

Running head: FUN ANATOMY A SUPPLEMENTAL WEBSITE

Fun Anatomy: A Supplemental Website for the Upper Extremity

May 15, 2014

This project, submitted by Kristen Norberg, Helen Groffman, and Kristi Ng, has been approved  
and accepted  
in partial fulfillment of the requirements for the degree of  
Master of Occupational Therapy from the University of Puget Sound.

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### **Abstract**

In accordance with the Accreditation Council for Occupational Therapy Education (ACOTE) standards, the occupational therapy program at the University of Puget Sound requires the completion of an anatomy course as part of the master's degree curriculum. Currently, the program's functional anatomy course does not provide any online resources to support students' mastery of course content. Due to advances in technology, an increasing number of professional degree programs are either web-based or are adding online elements (Donovan, 2008; Friedman, Watts, Croston, & Durkin, 2002; Fallon, 2011). Course-specific online resources have been shown to enhance student learning and performance (Thompson, Ford, & Webster, 2011). A customized supplemental website was created to accompany the functional anatomy course as a learning enhancement. The website includes diagrams, flash cards, quiz questions, case studies, and additional resources. The various elements of the website were developed to address different learning styles and to cycle students through the stages of Kolb's model of experiential learning (Kolb, 1984; Friedman, Watts, Croston, & Durkin, 2002). The goal of the website is for the user to achieve a 90% standard on the quizzes and case study questions, which is higher than the university graduate school's 83% (3.0 GPA) requirement to maintain good standing. Use of the website in a pilot study by a sample group of the program's students resulted in 100% positive recommendation for its use as a resource in the functional anatomy course.

### **Introduction**

As outlined in the Accreditation Council for Occupational Therapy Education (ACOTE) standards, students of occupational therapy must complete an anatomy course that covers content on biology, anatomy, physiology, neuroscience and biomechanics (ACOTE, 2012). Having a strong foundation in anatomy is essential for understanding and success in future courses in the

University of Puget Sound's (Puget Sound) occupational therapy (OT) program. In an interview with Jenny Ikard, a recent graduate of the OT program at Puget Sound, she stated that as a first-year student she studied anatomy using supplemental websites. Ikard specifically sought out websites that provided flashcards containing anatomy material. Though these resources were helpful to Ikard, she stated that they were not the most effective study tools because the information was not specific to the program's functional anatomy course, and thus did not support the level of detail necessary for the field of occupational therapy (J. Ikard, personal communication, Feb 2013). Ikard's experience demonstrates that students enrolled in the functional anatomy class may seek resources outside of the course to get a better understanding and mastery of course content. Available resources that specifically parallel content learned in the Puget Sound program's anatomy course would assist students in making stronger connections to the course material, as the information would be tailored to satisfy their specific learning needs.

Online learning is widely used throughout higher education. Given the prevalence of online learning, it is appropriate to consider online tools as a useful educational resource within the program at Puget Sound. The Puget Sound anatomy website will provide the necessary information that other websites lack by being specifically tailored to the functional anatomy course that students are required to take in their curriculum.

## **Background and Literature Review**

### **Trends in Education**

As the millennial generation has matured and technology has progressed, education has incorporated technology in new ways. Higher education has seen an increase in the number of programs that are either entirely online or that offer online courses. A literature review of the use

of technology and online tools within higher education revealed that current discussions in higher education include the effective use of well-designed online tools and methods in lectures and courses (Barbour, 2007; Duckett 2011; Thompson, Ford & Webster, 2011; Donovan, 2008). In 2007, an estimated 4 million students were involved in some form of online education (Allen & Seaman as cited in Kirtman, 2009). Further, this educational trend has been noticed in the political arena. Congress recently gave \$2 million to higher educational institutes to fund development of online educational tools (Obama, 2009). Additionally, professional organizations such as the American Occupational Therapy Association (AOTA) support the use of online educational tools within occupational therapy curricula (American Occupational Therapy Association, 2010).

Due to advances in technology, an increasing number of professional degree programs are either web-based or are adding online elements (Donovan, 2008; Friedman, Watts, Croston, & Durkin, 2002; Fallon, 2011). There are several reasons why more programs are moving toward web-based learning, such as offering students flexibility in how and when they learn, making distance learning easier, cutting down on commute costs, and keeping up with technological advances (Friedman, Watts, Croston, & Durkin, 2002; Fallon, 2011).

### **Hybrid Learning in Higher Education**

Educational programs use online resources in a variety of ways; for example, resources can either be supplemental to a course, or students can take a course entirely online instead of attending lecture. “Hybrid learning” (Olapiriyakul & Scher, 2006) is the combination of online and lecture taught classes. While the general consensus regarding entirely online courses is that they are no more or less effective than the traditional in-class lecture (Cooper as cited in Ury,

2004), research into effectiveness of hybrid courses has shown that they facilitate student learning for all student participants in the hybrid learning group (Kumrow, 2007).

Hybrid learning is popular for several reasons: it is cost effective for universities, students appreciate the ability to access course information when and where they want, and some students learn better by having information presented in a variety of formats. The majority of students in an online survey reported that online learning is an important part of their education (Roach as cited in Ury, 2004). Additionally, students prefer multisensory approaches and multiple modes of learning to enhance their learning of complex course material (Lujan & DiCarlo, 2006; Thompson, Ford, & Webster, 2011). Providing an online component to a traditional course has the possibility of meeting the learning style needs of more students than when using traditional methods alone because the information is being presented through multiple modes (Lujan & DiCarlo, 2005).

Anatomy students recognize that the hybrid learning format improves their ability to learn the material. A recent study found that students who had used an online component to their anatomy course reported on a questionnaire that the online resource had improved their learning. The key to this success, however, depended on the specific anatomy resource used. The students preferred resources that were either tailored to their course or that the instructor had selected as a relevant source (Johnson, Palmer, Burton, & Brockhouse, 2013). This suggests that online anatomy resources are most effective when they closely accompany the lecture content for the course.

Online educational resources are effective, as they have been shown to improve learning of course material. According to Thompson, Ford and Webster (2011), occupational therapy students increased their learning of complex neurological concepts by using supplemental

videos, web-based instruction, and online interactive games. Notably, 73% of the participants increased their post-test scores after using the supplemental modes during the test period (Thompson, Ford, & Webster, 2011). Based on this evidence, creating a functional anatomy supplemental website can be expected to enhance mastery of the anatomy course content for occupational therapy students.

High quality online tools also help health sciences students improve their retention of anatomy material (Rondon, Sassi, & Furquim de Andrade, 2013). A recent study specifically looked at the learning outcomes of health sciences students enrolled in an anatomy course who used a computer game-based online resource to study the course content. These students performed better than the traditional learning group on post-tests both immediately after the learning session and one month later (Rondon, Sassi, & Furquim de Andrade, 2013). This suggests that the computer game format increases knowledge retention for at least one month.

### **Experiential Learning Model**

Adult learning theories provide a framework to understand how interactive websites can contribute to educational programs (Ruthford-Hemming, 2012). Adult learners differ in learning style from children in the sense that adult learners tend to be more self-directed, have life experience from which to draw connections to learning material, and often need to solve a problem (Ruthford-Hemming, 2012). One framework for understanding adult learning theory within graduate programs is Kolb's experiential learning model. Kolb postulates that learning is a dynamic convergence among four modes of learning: active experimentation, concrete experience, reflective observation, and abstract conceptualization (Kolb, 1984; Friedman, Watts, Croston, & Durkin, 2002). According to Kolb (1984), active experimentation is when students use theories to solve problems. Concrete experience occurs when students are actively involved

in a new experience. Reflective observation is the process of watching others perform a task, or thinking critically about one's own ability to perform a task. Lastly, abstract conceptualization is the process of creating theories to explain observations.

The curriculum design for Puget Sound's occupational therapy program is highly influenced by Kolb's model of experiential learning. Kolb (1984) postulates that the process through which adults learn requires dynamic interaction of these four modes, ultimately leading to a higher and multifaceted level of understanding in which all four modes are reflected. Kolb's model is most effective if the students cycle through this learning spiral often so that different learning styles can engage with all aspects of the model (Friedman, Watts, Croston & Durkin, 2002).

Additional attractive elements of websites are components that are interactive and provide simulation. Simulation learning allows students to practice clinical skills through fine-tuning their techniques and correcting mistakes without causing harm to patients (Ruthford-Hemming, 2012). Websites can capitalize on how students learn through simulation activities by providing case studies to develop clinical reasoning abilities, which are essential for the effective practice of occupational therapy.

### **Effective Website Design Elements**

Websites have functions that can assist student learning through a variety of means such as providing instant feedback, interactive learning games, and providing links to resources. Integrating online educational websites to supplement a student's learning of material previously presented in a lecture is a strategy that helps students learn and also improves their grades (Thompson, Ford, & Webster, 2011). In research conducted by Thompson, Ford and Webster (2011) on the ways in which websites assist neuroscience students' understanding of material, it

was found that the relevancy of the website material to course lectures, clear presentation of material, and the ease of use of interactive games were all positive factors in student perceptions of computer-aided learning.

For the Puget Sound anatomy website to be effective, it is necessary to look at what design elements of a website foster learning. In order to create an effective supplemental website for the Puget Sound OT students, thought must be given to how to engage students through interactive elements (Whitton, 2011) while providing opportunities for different learning styles to connect to course material (Kolb, 1984). Website designers and educators agree that simpler designs are more effective because they allow the user to navigate through the site without becoming distracted or frustrated (Barbour, 2007; Duckett 2011). Navigation, clear presentation of material, and understanding the target audience are fundamental elements of effective websites. Designers must also be cautious of overusing multi-media in a distracting manner (Barbour, 2007; Duckett 2011).

**Game engagement as experiential learning.** A recent trend in education has been research regarding the effectiveness of educational games, or game theory, within online learning. Whitton (2011) argues that engaging games facilitate learning since they keep students motivated and interacting with the material. This idea dovetails with Kolb's model of adult learning, which postulates that adults learn by becoming engaged with material, especially if there is an internal motivation to learn the material (Kolb, 1984). In particular, opportunities to reflect critically have been found to foster the ability to make connections with experiences and events from different perspectives (Mouza, 2011). This finding supports Kolb's model of experiential learning. Allowing adults to make connections to material in a reflective manner strengthens their connections to the material (Mouza, 2011).



Since students are not always engaged or interested in the material that they are learning, focusing on using engaging entertainment computer game techniques can facilitate learning in a higher education setting (Rondon, Sassi, & Furquim de Andrade, 2013; Whitton, 2011). There is, however, a delicate balance between keeping students engaged in material without distracting them from studying or learning with elaborate graphics (Barbour, 2007).

### **Curriculum for Puget Sound's Occupational Therapy Program**

The Puget Sound occupational therapy curriculum is based on ACOTE standards, and to that end, includes a functional anatomy course (ACOTE, 2012). In addition to being based on ACOTE standards, the overall curriculum design for the program is influenced by education models. A key philosophical underpinning of the curriculum design is Kolb's experiential learning model. Since the website will enable the first year students to build on their mastery of course content while exploring other methods for improved knowledge retention and critical thinking, the website will support the Puget Sound curriculum design philosophy by serving as a supplement to the existing Puget Sound education program.

In congruence with the philosophy of the program, the website will assist in knowledge retention by enabling students to interact via different methods with the anatomy course material. The website will provide reflective and repetitive components in the quizzes and case studies, both of which will allow students to synthesize and apply the anatomy material at a deeper level. As found by Rondon, Sassi, and Furquim de Andrade (2013), website-based learning has a carry over effect for at least one month.

As stated in the curriculum framework, the "curriculum design reflects an approach to teaching and learning that relies upon both classroom and community experiences to support students' mastery of content and ability to 'think like an occupational therapist'." (Occupational

Therapy Program, 2011). The curriculum design relies on the assumption that learning experiences take place in and out of the classroom. The website supports the philosophy behind that assumption because it will enable students to actively interact with material outside of the classroom, which will enhance students' mastery of content. Having a supplemental website that supports the curriculum design philosophy will contribute to enhancing student success in the program.

**First year students.** Since the website will be tailored to the Puget Sound functional anatomy course, it will directly target first-year students. Learning is the primary area of occupation for the first year students, and as such, their performance patterns and client factors revolve around the educational environment. Learning styles, study habits, and environments all support the occupation of learning (American Occupational Therapy Association, 2008). Ideally, a supportive and inclusive educational environment engages students and allows them to interact with material in multiple ways. The proposed website will allow students with different ways of perceiving and processing information to engage with course material within the functional anatomy course, thus enabling them to maximize their occupational performance in education.

### **Purpose Statement**

The purpose of this project is to develop a supplemental website for the OT 605 functional anatomy course that first year Puget Sound occupational therapy students can use to facilitate learning, synthesize information, and increase knowledge retention of material for the upper extremity.

### **Procedure**

The website designers began by gaining knowledge of effective website design through reading literature pertaining to the subject and through active experimentation using the Weebly

web design. Discussions with key individuals from the Puget Sound library and technology services assisted in formulating design ideas and deciding where to find appropriate images. Those design ideas, along with previous literature reviews, were used to determine how to effectively formulate the learning activities during the website creation process. Flash cards, quiz questions, and case studies were generated using prior knowledge and resources from the functional anatomy course. Those learning activities were edited with feedback from the anatomy professor. Once the learning activities were finalized, the website was assembled. By librarian recommendation, historical anatomy images were chosen for the website to avoid copyright infringement. An image citation list was compiled and looked over by the librarian before the citations were added to the website. Additional resources were chosen based on peer recommendations and suggestions from the AOTA website.

After the website was created, a small pilot study questionnaire was sent to first and second year students (see Appendix A). The objective of the pilot study was to determine website ease-of-use and effectiveness of learning activities, as well as provide an overall design critique. Nine students were recruited, on a volunteer basis, to pilot the website and seven filled out response forms. Seven out of seven respondents indicated that if they had had access to the website during the time period they took the functional anatomy course, they would have used it. Feedback on the response form indicated that the respondents thought the website content related well to the course material and they appreciated another source to use when studying. One respondent stated, "...the more different ways you can expose yourself to the material the better." Additional feedback from the respondents indicated that they found the website to be a relevant supplemental source but would not replace the current course resources. Two

respondents indicated that they would appreciate more interactive images and automatically-graded quizzes. Adjustments were made to the website using this feedback from the pilot study.

The following are skills and knowledge that were developed in order to successfully complete the project:

- website design skills (i.e. using Weebly);
- knowledge of how to layout websites;
- active listening skills to increase the ability to listen to other members' and students' input;
- collaboration skills to work together effectively in creating the website;
- writing skills;
- knowledge of how to write effective quiz and case study questions;
- problem-solving skills to solve problems creating the website that may arise;
- research skills to provide evidence-based content;
- understanding of copyright, especially concerning images;
- knowledge of the Occupational Therapy Practice Framework;
- knowledge of Kolb's experiential learning model;
- knowledge of APA format.

### **Overview of Project**

The functional anatomy supplemental website was designed to accompany the two units of the functional anatomy course that cover the proximal and distal upper extremity. The website includes sections with content focused on the three main segments of the upper extremity: shoulder and elbow, forearm, and wrist and hand. Each section of the website has components designed to facilitate learning and that will complement different styles of learning. The elements

included in the modules are diagrams, flashcards, quizzes, and case studies. There is also a page with links to other websites and resources that can be used as additional study tools.

Diagrams included in the sections are copies of the various diagrams provided in the course manual and are available in JPG format. This allows students to print additional copies for practice or review as needed. The four diagrams included are: the brachial plexus, the carpal tunnel, the flexor pulley system/dorsal apparatus, and the wrist osteology. The diagrams are hand-drawn and stylized differently than those in the course manual so as to prevent copyright infringement.

Sets of flashcards will allow students to organize facts in a concise manner for more efficient learning of material (see Appendix B for an example). The flashcards will also provide an additional way for students to quiz themselves and will be made available for the students to print.

Each section contains a quiz that includes questions about the upper extremity content (see Appendix C for an example). Some questions are basic and simple in nature, while others require more complex clinical reasoning skills. Finally, there are several case study questions about the upper extremity that focus on the anatomical substrate of various conditions and pathologies typically encountered in occupational therapy (see Appendix D for an example). This section provides opportunities for processing information in active experimentation and abstract conceptualization methods, which are aspects of Kolb's model that students would benefit from additional practice with. The quizzes and case studies provide early practice for taking a computer-based test, which is important, as the National Board for Certification in Occupational Therapy (NBCOT) exam is also computer-based. The quizzes and case studies are self-graded and answer keys are provided for each.

The website was created to target the needs of first year occupational therapy students taking the anatomy course at Puget Sound. Attending lecture is necessary to gain a basic understanding of anatomy material. However, the flashcards, diagrams, and quizzes enable students to gain a higher level of mastery of the course material. Furthermore, the case studies allow the students to interact with material on a clinically applicable level. A supplemental website facilitates learning by helping to improve mastery of the course content, as well as assisting the first year students to establish a strong base of anatomy knowledge to apply in future courses.

### **Project Goal and Objectives**

After using the functional anatomy supplemental site's diagrams, flashcards, quizzes and case studies as a study aid, students will:

#### **Goal 1**

Be educated about muscles of the upper extremity, specifically their attachments, actions, and nerve innervations.

**Objective 1.** Students will be able to correctly identify muscle attachments of the upper extremity with 90% accuracy as determined by self-scoring after using online answer key.

**Objective 2.** Students will be able to correctly identify muscles actions of the upper extremity with 90% accuracy as determined by self-scoring after using online answer key.

**Objective 3.** Students will be able to correctly identify the nerve innervations for the muscles of the upper extremity with 90% accuracy, as well as independently recreate a schematic drawing of the brachial plexus as determined by self-scoring after using provided diagrams.

**Goal 2**

Be able to apply information learned in the anatomy course to answer questions in a clinical context through reflective questions on quizzes and case studies.

**Objective 1.** Students will complete reflective questions on quizzes to improve awareness of performance as students of functional anatomy.

**Objective 2.** Students will develop clinical reasoning skills through correctly answering case study questions with 90% accuracy as determined by self-scoring after using the online answer key.

These objectives are assessed through the completion of self-graded quizzes and case studies to determine the students' knowledge of the anatomy of the muscles of the upper extremity, their attachments, actions, and nerve innervations. The students are held to a 90% standard as that is sufficiently above the 83% (3.0 GPA) required of students to maintain degree candidacy in the graduate program at Puget Sound and demonstrates a higher level of mastery of the material.

**Implications for occupational therapy**

Kolb's model is reflected in the occupational therapy process as outlined by the Occupational Therapy Practice Framework: Domain and Process II (OTPF II) (American Occupational Therapy Association, 2008). Aspects of Kolb's experiential learning model can be seen in how occupational therapists work through the treatment process. Occupational therapists use active experimentation when collaborating with clients to formulate interventions that work well for the clients. Concrete experience is built over time through treatment sessions while working with clients. Occupational therapists develop reflective observation skills during the intervention review phase of a client's treatment process. Abstract conceptualization occurs as

occupational therapists use client factors and evidence-based practices to inform treatment sessions and to find treatments that address client goals.

The curriculum at Puget Sound is designed to eventually take the students through Kolb's model, course by course. Providing an opportunity for students to cycle through all elements of the model while in the functional anatomy course will aid in transferability of learned material. Currently, the functional anatomy lab provides an opportunity for students to gain concrete experience by utilizing cadavers and models. Abstract conceptualization occurs throughout exam questions as students are expected to take the basic knowledge learned in class and apply it to solving more complex questions. As of the moment, the reflective observation component of the model occurs primarily in later courses such as adult neurological disorders, in which students are expected to reflect on previously learned anatomy material.

The supplemental functional anatomy website will provide an opportunity for students to cycle through Kolb's model while in one course, thus enabling student-centered participation in learning. The website provides opportunities for both reflective observation and abstract conceptualization. Reflective observation will be accomplished through applying information that students learn in class to case studies, thereby increasing their understanding of the material. Each quiz contains questions prompting the students to both predict and reflect on their performance on the quiz before viewing the answers in order to complete the reflective observation component of performance and mastery of the material. Abstract conceptualization will also occur when students work through case studies and create hypotheses about possible solutions. Abstract conceptualization is an important skill that students will use as occupational therapists, and having more opportunities to practice this skill through case studies will contribute to enhancing their clinical reasoning skills.



The primary occupation of students is learning. Three domains influence engagement in this learning: the environment, client factors, and performance patterns. These domains are interlinked in supporting students' success in learning. The website will expand upon the classroom environment by adding a virtual component to the anatomy learning environment. The virtual environment is important because it will provide an additional way to study the anatomy content. In turn, this will support client factors such as different learning styles. Providing another approach for students to study may also impact performance patterns such as study habits. The website will help students fully engage with the material in order to maximize their occupational performance (American Occupational Therapy Association, 2008).

#### **Limitations for this project**

A limitation of this project is that it only contains the content for the upper extremity rather than the entire body. Due to time constraints when creating this project, the authors were unable to include information for the whole body. The upper extremity was chosen because it is of interest to occupational therapists who target that region of the body as a clinical focus of their profession.

An additional limitation of this project is that it is a public website that anyone can access. Due to the size of the website, the university was not able to house the project. This means that the website cannot be password protected, which limits the amount and type of information that can be put on the website due to copyright concerns.

A further limitation of this project is that the quizzes are self graded rather than automatically graded. Due to budget limitations and further research required to create automatically graded quizzes, that feature was beyond the scope of this project.

### **Recommendations for the future**

The authors recommend that a future project could extend the material covered in the website to include content from other body regions that are covered in the course. A future project could also include more interactive features such as automatically graded quizzes. Finally, the authors recommend that additional research be completed to determine if the website could be password-protected in order to expand the amount and type of information on the website.

### **Sustainability of the project**

In light of the fact that the organization of the anatomy course, as well as its specific details, may change when taught by a different professor in the future, the sustainability of this website project as now structured is limited to the time frame of the current instructor. The current instructor will post a link to the course Moodle page and department Moodle page for students to access the website. The password and login information will be left with the current professor for potential future editing purposes.

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## Appendix A

## Pilot Survey

Please share your thoughts on the anatomy website with us:

1. Did you view this website on your phone or computer?
2. How easy did you find it to navigate the website? If you experienced difficulties, please describe them.
3. Did all of the links work as expected?
4. What are your thoughts on the images used?
5. Please list comments for the Shoulder complex here, included thoughts about how hard/easy the case studies and quiz are:

Please list comments for the forearm here, included thoughts about how hard/easy the case studies and quiz are:

Please list comments for the wrist and hand here, included thoughts about how hard/easy the case studies and quiz are:

6. How well do you feel the content on the website relates to the course material

(1= does not relate, 5= relates very well)

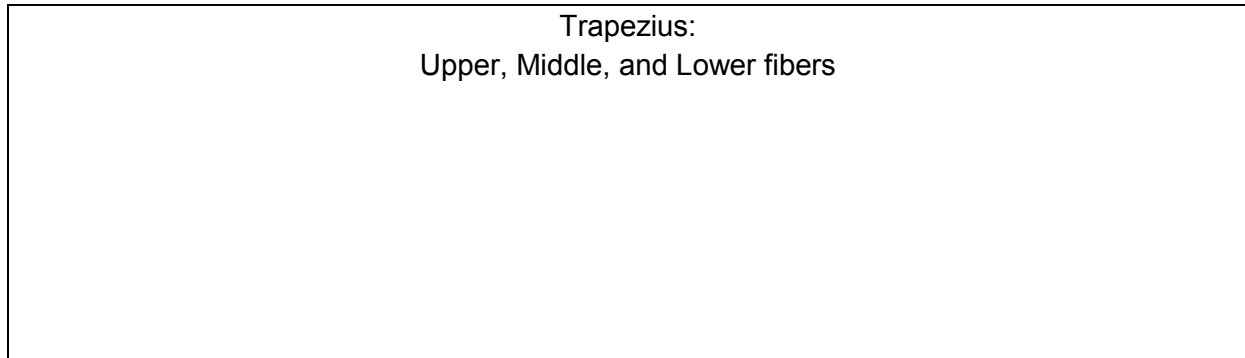
1 - 2- 3- 4- 5

7. If you had this website as a resource available when taking the anatomy 605 class, would you have used it?

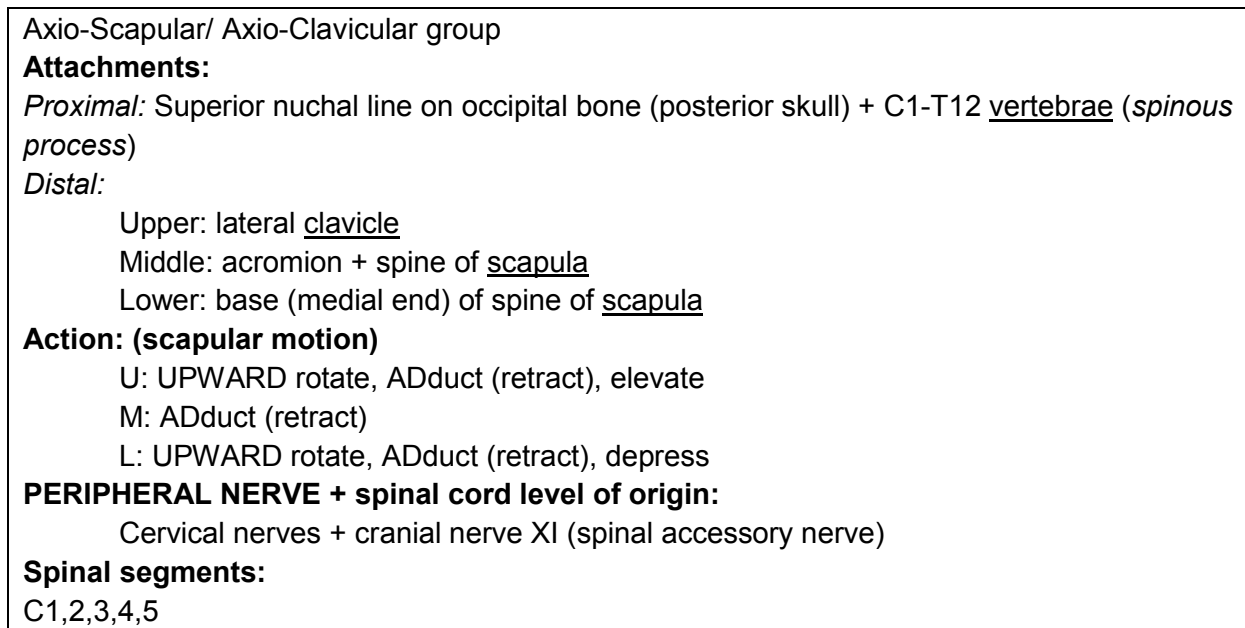
## Appendix B

## Shoulder Complex Flash Card Sample

Front



Back





## Appendix C

## Forearm Quiz Questions

1. Which of the following muscles has its distal attachment at the base of the distal phalanx of digits 2-5?
  - a. Flexor digitorum superficialis
  - b. Flexor digitorum profundus
  - c. Flexor pollicis longus
2. (T/F) The median nerve passes between the two heads of the Pronator teres.
3. Which tendon at the wrist (in anatomical position) is most medial?
  - a. Extensor digiti minimi
  - b. Extensor digitorum
  - c. Extensor carpi radialis brevis
4. State which nerve innervates the Abductor pollicis longus muscle:  

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5. If a bullet was shot through the forearm, in an anterior to posterior direction in its proximal 1/3 close to the midline, (with the arm in the anatomical position), what is the correct combination and order of muscles that the bullet will pass through?
  - a. Palmaris longus, Flexor digitorum superficialis, Flexor digitorum profundus
  - b. Palmaris longus, Flexor digitorum profundus, Flexor digitorum superficialis
  - c. Pronator quadratus, Flexor digitorum superficialis, Flexor digitorum profundus
  - d. Flexor carpi ulnaris, Flexor pollicis longus, Flexor carpi radialis
6. State the specific spinal segments that contribute to the innervation of the Extensor digitorum:  

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7. What nerve passes between the two heads of the Flexor carpi ulnaris?
  - a. Median
  - b. Ulnar
  - c. Radial
8. (T/F) Flexor digitorum superficialis flexes the DIP of digits 2-5.
9. State the distal attachment of the Extensor carpi radialis longus.
  - a. Base of the 3rd metacarpal
  - b. Base of the 5th metacarpal
  - c. Base of the 2nd metacarpal
  - d. Dorsal apparatus of digits 2-5
10. What is the primary action of the Extensor digiti minimi?
  - a. Extend MP of 4th digit
  - b. Extend DIP of 5th digit
  - c. Extend MP of 5th digit
11. (T/F) The primary action of the Flexor pollicis longus is to flex the IP joint of the thumb.
12. What is distal attachment of Extensor pollicis brevis?
  - a. Base of 1st MC
  - b. Base of proximal phalanx of thumb
  - c. Base of distal phalanx of thumb
13. State the two distal attachments of the Flexor carpi ulnaris:  

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## Forearm Quiz Answer Key:

1. (B) Flexor digitorum profundus
2. True, the median nerve passes between the two heads of the Pronator teres.
3. (A) Extensor digiti minimi
4. Radial nerve innervates the Abductor pollicis longus muscle
5. (A) Palmaris longus, Flexor digitorum superficialis, Flexor digitorum profundus
6. C6, 7, 8
7. (B) Ulnar
8. False, flexes PIP of digits 2-5
9. (C) Base of 2nd metacarpal
10. (C) Extends MP joint of 5th digit
11. True, the primary action of the Flexor pollicis longus is to flex the IP joint of the thumb.
12. (B) Base of proximal phalanx of thumb
13. Hook of hamate and base of 5th metacarpal

## Appendix D

## Intrinsic Hand Case Study 1

Three months ago, Mr. Jay injured his right elbow in a warehouse accident at work. He has been receiving occupational therapy twice a week for six weeks. While Mr. Jay has seen significant functional improvement, he still experiences some tingling and a variety of weaknesses in his right hand. For example, he has difficulty flexing the MP joint of digits 2-5. He feels tingling on the palmar surface of the hand from the wrist distally to the tip of digit 5 and the medial side of digit 4. The tingling also occurs on the dorsal surface of the hand from the wrist for the length of digit 5 and the medial side of the first two phalanges of digit 4.

1. Does Mr. Jay's sensory pattern follow a dermatomal distribution or peripheral nerve distribution pattern?  

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2. In which intrinsic hand muscle group will *all* the muscles be affected?
  - a. Thenar group
  - b. Hypothenar group
  - c. Palmar group
3. In addition to flexion of MP joint 5, what other movement(s) will be difficult for Mr. Jay?
  - a. Extension of IP joints of 5<sup>th</sup> digit
  - b. Flexion of MP joint of 1<sup>st</sup> digit
  - c. Abduction of MP joint of 5<sup>th</sup> digit
  - d. Both a and b
  - e. Both a and c

4. Which nerve did Mr. Jay injure?

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5. (T/F) Mr. Jay's injury will impact ulnar and radial deviation at the MP joint of digit 3.

### Intrinsic Hand Case Study Answer Key

#### Case Study 1

1. Peripheral Nerve Distribution Pattern
2. (B) Hypothenar group
3. (E) Extension of IP joint of 5<sup>th</sup> digit and abduction of MP joint of 5th digit
4. Ulnar Nerve
5. True

Mr. Jay injured his ulnar nerve as a result of the accident. Even though the injury occurred in the elbow, the majority of effects of the nerve damage are experienced in the hand.