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المرحلة الاولى-الدراسة الصباحية والمسائية

الفصل الدراسي الاول

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Biosafety
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First stage
Morning&Eveninig

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Lec. 1

Occupational Safety and Health

Occupational safety and health is defined as the science concerned with preserving human safety and health, by providing safe working environments free from the causes of accidents, injuries or occupational diseases, or in other words it is a set of procedures, rules and regulations within a legislative framework aimed at preserving the human being from the risk of injury and preservation on the property from the risk of damage and loss.

Occupational safety and health are involved in all areas of life. When we deal with electricity or household electrical appliances, it is essential to follow safety rules and their principles, and when driving cars or even walking on the streets, we need to follow safety rules and principles. To safety rules, but we can say that when taking medicines for treatment or food for the growth of our bodies, we need to follow safety rules.

General objectives of the Occupational Safety and Health

1. Protecting the human from injuries resulting from the hazards of the work environment by preventing them from being exposed to accidents, injuries and occupational diseases.
2. Preserving the components which represented in the installations and the devices and equipment they contain from damage and loss as a result of accidents.
3. Providing and implementing all occupational safety and health requirements that ensure the provision of a safe environment that achieves protection from risks for the human and physical components.
4. Occupational safety and health as a scientific approach aims to establish safety and assurance in the hearts of workers while they carry out their work and to reduce the worry and fear attacks that trouble them as they coexist by virtue of the necessities of life with

tools, materials and machines in whose folds there is a danger that threatens their lives and under insecure conditions that expose their lives from time to time to dangers Fatal.

In order to achieve the above-mentioned goals, the following elements must be available: -

1. Proper and targeted technical planning of the foundations of prevention in facilities.
2. Legislation stemming from the need to implement this technical planning
3. Implementation based on sound scientific foundations for construction operations, with the provision of specialized technical devices to ensure the continued implementation of occupational safety and health services.

Biosafety

Biosafety is the prevention of large-scale loss of biological integrity, focusing both on ecology and human health. The maintenance of safe conditions in biological research to prevent harm to workers, non-laboratory organisms, or the environment.

A fundamental objective of any biosafety program is the containment of potentially harmful biological agents.

The term “containment” is used in describing safe methods, facilities and equipment for managing infectious materials in the laboratory environment where they are being handled or maintained.

Technical Definitions

Biohazard: An agent of biological origin that has the capacity to produce deleterious effects on humans, i.e. microorganisms, toxins and allergens derived from those organisms; and allergens and toxins derived from higher plants and animals.

- **Biosafety:** The containment principles, technologies and practices that are implemented to prevent the unintentional exposure to pathogens and toxins, or their accidental release.
- **Biosecurity:** Control of accidental and deliberate release of biohazardous material.
- **Hazardous waste** is defined by the US Environmental Protection Agency (EPA) as a waste or a mixture of several wastes that pose a threat to human health or other living organisms, whether in the short or long time as: -
- A- Non-degradable and durable in nature.
- B- Or it may cause harmful cumulative effects.

There is another definition of hazardous waste by the British government, which is; "Hazardous waste is toxic or harmful to public health, or it is pollutant material that leads to environmental damage, which poses a threat to human health and living organisms as a result of pollution of environmental elements with these materials, especially surface and groundwater sources."

To control hazardous waste and reduce its damage to the environment and public health, many countries have put in place legislation to control hazardous waste and dispose of it in safe ways to reduce its potential risks to humans, animals and plants, but these controls were recently introduced and their application is relatively due to the presence of many The abuses that are carried out outside the scope of control, as there are many cases in which dangerous levels of toxic substances are discovered in them, and for the ease of classifying these wastes, they have been placed into five main groups :

1. Radioactive materials
2. Chemicals
3. Biological waste
4. Flammable waste
5. Explosives

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Biological waste. This group includes medical waste and waste resulting from biological research, and includes medical wraps resulting from emergency departments and operating rooms in hospitals and medical clinics, in addition to syringes and human tissues, damaged blood units, dead animal corpses, as well as expired medical drugs. Some of these wastes may be toxic, and others pose a risk to health as a result of bacterial contamination, so it must be handled with sufficient care to ensure that it does not affect public health, especially for the people who deal with it, whether in collecting or transporting and disposing it, and it can be collected in paper bags lined with material Wax, or plastic bags, and placed inside lined metal containers.

Treatment and drainage methods

The choice of appropriate treatment and disposal methods depends on the type of waste, its degree of risk and its quantity, and the following are some of the options available for this purpose:

A. Recycling and recovery.

B. Alter the chemical or physical properties using one or some of the following methods:

1. Incineration and pyrolysis
2. Biological treatment
3. Chemotherapy
4. Physical treatment

Mitigation and drainage

Storage by using permanent underground stores; Mines, silos, or warehouses in the form of tanks built underground to be insulated to prevent leakage into the groundwater.

The governmental authority concerned with the health and safety of the environment must have approved systems for controlling hazardous wastes before disposal, using a special form in which data related to hazardous wastes. The type of waste, quantity, and other

specific information related to the waste. In light of this information, the appropriate method for its final disposal shall be determined.

Decontamination in the laboratories of Microbiology

There are other ways to remove contamination such as use of dry heat, as well as the microwave, ultraviolet and ionizing rays may not be suitable in microbiology laboratories.

There are new techniques such as alkaline analysis or alkaline digestion that may be an alternative to incinerators in some cases.

Some contaminated materials or tools that have microbial contamination are removed with an autoclave can then be washed, reused or recycled.

Sodium hypochlorite and phenolic compounds are the materials most used in disinfection in laboratories as a general use, but there are other materials that are used according to the purpose for which they are used, such as some substances with surface activity or degreasers, and this includes alcohol, iodine and other oxidizing materials, as well as lowering the pH level it is effective in some cases.

Procedures and methods of trading and dealing with laboratory waste

The laboratory must adopt a system for identifying and separating infectious substances and their packages, and that system includes certain directions, for example:

Non-infectious waste can be recycled or reused like normal household waste.

Contaminated materials with sharp ends such as syringes, scalpels, knives, and shattered glass. All these items must be collected in non-perforating containers that are well sealed and treated as dangerous infectious substances.

The use of autoclaves is the preferred method for all decontamination operations, and there are materials that are intended to be decontaminated or disposed of that must be placed in packages.

The responsibility of management in achieving safety at work sites: -

1. Spreading awareness among workers.
2. Training individuals before starting their work, informing them of the risks of work, and ways to prevent them.
3. Direct control and supervision of the work environment.
4. Providing the work site with the required devices, such as devices for measuring temperature and humidity, devices for measuring work environment pollutants ... etc.
5. Taking appropriate measures when violating these regulations.
6. Form a special committee for occupational safety
7. Supporting safety programs.
8. Ensure that the right individual is appointed in the appropriate location.
9. Determining the responsibility of each individual.
10. Follow up on accidents, and take appropriate measures to prevent them from recurring.
11. Determining working and rest times.

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Why we need Biosafety?

Some unfortunate examples of disease outbreaks in research labs:

1950-1976:

•A survey of 5000 labs showed 3921 cases of disease outbreaks

•Most commonly reported were: Hepatitis, tuberculosis, typhoid, brucellosis, rabbit fever

2003-2014:

•SARS infects researchers in a lab in Singapore

•AUS. and a Russian scientist are infected by Ebola. One survives, one dies.
•Polio virus escapes from two Indian labs.
•Scientists from Boston University contract rabbit fever (a serious bacterial disease).
•Anthrax exposure in a Huston lab due to aerosols leaked inside an unshielded Centrifuge.

- Dengue
- Ebola

- Support medical and scientific research on microbes and the human immune response to them.
- Apply such research to the discovery and development of vaccines, drugs, and diagnostic tests designed to protect the general population
- Ensure that the every has sufficient research facilities to carry out these activities.

- **Biosafety in Various Disciplines**

Biosafety is related to several fields

- **ECOLOGY**
- **AGRICULTURE**
- **MEDICINE**
- **CHEMISTRY**
- **EXOBIOLOGY**

Biosafety is related to several fields

- **ECOLOGY:** referring to imported life forms not indigenous to the region (Reggie the alligator)

- **AGRICULTURE:** reducing the risk of alien viral or transgenic genes, or prions such as BSE/"MadCow"; reducing the risk of food bacterial contamination

- **MEDICINE:** referring to organs or tissues from biological origin, or genetic therapy products, virus; levels of lab containment protocols BSL-1, 2, 3, 4 in rising order of danger

- **CHEMISTRY:** i.e., nitrates in water, PCB levels affecting fertility
- **EXOBIOLOGY:** i.e., NASA's policy for containing alien microbes that may exist on space samples - sometimes called "biosafety level 5"

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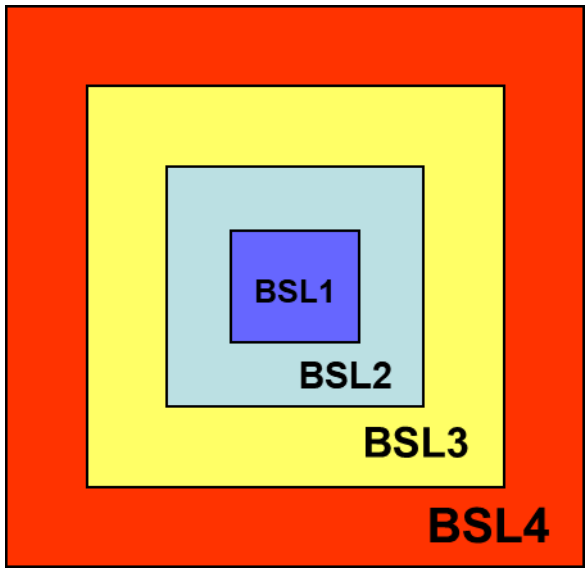
Biosafety containment levels

- **Biosafety levels**
  - Level 1& 2: basic laboratories .
  - Level 3: containment laboratories .
  - Level 4 : high containment laboratories .
  - Level 5: NASA's policy for containing alien microbes.
- Each level associated with appropriate equipment, practices, work procedures. Diagnostic and health-care laboratories must be biosafety level 2 or above.
- **Risk group classification**



Risk Group	Individual risk	Community risk
1	no, low	no, low
2	moderate	low
3	high	low
4	high	high
5	high	high

- **Risk Group 1**: Unlikely to cause animal or human disease, non-pathogenic agent

- **Risk Group 2**: Pathogenic for humans, Unlikely a serious hazard, Treatment and preventive measures available, limited risk of spread of infection.
- **Risk Group 3:** Pathogenic, cause serious disease, Effective treatment and preventive measures usually available, little person-to-person spread.
- **Risk Group 4:**Lethal, pathogenic agent,Readily transmittable Direct or indirect , effective treatment and preventive measures not usually available

This table shows risk groups, biosafety levels, practices and equipment

BSL	Laboratory type	Laboratory practices	Safety equipment
1	Basic teaching, research	Good microbiological techniques	None Open bench work
2	Primary health services; diagnostic services, research	Good microbiological techniques, protective clothing, biohazard sign	Open bench PLUS biological safety cabinet for potential aerosols
3	Special diagnostic services, research	As BSL 2 PLUS special clothing, controlled access, directional airflow	Biological safety cabinet and/or other primary devices for all activities
4	Dangerous pathogen units	As BSL 3 PLUS airlock entry, shower exit, special waste	Class III biological safety cabinet, positive pressure suits, double ended autoclave (through the wall), filtered air

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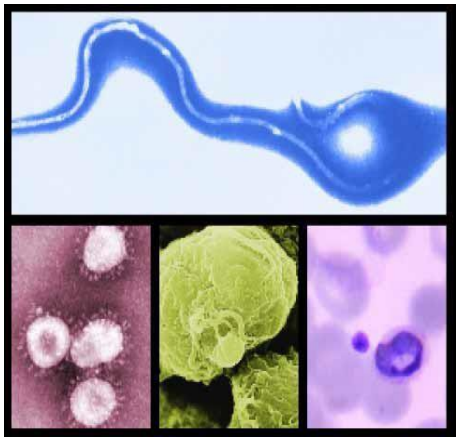
Biohazard Symbol

- In 1966, Charles Baldwin at National Cancer Institute at NIH (National Institute of Health).
  - Symbol to be memorable but meaningless" so it could be learned.
    (الرمز الذي ال ينسى ولكنه ال معنى له "حتى يمكن تعلمه)
  - Blaze orange – most visible under harsh conditions (اللون
    البرتقالي - أكثر وضوحا تحت الظروف القاسية)

Biosafety Issues

- Laboratory Safety
- Blood borne pathogens (BBP)
- Recombinant DNA (rDNA)
- Biological waste disposal
- Infectious substance and diagnostic specimen shipping



- Respiratory Protection

- Bioterrorism and Select agents
- Outdoor and indoor air quality
- Occupational safety and health in the use of research animals
- Biohazards used in animal models

Lec. 6

What are biological hazards?

Biological hazards - bacteria, viruses, mold and parasites have the ability to multiply quickly if given the right conditions or it is the negative effect of some microorganisms on the human body) The biological hazards have a strong and dangerous effect when exposed to them, they lead to death or infection with serious and infectious diseases, and the biological risks lie in occupational exposure to infectious microorganisms, their toxic secretions and parasites

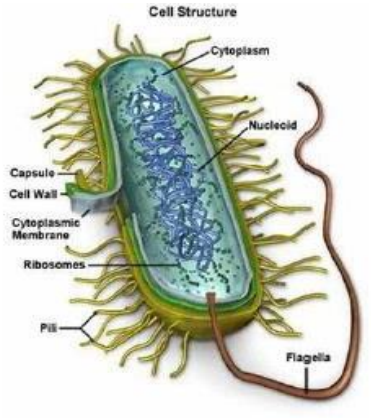
Biohazards Materials

- Viruses
- Bacteria

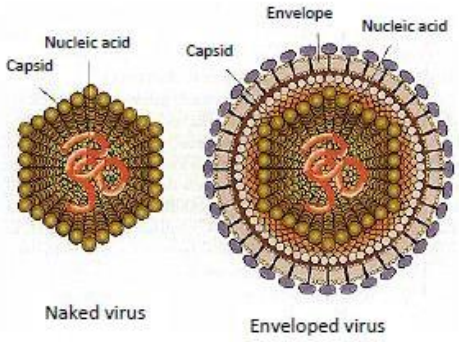
- Fungi
- Chlamydia/Rickettsia
- Prions
- Recombinant DNA

Types of pathogens
Bacteria
– Size: 0.3 to 2 μm
– Single-celled organisms
– Various morphologies
– Examples: *Salmonella spp., E. coli, Vibrio spp.* (Cholera), *Mycobacterium* (Tuberculosis)

Lung infected by tuberculosis



- **Virus**



Girl with polio

– Size: 18-200 nm
– Basic structure: capsid (protein) + nucleic acid
– Obligate parasites
– Enveloped vs. non-enveloped
– Examples: Hepatitis, polio, HIV

Protozoa

Size: 5-10 µm
– Single-celled eukaryotes
– Numerous morphologies
– Examples: *Cryptosporidium* spp., *Plasmodium* spp. (Malaria), *Giardia* spp.

Giardia

Malaria patient

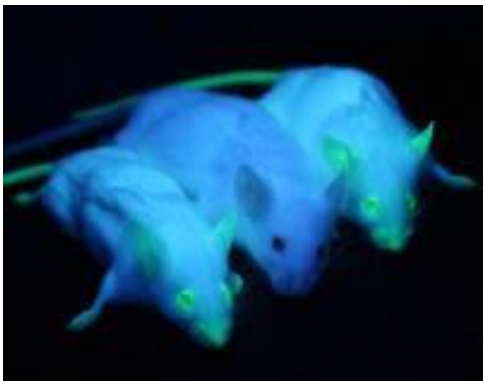
Helminthes

- – Size: 20-100 µm
- – Multi-cellular eukaryotes
- – For transmission mainly concerned with eggs

Ascaris lumbricoides egg
- Causes human roundworm
- 70 µm length

Biohazardous Materials

- Transgenic Plants, Animals and Insects



- Human and Primate Cells, Tissues, and Body Fluids
- Brain Tissue from Demented Patients
- Viral Vectors Replication deficient viruses

Pathogen risk assessment

To analyze the biological risk, we must take into account:

- Pathogenicity/infectivity
- Virulence/lethality
- Infective dose
- Therapy/Prophylaxes
- Epidemic potential
- Resistance
- Survival in the environment
- Geographic spread (endemic)
- Mode of transmission

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Control of biological hazards

The best way to prevent disease is to reduce or eliminate exposure to biological agents. Here are some tips to protect yourself from injury:

1. Practice good personal hygiene (such as regular hand washing) it is one of the best ways to prevent cross infection.
2. Keep your vaccinations up-to-date.
3. Ensure that any equipment that may harbor biological hazards (such as fans, ventilation systems) is regularly maintained, cleaned and sterilized.
4. Cleaning and disinfecting work surfaces often.
5. Clean up stains instantly.

6. Treat and dispose of all hazardous biological waste safely. Blood and any other body fluids should always be handled as if it could be contagious. In the event of injuries or bleeding, each individual should be treated in a manner that minimizes exposure to blood and body fluids.
7. Wear personal protective equipment (such as gloves, masks), where appropriate

Methods of control biological hazards

A. Construction design and furnishing of the laboratory

When preparing and equipping science laboratories, the following requirements and rules have been taken into consideration, which will help in reducing and controlling risks:

1. The area of the laboratory must be proportional to the numbers of students, in order to allow them freedom of movement during the conduct of experiments without crowding.

2. There must be two doors in the laboratory hall for entry and exit, and the direction of opening the doors should be to the outside (in the direction of people rushing).
3. Windows shall be provided with fire-resistant curtains and movable protection bars.
4. Equipping laboratories with natural and industrial lighting and ventilation in accordance with the permissible limits tables in this field, and following up on the periodic maintenance process for lighting and industrial ventilation equipment.
5. Floors for laboratories, sinks and tables must be of types that are not affected by chemicals.

6. A gas cabinet (the room for hazardous reactions) must be provided for use when preparing harmful or unpleasant-smelling gases such as hydrogen sulfide gas, carbon monoxide, chlorine gas, nitrogen peroxide and others.
7. The necessity to equip laboratories with comfortable and easy-to-move seats inside the laboratory, whose height can be controlled according to the student's height.
8. The laboratories must be equipped with a sufficient number of electrical points with covers (socket protectors) on both the laboratory walls and the student and teacher tables.
9. The gas pipelines must be made of copper pipes so as not to rust and be carried out in accordance with the technical principles recognized in this field to ensure that gas does not leak in the laboratories.
10. A special cabinet for gas cylinders must be allocated to the laboratory in one of the corners of the school far from the laboratory, and it must be safe and closed continuously to prevent tampering with gas cylinders and it is strictly forbidden to place gas cylinders inside the laboratory
11. The laboratory gas system should be equipped with a control switch and placed in a visible location that can be easily and quickly accessed in emergency situations.
12. Laboratories must be equipped with the necessary water and sewage installations.
13. The necessity of equipping the laboratory record room with water, gas and electricity installations, a desk and a table or a shelf for conducting experiments.
14. The necessity to equip laboratories with storage rooms for tools, devices and chemical materials and separate from the laboratory record office and are equipped with cabinets, drawers,

and a refrigerator to preserve chemicals, and these stores must be well ventilated.

15. It is recommended that the chemistry laboratory be equipped with mobile transport vehicles to transport devices, tools and materials from the preparation room to the laboratory and back, in order to save time and effort and prevent injuries that may occur as a result of dropping chemicals or tools as a result of collision while transporting materials and tools manually.

16. Laboratories must be equipped with primary firefighting means (fire extinguishers and dry sand buckets) and keep them in a visible place in the laboratory and carry out regular maintenance for them on an ongoing basis and ensure their suitability for use in emergency situations.

17. A cabinet should be provided for first aid and first aid supplies, and chemistry laboratories should be equipped with an emergency shower in order to quickly carry out the first aid operation in the event of injuries to anyone in the laboratory.

18. It is recommended to provide a means of communication to the administration and an alarm device to alert those present in the laboratory in the event of a fire, provided that it be connected to the main fire alarm panel located in the guard's room.

Note: - The laboratory must not be used for anything other than the purpose that it was established for, and in the event of an urgent need for that, a modification must be made in the laboratory that is compatible with the nature of the new work.

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2. Training and qualification of laboratory personnel

Training and qualification is of particular importance in reducing work risks. There are many definitions of the concept of training, but in its general entirety, it aims to define training as the process of improving the performance of an individual, building his capabilities and developing his skills and behaviors, in a way that directly affects the performance of his tasks in the best way and according to what is required.

Based on these basic concepts of training, the importance of training appears for the new employee and the old employee alike. A new employee who has recently joined the organization may not have the skills and experience necessary to perform the job duties with the required efficiency.

3. The right choice for those working in laboratories

There is a famous saying (the right person in the right place)

None of the workers in the field of microbiology or biomedical laboratories is allowed to work before verifying his background in dealing with this type of laboratory that includes microorganisms.

In many cases, some people are assigned tasks that they do not have sufficient experience to do. Or do not possess the scientific and physical qualifications for that.

4. Work Permits

A. Hot work permits:

These permits are issued for the completion of work that takes place in a dangerous area, as this hot work may pose great risks.

B. Cold work permits:

This type of permit is issued for the performance of actions that are not likely to have significant risks when carrying out them.

General precautions that must be followed when issuing work permits

Each type of work permit has the necessary precautions for it, but in general there are some general precautions that must be taken into account in all types of permits, including:

1. The correct choice of the type of work permit.

2. The described process should be specific and clear.

3. Determine the equipment on which the operation is performed.

4. The time allotted for the validity of the permits must be specified.

5. The workplace must be examined by the authority issuing the permits and permit executors before the permit issuance begins.

6. The necessary procedures for the mechanical isolation operations must be specified.

7. The necessity or not to implement the electrical separation operations must be determined.

8. The necessity of conducting gas detection operations must be determined.

9. The necessary safety tasks and equipment must be specified.

10. In cases of emergency, all work permits are suspended and canceled immediately.

5. Human relationships

Human relations are highlighted in their goals through the following: -

1-. Achieving the principle of cooperation between workers in the work environment on the one hand, and in aspects of society on the other hand, to enhance friendly ties, close understanding, and mutual trust.

2-. Achieving increased production, which would be an expected result of increased cooperation.

3- Achieving the fulfillment of the diverse needs of individuals, and achieving the objectives of the organization in which they work.

4-. Achieving high morale among working individuals in order to create a general psychological atmosphere in favor of work and production.

The most important behaviors of human relations

Humility, Encouragement, Cooperate, Ashura, Justice

Good example, the responsibility, mercy.

6. Psychological state and mental of safety

Excessive workloads.

Conflicting demands and lack of clarity of the role.

Not being involved in making decisions that affect workers and having no influence over the way the job is done.

Poorly managed organizational change, job insecurity.

Ineffective communication, lack of support from management or colleagues.

Psychological and sexual harassment, and third-party violence.

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7. The division of labor system

1- Increasing the skill in performing the work, in order to simplify the required work.

2- Organize work in an efficient manner in terms of timing, sequence and supervision.

3- Save time and reduce waste during worker transition from one process to another.

4- Facilitating the use of the machine as a result of dividing the production process into several partial operations.

5- All of the above leads to an increase in production efficiency and an increase in production.

6- And most importantly, division of work and specialization contribute effectively to reducing work accidents

8.Follow-up and continuous inspection

In all scientific institutions there are occupational safety units or safety committees. It is professional in proportion to the size of the facility and one of the duties of these departments is to control and inspect all works that take place inside it.

Inspection includes the following:

The extent to which workers apply safety and security instructions.

Inspection of devices and equipment.

Conditions for material transfer

Proper storage methods ..... etc.

9. Issuing instructions and legislation laws when needed

There are general instructions in the occupational safety literature that can be used in controlling work risks, but each institution maintains the privacy of its work, so it is the responsibility of a department, unit or occupational safety committee to issue instructions for work as well as to legislate laws that would reduce work accidents.

10.The media role

The media side has a special importance in reducing accidents and controlling work risks by raising awareness among workers and clarifying the danger of work and how to prevent risks. Among the most important methods adopted for this are: -

1- Signs and stickers.

2- Holding seminars.

3- Establishing workshops.

4- Issuing awareness brochures.

5- Audio and video means.

11.Proper storage

Many accidents happen as a result of poor storage in the laboratories so it's a duty attention to providing suitable storage conditions:

1- The materials shall be stored in places prepared for storage.

2- All appropriate conditions are taken into consideration for each article.

3- Not to store the dangerous materials with regular and traded materials.

4- Not to store dangerous materials with food .....etc.

12.The last line of defense (PPE)

After applying all the previous procedures, it became necessary to wear personal protective equipment**(PPE)** and according to the type of work, and here comes a responsible role biosafety and laboratory supervisors and do not forget the important role of the administration in providing these requirements.

Biological Agent:

- The number of microorganisms required to initiate infection

Q fever	**10 organisms by inhalation**
E. coli	**10^8 organisms by ingestion**
Malaria	**10 organisms by IV injection**
Poliovirus 1	**2 pfu (plaque- forming unit) by ingestion**

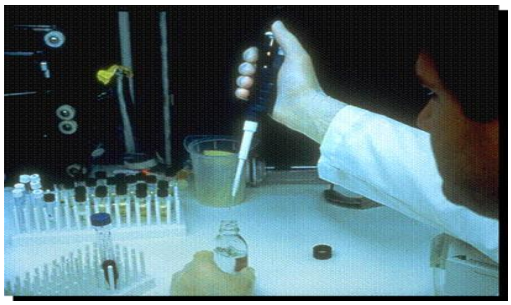
Blood borne Pathogens Training
Need to refresh yearly

Blood borne pathogens are present in human blood and may cause chronic disease or death in people who are exposed. These pathogens are most often spread through contact with infected blood, semen and vaginal secretions, torn or loose skin, or body fluids. The most common blood borne pathogens are: Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immuno deficiency Virus (HIV).

- **Safety Considerations**
  1. **Containment (**Physical, Practices).
  2. **Equipment/facilities (**Biological, Survival).
  3. **Transmission.**

Biosafety Levels of Containment

- Containment involves a combination of laboratory issues to include:
  - Standard microbiological practices (Personal protective equipment).
  - Safety equipment (Primary barrier).
  - Laboratory facilities (Secondary barrier).



- **Standard Microbiological Practices**
  1. Needles & sharps precautions
     - Use sharps containers
     - DON'T break, bend, re-sheath or reuse syringes or needles
     - Use alternatives to needles when available
  2. Use mechanical pipetting devices
  3. Wash hands
- **Safety Equipment (Primary Barrier)**
  - Biological Safety Cabinet
  1. To protect product, personnel and the environment.
  2. Equipment is laid out to not restrict airflow in the cabinet.
- **Facility Design (Secondary Barrier)**
- Facilities PLUS:

–Decontamination method

•Autoclave may be available

•Off-site program

–Eyewash station present

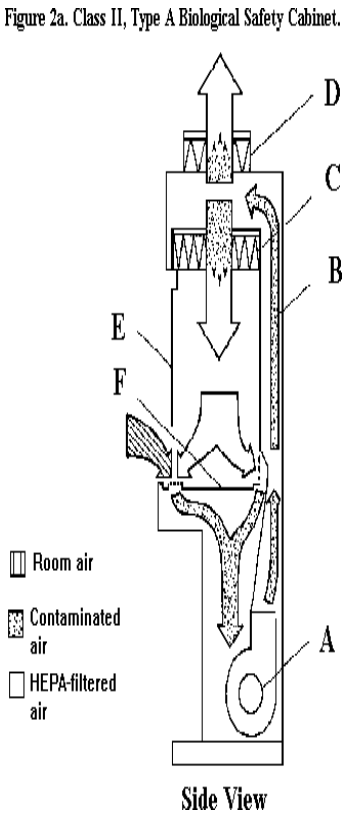


Figure 2a. Class II, Type A Biological Safety Cabinet.
Side View

- Reporting of Research Related Adverse Events
- Research related adverse events include
  - Biological spills
  - Exposure to biohazardous agents
  - Non-adherence to NIH Guideline

- **Biological Safety Cabinets (BSCs) Overview**

– Protection of

–Product

–Personal

–Environment

- Biological Safety Cabinet Airflow

A. Blower
B. Rear plenum
C. Supply HEPA filter
D. Exhaust
E. Sash
F. Work surface

- Biological Safety Cabinet Operation
  1. Not designed for chemical use
  2. May be used for non-volatile toxic chemicals or low-level radioactive materials

3. May be used for "minute" amounts of volatile chemicals if canopy connected

Ensure annual certification

Place all work materials into cabinet before starting

- **Biological Safety Cabinet Operation**

CAUTIONS

– Chemicals may damage HEPA filter

– Volatile chemicals NOT retained by HEPA filter

–Exposes personnel if not exhausted

– Fans NOT spark proof

–Chemical use may result in fire and/or explosion

–Never use flammable

–Open fire can damage HEPA filter

Lec. 10

Elements of Biosafety

Preventing lab-acquired infections

1. Bacteria
2. Viruses
3. Fungi
4. Human blood, unfixed tissue
5. Human cell lines
6. Recombinant DNA

Biosafety in Microbiological and Biomedical Laboratories.
Biosafety/Cabinets

Use of Biosafety Cabinet

1. Turn on fan 15 min before starting
2. Don't block grille
3. Disinfect work surface 70% alcohol
4. Discard pipets inside cabinet
5. Minimize movement of hands
6. Avoid use of flame unless necessary
7. Have cabinet certified annually

Clean Bench

- Air flows from back of cabinet, across work surface, and onto user.
- This does not provide worker protection.

➢ **Centrifuge - Hazards**

- Mechanical failure
- Lab equipment failure

  —tubes etc.
- Aerosol generation
- Operator error

● **Ultraviolet Lamps in BSCs**

UV lamps are not required or recommended in BSCs. If operated properly, BSCs do not need UV lights.

If installed UV lamps must be:

- Cleaned weekly to remove dirt and dust (they block germicidal effectiveness of UV light)
- Checked periodically to ensure the appropriate intensity of UV light is being emitted
- Turned off when the room is occupied to protect eyes and skin from UV exposure

  **can burn the cornea and cause skin cancer

Biohazard work area

1. Mark the work area with the
2. Warning sign and contact information

OSHA (Occupational safety &health Administration) Blood borne Pathogens Standard

Human blood, unfixed tissue, primary human cell culture, other potentially infectious materials Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immuno deficiency Virus (HIV).

OSHA Standard requires:

1. Annual training
2. Web-based program/DES homepage
3. Free HBV vaccine
4. Use of Universal Precautions

Universal Precautions

Treat ALL human blood and unfixed tissue as if it contains HIV and HBV .

Routes of Occupational Transmission

1. Puncture or cut (needle stick, contaminated broken glass).
2. Contact with broken skin.
3. Splash to mucous membranes of eyes, nose, mouth.

Precautions for First Aid

- Wear gloves.

- If conscious, have patient put pressure on wound.
- Use one-way valve for CPR.

Standard Microbiological Practices

➢ NOT permitted in laboratories:

- Eating .
- Drinking.
- Smoking.
- Handling contact lenses.
- Pipetting by mouth.
- Storing food and drink.

➢ ALWAYS wash hands:

- After handling microorganisms and animals.
- After removing gloves.
- Before leaving laboratory.

➢ Discard needles, razor blades, and scalpel blades into red, puncture resistant sharps containers.

➢ Dispose of broken glass into "broken glass" containers, never regular trash.

➢ NEVER

1. recap, bend, or break needles.
2. discard needles or sharps into biological waste bags.
3. discard needles into regular trash.

- Decontaminate all biological waste (including BL1) before disposal Solid waste (Petri dishes, cultures): autoclave and put in dumpster. Liquid waste: add disinfectant (bleach to 10%) and pour down drain.

Autoclaves

Autoclaves use pressurized steam to sterilize materials.

There is usually steam remaining in the chamber at the end of a liquid cycle.

Autoclave Safety

1. Opening door at end of liquid cycle:
   i) Wear eye and face protection.
   ii) Stand behind door when opening it.
   iii) Slowly open door only a crack to allow residual steam to escape.
   iv) Keep face away from door as it opens.

2. Removing liquids at end of cycle:
   i) Wait 5 min. before removing liquids.
   ii) Liquids removed too soon may be super-heated and boil up and out of container.
   iii) Aim mouth of flask away from face.
   iv) Don't knock flask against bench.

Standard Microbiological Practices

1. Decontaminate work surfaces daily and after any spill of viable material.
2. Report accidents .
3. Tell Health Care Provider that you work with infectious agents or chemicals.

Think Again
You've carefully thought out all the angles.
You've done it a thousand times.
Nothing could possibly go wrong, right?

Laboratory Hygiene

<u>DO NOT</u>:

- Eat
- Drink
- Smoke
- Apply cosmetics (including lip balm)
- Handle contact lenses
- Store food or drink in lab refrigerators
- Wear open-toed shoes

- **Hand Washing**

1. Wash hands immediately after removing PPE (personal protective equipement)
2. Use a soft soap
3. A hand sanitizer can be used but wash with soap and water as soon as possible.

- **Personal Protective Equipment (PPE)**

1. PPE can become an important line of defence (last line of defence).
2. USE proper PPE

➢ Spills

- Spill response will vary depending on:
  - What was spilled?
  - How much was spilled?
  - Where was the spill?
  - What is the potential for release to the environment?
- Spills should be cleaned up immediately to ensure proper decontamination.
- All spills are to be reported ASAP to the lab supervisor and Safety office.

Spills

- When cleaning up surfaces use 10% bleach solution or approved disinfectant (Mix bleach solution fresh each time.)
- Put wipes or paper towel on top of the spill
- Spray and allow it to stand for at least ten minutes before wiping up.
- Dispose of all wipes in biohazard containers.
- Decontaminate any materials used to clean up blood or OPIM (mops, sponges, buckets, etc.)
- PPE should be removed and disposed of in biohazard containers.

➢ Decontamination

- Generally for disinfection rather than sterilization
- Choice depends on;
  - Type of material to be disinfected
  - Organic load
  - Chemical characteristics
- Most common are chlorine compounds and alcohols (broad range)

● **Disinfection: What to use for my organism?**

Bacteria

Vegetative bacteria (E. coli,)

•2% domestic bleach
•75% Ethanol
•Quaternary ammonia
•6% formulated Hydrogen peroxide*

Mycobacteria and fungi

•10% domestic bleach
•75% Ethanol
•Phenolic compounds
•6% formulated Hydrogen peroxide*

Spore forming bacteria (Bacillus)

•10% domestic bleach
• Glutaraldehyde
• Formaldehyde
• 6% formulated Hydrogen peroxide*

➢ **Biohazardous Waste Containers**

- Biohazardous waste containers shall be clearly marked with the universal biohazard symbol.
- **Viruses**
- **Enveloped** (HIV, Herpes)
- 2% domestic bleach
- 75% Ethanol
- Quaternary ammonia
- 6% formulated Hydrogen peroxide*
- **Non enveloped** (Hepatitis, Adenovirus)
- 10% domestic bleach
- 6% formulated Hydrogen peroxide*
- Glutaraldehyde
- Formaldehyde

Biohazardous Waste Containers

- Biohazardous waste containers shall be clearly marked with the universal biohazard symbol.

➢ **Transportation**

Transportation of Dangerous Goods

- Ppackaging requirements (primary and secondary containers, dry ice etc.).
- Means and route of transportation (use of cart with guard rails, low traffic area etc.)
- Regulatory requirements (classification, labelling, signing, documenting)

Comply, or assure compliance, with applicable U.S. Department of Transportation, EPA, and USDA criteria in the transportation (on campus) or shipping (off campus) of regulated potentially biohazardous materials or wastes.

With proper knowledge, planning and care, a biological exposure is avoidable.

Let Us be Safe !!!!!!!!