



جامعة المستقبل  
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# Lab 1: Laboratory Safety

# Introduction

- Laboratory safety is essential in all medical and biochemical laboratories. Medical students work with **chemicals, biological samples, equipment, and potentially hazardous materials**, so understanding safety principles is critical.
- Laboratories may expose students to several hazards during work.
- Therefore, following proper safety procedures protects **students, staff, patients, and the environment**.

# Types of hazards

- **Chemical Hazards:** Exposure to toxic, corrosive, flammable, or reactive chemicals (e.g., acids, solvents) that may cause burns, poisoning, or fire.
- **Biological Hazards:** Infectious agents from blood, tissues, or microorganisms that may transmit diseases.
- **Physical Hazards:** Injuries caused by equipment, heat, broken glass, electricity, or slippery floors.
- **Radiation Hazards:** Exposure to ionizing or non-ionizing radiation (e.g., X-rays, UV)



# 1. Laboratory Rules and Protocols

- Before starting any laboratory work, students must become familiar with the **rules and safety protocols used in the laboratory.**
- Follow all instructions given by the instructor.
- Understand **emergency** procedures.
- Learn the **correct use of** laboratory **instruments** and chemicals.
- **Failure** to follow laboratory rules may result in **serious accidents or contamination.**

## 2. Personal Protective Equipment (PPE)

- Personal Protective Equipment is the **first line of protection** against laboratory hazards.
- Essential PPE includes:
  - **Lab coat** – protects clothing and skin
  - **Gloves** – prevent chemical or biological contact
  - **Safety goggles** – protect the eyes
  - **Face shields** – for splash protection
  - **Closed shoes** – prevent foot injury



# 3. Safe Handling of Chemicals

- Medical chemistry laboratories contain many chemicals that may be **toxic, corrosive, flammable, or reactive.**
- Students must:
- **A. Read Safety Data Sheets (SDS)**
- These sheets contain:
  - Chemical properties
  - Hazards
  - First aid measures
  - Storage instructions

- **B. Work in Well-Ventilated Areas**
- Use **fume hoods** when working with volatile or toxic chemicals.
- **C. Avoid Direct Contact**
- Never touch chemicals with bare hands.
- Use tools such as **pipettes or spatulas**.
- **D. Proper Labeling and Storage**
- Clearly label chemical containers.
- Store chemicals according to compatibility guidelines.



**Fume Hood**

## 4. Good Laboratory Hygiene

- Maintaining cleanliness reduces contamination and infection risk.
- Important practices include:
- Keep laboratory benches clean and organized.
- **Wash hands** before and after experiments.
- Do **not eat** or **drink** in the laboratory.
- Do not use mobile **phones** in the lab.
- Avoid applying **cosmetics** in the laboratory.
- These practices help prevent **cross-contamination and exposure to pathogens**.

# 5. Handling Biological Materials

- Medical laboratories frequently deal with **blood samples and biological specimens**.
- Safety precautions include:
- Wear appropriate PPE.
- Use **biological safety cabinets** when necessary.
- Follow universal precautions for bloodborne pathogens.
- Dispose of needles and sharps in **special sharps containers**.
- These precautions protect students from infections such as **hepatitis or HIV**.



## Chemical fume hood

VS

## Biosafety cabinet

Used for dangerous chemicals

Used for infectious biological agents

Protects the user

Protects the user, the environment, and the material

No HEPA filter

Must have HEPA filter

Exhausts air outside the building

Does not exhaust air outside the building (without decontamination)



Biosafety Cabinet



Fume Hood

# 6. Safe Use of Laboratory Equipment

- Students must handle laboratory equipment carefully.
- Use equipment only after proper **training**.
- **Inspect** equipment for **damage** before use.
- Follow manufacturer **instructions**.
- Do **not modify** equipment without authorization.
- Improper equipment use may cause **injury, burns, or chemical exposure**.

# 7. Emergency Response

- Students must know how to respond during laboratory emergencies.
- Important safety equipment include
  - Fire extinguishers
  - Eyewash stations
  - Safety showers
  - Emergency exits
- During emergencies:
  - Stay calm
  - Follow laboratory procedures
  - Inform the instructor immediately



# 8. Hazard Symbols in the Laboratory

- Laboratories use **hazard pictograms** to indicate dangerous materials.
- Common symbols include:
- Flammable
- Explosive
- Oxidizing
- Corrosive
- Toxic
- Harmful / irritant
- Compressed gas
- Health hazard
- Biohazard
- Environmental hazard
- These symbols help workers quickly **recognize potential risks**.

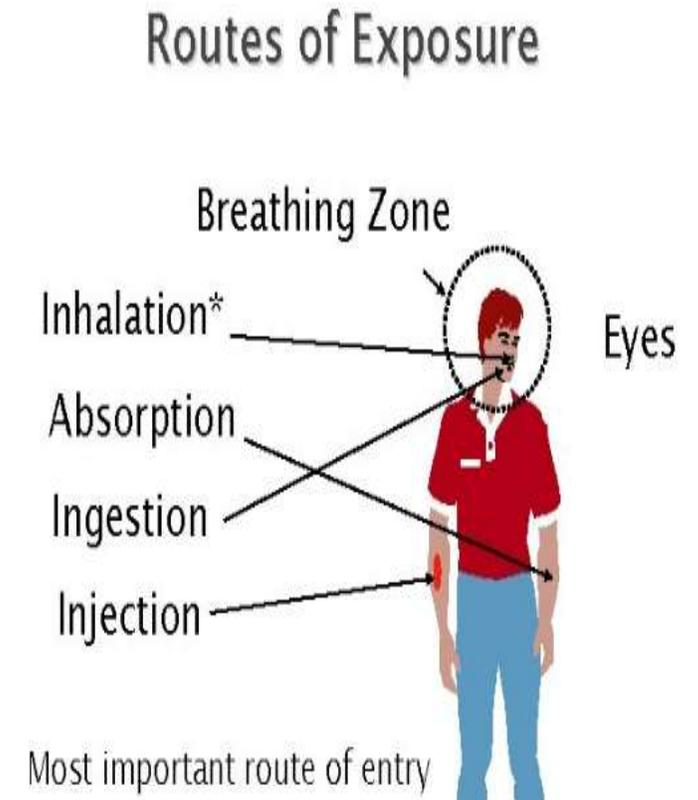


# 9. Exposure to Hazards

- The effect of a hazardous substance depends on:
- **Dose**: the amount of chemical entering the body.
- Health effects increase with:
- **Higher concentration**
- **Longer exposure**
- **Frequent exposure**
- **Individual Susceptibility** (Different individuals may react differently to the same exposure) .

# 10. Routes of Exposure

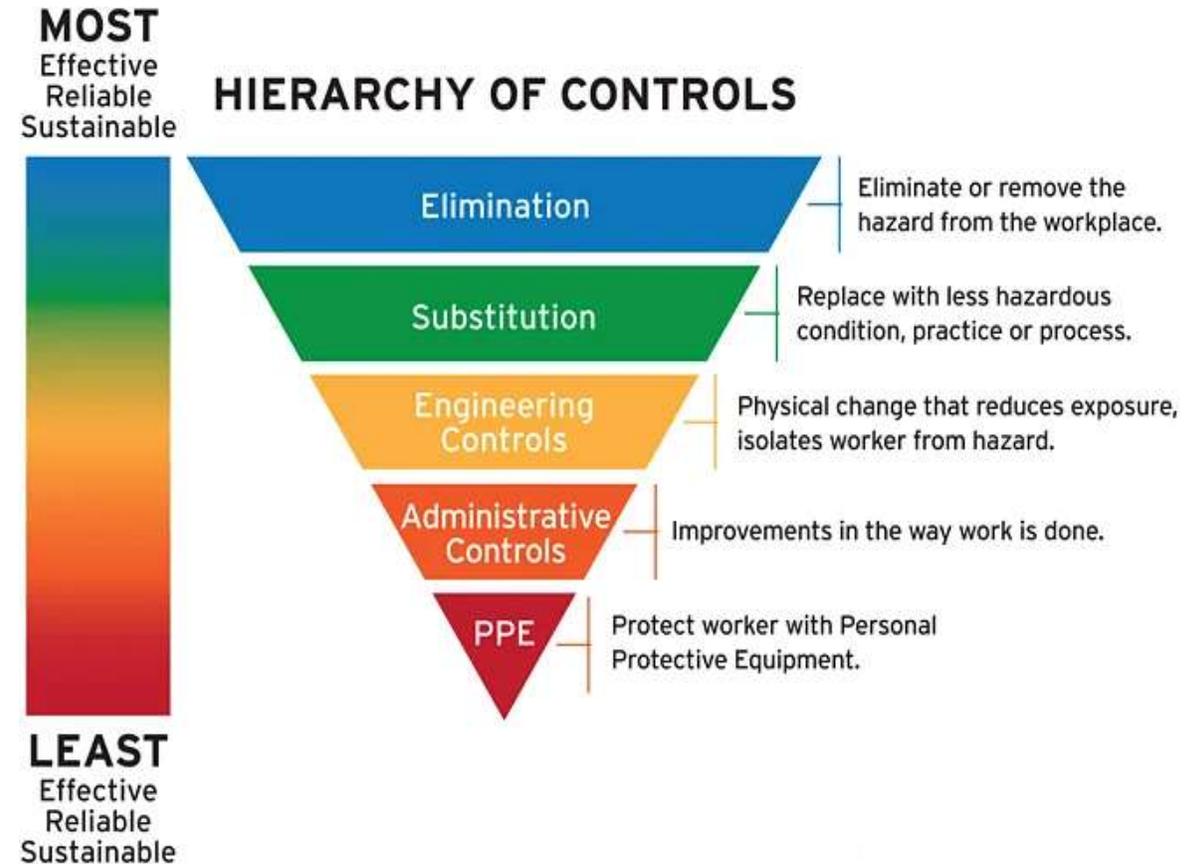
- Hazardous substances can enter the body through several routes:
- **Inhalation** - breathing vapors or gases
- **Ingestion** - swallowing contaminated materials
- **Skin absorption** - through skin contact
- **Injection** - through cuts, needles, or sharp objects
- Understanding these routes helps determine the **appropriate**



# 11. Controlling Laboratory Hazards

The **Hierarchy of Controls** is used to minimize risks in laboratory as the following from most to least effective way:

- **Elimination** - remove the hazard
- **Substitution** - replace with safer material
- **Engineering controls** - isolate the hazard
- **Administrative controls** - change procedures
- **Personal protective equipment (PPE)**
- PPE is considered the **last line of defense**.



**Good luck**