

Ergonomics In the Anatomic Pathology Lab:

A Computer-Based Learning Presentation

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Table of Contents

Abstract .....3

Ergonomics In the Anatomic Pathology Lab: A Computer Based Learning Presentation

    Support Paper ..... 4-14

References ..... 15-16

Appendices

    Appendix A: Survey Results: Pre-Presentation

        Tables A1 – A4 ..... 17-20

    Appendix B: Survey Results: Post-Presentation

        Tables B1 – B3 ..... 21-23

    Appendix C: Lesson Plan ..... 24-25

    Appendix D: PowerPoint Show CD-R .....26

    Appendix E: PowerPoint Presentation with Script ..... 27-46

### Abstract

There is a common saying amongst workers in the Histology Anatomic Pathology Lab: “It’s not a matter of IF you will get carpal tunnel syndrome, it’s only a matter of WHEN.” Due to the nature of the tasks that histology and other anatomic pathology laboratory workers perform repeatedly on a daily basis, they are at a high risk for developing carpal tunnel syndrome, other musculoskeletal disorders and vision problems. Fortunately, there is hope for preventing the development of these types of conditions and stopping their development through early recognition and ergonomic modifications in the workplace. This project was designed to deliver a computer-based learning presentation about ergonomic problem areas within the laboratory, their relation to the development of certain health problems, and ways to recognize and prevent them through ergonomic modifications to biomechanics and laboratory work environments.

## Ergonomics In The Anatomic Pathology Lab: A Computer-Based Learning Presentation

The workplace is ripe with health hazards for the employees who spend a large portion of their lives within them. These hazards can come from many sources: for example, slipping on a wet floor in an office bathroom, machinery accidents in a factory, and electrical dangers to utility workers. Laboratory workers face additional health hazards in the workplace like chemical exposure, manual trauma from dangerous equipment and tools, and exposure to biohazard material from the patient samples that they handle. All of these hazards are present in anatomic pathology laboratories where workers specialize in areas like histology, cytology, autopsy, electron microscopy and immuno- or enzyme histochemistry. The most insidious threat to these workers, though, is one that can develop somewhat undetected over months or years and stems from the very nature of the work that they perform. Repetitive motion and awkward posturing can lead to repetitive stress injuries and musculoskeletal disorders, potentially creating a painful situation for the employee, as well as concerns and loss of productivity for the employer. Proper ergonomics have become a necessary part of laboratory practice, although many labs and their employees are not utilizing equipment and biomechanical modifications effectively. The goal of this creative project is to determine whether or not a computer-based learning presentation could effectively educate a sample of anatomic pathology laboratory workers about proper ergonomic practices by highlighting ergonomic problem areas within the laboratory, associated health conditions, and improved ergonomic practices.

The issue of occupational injuries is not only a problem for singular laboratories and their employees; it has been investigated and considered at the national level. A 2010 report from the Bureau of Labor Statistics shows that employees within professional and related occupations account for 25.7 percent of nonfatal occupational injuries and illnesses involving days away from work, and they account for 24.9 percent of reported musculoskeletal disorders (Department of Labor, 2010). For the purpose of the report, musculoskeletal disorders are considered “where the nature of the injury or illness is sprains,

strains, tears; back pain, hurt back; soreness, pain...carpal tunnel syndrome...when the event or exposure leading to the injury or illness is bodily reaction/bending, climbing, crawling, reaching, twisting; overexertion; or repetition” (Department of Labor, 2010). Sprains, strains and tears account for 74.7 percent of the reported musculoskeletal disorders, carpal tunnel syndrome accounts for 2.9 percent, and soreness and pain, including back pain, accounts for 16.0 percent (Department of Labor, 2010). Additionally, the Healthy People 2020 initiative has set forth specific Occupational Safety and Health objectives for reducing nonfatal work-related injuries. Within those listed, specific objectives include the reduction of work-related injuries that result in time away from work or the restriction of work activity and treatment in the emergency department. Of particular interest is the objective OSH-3: “Reduce the rate of injury and illness cases involving days away from work due to overexertion or repetitive motion.” The Healthy People 2020 initiative seeks a 10 percent improvement in the number of reported cases that fit these criteria (Department of Health and Human Services, 2013).

Basically, all of this data supports the conclusion that occupational hazards of this nature are more prevalent than they should be and that efforts of reducing their rate of occurrence should be of importance to laboratory workers and their employers, as well as being considered a matter of general public health. When the focus is shifted to examine the hazards to anatomic pathology lab workers more specifically, there are several types of injuries that are prevalent and can be reduced by the implementation of proper ergonomic practices. Those injuries include “carpal tunnel syndrome, tendinitis, tenosynovitis, headaches and chronic back, shoulder or neck pain”; the causes of these types of musculoskeletal disorders are linked closely with repetitive motions, posture problems and other stressors (Minshew, 2013).

A study conducted to assess ergonomic risks in pathological anatomy laboratories states that “all respondents argue that the labs where they perform their duties should have ergonomic equipment... however only 12 percent of respondents say that the facilities of the places where they perform their duties were the target of an ergonomic evaluation.” (Rangel, Dias-Teixeira, Maia, Maia, Baptista, & Dias-

Teixeira, 2013). While it can be agreed that ergonomic practices are contributing heavily to the health of anatomic pathology lab workers, there is often little done to address the problem. The ultimate goal of this project is to support the reduction of injuries in anatomic pathology laboratory workers that can be prevented and/or treated by improving ergonomic practices in the laboratory. Research and data were collected to create a targeted learning presentation and analyze the presentation's effectiveness as a teaching tool for laboratory workers, themselves, so that they might be able to address ergonomic issues at the individual level. The creative project was designed utilizing knowledge and goals from three areas of study: Health Promotion, Health Sciences and Health Administrative Services.

### **Health Promotion**

The primary focus of this project centers around improving the safety and long-term health of laboratory workers, supporting the most basic goal of health promotion: to support and promote better health practices and healthy lifestyles. An effort to improve occupational health conditions for laboratory workers translates this goal to the occupational environment, in this case, the anatomic pathology laboratory. While a large part of the focus of this project involved research about the common injuries associated with laboratory tasks, the main goal is to convey the importance of proper ergonomic practices to prevent and treat those injuries, thus promoting a healthier work environment for laboratory staff.

The first premise of the learning presentation seeks to highlight the impact how poor ergonomics can lead to the development of common injuries like musculoskeletal disorders, repetitive stress injuries, chronic pain, and eye strain. More specifically noted in a study of chronic tendinopathy, are injuries like overuse tendinopathy, with symptoms of chronic pain and tendon thickening that can be seen in workers who have "overused" their extremities. Ergonomically speaking, "numerous studies have found associations between abnormal biomechanics or specific performance characteristics and the development of tendinopathy" (Khan, Scott, Fields, & Grayzel, 2013). In a study related to sit-stand workstations used for video display terminals, it was found that "it is well known that the incidence of musculoskeletal

disorders (MSDs) of the neck, shoulders and lower back is associated with prolonged sedentary work with constrained posture” (Ebara, et al., 2008),

When considering these types of worker injuries, it must also be noted that often extensive and long-term treatment is needed to correct the injury or even just manage pain so that the worker may continue to lead a normal, productive life. Tendinopathies, for example, “are chronic injuries that are slow to resolve, often requiring months for complete healing” (Khan, Scott, Fields, & Grayzel, 2013). Treatment can vary for different types of injuries. For laboratory workers with long-term pain in the back, neck and upper extremities, specific strength training can be prescribed. However, it should be noted that the exercise is recommended for at least ten weeks duration for improvement to be seen (Perdersen, Anderson, Zebis, Sjagaard, & Andersen, 2013).

The National Commission for Health Education Credentialing lists seven areas of responsibility, complete with correlating competencies for proficiency as a health educator (National Commission For Health Education Credentialing, Inc. (NCHEC), 2010). The 2010 list of competencies and sub-competencies for Health Education Specialists was reviewed with respect to this presentation and multiple objectives within the seven areas of responsibility were satisfied during the conception, design, implementation and analysis of this project. Following are representative examples of the areas of responsibility and correlating competencies supported during this project. In the Area of Responsibility 1 (ASSESS NEEDS, ASSETS AND CAPACITY FOR HEALTH EDUCATION), competency areas 1.4 and 1.5 were supported through the analysis of factors that can enhance or compromise health and the identification and analysis of factors that can foster or hinder the learning process. Area of Responsibility 2 (PLAN HEALTH EDUCATION) competency areas 2.2 and 2.4 are represented with the development of goal statements, concrete objectives, and the development of a process to integrate health education into other programs. Area of Responsibility 5 (ADMINISTER AND MANAGE HEALTH EDUCATION) competency 5.2 was supported with communication efforts to ensure appropriate use of institution resources during the administration of the learning presentation. Area of Responsibility 7

(COMMUNICATE AND ADVOCATE FOR HEALTH AND HEALTH EDUCATION) competency areas 7.2 and 7.3 were realized with the recognition of the target population for the presentation and the use of technology to communicate and educate members of the sample group.

### **Health Sciences**

This project supports the concentration and focus of health sciences in a twofold manner. First and foremost, laboratory workers are the agents of health science. First, the targeted audience consists of professionals in anatomic pathology laboratories that facilitate the focus and functions of health science on a daily basis. The audience for this presentation consists of those agents and facilitators, representing and attending to their unique needs while they carry out this essential work.

Secondly, ergonomics is inherently a health science. Ergonomics includes studying workers movements as they perform job tasks while simultaneously considering normal anatomy and physiology. The ultimate goal of proper ergonomic practice is to reconcile the two. Ergonomics examines the pathophysiology that results from poor ergonomics, taking in to consideration the biomechanics of workers and the structure of their environment. Specific to anatomic pathology laboratory workers are many ergonomic danger zones: pipetting, the use of small instruments (fine motor skills to perform job tasks), handling specimen containers (opening and closing bottles), poor posture during microscopy, and awkward posture while working within fume hoods (Rangel, Dias-Teixeira, Maia, Maia, Baptista, & Dias-Teixeira, 2013). Other cited problems include fatigue from prolonged standing on tiled floors without supportive mats, awkward posture and biomechanics in all areas, and standing versus seated work (Bohr, Evanoff, & Wolf, 1997). One of the most prevalent areas of concern is the histology lab. The Michigan Society of Histotechnologists cites several reasons for this disparity: inappropriate workstations (such as those used for purpose other than intended), lack of newer automated equipment, increasing workloads in labs with a shortage of certified technicians/technologists, and the stress that these pressures can cause (Minshew, 2013).



While the pathological conditions associated with poor ergonomic practice are numerous, the most prevalent conditions that afflict workers in the anatomic pathology lab are several classifications of musculoskeletal disorders including disorders associated with tendons and disorders associated with nerves (Minshew, 2013). Disorders associated with tendons include the aforementioned tendinitis and also tenosynovitis, a condition that develops when tendons that run through tendon sheaths surrounded by synovial fluid are subject to excessive friction. This friction causes an overproduction of synovial fluid that leads to swelling. Common areas for tenosynovitis to develop are on the side of the wrist at the base of the thumb and in the digits (Minshew, 2013). Disorders associated with nerves include carpal tunnel syndrome (compression of the median nerve in the arm that results in numbness, tingling, soreness and eventually severe pain), and compression syndromes of the ulnar nerve (Minshew, 2013).

Within the laboratory workers' population, there is a growing concern for aging workers. As the number of aging workers increases, special attention will have to be paid to the unique needs of this group. Aging laboratory workers are more likely to experience the aches and pains associated with their job tasks, eye strain, and to develop long-term injury from poor ergonomics. Aging workers are especially susceptible to computer-vision syndrome (CVS), a condition caused by long hours of eye strain at a computer monitor. The symptoms of CVS include blurry vision, dry or irritated eyes, double vision and headaches (Gile, 2009). CVS can be linked to monitor work, but possibly also to extended time performing microscopy. Other sources of increased eye strain for aging laboratory workers should also be evaluated. Such areas may include working with tiny biopsy specimens for extended periods without a break for resting the eyes. Laboratory managers will need to be aware of and sensitive to the needs of aging workers, making concessions and accommodations as appropriate (Gile, 2009).

### **Health Administrative Services**

Like the Health Sciences concentration, this project supports dual purposes from the perspective of Health Administrative Services. First, as previously demonstrated, injuries due to poor ergonomic

practice can negatively affect the work environment. Injured workers or those experiencing chronic pain are unable to perform at peak productivity levels. A review from Applied Ergonomics states: “There has been work showing a potential association between increasing discomfort and decreasing productivity...It has also been suggested that there may be an association between certain postures, other than a traditional sitting posture, and decreased worker productivity” (Karakolis & Callaghan, 2013). These workers will also be more likely to miss days of work due to those injuries, thereby reducing the productivity levels of the laboratory as a whole. From a management perspective, this should be of great concern. Not only will injured workers and those out of work due to injuries affect the bottom line, their diminished ability and absence is a strain to the remaining laboratory staff. In efforts to compensate for the reduced efforts of their injured co-workers, laboratory workers are burdened with undue stress which affects them mentally and physically (Minshew, 2013). In a field that is already short on competent and appropriately credentialed workers, the loss of any staff member can be a significant blow to morale. High productivity demands dictate working at a fast pace, but patient care demands that the work must also be complete and accurate (Minshew, 2013). Meeting these demands without the support of a fully functioning lab staff can cause rushed work, performed with the fear of making a mistake and under excessive fatigue. Management personnel are responsible for ensuring the safety of their workers and performing, or ordering, ergonomic evaluations of the workplace. For any ergonomic interventions to be successful, they must be supported by management, who is ultimately responsible for their continued review and implementation.

Secondly, this presentation was created with skills garnered from coursework and research in clinical instruction and effective computer-based learning. Clinical instruction techniques dictated the need for clearly defined goals and objectives, careful lesson planning, consideration of the learners’ needs, and an effective method of reviewing the learners’ experience (Dean, 2002). Research in the area of computer-based learning identified several key techniques to enhance the effectiveness and use of the

learning presentation: self-pacing, review activities, demonstrations, and active presentation engagement for the learner.

The use of computer-based presentations is a key method to facilitating learning, especially for adults. It creates ease of access outside of a classroom environment and can work for limitations on their time. The use of this format puts the learner in control, where they can set the pace of the activity and repeat portions of the presentation for further understanding (Salih USUN, 2003). The use of interactive activities within the presentation makes the learner participate. The “lesson should require periodic interaction by the student.” (ASSE Training & Communications Branch Leadership, 2012).

### **Presentation Structure**

A comprehensive lesson plan was created to develop the goals, objectives and parameters of the presentation (see Appendix C). The resulting presentation developed consists of a PowerPoint show with voice narration and has a running time of approximately 25 minutes (see Appendix D). The presentation was created and recorded using a rehearsed script (see Appendix E). Embedded within the presentation are a pre-presentation survey, a post-presentation survey, and interactive review questions after each goal section has been covered. The presentation requires the learner to click after each slide to advance. Controls are enabled so that the learner can repeat the narration for slides as needed. Text and images are included in the presentation to increase the comprehension of the learner and to demonstrate visually what proper ergonomics should look like, as well as what improper ergonomic positioning looks like.

The pre-presentation survey assessed the learners’ current knowledge of ergonomic practices, the amount of time they spend performing tasks that are likely to cause injury, whether or not they are currently experiencing any symptoms of poor ergonomics, and how long they have been working within the anatomic pathology laboratory environment. The post-presentation survey assesses whether or not the learner felt the presentation was beneficial to them, whether or not it would be beneficial to colleagues,

their impressions of the presentation's content and the abilities of the speaker, and how much they felt their knowledge of ergonomics had increased by participating in the learning experience.

In total, 20 out of 25 initial volunteers completed the learning presentation. Participants included anatomic pathology workers from histology, cytology, gross dissection, renal biopsy, electron microscopy and surgical pathology/autopsy laboratories. The respondents held different positions within their laboratories, including varying designations of lab technicians, lab assistants, and pathology assistants. Participants ranged from 0-5 years of experience to over 10 years of experience in anatomic pathology labs.

### **Survey Results: Pre-Presentation**

All 20 participants completed the pre-presentation survey. First, participants were asked to rate the amount of time spent performing varied tasks within the work environment. As demonstrated in Table A1, the most frequently performed tasks across the sample group included computer use, microscopy, and various fine motor tasks. When asked about specific behaviors performed, the most cited possible ergonomic problem area was in the performance of fine motor movements (see Appendix A, Table A2). The majority of respondents (approximately 75 percent) have worked in anatomic pathology labs for 0-10 years. As seen in Appendix A, Table A3, a majority of respondents have experienced symptoms of possible injury related to the performance of work tasks that include back pain, neck pain, eye strain, and pain in the extremities. When asked to rate their pre-presentation knowledge of ergonomics, most participants responded "good" or "fair" (see Appendix A, Table A4).

As a whole, the pre-presentation survey results indicated that a varying range of work experience was represented among the participants. The results also showed that the respondents are performing a variety of work tasks that can lead to injury without proper ergonomic practice and that they are performing biomechanical actions that could lead to injury. Lastly, most participants (95 percent) indicated that they had a fair or better basic knowledge of ergonomics.

### **Survey Results: Post-Presentation**

Of the 20 participants, 19 completed the post-presentation survey. The surveys were administered anonymously, so no one participant could be singled out for non-participation or ratings. First, participants were asked to rate their understanding of the main topics presented. An overwhelming majority indicated that the topics were “well understood”, with only one participant rating several categories as “mostly understood” (see Appendix B, Table B1). Participants were then asked to rate the skills of the presenter by assessing the presenter’s knowledge of the content area, reviewing of concepts, and the ability to maintain the interest of the learner. The respondents were also asked to give an overall rating of the presenter. As seen in Appendix B, Table B3, the majority of participants gave ratings of “excellent” in all categories, with lower ratings in the area of maintaining learner interest.

When asked how much additional knowledge of ergonomics was gained by participating, responses ranged from “a small amount” to “quite a bit”, with the majority (approximately 58 percent) responding “a moderate amount” (see Appendix B, Table B3). One hundred percent of respondents indicated that they felt that they had a better understanding of ergonomic practices and how to utilize them in the workplace after viewing the presentation. All 19 respondents also indicated that the presentation was beneficial to them and/or would be beneficial to their colleagues. Additional positive comments stated that the presentation was interactive, well-spoken, and able to keep the learners attention. Critical feedback indicated that the presenter spoke too fast at times and that they would have like to see more pictures of poor ergonomic practice in more specific situations, particularly those involving histology-related tasks.

### **Conclusion**

The pre-presentation survey results were strongly indicative that the sample of anatomic pathology lab workers that participated are working in ergonomic problem areas and that they may already be experiencing symptoms of poor ergonomic practice while performing routine job tasks. This supports the cited research that connect the performance of certain tasks with chronic pain and potential injury that could be reduced or relieved by proper ergonomic intervention. The post-presentation results were overwhelmingly positive, indicating that the presentation goals were met and learning objectives were well-developed. Most importantly, all post-presentation survey respondents felt that they had increased their knowledge of ergonomics to some degree and that the presentation content would help them to apply that knowledge to performance of work tasks in a safer manner. The computer-based learning platform for the presentation was successfully utilized to educate the sample of anatomic pathology laboratory workers about proper ergonomics practices. Laboratory dangers extend far beyond the obvious, critical exposures or accidents that can befall workers. Education about proper ergonomic practices can help to prevent those injuries that are stealthier, helping workers to remain productive and healthy while they perform vital, life-saving work for the patients that they serve.

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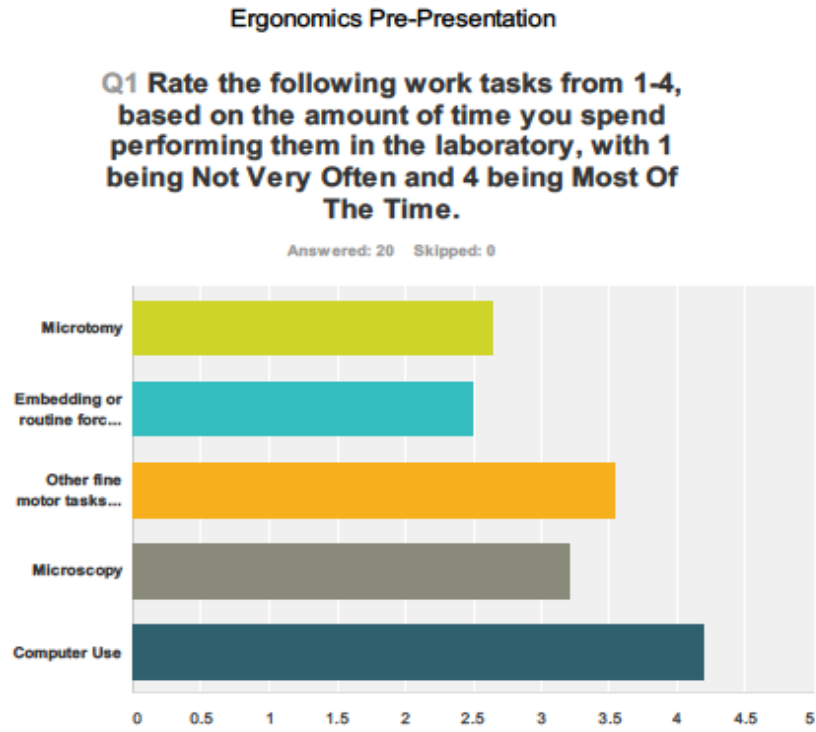
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Appendix A

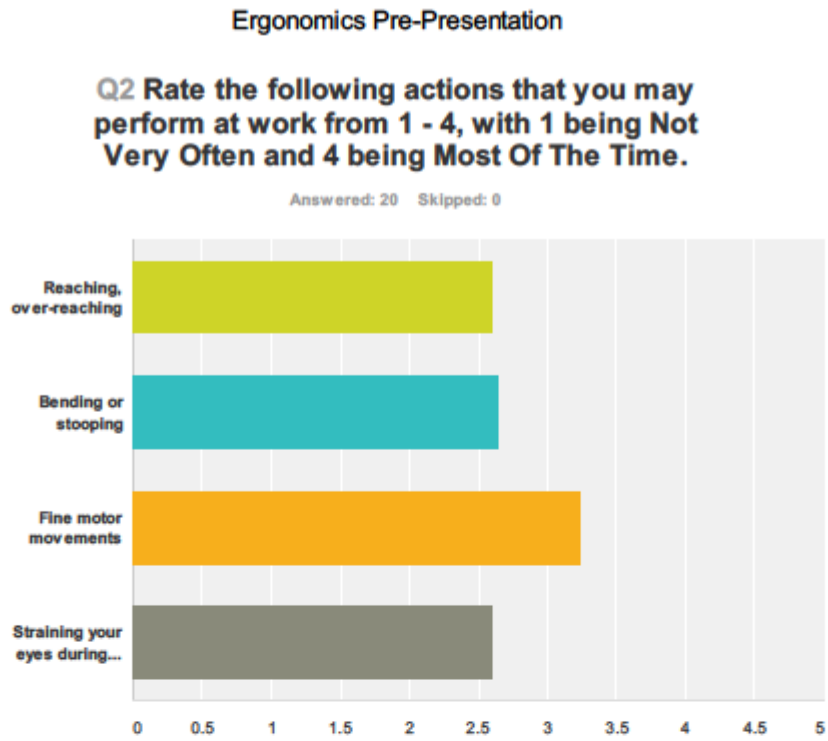
Pre-Presentation Survey Results

Table A1



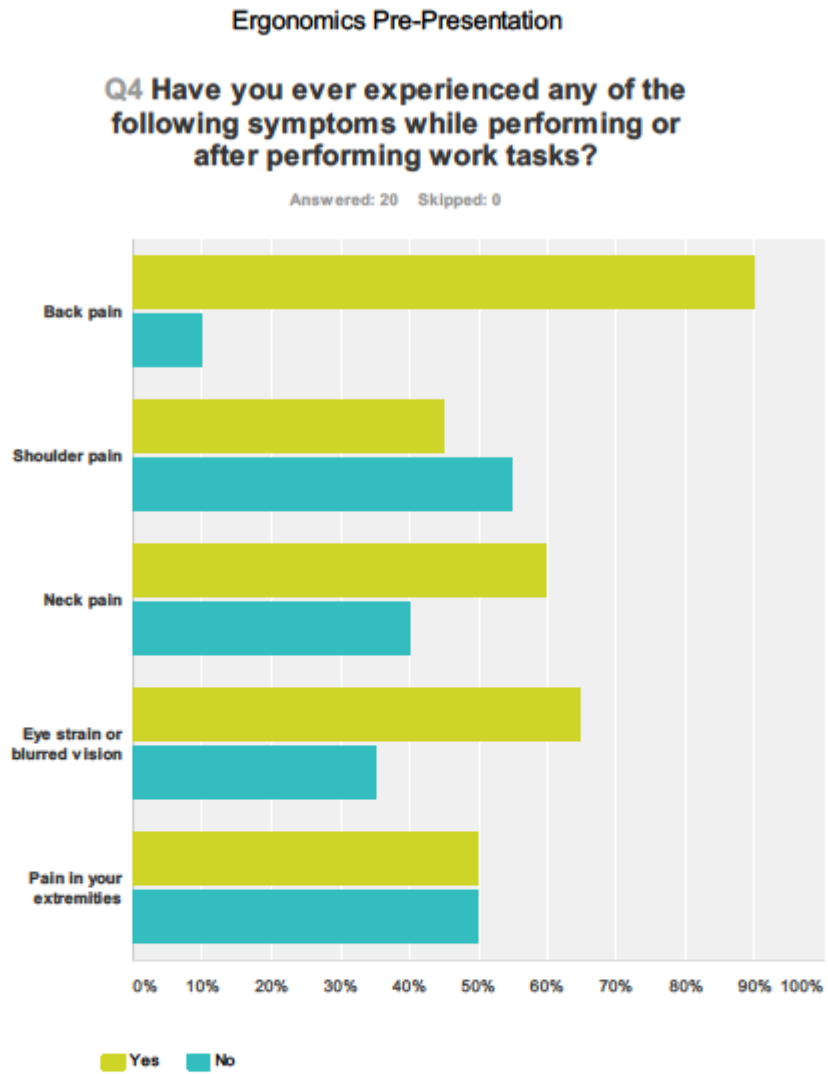
	Never	Occasionally	Frequently	Most Of The Time	Total	Average Rating
Microtomy	45.00% 9	15.00% 3	25.00% 5	15.00% 3	20	2.65
Embedding or routine forceps use	45.00% 9	25.00% 5	20.00% 4	10.00% 2	20	2.50
Other fine motor tasks (ex. pipetting, dissection)	15.00% 3	40.00% 8	5.00% 1	40.00% 8	20	3.55
Microscopy	25.00% 5	25.00% 5	30.00% 6	20.00% 4	20	3.20
Computer Use	0.00% 0	30.00% 6	20.00% 4	50.00% 10	20	4.20

Table A2



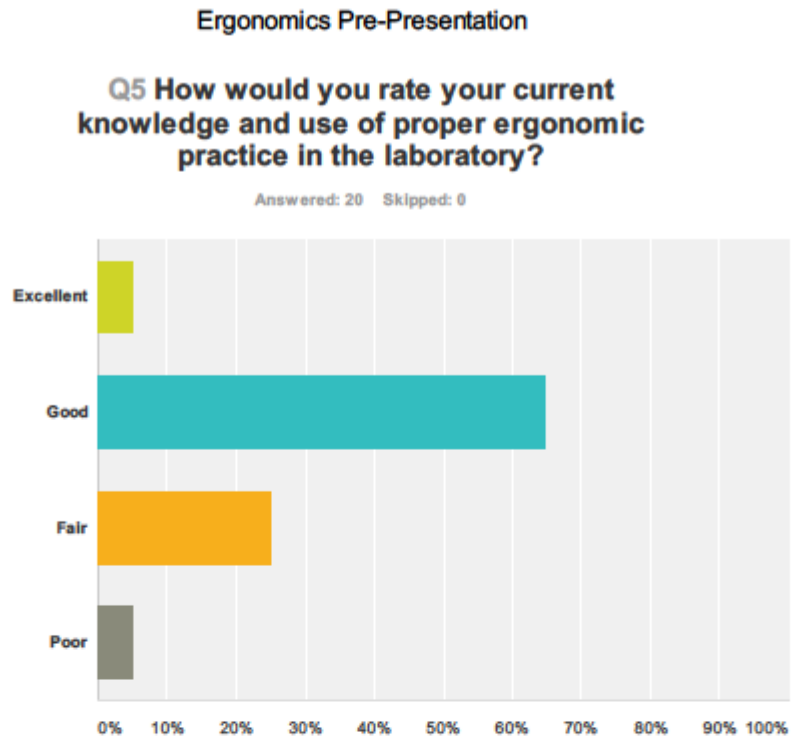
	Not Very Often	Sometimes	Frequently	Most Of The Time	Total	Average Rating
Reaching, over-reaching	10.00% 2	35.00% 7	40.00% 8	15.00% 3	20	2.60
Bending or stooping	10.00% 2	30.00% 6	45.00% 9	15.00% 3	20	2.65
Fine motor movements	0.00% 0	30.00% 6	15.00% 3	55.00% 11	20	3.25
Straining your eyes during tasks	10.00% 2	45.00% 9	20.00% 4	25.00% 5	20	2.60

Table A3



	Yes	No	Total	Average Rating
Back pain	90.00% 18	10.00% 2	20	0.00
Shoulder pain	45.00% 9	55.00% 11	20	0.00
Neck pain	60.00% 12	40.00% 8	20	0.00
Eye strain or blurred vision	65.00% 13	35.00% 7	20	0.00
Pain in your extremities	50.00% 10	50.00% 10	20	0.00

Table A4

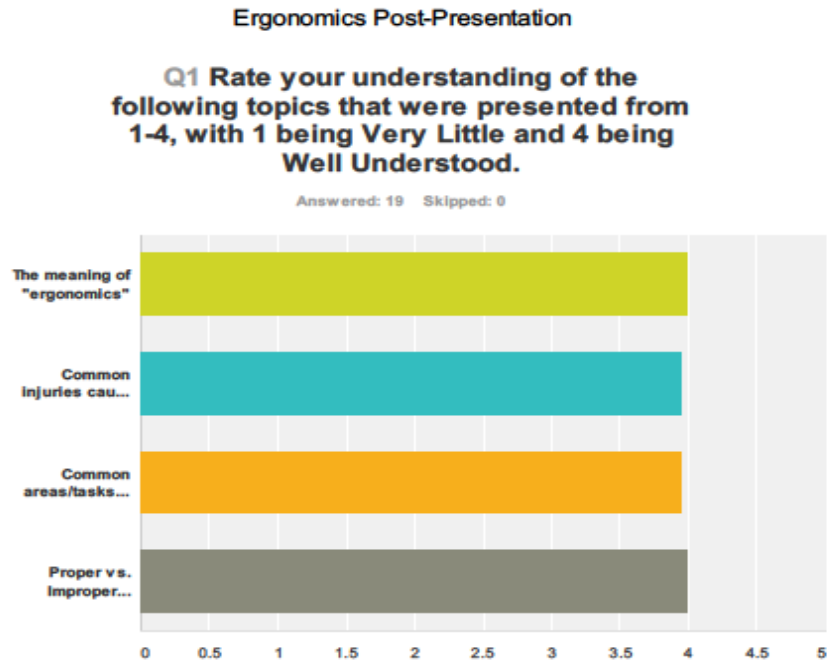


Answer Choices	Responses	
Excellent	5.00%	1
Good	65.00%	13
Fair	25.00%	5
Poor	5.00%	1
<b>Total</b>		<b>20</b>

Appendix B

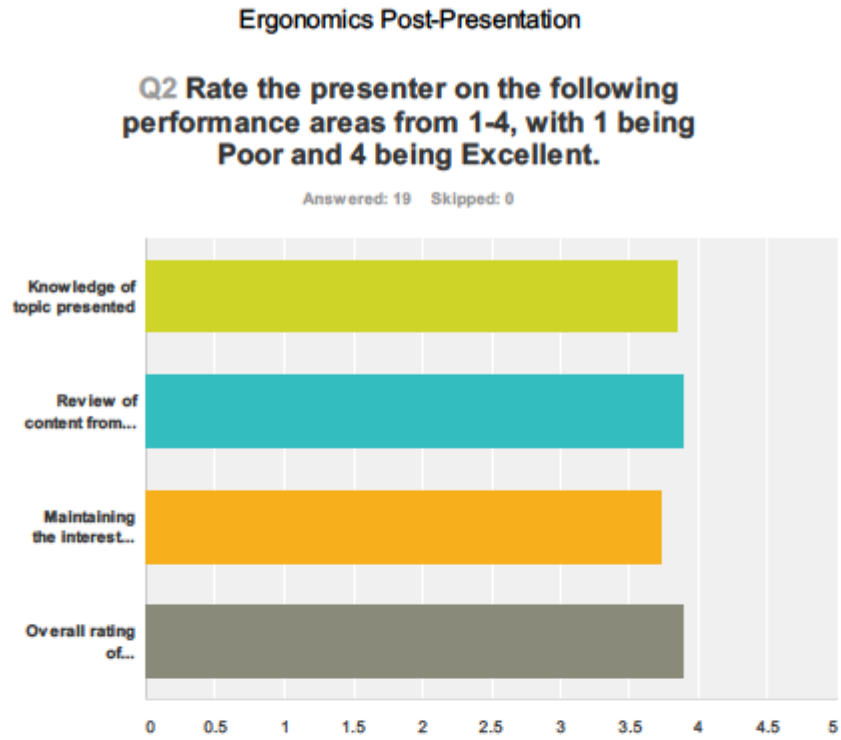
Post-Presentation Survey Results

Table B1



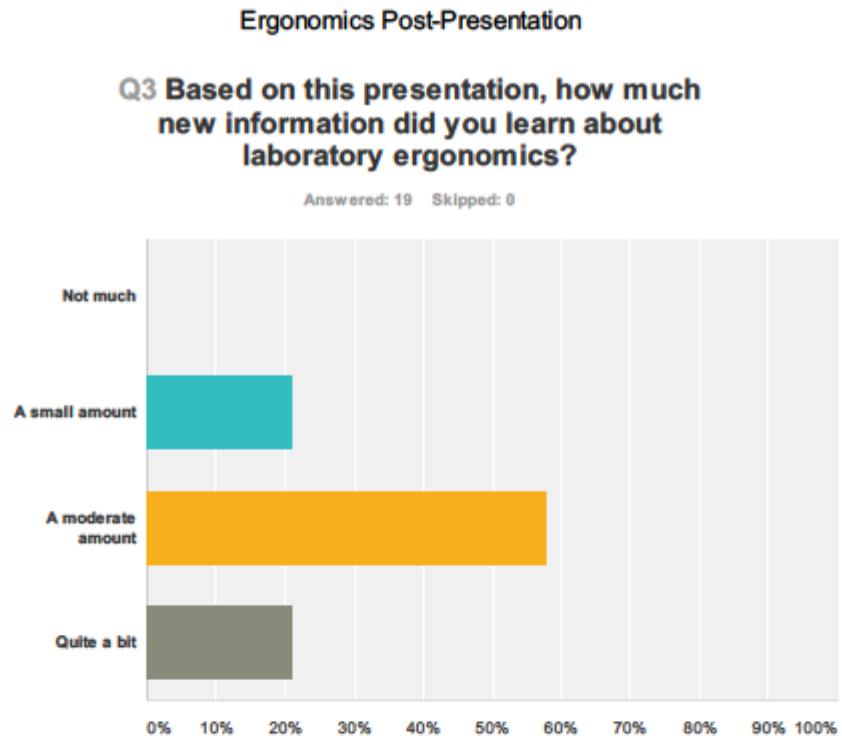
	Very Little	Some Understanding	Mostly Understood	Well Understood	Total	Average Rating
The meaning of "ergonomics"	0.00% 0	0.00% 0	0.00% 0	100.00% 19	19	4.00
Common injuries caused by improper ergonomics	0.00% 0	0.00% 0	5.26% 1	94.74% 18	19	3.95
Common areas/tasks that can cause injuries	0.00% 0	0.00% 0	5.26% 1	94.74% 18	19	3.95
Proper vs. Improper ergonomic practices	0.00% 0	0.00% 0	0.00% 0	100.00% 19	19	4.00

Table B2



	Poor	Fair	Good	Excellent	Total	Average Rating
Knowledge of topic presented	0.00% 0	0.00% 0	15.79% 3	84.21% 16	19	3.84
Review of content from goal areas for comprehension	0.00% 0	0.00% 0	10.53% 2	89.47% 17	19	3.89
Maintaining the interest of the learner throughout the presentation	0.00% 0	5.26% 1	15.79% 3	78.95% 15	19	3.74
Overall rating of presentation/presenter	0.00% 0	0.00% 0	10.53% 2	89.47% 17	19	3.89

Table B3



Answer Choices	Responses
Not much	0.00% 0
A small amount	21.05% 4
A moderate amount	57.89% 11
Quite a bit	21.05% 4
<b>Total</b>	<b>19</b>

## Appendix C

## Lesson Plan

## PURPOSE:

The purpose of this learning presentation is to teach anatomic pathology lab workers basic ergonomic practices using a self-guided computer-based learning presentation.

## GOALS:

- To define the term “ergonomics” and explain why it is important in practice.
- To identify common ergonomic problem areas in anatomic pathology labs.
- To discuss basic proper ergonomic practices and how to utilize them.

## LEARNING OBJECTIVES:

Goal #1: To define the term “ergonomics” and explain why it is important in practice.

- The learner will be able to define “ergonomics”.
- The learner will be able to give examples of common injuries in lab employees that are associated with improper ergonomics.

Goal #2: To identify common ergonomic problem areas in anatomic pathology labs.

- The learner will be able to correlate common laboratory tasks with related injuries.
- The learner will be able to recognize the symptoms of common injuries associated with poor ergonomics.

Goal #3: To discuss basic proper ergonomic practices and how to utilize them.

- Given examples, the learner will be able to differentiate between proper and improper ergonomic practice.



- The learner will be able to demonstrate basic proper ergonomic posture and positioning in the work area.

#### LEARNING ACTIVITIES:

- A PowerPoint presentation on a CD-R will be provided to participants. The presentation is complete with a voice narrative to guide the learner through the content material; however the pace of the presentation will be controlled by the participant.
- Content review questions will be provided at the end of each segment of the presentation. Each segment and set of review questions will correlate to the three goals of the presentation.

#### VISUAL AIDS:

Visual aides are included within the PowerPoint presentation, consisting of pictures and diagrams that demonstrate the topical information and support the learning objectives.

#### EQUIPMENT:

- CD-R of presentation
- Computer access with sound and internet access for the participant to view/hear the presentation and complete pre- and post-evaluation exercises.

#### EVALUATION:

- A pre-presentation evaluation will assess the background knowledge of participants. This evaluation will also assess how often participants perform certain work tasks and whether or not they currently experience any pain that might be related to poor ergonomics.
- A post-presentation evaluation will assess the effectiveness of the learning presentation, the skills of the presenter, and whether or not the learner's knowledge of the topics presented increased.

Appendix D

Ergonomics in the Anatomic Pathology Lab: CD-R PowerPoint Show

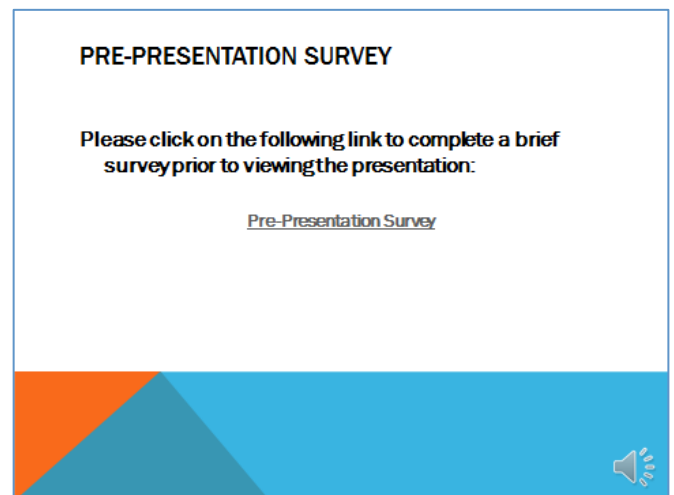
## Appendix E

## Ergonomics in the Anatomic Pathology Lab: PowerPoint Presentation and Script

1. Hello, welcome to “Ergonomics in the Anatomic Pathology Lab”. My name is Angela Johnsrud and I’d like to thank you for participating in this learning presentation. Ergonomics is an often overlooked and forgotten part of our daily lives when working under the pressures of heavy workloads and time constraints. However, it is an important part of our long-term health as we move through our careers. This presentation is designed to provide some basic information about the common ergonomic problem areas within the laboratory, how to recognize them, and how we can manipulate our work space and be mindful of our own habits in order to combat workplace injuries like musculoskeletal disorders, eye strain and repetitive stress injuries.



2. Before you start, please click on the link you see on the screen. This will take you to a quick pre-presentation survey that will assess your current knowledge of basic ergonomic practices, what types of work tasks you perform and whether or not you might currently exhibit symptoms of poor ergonomic practice. All survey results are anonymous and confidential. After completing this short survey, please return to the presentation and click the screen to continue.




3. These three goals constitute the overarching themes of today's presentation:

- 1) To understand the term ergonomics and why it is important in practice.
- 2) To identify common ergonomic problem areas in anatomic pathology labs.
- 3) To discuss basic proper ergonomic practices and how to utilize them.

For each goal, we will highlight and explore several supporting objectives.

### **GOALS**


- 1) **To define the term "ergonomics" and explain why it is important in practice.**
- 2) **To identify common ergonomic problem areas in anatomic pathology labs.**
- 3) **To discuss basic proper ergonomic practices and how to utilize them.**



4. So, to understand what ergonomics really is and why it is so important, we are going to define it and talk about how it relates to certain injuries that develop in laboratory workers.

### **LEARNING OBJECTIVES - GOAL #1**

- **The learner will be able to define "ergonomics".**
- **The learner will be able to give examples of common injuries in lab employees that are associated with improper ergonomics.**



5. So, first we are going to start by defining ergonomics and Oklahoma State University uses a definition of ergonomics that I really like. "The word "Ergonomics" comes from two Greek words "ergon", meaning work, and "nomos" meaning "laws". Today, though, the word is used to describe the science of designing the job to fit the worker and not forcing the worker to fit the job. So basically ergonomics is a science that examines how a human operates in their work environment and tries to create an environment that is conducive to good health and safety. This might involve modifying the behaviors of the individual within the environment, how things are placed within their environment, or what type of equipment they use. This becomes very important in many work environments and especially in the laboratory where workers perform many varied tasks that generally require the use of motor skills, keen eyesight, and the use of a variety of equipment.

### DEFINING ERGONOMICS...

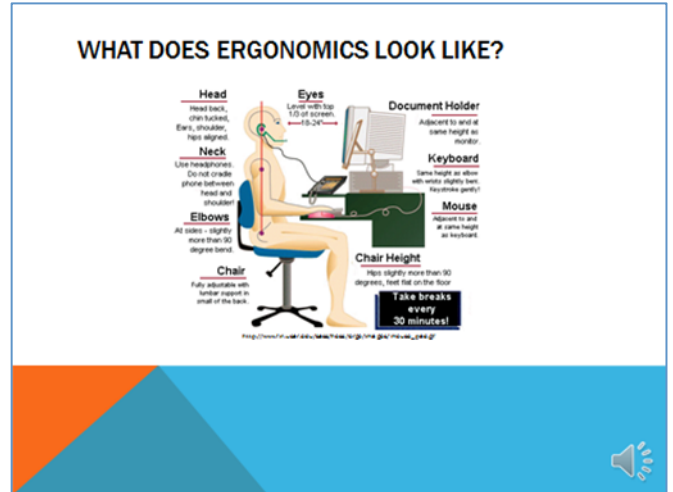
- **Oklahoma State University defines ergonomics this way:**
- "The word "Ergonomics" comes from two Greek words "ergon", meaning work, and "nomos" meaning "laws".
- Today, however, the word is used to describe the science of "designing the job to fit the worker, not forcing the worker to fit the job."
- This covers all aspects of a job, from the physical stresses it places on joints, muscles, nerves, tendons, bones and the like, to environmental factors which can effect hearing, vision, and general comfort and health.

6. I've included some information here about Healthy People 2020 just to show that ergonomics is considered a health problem at the national level. Healthy People is a national public health initiative that targets all aspects of health behaviors that affect American citizens. Healthy People 2020 outlines current states of health behaviors and sets the goals for improvement that they are working to meet by the year 2020. As you can see, this initiative includes goals for improving Occupational Safety and Health of American workers. Here I have noted the specific goal to reduce cases of injury and illness due to overexertion and repetitive motion.

### HEALTHY PEOPLE 2020

- **Healthy People is an initiative that provides ten-year goals and objectives for "improving the health of all Americans."**
- **Outlines objectives in numerous categories, one of which is Occupational Safety and Health. These objectives include:**
- Reducing the rate of injury and illness cases involving days away from work due to overexertion or repetitive motion (OSH-3)
  - 2008 reported: 29.6 cases per 10,000 workers
  - Healthy People 2020 Goal: 26.6 cases per 10,000 workers (10% improvement)

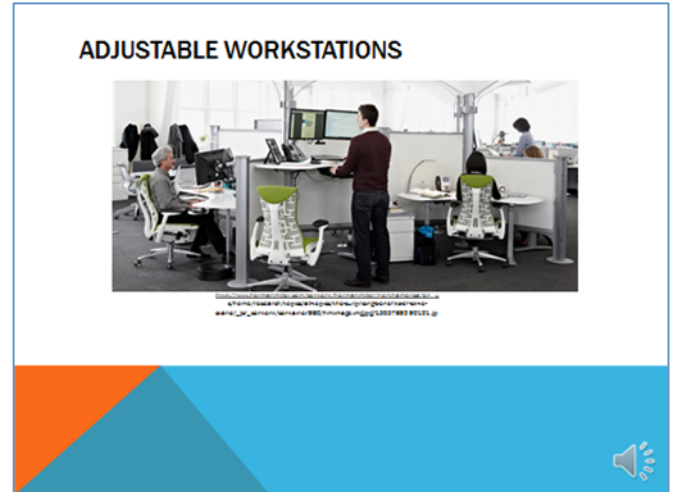
7. So, what does ergonomics look like? What images might we associate with the definition of ergonomics? Here is a general idea. Ergonomics involves not only how the body is positioned, but how equipment is positioned for the worker. This is a nice image as it provides some brief tips or rules of thumb for working comfortably and safely. We will look at some of these options in more detail later in the presentation. Next up, let's look at some of the ergonomically designed equipment that can be used in anatomic pathology laboratories.



8. Here is a picture of an automated microtome. Microtomes are used to cut tissue samples into thin slices that can be placed on a slide for microscopic examination. On the right, you can see a black hand crank. In recent years, companies that manufacture microtomes have started to offer an automated option. Notice the keypad on the left. This allows the user to push a button to power the microtome crank, saving the user from doing it manually which can cause repetitive stress injuries. Some automated microtomes also have a foot pedal that the user can press so that they don't have to use the keypad either!



9. Adjustable workstations are used to accommodate the height of the specific user. They can often adjust so that the user can sit OR stand to do their job. This example shows sit/stand workstations in an office environment, but they can also be used in labs and other workplaces. A review of how sit-stand workstations impact job productivity in the journal “Applied Ergonomics” found that the use of sit-stand workstations can reduce whole body discomfort, lower back discomfort, and foot swelling without significantly altering productivity. While this review was conducted on workers in an office environment, the implications for improved comfort could be translated to other work environments as well.



10. So, now we've defined what ergonomics is, but why are proper ergonomics so important? According to OSHA (The Occupational Health and Safety Administration) and the National Institute of Environmental Health Sciences, these are just a few of the Musculoskeletal Disorders that are commonly associated with poor ergonomics in the workplace. This list is not all inclusive, but mentions the most common.

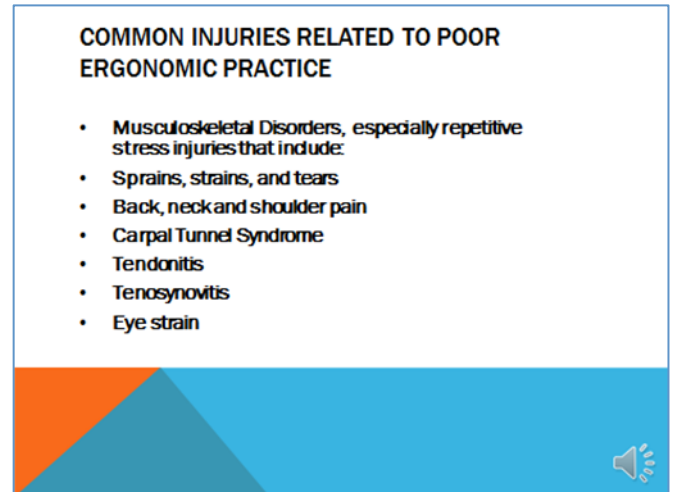
In 2010 the Bureau of Labor and Statistics reported that sprains, strains and tears accounted for the largest percent of occupational injuries in the private sector. For perspective, let's note that workers missed an average number of 21 work days for an amputation, while workers suffering from carpal tunnel syndrome missed an average of 27 days. The chronic injuries that can be prevented by proper ergonomics are more serious than most workers think.

So, as you review the list on your screen, ask yourself these questions:

-Have I ever suffered from some of these problems? Do I know anyone who has?

-Have I considered the possibility of that you might get these types of injuries from the tasks you perform at work?

In the next three slides, three review questions for this section of the presentation will be provided. After you have read the question and answers, click to see the correct answer.



**COMMON INJURIES RELATED TO POOR ERGONOMIC PRACTICE**

- Musculoskeletal Disorders, especially repetitive stress injuries that include:
- Sprains, strains, and tears
- Back, neck and shoulder pain
- Carpal Tunnel Syndrome
- Tendonitis
- Tenosynovitis
- Eye strain




## 11. Review (no narration)

**GOAL #1 REVIEW**

**What is the best definition of ergonomics?**

- Ergonomics – the science of how people injure themselves
- Ergonomics - a method to promote mind-body wellness in the workplace
- ➔ • Ergonomics – a science that examines how people work and helps determine ways to work that promote good health and safety
- Ergonomics – a method of exercise that will relieve musculoskeletal disorders in workers




## 12. Review (no narration)

**GOAL #1 REVIEW**

**Which of the following is a good example of adaptive equipment that promotes good ergonomic practice?**

- ➔ • Automated microtomes
- Electronic pipettes
- Posters that show proper posture
- Standing only workstations




## 13. Review (no narration)

**GOAL #1 REVIEW**

**Which of the following injuries among laboratory workers are commonly related to poor ergonomic practice?**


- Sprains, bruises, and fractures
- Burn injuries, amputations and muscle tears
- Puncture wounds, strains, and chemical burns
- ➔ • Tendonitis, Carpal Tunnel Syndrome, and back pain



14. Now you should have a basic idea of what ergonomics means, what representations you might associate with the term ergonomics and why attention to ergonomics is so important. Next, we want to learn how to identify areas within the lab that might lend themselves to poor ergonomic practice and specific tasks that might be likely to cause some of the musculoskeletal disorders and other injuries that we previously discussed.


**LEARNING OBJECTIVES – GOAL #2**

- The learner will be able to correlate common laboratory tasks with related injuries.
- The learner will be able to recognize the symptoms of common injuries associated with poor ergonomics.




15. In this picture, you can see a laboratory worker using a microtome. Notice that he is using a manual microtome with a hand crank. This repetitive motion can cause stress to the hand, wrist, elbow and shoulder. Long-term, some laboratory workers can develop injuries like tendonitis and carpal tunnel syndrome.

**MICROTOMES**




- Repetitive motion and the exertion needed to turn the crank stresses the hand, wrist, elbow and shoulder
- Carpal Tunnel Syndrome
- Tendonitis

<http://www.education.com/stock-photos/stock-photo/>



16. Embedding is the process of taking tissue specimens and placing them in a mold that will then be filled with wax to render the tissue stationary for cutting on a microtome. Embedding requires the use of fine motor skills and repetitive precision movement, which can cause injury to the hands and wrist. The embedding station is also an ergonomic problem area as it often lends itself to awkward positioning and low lighting. Awkward posturing can lead to chronic neck and back pain.

**EMBEDDING**




- Fine motor skills to handle small forceps
- Repetitive motion and precision movement can cause tendonitis in the hands and wrist
- Awkward seating at the workstation can promote stooping and awkward posture leading to chronic neck and back pain

http://www.researchgate.net/publication/272202107/figure/fig1/352940114/20160701.jpg

17. Pipetting shares some similar dangers with work at the embedding station. Notice in the picture the awkward positioning of this woman's neck, elbow and wrist as she pipettes. This can lead to injuries like tendonitis, back and neck pain, and repetitive stress injuries like Carpal Tunnel Syndrome.

**FINE MOTOR MOVEMENTS**




- Fine motor movements like pipetting can have the same dangers as embedding
- Tendonitis
- Back and neck pain
- Repetitive stress injuries like Carpal Tunnel Syndrome

http://www.researchgate.net/publication/272202107/figure/fig1/352940114/20160701.jpg

18. Microscopy is an often underestimated ergonomic problem area. Not only can awkward positioning at the microscope cause chronic pain in the neck, back, and extremities, but it can also lead to bothersome eye strain that can have long-term implications.

**MICROSCOPY**




**Wrong:**  
Neck bent  
Shoulders hunched  
Elbows out

[http://www.schirmer.com/ergo/ergo\\_micrscope1282](http://www.schirmer.com/ergo/ergo_micrscope1282)

- Poor form during microscopy OR performing microscopy for extended periods of stresses the neck, back, arms, wrist, elbows and eyes

19. Remember this guy? We are looking more closely at this image because it gives great examples of the different areas of your body that can be affected by poor ergonomic practice when using computers. Note that the diagram offers tips for how the user should position their body, but also addresses properly adjusting chairs and equipment for the benefit of the user. This is a great example of not only controlling your body in the work environment, but also manipulating the environment for the best benefit of the worker. Also noted on this slide is the issue of prolonged sitting. Even when working within the confines of proper ergonomics, it is important to change positions, stand, stretch and/or move around as often as you can.

**COMPUTERS**



- Prolonged sitting can stress the lower back
- Sitting or standing poorly placed equipment at a computer station can cause eye strain and pain in or injury to the extremities

[http://www.fruehauf.com/ergo/ergo\\_mvcomp1282](http://www.fruehauf.com/ergo/ergo_mvcomp1282)

20. Here is a short list of the “symptoms” of poor ergonomics. This list isn’t exhaustive, but it does contain some of the most common symptoms that workers should be aware of, including chronic or recurring pain during or after performing work tasks, increasing difficulty performing fine motor tasks and eye strain or vision problems. Eye strain, blurred vision, or dry and irritated eyes could be a symptom of a condition called Computer Vision Syndrome. The main point here is that any pain that you are concerned about should be taken seriously.

#### THE “SYMPTOMS” OF POOR ERGONOMICS

- Any chronic or recurring pain during work tasks
- Any chronic or recurring pain that continues after you have completed work tasks
- Difficulty using your hands for fine motor tasks
- Eye strain or vision problems (Computer Vision Syndrome)

21. Okay, so what should you do? First, you should evaluate your work environment and tasks for possible ergonomic improvements. If you do think you have suffered an injury, you should tell your employer right away. Your workplace may employ ergonomics experts that you can consult with. Lastly, if you have an injury that you think might be very serious or if you are experiencing any chronic pain that you are concerned about, you should see your doctor. Any chronic pain should be investigated and the earlier you identify and begin to treat a musculoskeletal disorder or other injury, the better.

#### BUT WHAT SHOULD YOU DO?

- Evaluate your work environment and tasks for possible ergonomic improvements
- Tell your employer right away
- If your workplace employs ergonomic experts, consult them. They are experts for a reason!
- See your doctor. Any chronic pain should be investigated. The earlier that you identify and are able to treat MSD’s or other related injuries, the better!

When you see your doctor, mention the specific nature of your work tasks. For example, you might want to tell your eye doctor that you perform microscopy for an extended amount of time if you have symptoms of eye strain.


Next, we’ll do another quick review so that you can see how much you learned about common ergonomic problem areas in the lab. As before, read the question and answer choices, and then click to see the correct choice.

## 22. Review (no narration)

**GOAL #2 REVIEW**

Fine motor skills are involved many different laboratory tasks. Which of the following lab areas utilize fine motor movements

- Microtomy an microscopy
- Microscopy and embedding
- • Embedding and pipetting
- Pipetting and microtomy



## 23. Review (no narration)

**GOAL #2 REVIEW**

Which injuries are most commonly associated with working at the embedding station?

- • Tendonitis in the hands and wrist from repetitive precision movement
- • Chronic neck and back pain from stooping
- Shoulder pain
- Eye strain




## 24. Review (no narration)

**GOAL #2 REVIEW**

What symptoms might a worker experience from poor laboratory ergonomics?


- Eye strain, tingling in the feet, increased urination
- Chronic back pain, temporary blindness, headache
- • Wrist pain, shoulder and elbow pain, eye strain
- Headache, lower back pain, lockjaw



25. Now that you've learned a little more about the ergonomic danger zones in the laboratory and the potential injuries they can cause, let's see if we can identify what proper vs. poor ergonomic practice looks like. This should help you to evaluate and demonstrate proper posture and positioning within your own work environment.

**LEARNING OBJECTIVES – GOAL #3**

- Given examples, the learner will be able to differentiate between proper and improper ergonomic practice.
- The learner will be able to demonstrate basic proper ergonomic posture and positioning in the work area.




26. First, let's look at a few comparison pictures. Based on what we have already talked about and on what you might be able to easily observe, I'd like for you to evaluate the following series of photos.

Which photo shows poor ergonomics? And what do you think is wrong with it?


This one is easy because the pictures are labeled! In the photo on the left, the woman is working with her neck, shoulders and elbows out of a neutral position. This means that she is working with her body at angles that are unnatural and can cause injury. In the photo on the right, she is demonstrating better posture by standing more upright, with her neck and shoulders at a more natural angle and keeping her elbows closer to her body.

**MICROSCOPY EXAMPLES**

**WHICH ONE IS CORRECT? WHY?**




**Wrong:**  
Neck bent  
Shoulders hunched  
Elbows out



**Right:**  
Head upright  
Elbows close to sides

<http://www.nihs.nih.gov/health/ergonomics/>

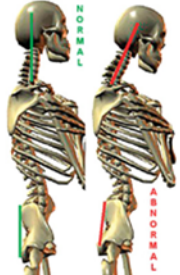






29. I like this illustration because it helps to see what proper spinal alignment looks like. You should attempt to keep proper spinal alignment whether you are sitting or standing. Other posturing tips include keeping your elbows close to the body and avoiding awkward bends at joints like the wrist and elbows. When possible, keep your feet flat on the floor to help with this positioning.

**BASIC POSTURE TIPS**




- Maintain proper spinal alignment, whether sitting or standing
- Keep elbows close to body
- Avoid bending wrists awkwardly, try to keep them in a neutral position
- Keep feet flat on the floor

http://www.aplab.com/wordpress/wp-content/uploads/2007/10/190101.jpg

30. When sitting, it is important to adjust your chair to the correct height and to adjust other controls to be conducive to maintaining proper spinal alignment. When sitting at a workstation, you should have ample legroom that will allow you to move closer to your equipment so that you don't have to overextend or strain to reach it.

**BASIC WORKSTATION/CHAIR POSITIONING**




- Modify chair or workstation height to meet your needs
- Ensure that you have adequate legroom that allows you to sit closely to your equipment
- Adjust seat and back of chair to promote good posture

http://www.aplab.com/wordpress/wp-content/uploads/2007/10/190101.jpg

31. When performing fine motor tasks, make sure that you are maintaining good posture and neutral positions of your limbs. Adjusting workstations or chairs to the correct height should help you to accomplish this. If you can, alternate hands or fingers that you are using to hold small objects. Notice the alternative positioning of the forceps in this picture. While I think this change would be difficult to master, it is just one idea that could help. Finally, take breaks. Take a moment to move, stretch or stand whenever possible. This can help prevent discomfort and injury.


**FINE MOTOR MOTIONS TIPS:**



- Perform work at the correct height
- Avoid awkward bends at the joints in your back, neck and wrists
- Take breaks
- Practice alternating hands or which fingers you use to hold small items like forceps

32. These tips are helpful for when you are using a computer or microscope, or working with small objects or equipment. Take short breaks occasionally. Close your eyes or focus on something in the distance. When performing microscopy, utilize programs and hardware that can project onto a computer screen to reduce the use of binocular eyepieces. This can help prevent eye strain AND also help with posture.

**VISION TIPS**



- Short breaks to close your eyes or focus on something in the distance.
- When possible, use programs/ hardware that project onto a computer screen




## 35. Review (no narration)

**GOAL #3 REVIEW**

**When setting up your workstation, you should consider the following:**

- Proper workstation height and frequency of use of equipment and items
- Workstation depth and alternating the hand you write with
- Room to stretch and how old you are
- Where to place your pictures and how well you can see them




## 36. Review (no narration)

**GOAL #3 REVIEW**

**When performing fine motor tasks, you should:**

- Take frequent breaks, adjust your lighting and bend over to be close to the work
- Alternate the position of your equipment in your hands, take frequent breaks, maintain good posture
- Keep items nearby, work with larger specimens or squint your eyes to see smaller specimens better
- Raise your workstation higher than normal to be close to the specimens




## 37. Review (no narration)

**GOAL #3 REVIEW**

**When setting up any type of workstation, why should you put some items farther away than others?**

- To maintain feng shui
- So that it doesn't get too cluttered and messy
- So that you can keep your elbows close to your body at all times
- Because some items are not used as often as others and should not obstruct frequent movements



38. So, here are some final tips. Use available ergonomically designed equipment when it is available. Refer to the OSHA website and other official websites that provide ergonomic tips for workers. Seek out resources from your employer. They may have ergonomic specialists available to assist you.

#### SOME FINAL TIPS:

- Use available ergonomically designed equipment when it is available.
- Refer to the OSHA website and other official websites that provide ergonomic tips for workers.
- Seek out resources from your employer. They may have ergonomic specialists available to assist you.



39. Arrange work spaces in a way that is comfortable for you. Be aware of proper ergonomics. Try to identify areas where you could improve or might benefit from adjustments. And, last but not least, practice! Changing your behavior and/or environment can be hard to get used to. Just remember the benefits of making those changes.

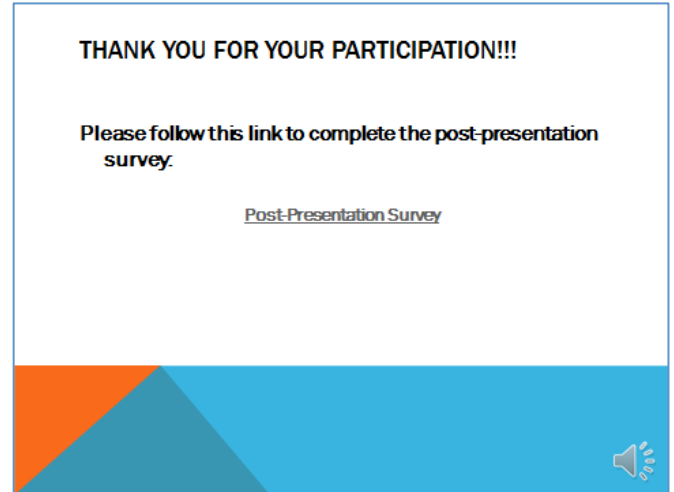
#### SOME FINAL TIPS:

- Arrange work spaces in a way that is comfortable for you. For examples, avoid excessive reaching for often used items.
- Be aware of proper ergonomics. Try to identify areas where you could improve or might benefit from adjustments.
- Practice! Changing your behavior and/or environment can be hard to get used to. Just remember the benefits of making those changes.



40. On this screen, you should see the link for the post-presentation survey. This short survey will assess how much information you may have learned, how it was presented, and will ask for any additional comments that you would like to add. As I mentioned at the beginning of the presentation, the surveys are anonymous and confidential. Your feedback is appreciated and will be used to improve this presentation and my skills as a presenter.

Thank you once again for your time and participation. I hope that this presentation has been, and will continue to be, helpful for you as you navigate your career as an anatomic pathology lab professional.



**THANK YOU FOR YOUR PARTICIPATION!!!**

Please follow this link to complete the post-presentation survey.

[Post-Presentation Survey](#)

#### 41. References (no narration)



**REFERENCES**

- [http://ehs.uky.edu/docs/pdf/ohs\\_erg\\_ergonomics\\_guide\\_0001.pdf](http://ehs.uky.edu/docs/pdf/ohs_erg_ergonomics_guide_0001.pdf)
- <http://ehs.okstate.edu/kopykit/erjb.htm>
- <http://www.chem.purdue.edu/chemsafety/safetyclass/injury/lecture/LabErgo.htm>
- [http://www.ors.od.nih.gov/es/dohs/HealthAndSafety/Ergonomics/atwork/Pages/erjb\\_computers.aspx](http://www.ors.od.nih.gov/es/dohs/HealthAndSafety/Ergonomics/atwork/Pages/erjb_computers.aspx)
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