

The Muscular System

I. Introduction

A. The three types of muscle in the body are _____
_____.

B. This chapter focuses on _____.

II. Structure of a Skeletal Muscle

A. Each muscle is an organ, comprised of skeletal muscle tissue, _____
_____.

B. Connective Tissue Coverings

1. Layers of _____ connective tissue (_____),
surround and _____.

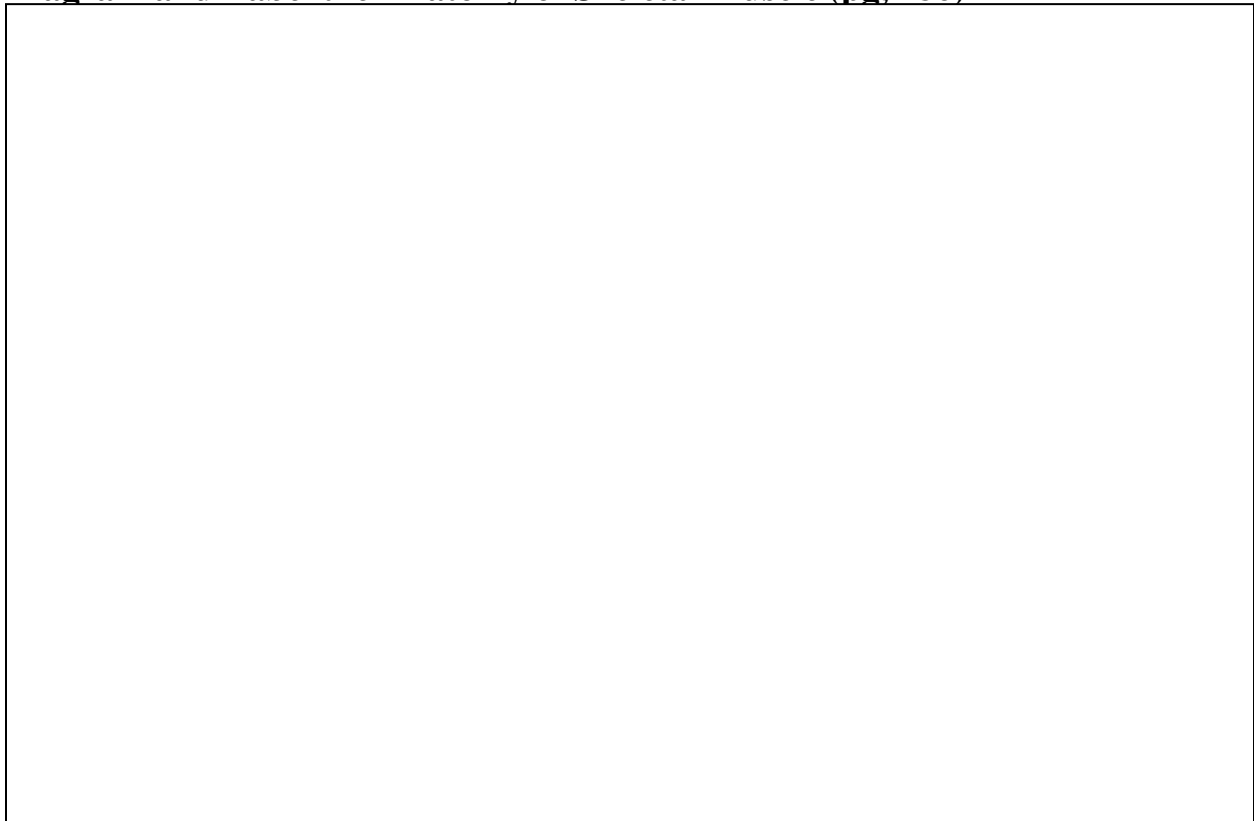
2. Fascia extends beyond the ends of the muscle and _____
_____ that are fused to the _____
of bones.

3. Sometimes tendons are broad sheets of connective tissue called
_____.

4. The layer of connective tissue around each whole muscle is the

a. the _____ surrounds individual
bundles (_____) within each muscle.
b. each muscle cell (_____) is covered by a
connective tissue layer called _____.

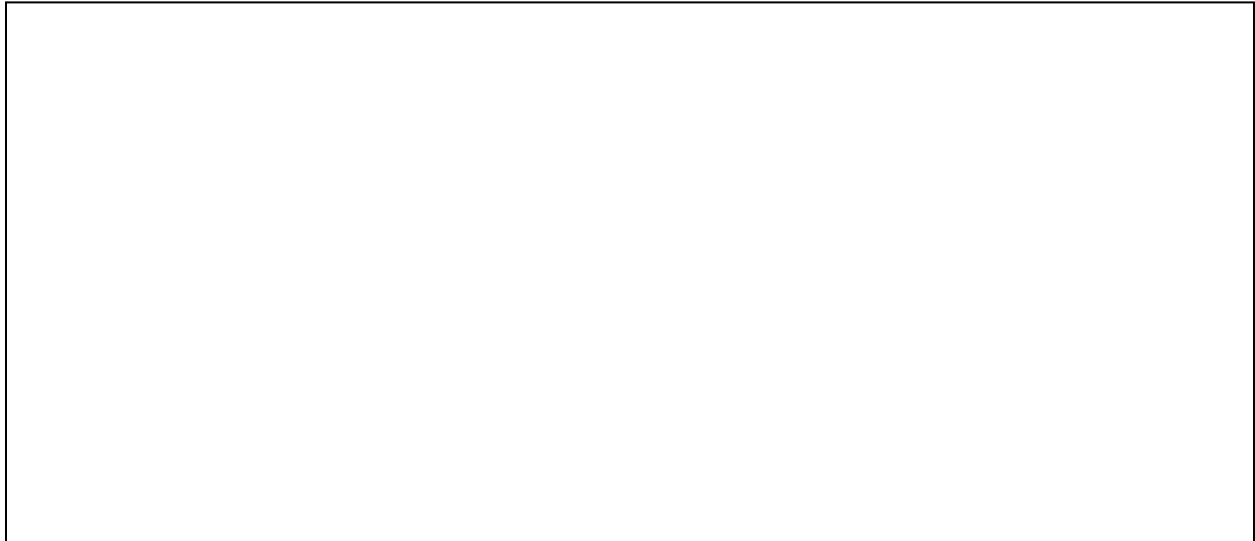
Diagram and Label the Anatomy of Skeletal Muscle (pg, 186)



C. Skeletal Muscle Fibers

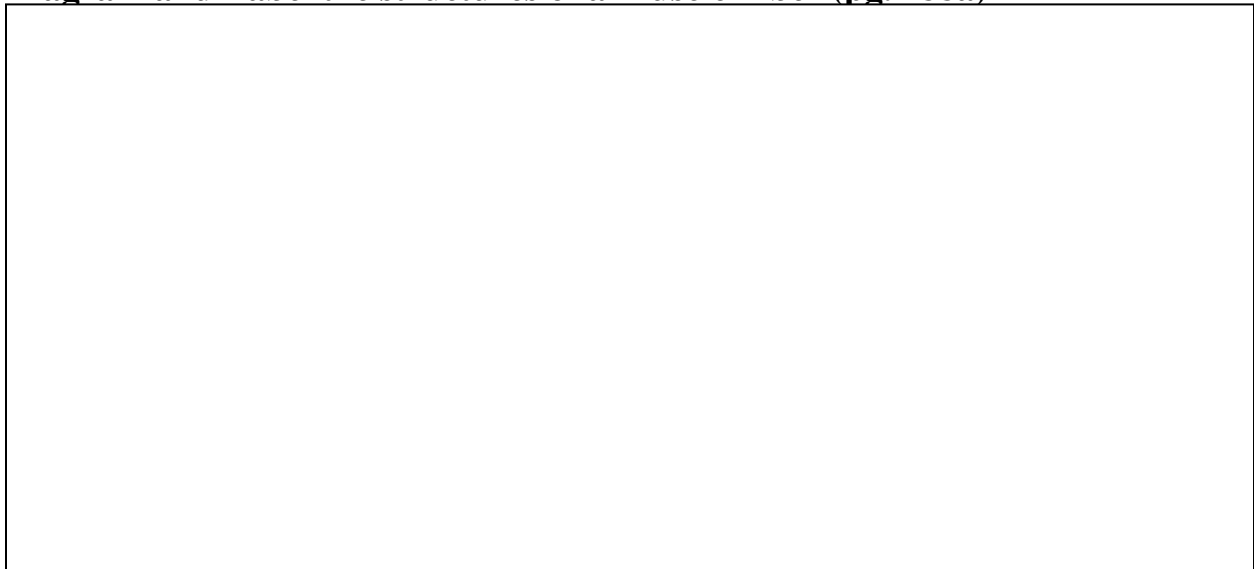
1. Each muscle fiber is a _____, long, cylindrical _____.
2. Beneath the sarcolemma (_____) lies sarcoplasm (_____) with many _____.
3. The sarcoplasm contains _____.
 - a. _____ filaments are made up of the protein _____.
 - b. _____ filaments are made up of the protein _____.
 - c. The organization of these filaments produces _____.
4. A _____ extends from Z line to Z line.
 - a. I bands (_____) made up of _____ filaments are anchored to Z lines.
 - b. A bands (_____) are made up of overlapping _____ filaments.
 - c. In the center of A bands is an _____, consisting of _____.

Diagram and label the striations of Actin and Myosin in a Sarcomere (pg. 188b)



5. Beneath the sarcolemma lies the sarcoplasmic reticulum (_____).
6. Sarcoplasmic Reticulum is associated with transverse (T) tubules (_____).
 - a. Each T tubule lies between two _____ of the sarcoplasmic reticulum.
 - b. The sarcoplasmic reticulum and transverse tubules activate the _____ when the fiber is stimulated.

Diagram and Label the structures of a Muscle Fiber (pg. 188a)

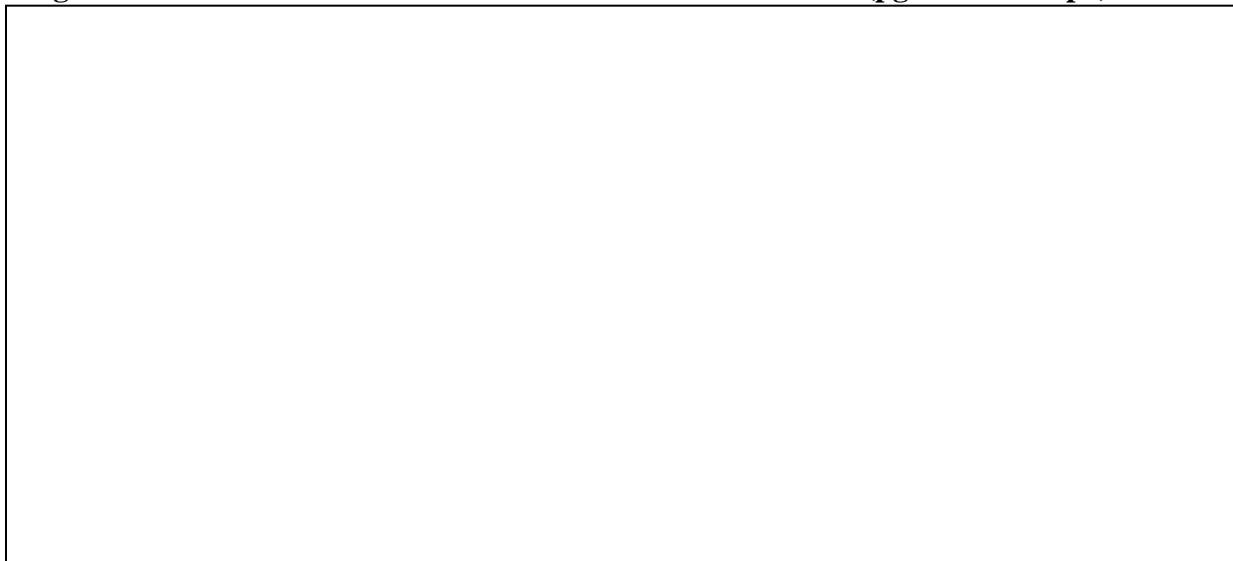


D. Neuromuscular Junction

1. The site where the _____ neuron and

- a. The muscle fiber membrane forms a _____ in which the _____ is tightly folded and where _____ are abundant.
- b. The cytoplasm of the _____ contains numerous _____ and _____ storing _____.

Diagram and Label the structures of a Neuromuscular Junction (pg. 191b & step1)



E. Motor Units

1. A _____ and the _____ it controls.

2. When stimulated to do so, the muscle fibers of the motor unit
- _____.

Diagram and Label the structures of a Motor Unit (pg. 197)



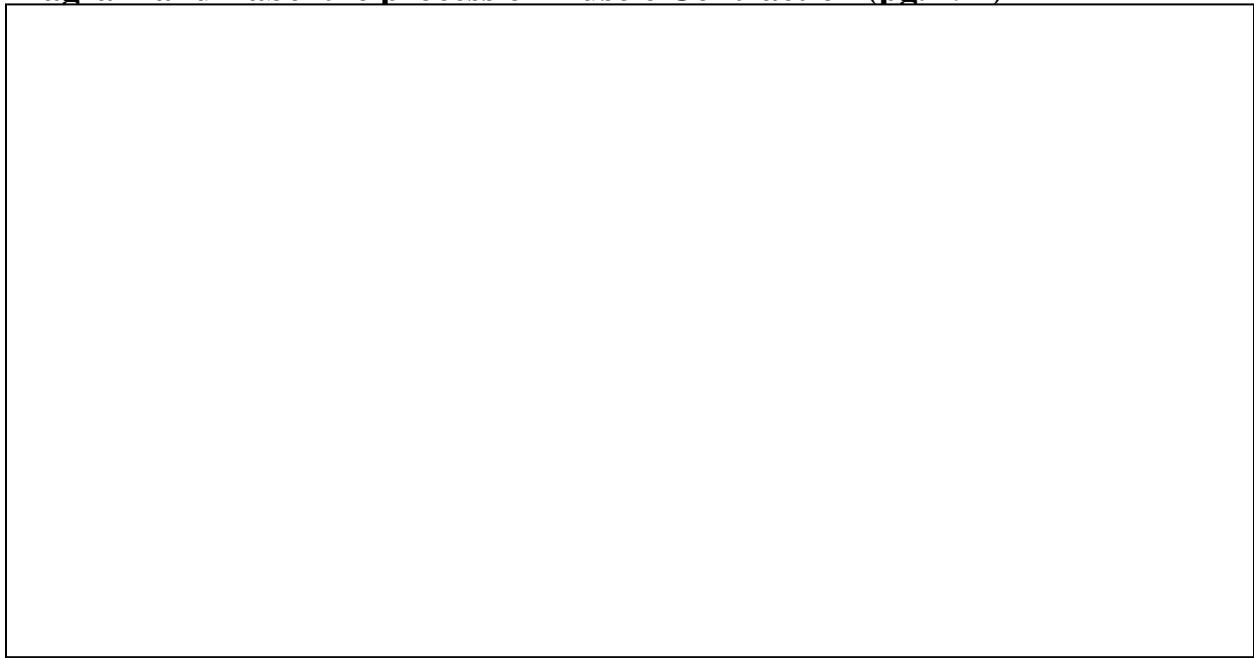
III. Skeletal Muscle Contraction

A. Involves several components that results in the shortening of _____, and the pulling of the muscle against its _____.

B. Role of Myosin and Actin

1. Myosin- two twisted strands with _____ projected outward along the strands.
2. Actin
 - a. globular protein with _____
 - b. _____ are two proteins associated with the surface of the actin filaments.
3. _____ of muscle contraction
 - a. The myosin _____ attaches to the _____ on the actin filament and _____, pulling on the actin filament.
 - b. Myosin then _____ and attaches to the _____ on the actin, pulling again.
4. Energy from the conversion of _____ is provided to the cross-bridges from the enzyme _____, causing them to be in a “ _____ ” position.

Diagram and Label the process of Muscle Contraction (pg. 194)



C. Stimulus for Contraction

1. The _____ releases the neurotransmitter _____ from its synaptic vesicles into the _____.
2. _____ in the motor end plate detect the _____.
3. A _____ spreads over the surface of the sarcolemma and into the T tubules, where it reaches the _____.
4. Muscle impulse causes the sarcoplasmic reticulum to release its _____ into the _____ of the muscle fiber.
5. The high concentration of calcium in the sarcoplasm interacts with the _____ molecules, which move aside, _____ the myosin binding sites on the _____.
6. _____ now bind and pull on the actin filaments, causing the sarcomeres to _____.
7. After the nervous impulse has been received, _____ rapidly decomposes the _____.
8. Then, _____ is returned to the sarcoplasmic reticulum, and the linkages between myosin and actin are _____.

D. Energy Sources for Contraction

1. Energy for contraction comes from molecules of _____.
2. _____, stores excess energy released by the mitochondria and is present to regenerate ATP from _____.

3. Whenever the supply of ATP is sufficient, _____ promotes the synthesis of creatine phosphate.
4. As ATP decomposes, _____ from creatine phosphate can be transferred to ADP molecules, converting them back to _____.

E. Oxygen Supply and Cellular Respiration

1. The early phase of cellular respiration (_____) yields few molecules of ATP, so muscle has a high requirement for _____, which enables the complete breakdown of glucose in the _____.
2. _____ in red blood cells carries oxygen to muscle.
3. The pigment _____ stores oxygen in muscle tissue.

F. Oxygen Debt

1. During rest or moderate activity, there is enough oxygen to support _____.
2. Oxygen deficiency may develop during strenuous exercise, and _____ as an end product of _____.
3. Lactic acid diffuses out of muscle cells and is carried in the bloodstream to the _____.
4. Oxygen debt refers to
 - a. the amount of oxygen that _____ require to convert the accumulated lactic acid into _____
 - b. the amount of oxygen that _____ need to resynthesize ATP and _____ to their original concentrations.
5. Repaying oxygen debt may take _____.

G. Muscle Fatigue

1. When a muscle loses its _____ during strenuous exercise.
2. Usually arises from the accumulation of _____ in the muscle.
3. A _____ as a result of accumulated lactic acid prevents the muscle from _____.
4. A muscle cramp occurs due to a lack of _____ required to return _____ back to the sarcoplasmic reticulum so muscle fibers can _____.

H. Heat Production

1. From _____ of skeletal muscle.
2. From the energy produced through the reactions _____.

IV. Muscular Responses

- A. One method of studying muscle function is to remove a _____ and connect it to a device that records its responses to _____.
- B. _____ - muscle remains unresponsive to stimulation unless the stimulus is of a certain _____.
- C. All-or-None Response: A fiber contracts to its _____; it cannot contract _____.
- D. Recording a Muscular Contraction
1. A _____ is the recording of an electrically-stimulated muscle _____.
 2. A single, short contraction involving only a _____ is referred to as a _____.
 3. The _____ between when the stimulus is applied and when the muscle contracts is called the _____ (less than 0.01 second).
 4. The latent period is followed by a period of contraction and then a period of _____.
- E. Summation
1. When the force of individual _____ combine without complete _____.
 2. If the sustained contraction lacks any relaxation, it is called _____ (tetanus).
- F. Recruitment of Motor Units- An increase in the _____ of activated motor units within a muscle at higher _____ of stimulation.
- G. Sustained Contractions
1. _____ together can produce a sustained contraction of increasing strength.
 2. _____ is achieved by a continuous state of sustained contraction of motor units within a muscle.

V. Smooth Muscles

A. Smooth Muscle Fibers

1. Elongated with tapered ends, _____, and have a relatively undeveloped _____.
2. Two types of smooth muscles.
 - a. _____
 - 1) In the blood _____ of the eye
 - 2) Fibers occur _____ rather than as sheets.
 - b. _____
 - 1) Occurs in _____ and is found in the walls of _____

- 2) These fibers can stimulate one another and display _____, are thus responsible for _____ in hollow organs and tubes.

B. Smooth Muscle Contraction

1. The myosin-binding-to-actin mechanism is mostly _____ for smooth muscles and skeletal muscles.
2. Both _____ and _____ stimulate and inhibit smooth muscle contraction, depending on the target muscle.
3. _____ can also stimulate or inhibit contraction.
4. Smooth muscle is _____ to contract and relax than is skeletal muscle, but can contract _____ using the same amount of _____.

VI. Cardiac Muscle

- A. Contraction is essentially _____ as that for skeletal and smooth muscle, but with some differences.
- B. Cardiac muscle has _____ that supply _____, and can thus contract for longer periods.
- C. Complex membrane junctions, called _____, join cells and transmit the force of contraction from one cell to the next, and aid in the rapid _____ of impulses throughout the heart.
- D. Cardiac muscle is _____, and the whole structure contracts as a unit.

VII. Skeletal Muscle Actions

A. Origin and Insertion

1. The immovable end of a muscle is the _____.
2. The movable end is the _____.
3. Contraction pulls the insertion _____ the origin.
4. Some muscles have _____ insertion or origin.

B. Interaction of Skeletal Muscles

1. Of a group of muscles, the one doing the majority of the work is the _____.
2. Helper muscles are called _____.
3. Opposing muscles are called _____.

VIII. Major Skeletal Muscles

- A. Muscles are named according to any of the following criteria: Size, shape, location, action, number of attachments, or _____.

B. Muscles of Facial Expression

1. Attach to underlying bones and overlying _____ of skin.

2. Major muscles include (for action, origin, and insertion(AOI), refer to Table 7-4): _____, orbicularis oculi, orbicularis oris, _____, zygomaticus, and _____.

C. Muscles of Mastication

1. Include _____ as well as side-to-side grinding motions of muscles attached to the skull and _____.
2. Chewing muscles include (for AOI refer to Table 7-4): _____ and _____.

D. Muscles that Move the Head

1. Paired muscles in the neck and back flex, extend, and _____.
2. Major muscles include (for AOI refer to Table 7-4,7-5): _____, splenius capitis, and semispinalis capitis.

E. Muscles that Move the Pectoral Girdle

1. The chest and shoulder muscles that move the _____.
2. Major muscles include (for AOI refer to Table 7-8): trapezius, rhomboideus major, levator scapulae, serratus anterior, and _____.

F. Muscles that Move the Arm

1. Connect the arm to the pectoral girdle, ribs, and vertebral column, making the _____.
2. _____ include the coracobrachialis and pectoralis major.
3. _____ include the teres major and latissimus dorsi.
4. _____ include the supraspinatus and the deltoid.
5. _____ : subscapularis, infraspinatus, and teres minor.
6. For AOI refer to Table 7-9

G. Muscles that Move the Forearm

1. Arise from the _____ and connect to the ulna and radius.
2. _____ are the biceps brachii, brachialis, and brachioradialis.
3. An extensor is the triceps brachii muscle.
4. _____ include the supinator, pronator teres, and pronator quadratus.
5. For AOI refer to Table 7-10

H. Muscle that Move the Wrist, Hand, Fingers

1. Movements of the hand are caused by muscles originating from the distal humerus, and the _____.
2. _____ include the flexor carpi radialis, flexor carpi ulnaris, palmaris longus, and flexor digitorum profundus.
3. _____ include the extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi ulnaris, and extensor digitorum.
4. For AOI refer to Table 7-10

I. Muscles of the Abdominal Wall

1. Connect the rib cage and vertebral column to the _____
2. _____
 - a. A band of tough _____.
 - b. Extends from the xiphoid process to the _____.
 - c. Attachment for certain _____ wall muscles.
3. These four muscles include _____, internal oblique, transverse abdominis, and _____.
4. For AOI refer to Table 7-6

J. Muscles of the Pelvic Outlet

1. The superficial _____
 - a. Fills the space within the _____.
 - b. Includes the superficial transversus perinei, bulbospongiosus, and _____.
2. The pelvic diaphragm
 - a. Forms the floor of the _____.
 - b. Includes the _____.
3. For AOI refer to Table 7-7

K. Muscles that Move the Thigh

1. Are attached to the femur and to the _____.
2. _____ includes the psoas major and iliacus.
3. _____ is made up of the gluteus maximus, gluteus medius, gluteus minimus, and tensor fasciae latae.
4. Thigh _____ include the adductor longus, adductor magnus, and gracilis.
5. For AOI refer to Table 7-11

L. Muscles that Move the Leg

1. Connects the tibia or fibula to the femur or _____.
2. _____ (hamstring group: biceps femoris, semitendinosus, semimembranosus, and sartorius).
3. _____ (quadriceps femoris group): rectus femoris, vastus lateralis, vastus medialis, and vastus intermedius.
4. For AOI refer to Table 7-12

M. Muscles that Move the Ankle, Foot, Toes

1. Are attached to the femur, fibula, or tibia, and move the foot upward, downward, or in a _____.
2. _____ include the tibialis anterior, peroneus tertius, and extensor digitorum longus.
3. _____ are the gastrocnemius, soleus, and flexor digitorum longus.
4. An _____ is the tibialis posterior.
5. An _____ is the peroneus longus.
6. For AOI refer to Table 7-13