



Lab Biosafety

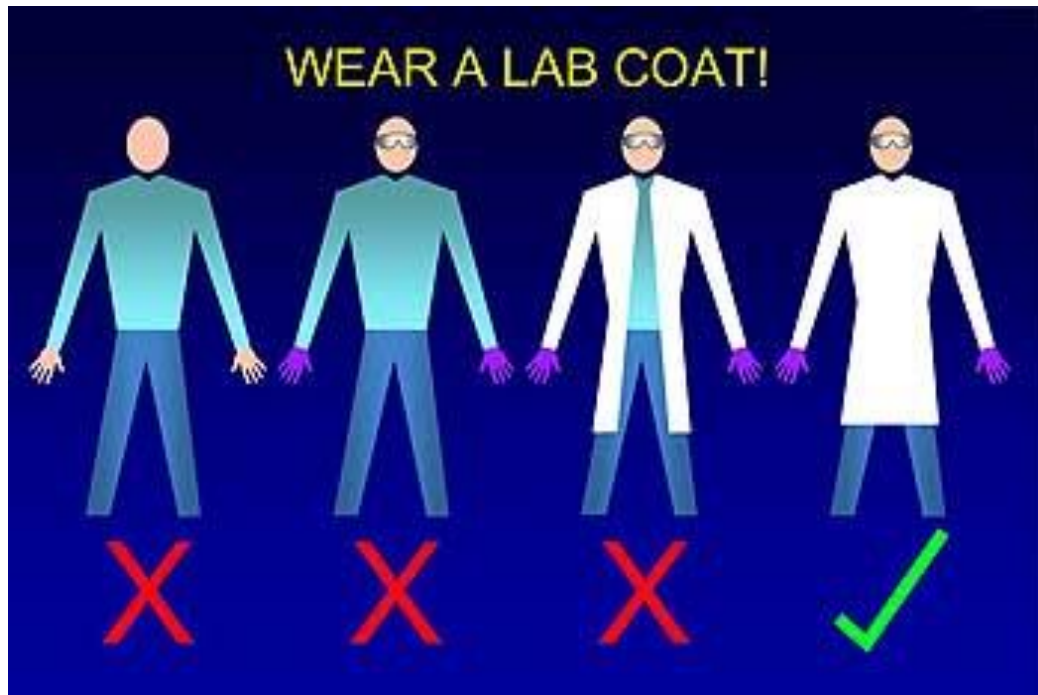
Lab Biosafety



Laboratory is an interesting scientific environment if you take care of:

- Yourself
- Others
- Environment

General rules in laboratory



General rules in laboratory



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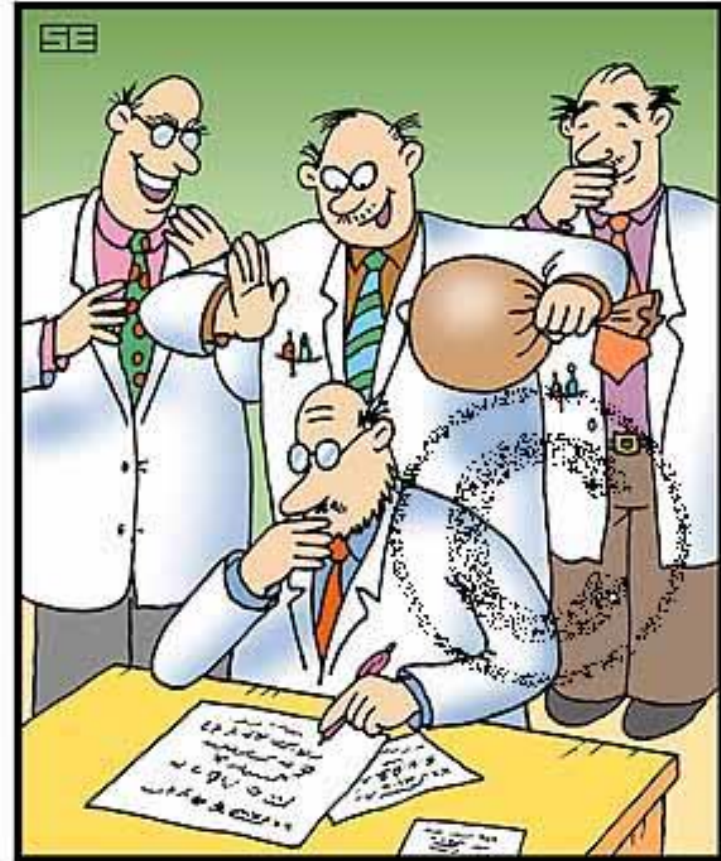


"They hate it when you carry the testtubes that way."

General rules in laboratory



General rules in laboratory



The favourite practical joke amongst Big Bang theorists.

General rules in laboratory



Radioactive



Biohazard



Poison



Oxidizing



Explosive



Flammable

Lab Safety



- Chemical Safety
- Physical Safety
- Biological Safety (Biosafety)

Biohazards



Biohazards



- **Biohazard**

An agent of biological origin that has the capacity to produce negative effects on humans, plants or animals.

- **Biosafety**

Programs to reduce or eliminate exposure of individuals and the environment to potentially hazardous biological agents

- **Biosecurity**

To Prevent loss, theft or misuse of microorganisms, biological materials, and research-related information

Biohazards



- Bacteria
- Viruses
- Parasites
- Fungi
- Human and Non-Human Primate Material
- Recombinant DNA
- Animals
- Biological Toxins

Chartlof, E. *Biosafety in Research Laboratories* [PowerPoint Slides]. Retrieved from: <https://research.mclean.harvard.edu/safety/docs/Biosafety09.ppt>

Biohazards



- **Inhalation -80% of lab acquired infections (LAI)**

- Perform experiments in biological safety cabinets
- Use respiratory protection

Remaining 20% LAI are a combination of:

- **Percutaneous**

- Avoid sharps when possible, use plastic pipettes and disposable glassware

- **Mucous Membrane (eyes, nose and mouth)**

- Wash hands often, avoid touching face

- **Ingestion**

- Wash hands often, No eating, drinking, smoking or applying cosmetics

Chartlof, E. *Biosafety in Research Laboratories* [PowerPoint Slides]. Retrieved from: <https://research.mclean.harvard.edu/safety/docs/Biosafety09.ppt>



Table 1: Classification of Infectious Microorganisms by Risk Group

Risk Group Classification	NIH Guidelines for Research involving Recombinant DNA Molecules 2002 ²	World Health Organization Laboratory Biosafety Manual 3 rd Edition 2004 ¹
Risk Group 1	Agents not associated with disease in healthy adult humans.	(No or low individual and community risk) A microorganism unlikely to cause human or animal disease.
Risk Group 2	Agents associated with human disease that is rarely serious and for which preventive or therapeutic interventions are <i>often</i> available.	(Moderate individual risk; low community risk) A pathogen that can cause human or animal disease but is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment. Laboratory exposures may cause serious infection, but effective treatment and preventive measures are available and the risk of spread of infection is limited.
Risk Group 3	Agents associated with serious or lethal human disease for which preventive or therapeutic interventions may be available (high individual risk but low community risk).	(High individual risk; low community risk) A pathogen that usually causes serious human or animal disease but does not ordinarily spread from one infected individual to another. Effective treatment and preventive measures are available.
Risk Group 4	Agents likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available (high individual risk and high community risk).	(High individual and community risk) A pathogen that usually causes serious human or animal disease and can be readily transmitted from one individual to another, directly or indirectly. Effective treatment and preventive measures are not usually available. ³

US Department of Health and Human Services, Centers for Disease Control and Prevention, & National Institutes of Health. (2009). Biosafety in microbiological and biomedical laboratories . LC Chosewood & DE Wilson.

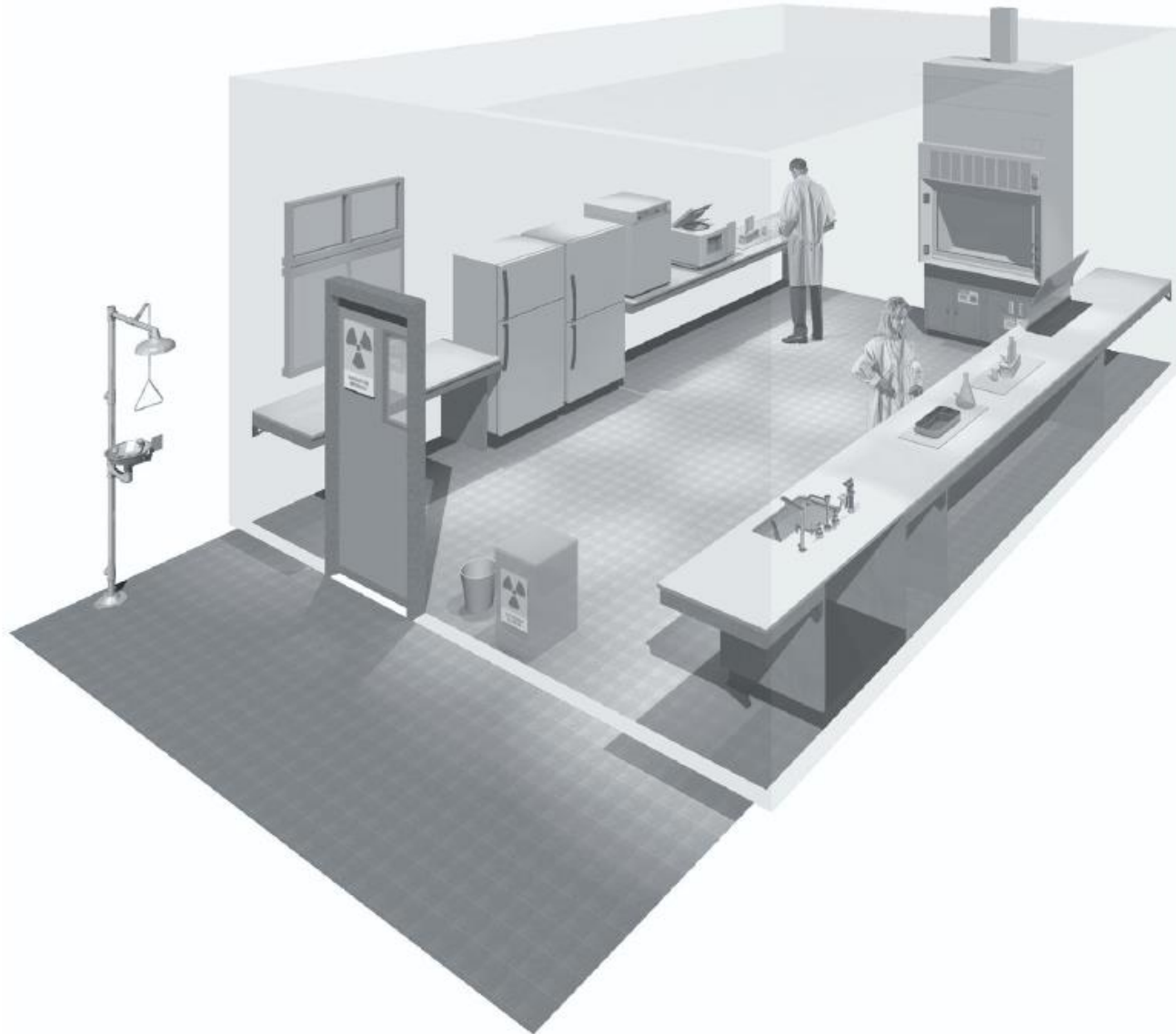
Biosafety levels



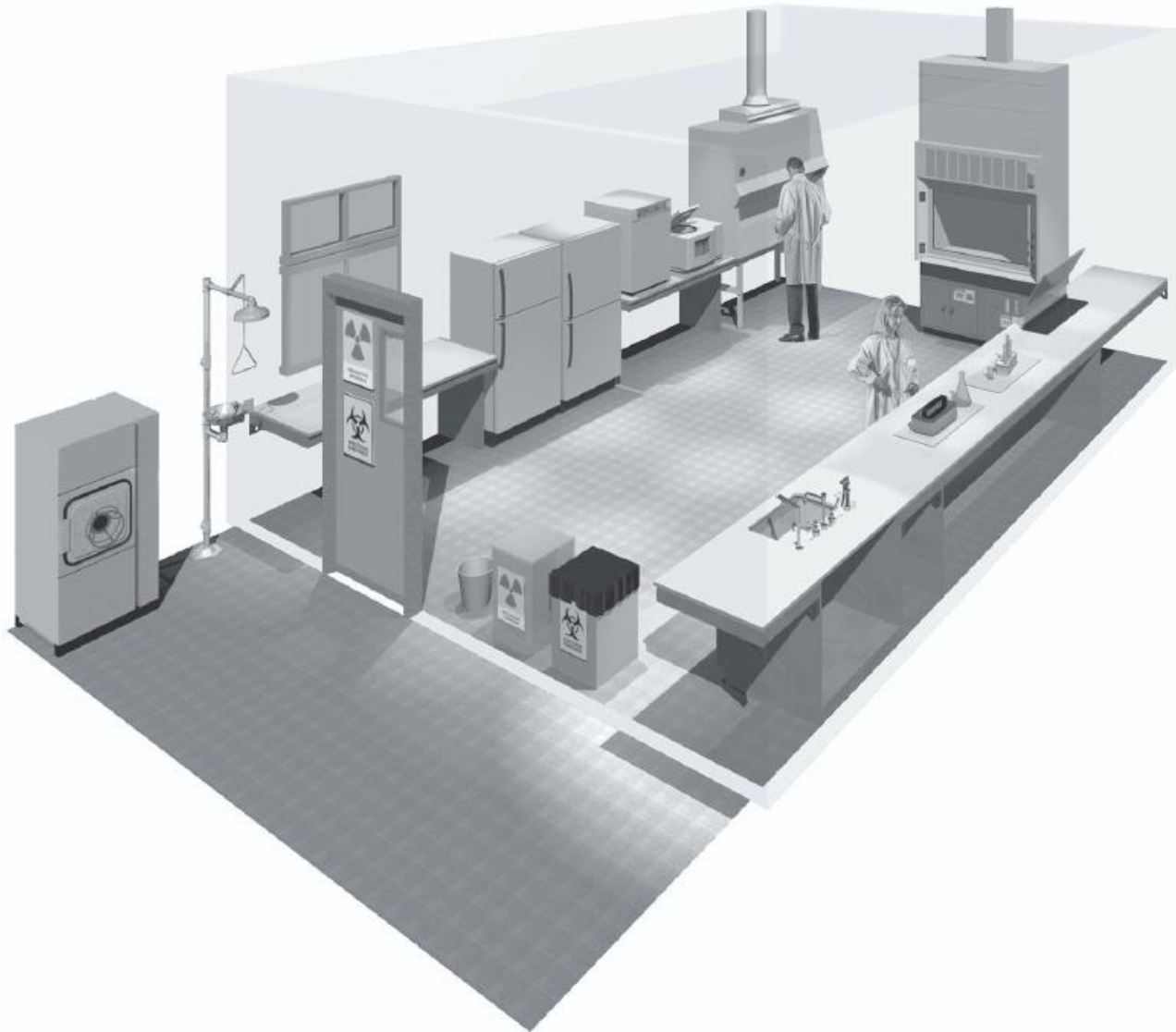
RISK GROUP	BIOSAFETY LEVEL	LABORATORY TYPE	LABORATORY PRACTICES	SAFETY EQUIPMENT
1	Basic – Biosafety Level 1	Basic teaching, research	GMT	None; open bench work
2	Basic – Biosafety Level 2	Primary health services; diagnostic services, research	GMT plus protective clothing, biohazard sign	Open bench plus BSC for potential aerosols
3	Containment – Biosafety Level 3	Special diagnostic services, research	As Level 2 plus special clothing, controlled access, directional airflow	BSC and/or other primary devices for all activities
4	Maximum containment – Biosafety Level 4	Dangerous pathogen units	As Level 3 plus airlock entry, shower exit, special waste disposal	Class III BSC, or positive pressure suits in conjunction with Class II BSCs, double-ended autoclave (through the wall), filtered air

BSC, biological safety cabinet; GMT, good microbiological techniques (see Part IV of this manual)

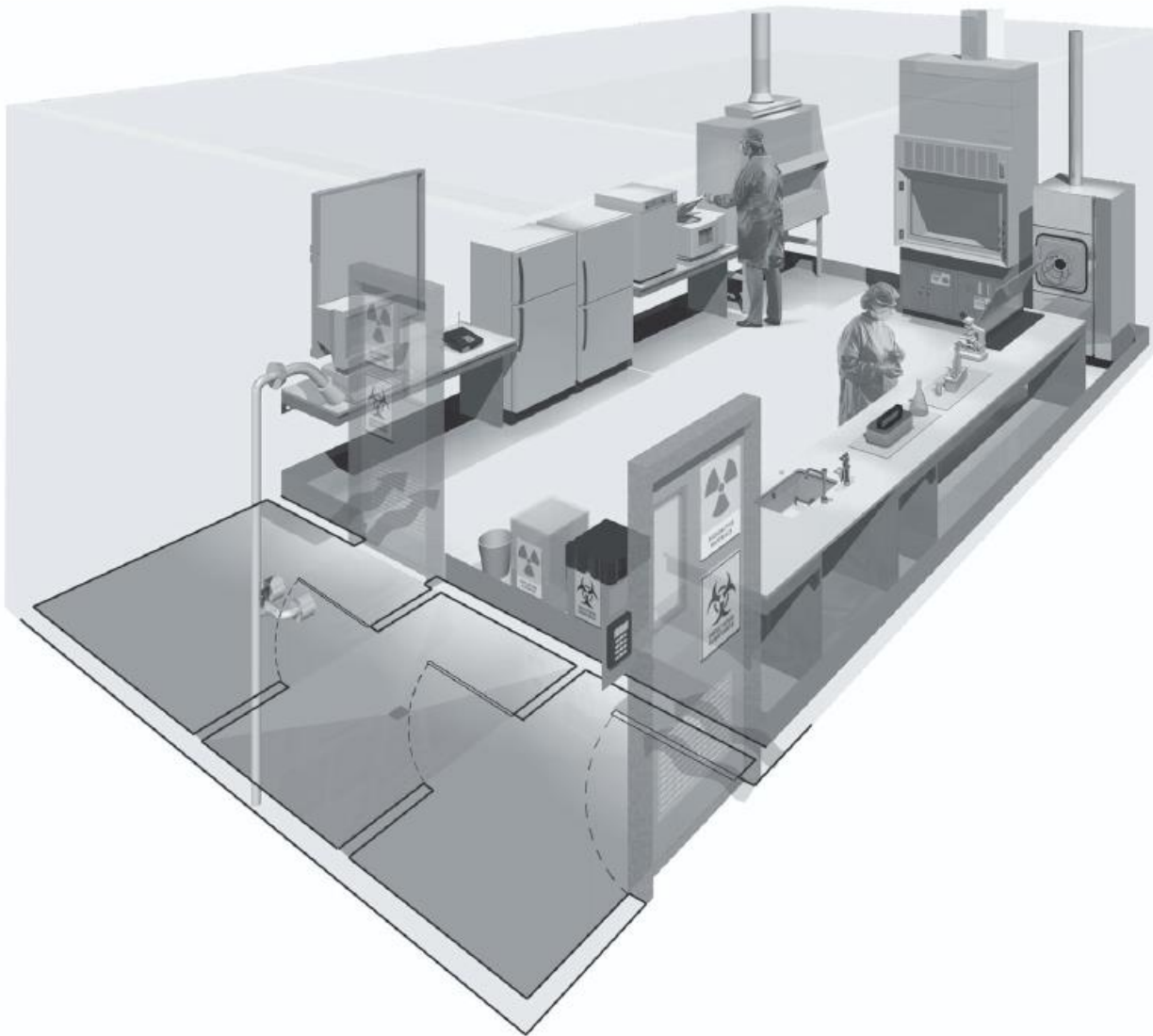
BSL1



BSL2



BSL3



Biosafety Equipment



- Autoclave
- Biological Safety Cabinets
- Leak-proof vessels
- Screw-capped bottles
- ...

Autoclave



- A pressurized vessel using saturated steam under pressure to sterilize or decontaminate materials and equipment.
- 121 °C at 15 psi (1 Atm) for 20-60 minutes
- In a dry air oven, it takes two hours at 160°C to kill spores of the bacterium Clostridium botulinium (associated with canned food). Using saturated steam, the same spores are killed in just five minutes at 121°C

Biological Safety Cabinet (BSC)

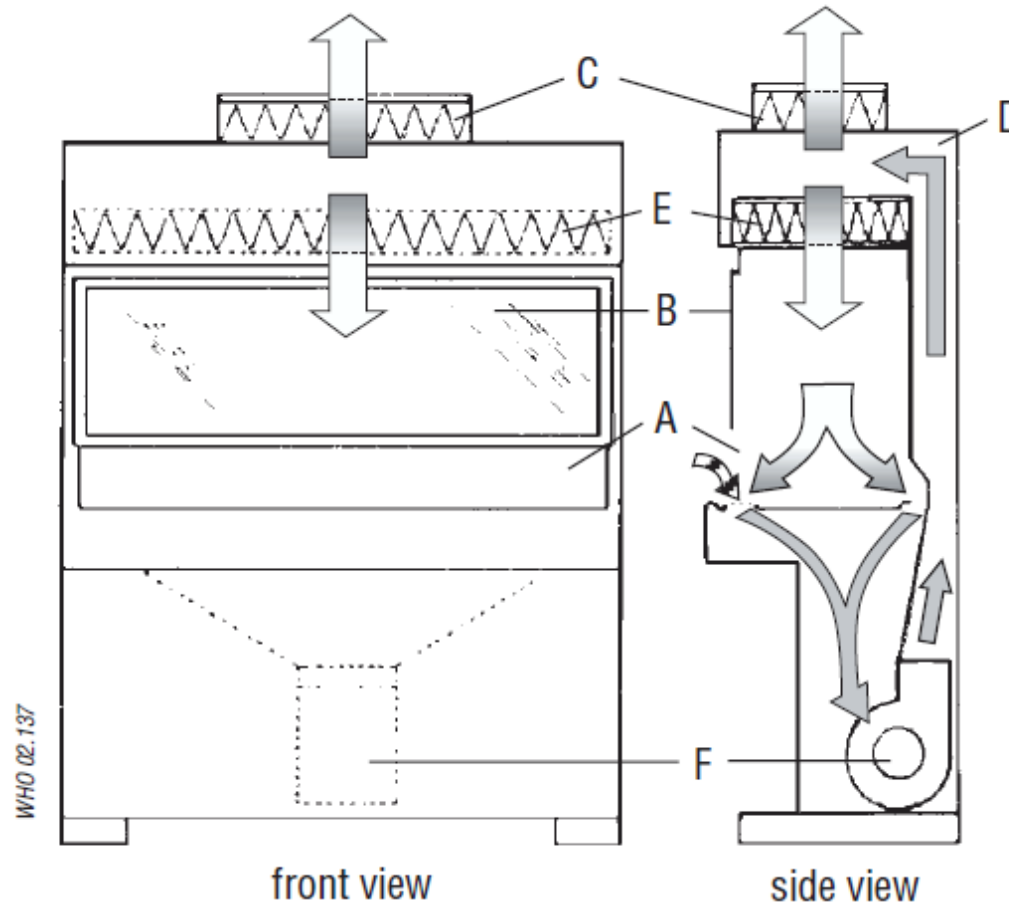





BSC Provide:

- Product Protection
- Personnel Protection
- Environmental Protection



Biological Safety Cabinet (BSC)



-  room air
-  potentially contaminated air
-  HEPA-filtered air

BSC is different from Fume Hoods



Fume hoods are designed solely to protect the individual from exposure to chemicals and noxious gases

BSC is different from clean bench



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

How to use a BSC?



Before Using the Biosafety Cabinet

- Turn off **ultraviolet light** (if so equipped) as soon as you enter the room.
- Turn on all **blowers** and cabinet illumination lights.
- Allow **five** minutes of operation to purge the system.
- **Decontaminate** readily accessible interior surfaces with a disinfectant appropriate for the agents or suspected agents present.

How to use a BSC?



During Use of the Biosafety Cabinet

- **Minimize disruption** of airflow.
- Open continuous flames are not permitted to be used inside the BSC.
- Keep front and back **grills free** of materials that might block airflow.
- Minimize items within the cabinet.

How to use a BSC?



After Use of the Biosafety Cabinet

- All items removed from the Biosafety Cabinet must be decontaminated first.
- Decontaminate readily accessible interior surfaces with a disinfectant appropriate for the agents or suspected agents present.
- Allow five minutes of operation to purge the system.
- Turn off cabinet blower.

How to use a BSC?



Don'ts

- Do not use cabinets as a permanent **storage area** for supplies (disrupts airflow)
- Do not work inside cabinet with **UV lamp on**, if so equipped. (skin/eye burns)
- **Do not rapidly insert or withdraw arms.** (disrupts airflow)
- Place required equipment or supplies for procedure inside **before beginning** work. (minimizes hand/arm withdrawals which can disrupt airflow)



Recombinant and synthetic nucleic acids

How to use a BSC?



In the context of the NIH Guidelines, recombinant and synthetic nucleic acids are defined as:

- i) molecules that a) are constructed by joining nucleic acid molecules and b) that can replicate in a living cell, i.e., recombinant nucleic acids
- ii) nucleic acid molecules that are chemically or by other means synthesized or amplified, including those that are chemically or otherwise modified but can base pair with naturally occurring nucleic acid molecules, i.e., synthetic nucleic acids
- iii) molecules that result from the replication of those described in (i) or (ii) above.

Biosafety Levels for rDNA Research in Plant



For research involving plants, four biosafety levels (BL1-P through BL4-P) are described:

- BL1-P is designed to provide a moderate level of containment for experiments for which there is convincing **biological evidence that precludes the possibility of survival, transfer, or dissemination of recombinant DNA into the environment**, or in which there is **no recognizable and predictable risk** to the environment in the event of accidental release.

Biosafety Levels for rDNA Research in Plant



- BL2-P is designed to provide a greater level of containment for experiments involving plants and certain associated organisms in which there is a **recognized possibility of survival**, transmission, or dissemination of recombinant DNA containing organisms, but the consequence of such an inadvertent release has a predictably **minimal biological impact**.
- BL3-P and BL4- P describe additional containment conditions for research with plants and certain pathogens and other organisms that require special containment because of their recognized **potential for significant detrimental impact on managed or natural ecosystems**

Biohazard Label



- **Biohazard labels shall be placed on:**
 - the surface of all equipment (freezers, incubators, refrigerators) which may be contaminated with biohazardous materials.
 - sample transport outer containers.
 - medical waste bins

- **Biohazard signs shall be placed on:**
 - the outer door of BL 2 labs.
 - medical waste storage areas

Hashimoto, R.J. 2007. Biological Safety in the Laboratory [PowerPoint Slides]. Retrieved from www.research.umn.edu/ibc/documents/UMNBiologicalLaboratorySafety.ppt

Take Home Message



- Plan ahead before jumping to the lab
- Always ask PI or lab manager if you don't know
- Always use your head
- Always be cautious and honest

- Working in the lab is a serious business so:
 - Don't mess around
 - Don't play practical jokes
 - Don't rush
 - Don't get too excited

Respect your and others safety

Further Information



Office of Biotechnology Activities



Further Information



Contact me at:

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- Good Luck with Your Research