washing and rinsing. Waste material should otherwise be collected for pickup and disposal.

Appendix 1

<b>Laboratory Hygiene Plan Department of Biology Laboratory</b>	
Main Investigator	:
Supervisor	:
Study Program	:
Research Project Title	:
Brief Procedure	:
Hazard Identification (Check if applied)	Description
<input type="checkbox"/> Biological	
<input type="checkbox"/> Chemical	
<input type="checkbox"/> Dust	
<input type="checkbox"/> Impact	
<input type="checkbox"/> UV light	
<input type="checkbox"/> Radiation	
PPE Required (Check if applied)	Main Chemical/Biological List:
<input type="checkbox"/> Lab Coat	1
<input type="checkbox"/> Safety glasses	2
<input type="checkbox"/> Safety goggles	3
<input type="checkbox"/> Face shield	4
<input type="checkbox"/> Welding helmet	5
<input type="checkbox"/> Cutting goggles	6
<input type="checkbox"/> Gloves	7
Etc.	This document can be extended if necessary

Appendix 2

<b>Accident report Department of Biology Laboratory</b>	
Name	:
Date	:
Lab Assistant/Supervisor	:
<p>Accident details:</p>	
<p>Action Taken:</p> <p><input type="checkbox"/> First aid treatment</p> <p><input type="checkbox"/> Injured-transported to clinic/hospital</p> <p><input type="checkbox"/> Other (explain):</p>	
Lab Manager	(signature)
Head of Laboratory	(signature)

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