

LABORATORY ERGONOMICS

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APHIS ERGONOMICS

Work Healthy



2012

Ergonomics

- Definition: Fitting the job to the worker.
- Goals:
 - Work in neutral postures (i.e. the position that requires the least amount of muscle force and allows maximal room for blood flow).
 - Seeks to improve the interaction between humans and the machines & tools they use to perform their work.
 - Decrease risk of injury/illness.
 - Enhance worker productivity.

Understand

- There is no such thing as the average person.
- It is not normal to be in pain.
- Different people respond differently to their work environments, particularly after an injury, due to:
 - Hereditary.
 - Age.
 - Gender.
 - Lifestyles.

Today's Objectives

- Ergonomic techniques that will reduce your risk for work-related musculoskeletal disorders within the laboratory.
- How to properly set up your laboratory work area.
- Exercises and stretches to relieve tension.
- How to obtain reasonable accommodations.

Question?

- What types of lab functions do you perform?
- Do these functions require your body to be in an uncomfortable position?



Ergonomic Disorders and Injuries

The absence of a sound ergonomics workplace environment can lead to a variety of physical ailments named work-related musculoskeletal disorders (WMSDs), cumulative trauma disorders (CTDs), or repetitive strain injuries (RSIs).

WMSDs, CTDs, and RSIs

- Disorders of the muscles, joints, nerves, tendons, ligaments, cartilage, or spinal discs.
- Mainly occur in the neck, back, arms, and wrists.
- Reflect gradual or chronic development.

Causes of WMSDs

- Awkward/Deviated Postures
 - ▣ Overhead reaching
 - ▣ Twisting the body

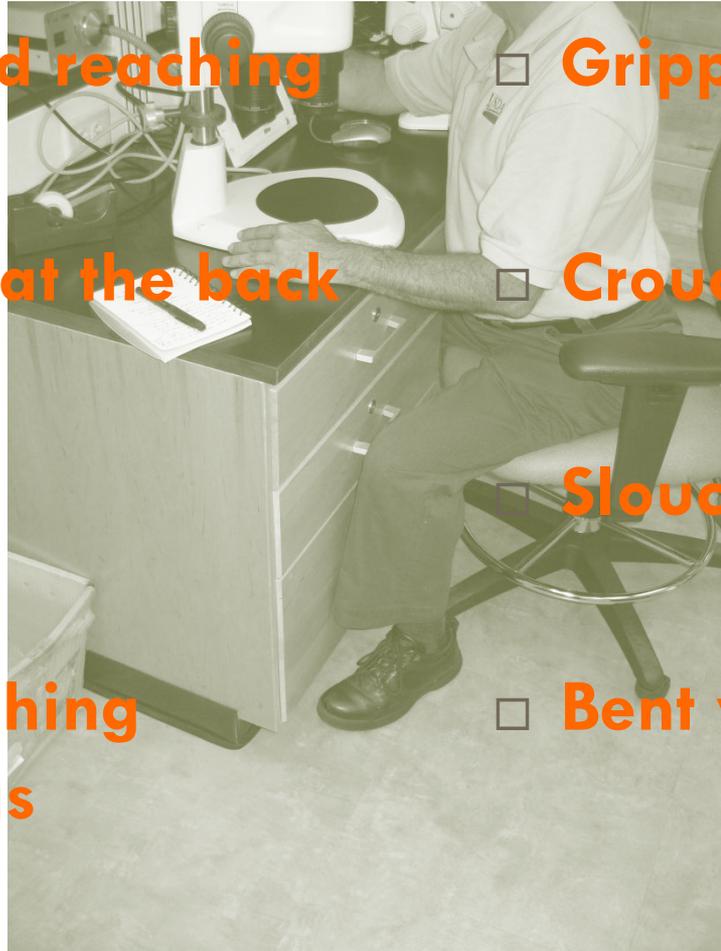
- Highly Repetitive Work
 - ▣ Pipetting
 - ▣ Screwing/Unscrewing caps on lab samples

- Contact Stress
 - ▣ Resting wrists and arms off surface edge
 - ▣ Leaning forward with elbows on work surface



Awkward Postures

- **Overhead reaching**
- **Bending at the back**
- **Twisting**
- **Outstretching arms/legs**
- **Gripping**
- **Crouching shoulders**
- **Slouching**
- **Bent wrists**



Most Common WMSDs

- Lower Back Pain
 - ▣ Back Injuries Cost - \$125K per incident

- Carpal Tunnel Syndrome (CTS)
 - ▣ CTS Injuries Cost - \$30K per incident

WMSDs – Lower Back Injuries

- Causes
 - Lifting heavy objects.
 - Twisting.
 - Standing for lengthy periods.

- Symptoms
 - Pain.
 - Tightness.
 - Sitting is uncomfortable.



WMSDs - CTS

- Causes:
 - Poor wrist posture.
 - Repetitive motions.

- Symptoms:
 - Pain.
 - Numbness & tingling in hands.
 - Frequently dropping items.
 - Hand falling asleep often.



Most Common WMSDs in Labs

<u><i>Injury Root</i></u>	<u><i>Cause</i></u>	<u><i>Lab Tasks</i></u>
Rotator Cuff Tendinitis	Repetitive tasks with elbows above mid-torso height	Fumehood work
DeQuervain's Tendinitis	Forceful grasping and turning	Volumetric handling
Trigger Finger	Repetitive use of tools with sharp handles or hard edges	Pipetting
Ganglion Cyst	Appears after wrist strain	Adjusting microscope
Thoracic Outlet Syndrome	Arm elevation	High workstation

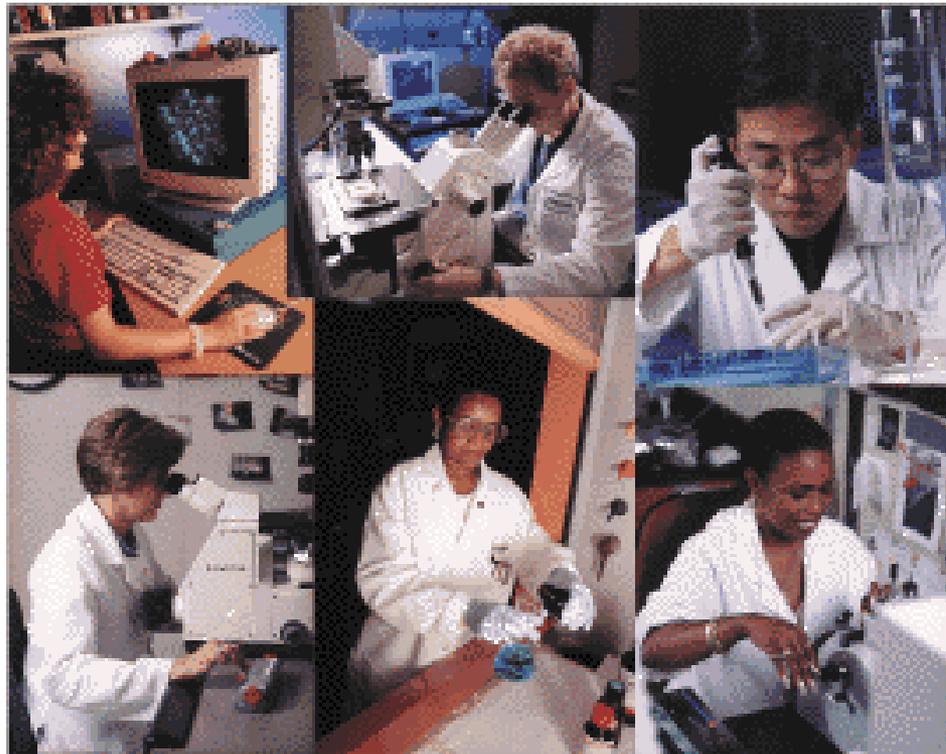
Most Common WMSDs in Labs



Review

Do you recognize any of the aforementioned causes of WMSDs in your work environment or job functions?

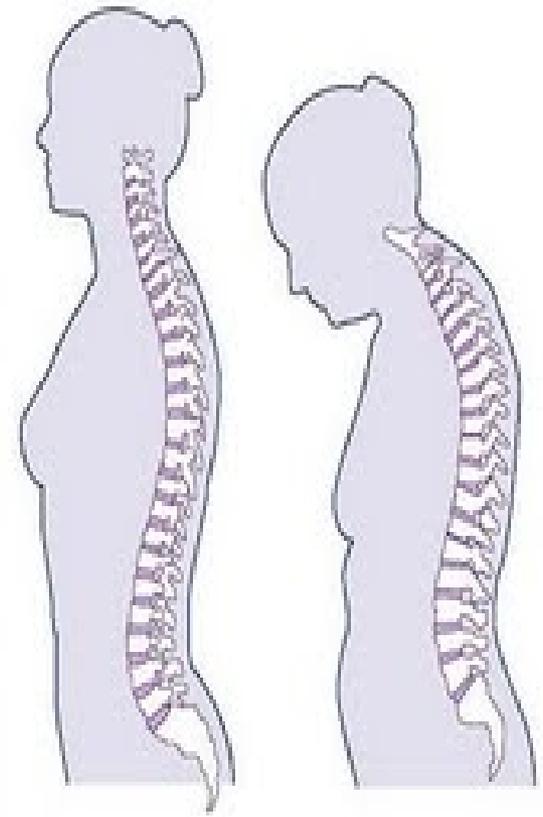
Laboratory Ergonomics



Postures in the Lab

Components of proper posture:

- Ears over shoulders.
- Shoulders in line with hips.
- Forearms 90° or more from the upper arms.
- Wrists in a neutral position.



Postures in the Lab

- Combating the “hunched-forward” posture:
 - Use an industrial-height footstool.
 - Allows the employee to bend forward at the hips rather than round the neck, back, and shoulders.
 - Use an adjustable lab stool with enhanced lumbar support.
 - Provides employees working in a forward position (such as at a BSC) with needed support during rest periods.

Useful Equipment

Laboratory Footrest



Laboratory Stools



Laboratory Ergonomics Elements

- Pipetting
- Microscopy
- Laboratory Hoods/Biological Safety Cabinets
- Micro-Manipulation & Fine Motor Skills
- Laboratory Workstations

Pipetting



Pipetting - General

- Source of hand and shoulder problems.
- Short pipettes are preferable to decrease hand and arm elevation.
- Pipettes where the thumb dispenses and the index finger aspirates are best.
- Pipette usage should be alternated between the right and left hand.

Pipetting – Multi-tasking



Pipetting - Tips

- Use an electronic operated or a latch-mode pipettor to replace manual plunger-operated pipettes.
- Use an electronic pipettor with mixing functions for tasks such as mixing or aliquotting.
- Use a multichannel pipettor for large aliquotting tasks.
- Use thin-walled pipette tips that are easy to eject.
- Take micro-breaks of 2 minutes for every 20 minutes of pipetting. Mild hand exercises and stretches are beneficial.

Pipetting - Tips

- Clean pipettors regularly to; reduce "sticking" and improve quality of work).
- Work with arms close to the body.
- Avoid arm elevation without support for lengthy periods.
- Keep samples and instruments within easy reach.
- Rotate pipetting activities between laboratory tasks, hands, and people.



Pipettors - Choices

Considerations are highly individual:

- *Hand size*
 - ▣ *Most important.*
 - ▣ *Different sizes available.*

- *Weight*
 - ▣ *A light weight pipettor requires less force to hold.*

- *Force*
 - ▣ *Use a pipettor that requires as little force as possible to control.*

Pipettors - Choices

- *Location of controls*
 - *Multi-finger controls help distribute the force among several fingers rather than continuously using the same finger.*
 - *Some pipettors have a button on the top which may require the thumb to be repeatedly extended out of a relaxed, neutral position.*

Pipettors - Types



Single Channel Electronic

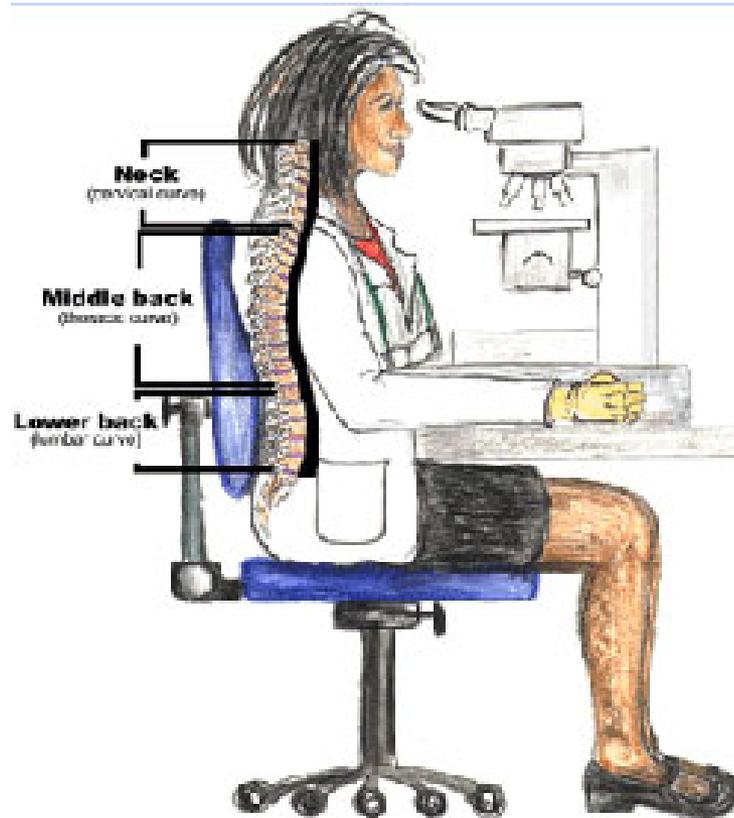


Multi-Channel Electronic

Pipettors – Other Tips

- Heights should all be approximately the same, and these items should be within easy reach in a logical work order.
- Prevent twisting and bending of the wrist, neck and arms, elevation of the shoulders, and overreaching, by adjusting the height and position of:
 - Sample holders (e.g. place on a tilt)
 - Solution container(s)
 - Waste receptacle(s) – keep at low height (e.g. no higher than top of tube being filled)

Microscopy



Microscopy

- Operating a microscope for long hours will strain the neck, shoulders, eyes, lower back, arms and wrists.

- Working at a microscope that is not at the correct height and angle requires:
 - A hunched-forward position.
 - Contact stress on the forearms from the work surface edge.

Microscopy Related Trauma

The percentage of medical problems reported with long-term microscope use by body part is:

- Neck 50-60%
- Shoulders 65-70%
- Back (Total) 70-80%
- Lower Back 65-70%
- Lower Arms 65-70%
- Wrists 40-60%
- Hands and Fingers 40-50%
- Legs and Feet 20-35%
- Eyestrain 20-50%
- Headaches 60-80%

Microscope Use Problems



Microscopy - Tips

- Pull the microscope towards the edge of the work surface to position the operator in a more upright posture.
- Elevate the microscope.
- Adjust the eyepieces and angle of observation to prevent neck strain.
- Use lifters and angled microscope arm supports to relieve fatigue and strain.
- Maintain neutral spine.

Microscopy – Other Tips

- Set scope over a space with adequate room for your legs so you can sit directly under the microscope.
- Position your head upright and your line of sight approx. 30-45° below straight ahead vision.
- Remove armrests from chairs if they interfere with your arms.
- Apply padding to the edge of the work surface in the form of foam rolls or padded edge protectors where arms are in contact with surface edges.



Microscope Use Example

Before



After



Microscope Use Example



Microscopy – Other Tips

- Tilt storage bins toward you to reduce awkward postures while reaching for supplies.
- Enlarge small hand tools by placing cylindrical foam around them.
- Make simple tool modifications if you are not able to keep your wrists straight.



Microscopy - Preventing Eye Strain

- Make sure the scope is clean, lighting is adequate, and the microscope lamp and optical pathway are correctly aligned.

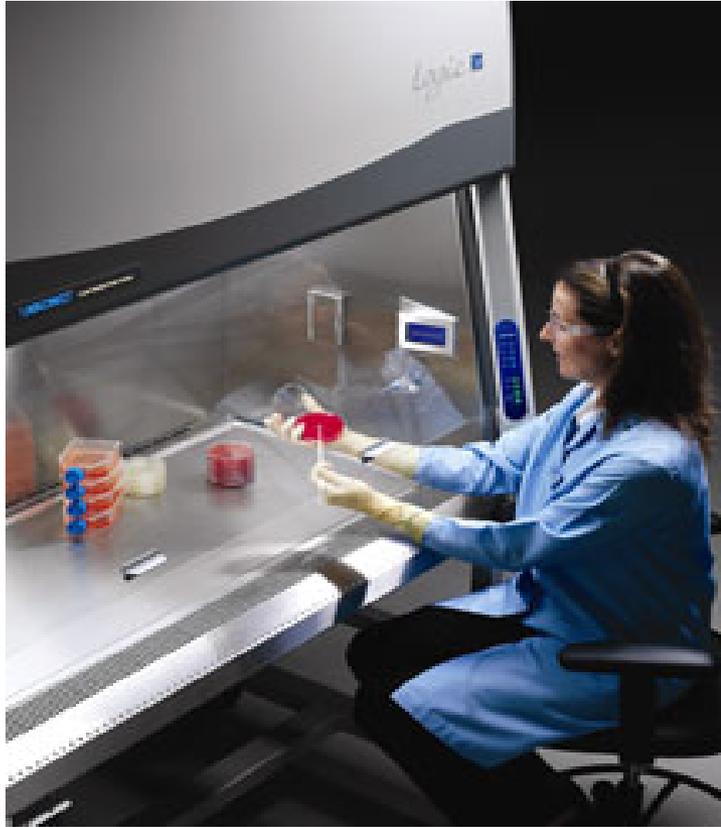
- When possible, use a video display terminal to view the sample.
 - Place the monitor at:
 - Eye level.
 - Straight ahead.
 - An easy viewing distance.



Preventing Eye Strain

- Perform eye exercises/stretchers.
- Check lab environment for excessive glare and reflections from overhead lighting, and adjust internal microscope light to compensate.
- Temperature, humidity, air currents, ventilation, excessive noise, and ambient lighting levels all affect operator comfort and fatigue.
 - Temperature = 66-73° F.
 - Low humidity conditions lead to drying of the eyes.

Lab Hoods/Biological Safety Cabinets (BSCs)



Lab Hoods/BSCs

- Similar hazards as microscope work are seen.
 - ▣ Hunched postures.
 - ▣ Forward reaches.



Newer BSCs

- Eliminate the bent, forward posture of traditional BSCs via:
 - Height adjustable tables with downdraft or backdraft rather than the traditional updraft exhausting.
 - A perforated front grill reduced by 1-2 inches which allows the work platform to be closer to the worker.
 - Non-glare glass on the sash window and/or adjustable plexiglass barriers.
 - A platform with wells for placement of tall containers to reduce reaching.

Lab Hoods/BSCs – Tips

- To reduce contact stress to forearms & wrists:
 - Apply closed-cell foam padding to the front edge of the hood/BSC.
 - Can be decontaminated.
 - Attach arm rests external to the cabinet.
 - To support the arms at the correct height and angle
 - Does not restrict air flow.
 - Where decontamination is a problem, consider the use of bubble wrap.
 - Disposable
 - Inexpensive



Lab Hoods/BSCs – Tips

- Use a fully adjustable chair that provides adequate back support, adjustable seat angle, and height adjustability.
 - Ensure adequate leg & thigh clearance under the cabinets.
 - Raise the cabinet a couple of inches if necessary.
 - Use a footrest, not the chair ring, to:
 - Provide stability in leaning forward from the hips.
 - Reduce pressure on the back of the legs.

Proper Use of a Footrest



Other Footrest Postures to Consider



Lab Hoods/BSCs – Work Practices

- If standing at the hood/BSC, use anti-fatigue matting and wear supportive shoes.
- Position materials as close as possible to avoid extended reaching.
- Use a turntable to store equipment close at hand. This prevents reaching and twisting.



Lab Hoods/BSCs – Eye Strain

- To prevent eye strain:
 - Make sure that lights in hoods/BSC are working properly.
 - Keep the viewing window of the hood/BSC clean and the line of sight unobstructed.
 - Use diffused lighting to limit glare.

Test Tube Handling



Test Tube Handling - Tips

- Whole body posture comes into play.
- Adjust the chair properly before you start work so it provides adequate back support.
 - Remove the chair arms if they interfere with the ability to get close to your work.
 - Sit back in the chair for lumbar support.
- Arrange tubes to minimize reaching and twisting by placing them as close as possible to you.
- Use container to raise test tube racks when necessary.

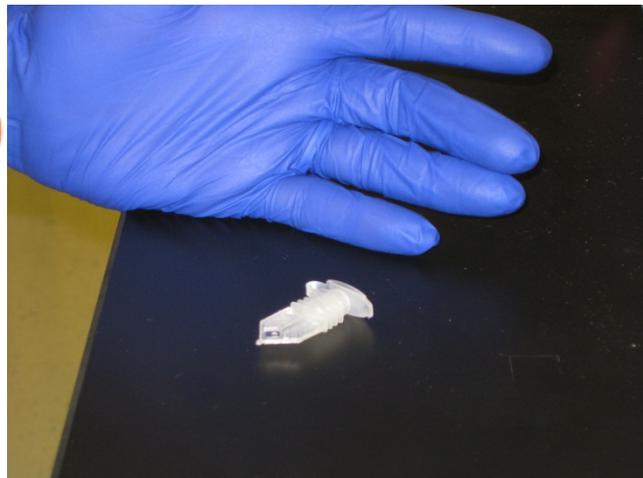
Test Tube Handling - Tips

- When possible use a vortexer mixer rack instead of holding tubes by hand.
- Use both hands to open and close test tubes to lessen the stress on one hand or the other.
- Use cap removers to minimize pinch grip and stress on the fingers.



Cap Removers

- Gilson's Jimmy microtube opener



Micro-Manipulation & Fine Motor Skills



Considerations

- Use plastic vials with fewer threads to reduce twisting motions during capping and uncapping lids.
- Tilt storage bins toward the worker to reduce wrist flexion while reaching for supplies.
- 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.
- Practice using forceps between the 1st and 2nd digits instead of using the thumb and the first digit.

Instrument Handling



Typical method of handling forceps.

Alternative method to reduce thumb micro-trauma.

Laboratory Workbenches



Laboratory Workbenches

Laboratory workbenches are at fixed heights and have been designed using general guidelines suggested by the National Institute of Occupational Safety and Health (NIOSH). These guidelines are as follows:

- **Precision Work** - Workbench height should be above elbow height.
- **Light Work** - Workbench height should be just below elbow height.
- **Heavy Work** - Workbench should be 4-6 inches below elbow height.

****Note:** Remove drawers, supplies and other materials underneath workbenches to provide additional leg room. Also, provide a foot rest underneath workbenches to rest feet on.

Working at the Proper Height



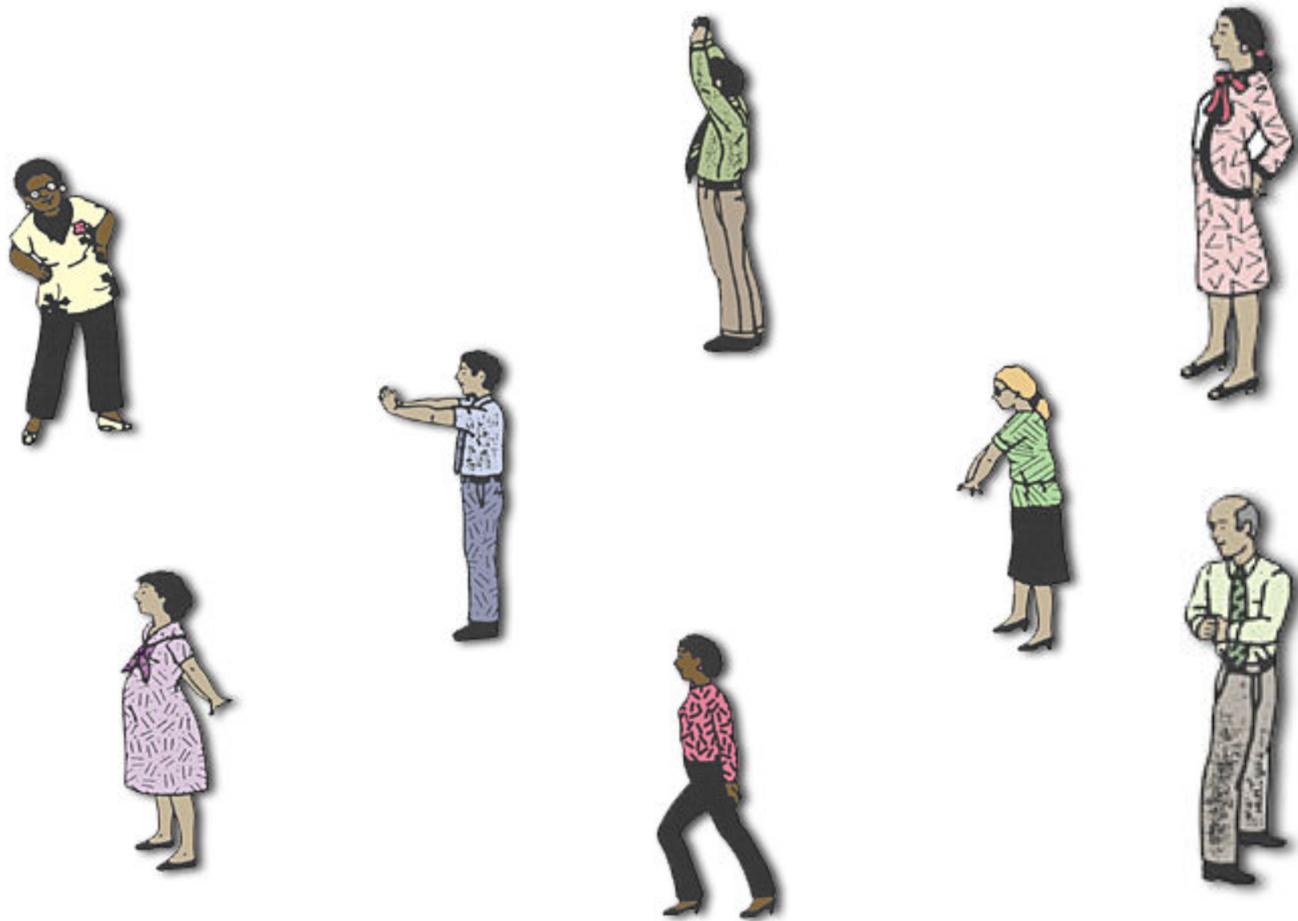
Recommendations for All Lab Activities

- Use an ergonomically designed chair or stool that provides adequate back support, adjustable height, and adjustable seat angle. (Arm rests may be helpful as well.)
- Use industrial footrests vs. foot rings on stools.
- Use sit-stand seats in areas where there is restricted leg room.
- Use anti-fatigue matting in areas of lengthy standing.

Recommendations for All Lab Activities

- Take frequent micro-breaks.
- Vary lab activities (esp. those requiring excessive hand use).
- Alternate lab tasks between right and left hands.

Laboratory Exercises & Stretches



Available Services

- Equipment Loans – USDA Target Center
 - Keyboards, mice, footrests, etc.
 - 1-2 week loan period
 - Ordering information provided as requested

- Ergonomics Video-Lending Library (APHIS only)
 - “Back Protection – Defending Your Safety Zone”
 - “Office Ergonomics – It’s Your Move”

- Individual Ergonomic Evaluations

- Phone & Email Consultations

*Contact your agency Safety and Health Program for more information.

USDA Target Center

□ Background:

- Target = Technology Accessible Resources Give Employment Today
- Est. in 1992 to support USDA with assistive technology (AT) & ergonomic solutions.
- Ensure all employees have safe and equal access to electronic and information technology.
- Collaborate with the DoD Computer/Electronic Accommodations Program (CAP) to provide services for employees with disabilities.

TARGET Center

- Provides:
 - Worksite assessments/consultations.
 - Presentations on AT, ergonomics, disability awareness.
 - Group & individual demonstrations.
 - Equipment loans.
 - Alternative Formats.

Contact the Target Center

target-center@usda.gov

Phone

202-720-2600 (v/tty)

TTY

202-690-0942

Address

Room 1006-South Building
1400 Independence Avenue, SW
Washington, DC 20250

Successful Ergonomics

- **Understand:** causes of WMSDs & ways you can prevent them.
- **Respect:** potential hazards caused by poor posture & an unhealthy laboratory environment.
- **Communicate:** ways to eliminate stress factors & report symptoms early.
- **Commitment:** eliminate WMSDs in your laboratory environment.

Questions



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