

Overview of Biosafety Cabinets

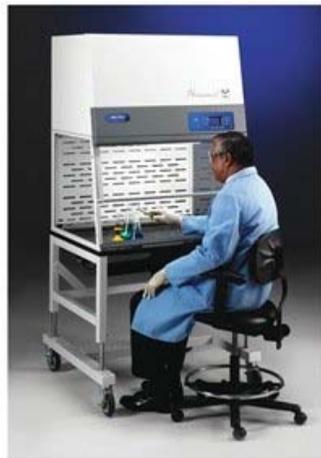
Jim Hunter, Senior Project Engineer
October 11, 2017

The LABCONCO logo is a blue, horizontally-oriented oval shape with a white border. Inside the oval, the word "LABCONCO" is written in a bold, white, sans-serif font. A small registered trademark symbol (®) is located at the end of the word.

LABCONCO®



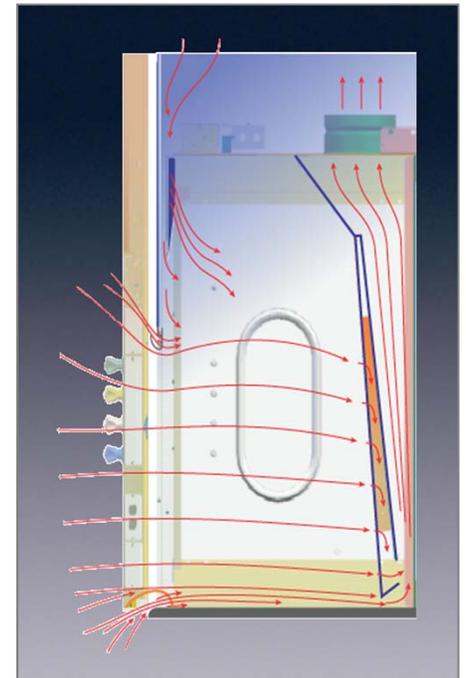
A number of different ventilated enclosures may be in the lab...



Common ventilated enclosures in the lab



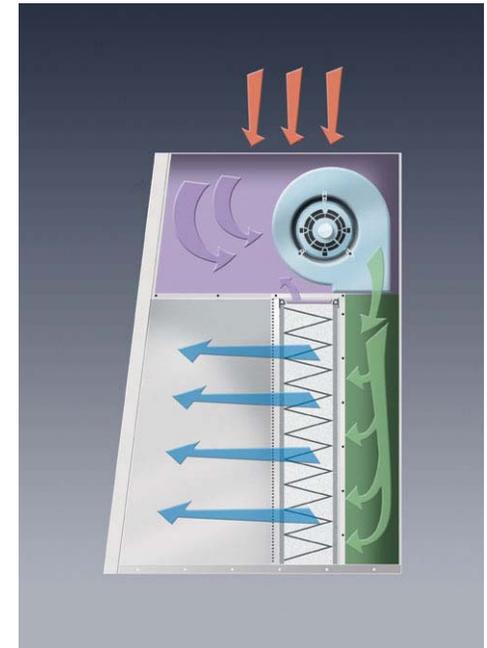
Fume Hoods - Enclosures that capture, contain and remove chemical *fumes* and *vapors*.



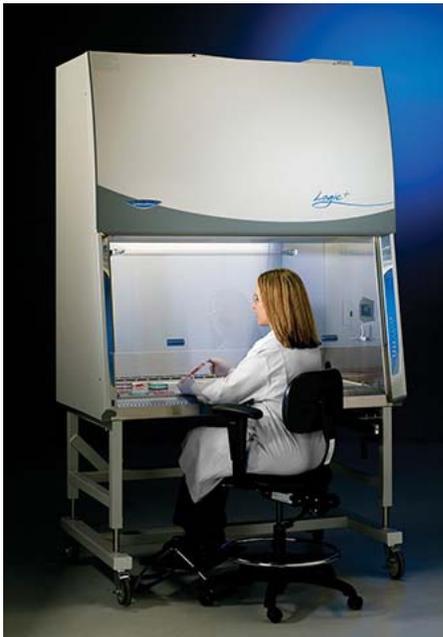
Common ventilated enclosures in the lab



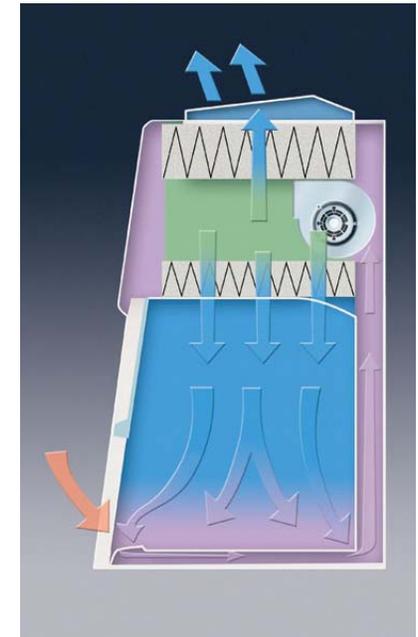
Clean Benches - Enclosures that direct HEPA-filtered air through a work area, providing product protection.



Common ventilated enclosures in the lab



Biological Safety Cabinets - Enclosures that capture and contain *biohazardous aerosols* within the cabinet.



DEFINITIONS - Biosafety Cabinet (BSC)



- Primary Containment Barrier, designed to contain biohazardous aerosols
- Should provide personnel protection
- May also provide product protection, *depending on its class.*
- Defined in CDC's: *Biosafety in Microbiological and Biomedical Laboratories* (BMBL) 5th Edition, and by NSF International.

Who regulates BSCs in the U.S.?



NSF International

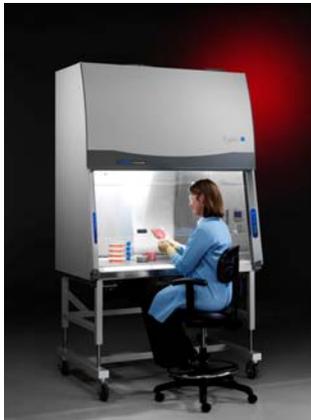
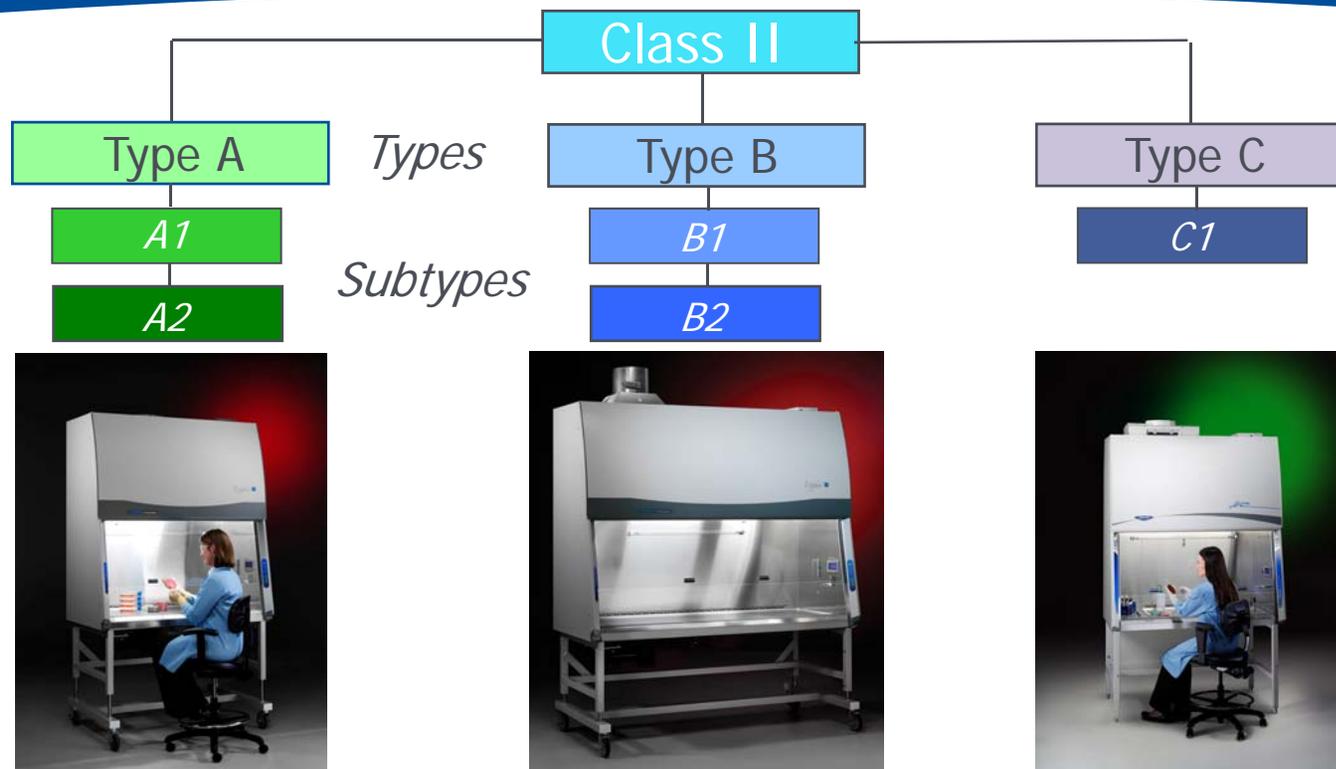
NSF International is a not-for-profit agency, developing solutions for problems pertaining to public health.

NSF Standard 49 is a consensus standard developed to define the minimum construction, performance and testing requirements for Class II Biological Safety Cabinets. This standard includes basic requirements for design, construction, and performance.

NSF policy establishes the requirements for testing and periodic re-testing of cabinets by NSF and periodic unannounced audits of the manufacturer's facility and records.



Types of Class II Biological Safety Cabinets



Which Type to choose?

Type A

Used for routine microbiological work without the use of toxic chemicals

Type B

Developed to offer greater containment and removal of toxic gases and fumes used in conjunction with biological research

Type C

Offers the option of the removal of toxic gases and fumes as in a B, with the installation flexibility of an A

The critical factor in choosing Type A, B or C is not biological containment, but should be if the user plans to work with volatile toxic compounds.

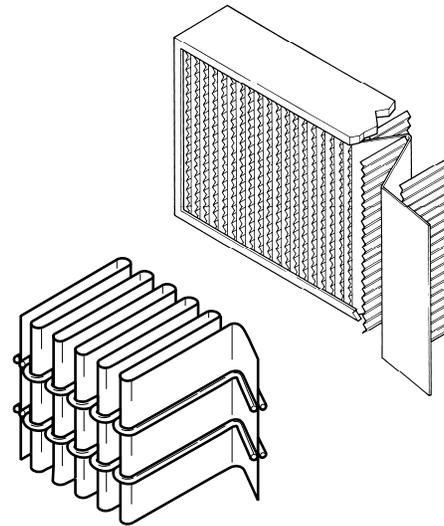
How do BSCs work?

- HEPA filters
- Motor blower – forces air through the unit
- Speed controller for the motor
- Internal duct work, air inlets and balance controls



How do BSCs work?

- High Efficiency Particulate Air Filters
 - Removes **ONLY** airborne particulates
 - 3 parts
 - Frame (wood or aluminum)
 - Filter media
 - Bonding agent



How do BSCs work?

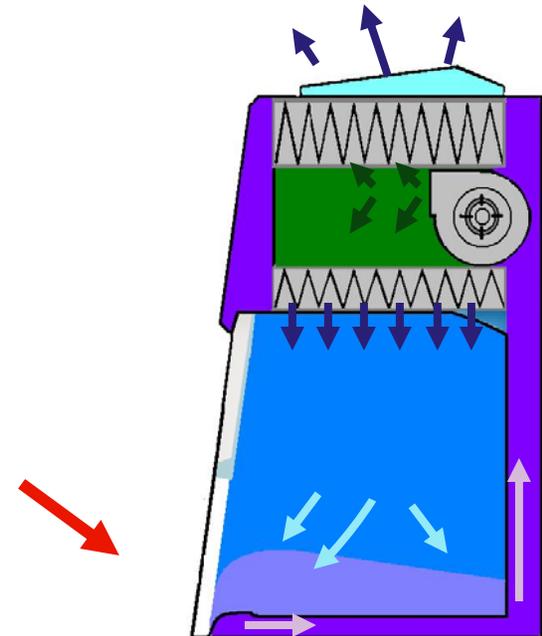
- Airflow

- Personnel protection

- Pulls room air around the user
 - Returns HEPA filtered air into the lab

- Product protection

- Produces purified HEPA filtered air
 - Laminar supply of purified air



How do BSCs work?

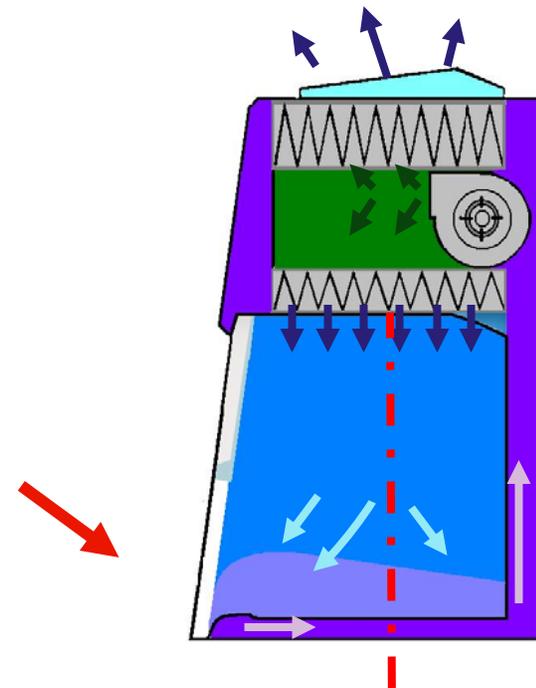
- Understanding Airflow

- The “Smoke Split”

- The vertical plane in the work area where the downflow splits between the front and rear grilles.

- For maximum containment/protection

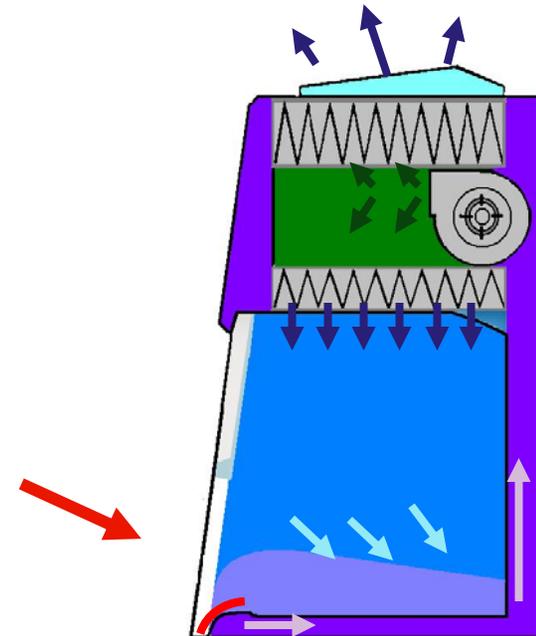
- Work or store materials behind the split.
 - Visualize and mark the split with “smoke”.



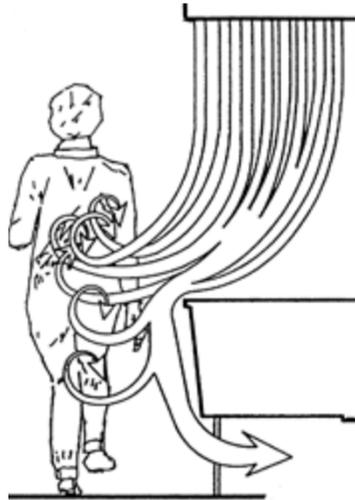
How do BSCs work?

- Understanding Airflow

- The importance of the front grille
 - Blocking even a part of the grille will alter the inflow and downflow patterns radically. Room air may be drawn over the work surface, negating product protection.



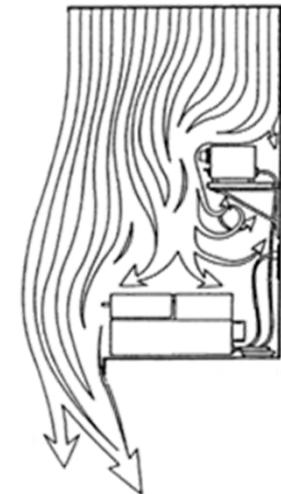
Working in a clean environment



Fast walking causes turbulence due to low pressure points.

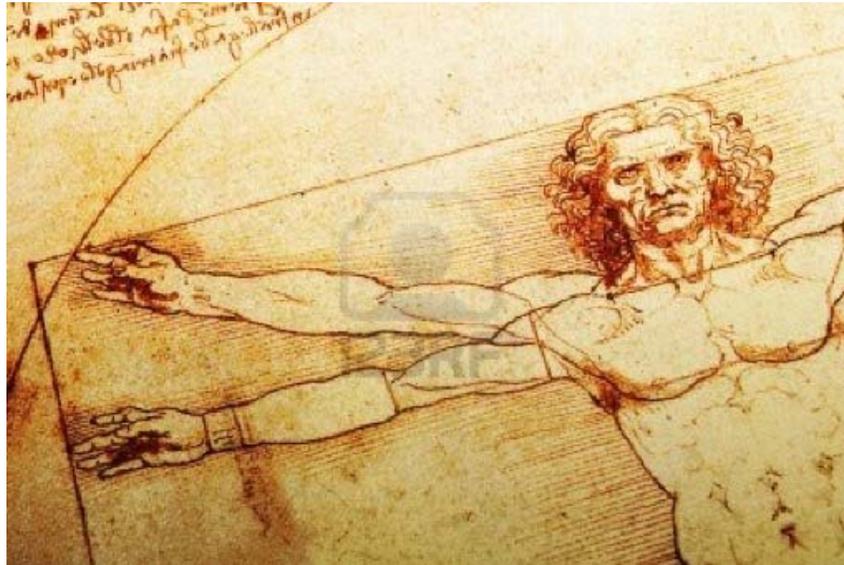


Grabbing something quickly from above creates turbulence and spreads contaminants

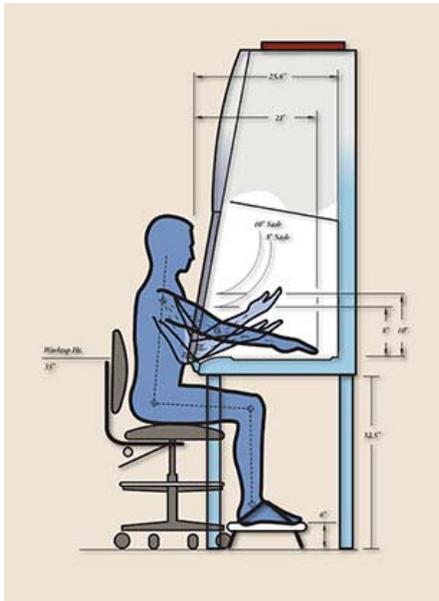


Large objects set perpendicular to the air flow, creates turbulence on the underside.

BSC Ergonomics

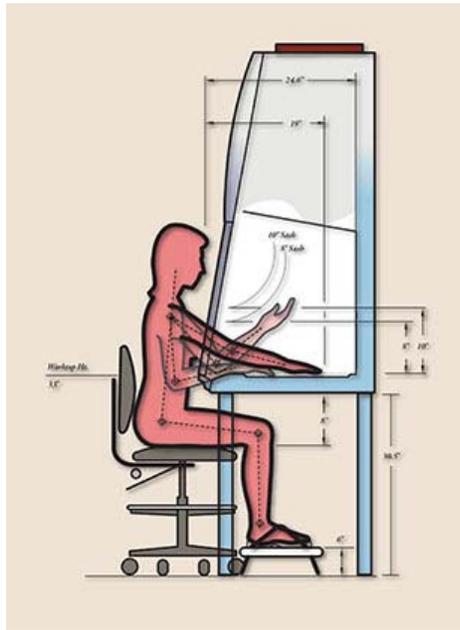


Ergonomics: Feet, Knees and Legs



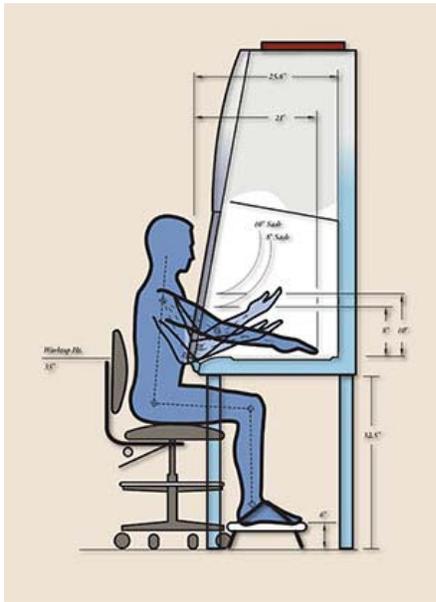
- Avoid concentrated pressure points along the underside of your thigh near the knee and the backside of your lower leg.
- Stretch your legs and vary your leg posture throughout the day.
- You should be able to pull your chair all the way up to your work without interference.
- Walk - Get up from your work periodically and take brief walks.

Ergonomics: Your Back While Sitting



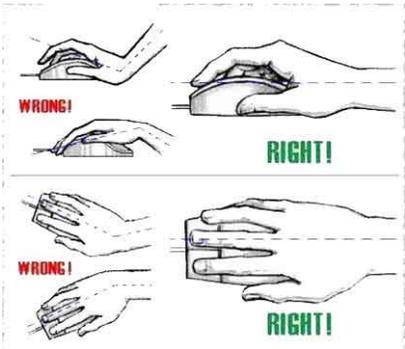
- Use your chair to fully support your body.
- Distribute your weight evenly and use the entire seat and backrest to support your body.
- If your chair has adjustable low back support, match the contours of the chair's backrest to the natural curve of your lower spine.
- Always make sure your lower back is well supported.

Ergonomics: Your Back While Sitting



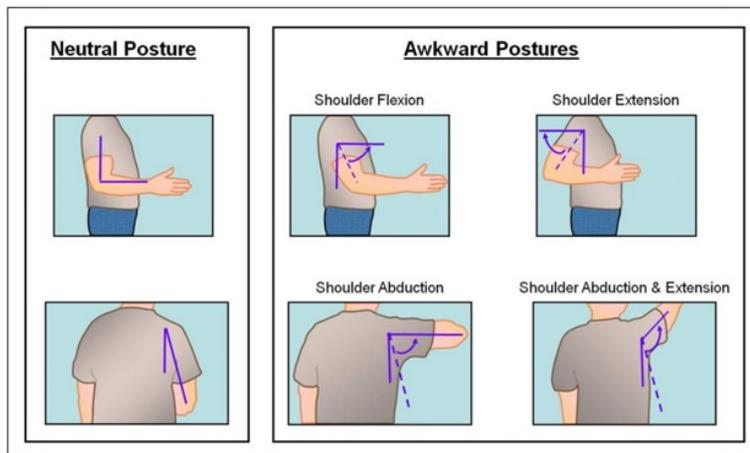
- Make sure it feels comfortable in the position in which you are working.
- Adjust often
- If your chair is adjustable, experiment with the adjustments to find numerous comfortable positions, then adjust the chair frequently.
- If you are using a chair for the first time, or if you share a chair with someone else, don't assume the settings are properly set for you.

Ergonomics: Forearms, Wrists and Hands



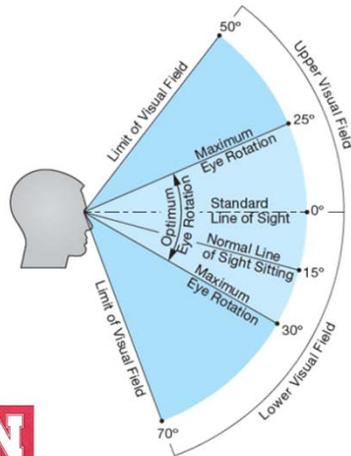
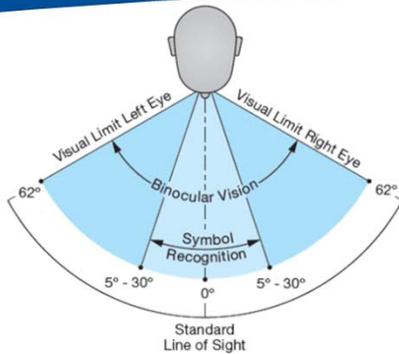
- Keep your forearms, wrists, and hands aligned in a straight, natural position.
- Avoid bending or angling your wrists while working.
- When working, do not anchor or rest your wrists on the work surface.
 - Resting on your palms while working may be harmful because it can cause you to bend your wrists back and can apply pressure to the undersides of your wrists.
- Maintain a straight, natural wrist position while working.

Ergonomics: Shoulders & Elbows



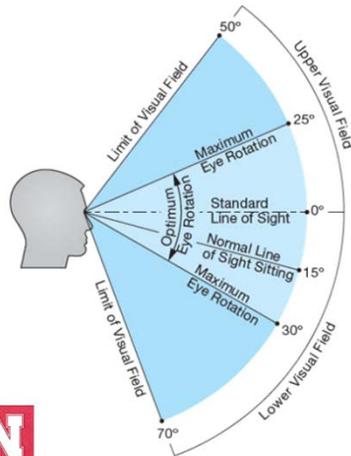
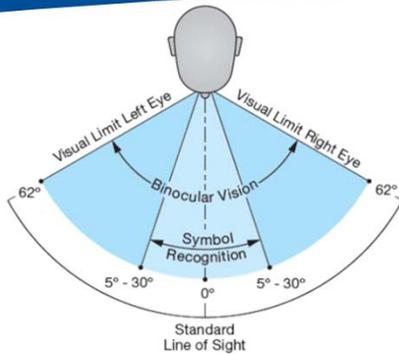
- Adjust your chair height or work surface height so that your shoulders are relaxed and your elbows hang comfortably at your sides.
- Remember to relax, particularly in areas where muscle tension often builds, such as your shoulders.

Ergonomics: Eyes



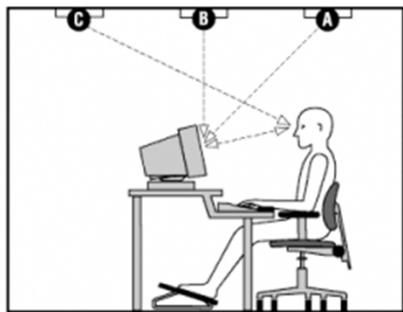
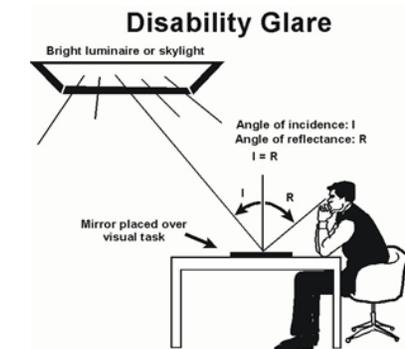
- Working at a single task for long periods is a visually demanding task and may cause your eyes to become irritated and fatigued.
- Give special attention to vision care, including the following recommendations:
 - Give your eyes frequent breaks.
 - Periodically look away from the work area and focus at a distant point.
 - This may also be a good time to stretch, breathe deeply, and relax.
 - Keep your BSC and Fume Hood sashes and your glasses clean.

Ergonomics: Eyes



- To be sure that your vision is adequately corrected, have your eyes examined regularly by a vision care specialist.
- If you wear bifocals or trifocals, you may find monofocal glasses more comfortable for fixed distance use.
- While working, and also while resting your eyes, remember to blink. This helps keep your eyes naturally protected and lubricated, and helps prevent dryness, a common source of discomfort.

Ergonomics: Glare



- Take the time to eliminate glare and reflections. To control daylight, use blinds, shades, or drapes, or try other glare-reducing measures.
- Use indirect or reduced lighting to avoid bright spots on the fume hood or BSC sashes. If glare is a problem, consider these actions:
 - Turn off or reduce ceiling lights
 - Use task lighting (one or more adjustable lamps) to illuminate your work.
 - Avoid compromising your posture to compensate for glare or reflections.

Working in Biosafety Cabinets



Working in Biosafety Cabinets

Planning



- Thoroughly understand procedures and equipment required before beginning work - *Plan your work, and work your plan.*
- Arrange for minimal disruptions, such as traffic in the room during work.
- Have disinfectant and spill cleanup materials prepared.

Working in Biosafety Cabinets

Start Up



- Turn off UV light, Open sash to its proper height, turn on cabinet lights and blower.
- Check all grilles for obstructions, and let the cabinet operate for 5 minutes.
- Wash hands and arms thoroughly with disinfectant soap; wear a long sleeved lab coat with knit cuffs and over-the-cuff gloves. Use protective eyewear.

Working in Biosafety Cabinets

Wipe-Down



- Wipe down all interior surfaces of the work area with a solution of 70% ethanol, or a suitable disinfectant.

Working in Biosafety Cabinets

Loading



- Only load the materials needed. Do not overload the cabinet. Do not obstruct the grilles. Keep large objects separated.
- Lower the sash until it is in its proper position. Allow the unit to operate for 2-3 minutes to purge any airborne contaminants.

Working in Biosafety Cabinets

Work Techniques



- Keep all materials at least 4 inches inside of the sash, and perform all contaminated operations as far to the rear of the work area as possible.
- Segregate clean and contaminated materials; Arrange materials to minimize the movement of contaminated materials into clean areas; keep all contaminated material in the rear of the work area.
- Avoid moving materials or arms through the front opening during operation

Working in Biosafety Cabinets

Work Techniques, Continued



- Avoid using an open flame, and use proper aseptic technique.
- Avoid techniques that disrupt airflow patterns in the cabinet.
- If there is a spill or splatter during use, all objects must be decontaminated before removal. Thoroughly disinfect the interior surfaces of the cabinet **WHILE IT IS STILL IN OPERATION.**

Working in Biosafety Cabinets

An Idealized Work Setup

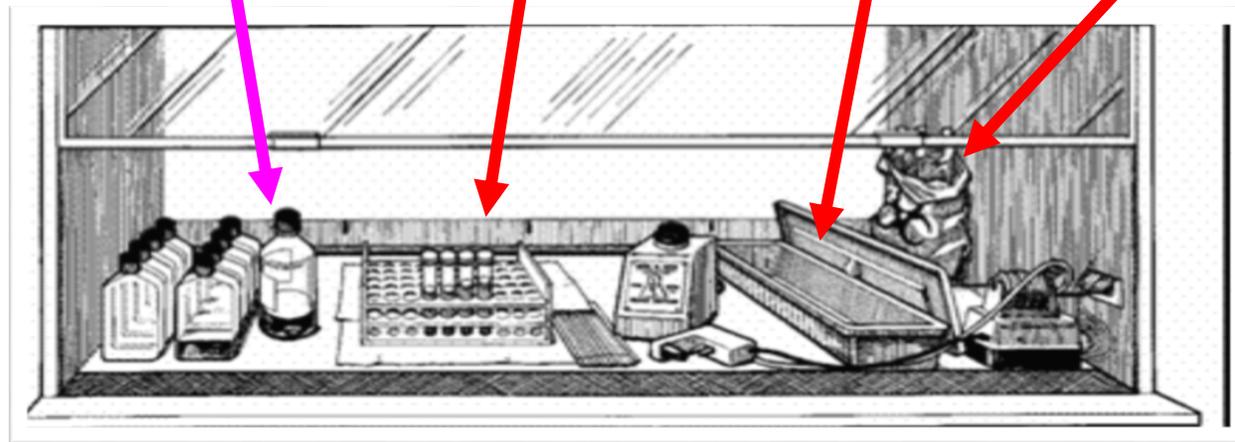


Clean
Materials

Contaminated
Area

Discard
Pan

Discard
Bag



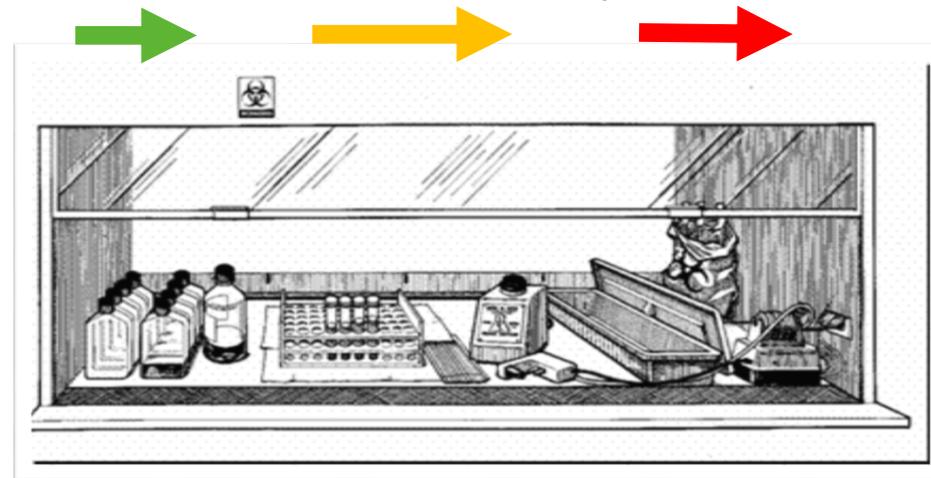
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Working in Biosafety Cabinets

An Idealized Work Setup

All equipment is laid out to not restrict airflow in the cabinet.
Note how work flows across the work surface:

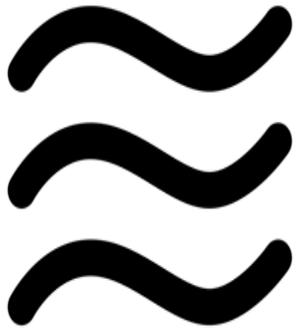
From sterile, to inoculation, to disposal.



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Working in Biosafety Cabinets

Final Purging



- After completing work, allow the cabinet to operate for 2-3 minutes undisturbed to purge airborne contaminants from the work area

Working in Biosafety Cabinets

Wipe-Down



- Wipe down all interior surfaces with disinfectant, and allow to dry.
- Periodically lift the work surface and clean underneath it; clean the towel catch.
- Dispose of rubber gloves; have lab coat properly laundered, and wash arms and hands thoroughly with germicidal soap.

Working in Biosafety Cabinets

Shutdown



- Turn off the fluorescent light and cabinet blower, close the sash, and turn on the UV light if appropriate.

Cabinet Maintenance

Certification

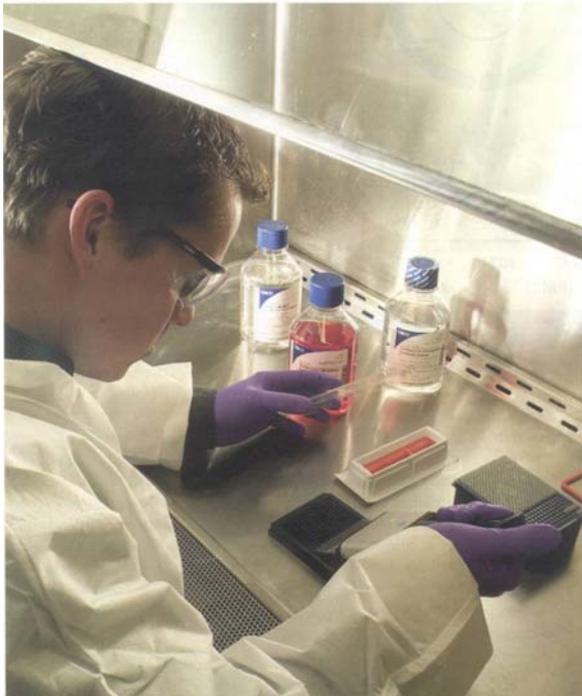


- A validation of cabinet integrity and performance.
- Performed by a qualified independent technician.
- Should be performed when the cabinet is new, annually thereafter, or if the cabinet is moved to a new location.

Hall Of Shame



Hall Of Shame



What's Wrong Here?

Hall Of Shame

And Here?



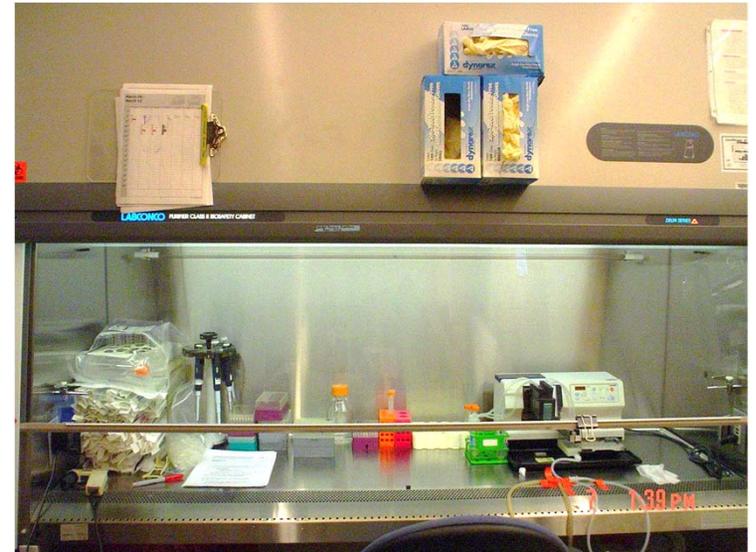
Hall Of Shame

And Here?



Hall Of Shame

And Here?



Hall Of Shame



And Here?



Hall Of Shame

And Finally, Here?



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Questions?

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