THE BASICS OF ERGONOMICS TRAIN THE TRAINER

This is a task we are all familiar with, where do you think the cashier will 'hurt' at the end of the day…and why?

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Objectives

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- Comprehend the terms common to and practice of occupational ergonomics
- Understand how occupational ergonomics improves work environments by matching tasks, tools and processes to peoples capabilities and limitations
- Identify and remember the physical work place risk factored used to determine when ergonomic improvements are deemed beneficial

What Ergonomics not

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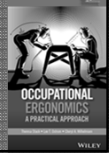

Ergonomics in everyday things?

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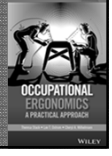
[redacted] is easier to read, color coded rings are special indicators to reduce errors (ex: time of day, dose, or family member). Back "caution label" is easy to read. Prescription information on card attached to back.

"Ergonomics removes barriers to quality, productivity and human performance by fitting products, tasks, and environments to people." – ErgoWeb



Ergonomics ~ Fitting the workplace to the worker

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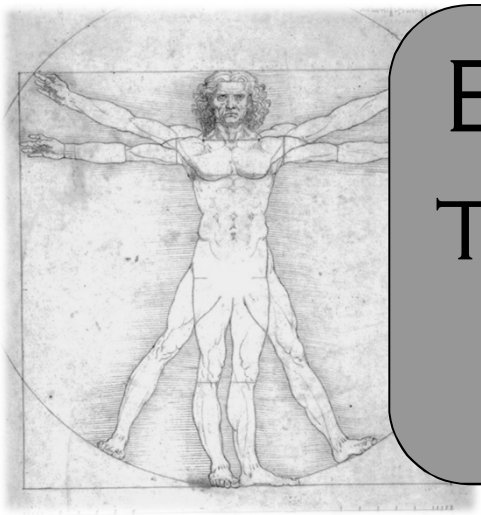
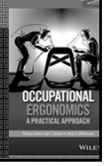


ERGONOMICS IS THE SCIENCE OF WORK

"*Ergonomics is essentially fitting the workplace to the worker. The better the fit the higher the level of safety and worker efficiency*." *Fitting the Task to the Human* ~ Grandjean 1990

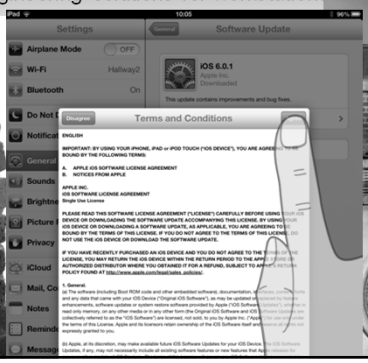


INCREASE PERFORMANCE...DECREASE INJURY

1900 *Frederick Taylor* – Scientific Management proposed a way to find the optimal method of carrying out a given task. Example: Coal shoveling (decreased size – increased rate)

18-4.5 steps 120-320 bricks/hr

1900 Frank Gilbreth – time and motion studies Example: Brick laying)
1914 – cockpit design and aviation controls and displays (anthropometry / cognitive under altitude))
1920 *Henry Ford*
No man should ever have to stoop…
1940 – Cockpit design and aviation controls and displays (
1960 – Nuclear controls and displays and weaponry
1970 – Computer hardware and work station design
1980 – Computer software and automation
1990 – Internet, software and robotics
2000 – adaptive technology, engineering solutions for workstations



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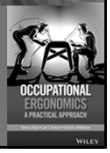
Modern Day Develops in Ergonomics

HULC Exoskeleton

Zero G Arm



Ergonomics ~ *Fitting the workplace to the worker*

Historic Occupational Disorders

Dr. Ramazzini, 1713 published "*Disease of Workers*"

- Black Lung Disease ~ Miners
- Leg Strain ~ Blacksmiths
- Overtaxed Minds ~ Learned man

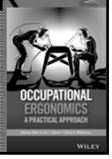
What could cause these disorders?

- House Maids Knee ➲ Carpenters Knee ~ Patella Bursitis
- Washer Woman's Sprain ➲ Iphone thumb~ De Quervain Syndrome
- Mad Hatter Disease ➲ Gold Miners Disease ~ Mercury poisoning
- Weavers Bottom ➲ Office Butt ~ Sciatica

Ergonomics ***~ Fitting the workplace to the worker ~ to prevent injury, and increase efficiency and comfort***

- **M**usculo**S**keletal **D**isorders
  - Occur slowly over time due to repeated trauma to the soft tissues (muscles, tendons, ligaments, joints, cartilage) and nervous system.
    - Not usually caused by acute trauma.

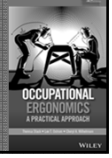
- Work-related MSDs (WMSDs)
  - MSDs that are caused or aggravated by the work methods and environment.



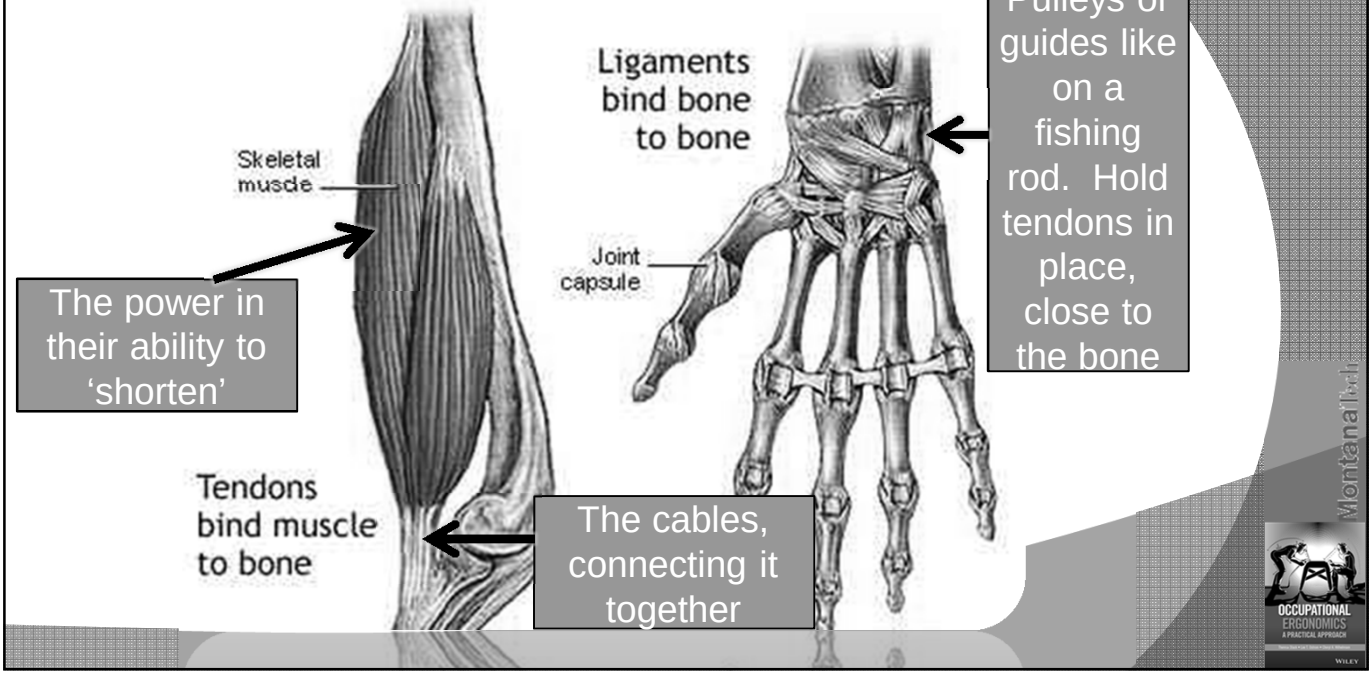
INSTRUCTIONAL TIP

When training a specific exposure group research and list the ‘specific’ occupational disorders within that field.

For example: welders differ from office workers who differ from nurses who differ from mechanics



INSTRUCTIONAL TIP

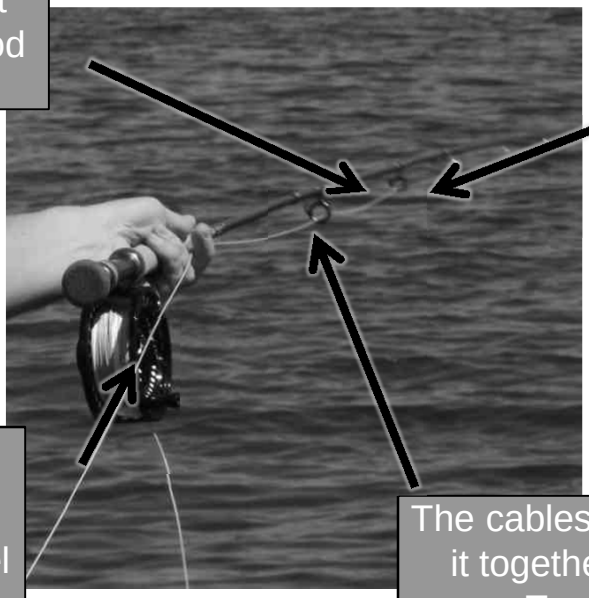


The power in their ability to 'shorten'

Pulleys or guides like on a fishing rod. Hold tendons in place, close to the bone

The cables, connecting it together

INSTRUCTIONAL TIP



The support structure (Rod or Bone)

Hold it together (Guides or Ligaments)

The power in their ability to 'shorten' (Reel or Muscle)

The cables, connecting it together (Line or Tendons)

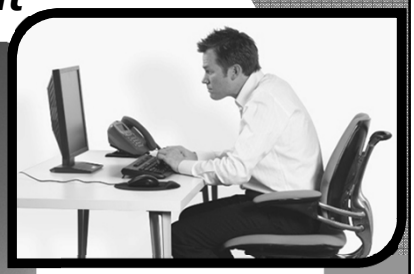
Physical work place risk factors

- ***Must occur in combination to cause injury***
  - **Posture**
  - **Compression**
  - **Force**
  - **Repetition**
  - **Vibration**
  - **Duration**

Frequent kneeling, squatting or stopping causes direct stress on the knees. The back fatigues quickly.

Fitting the workplace to the worker ~ ***to prevent injury, and increase efficiency and comfort***

- **Other Risk Factors** ***Contribute to but do not cause WMSDs***
  - Temperature,
  - Work Pace, Stress
  - Age, Gender,
  - Hobbies,
  - Previous Injury,
  - Medical Conditions,
  - Smoking,
  - Fatigue



INSTRUCTIONAL TIP

Neutral Posture *~ the resting position of each joint*

Body Landmarks

Ears over the shoulders

Shoulders over the hips

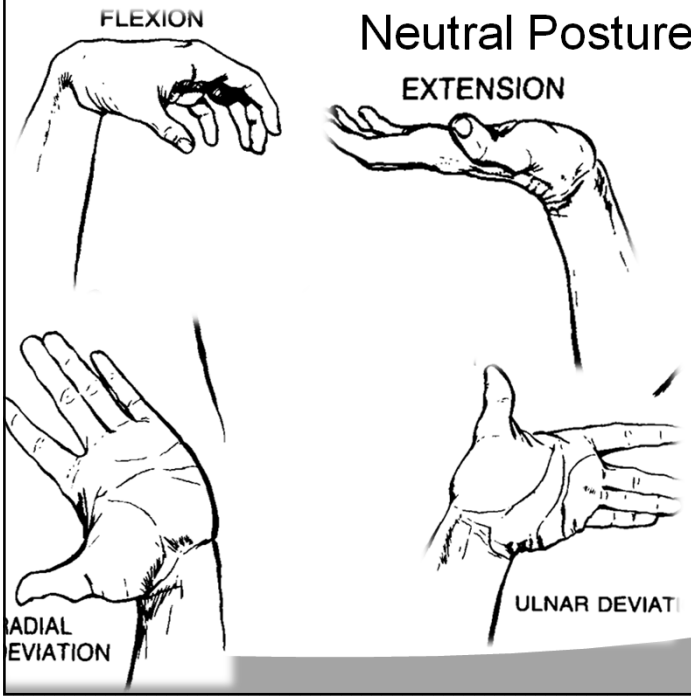
Hips over the knees

Knees over the ankles

Neutral is the optimal position of the body to reduce the risk of WMSDs. The neutral posture promotes blood flow, nerve conduction, muscle strength and control.

You can recognize the neutral posture in the work place by looking for the body landmarks.

Neutral Posture ~ *Strength and Posture*



Neutral Posture and Strength Demonstration

Neutral 100% Grip Strength
Extension 45° = *25% decrease*
Flexion 45° = *30% decrease*
Radial Deviation 25° = *20% decrease*
Ulna Deviation 40° = *25% decrease*

Awkward Postures ~ *Posture outside of neutral*

Neutral is the optimal position of each joint that provides the most strength and control

Awkward or unsupported postures that stretch physical limits, can compress nerves and irritate tendons. Awkward postures increase the rate of fatigue

Raise the work or tool to elbow height to avoid bending the head, torso and knees.

Neutral Postures ~ adjust the tools

A bull float with a fixed knuckle joint may force workers to bend forward and work in awkward postures.

A bull float with a rotating knuckle joint allow greater flexibility in moving the float which can reduce strain.

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Neutral Posture for Computer Use

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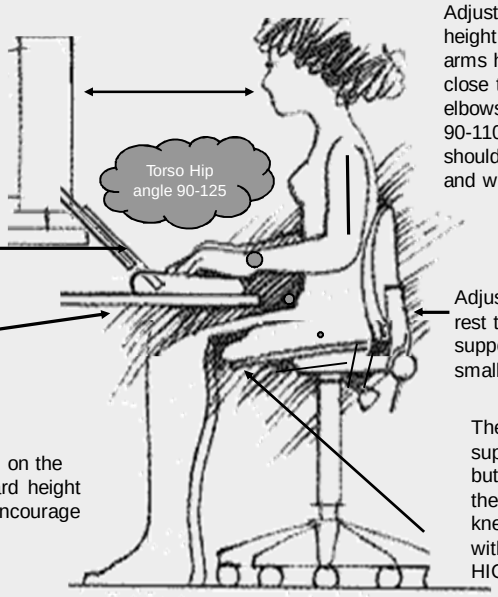
Position the monitor directly in front of you and about an arm's length away. The top row of characters on the screen should be no higher than seated eye height

Use a document holder close to the monitor

Mouse should be next to the keyboard, both at a height equivalent to your seated elbow height

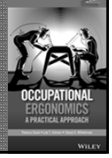
Knees comfortably bent with feet resting on the floor. If the chair is raised so the keyboard height equals elbow height, use a foot rest to encourage sitting fully back on the chair



Adjust the seat height so upper arms hang vertically, close to the body, elbows bent about 90-110 degrees, shoulders relaxed and wrists straight

Adjust the back rest to provide firm support to the small of the back

The seat pan supports the thighs but does not contact the back of the knees, thighs even with knees or slightly HIGHER



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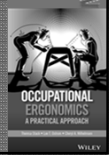
Is SITTING the new SMOKING?



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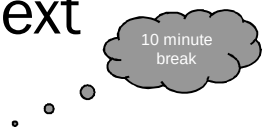
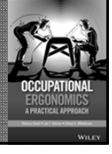
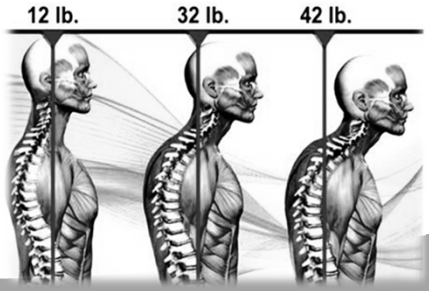
The best posture is the next posture





Static Postures ~ *holding the same position or using the same muscles for extended periods of time*

Static postures, or positions that a worker must hold for long periods of time, can restrict blood flow and damage muscles. Recovery is typically insufficient



Repetition~ *Performing the same motion or group of motions excessively*

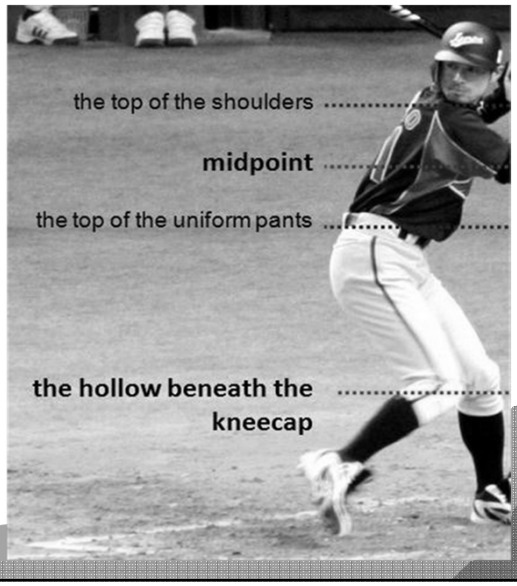
Keep hands in neutral posture, alternate hands if possible, use two hands for power. Powered caulking gun eliminates repetition.

Repetition of movements that can irritate tendons and increase pressure on nerves. Repetition does not allow time for rest and recover.

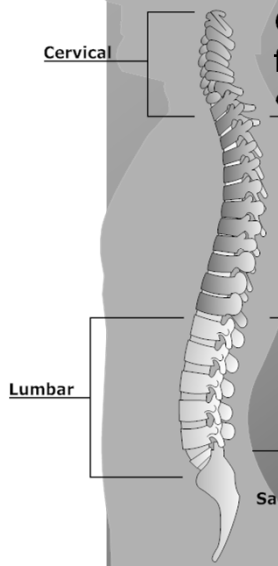
Force ~ *a strong physical exertion*

Forceful exertions due to weight, friction, or posture can stress soft tissues (ex: muscles, tendons, ligaments) beyond their capacity, lead to fatigue and possible damage.

The ***power zone*** for lifting with the greatest strength and lowest risk of injury is close to the **body between knuckle and shoulder** height. Comparable to the strike zone in baseball.



INSTRUCTIONAL TIP



Cervical spine are the most movable and make up the first 7 vertebrae of your upper back starting at the base of your skull (C1-C7)

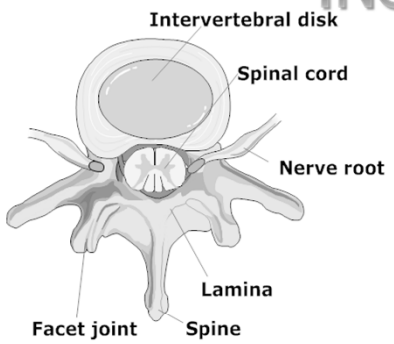
Thoracic spine is the least moveable due to the attachment of the ribs (T1-T12)

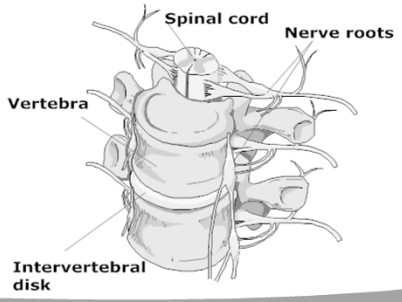
Lumbar spine holds most of the weight (L1-L5)

Sacrum consists of 5 fused modified vertebra and with the two ilium bones completes the pelvic ring (S1)

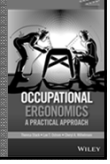
Coccyx consists of 4 fused modified vertebra

INSTRUCTIONAL TIP

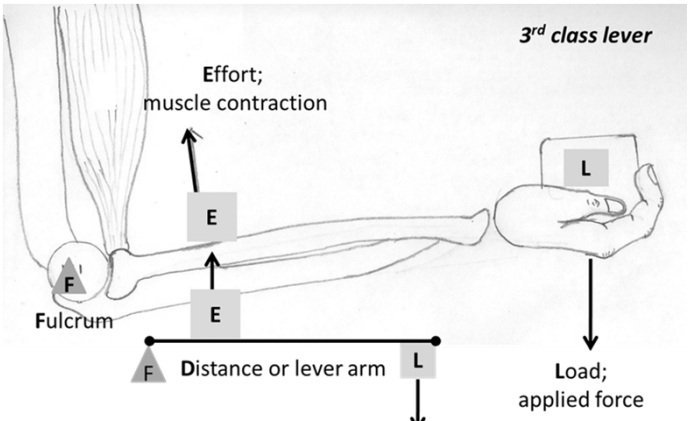




- Vertebrae are similar to **stacked** children's building blocks
  - **Fixed segments** (bones) with **moveable connections** (disc / ligaments)
- Small bones **project** from each outside corner and from the back called Processes
  - act as points of **attachment for muscles/ligaments**



Instructional Tip



50 lbs x 10" =	500 in-lbs
50 lbs x 20" =	1000 in-lbs
50 lbs x 30" =	1500 in-lbs

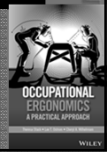
There are two forces
Effort = muscle
Load = weight

Load: 10lb x 10" = 100 in lbs
Effort: 100
lb x 1" = 100 in lbs

You can tip the scale in favor
Of the effort (right) how?

Points to cover:
- Lever arm and mechanical advantage
- Opposing (effort forces) when lever arm is small
- Position of the fulcrum
- Relation to human body

FORCE = WEIGHT X DISTANCE



...Lifting Rules ...

the goal is the neutral posture

- ***If the load is not close, the pressure is gross***
- ***If the back is bent, you will not prevent***
- ***If your muscles are slack, you will hurt your back***

Compression = soft tissue is pressed between the bone and a hard or sharp object

Compression, from grasping or contacting sharp edges, can concentrate force on small areas, reduce blood flow and nerve transmission and damage tendons and tendon sheaths

Before: Worker rests his wrists on the *sharp tray edges*. His wrist is extended into a non-neutral posture.

Ergonomics Improvement: Worker rests her wrists and forearms on a padded surface. Wrist and forearms are in a neutral position.

Less Compression *distribute the force*

Shoulder pad for carrying

Gloves

Click to Enlarge

Bucket Stool

Tool belt with shoulder support. Aim to balance weight in each side.

Vibration = *rapid back and forth movement*

- Single Point or Hand and Arm exposure results from hand-held vibrating objects used such as power tools.
- Full body vibration results primarily from vibration transmission from a vehicle (train, bus, earth moving) to the person.
- Damping the vibration at the source is useful as well as timely maintenance.

Improve other risk factors for example posture and glove use for compression and temperature. Timely tool maintenance and sharp bits reduce vibration and force. Let the tool do the work!

Vibration = rapid back and forth movement

Duration = time period

Continuous exposure may not allow sufficient recovery time for muscles, tendons, and nerves. Duration magnifies other risk factors.

Sometimes it is not the weight of the load, but the distance that it is carried that makes it tiresome.

Charged concrete hoses are heavy and difficult to move. Latches tend to snag rebar.
Skid plates under coupling reduce friction making the hose easier to pull. Reducing the duration of the task as well as the force.

Other factors **contribute** to the development of WMSDs but do not cause them

- Temperature
- Work Pace,
- Stress
- Age,
- Gender,
- Hobbies,
- Previous Injury,
- Medical Conditions,
- Smoking, Fatigue

Contributing Factors ~ Temperature Extreme

Prolonged work in cold temperatures can result in decreased muscle strength, endurance and a loss of tactile sensation.

Workers tend to exert extra hand forces in temperatures below 39º F

Prolonged work in hot environments can result in fatigue and a variety of heat related illnesses.

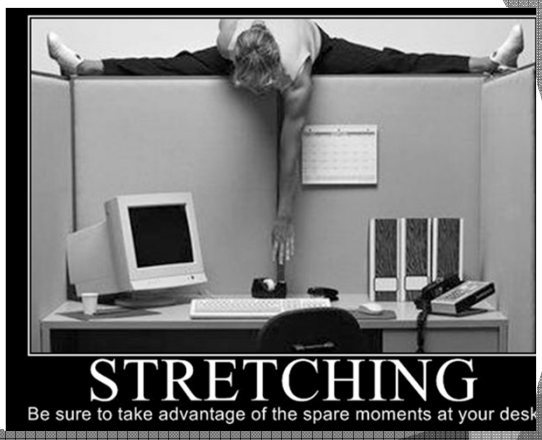
Workers tend to lose productivity in temperatures above 84º F

PPE can decrease evaporation and lead to dehydration

Contributing Factors ~ Inadequate Recover

Working without rest can cause fatigue and contribute to injury

Muscles need blood flow to supply nutrients and oxygen, and to carry away the waste products of muscle metabolism



Stretching, using alternative muscle groups, and micro-breaks aids in recovery and helps prevent fatigue

WMSD Signs and Symptoms

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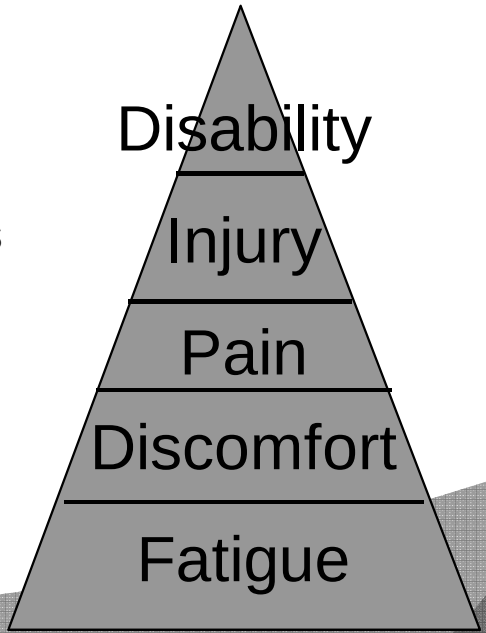
- Painful aching joints, muscles
- Pain, tingling or numbness
- Shooting or stabbing pains
- Swelling or inflammation
- Stiffness or difficulty moving
- Burning sensation
- Pain during the night
- Loss of strength and mobility



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WMSD Sign or Symptom?

- If you experience signs or symptoms of WMSDs, report it to a supervisor, industrial hygienist, or safety professional
- If pain or discomfort does not go away when you leave work or interferes with you carrying out normal activities, see an occupational health nurse or physician

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Applying ergonomics

The anticipated benefits

- Improved health and safety by reducing work-related injuries and disorders
- Improved comfort, morale and job satisfaction
- Improved productivity and reduced workers' compensation costs and employee turnover

Training is part of the Intervention

Make sure the users know how to use their tools and equipment

Never was so much owed by so many to so few
~ Winston Churchill

BASIC ERGONOMICS
TRAIN THE TRAINER

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