

BNL Ergonomics Bulletin

July 2001, Issue no.2

Brought to you by the Safety and Health Services Division



■ ***In this Issue:***

■ <i>Laboratory Ergonomics</i>	<i>1</i>
■ <i>Microscopy</i>	<i>1</i>
■ <i>Pipetting</i>	<i>2</i>
■ <i>Microtomy</i>	<i>3</i>
■ <i>Laboratory Workbenches</i>	<i>3</i>
■ <i>Biological Safety Cabinets/fume hoods</i>	<i>4</i>
■ <i>Other Tips for Using other Lab Equipment</i>	<i>5</i>
■ <i>General Tips for Laboratory Personnel</i>	<i>6</i>
■ <i>General Laboratory Stretching Exercises</i>	<i>6</i>
■ <i>References</i>	<i>6</i>

■ ***Laboratory Ergonomics***

About 17-20% of BNL employees work in a laboratory environment with equipment such as microscopes, pipettes, and fume hoods. Besides the the potential daily risk of dealing with harmful substances, laboratory personnel may also be exposed to many ergonomic risk factors due to the nature of their work and research being performed.¹

Laboratory ergonomic risk factors do not deviate greatly from those in an office environment and those found in general industry. Some of those risk factors include: contact stresses, awkward and static postures, repetitive motions, forceful exertions, and vibration. In this issue you will find valuable information on how to minimize repetitive strain injuries from ergonomic risks in the your lab and improve lab work habits.

■ ***Microscopy***

Depending on the amount of research performed, researchers and scientists may use a microscope for prolonged periods. Using the microscope for long hours causes strain on your back, neck, shoulders, eyes, arms and wrists. ¹ There are several things that may be done to avoid or decrease the occurrence of discomfort that arises from awkward postures. Changes may be made to your work environment, work tools, and personal work techniques and habits.

Protective and Preventive Measures when using Microscopes:²

- To prevent neck strain, adjust the eyepieces and angle of observation; and use adjustable microscope stands whenever possible. Adjust the height of the microscope, workbench, or chair as needed to avoid flexing or extending your neck.
- Ensure that there is sufficient leg room at your workstation (approximately 18inches deep, 28 inches in width).
- Raise your microscope to position yourself so that you are in the outermost upright position to reduce tilting your head and rounding your shoulders.
- Place your microscope towards the edge of your work surface so that you can look into it as upright a position as possible.
- To relieve fatigue and strain, utilize lifters and angled microscopes.

BNL Ergonomics Bulletin

July 2001, Issue no.2

Brought to you by the Safety and Health Services Division



• *Protective and Preventive Measures when using Microscopes (cont):*^{2,3}

- If your microscope is too high and you have to raise your head to use it, adjust your chair's height and use a chair ring or foot rest.
- Keep your microscope clean.
- Verify that illuminators are aligned and the light is even and of proper intensity.
- To reduce pressure on your body, use padding when possible. (ie use elbow pads to reduce pressure on the arms while working at the bench; apply padding at the edge of the work surface to avoid resting on hard edges)
- Use proper sitting posture and positioning (Fig.1).
- Use television system to eliminate the use of binocular eyepieces when appropriate.

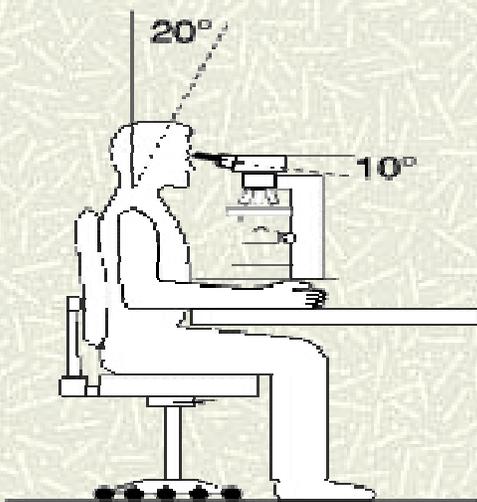


Fig 1. Workstation Set-up for Microscopy¹

■ *Pipetting*^{2,3}

Pipetting is one of the most repetitive tasks in medical and research laboratories; and has many associated ergonomic risk factors. Some of the risk factors are: repetitive hand motion; pinch grip when handling pipette tips or opening vials; bending and twisting of the wrist; working with the elbow held at an elevated position away from the body; awkward and static postures; bent neck or jutted chin; excessive thumb force; overreaching; and standing for long periods.

Studies have shown that there is a significant increased risk of hand and shoulder discomfort when laboratory researchers or scientists pipetted for more than 300 hours per year (equivalent to 2 hours per day for a 50 week work year!). Often this task is done for longer periods each day. Steps may be taken to prevent the onset of repetitive strain injuries such as tendonitis, shoulder pain, finger pain, etc.

■ *Protective and Preventive Measures when using Pipettes:*^{2,3}

- Use an electronic operated or latch-mode pipetter whenever possible. This will reduce the need for excessive thumb force and repetition.
- Take breaks and limit pipetting to 20 minutes or less at one time.
- Rotate pipetting tasks among several people.
- Keep your arms as close to your body as possible to reduce shoulder strain.

BNL Ergonomics Bulletin

July 2001, Issue no.2

Brought to you by the Safety and Health Services Division



Protective and Preventive Measures when using Pipettes (cont.):^{2,3}

- Use thin-walled pipette tips that fit correctly and are easy to eject
- Use pipettes that use a pointer finger to aspirate and thumb to dispense.
- Use padding whenever possible to reduce pressure on your body and pad equipment to increase ease of gripping. (You may wear elbow pads to reduce pressure on your arms while working at a bench and apply padding to the edge of the work surface to avoid resting your elbows on hard/sharp edges.)
- Use gloves that fit properly to avoid undue stress.
- Maintain your wrist in a neutral position (straight).
- Retrofit pipetter so that it may be activated with a finger rather than a thumb trigger.

■ Microtomy¹

Microtomes are widely used in histology labs. They require a lot of repetitive hand motions and forceful exertions. In one day, a scientist/researcher may use between 40 and 50 cassettes or blocks a day, thus rotate the microtome wheel for at least 1000 times!

Use of specimens and trimming the wheel may also increase the risk for an MSD while using a microtome.

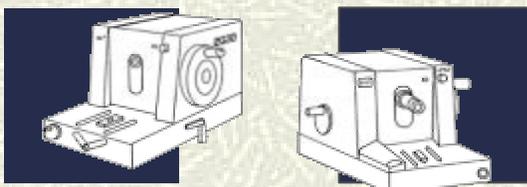


Fig 2. Microtomes

Protective and Preventive Measures when using Microtomes (cont.):^{2,3}

- Use an automatic microtome instead of a manual unit if possible.
- If you will be using the microtome on a sitting workstation, make sure there is enough leg room (approximately 18 inches deep, 28 inches in width).
- Use less forceful exertions when rotating the wheel. You can adjust the feed wheel position to reduce stress.
- If possible use a front pedal instead of hand operated wheel.
- Avoid sharp edges when possible. You may apply padding to the work surface and the edge of your work surface in order to increase the amount of blood flow to the hands.
- Take breaks frequently.

■ Laboratory Workbenches²

Laboratory workbench heights are fixed and cannot be modified. Their height is set according to guidelines suggested by NIOSH according to the type of work that is to be performed. There are three categories or guidelines that have been set: precision, light and heavy work (Fig 3.).

Using your laboratory workbench inappropriately may introduce ergonomic risk factors depending on the work.

BNL Ergonomics Bulletin

July 2001, Issue no.2

Brought to you by the Safety and Health Services Division



■ *Laboratory Workbenches (cont.)*²

An example of using the work bench inappropriately is when you use it as a computer workstation. This forces you to assume a variety of awkward postures and may increase the likelihood of developing an MSD.

***Protective and Preventive Measures when using Workbenches:*²**

- Use the appropriate workbench height specific to the type of work you will be doing (i.e. For precision work height should be set above elbow height - between 37-43 inches and so on. See Fig 3. below).
- If performing work while standing, use of anti-fatigue matting may be useful.

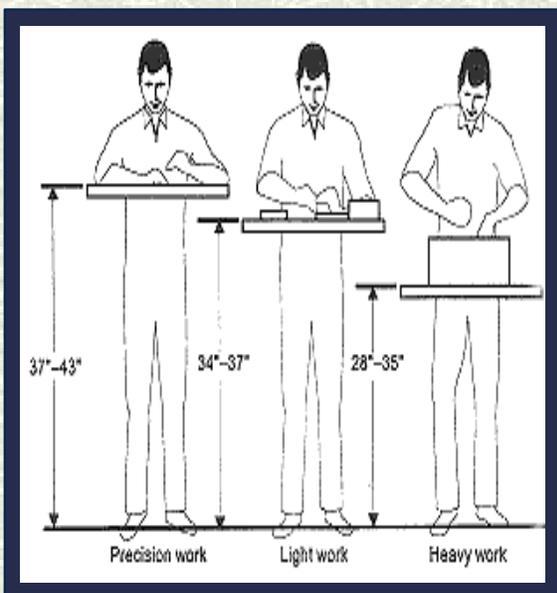


Fig 3. Laboratory Workbench Heights¹

***Protective and Preventive Measures when using Workbenches (cont.)*²**

- If you will be performing work sitting down, use an adjustable stool or chair with a built-in footrest and arm rest. This will insure proper lower back, thigh, and feet support.
- Take breaks frequently.

■ *Biological Safety Cabinets/fume hoods:*¹

Working in biological safety cabinets (BSCs) or fume hoods require lab personnel to assume awkward postures.

These postures arise from limited work access, which restrict arm movements, and therefore

increases the amount of stress on joints of the upper limbs, neck and back. There are

other ergonomic risk factors

associated with this equipment such as: repetitive motions of the hands, wrists, and forearms;

constrained body position including constrained knee and leg space (especially in fume hoods and older BSCs), contact on forearms, wrists, knees, and legs; and prolonged static and restricted postures.



***Protective and Preventive Measures when using Biological Safety Cabinets/fume hoods:*¹**

- To avoid overreaching/overextending, place all materials in the hoods/BSCs as close as possible to you. Note: For safety reasons it is suggested that you work at least 6" back into the hood. This will help maintain optimal airflow containment for material and personal protection.

BNL Ergonomics Bulletin

July 2001, Issue no.2

Brought to you by the Safety and Health Services Division



Protective and Preventive Measures when using Biological Safety Cabinets/Fume hoods (cont):¹

- Avoid contact with sharp edges on forearms and hands. You may apply foam padding to the front edge of the hood/BSC (away from the downdraft) to minimize contact forces of your forearms and wrists.
- Use anti-fatigue matting or a foot rest if you are standing while working for long periods. This will reduce fatigue on your muscles, joints, and back.
- Keep line of sight unobstructed and maintain the hood/BSC window clean to reduce eye strain and any awkward postures.
- Take breaks frequently.



Fig.4 Restricted work access¹

Fig.5 Restricted work access (overall and legroom clearance)¹



Other Tips for Using other Lab Equipment:²

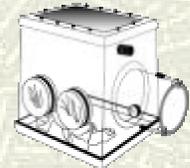
Cryostats:



- Avoid placing utensils such as forceps inside the cryostat. This will keep utensils at room temperature and reduce cold exposure to the hands and fingers.
- To minimize contact stresses, apply padding to the edge of the cryostat.
- Take frequent breaks.
- If possible use a foot operated cryostat.

Glove Boxes:

- For better glove comfort, use absorbent material to reduce hand moisture and allow for better grip.
- To reduce side reaching, move all materials to be used in the experiment/procedure from the side chamber to the main chamber.
- Take frequent breaks.



Centrifuge Rotors:



- Do not lift heavy centrifuge rotors on your own. Get assistance from one of your team members.
- Use a cart or other carrying device to transport rotors.
- To avoid frequent reaching, keep wrists straight when taking test tubes in and out of the centrifuge and keep the centrifuge as close to you as possible.

BNL Ergonomics Bulletin

July 2001, Issue no.2

Brought to you by the Safety and Health Services Division



■ **General Tips for Laboratory Personnel:**³

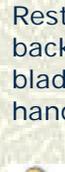
Here are some other general tips to lower your risk of developing repetitive strain injuries from lab work:

- If you will be performing most of your work standing up, then wear shoes with good arch support.
- When sitting, sit with your back in the chair/stool. (Adjust the foot ring or get a foot stool if your feet do not reach the floor/stool ring.
- Work at a cut out in the lab bench- this allows you to work as close as possible to the bench and sit back in your chair.
- Avoid spending long periods looking down while reading. (You can use angled copy holders to position your materials up.
- Maintain neutral wrist/arm postures as much as possible. (For information see bulletin no. 1 for info on neutral hand posture).
- Keep all materials at the most comfortable reach possible.
- Alternate position of objects such as forceps held in your hand. (Alternate between the first finger and the thumb and the first and second fingers to vary the task.)
- Stretch throughout the day. (See next section for some tips on stretching exercises.)
- **TAKE SHORTS BREAKS FREQUENTLY AND AVOID PERFORMING REPETITIVE MOTIONS WITH THE EQUIPMENT DISCUSSED FOR MORE THAN 20 MINUTES AT A TIME.**

■ **General Laboratory Stretching Exercises:**³



Roll your shoulders backwards



Rest back of hands on lower back, gently squeeze shoulder blades together while pressing hands against lower back.



With right hand resting on left, palms facing toward floor, extend arms down.



Arms in front, turn trunk to the right. Repeat to the left.



Stretch arms overhead with palms up.

- For more stretching exercise tips go to :
<http://www.niehs.nih.gov/odhsb/ergoguid/chapiii.htm>

- References:

1. <http://dehs.umn.edu>
2. <http://www.niehs.nih.gov>
3. <http://ergonomics.ucla.edu>

ON THE NEXT ISSUE: OFFICE ERGONOMICS