ALMUSTAQBAL UNIVERSITY

College of Health and Medical Techniques
Medical Laboratories Techniques Department

Stage : Fourth year students
Subject : Laboratory Managment - Lecture 2

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The role of the laboratory in diagnosing and controlling infection

- The purpose of laboratory diagnosis of infection is to assist the clinician in determining whether or not a patient has a significant infection
- Infection control prevents or stops the spread of infections in healthcare settings.
- Healthcare workers can reduce the risk of healthcare-associated infections and protect themselves, patients and visitors by following Centers for Disease Control and Prevention CDC guidelines.

Laboratory workers face the risk of exposure to microbes that cause diseases transmitted through the blood or as a result of exposure to the eyes or mouth of the spray or from Performing secondary bacterial blood cultures, centrifugation, etc.

Types of Hazards in laboratories

1. Chemical hazards

2. Physical hazards

3. Engineering hazards

4. Health hazard

5. Personal hazards

6. Fire hazards

7. Mechanical hazards

Steps in the risk assessment process

A. Define the target

B. Determine the severity

C. Take the necessary measures and procedures

D. Make a Revision

E. Asses the Risk

F. Implement the plan

Determine the scope of the project or experiment. Define the purpose of the project, where, when, and how will the work be done, and who will do the work. Ascertain the level of their knowledge, skills, and expertise

Dangerous biological materials

Dangerous biological materials and microbes include the following:

1. Microbes that cause infection (bacteria, fungi, parasites, viruses, etc.) can cause diseases for healthy individuals or affect the environment and agriculture.
2. Cultures of cells, fluids, human tissues, or major mammalian tissues.

Hazardous substances

In general, hazardous materials can be divided into
physical factors (such as needles, and glass),
chemical agents (such as acids, and alkalis),
and **biological agents** (such as clinical samples and microbial cultures), which may be harmful if used or handled inappropriately.

Biological safety cabin (BSC)

It is a major device for preventing the spread of infection. It is designed to draw air inside by mechanical methods used to prevent the spread of infectious airborne dispersal and aerosols emitted from some laboratory procedures.
There are three classes of biosecurity cabins: Class I, Class II, and Class III . In these cabins, very dangerous pathogenic microbes are dealt with.

Biological Safety Cabinet (BSC)

Class I BSCs work by drawing unfiltered room air in through a front opening, passing it over the work surface, and then expelling it through an exhaust duct.

Class I BSCs protect workers but do not protect work products (such as specimens or cultures) against contamination because unsterilised room air is drawn over the work surface.

Room air is drawn in through the front opening then passes over the work surface and is expelled from the cabinet through the exhaust duct. The directional flow of air carries aerosol particles that may be generated on the work surface is away from technicians and into the exhaust duct.

The air from the cabinet is expelled through a High-Efficiency Particulate Air (HEPA) filter:

(a) into the laboratory and then to the outside of the building through the building's exhaust system; or

(b) directly to the outside.

Class I provides protection for the user and surrounding environment, but no protection for the sample being manipulated.

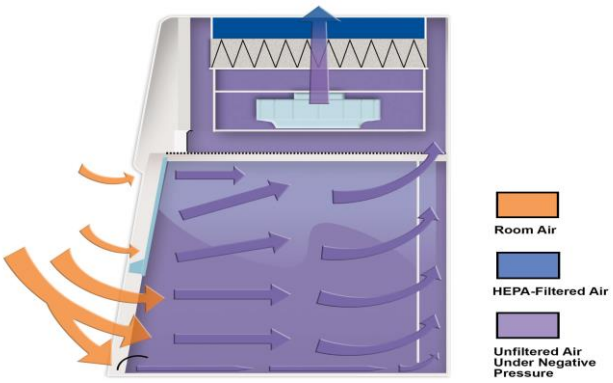
Class II protects the user, environment and sample

A Class I Biosafety Cabinet is defined as a ventilated cabinet that provides **personnel and environmental protection**.

Class I BSCs are designed with an open front with inward airflow (**personnel protection)**

and HEPA-filtered exhaust air (**environmental protection**).

They pull room air through the front of the cabinet and across the work surface, away from the operator (similar to a fume hood), and use a HEPA filter at the exhaust outlet. They commonly recirculate air back to the laboratory but can be externally exhausted if needed.



A **Class II cabinet** is defined as a ventilated cabinet for **personnel, product and environmental protection**, often used for microbiological work or sterile pharmacy compounding. In some labs, these containment hoods are referred to as cell culture or tissue culture hoods. In pharmacy settings, these hoods are referred to as chemo hoods.

Class II cabinets are designed with an open front with inward airflow (**personnel protection)**, downward HEPA-filtered laminar airflow (**product protection**) and HEPA-filtered exhaust air (**environmental protection**).

Then Class I biosafety cabinets: provide **personnel and environmental protection but NO product protection .**
Class II and Class III cabinets: provide **personnel, environmental, and product protection.**

The **Class III** Biosafety Cabinet is designed to work best with the high risk of microorganisms. **It ensures the safety of the environment and the worker from the specimen that is being studied.**

It is also called **Gloveboxes**, due to work being conducted using arm-length gloves. These gloves are fixed to the cabinet glass which completely isolates the environment from the ongoing process inside the chamber.

The supply air is drawn in through HEPA filters and the air inside the chamber is treated by passing the two HEPA filters before being discharged outside. An independent exhaust system outside the work chamber is responsible for the airflow being maintained

The role of the laboratory in infection control

1. Collect samples
2. Perform identification and sensitivity testing
3. Laboratory information systems
4. Rapid diagnostic test
5. Reporting of laboratory data
6. Storage of living organisms

Personal Protective Equipment (PPE):

Are equipment worn to minimise exposure to a variety of hazards and to protect the body from risks in the laboratory

An adequate supply of PPE must be maintained for all lab personnel, visitors, or any other personnel who need to enter the lab.

PPE worn inside the laboratory should not be worn outside the laboratory unless you transfer hazardous material between labs.

Standard PPE for Each Biosafety Level

Biological safety level I (BSL1)

1. Lab coats, gowns, or uniforms are recommended to prevent contamination of personal clothing.

2. Safety glasses are recommended to be worn in the laboratory at all times.

Safety glasses are required to be worn when conducting procedures that have the potential to create splashes of biohazards or other hazardous material.

3. Gloves must be worn to protect hands from exposure to biohazards.

Remove gloves and wash hands when work with biohazards has been completed and before leaving the laboratory.

Biological Safety Level II (BSLII)

1. **Lab coats** must be worn when working with hazardous materials and must remain in the laboratory. They may be reusable cloth lab coats or disposable. Lab coats must be removed before leaving the laboratory area.

2. Safety glasses are recommended to be worn in the laboratory at all times.

Eye and face protection such as goggles, or face shield must be utilized if manipulating or handling infectious material or microorganisms outside the BSC.

Face shield

protective glasses

medical goggles

3.Gloves must be worn to protect hands from working with infectious materials and other biohazards. Glove selection should be based on appropriate risk assessment.

Nitrile gloves are the preferred choice given their wide range of protection. Gloves must be changed when contaminated. Gloves must be removed, followed by hand washing, when working with infectious material and other biohazards is complete and before leaving the laboratory. Gloves must not be washed and reused.

Nitrile gloves

Biological Safety Level III (BSLIII)

Lab workers are prohibited from wearing personal clothing, shoes, or jewellery in the BSL3 High Containment Area (HCA). Before entering the HCA, lab workers must change into **facility-captured scrubs and shoes.**

Depending on the procedure being performed, either a solid-front gowning or Tyvek suit is required to be worn.

Gown

Tyvek suit

- Eye, face, and respiratory protection are required for entry into the HCA. A Powered**, Air-Purifying Respirator (PAPR)** must be worn at all times within the HCA.

- **Gloves** must be worn to protect hands from working with infectious materials and other biohazards. Glove selection should be based on appropriate risk assessment. **Nitrile gloves** are the preferred choice given their wide range of protection. **Double** gloves are required for use in the HCA. Gloves must be changed when contaminated. Outer gloves must be removed when working with infectious material and other biohazards is complete and before leaving the laboratory. Gloves must not be washed and reused.

How to deal with risks or reduce exposure to them?
Take note of the following when working

- Disinfect hands before and after wearing protective Gearings
- Do not touch the face
- Change gloves when they get contaminated or dirty
- Not to wear loose clothing and accessories
- Not to eat or drink inside the laboratory
- Writing a report in the event of an occupational infection or needling
- Apply professional safety measures and caution when handling patient samples