# Summer Student Intern Training: Biosafety & Bloodborne Pathogens Exposure Control

# JABSOM EHSO

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# Question

***What is the difference between a chemical hazard and a biohazard?***

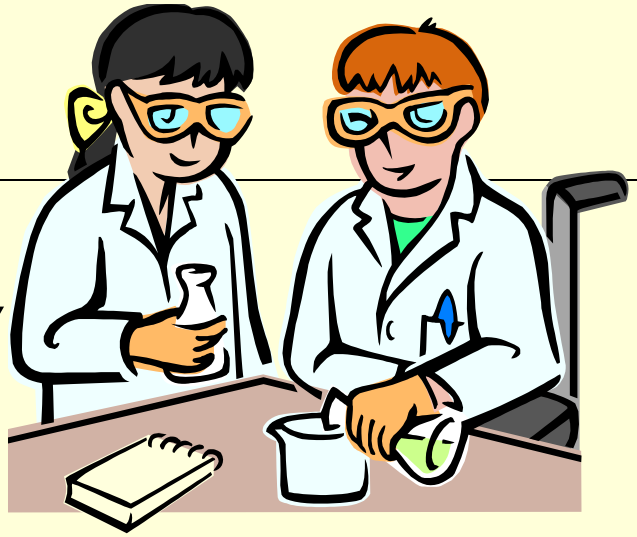
# Biohazard

## Definition of 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.***

*What are some examples of biohazardous agents or biohazardous materials?*

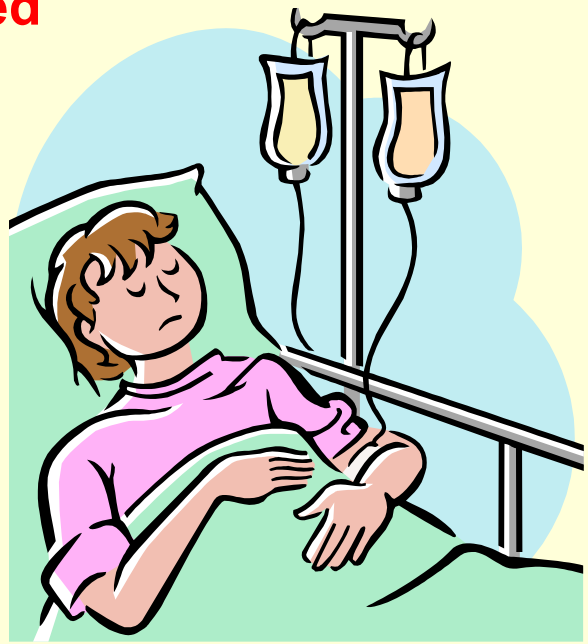
# Biosafety



**Definition of BIOSAFETY**

***The application of combinations of laboratory practice and procedure, laboratory facilities, and safety equipment when working with potentially infectious microorganisms.***

**Biosafety practices were developed because of lab acquired infections (LAI) that were documented since about the 1940s.**



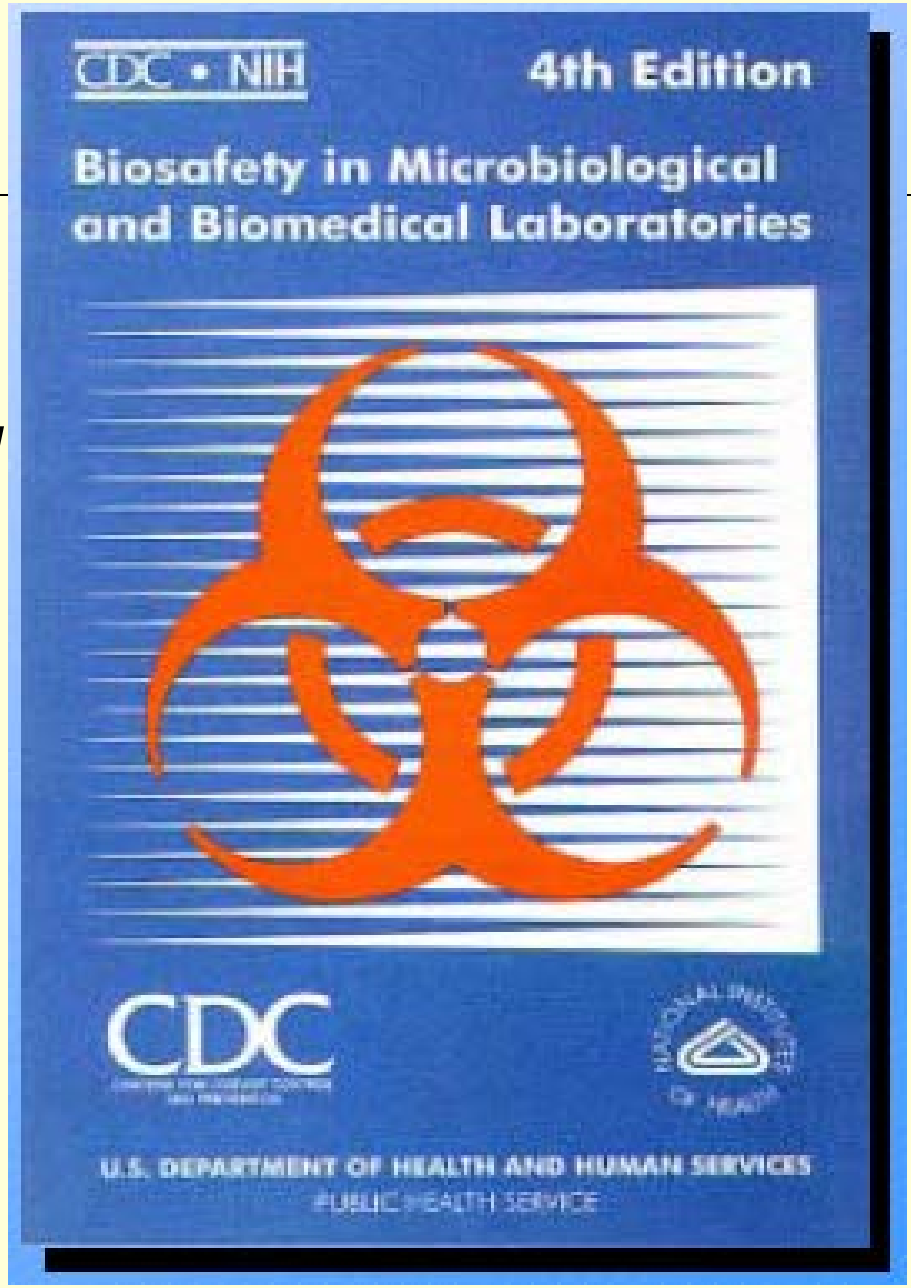
***Biosafety Practices can PROTECT:***

- ***You***
- ***Your Co-Workers***
- ***Lab Support Staff***
- ***The Public***
- ***The Environment***
- ***Your Research***

# The BMBL

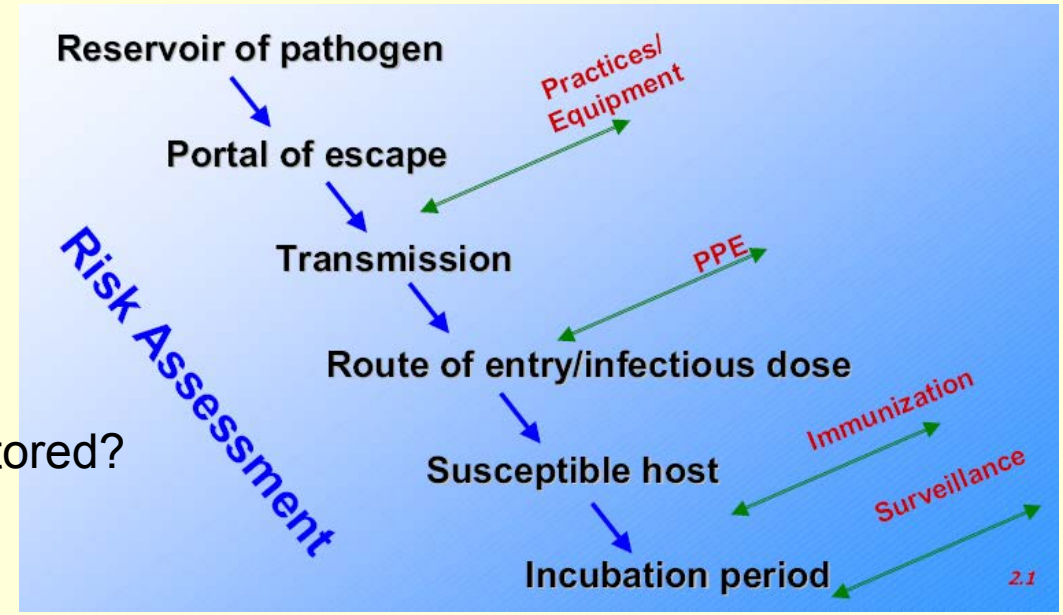
***Biosafety Practices are based on the CDC-NIH Biosafety in Microbiological and Biomedical Laboratories or BMBL.***

***5th edition is in effect and online.***



# Risk Assessment
# Probability of Infection

- What is the natural host?
- Does the pathogen cross or jump species barriers?
- Is the pathogen a “wild type” or “attenuated” strain?
- Does the agent typically infect normal healthy or immunocompromised individuals?
- What is the mode of transmission?
  - Contact
  - Fomites
  - Mucous Membrane
  - Ingestion
  - Innoculation/Vector
  - Inhalation
- What is the volume manipulated, stored?
- What is the concentration?
- What is the infectious dose?
- How many documented LAI’s?
- What is the probability of secondary spread?
- What is the availability of prophylaxis (immunizations, vaccinations, treatment)?



# Biosafety Levels

**A risk assessment will determine the appropriate biosafety level.**

**What biosafety level are the majority of UH labs?**

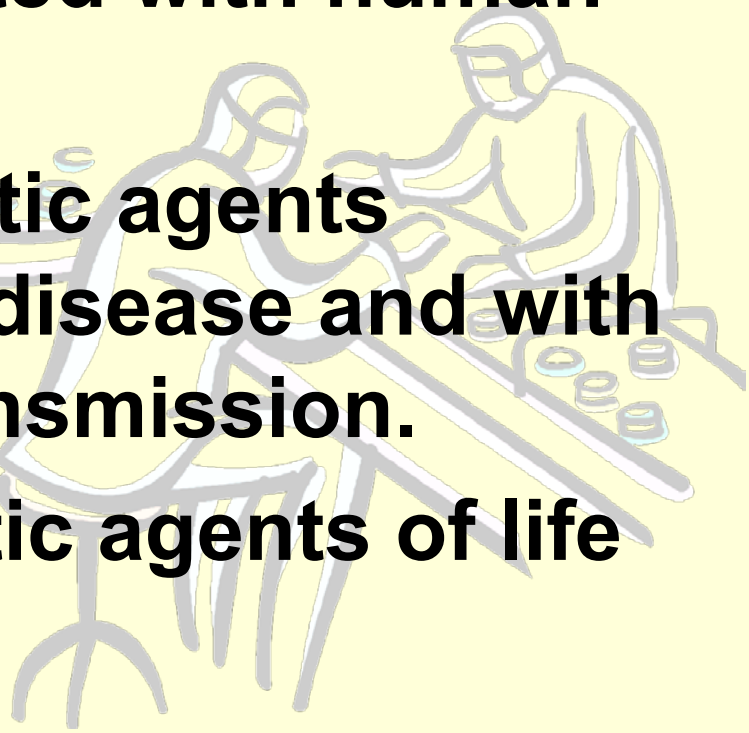
**How many biosafety levels are there?**

# BSLs Overview

- BSLs assign varying degrees of protection for personnel, the environment, and the community.
- There are four levels of BSLs, in ascending order or protection. BSL-1 requires the most basic level of protections and BSL-4 requires the most stringent.
- BSLs are based upon by the properties of a disease or organism, such as its infectivity, the severity of disease, its transmissibility, and the nature of work being conducted.
- BSLs incorporate laboratory practice and technique, safety equipment and facility design to ensure adequate protection from diseases being researched.

# Biosafety Levels

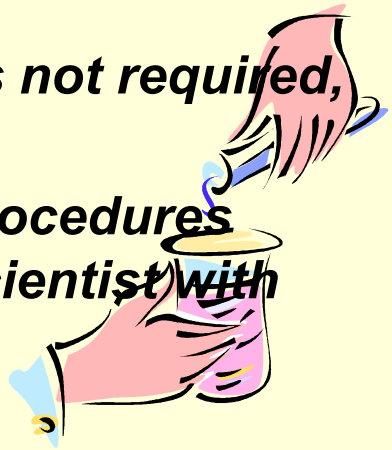
- *BSL1* - agents not known to cause disease.
- *BSL2* - agents associated with human disease.
- *BSL3* - indigenous/exotic agents associated with human disease and with potential for aerosol transmission.
- *BSL4* - dangerous/exotic agents of life threatening nature.



# Biosafety Level 1 (BSL1)

***BSL1 is suitable for work involving well-characterized agents not known to consistently cause disease in immunocompetent adult humans, and present minimal potential hazard to laboratory personnel and the environment.***

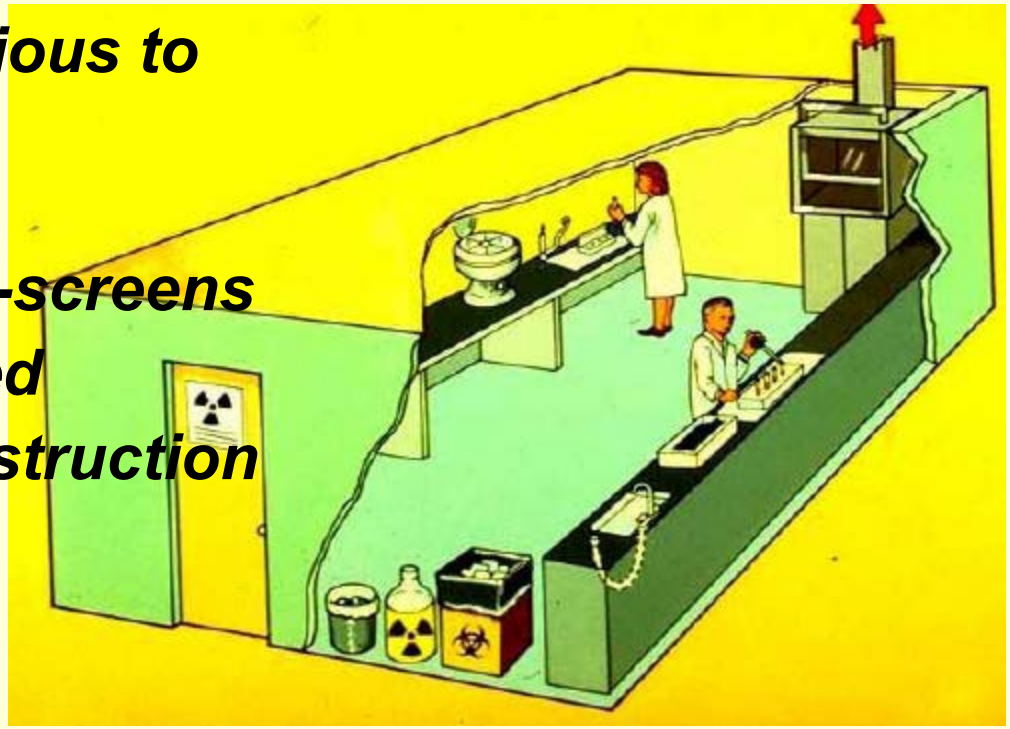
- ***Labs are not necessarily separated from the general traffic patterns in the building.***
- ***Work is typically conducted on open bench tops using standard microbiological practices.***
- ***Special containment equipment or facility design is not required, but may be used as determined by risk assessment.***
- ***Lab personnel must have specific training in the procedures conducted in the lab and must be supervised by a scientist with training in microbiology or related science.***



# BSL1 Facility Design, Construction (Secondary Barriers)

**Requirements:**

- ***Laboratories have doors***
- ***Sink for hand washing***
- ***Work surfaces easily cleaned***
- ***Bench tops are impervious to water***
- ***Sturdy furniture***
- ***Windows fitted with fly-screens***
- ***Location - not separated***
- ***Structure - normal construction***
- ***Ventilation - none***



# BSL1 Standard Microbiological Practices

- ☑ Restrict or limit access when working
- ☑ Prohibit eating, drinking and applying cosmetics or fussing with contacts
- ☑ Prohibit mouth pipetting; use mechanical pipetting devices
- ☑ WASH HANDS!!!
- ☑ Minimize splashes and aerosols
- ☑ Decontaminate work surfaces daily
- ☑ Decontaminate wastes
- ☑ Maintain insect & rodent control program

# BSL1 Safety Equipment (Primary Barriers)

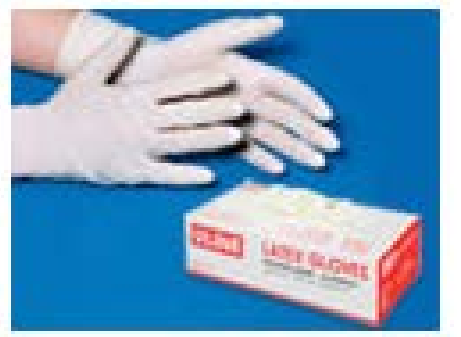
**Personal Protective Equipment (PPE)**

**Lab Coat**

**Gloves**

**Face Protection**

**Eye Protection**



# Biosafety Level 2 (BSL2)

***BSL2 builds upon BSL1. BSL2 is suitable for work involving agents that pose moderate hazards to personnel and the environment. It differs from BSL1 in that:***

***1) Lab personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures***

***2) Access to the lab is restricted when work is being conducted***

***3) All procedures in which infectious aerosols or splashes may be created are conducted in Biosafety Cabinets or other physical containment equipment***

# BSL2 Agents

*Examples include:*

- ***Measles virus***
- ***Salmonellae***
- ***Toxoplasma spp.***
- ***Hepatitis B virus***
- ***Bloodborne Pathogens***

- ***Human body fluids/particularly when visibly contaminated with blood***

** Immunization or antibiotic treatment is available*

** Extreme precaution with contaminated needles or sharp instruments*

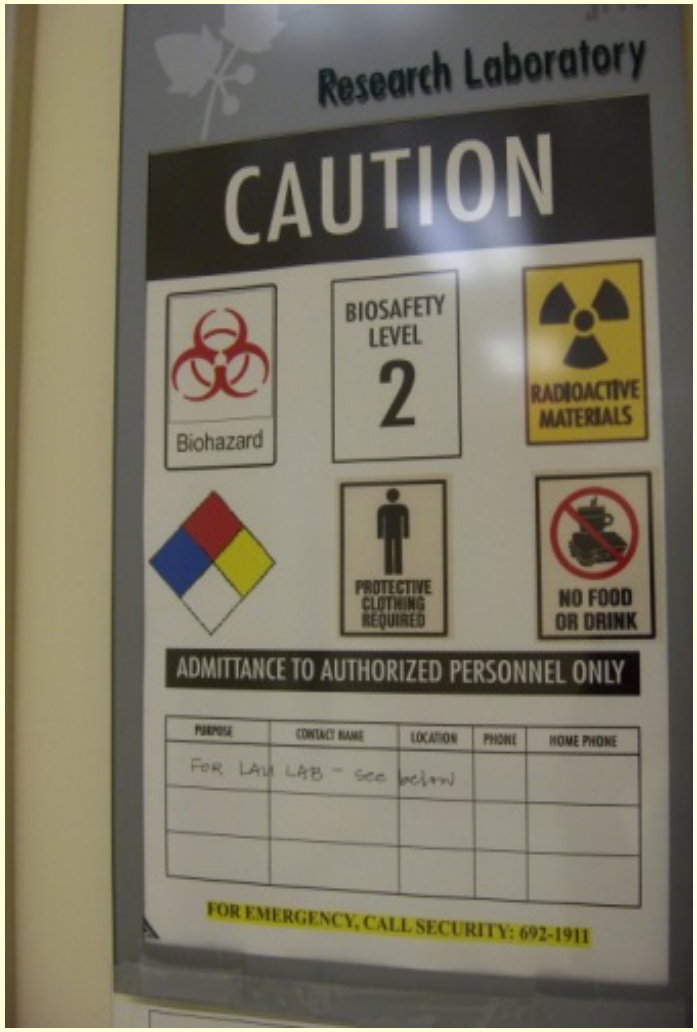
# Biohazard Signage and Labels

- Policies and procedures for entry
- Biohazard warning signs
- Red containers and bags

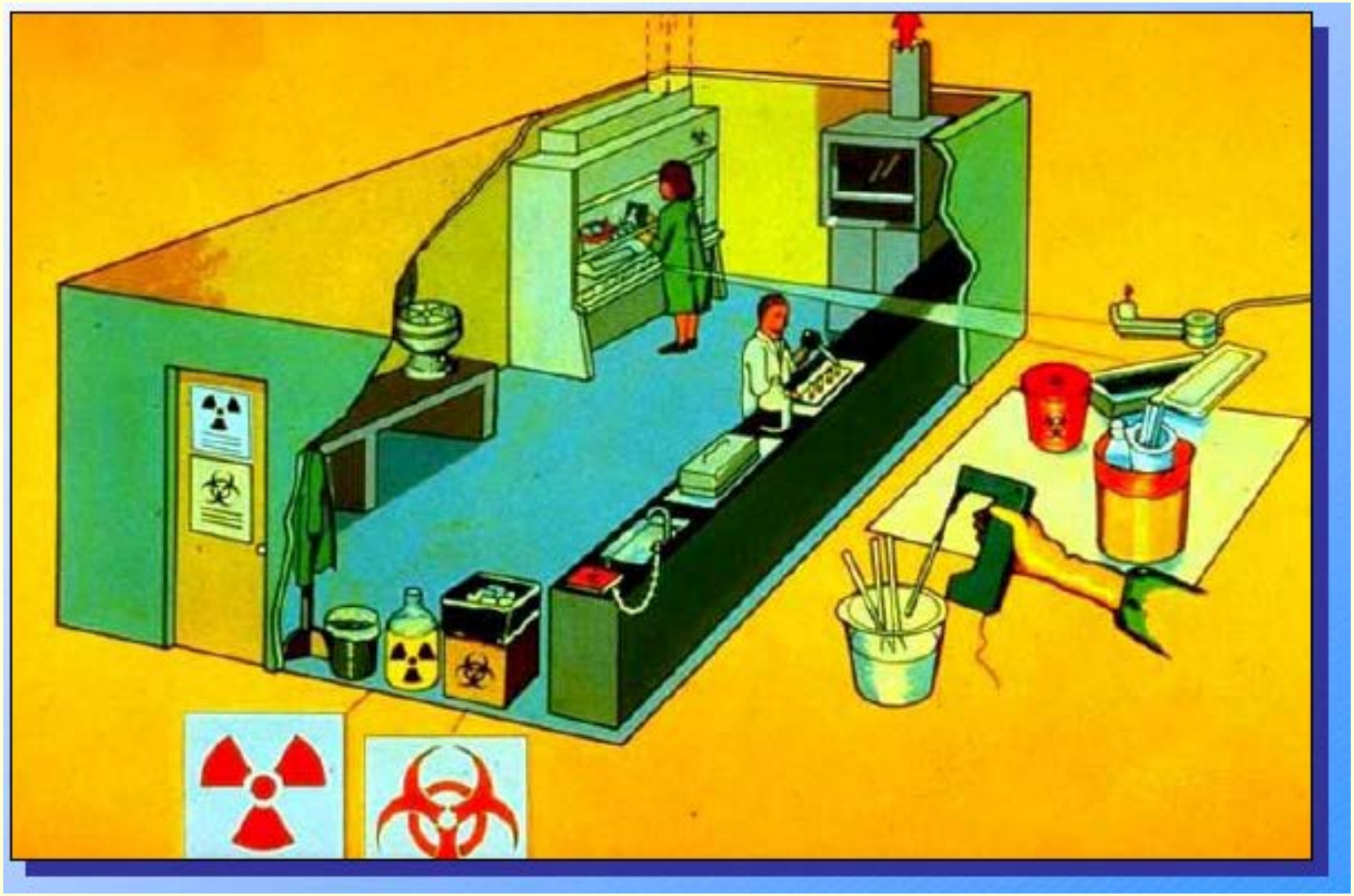
# BSL2 Facility Design & Construction

**Requirements: (BSL1 Facilities PLUS)**

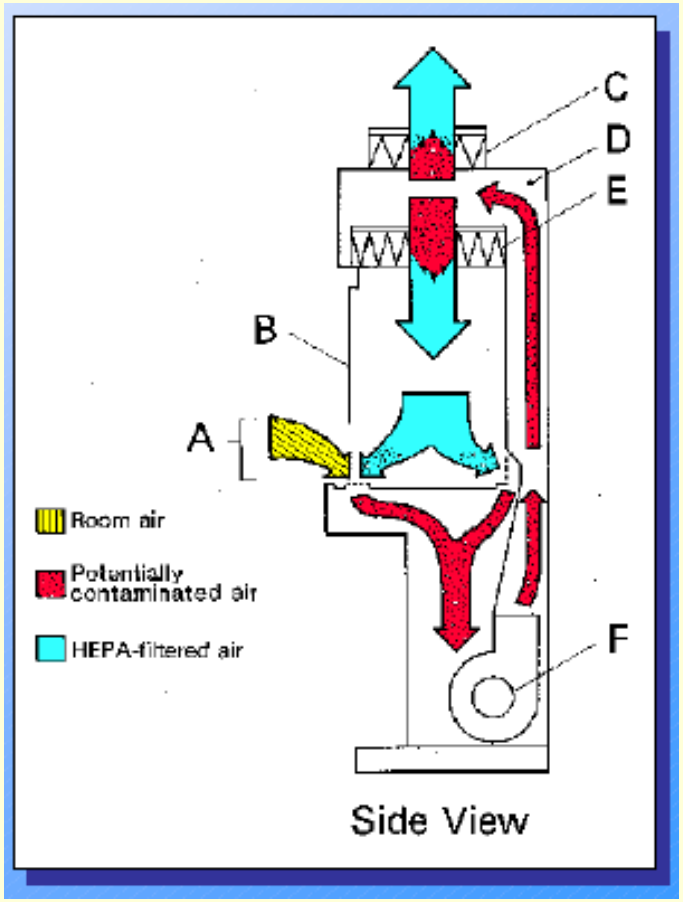
- ***Laboratories have lockable doors***
- ***Sink for hand washing***
- ***Work surfaces easily cleaned***
- ***Bench tops are impervious to water***
- ***Sturdy furniture***
- ***Biological safety cabinets installed as needed***
- ***Adequate illumination***
- ***Eyewash readily available***
- ***Air flows into lab without re-circulation to non-lab areas***
- ***Windows fitted with fly-screens***
- ***Restricted access when working with pathogens***
- ***Autoclave is available***
- ***Eyewash station is available***
- ***Location - separated from public areas***
- ***Structure - normal construction***
- ***Ventilation - directional***



# BSL2 Facility Design, Construction



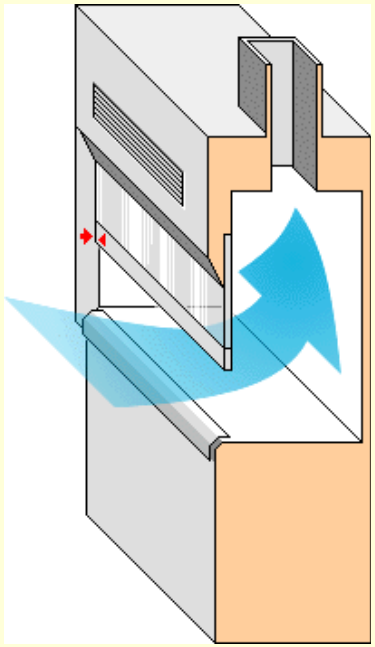
# Class II Biosafety Cabinets




**Class II BSC**

- Airflow
  1. Product Protection
  2. Personal Protection
  3. Environmental Protection
- When to use a Class II BSC

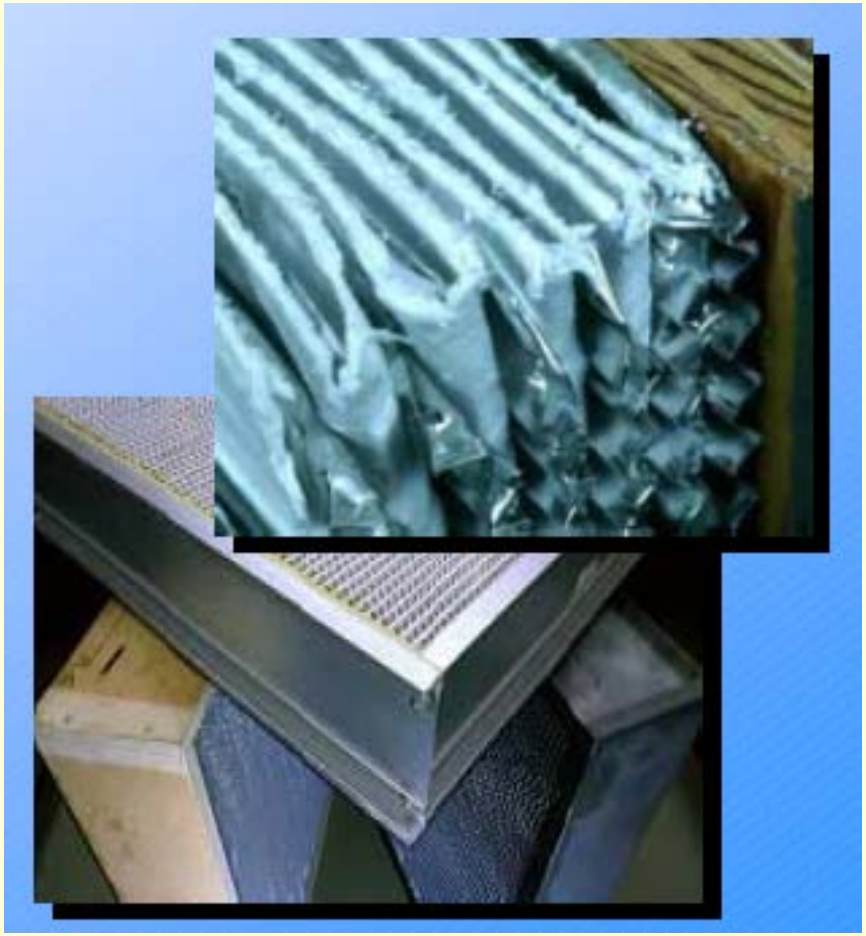
- **A BSC is NOT a Fume Hood!**
- When not to use a Class II BSC (volatile chemicals, radioisotopes, carcinogens or toxins)



# BSC HEPA Filtration

## High Efficiency Particulate Air (HEPA) Filtration

- **Traps particulates ONLY; 0.3 microns in diameter**
- **99.5%-99.9% efficient**
- **Gases and vapors will pass through**
- ***Continuous sheet of flat filter medium with aluminum separators***
- ***Gasket sealed***
- ***Adhesive bond between filter pack and frame***



# Use of the BSC - Preparation

- Only work in a properly operating and certified BSC
- Thoroughly understand procedures and equipment required before beginning work
- Arrange for minimal disruptions, such as room traffic or entry into the room, while cabinet is in use

**Start-Up:**

- Turn off the UV light if in use
- Ensure the sash is set in the correct operating position
- Turn on fluorescent light and cabinet blower
- Check the air grills for obstructions
- Allow the cabinet to operate unobstructed for 15 minutes (purge the BSC)
- Wash hands and arms thoroughly
- Wear long sleeved splash resistant closed front lab coat, gloves either under or over sleeves, double gloving.  Use protective eyewear.

# Use of the BSC - Preparation

**Wipe-Down**

- Wipe down the interior surfaces of the cabinet with 70% ethanol, or a suitable disinfectant, and allow to dry

**Loading Materials and Equipment**

- Decontaminate the surfaces of the materials and equipment you bring in to the BSC
- Only load the materials required for the procedure; do not overload the cabinet
- Do not obstruct the front, side, or rear return air grills; large objects should not be placed together
- After loading the cabinet, wait 2-3 minutes to purge airborne contaminants from the work area
- You should never stick your head into the work area

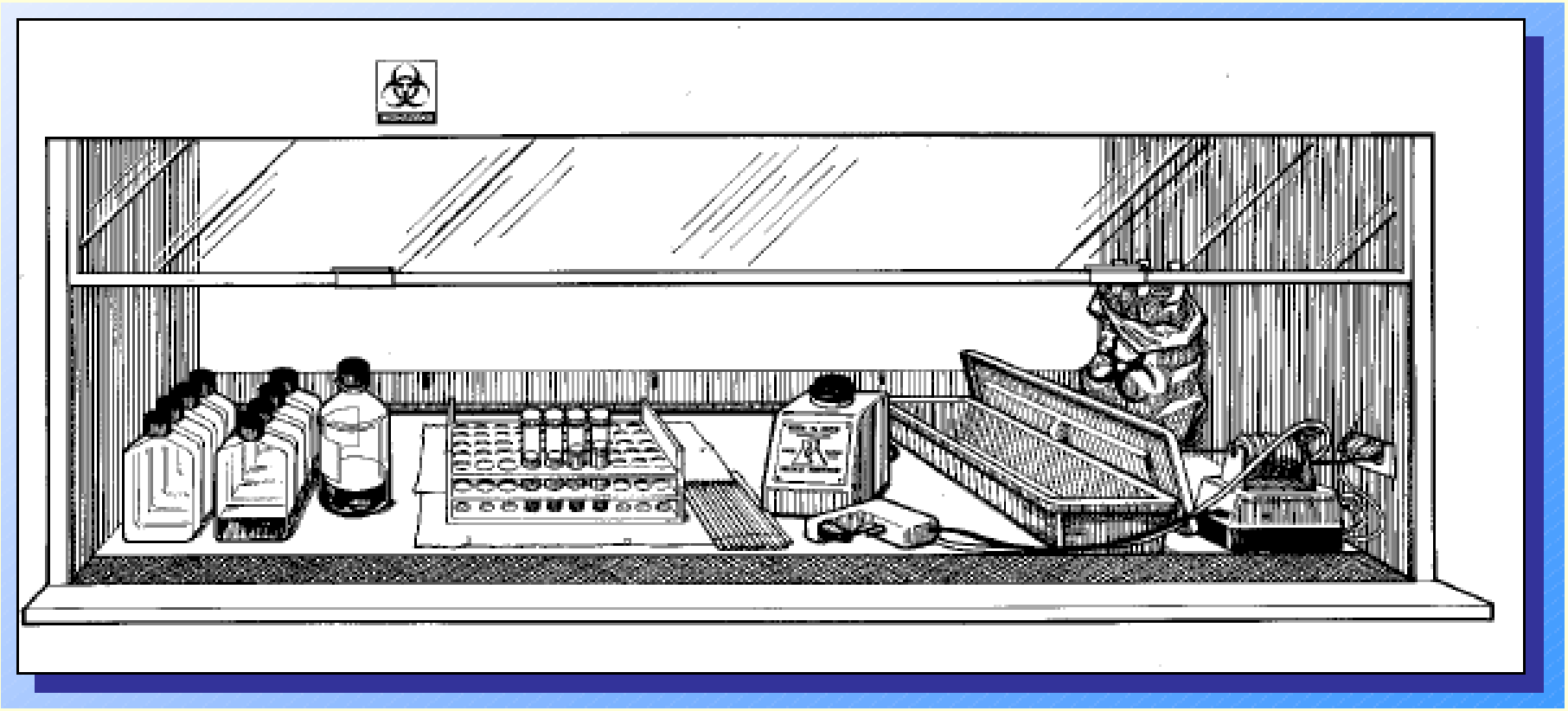
# Use of the BSC - Technique

- Keep all materials at least 4 inches inside the sash, and perform all contaminated operations as far to the rear of the work area as possible
- Segregate all clean and contaminated materials in the work area
- Arrange materials to minimize the movement of contaminated items into the clean area
- Keep all discarded contaminated material to the rear of the cabinet
- Avoid moving materials or excessive motion of the operator's hands and arms through the front access during use
- Always enter straight into the cabinet, no sweeping motions
- No open flames allowed
- If there is a spill or splatter during use, all objects in the cabinet should be surface decontaminated before removal
- Thoroughly disinfect the working area while the cabinet is still in operation

# BSC Layout

## Equipment Layout

Clean (Sterile) ➔ Dirty (Contaminated)



# BSC Alarm or Failure


**If the BSC alarm sounds or the exhaust fails**

- Stop what you are doing
- Calmly but quickly close all open containers of potentially infectious items and any items that must remain free of contamination
- Close the sash
- Do not continue to work in the BSC until it is operating properly

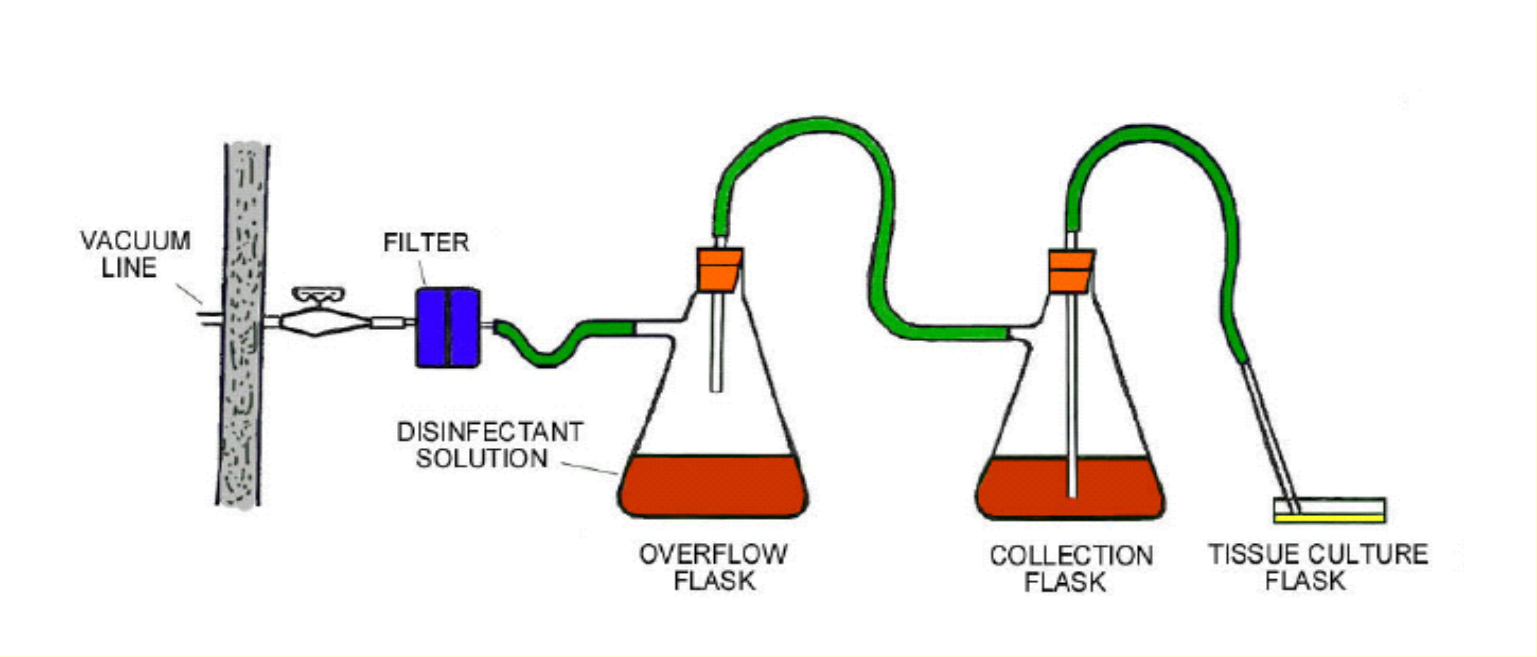
# Needles & Sharps

**Needles & Sharps Precautions**

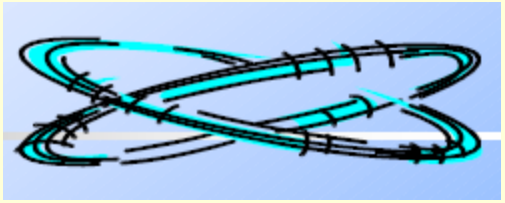
- *Use sharps containers*
- *DON'T break, bend, re-sheath or reuse syringes or needles*
- *DON'T place needles or sharps (glass, plastic pipets, anything that will puncture a bag) in the regular trash*
- *DON'T touch sharps with hands, use forceps, scoops, etc.*


# Vacuum Lines – HEPA Filters

- **Central vacuum lines must be fitted with an in-line HEPA filter**
- **For PI lab equipment such as vacuum pumps, these should also be fitted with HEPA filters and protected with liquid disinfectant traps**



# Centrifuges



## Hazards

- Mechanical failure of machine
- Lab equipment failure (tubes etc.)
- Aerosol generation
- Operator error

## Operating Procedure

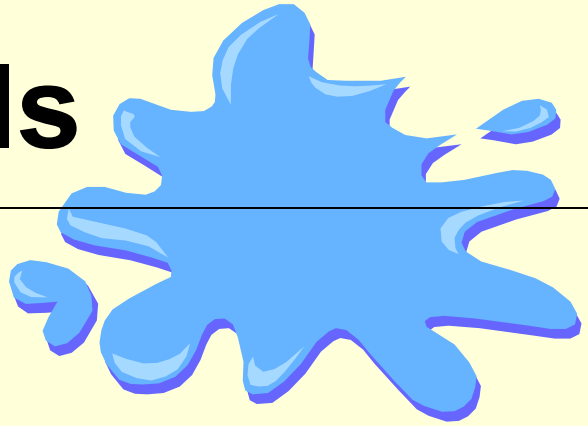
1. Check tubes for cracks/chips.
2. Use matched sets of tubes, buckets etc.
3. Tightly seal all tubes and safety cups.
4. Ensure that rotor is locked to spindle and bucket seated.
5. Close lid during operation.
6. Allow to come to complete stop before opening.
7. Wait 5-30 minutes after the each run before opening the centrifuge.
8. Remove the rotor and place in a BSC before opening.

## Safe Operation

- Use safety cups whenever possible
- Disinfect weekly and after all spills or breakage's
- Do not use rotors that have been dropped
- Balance your samples
- Contact your centrifuge rep for specific information
- Microcentrifuges can be placed in a BSC

| *Types* | *Speeds (rpm)* |
|---|---|
| Microcentrifuges | ~15,000 |
| Low/high speed | 2,000 – 20,000 |
| Ultracentrifuges | ~ 120,000 |

# Minimize Aerosols



- Use careful pipetting practices
- Avoid drops onto hard surfaces – cover lab benches with bench protectors
- Wipe up spills promptly with appropriate disinfectant
- Use capped tubes when mixing, blending, or vortexing
- Pour liquids carefully
- Avoid bubbles

# Careful Pipetting Techniques

- Never blow out last drop in pipette
- Use pipetting aids with filters
- Discharge liquid down side of container, using tip-to-wall contact
- Deliver as close as possible to contents
- For ejection of liquid from micropipette
  - No blowout
  - No pressure ejection
  - Use wall contact
- Work over plastic-backed absorbent matting (ensure it doesn't slide forward or backward blocking air grill in a BSC)

# Decontamination

## Decontamination

- To render the object/material safe by reducing or removing the bio-burden

## Agent Selection

- Degree of microbial killing required
- Nature of item/surface to be treated
- Ease of use
- Safety
- Cost

## Agent Efficacy

- Type of organism
- Number of organisms
- Amount of organic material present
- Type & configuration of material to be treated
- Type & concentration of germicide
- Time and temperature or exposure
- pH
- Humidity

**Methods: Heat/Pressure & Chemical**

# Decontamination

## Autoclave

- *Hazards*
- *Ensure proper functioning of autoclave*
- *Vessels should not be capped or plugged*
- *Large loads require longer contact time*
- *Excessive amounts of liquid should not be added to load*
- *Quality Control*

## Chemical

- *Bleach, 70% Ethanol, Quaternary Ammonium, VHP, etc.*
- *EPA registered disinfectants must be used strictly according to manufacturer label instructions*
- *Agent specific considerations*
- *Contact time*
- *Reactivity*
- *Hazards*

# Biological WASTE

## Types

- *cultures, stocks, isolates*
- *materials containing or contaminated with*
- *blood*
- *sharps*
- *pipettes, wrappers, tips*

## Disposal

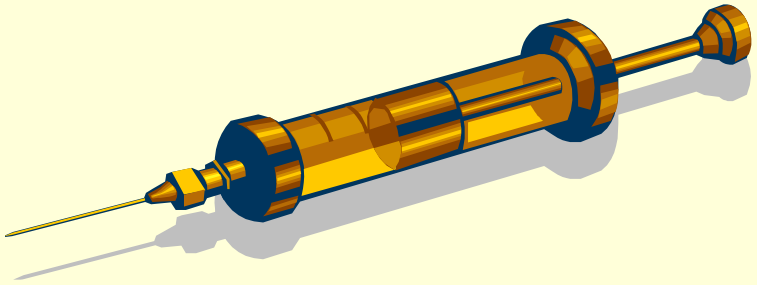
- *puncture-proof, leak-proof, sealable receptacles*
- *avoid over-filling*
- *dispose properly*
- *Never place lab waste into office waste containers*
- *Place sharps into "sharps" container*
- *Line discard containers with autoclave bag*
- *Decontaminate discard pans before they leave the lab:*

1. Disinfect outside
2. Label
3. Tape ends with autoclave tape
4. Secure for transport to autoclave

# Hepatitis B Vaccination

**Refer to the BBP ECP for more information about the Hepatitis B Vaccination.**

**All students or employees who have been determined to have occupational exposure shall be vaccinated against Hepatitis B or decline the vaccination.**



JABSOM EHSO – BBP ECP Template – Created: January 2008 – Updated: December 4, 2008
Appendix I – Hepatitis B Vaccination Status Form
Page 1 of 2

**JABSOM BBP ECP – APPENDIX I**

**HEPATITIS B VACCINATION STATUS**

If you have occupational exposure to human blood and body fluids and other potentially infec
materials, you should be vaccinated against Hepatitis B. Read your department's Bloodborn
Exposure Control Plan, especially the section about the Hepatitis B Vaccination Program. F
information about the Hepatitis B Vaccine, please refer to the Centers for Disease Control's
Need to Know Fact Sheet online at http://www.cdc.gov/vaccines/pubs/vis/downloads/vis-hep

**To be completed by the Supervisor:**

The following employee has participated in a training program on bloodborne pathogens. Inf
been provided regarding Hepatitis B, Hepatitis B vaccination, benefits of vaccination and tha
and vaccination are made available free of charge to employees identified as having occupa
exposure in accordance with the JABSOM Bloodborne Pathogens Exposure Control Plan.

Name: _____ UH ID: _____

Title: _____ Department: _____

Supervisor: _____ Title: _____

**To be completed by the Employee:**

# Emergency Response

## Personal Contamination or Exposure

1. Alert co-workers
2. Clean exposed surface with soap/water, eyewash (eyes), or saline (mouth)
3. Apply first aid and treat as an emergency
4. Notify supervisor and EHSO
5. Seek medical attention for treatment/counseling
6. Refer to the BBP ECP for post exposure evaluation and follow-up procedures, forms, record keeping

# Biological Spill Response

**SPILL Procedures**

1. Alert co-workers
2. Define/isolate contaminated area
3. Put on appropriate PPE
4. Remove glass/lumps with forceps or scoop
5. Apply absorbent towel(s) to spill; remove bulk & reapply if needed
6. Apply disinfectant to towel surface
6. *Allow adequate contact time (20 minutes)*
8. Remove towel, mop up; clean with alcohol or soap/water
9. Properly dispose of materials
10. Notify supervisor & EHSO