## Welcome to USDA ARS MWA Laboratory Ergonomics!

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Menu



*Presented by:*
**Mark Anderson, PT, CPE**
**Ergosystems Consulting, LLC**
**Minneapolis, MN**

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## Instructor Background/Experience

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Menu

- **Mark A. Anderson, MA, PT, CPE**
  - Founder of Minneapolis, Minnesota based ErgoSystems Consulting, LLC
  - Industrial Rehabilitation clinical practice in mid 1980's led to interest in ergonomics
  - Since 1993 certified by Board of Certification in Professional Ergonomics as Certified Professional Ergonomist (www.bcpe.com)
  - Consulted in ergonomics for over 30 years
  - Education
    - Bachelor of Science Degree from University of North Dakota Physical Therapy program
    - Master of Arts Degree in Physical Therapy from the University of Iowa

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## Role of ARS MWA

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Menu

- **USDA chief scientific in-house research agency**
- **Find solutions to agricultural problems**
  - Affect Americans every day from field to table
- **Support overall USDA mission**
  - Protect and promote food, agriculture, natural resources and related issues



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## Work in Labs

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Menu

- **Critical work in laboratories in the Midwest**
- **Training session details how to perform laboratory tasks**
  - Enhance ARS mission
  - Facilitate well-being and performance
  - Application of ergonomics principles


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## Successful Workplace?

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Menu

- **Expect to accomplish?**
- **Words describe successful workplace?**
- **Want a workplace that is**
- _____
- **What do you think?**

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## First Word?

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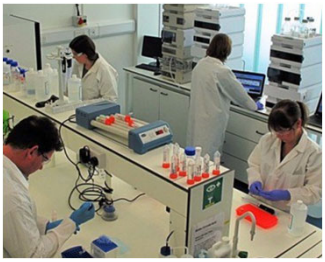
Menu

- **If you answered, "Comfortable" you're not alone**
- **About 9 out of 10 people**
- **Then words like**
  - Productive
  - Well-organized
  - Functional
  - Well lit
  - Safe



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## Direct Relationship

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Menu

- Between workplace comfort levels and other descriptors
- Workplace more comfortable is also more
  - Productive
  - Functional
  - Safe
- Use ergonomics principles and techniques
  - Enhance comfort level
  - Enhance safety and productivity


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## Objectives

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Menu

- Practical definition of ergonomics
- Ergonomics principles
- Step-by-step ergonomics workstation assessment
  - Pipetting
  - Microscopy
  - Biological safety cabinets/Fume hoods
  - Set-up workstations
  - Material Handling

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## Objectives

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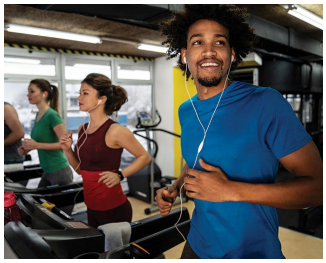
Menu

- Personal performance and comfort
  - Warmup and stretching
  - Physical fitness
  - Health and wellness
- Apply this assessment process to other work or even home environments



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## Ergonomics – Definition

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Menu

- Heard word, "ergonomics" before
- Marketeers tout product's "ergonomic" qualities and benefits
  - Tool with "ergonomic handle"
  - Car seat with "ergonomic design"
- In lab environment how best to define ergonomics?


Any product illustrations do not constitute official USDA endorsement.

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## Fit the Job to the Person

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Menu

- Picture people in labs
  - **Very diverse workforce**
- Accommodate diverse population
  - "Fit the job to the person"
  - Not force, "The person to fit the job"
- Microscopy
  - Properly set-up for shorter person
  - Very uncomfortable for taller person
  - Potentially lead to musculoskeletal issue

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## Work Smarter, Not Harder

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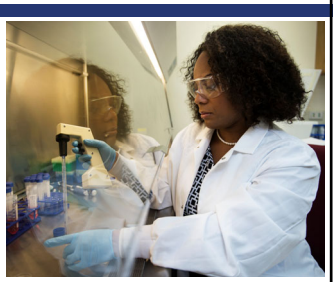
Menu

- Control level of physical stress and exertion
- Examine how tasks are accomplished
- Craft methods
  - "Fit the Job to the Person"
  - "Work Smarter, Not Harder"



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## Ergonomics Principles

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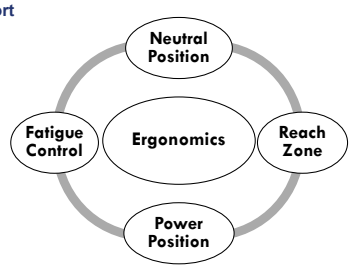
Menu

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

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## Neutral Position and Support

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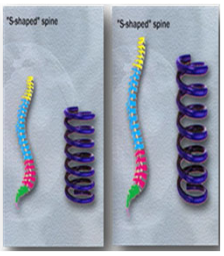
Menu

- Spine and pelvis provide foundation
- S-shape configuration
  - Inner curve in lower back and neck
  - Outer curve in mid-back area
- Why S-shape?
  - Think springs!

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## Mid-range of Joint Position

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Menu

- What position of elbow most functional?
  - With elbow straight or bent all the way?
- About 90 degrees of bend
  - Greatest strength
  - Protects joint and surrounding soft tissues
- Every joint of body has a "mid-range of joint position"

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## 15 % More in Neutral Position

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Menu

- Can't spend all time in neutral position
- Next time in an out-of-neutral position
  - Identify why out of neutral
  - Consider options to improve
  - 15% can make a big difference

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## Reach Zone

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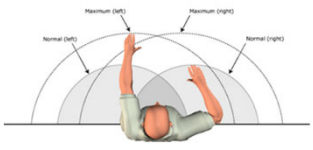
Menu

- How long hold 10# load at arm's length?
  - Gets heavy quite quickly
  - Hold as close to your body as you can
- Operating range
  - Determined by arm's length
  - Sphere from hip to shoulder level within arm's reach to the front and side

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## Never Reach Outside Reach Zone?

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Menu

- Of course, the answer is NO!
- Find yourself
  - Reaching way outside reach zone
  - Heavy load
  - Awkward position
- Set up to work within your Reach Zone

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## Power Position

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Menu

- Lift or move supplies, containers and equipment?
- Neutral Position best position?
  - As it turns out – it's not
- Power Position is better

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## Power Position

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Menu

- Feet shoulder width or slightly wider
- Good footing so you don't slip
- Spine maintained in neutral
- Hips and knees bent slightly
- Head and shoulders upright

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## "Ready" Position in Sports

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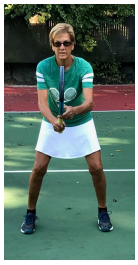
Menu

- Ready position in sports
- Use Power Position
  - Lifting materials
  - Using tools and equipment
  - Setting up the work area
- Water fountain
  - Give it a try!



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## Fatigue Control

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Menu

- "Control" and not "Eliminate"
- Physical fatigue is normal occurrence
  - Not possible to eliminate fatigue
- For overall health and wellness
  - Recover from fatigue through appropriate rest, hydration and nutrition

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## Recognize Fatigue?

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Menu

- Physical and/or repetitive tasks
  - Muscle tiredness
  - Decrease in general physical strength and coordination
  - More prone to making mistakes
  - More likely to experience injuries

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## What Can You Do to Control Fatigue?

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Menu

- Mix up job tasks to provide variety of physical activities
- Break 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

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## What Can You Do to Control Fatigue?

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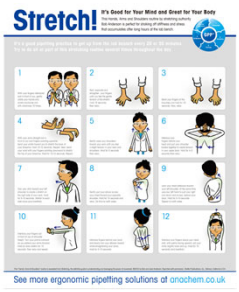
Menu

- Drink plenty of fluid on periodic basis
- Stretching
  - Promote blood circulation and joint lubrication
- Consciously work to identify and control fatigue at work!

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## Use Ergonomics Principles

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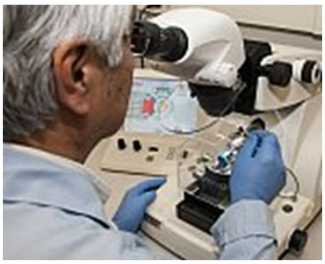
Menu

- Ergonomics is all about "fitting job to the person" and "working smarter not harder"
- Four ergonomics principles
  - Neutral Position and Support
  - Reach Zone
  - Power Position
  - Fatigue Control
- Guide how to safely and effectively do your work



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## Quiz – Ergonomics

Ergonomics can be defined as:

- ☐ Fitting the job to the person
- ☐ Fitting the person to the job
- ☐ Working harder, not smarter
- ☐ Working smarter, not harder

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## Warm-up and Stretching

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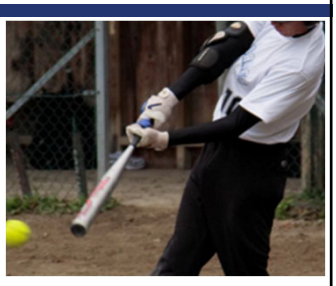
Menu

- Benefits
  - Minimizes likelihood of injury
  - Enhances performance
- Specifically doing to warm up and stretch as part of job?
  - If the answer is . . . nothing
  - Increasing risk of suffering musculoskeletal disorder
  - Limiting level of job performance



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## Warm-up and Stretching

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Menu

- Stretching not only primes body:
  - Increases blood flow to working tissues providing more oxygen and nutrition
  - Loosen joints to decrease stiffness
  - Improve alertness levels through increased levels of oxygen in blood going to brain
- Think of it, all of this just from stretching!

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## Quiz – Warm-up and Stretching

Stretching:

- ☐ Increases blood flow to the working tissues providing more oxygen and nutrition
- ☐ Helps to loosen the joints to decrease stiffness
- ☐ Improves alertness levels

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## Physical Fitness and Health and Wellness

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Menu

- **Well-balanced Physical Fitness Program**
  - Job provide all components of well-rounded, well-balanced physical fitness program?
  - More than likely the answer is NO
- **Individuals with balanced personal physical fitness less likely to sustain injury**
- **Strength, flexibility and aerobic endurance**

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## Very Important Point

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Menu

**If you have any health concerns about starting a physical fitness program you should always consult with your health care professional before starting.**

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## Personal Health and Wellness

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Menu

- **Factors**
  - Adequate diet and nutrition
  - Body weight control
  - Stress management
  - Smoking cessation
  - Blood pressure control
  - Adequate rest from sleep and
  - Fluid intake to avoid getting dehydrated
- **Factors under our control**
  - Personal physical fitness and health and wellness

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## Ergonomics Workstation Assessment

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Menu

- **USDA ARS MWA Laboratory Ergonomics Assessment Worksheet**

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## Step One – Identify Task

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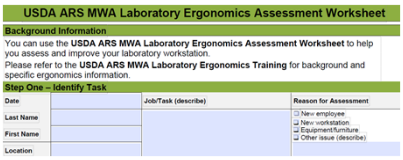
Menu

- **First step is to identify workstation or task want to analyze**
  - Existing workstation or task
  - One that is new



USDA ARS MWA Laboratory Ergonomics Assessment Worksheet

Background Information

You can use the **USDA ARS MWA Laboratory Ergonomics Assessment Worksheet** to help you assess and improve your laboratory workstation.
Please refer to the **USDA ARS MWA Laboratory Ergonomics Training** for background and specific ergonomics information.

Step One – Identify Task

| | | | |
|---|---|---|---|
| Date | | Job/Task (describe) | Reason for Assessment |
| Last Name | | | ❑ New employee<br>❑ New workstation<br>❑ Equipment/furniture<br>❑ Other issue (describe) |
| First Name | | | |
| Location | | | |

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## Step Two – Apply Ergonomics Principles

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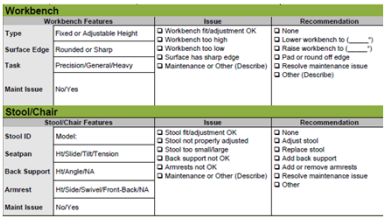
Menu

- **Neutral Position and Support**
  - What is your body and limb position?
  - Able to reasonably work in Neutral Positions (able to support body and limbs in neutral position)?
  - If not, try to identify why not



Workbench

| Workbench Features | | Issue | Recommendation |
|---|---|---|---|
| Type | Fixed or Adjustable Height | ❑ Workbench fit/adjustment OK<br>❑ Workbench too high<br>❑ Workbench too low<br>❑ Surface has sharp edge<br>❑ Maintenance or Other (Describe) | ❑ None<br>❑ Lower workbench to (_____")<br>❑ Raise workbench to (_____")<br>❑ Pad or round off edge<br>❑ Resolve maintenance issue<br>❑ Other (Describe) |
| Surface Edge | Rounded or Sharp | | |
| Task | Precision/General/Heavy | | |
| Maint Issue | No/Yes | | |

Stool/Chair

| Stool/Chair Features | | Issue | Recommendation |
|---|---|---|---|
| Stool ID | Model: | ❑ Stool fit/adjustment OK<br>❑ Stool not properly adjusted<br>❑ Stool too small/large<br>❑ Back support not OK<br>❑ Armrests not OK<br>❑ Maintenance or Other (Describe) | ❑ None<br>❑ Adjust stool<br>❑ Replace stool<br>❑ Add back support<br>❑ Add or remove armrests<br>❑ Resolve maintenance issue<br>❑ Other |
| Seatpan | Ht/Slide/Tilt/Tension | | |
| Back Support | Ht/Angle/NA | | |
| Armrest | Ht/Side/Swivel/Front-Back/NA | | |
| Maint Issue | No/Yes | | |

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## Step Two – Apply Ergonomics Principles

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- **Neutral Position and Support**
- **For example**
  - Is worksurface too low?
  - Is chair or stool not properly adjusted?
  - Does tool or equipment not allow neutral position?
- **Then think about how you can make it better!**

**Workbench**

| Workbench Features | | Issue | Recommendation |
|---|---|---|---|
| Type | Fixed or Adjustable Height | ❑ Workbench fit/adjustment OK<br>❑ Workbench too high<br>❑ Workbench too low<br>❑ Surface has sharp edge<br>❑ Maintenance or Other (Describe) | ❑ None<br>❑ Lower workbench to (_____")<br>❑ Raise workbench to (_____")<br>❑ Pad or round off edge<br>❑ Resolve maintenance issue<br>❑ Other (Describe) |
| Surface Edge | Rounded or Sharp | | |
| Task | Precision/General/Heavy | | |
| Maint Issue | No/Yes | | |

**Stool/Chair**

| Stool/Chair Features | | Issue | Recommendation |
|---|---|---|---|
| Stool ID | Model: | ❑ Stool fit/adjustment OK<br>❑ Stool not properly adjusted<br>❑ Stool too small/large<br>❑ Back support not OK<br>❑ Armrests not OK<br>❑ Maintenance or Other (Describe) | ❑ None<br>❑ Adjust stool<br>❑ Replace stool<br>❑ Add back support<br>❑ Add or remove armrests<br>❑ Resolve maintenance issue<br>❑ Other |
| Seatpan | Ht/Slide/Tilt/Tension | | |
| Back Support | Ht/Angle/NA | | |
| Armrest | Ht/Slide/Swivel/Front-Back/NA | | |
| Maint Issue | No/Yes | | |

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## Step Two – Apply Ergonomics Principles

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- **Reach Zone**
  - Where are you using hands?
  - Primarily use them in Reach Zone?
  - If not, try to identify preventing factor
- **For example:**
  - Is work too far away?
  - Physical barrier that limits access?
- **Then think about how you can make it better!**

**Pipetting**

| Pipetting Features | | Issue | Recommendation |
|---|---|---|---|
| Set-up within reach | No/Yes | ❑ Pipette is OK<br>❑ Location does not allow neutral arm/hand position<br>❑ Pipette technique is not ideal<br>❑ Wrong pipette type (too large/small/heavy, trigger configuration, etc.)<br>❑ Other | ❑ None<br>❑ Adjusted workstation set-up to promote neutral position<br>❑ Improve pipette technique<br>❑ Replace pipette<br>❑ Other (Describe) |
| Type | Single/Multi Channel | | |
| Power | Manual/Power | | |
| Trigger configuration | Thumb/Fingers | | |

**Microscopy**

| Microscopy Features | | Issue | Recommendation |
|---|---|---|---|
| Type | Optical/Video Display | ❑ Set-up is OK<br>❑ General workstation set-up does not promote neutral position<br>❑ Body and eyepiece not set-up to promote neutral position<br>❑ No support for forearms<br>❑ Other (Describe) | ❑ None<br>❑ Adjust workstation set-up<br>❑ Adjust body and eyepiece set-up<br>❑ Add forearm support<br>❑ Consider video display<br>❑ Other (Describe) |
| Body | Height/Angle Adjustable No/Yes | | |
| Eyepiece | Height/Angle Adjustable No/Yes | | |
| Forearm support | No/Yes | | |

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## Step Two – Apply Ergonomics Principles

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- **Power Position**
  - Use Power Position to accomplish task?
  - If not, try to identify what is the limiting factor
- **For example:**
  - Is material being handled too low or too high?
  - Does equipment in use not allow power position?
- **Then think about how you can make it better**

**Material and Equipment Handling**

| Material/Equipment Handling Features | | Issue | Recommendation |
|---|---|---|---|
| Type | Manual/Powered material handling | ❑ Material handling is OK<br>❑ Manual material handling used instead of powered equipment<br>❑ Inadequate lifting technique<br>❑ Other (Describe) | ❑ None<br>❑ Add powered material handling equipment<br>❑ Promote Power Lifting Technique<br>❑ Other (Describe) |
| Technique | Power Lift technique used: No/Yes | | |

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## Step Two – Apply Ergonomics Principles

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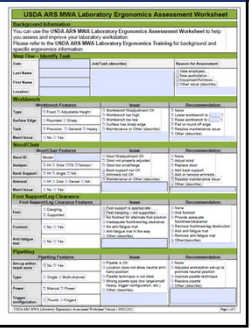
- **Fatigue Control**
  - Able to Control Fatigue through-out work shift?
  - If not, what are inhibiting factors
- **For example:**
  - Using wrong tool or incorrectly
  - Not taking recovery breaks?
  - Becoming dehydrated?
  - Not using stretching as micro-breaks through-out shift?
  - A combination of above?
- **What actions can you take to control fatigue?**

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## Step Three – Recommend/Implement Improvements

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- **List of potential improvements**
  - Workstation set-up
  - Particular use of a tool or piece of equipment
  - Change of workstation, tool or equipment

**Other Ergonomics Concerns**

| Document any other ergonomics concern(s) | Fill out Issue and Recommendation sections | |
|---|---|---|
| Concern | Issue | Recommendation |
| | | |
| | | |
| | | |

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## Practice

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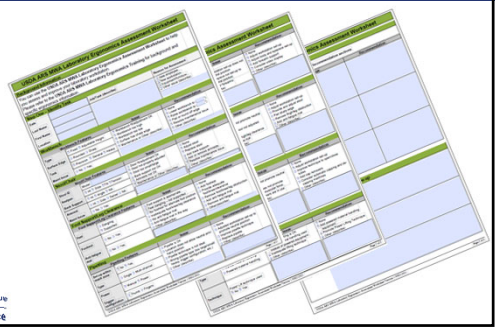
- **Choose a task you would like to analyze**
- **Go through *USDA ARS MWA Laboratory Ergonomics Assessment Worksheet***



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## Quiz – Ergonomics Workstation Assessment

The steps of the Ergonomics Workstation Assessment include:

- ☐ Identifying the task to be assessed
- ☐ Applying the ergonomics principles to the current method of the task
- ☐ Generating and implementing recommendations

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## Laboratory Ergonomics – Tips and Techniques

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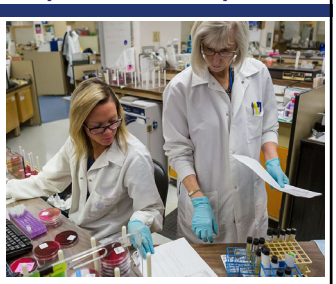
- Ergonomics principles
  - Neutral Posture, Reach Zone
  - Power Position, Fatigue Control
  - Warm-up and Stretching
  - Physical Fitness and Health and Wellness
- Step-by-step ergonomics problem solving approach
- Laboratory Ergonomics Tips and Techniques
  - "Fit the Job to the Person!"
  - "Work Smarter, Not Harder!"



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## Laboratory Workbenches, Stools and Footrests

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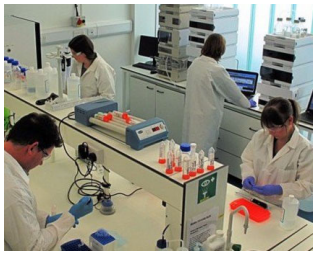
- Workbenches at fixed height
- Workbench user-controlled height adjustable
- Stools available
  - Ensure surface decontamination
- Footrests for foot support
- Set up workbench, stool and footrest
  - Neutral position
  - Reach zone
  - Power position
  - Fatigue control



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## Workbench/Elbow Height Relationship

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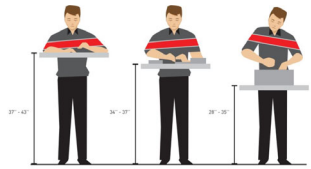
- Based on tasks you are performing
- Precision work, need to precisely view hands
  - Fixed height workbench
    - Elbow height about 2 to 4 inches above workbench height
  - Adjustable height workbench
    - Workbench height so elbows are about 4 to 6" above resting elbow height (this is with arms at sides)



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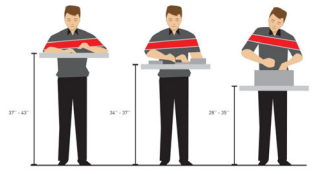
## Workbench/Elbow Height Relationship

47 Menu

- Based on tasks you are performing
- General light work
  - Handling test tubes, pipetting, etc.
- Heavy work
  - Downward force exerted (pushing down on tool or other materials)



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## Workbench/Stool/Footrest Adjustment Strategies

48 Menu

- Once you understand task to be performed
- Follow adjustment strategies based on whether workbench
- Fixed height or height adjustable

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48

## Workbench Fixed Height

49

Menu

- **Adjust Stool Height**
  - Use height adjustment feature
  - 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

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## Workbench Fixed Height

50

Menu

- **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**
- **Foot Support**
  - Foot ring primarily there to help you get on and off seat of stool
    - Adjust footrest height
    - Footrest and foot ring should be about same height

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## Workbench Adjustable Height

51

Menu

- **Adjust Stool Height**
  - Stool may not go lower enough to get feet on floor
  - Need footrest for adequate foot support
- **Other Stool Adjustments**
  - Seat tilt forward and backward
  - Back support height and angle adjustable
  - Armrests, height adjustable to provide for forearm support
- **Adjust Workbench Height**

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## Workbench Adjustable Height

52

Menu

- **Leg/Foot Clearance**
  - Removed or relocated
- **Foot Support**
  - Best place is on the floor
  - Footrest may be required
  - Provide for adequate foot support

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## Standing at a Workbench

53

Menu

- **Standing makes sense**
  - 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)

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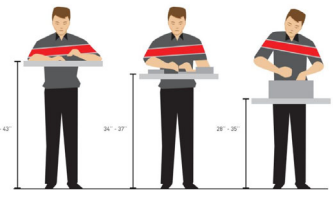
## Workbench Height – Standing

54

Menu

- **Apply same elbow and workbench height relationship for standing as for seated**
  - Precision work: 2 to 4" above elbow height
  - General light work: about elbow height or slightly lower
  - Heavy work: 4 to 6 inches below elbow height



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## Workbench Height – Standing

55

Menu

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

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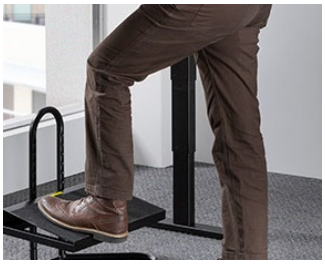
## Footrests – Standing

56

Menu

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



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## Anti-fatigue Mats – Standing

57

Menu

- **Anti-fatigue standing mats cushion feet and 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

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## Anti-fatigue Mats – Standing

58

Menu

- **Stools and mats**
  - Most stools will not roll easily on mats
  - Mat is pushed out of the way and not used as it should be
  - More sustained standing than is recommended occurs

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## Quiz – Workbenches and Stools

When performing precision tasks at a fixed height workbench of 36" your elbows should be:

- ☐ Four to 6 inches above the workbench height
- ☐ At or slightly below (1 to 2 inches) below elbow height
- ☐ Four to 6 inches below elbow height

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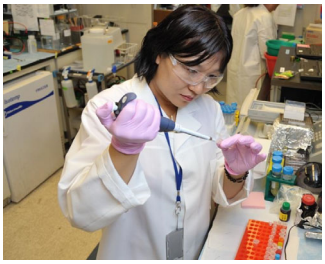
## Pipetting

60

Menu

- **Pipetting – Common Task**
  - Pipetting is very common task in lab
  - Repetitive nature, can be a source of hand and shoulder problems



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## Pipettes – Workstation Set-up/Work Practices

61

Menu

- **Equipment, tray and supply heights**
  - About same height
  - 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 tools and equipment

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## Pipettes – Workstation Set-up/Work Practices

62

Menu

- **Adjusting height and position of various tools and equipment**
  - Sample holders (placed on tilt)
  - Solution container positioned within reach
  - Waste receptacles – kept at low height (no higher than top of tube being filled)
  - Work with arms close to body
  - Avoid arm elevation without support for lengthy periods
  - Keep samples and instruments within easy reach

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## Pipette Design – Choices

63

Menu

- **Hand size**
  - Correlating hand size to pipette size
  - Different sizes available
  - Correct size pipette will allow hand to comfortably grasp/manipulate pipette
- **Weight**
  - Light weight as possible
- **Force**
  - Little force required as possible

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## Pipette Design – Choices

64

Menu

- **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
    - Limit sustained use as possible

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## Pipette Design – Configuration Choices

65

Menu

- **Shorter vs Longer**
  - Longer pipettor with longer handle
  - Better on shoulder and arm
  - Using 50-100 ml
- **Multi-channel pipettes**
  - Microtiter plates
  - Robotics

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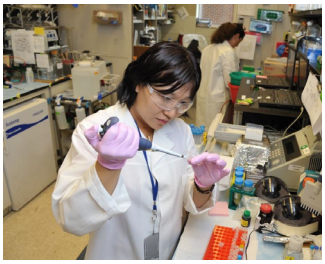
## Pipetting – Guidelines

66

Menu

- **Pipettes where thumb dispenses and index finger aspirates**
- **Pipette usage alternated between right and left hand**
- **Clean pipettes regularly to reduce "sticking" and improve quality of work**
- **Use thin-walled pipette tips that are easy to eject**



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## Manual vs Power Pipettes

67

Menu

- **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

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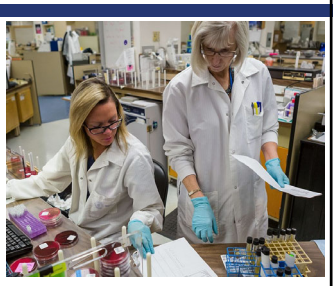
## Microbreaks and Task Rotation

68

Menu

- **Focus on Fatigue Control throughout day**
  - 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



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## Quiz – Pipetting

When pipetting you can prevent twisting and bending of the wrist, neck and arms by adjusting the height and position of tools and equipment by:

- ☐ Positioning solution container outside your reach
- ☐ Keeping waste receptacles at a low height; no higher than top of tube being filled
- ☐ Working with your arms away from your body
- ☐ Elevating your arms without support for lengthy periods

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## Microscopy

70

Menu

- **Microscopy – Common Task**
  - Operating microscope is very common task
    Potential exists for strain
    - Neck
    - Shoulders
    - Eyes
    - Lower back
    - Arms
    - Wrists

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## Microscope Set-up Before and After Example

71

Menu

- **Working at microscope that is not at correct height and angle results in**
  - A hunched-forward position, uncomfortable position of neck, shoulders, arms, back and hips
  - Contact stress on forearms from work surface edge

Before

After

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## Microscopy – Workstation Set-up

72

Menu

- **Multi-user**
  - Variety of individuals in lab
  - Critically important each user take time to set-up microscopy workstation for their unique needs

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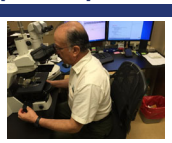
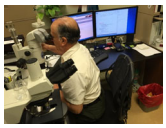
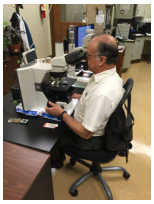
## Microscope Step-by-Step Set-up Protocol

73

Menu

- **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

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## Neutral Position/Support, Reach Zone

74

Menu

- **Microscope adjustment**
  - Adequate room for legs so you can sit directly under microscope
  - Adjust stool or chair
  - If needed, provide footrest
  - Position microscope towards edge of work surface
  - Position head upright and line of sight approximately 20 to 30º below straight-ahead vision

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## Neutral Position/Support, Reach Zone

75

Menu

- **Microscope adjustment**
  - 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 edge of work surface
  - Padded angled microscope forearm supports to relieve fatigue and strain

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## Fatigue Control

76

Menu

- **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


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## Microscopy – Other Tips

77

Menu

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

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## Microscopy – Control Eye Strain

78

Menu

- **Visually intensive**
  - Scope is clean
  - 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

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## Microscopy – Control Eye Strain

79

Menu

- Control excessive glare and reflections from overhead lighting
- Adjust internal microscope light
- Temperature and humidity conditions affect eyes
  - Ambient temperature range of 66 to 73º Fahrenheit is suggested
  - Eye drops can be beneficial for some, but should not be applied in the lab environment

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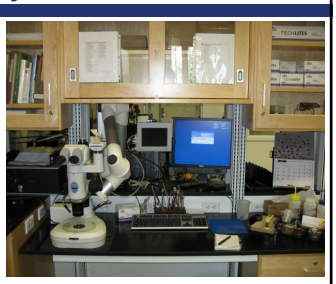
## Video Display Microscopy

80

Menu

- Becoming more viable with technological improvements
- When possible, use video display terminal to view sample
- Monitor placement
  - Top of screen is about at eye level
  - Viewing distance about 24 to 28 inches
  - Positioned directly in front



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## Quiz – Microscopy

Because most microscopes will be used by a variety of individuals, it is critically important that each user take the time to set-up the microscopy workstation for their unique needs.

- ○ True
- ○ False

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## Lab Hoods or Biosafety Cabinets

82

Menu

- An integral part of lab
- Similar hazards as for microscope work
  - Hunched postures
  - Forward reaches
- Ergonomics principles enhance use

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## Lab Hoods or BSCs – Work Practices and Tips

83

Menu

- Work practices and tips
  - If standing at 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

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## Lab Hoods or BSCs – Work Practices and Tips

84

Menu

- Reduce contact stress to forearms & wrists
  - Apply closed-cell foam padding to the front edge of 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

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## Lab Hoods or BSCs – Work Practices and Tips

85

Menu

- **Seated at BSC**
  - Fully adjustable chair or stool
  - Provides adequate back support, adjustable seat angle, and height adjustability
  - Adequate leg and thigh clearance under cabinets
  - Raise cabinet couple of inches if necessary and possible
  - Use footrest to provide stability in leaning forward from hips
- **Chair/stool options**
  - Sit-stand stools (Salli or Bambach)

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## Newer BSCs

86

Menu

- **Height adjustable tables with downdraft or backdraft**
  - Eliminate bent, forward posture of traditional BSCs
- **Other improvements**
  - Perforated front grill reduced by 1-2 inches allows work platform to be closer to worker
  - Non-glare glass on sash window
  - Adjustable plexiglass barriers
  - Platform with wells for placement of tall containers to reduce reaching

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## Test Tube Handling Tips

87

Menu

- **Body posture**
  - Adjust chair properly to provide adequate back support
  - Remove chair arms if interfere with ability to get close to work
- **Arrange tubes**
- **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

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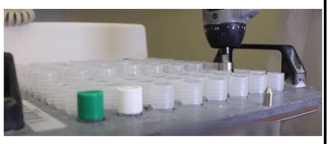
## Test Tube Handling Tips

88

Menu

- **Cap Removers**
  - Use cap removers to minimize pinch grip and stress on fingers
  - Example is Gilson's Jimmy microtube opener
  - https://www.pipettesupplies.com/product/jimmy-microtube-opener-for-pipetman-pipettes-3-pack-gilson/
- **Automatic/powered capping/decapping equipment**
  - If screwing many similar microtubes, automatic/powered capping and de-capping equipment may be appropriate



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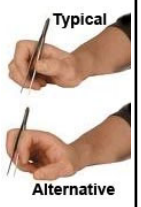
## Micro-manipulation & Fine Motor Skills

89

Menu

- **Considerations**
  - Use plastic vials with fewer threads to reduce twisting motions during capping and uncapping lids
  - Tilt storage bins toward you to reduce wrist flexion while reaching for supplies
  - For forceps manipulation, use small pieces of foam, like type used on pencils and pens
  - Practice using forceps between index and middle fingers instead of using thumb and index finger

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## Quiz – Test Tube Handling

You can use cap removers to minimize pinch grip and stress on the fingers.

- ○ True
- ○ False

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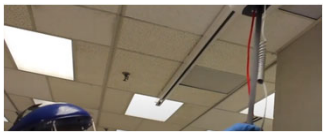
## Material and Equipment Handling

91

Menu

- What is very first guideline for safe material handling?
- What is the safest lift you can do?
  - It's the one you don't do!
  - As appropriate, make sure you use equipment available to assist with or accomplish lift



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## Material and Equipment Handling

92

Menu

- Lift cart
  - Pneumatic lift for heavy objects to move around the lab

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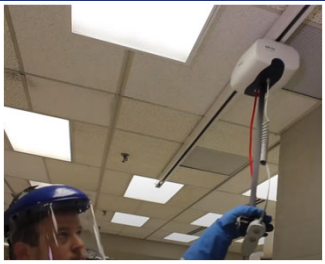
## Material and Equipment Handling

93

Menu

- Assistive devices that may be appropriate
  - Better to have a device do the lift than the human



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## Material and Equipment Handling – Tools

94

Menu

- Correct tool for the job
  - Compressed gas cylinder wrench

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## Up-front Planning with Manual Handling

95

Menu

- Front planning minimizes stress and strain
  - Allows you to get assistance if you need it
- Understand your personal physical performance limit
  - If you exceed your limit, significantly increase risk of injury
  - Literally takes only a quarter of a second for a life-changing injury to take place
- If you need help. . . get it!

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## Power Lift Technique

96

Menu

- Task within your personal performance limit
- What is best technique?
  - Professional weightlifters
  - Power Lift makes use of Power Position
- 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

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## Power Lift – Step-By-Step Details

97 Menu

- **Power Lift**
  - Approach object with feet slightly wider than shoulder width
  - Good footing
  - Straddle object
  - Bend hips and knees somewhat, reach hands to object
  - Grip object, might be at a diagonal
  - Build "bridge" with elbow on knee to unload back

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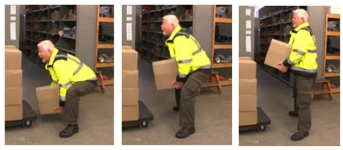
## Power Lift – Step-By-Step Details

98 Menu

- **Power Lift**
  - Keep object as close as possible
  - Tighten up stomach muscles
  - At moment of exertion . . . LOOK UP!
  - Why LOOK UP
    - Automatically puts you into Power Position
    - Use large muscles of legs and thighs to accomplish lift
    - Back muscles work with stomach muscles to stabilize your spine



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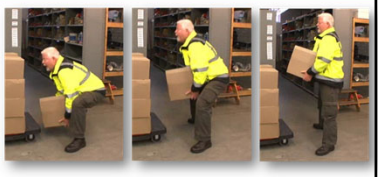
## Practice Power Lift

99 Menu

- **Practice Power Lift technique to get comfortable with it**
  - May seem a bit strange at first
  - Make it a habit and you will be amazed at the difference it makes
- **Feel stronger and more powerful using technique**
- **That must be why it's called the "Power Lift"!**



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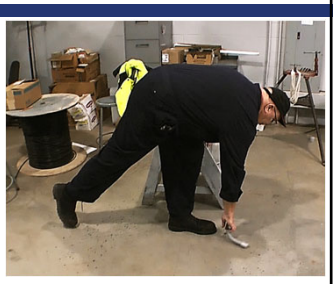
## Golfer's Lift

100 Menu

- **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**



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## Two Stage Lift

101 Menu

- **Item to higher level**
  - Use power position to bend hips/ knees to start 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, first stage of lift
  - Once its closer, use power lift technique to lift

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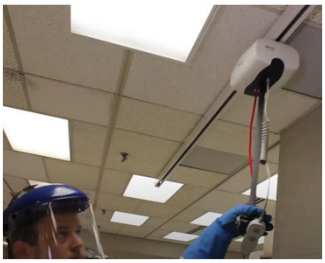
## Bottom Line

102 Menu

- **Always use lift assistive devices that may be appropriate**
  - Better to have a device do the lift than the human
- **Keep in mind**
  - Knowledge of your personal limit
  - Always get assistance if needed!



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## Quiz – Material Handling

If possible, it makes sense to consider use of lift assistive devices for material handling jobs that justify their need (heavy items that must be transported frequently).

- ○ True
- ○ False

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## Successful Ergonomics

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Menu

- Defined ergonomics
  - "Fit the Job to the Person"
  - "Work Smarter, Not Harder"
- Outlined ergonomics principles
- Lab Ergonomics Assessment Process

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## Successful Ergonomics

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Menu

- Personal physical fitness and health and wellness
- Learned a series of stretches
- Specific ergonomics tips and techniques:
  - Pipetting
  - Microscopy
  - Biological safety cabinets
  - Test tube handling
  - Set-up of laboratory workstations

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## Successful Ergonomics

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Menu

- All in all, we hope this information helps you be more comfortable, safe and productive in the lab!
- Thanks for your time and attention!

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## Resources

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Menu

- APHIS Ergonomics Website
  - https://www.aphis.usda.gov/aphis/ourfocus/emergencyresponse/emergency_management/ergonomics_program/services
- Mayo Clinic- video discusses creative solutions to control risk factors
  - https://youtu.be/hB_k8_W1KjA2
- Mayo Clinic - video discusses a lift assist device that can be used in a lab
  - https://youtu.be/lQ8Pa3lwmM
- Mayo Clinic - video addresses a screw cap tube device that can help with tube capping
  - https://youtu.be/o2cy6p8uURq
- Pipetting safety from UCLA
  - https://youtu.be/bqAsXMSs27s
- Electronic pipetting
  - https://youtu.be/vBMhtiypVuc
- Jimmy Microtube Opener
  - https://www.pipettesupplies.com/product/jimmy-microtube-opener-for-pipetman-pipettes-3-pack-gilson/
- OSHA Fact Sheet: Laboratory Safety Ergonomics
  - https://www.osha.gov/Publications/laboratory/OSHAfactsheet-laboratory-safety-ergonomics.html
- UCLA Tips For Lab Workers
  - https://www.ergonomics.ucla.edu/laboratory-ergonomics/tips-for-lab-workers
- OSHA Lab Fact Sheet – Prevention of Musculoskeletal Disorders
  - https://www.osha.gov/Publications/laboratory/OSHAfactsheet-laboratory-safety-ergonomics.pdf
- Lab Manager – Laboratory Ergonomics
  - https://www.labmanager.com/lab-health-and-safety/laboratory-ergonomics-20312
- Laboratory Checklist
  - http://www.wsha.org/wp-content/uploads/Worker-Safety_Lab-Ergo-Checklist-HumanFit.pdf

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## Menu

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Menu



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## Instructor Background/Experience

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Menu

- **Mark A. Anderson, MA, PT, CPE**
  - Founder of Minneapolis, Minnesota based ErgoSystems Consulting, LLC
  - Industrial Rehabilitation clinical practice in mid 1980's led to interest in ergonomics
  - Since 1993 certified by Board of Certification in Professional Ergonomics as Certified Professional Ergonomist (www.bcpe.com)
  - Consulted in ergonomics for over 30 years
  - Education
    - Bachelor of Science Degree from University of North Dakota Physical Therapy program
    - Master of Arts Degree in Physical Therapy from the University of Iowa

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## 30/30/30 Micro-breaks

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Menu

- **Micro-breaks**
  - Frequent and regular body movement is basic ergonomics principle
- **30/30/30 Rule of Physical Movement**
  - Physically active micro-breaks 30 seconds in length
  - About every 30 minutes
  - 30 days to make it a habit
- **Benefits**
  - Reduce tissue compression and joint stiffness,
  - Enhance circulation
- **Practice what we preach!**
  - Introduce basic stretch

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## Micro-breaks – Guidelines

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Menu

- **Guidelines**
  - Absolutely have to follow doctor's orders
  - Technically correct
  - Energy input/output
  - Neutral Position
  - Joint noises
  - Don't hold breath
  - Regular and consistent
  - Intensity/controlled stretching
- **Back Bend**

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## Take break

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Menu

- **Add stretching to day**
  - A little post it note put on computer monitor
  - Software that reminds you to stretch
  - Old-fashioned egg timer
  - New-fashioned FitBit
  - Team up with someone else in office
  - Take advantage of natural breaks between activities
  - Drink lots of water!


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## Micro-breaks – Guidelines

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Menu

- **Guidelines**
  - Absolutely have to follow doctor's orders
  - Technically correct
  - Energy input/output
  - Neutral Position
  - Joint noises
  - Don't hold breath
  - Regular and consistent
  - Intensity/controlled stretching
- **Elbow Pull**

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