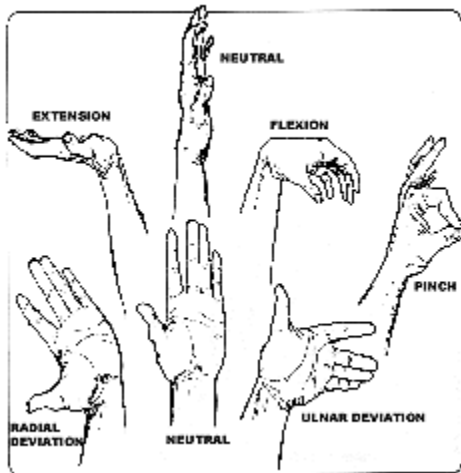


LABORATORY GUIDELINES



Many ergonomic risk factors are present in the laboratory, including awkward posture, high repetition, excessive force, contact stresses, and vibration. By learning how to control laboratory ergonomic risk factors, you can improve comfort and productivity while lowering chances for repetitive strain injuries.

Many tools used in the lab are not designed properly for the human hand. Electric pipettes and other redesigned tools are available from laboratory suppliers such as Ranin, VWR and North Coast Medical.

Click on the following titles to learn more ways to reduce ergonomic risk factors for several common laboratory activities.

- [pipetting](#)
- [handling test tubes](#)
- [microscope use](#)
- [dishwashing](#)
- [other lab activities](#)
- [Computer](#)

Awkward postures take the body out of neutral positions and can result in increased stress to muscles, tendons, and nerves. For example, the neutral

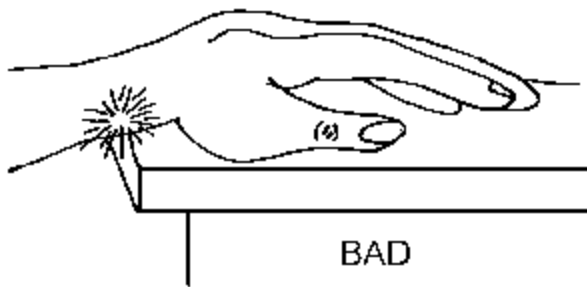
position for the wrist is when the wrist is straight. Working with the wrist in a forward bent position results in compression or crimping of tendons on the palm side of the wrist and tension of tendons on the back of the wrist. This awkward position restricts the normal ability of the tendons to glide during the work activity and may result in injury. Awkward positions also increase muscle load, constrict blood flow, and in some cases compress nerves.

High Repetition can result in injury if the repetition exceeds the body's capacity to recover from the muscle tension that results from repetitive movement. Typically, given time, muscles, tendons, and ligaments accommodate to given levels of repetition. Problems arise when there are dramatic increases in repetition and no action is taken to change how a task is done. Symptoms of repetitive strain (such as muscle tension, aches and pains that come and go, burning or tingling and numbness) are a signal that you may be exceeding your limits.

Forces vary with equipment type, design, and state of repair. Recognize that when applying force to an object, forces are transferred through your body. For example, when activating a pipette, forces are transferred to your finger or thumb. Forces transferred to your body are affected not only by the amount of force, but also the distance through which a force is applied. Consider how your arms, neck and back feel when the vortex machine is at the back of the bench.

Choosing equipment that requires less force to activate and requires a shorter activation distance can reduce forces transferred to your body. Assuring equipment is in good working order also helps reduce the overall forces to the body.

The amount of force your body can accept without injury varies with the individual. It is also dependent on the size of the joint and the size of ligaments and muscles surrounding the joint. In general, it is best to position yourself and/or use tools that help transfer forces to larger joints (e.g., using the larger shoulder muscle instead of the smaller wrist).



Contact Stresses occur when a force is concentrated to a small area, also known as pressure. Contact stress

occurs when resting your forearm against the sharp edge of a hood. In this case, highly concentrated forces can disrupt the ability of the tendons to move within the forearm and cause inflammation of the tendon. If resting on a sharp edge is necessary, either pad the edge or pad yourself to distribute forces. When grasping hand-held equipment, contact stress occurs in the hand and this stress can effect structures of the hand. It is important to assure hand-held equipment fits your hand well. Hand-held equipment should not result in pressure at the base of the palm of the hand since the pressure can effect the median nerve. If necessary, padding can be added to the equipment or you can wear a padded glove to reduce pressure.

Vibrations can be transferred to the body when holding an object on some type of oscillating equipment. For example, vibration to the hand occurs when holding tubes by hand on a vortex mixer. In this case, vibration can be eliminated by using a vortex mixer rack instead of holding the tubes by hand. In other cases where it is not possible to eliminate vibration, the amount of vibration transferred to the body can be reduced by padding the hand. [TOP](#)

LABORATORY GUIDELINES

Pipetting

To Control Awkward Postures:

- Work with wrists in straight, neutral positions - may need to incline sample holder or solution flask.
- Reduce reaching by:

- Using short pipettes.
 - Using low profile waste receptacles for used tips.
 - Using low profile solution containers.
-
- Keep items as close as possible.
 - Work with elbows as close to sides as possible.
 - Assure proper lower back and thigh support from chair. Support the feet.
 - Assure items are positioned to minimize twisting of the neck and torso.



To Control High Repetition:

- Automate pipetting tasks.
- Use multi-pipetters whenever practical.

- Share workload between right and left sides.
- Vary pipetter types having different activation motions (e.g. thumb controlled vs. finger controlled).
- Take adequate breaks away from pipetting activity-even short several second "micro-breaks" help.
- Rotate pipetting among several employees.
- Evaluate work processes to spread pipetting throughout the day.
- Add personnel for peak periods.

To Control Excessive Force:

- Choose pipetters that require less finger or thumb motion to activate.
- Use pipette tips that seal easily; avoid banging when applying tips.
- Use tips designed for the pipette.
- Use multi-channel pipettors when possible.
- Choose pipetters that require less force to activate.
- Use only the force necessary to activate.

To Control Contact Stresses:

- Choose pipetters that best fit your hand.
- Do not rest forearms on a sharp edge. Pad the edge or forearm, or create a forearm rest.

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Handling Test Tubes

To Control Awkward Postures:

- If seated, assure proper lower back and thigh support from chair and assure feet are supported.
- If standing, assure work surface is at proper height to reduce need to reach upward or bend forward. Use a stepstool if necessary. Upside down containers can be used to create higher work surfaces.
- Arrange test tube racks to minimize reaching and twisting.
- Work with elbows close to sides.
- Maintain straight wrist positions. This may require inclining test tube racks.

- When possible, use clamp to hold test tubes.

To Control High Repetition:

- Automate processes when possible.
- Share workload between right and left sides.
- Take adequate breaks away from handling activity-even short several second "micro-breaks" help.
- Rotate handling among several employees.
- Evaluate work processes to reduce steps requiring manual handling.
- Add personnel for peak periods.

To Control Excessive Force:

- Automate test tube opening when possible.
- Use pinch (thumb working with index finger) for precision activities that require minimal force.
- Use full hand grip for activities that require greater force (not the pinch grip).
- Use cap removers that change handling from pinch to full hand grip.
- Request samples be received in test tubes that allow improved ergonomics.
- Explore other sample mediums (e.g. genetic testing is moving away from testing blood to testing hair).

To Control Contact Stresses:

- Use two hands to open test tube samples.
- Do not rest forearms on a sharp edge. Pad the edge or forearm, or create a forearm rest.

To Control Vibration:

- Use vortex mixer rack - do not hold tube by hand.

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Microscope Use

To Control Awkward Postures:

- Assure proper lower back and thigh support from chair and that feet are supported.
- Assure adequate thigh clearance under lab bench. Often low hanging false fronts need to be removed.
- Raise, incline, and move microscope as close as needed to assure upright head position.
- Work with elbows close to sides.
- Work with wrists in straight, neutral positions.
- Choose microscope eye pieces which allow improved head and neck posture.
- Move microscope to line up eyepieces with table edge.
- Keep upper arm vertical, forearms horizontal, wrists neutral.
- Install ocular eyepiece extensions where feasible.



Wrong:
Neck bent
Shoulders hunched
Elbows out



Right:
Head upright
Elbows close to sides

To Control High Repetition:

- Take adequate breaks - even short several second "micro-breaks" help.
- Rotate microscope work between several employees.
- Evaluate work processes to spread microscope work throughout the

day.

- Add personnel for peak periods.

To Control Contact Stresses:

- Do not rest forearms on sharp work surface edges. Pad the edge or forearm, or create a forearm rest pad.

To Control Eye Fatigue:

- Keep scopes clean.
- Assure illuminators are in alignment and light is even, and of proper intensity.
- Assure optical components are in proper repair.
- Take frequent short breaks to rest your eyes; focus far away or shut eyes to change eye focal length.

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LABORATORY GUIDELINES

Dishwashing

- Gloves - good grip, dexterity and fit.
- Use brush handles with larger grips and/or curved handles.
- Load dishwashers with tray pulled out.
- Place tubs upside down in sink to raise items to be washed.
- Minimize grip force.

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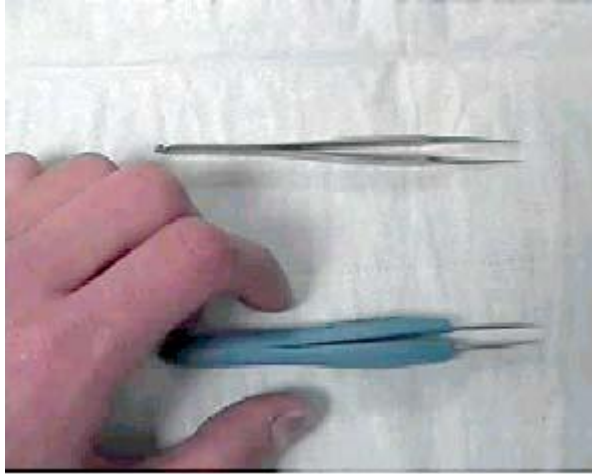
LABORATORY GUIDELINES

Other Laboratory Activities

- Ensure hand-held equipment fits hand well (i.e., does not press on palm of hand or concentrate pressure to one point).
- Select tools that require less force to activate (e.g.,

reverse tweezers).

- For small-handled tools, enlarge the grip area.



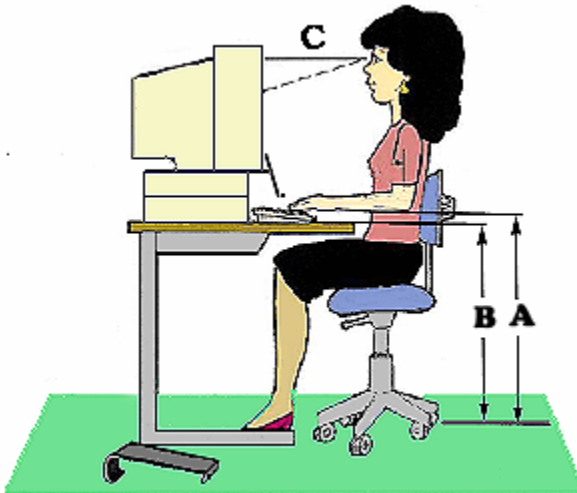
- Get help to move heavy objects. Use carts, dollies and lifts to lift & transport drums.
- Push don't pull carts; handles should be at waist height.
- Use beakers with handles and two-handled jugs.
- Use stools/ladders to reach high objects.
- Keep back straight/slightly curved in at the small of the back - DO NOT bend over from the back.
- Avoid twisting.
- Before lifting, check path, get a good grip.
- Hold object close to body, at waist height.



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WORKSTATION DESIGN

What is the Optimal Keyboard, Mouse and Monitor Height?



Measurement A: Sitting Elbow

1. Adjust the chair so your feet are firmly on the floor and your knees are even to or slightly lower than your hips.
2. Relax your shoulders, place your hands in your lap, then raise your hand even with your elbow.
3. Ask your ergo buddy to measure the distance from the floor to your elbow.

Measurement B: Keyboard/Mouse Surface

There are three options for the height of the surface that supports the keyboard and mouse depending on what type of keyboard you use and on your typing style. In any case, the keyboard and mouse should never be higher than your elbows. Using the Sitting Elbow

height you measured above (Measurement A), determine the correct keyboard/mouse surface height for yourself as follows:

- 1" lower than Measurement A for an ordinary keyboard.
- 2" lower than Measurement A if the MS Natural keyboard is used
- Equal to Measurement A if you look at your hands to type.

Measurement C: Monitor Height

The monitor should never be so high that you have to lift your chin to see any part of the screen. Therefore, the top ¼ of the screen should be equal with your straight-ahead vision, unless most of your work is done in the lower ¼ of the screen (then the monitor can be higher) OR if you wear bifocals (then the monitor needs to be lower). Do not place the monitor on the hard drive/docking station if it sets it too high.

Reading/Writing Surface

Your work surface should be 2" above your sitting elbow. You should be able to sit comfortably under the surface and work at it without elevating your shoulders.

Ergonomic Equipment, Tools, Office Supplies

An "ergonomic" product is one that fits the user and is appropriate for the task (i.e., it does not cause discomfort or injury and improves productivity). There are a large variety of quality and cost-effective products available. Please refer to the Products portion of this website for our recommendations.

- **Ergonomic chairs.** Please click [here](#) for detailed information on selecting an appropriate chair.
- **Wrist rests and arm supports.** Wrist rests should be used to keep the wrists flat and off of a cold, hard surface when you are not typing or using the mouse. It is important to move your hands across the keyboard, to use your full arm while mousing, and to not plant your wrists on the rest to avoid hand strain.
- **Footrests.** A footrest should be used if the work surface cannot be lowered to the appropriate height (i.e., keyboard surface @ 1 - 2" below the user's sitting elbow)

height, writing surface @ 2" above sitting elbow height). The chair must be raised to accommodate the work surface height, causing the knees to be lower than the hips. A footrest will improve this angle and, more importantly, will create adequate back support by allowing the back to rest against the back of the chair.

- **Keyboards and trays.** If your forearm is not parallel to the floor, the keyboard is too high. If your elbows are away from your body while typing/mousing, the keyboard/mouse is too far away. Finally, if your upper body feels tense while typing with your wrists off the rest/desk, the keyboard is too high. A keyboard tray is one option of improving your computer set-up. Warning: a keyboard tray should always be long enough to accommodate the mouse.
- **Input devices (i.e. mice).** Many standard-issue input devices are not designed correctly for the user's hand. Alternative devices with a click-lock feature and programmable software are superior. (Note: The software can always be updated by downloading the latest version from the Internet.) The device must not increase stress in the hand, promote wrist extension, or overuse the thumb. The Logitech, Kensington products and Contour products are good options.

The mouse or trackball should be placed adjacent to the keyboard. The user should be able to keep the elbow close to the body. Users tend to chase the mouse to the opposite side of the work surface and wind up using the mouse at full arm reach resulting in very awkward postures for the neck, upper back, and shoulders. Movement of the mouse should come from the shoulder and arm, not isolated to the wrist and hand. Trackballs should be moved with the entire palm, fingers, and forearm. Curling and extension of the fingers is not desirable.

- **Office supplies.** Writing tools, scissors and staplers can all cause undue stress in the user's hands. Individuals should use the tools that fit their hands and task. For example, a pen that is too slim requires much more forearm force to grip than does a wider pen or a pen with a foam grip on it.
- **Slant boards and document holders.** To avoid serious neck and back pain, it is critical that all documents referred to during keyboarding are supported by a holder. Individuals who read or edit should always use a slant board to prevent neck flexion.
- **Monitor stands.** Typically, the computer CPU case is **not** an appropriate monitor stand because it raises the monitor much higher than the user's straight-ahead vision. The **top of the screen** should be at eye level unless you are wearing bifocals, not the middle of the screen. Stackable risers or a height-adjustable stand is most effective for supporting the monitor.
- **Computer accessories.** Alternative keyboards and other computer accessories are not designed for all users. ("Ergonomic" keyboards sometimes cause more problems than they alleviate.)

- **Headsets.** If your job requires prolonged phone conversations or simultaneous phone and computer/desk work, a headset is a necessity. Cradling the phone causes tremendous neck strain.

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