Lab TWO :.

Laboratory safety rules

Biological material is used intensively in biological and biomedical research. In this type of research, the use of modern molecular biological techniques like recombinant-DNA technology is still on the increase.

Biosafety: is about the intrinsic hazards of living organisms and how to handle them safely. Genetic material as such ('naked' DNA) can be dangerous as well. Before starting to work with pathogens or genetically modified organisms (GMOs) in a laboratory one should stop and think about the possible hazards of these organisms and take proportionate measures to minimise any risks for human health and the environment. ....Safety first...!

The American National Institutes of Health (NIH) guidelines constituted the reference for the development of rules for laboratory work using genetic engineering techniques and were at the basis of specific worldwide rules or national laws in many countries. A worldwide agreement exists on the four-group classification system (Table 1) for human pathogens (bacteria, fungi, viruses and parasites) ranking from those that pose no or negligible hazard (class /group 1) to those responsible for very serious diseases (class/group 4).

Risk Group I	(low individual and community risk). A microorganism that is unlikely to cause human disease or animal disease of veterinary importance.
Risk Group II	(moderate individual risk, limited community risk). A pathogen that can cause human or animal disease but is unlikely to be a serious hazard to laboratory workers
Risk Group III	(high individual risk, low community risk). A pathogen that usually produces serious human disease but does not ordinarily spread from one infected individual to another.
Risk Group IV	(high individual and community risk). A pathogen that usually produces serious human or animal disease and may be readily transmitted from one individual to another, directly or indirectly.

What are the hazards?

1- The pathogenicity of an organisms

2- Toxicity: Toxicity means poisoning.

3- Allergenicity: Allergenicity is a non-toxic, immune system mediated, undesired reaction of the body to a substance or agent.

4- Disturbance of ecological balances:. Disturbance of an ecological balance may happen when a GMO possessing a certain characteristic is accidentally spread to the environment, or when genetic material originating from that organism spreads to other organisms in the environment.

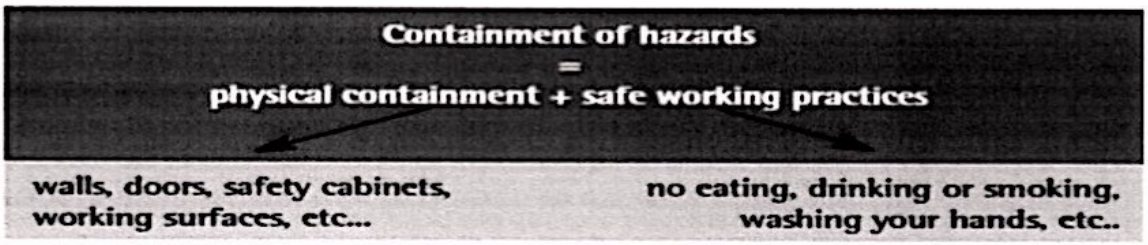
5- Other harmful effects: Sometimes there are other unwanted effects that urge one to be even more cautious when handling biological material. It is not possible to give an exhaustive list of these effects.

The Seven Basic Rules of Biosafety:

The most common means of exposure can be essentially eliminated as occupational hazards by following the seven basic rules of biosafety:

1. Do not mouth pipette.
2. Manipulate infectious fluids carefully to avoid spills and the production of aerosols and droplets.
3. Restrict the use of needles and syringes to those procedures for which there are no alternatives; use needles, syringes, and other "sharps" carefully to avoid self-inoculation; and dispose of "sharps" in leak- and puncture-resistant containers.
4. Use protective laboratory coats and gloves.
5. Wash hands following all laboratory activities, following the removal of gloves, and immediately following contact with infectious materials.
6. Decontaminate work surfaces before and after use, and immediately after spills.
7. Do not eat, drink, store food, or smoke in the laboratory.

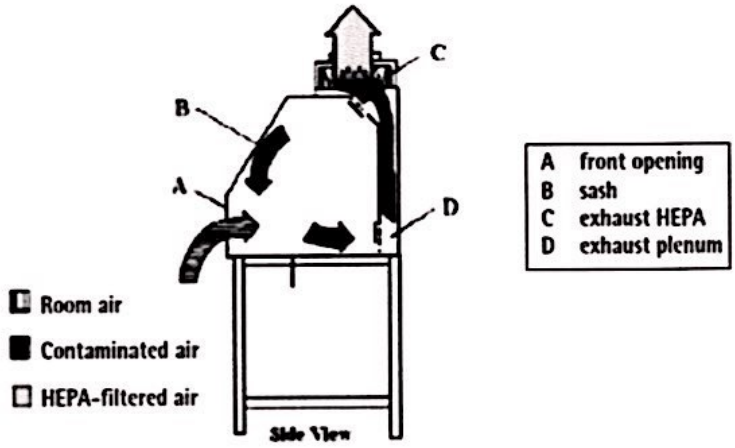
Containment: A combination of infrastructure and working practices:



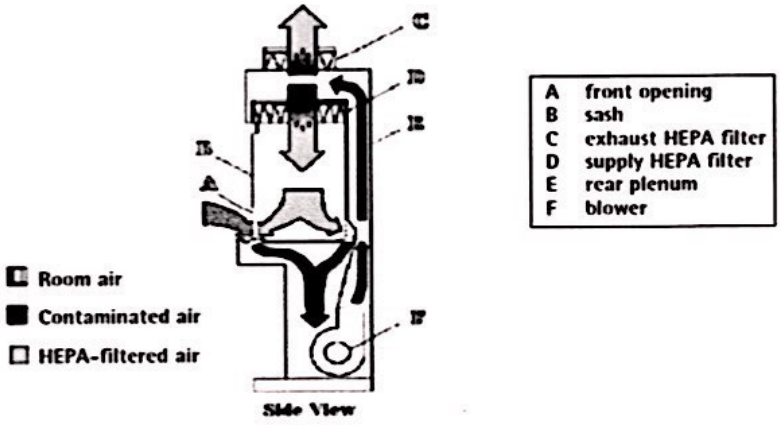
Safety cabinets:

A safety cabinet is an important type of physical containment. In fact, a safety cabinet creates a safe working space within the laboratory. Safety cabinets are designed to protect the worker in the first place and the environment in the second place. A distinction is made between three types of safety cabinets: class I, II and III.

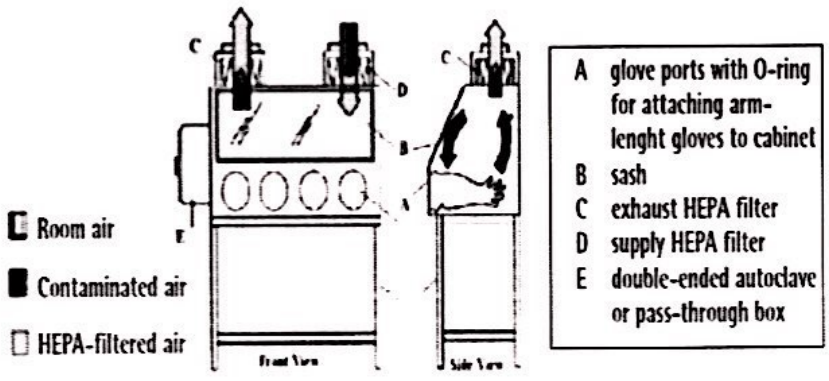
Class I safety cabinets



Class II safety cabinets



Class III safety cabinets



Safety cabinet	Protection		
	worker	environment	experiment
Class I	good	good	bad
Class II	good	good	good
Class III	excellent	excellent	good

How to decontaminate materials and work surfaces:

There are several disinfectants available, all of which are characterised by their own specific mode of action. In general, there are two common modes of action:

1) by destroying the lipid membrane of a micro-organism which results in the leaking of cell material.

2) by destroying proteins and enzymes necessary for the survival of the micro-organism Ethanol, quaternary ammonium salts and surfactants (a.o. detergents and soap) exploit the first mode of action.

Strong oxidising agents like chlorine of hydrogen peroxide exploit the second mode of action. Phenolics like lysol work by destroying both proteins and the lipid membrane. Some more information on specific disinfectants in table below

The effectiveness of different decontaminants

	Fungi	bacteria	mycobacteria	spores	lipid viruses	non-lipid viruses
Ethanol	-	+++	+++	-	+	V
Hypochlorite	+	+++	++	++	+	+
Formaldehyde	+++	+++	+++	+++*	+	+
Peroxide	+	+++	++	++	+	+

* above 40 °C V = variable

Natural routes of infection: Pathogens all have their own route of infection, by which they spread from one hostorganism to another.

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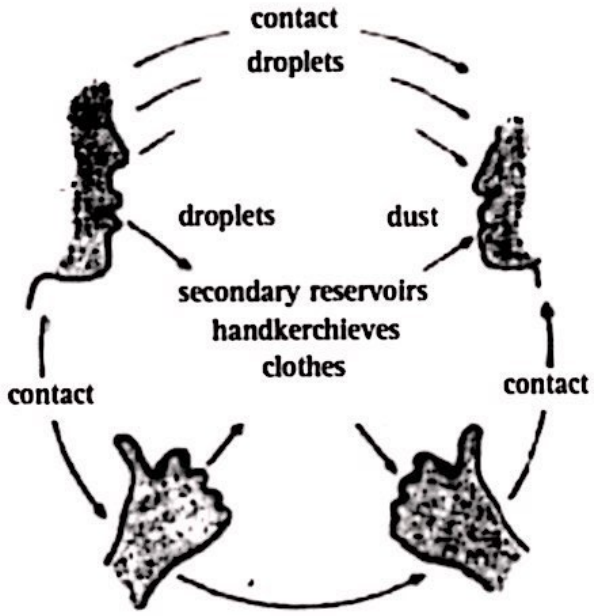
to another. The table below lists a number of important routes of infection:

Route of infection	example
Skin contact	fungi
Through air or aerosols	flu
Through pricking (insects or needles)	malaria Yellow fever
Blood-blood contact	HIV-virus Hepatitis B
Through wounds	staphylococci
Through faecal material	typhoid bacteria Poliovirus

All these routes of infection may, depending on the type of work that is being performed, occur in the laboratory. As regards organisms that are able to spread through the air, very small droplets play a role, but infection may also be the result of direct contact, for instance with hands, handkerchieves, or clothes.



the spread of micro-organisms via air

Biological waste:

Biological waste must be disposed of an important distinction should be made between biological waste that has been inactivated before disposal, and biological waste that has not been inactivated before disposal. The latter has to be treated as hazardous medical waste and should be transported to an incinerator that is suited for the incineration of hazardous medical waste.

Biological waste includes:

- All genetically modified and/or pathogenic biological material: cell cultures, cultures of Microorganisms, tissues, blood, etc.
- Typical laboratory waste of organic origin: gels, etc.
- All kinds of biologically contaminated material: gloves, paper tissues, disposable culture flasks, pipettes, etc.
- Materials that are not necessarily contaminated, but cannot be thrown into an ordinary waste disposal bag because they have sharp edges or look dirty (bones, blood, etc.).

Biological waste does not include:

- Radioactive contaminated material. Such material should be dealt with separately.