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# Laboratory Ergonomics

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Laboratory researchers are at risk for repetitive motion injuries during routine laboratory procedures such as pipetting, working at microscopes, operating microtomes, using cell counters and video display terminals. Repetitive motion injuries develop over time and occur when muscles and joints are stressed, tendons are inflamed, and nerves are pinched and the flow of blood is restricted. Standing and working in awkward positions in laboratory hoods/biological safety cabinets can also present ergonomic problems. By becoming familiar with how to control laboratory ergonomic risk factors, you can improve employee comfort, productivity, and job satisfaction while lowering chances for occupational injuries.

## Repetitive Pipetting

Pipetting is one of the most common tasks performed in the research laboratory. It involves several ergonomic stressors - thumb force, repetitive motions, and awkward postures, especially of the wrists, arms, and shoulders. The following are recommendations for ergonomics hazards associated with the use of pipettes:

- Use pipettes with newer trigger mechanisms requiring less force to activate, and use the pointer finger to aspirate, and the thumb to dispense (see [Laboratory Ergonomic Products](#))
- Use pipettes that fit comfortably in the user's hand.
- For tasks such as mixing or aliquotting, use an electronic pipetter with mixing functions.
- Use a multichannel pipettor for large aliquotting tasks.
- Use shorter pipettes. This decreases hand elevation and consequent awkward postures.
- Use low profile waste receptacles for used tips. They should be no higher than the top of the tubes being filled.
- Take micro-breaks of 3-5 minutes for every 20-30 minutes of pipetting. Mild hand exercises and stretches are beneficial (see [Exercises & Stretches](#)).

Clean pipetters on a regularly scheduled basis - this reduces "sticking" and improves quality of work.

- Adjust the workstation so the individual doesn't have to work with their arms in an elevated position. Work with arms close to the body.
- Rotate pipetting activities between laboratory tasks, hands, and people.
- Use thin-wall pipette tips that fit correctly and are easy to eject.
- Use minimal force when applying pipette tips.
- Keep samples and instruments within easy reach.
- Use an adjustable stool or chair when sitting at a lab bench.
- If it is necessary to stand for long periods of time during pipetting, provide anti-fatigue matting.

### Computer Workstation

Many researchers spend 50% or more of their day entering data with their keyboard and mouse resting on a lab bench. Most of these lab benches are too high, and require the researcher to elevate the arms and excessively deviate the wrists while inputting data. Depending upon the location of the mouse, awkward reaches and manipulations of the mouse with bent wrists may occur. Within infectious disease laboratories, the establishment of primary computer workstations for office work is not recommended. The following are recommended for control of ergonomic hazards associated with the use of computers in the lab:

- Install adjustable keyboard platforms under lab benches which accommodate use of the mouse beside the keyboard.
- Where possible, position computer workstations in corners or other areas away from doors, entrances, and passageways.
- Provide fully adjustable seating.
- Place monitors so the user's viewing distance is between 18 and 30".
- Place monitor so the top of the screen is approximately eye level. This allows the eyes to naturally gravitate toward the center of the screen.
- Use a document holder placed adjacent to and in the same plane as the computer screen.
- Provide foot rests, where possible, for individuals in order for them to change leg positions throughout the day.
- Provide for a choice of keyboards and mouse or other input devices for individuals who have existing musculoskeletal problems.
- Encourage mini-breaks of 3 to 5 minutes for every 20 -

30 minutes of keyboarding or mouse work. These breaks can be spent doing mild hand exercises or stretches.

- Laboratory personnel should not go from keyboarding to pipetting activities (or vice versa) without an adequate break (at least 15 minutes) to allow the hands to recover.

## Microscopy

When designing the microscope workstation, one should take into account the dimensions of its potential users. Since laboratory personnel come in many different shapes and sizes, the workstation should be made as adjustable as possible. Ideally, the microscopist should be able to adjust the height of his or her chair, work surface, and microscope. The following are recommended for control of ergonomic hazards associated with the use of microscopes:

- Don't use a microscope for more than 5 hours per day. Spread the use out over the entire work day, avoiding long uninterrupted periods of microscope work.
- Try pulling the microscope toward the edge of the work surface to position the operator in a more upright posture.
- Use a cut-out work table. This puts you close to the scope and gives an area for supporting forearms.
- If possible, try elevating the microscope or placing it at an angle so you can look directly into the eyepiece. This can help position the operator in a more upright posture and reduce rounding of the shoulders and neck.
- Maintain neutral spine.
- Provide arm rests to support the operator's forearms while using adjustment knobs.
- Use an ergonomically designed chair that provides adequate back support, adjustable height, and adjustable seat angle.
- Make sure there is adequate room under the work surface so the operator can pull the chair up to the ocular(s).
- Provide footrests and discourage the use of foot rings on stools.
- Provide sit-stand seats for areas where there is restricted leg room.
- Encourage frequent breaks from microscopy work as well as stretching exercises (see [Exercises and Stretches](#)).
- Use television systems where possible to eliminate the use of binocular eyepieces.

## Biosafety Cabinets and Laboratory Workbenches

Biosafety cabinets and laboratory workbenches present similar ergonomic hazards which are mostly due to lack of adjustability and leg room. The following are recommended for control of ergonomic hazards associated with the use of biosafety cabinets and laboratory workbenches:

- Use an ergonomically designed chair that provides adequate back support, adjustable seat angle, and height adjustability between 28 inches to 33 inches.
- Use footrests for individuals whose feet do not rest comfortably on the floor.
- Consult with the Laboratory Safety Branch, OHS, for approval to apply closed-cell foam padding to the front edge of the biosafety cabinet (away from the downdraft) or workbench. Alternatively, factory-applied movable armrests may be installed external to the cabinet or edge of the workbench to provide support for the arms and still maintain the required airflow. This reduces contact forces by increasing the surface area that comes into contact with the forearm and therefore reduces the chances of impinging nerves, tendons, or blood vessels. If applying closed-cell padding to the front edge of the biosafety cabinet, make sure the material can be properly decontaminated.
- Remove drawers, supplies, refrigerators, etc. from under the workbenches and cabinet doors from under biosafety cabinets in order to provide leg room.
- Use a turntable to store equipment near the worker. This reduces excessive reaching and twisting, which places an increased load on the low back.
- Position materials in the cabinet and on the bench top as close as possible to avoid extended reaching without compromising containment of the cabinet.
- Use anti-fatigue matting for laboratory personnel who must stand for extended periods of time.
- Take frequent mini-breaks to perform stretching exercises (see [Exercises & Stretches](#)).

New biosafety cabinets that incorporate the features below may be purchased. Desirable features for the new biosafety cabinets include:

- A perforated front grill reduced by 1 inch to 2 inches to bring the work platform closer to the laboratory worker.
- Adjustable height (hand-crank or hydraulic lift) — may not be possible for all biological safety cabinets or in all labs.
- Non-glare glass on the sash window and/or adjustable plexiglass barriers.
- A platform configuration with "wells" for placement of tall containers.

## Micro-Manipulation & Fine Motor Skills

Many laboratory procedures require repetitive use of the extensor and flexor muscles of the fingers and wrist. For example, removing caps and screw-off lids from vials, reaching into bins, use of forceps, etc. all require the use of these small muscle groups or result in awkward postures. The following are recommended for control of ergonomic hazards associated with micro-manipulation techniques:

- If feasible for your work, use plastic vials with fewer threads. This will reduce twisting motions during capping and uncapping lids.
- Use small pieces of foam similar to the type used on pencils and pens, to prevent soreness on the fingertips, where fingers and forceps articulate. This will distribute the force over a greater surface area, thus reducing the compressive forces on the soft tissue.
- Practice using the forceps between the 1<sup>st</sup> and 2<sup>nd</sup> digits instead of using the thumb and 1<sup>st</sup> digit. Then try alternating between the two positions to reduce the use of the thumb. The thumb is used repetitively with almost every job task performed in the laboratory.
- Tilt storage bins toward the worker to reduce wrist flexion while reaching for supplies.
- Encourage mini-breaks and hand exercises (see [Exercises & Stretches](#)).

## Microtome & Cryostat Work

The following are recommended for control of ergonomic hazards associated with the use of a microtome or cryostat:

- Lower the workstation to keep arms closer to body.
- Apply padding to the front edge of work surface to eliminate sharp edges and increase the amount of blood flow to the hands.
- Retrofit the existing handle with an adapter that will allow the operator to use the handwheel in a pistol grip position. This will alleviate repetitive wrist flexion and extension.
- Consider the use of an automatic foot operated cryostat when frequent cryosectioning is performed.
- Avoid placing utensils such as forceps inside the cryostat.
- Use an ergonomically designed chair.
- Take frequent mini-breaks. These breaks should be used to perform stretching exercises, especially the hands (see [Exercises & Stretches](#)).

## Flow Cytometers

The use of a flow cytometer requires frequent lateral bending, neck and back flexion, and extended arm reaching. This is due to the receiving port being located on the bottom of the flow cytometer. The operator must sit in awkward positions in order to see the controls. The following are recommended for control of ergonomic hazards associated with using a flow cytometer:

- Raise the flow cytometer by placing a block between the flow cytometer and the workbench. When droplet exposure is a concern, a shield is needed to protect your face. Ensure that the shield is also properly positioned.
- Use an electric or hydraulic adjustable table. Each individual will be able to adjust the flow cytometer to a height which is most comfortable.
- Use an ergonomically designed chair.
- Place the top of the monitor so the top of the screen is approximately at eye level.

### Glove Boxes

Working in glove boxes or anaerobic chambers requires extended static loading on the shoulders. Extending the arms for more than a couple of minutes can become very exhausting. In addition to static loading and frequent side reaching, the thick gloves also make the user over compensate on grip strength. Where possible, the following controls are recommended for ergonomic hazards associated with using a glove box:

- Move all needed materials for the experiment from the side chamber to the main chamber at one time to reduce the amount of side reaching.
- Use highly absorbent hand powder for glove comfort.
- Utilize job enlargement (periodically performing other activities) to avoid long continuous use of glove boxes.
- Provide anti-fatigue matting for extended use of the glove box.
- If necessary, use a sit-stand seat to alleviate stress on the low back.
- Take frequent mini-breaks (3-5 minutes for every 20-30 minutes of glove box work) to perform stretching exercises and relieve static loading from the shoulders.

### Centrifuges

Centrifuge rotors present a unique lifting hazard in the laboratory. Centrifuge rotors can weigh up to 35 pounds and are awkward in shape. The following are recommended for control of ergonomic hazards associated with lifting centrifuge rotors:

- If possible, use a second person to assist with lifting and removing the rotors.
- Use a cart to transport rotors.
- Look for manufacturers which produce lighter-weight rotors.
- Implement a pulley system, which would attach to the ceiling directly above the centrifuge.

### Overhead Lifting

Due to lack of space in the laboratory, many laboratory workers must store equipment and supplies on overhead shelves. This is recognized by NIOSH as a risk factor for ergonomically related disorders. The following are recommended for control of ergonomic hazards associated with overhead lifting:

- Store heavy objects on shelves below shoulder height whenever possible.
- Use a stable footstool or stepladder to reach objects that are stored on shelves.
- Avoid asymmetric lifting (twisting while lifting). The object to be lifted should be directly in front of the worker.
- Store materials that are frequently used on shelving units which are located higher than shoulder height.
- Use rotating carousels to store material close to the worker. This reduces excessive reaching for objects.

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## Manufacturers of Ergonomically Designed Lab Equipment

Disclaimer: Products listed on this website do not constitute endorsement by the Centers for Disease Control and Prevention or the U.S. Government.

Pipettes:

Microscope Accessories:

Ergo Source P.O. Box 695 Wayzata, MN 55391

Phone: 612-404-1969 Fax: 612-404-1058

Bay Optical Instrument 2403 - 15<sup>th</sup> Street, San Francisco, CA

94114

Phone: 415-431-8711 Fax: 415-252-9184

Website: [www.bayoptical.com](http://www.bayoptical.com)

MSM Microscope Forearm Supports R&D Ergonomics Inc. 6  
Harvey Brook Drive, Freeport, ME 04032 Phone: 207-865-  
6445 Fax: 207-353-5308

Website: [www.morencyrest.com/msm.htm](http://www.morencyrest.com/msm.htm)

Leica Microsystems, Inc. 2345 Waukegan Road,  
Bannockburn, IL 60015

Phone: 800-248-0123 Fax: 847-405-0147

Website: [www.leica-microsystems.com](http://www.leica-microsystems.com)

Anti-Fatigue Matting:

Tiffin Systems 450 Wall Street, Tiffin, OH 44883

Phone: 800-221-1994 Fax: 419-447-8313

Alimed, Inc. 297 High Street, Dedham, MA 02026

Phone: 800-225-2610 Fax: 800-437-2966 Website:  
[www.alimed.com](http://www.alimed.com)

Tennessee Mat Company, Inc. 1414 Fourth Avenue, South  
Nashville, TN 37210-4123

Phone: 800-264-3030 Fax: 615-255-4428

Website: [www.wearwell.com](http://www.wearwell.com)

Ergo Source P.O. Box 695 Wayzata, MN 55391

Phone: 612-404-1969 Fax: 612-404-1058

Adjustable Tables and Edge Guards/Padding

Alimed, Inc. 297 High Street, Dedham, MA 02026

Phone: 800-225-2610 Fax: 800-437-2966

Website: [www.alimed.com](http://www.alimed.com)

Ergo Source P.O. Box 695 Wayzata, MN 55391

Phone: 612-404-1969 Fax: 612-404-1058

Automatic Microtomes:



Leica Microsystems, Inc. 2345 Waukegan Road,  
Bannockburn, IL 60015

Phone: 800-248-0123 Fax: 847-405-0147

Website: [www.leica-microsystems.com](http://www.leica-microsystems.com)

Automatic and Adjustable Cryostats:

Leica Microsystems, Inc. 2345 Waukegan Road,  
Bannockburn, IL 60015

Phone: 800-248-0123 Fax: 847-405-0147

Website: [www.leica-microsystems.com](http://www.leica-microsystems.com)

Biological Safety Cabinets:

NuAire, Inc., 2100 Fernbrook Lane, Plymouth, MN 55447-  
4722

Phone: 612-553-1270

Website: [www.nuaire.com/products/index.html](http://www.nuaire.com/products/index.html)

Labconco Corp. 8811 Prospect Ave., Kansas City, MO 64132-  
2696

Phone: 800-821-5525

Website: [www.labconco.com/products/hepa\\_cabinets/](http://www.labconco.com/products/hepa_cabinets/)

The Baker Company, P.O. Drawer E, Sanford Airport Road,  
Sanford, ME 04073

Phone: 800-992-2537

Website: [www.bakerco.com/catalog/sg3advance/](http://www.bakerco.com/catalog/sg3advance/)

Keyboard Protectors and Keyboard Skins

<http://www.protectivecovers.com>

<http://www.amdata.com/amdata.comsec.html>

<http://www.fentek-ind.com/kbprtect.htm>

<http://www.kador.com/comp.htm>

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