

# USDA ARS MWA LABORATORY ERGONOMICS TIPS

## Ergonomics

### Definition

- Fit the Job to the Person
- Work Smarter, Not Harder

### Ergonomics Principles

- Neutral Position and Support
- Reach Zone
- Power Position and
- Fatigue Control

### What can you do to control fatigue?

- Mix up job tasks to provide variety of physical activities
- Break a larger task into smaller tasks.
  - *Alternate lab tasks, like pipetting between right and left hands*
- Appropriate recovery breaks
  - *Replenish energy supplies and fluid intake*
  - *Try to not skip breaks and lunch*
- Drink plenty of fluid on a periodic basis
- Stretching
  - *Promote blood circulation and joint lubrication*
- Consciously work to identify and control fatigue at work!

## Warm-up and Stretching

### Guidelines

- Follow any specific medical restrictions
- Warm-up by performing a few repetitive movements
- Always stretch from neutral position
- Use slow controlled movement
- Push stretch only as far as is comfortable for you
- You should feel a stretch not pain
- Listen to your body - Stop stretch if experience any numbness or tingling
- Don't hold breath during stretch – breathe in with stretch and out with relaxation
- Selected Stretches (pipetting/lab ergonomics)

## Laboratory Workbenches, Stools and Footrests

### Workbench/Elbow Height Relationship

- Precision work, need to precisely view hands
  - *Fixed height workbench*
    - Elbow height about 2 to 4 inches above workbench height
  - *Adjustable height workbench*
    - Workbench height so elbows about 4 to 6" above resting elbow height (this is with arms at sides)
- General light work (handling test tubes, pipetting, etc.)

Workbench at or slightly below (1 to 2 inches) below elbow height

- Heavy work, downward force exerted (pushing down on tool or other materials)

Workbench 4 to 6 inches below elbow height

### Workbench/Stool/Footrest Adjustment Strategies

#### Workbench Fixed Height

- Adjust Stool Height
  - *Use height adjustment feature of stool*
  - *Establish desired physical relationship between elbow height and workbench height*
- Other Stool Adjustments
  - *Seat tilt forward and backward*
  - *Back support height and angle adjustable*
  - *Armrests, height adjustable to provide for forearm support*
- Most important guideline for stool use
  - *Get out of it on a regular basis!*
  - *Limit sustained seated positions to 30 minutes or less*
- Leg/Foot Clearance
  - *Remove or relocate obstacles to provide for clearance needed*
- Foot Support
  - *Foot ring primarily there to help you get on and off seat of stool*
  - *Use height adjustable footrest to provide*

*for foot and leg support*

- Adjust footrest height
- Footrest and foot ring should be about same height

### **Workbench Adjustable Height**

- Adjust Stool Height
  - *Adjust stool height to get feet directly on floor*
  - *Stool may not go lower enough to get feet on floor*
    - Need footrest for adequate foot support
- Adjust Workbench Height
  - *Adjust workbench height based on task at hand*
  - *Establish desired physical relationship between elbow height and workbench height*
- Other Stool Adjustments
  - *Seat tilt forward and backward*
  - *Back support height and angle adjustable*
  - *Armrests, height adjustable to provide for forearm support*
- Leg/Foot Clearance

Remove or relocate obstacles to provide for clearance needed

- Foot Support
  - *Foot ring primarily to help get on and off seat*
  - *Use height adjustable footrest to provide foot and leg support*
    - Adjust footrest height
    - Footrest and foot ring about same height

### **Standing at a Workbench**

- Spending only a short time (a few minutes)
- Move frequently between different locations at workbench
- Handle heavier items (more than 5 pounds)
- Need to exert significant downward force (more than 10 pounds of force)
- Workbench Height - Standing
  - *Apply same elbow and workbench height relationships for standing as for*

*seated*

- *Too low fixed height workbench - build up workbench height*
  - Platform on workbench top to position tools, equipment or materials
  - Entire workbench itself raised on a permanent basis.

### **Footrests - Standing**

- Promote neutral position and increased comfort when standing
  - *Footrest to put one foot up on footrest and then alternate with the other foot*
  - *Utilize footwear that has significant cushioning and support*
    - Good walking shoes are good standing shoes
  - *Shift weight forward to balls of feet and backwards to the heels*
  - *Perform "heel lifts" frequently*

### **Anti-fatigue Mats - Standing**

- Anti-fatigue standing mats to cushion feet and weight bearing joints of ankles, knees, hips and back
  - *Large enough to allow for at least shoulder width foot placement*
  - *Beveled mat edges to eliminate any trip hazard.*
  - *Adequate cleaning of mat and underlying floor*

## **Pipetting**

### **Pipettes – Workstation Set-up**

- Approximately same equipment, tray and supply heights
- Within easy reach in logical work order
- Prevent twisting and bending of wrist, neck and arms, elevation of shoulders and overreaching
- Adjusting height and position of various tools and equipment:
  - *Sample holders (place on a tilt)*
  - *Solution container positioned within reach*
  - *Waste receptacles – keep at low height (no higher than top of tube being filled)*

- *Work with arms close to the body*
- *Avoid arm elevation without support for lengthy periods*
- *Keep samples and instruments within easy reach*

### Pipette Design - Choices

- Hand size
  - *Correlating hand size to pipette size is most important*
  - *Different sizes available*
  - *Correct size pipette will allow hand to comfortably grasp and manipulate pipette.*
- Weight
  - *As possible use lightweight pipette; requires less force to hold*
- Force
  - *Use pipette that requires as little force as possible to control*
- Location of Controls
  - *Multi-finger pipette controls help distribute force among several fingers rather than continuously using same finger*
  - *Button on top requires thumb to be repeatedly extended out of a relaxed, neutral position.*
    - Try to avoid and if not possible to avoid entirely, remember to limit sustained use as possible

### Pipetting - Guidelines

- Short pipettes are preferable to decrease hand and arm elevation
- Pipettes where thumb dispenses and index finger aspirates are best
- Pipette usage should be alternated between right and left hand
- Clean pipettes regularly to; reduce "sticking" and improve quality of work
- Use thin-walled pipette tips easy to eject

### Manual vs Power Pipettes

- Power pipettes rather than manual pipettes help to reduce hand stress and exertion
  - *Electronic operated or a latch-mode pipette to replace manual plunger-*

*operated pipettes*

- *Electronic pipette with mixing functions for tasks such as mixing or aliquotting*
- *Multichannel pipette for large aliquotting tasks*

### Microbreaks and Task Rotation

- Focus on Fatigue Control throughout day
  - *Take micro-breaks of 2 minutes for every 20 minutes of pipetting*
  - *Perform hand stretches frequently*
  - *Rotate pipetting activities:*
    - Between right and left hands
    - Among different laboratory tasks
    - Different people

## Microscopy

### Microscope Step-by-Step Set-up Protocol

- Understand Adjustment Options
  - *Analyze current set-up to make sure you fully understand what adjustment options exist:*
    - Height and angle of microscope itself
    - Microscope eyepiece height and angle
    - Stool or chair seat height, back support and armrests
    - Worksurface
- Neutral Position/Support, Reach Zone
  - *Adequate room for legs so you can sit directly under microscope*
  - *Adjust stool or chair*
  - *Provide a footrest*
  - *Position microscope towards edge of work surface*
  - *Position your head upright and your line of sight approximately 20 to 30° below straight-ahead vision*
  - *Adjust microscope to match neutral head and neck position*
  - *Adjust eyepieces and angle of view*
  - *Use chair armrests to support forearms with elbows at sides*
  - *Apply padding (foam rolls or padded edge protectors) to the edge of work surface*
  - *Padded angled microscope forearm*

*supports to relieve fatigue and strain*

- Fatigue Control
  - *Employ fatigue control measures*
  - *Take 2-minute micro-breaks every 20 minutes of microscope use*
  - *Stretch to promote circulation and reduce joint stiffness*
  - *Rotate between variety of laboratory tasks*
  - *Mix it up throughout day*

### **Microscopy – Other Tips**

- Tilt storage bins toward you
- Enlarge handle diameter of small hand tools by placing cylindrical foam around them
- Make simple tool modifications

### **Microscopy - Control Eye Strain**

- Scope is clean and lighting is adequate
- Microscope lamp and optical pathway correctly aligned
- Looking at distance point (more than 10 to 15 feet away) allows eyes to relax
- Control excessive glare and reflections from overhead lighting
- Adjust internal microscope light
- Temperature and humidity conditions affect eyes
  - *Ambient temperature range of 66 to 73° Fahrenheit is suggested*
  - *Eye drops can be beneficial for some.*

### **Lab Hoods or BSCs**

#### **Work practices and tips:**

- If standing at the lab hood or 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.

#### **Reduce contact stress to forearms & wrists:**

- Apply closed-cell foam padding to the front edge of the lab hood or BSC.
- Make sure padding can be decontaminated.

#### **Armrests**

- Support arms at correct height and angle

- Do not restrict air flow
- Bubble wrap that is disposable and inexpensive

### **Seated at Lab Hood or BSC**

- Fully adjustable chair or stool
- Provides adequate back support, adjustable seat angle, and height adjustability
- Adequate leg and thigh clearance under the cabinets
- Raise cabinet a couple of inches if necessary and possible
- Use a footrest to provide stability in leaning forward from the hips

### **Chair/stool options**

- Sit-stand stools

### **Test Tube Handling Tips**

#### **Body posture**

- Adjust chair properly to provide adequate back support
- Remove chair arms if interfere with ability to get close to work

#### **Arrange tubes**

- Arrange tubes to minimize reaching and twisting
- Use container to raise test tube racks
- Use a vortexer mixer rack instead of holding tubes by hand

#### **Open/close test tubes**

- Use both hands to open and close
- Rotate cap in one direction with one hand while rotating tube in opposite direction with other hand

#### **Cap Removers**

- Use cap removers to minimize pinch grip and stress on fingers

#### **Automatic capping/decapping machines**

- If screwing many similar microtubes, automatic capping and de-capping machines may be appropriate.

### **Micro-Manipulation & Fine Motor Skills**

#### **Considerations**

- Use plastic vials with fewer threads to reduce twisting motions

- Tilt storage bins toward you to reduce wrist flexion while reaching for supplies
- For forceps manipulation, use small pieces of foam, like the type used on pencils and pens
- Practice using forceps between index and middle fingers instead of using thumb and index finger

## Material and Equipment Handling

### Up-front planning

- Need to use mechanical equipment or get someone to help you
- You have thought through where material is going to end up.
- You have anticipated any surprises

### Power Lift - Step-By-Step Details

- Approach object with feet slightly wider than shoulder width
- Good footing
- Straddle object
- Bend your hips and knees somewhat, reach your hands to object
- Grip object, might be at a diagonal
- Build “bridge” with elbow on knee to unload back
- Your goal is to keep object as close as possible to you
- Tighten up stomach muscles
- At the moment of the exertion . . . LOOK UP
- Automatically puts you into Power Position
- Use large muscles of legs and thighs - not your back to accomplish the lift
- Back muscles will work with stomach muscles to stabilize spine in neutral position

### Golfer's Lift

- Lighter weight item that you can handle with one hand
  - *Lift one leg back as you bend over at hip to reach to the item*
  - *Counterbalances trunk*
- Practice using Golfer's Lift

### Two Stage Lift

- Break lift into stages

- Item to higher level
  - *Use power position to bend hips and knees to start item at higher position*
  - *As you stand upright item is already at height you need it to be*
  - *Makes good use of leg strength and not just arm strength*
  - *Legs are stronger than arms!*
- Item at a distance
  - *Slide item to edge as first stage of lift*
  - *Once its closer, use power lift technique to lift*

## Available Services

### Individual Ergonomics Evaluations and/or Training Services

For employees wishing to request an ergonomics evaluation or training services follow the instructions listed in the APHIS Ergonomics website:

[https://www.aphis.usda.gov/aphis/ourfocus/business-services/emergency\\_management/ergonomics\\_program/](https://www.aphis.usda.gov/aphis/ourfocus/business-services/emergency_management/ergonomics_program/)

**NOTES:**