Strength Training

Course Manual

Blueprint for Building Strong Muscles

Written By Jeff LeDuff

Athletic
Performance Systems

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Strength Training Course Manual-Blueprint for Building Strong Muscles

This course manual has been written for High School students. The purpose of this manual is to help students build a solid foundation of knowledge to help them understand the human body and the principles of strength training.

This manual does not attempt to include everything there is to know about the human body or strength training. This course manual is designed for the beginning student.

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38713 Tierra Subida, Ave. # 200114

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Lesson One

Anatomy

The skeleton forms the supporting frame work of the human body. The body is composed of 206 bones that give form to the body and with the joints allow bodily motion. The skeleton also protects vital internal organs by shielding them; the brain lies within the skull; the heart, lungs, and greater vessels are within the thorax; much of the liver and spleen are protected by the lower most ribs; and the spinal cord is contained within and protected by the body spinal column formed by the vertebrae. Bones of the skeleton come into contact with one another at joints where they are moved by the action of muscles. The skeleton thus is a rigid framework for the attachment of muscles and protection of organs and a flexible framework to allow the parts of the body to move by muscular contraction. The skeletal framework allows an erect posture against the pull of gravity and gives recognizable form to the body. Bones must be rigid and unyielding to fulfill their function, but they must also grow and adapt as the human being grows. Bones growth is complete most of the time by late teens.

Shape and Function

Parts of the bone structure. The Head of a bone is the founded end that allows joint rotation. The area below the head is called the Neck. The Shaft is the long, straight cylindrical mid portion of a bone.

Condyles- are at one or both ends of the bones that usually serve as points of ligament attachments.

Tuberosities- are areas on the bones where tendons insert.

Epiphyseal plate- is responsible for growth in bone length.

Bone Composition

Protein is the nutrient that allows for growth and remodeling. Calcium and phosphorous are nutrients deposited into the bone framework which allows the bone to get hard and strong. Calcium and phosphorus are constantly being deposited in the bone and withdrawn from them. Bones are just as much living tissue as muscle and skin. A rich blood supply constantly provides the oxygen and nutrients that bones require. Bones also have a good nerve supply. Fractures of bones produce severe pain from irritation of its nerves as well as heavy bleeding from damage to the blood vessels.

Bones divided by Structures

Long Bones- are found in the limbs where they form a system of levers. Bones like tibia or humerus.

Short Bones- intended for strength and compactness and motion is slight and limited. Bones like metatarsal and metacarpal.

Flat Bones- principle requirement is either extensive protection or for muscular attachment. Bones like scapula and clavicle.

Joints

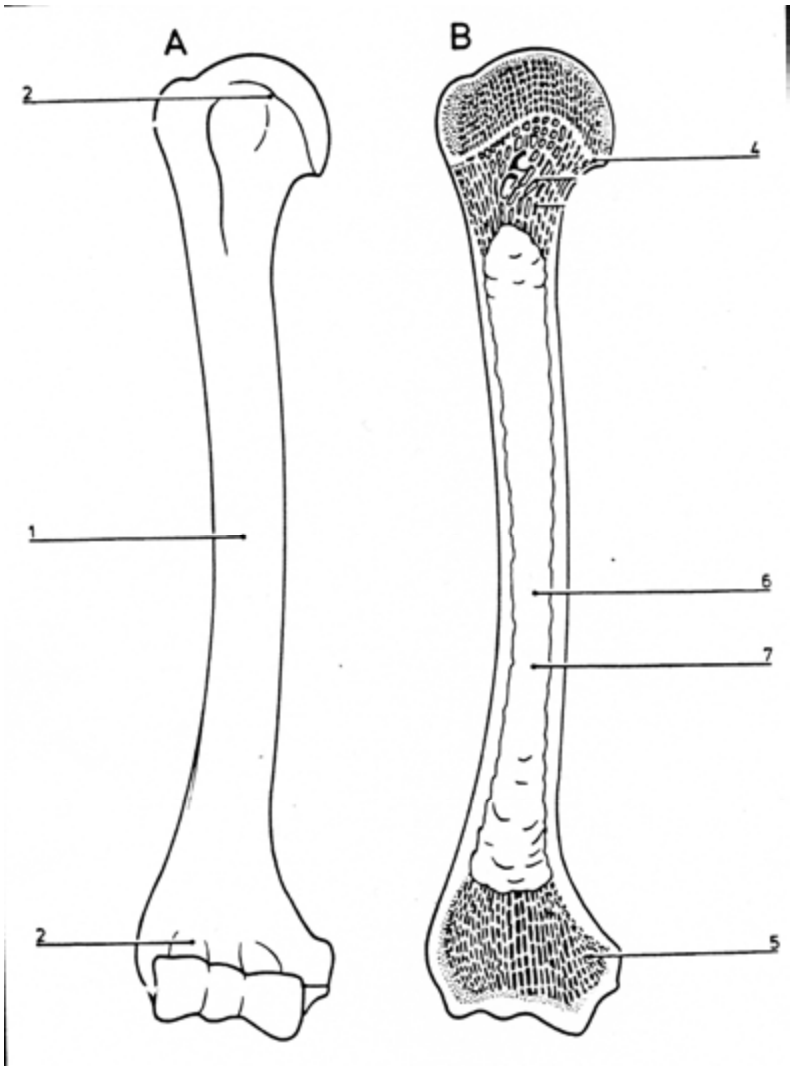
Wherever two bones come into contact they form a joint. Inside the joints are the meniscus they cushion between the bones and aid in the joint gliding motion. If injured and torn from its attachment the meniscus can produce symptoms of locking or catching in the joint.

Ligaments

Ligaments attach bone to bone. Ligaments are flexible so as to allow the most perfect freedom of movement, but strong and tough. Joints surrounded by thick ligaments produce little motion. Joints with few ligaments are free to move in almost any direction. Thatôs why areas like the shoulder with few ligaments are more prone to dislocation and injuries.

Bone Structure

Label the parts of the bone:



Parts of the Bone

1. Shaft
2. Epiphyseal
4. Spongy
5. Inner and outer tables
6. Compact bone
7. Bone Marrow

Joint Motion

A joint in the body are bones that are connected with each other either immovably or movably. The extent and kind of movement determine the name applied to the joint.

Joint Motion Names

Gliding Joint- Limits movement as in the bones in the wrist (carpal) and those in the foot (tarsal).

Ball-and-Socket Joint-Permits movement in all planes and also rotation in the shoulder and hip joint.

Hinge Joint-Permits a wide range of movement in only one direction in the elbow and knee joints.

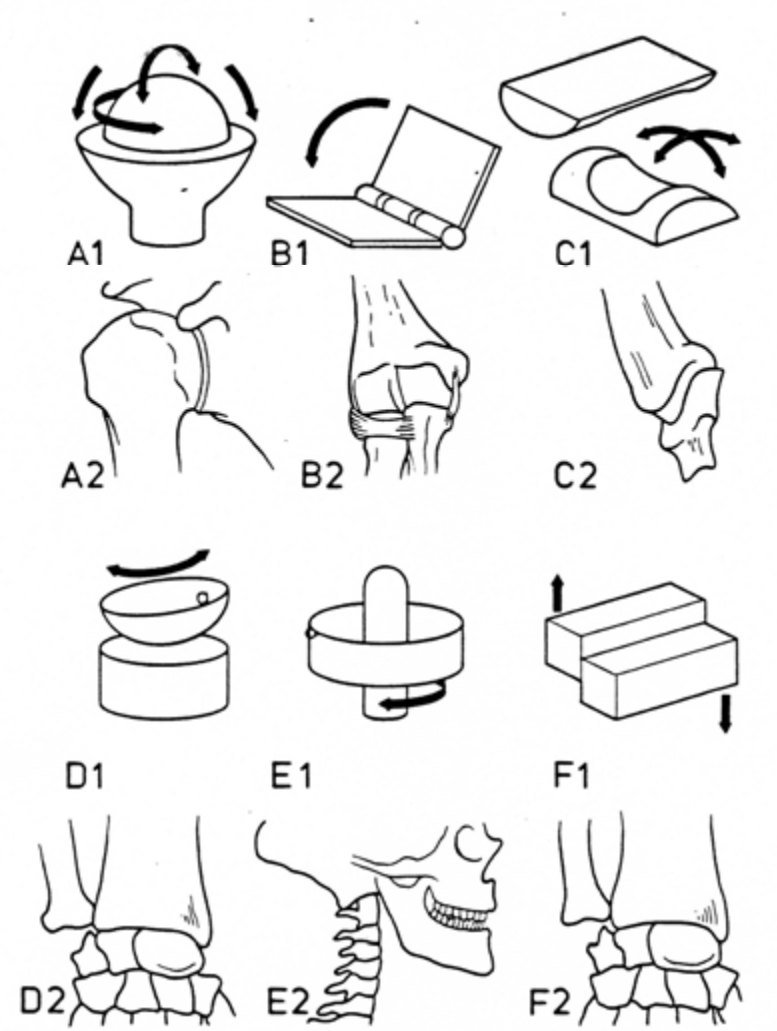
Saddle Joint-Found only in the thumb, that permits ball and socket movement with the exception of rotation.

Pivot Joint-A rotation movement around a long axis as the rotation of the radius bone.

Ellipsoid Joint-This is a reduced ball and socket configuration in which rotation is not permitted. Example wrist joint.

Types of Joints

Name the types of joints for the Body Parts

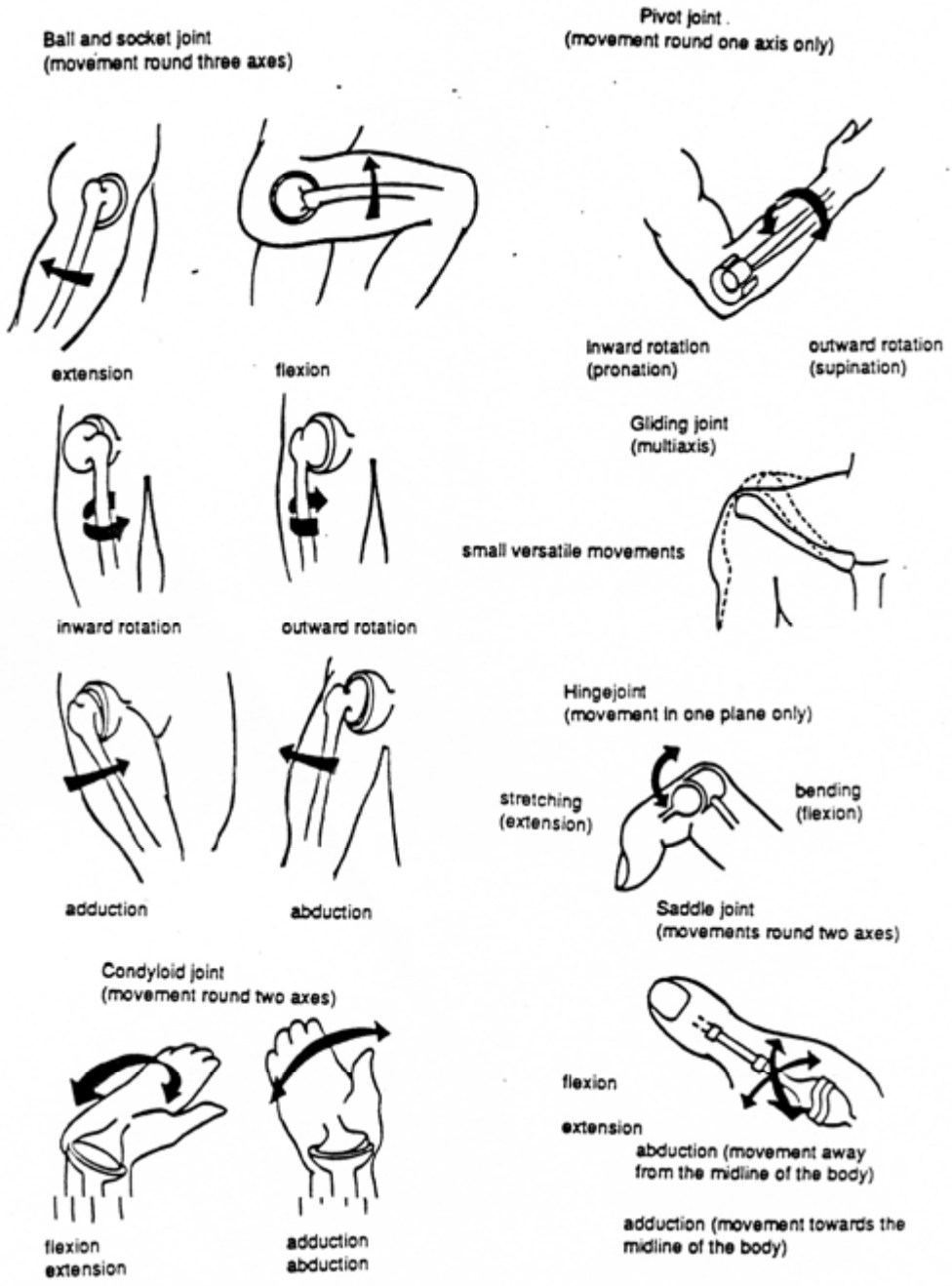


A1-A2_____ B1-B2_____

C1-C2_____ D1-D2_____

E1-E2 _____ F1-F2_____

Joint Movement



Lesson One-Questions

1. The body contains how many bones?

2. Name the parts of the skeleton area that protects the internal organs.

3. What is the name of the skeleton area that comes in contact with one another!

4. Bone growth is complete at what age?

5. Name the three parts of the bone?

6. The area where tendons insert to the bone is called?

7. What are the names of the two elements deposited in the bones?

8. Why does breaking a bone cause so much pain?

9. Name the bones on the body that are the ñLong Bonesò, ñShort Bonesò, Flat Bonesò.

10. Ligaments attach what to what?

Lesson Two

Human Motion

All motion including motion of the human body and its parts, is the results of the application of forces and is subject to the laws and principles which govern force and motion.

Force and Motion

All types of force and motion are governed by principles of nature. These principles were observed by Sir Isacc Newton in the Seventeenth Century. He formulated three laws of motion which explain why objectives move as they do. The three laws are ñLaw of Inertiaò, ñLaw of Accelerationò, and ñLaw of Reactionò.

Newton Laws

1st Law: Law of Inertia: Objects moving along a straight line. Objectives at rest will remain at rest unless acted on by an outside force.

2nd Law: Law of Acceleration: Objects accelerate in the direction of the applied force. Acceleration is less when the mass of the object is greater.

3rd Law: Law of Reaction: Every action force there is an equal but opposite reaction force.

Motion

Motion is fundamental in all types of physical activities. Body motion is generally produced or at least started by some action of the muscular system. No motion can occur without a force, and the muscular system is the source of force in the human body.

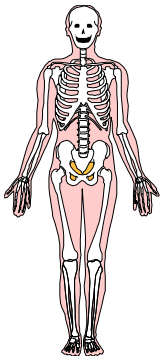
Basically there are three two types of motion.

Linear motion: motion in a straight line.

Angular motion: motion around an axis.

The human body experiences all kinds of motion. When describing human movement, there is an anatomical starting point that is accepted as being the position all movementsôstarts called the ñAnatomical Positionò. In this position all joints are considered to be in a neutral position or at 0 degrees, with no movement having yet occurred.

Anatomical Position



Anatomical Locations

These terms describe the different position and the structural locations in relation to the human body anatomical position.

Superior: something that is above or higher than another structure (The head is superior to your chest).

Inferior: something is below or lower than another structure (The chest is inferior to your head).

Lateral: something farther away from the midline of the body than another structure (The arms are lateral to your spinal column).

Medial: structure is closer to the midline of the body than another structure. (The nose is medial to your ears).

Anterior: structure that is in front of another structure. (The abdomen is anterior to your spinal column).

Posterior: structure that is behind another structure. (The spinal column is posterior to your abdomen).

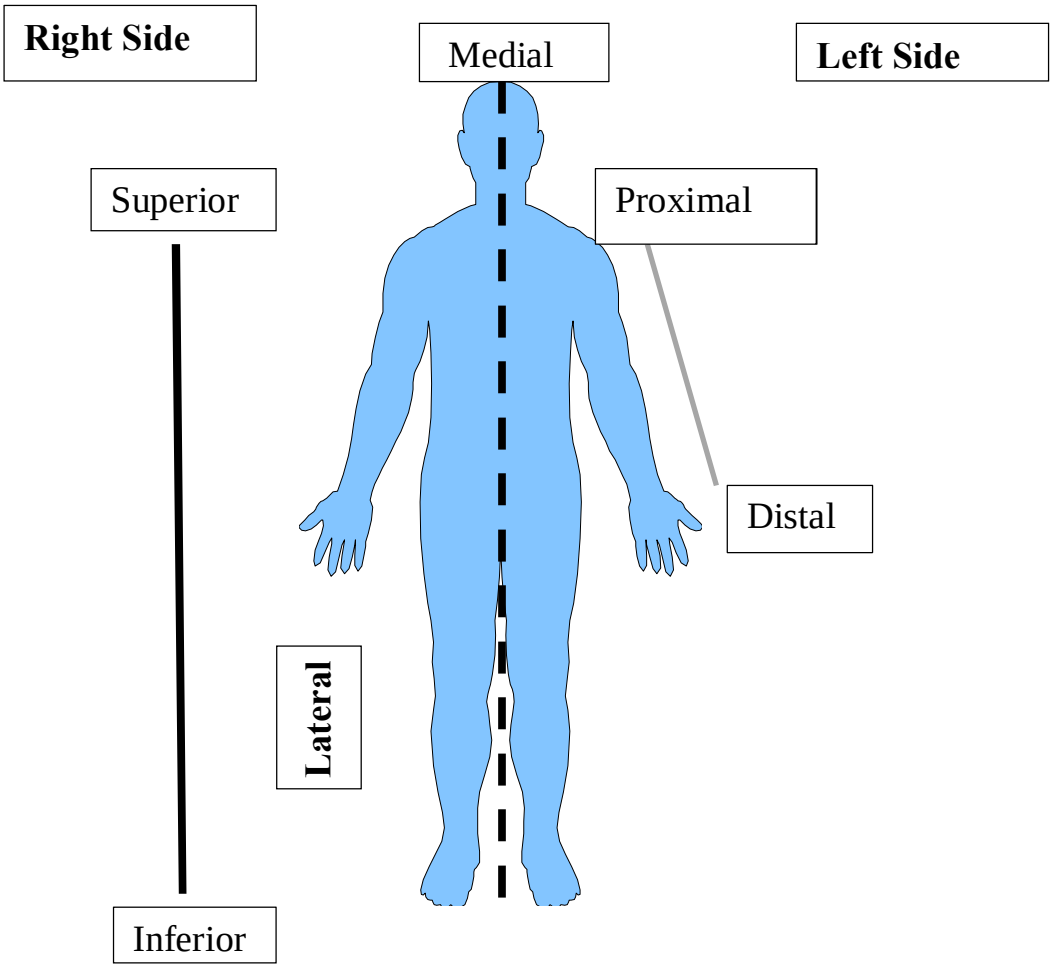
Proximal: close to the trunk in reference to structure of the extremities (Arms and Legs).

Distal: farther from the trunk. (The hand is distal to your wrist).

Dorsal: top side of a structure.

Plantar: bottom of the foot.

Anatomical Locations



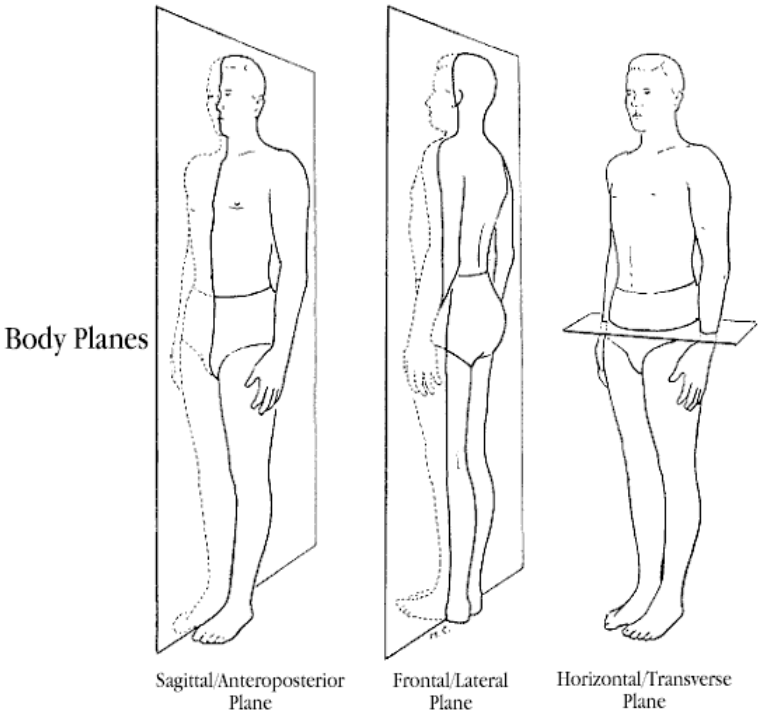
Anatomical Planes

All motion in the human body occurs in the anatomical planes which there are three types that divide the body in half. The names of these planes are sagittal plane, frontal plane, and horizontal or transverse plane. All of these planes of movement intersect in the bodyôs center of gravity.

Sagittal Plane: passes from the front through the back of the body, creating a left side and right side of the body.

Frontal Plane: passes from one side of the body to the other creating and front side and a back side of the body.

Horizontal or Transverse Plane: passes through the body horizontally to create top and bottom segments of the body.



Anatomical Planes	Fundamental Movements
Sagittal Plane	Flexion and Extension
Frontal Plane	Abduction and Adduction
Horizontal Plane	Internal and External Rotation

Fundamental Movements

The terms describe the movements that take place in the anatomical planes in the body. These movements are used to explain all types of body positions in weightlifting and sports analysis.

Flexion: decreasing the angle formed by the bones of the joint.

Extension: increasing the joint angle.

Abduction: movement away from the midline of the body.

Adduction: movement toward the midline of the body.

Internal Rotation: arm or leg rotates toward the midline of the body.

External Rotation: arm or leg rotates away from the midline of the body.

Pronation: turning the forearm from the anatomical position toward the body.

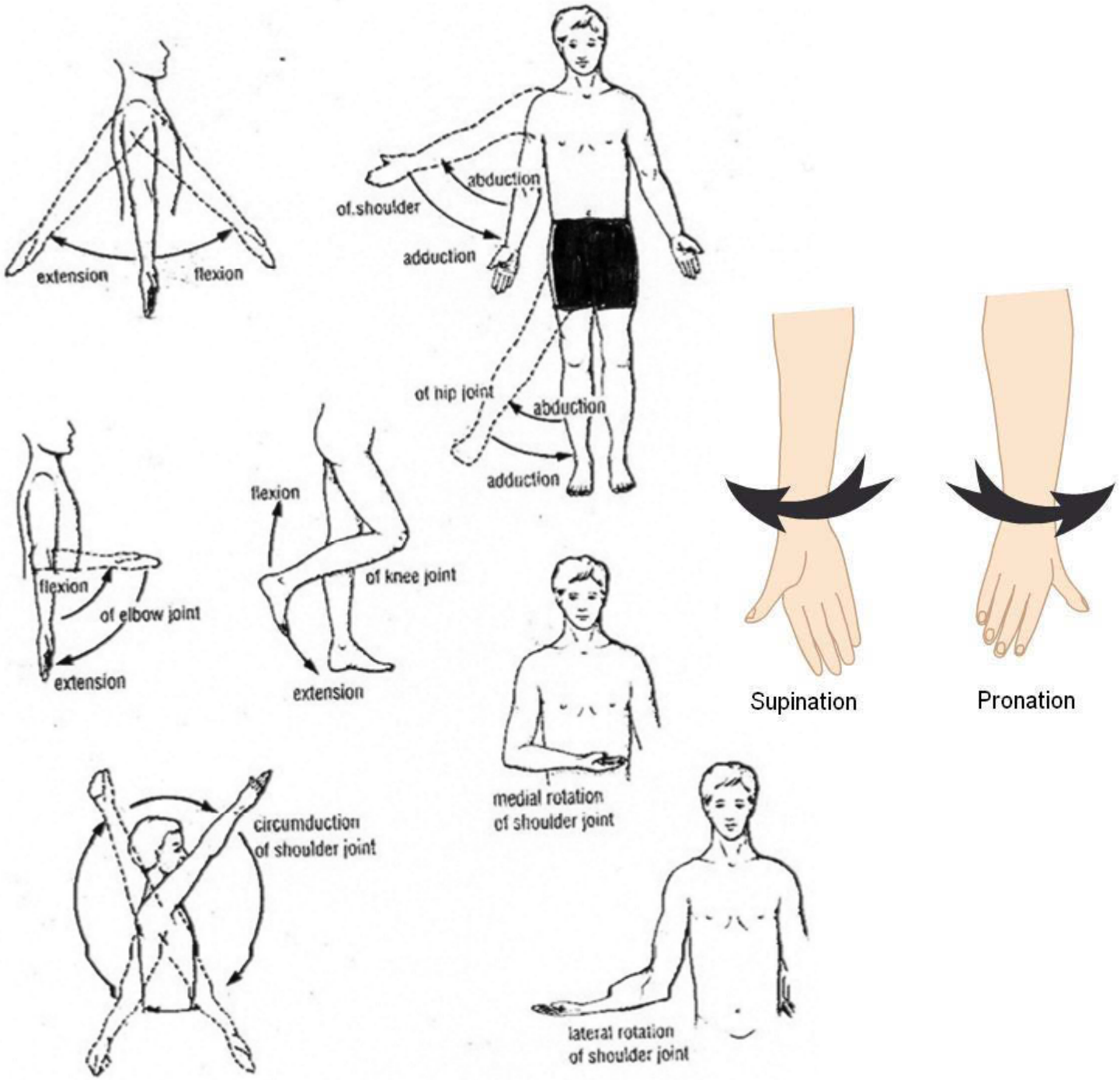
Supination: turning the forearm outward, upward and outward movement of the foot away from the other foot.

Elevation: Movement upward as in shrugging the shoulders.

Depression: Movement returning to the normal position.

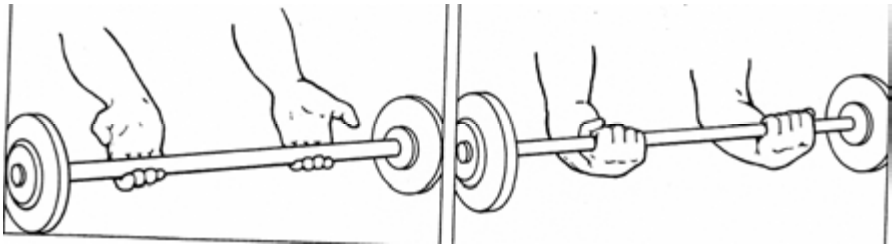
Circumduction: is not considered a fundamental movement but this happens with the arm at the shoulder joint in a ñwindmillò motion.

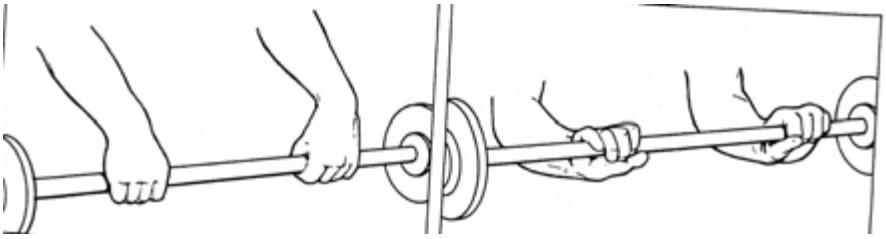
Types of Movement



Joint Movement

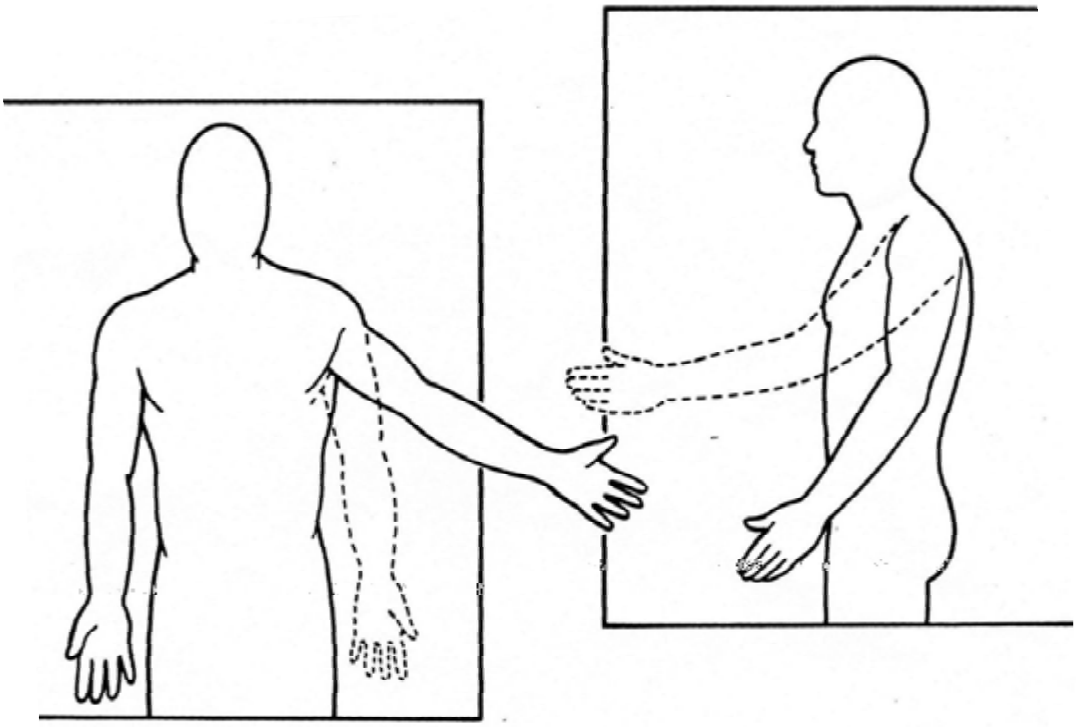
Label and indicate the joint movement of the wrist, palm, and fingers in the pictures.

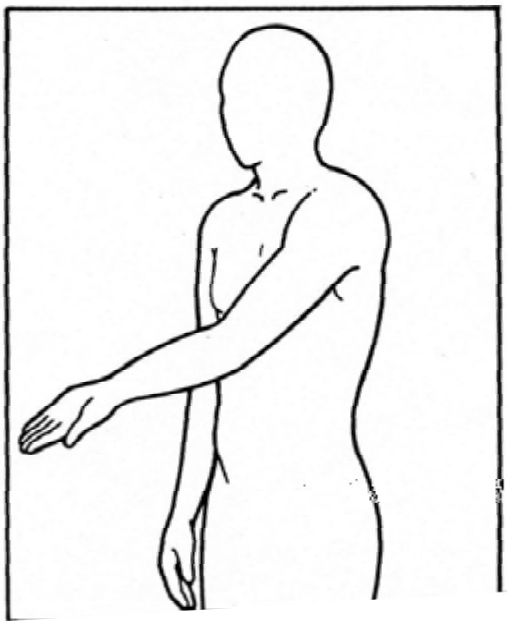




Joint Movement

Label and indicate the movements of the shoulder joint in the pictures.

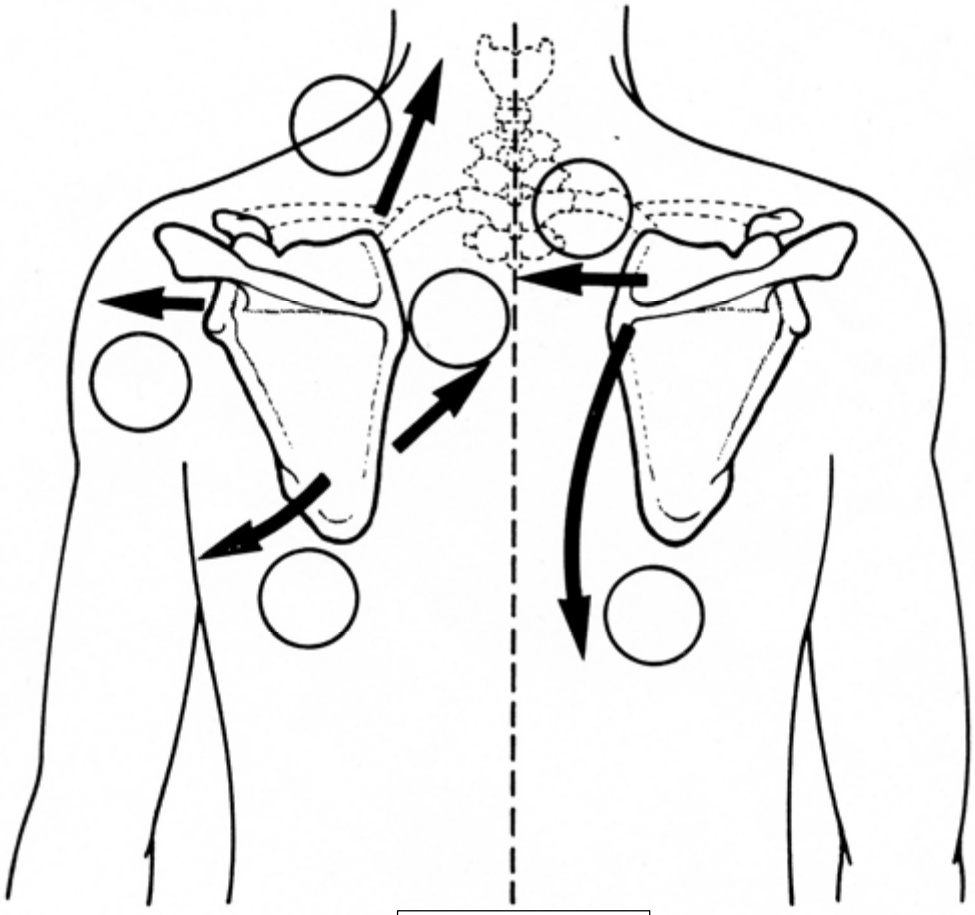




Joint Movement

Label and indicate by arrows the following movements of the shoulder girdle.

A. Adduction
B. Abduction
C. Rotation upward
D. Rotation downward
E. Elevation
F. Depression



Medial

Lesson Three

Anatomy Upper Body Skeleton

The skeleton system of the upper body consists of 64 bones not counting the spine/vertebral column that area consists of 33 bones. The upper body skeleton contains the thorax, spine, and extremities.

Anatomy of the Spine

The spine is a segmented column of 33 vertebrae stacked one on the next and extending from the base of the skull to the tip of the coccyx. This segmented spinal column is called the vertebral column it is composed of 24 movable vertebrae 7 cervical, 12 thoracic, and 5 lumbar, as well as 5 sacral vertebrae and 4 coccygeal vertebrae which are fused. The vertebrae become progressively larger from the skull to the sacrum and then become progressively smaller. The total length of the vertebral column amounts to about two-fifths of the total height of the body. The vertebral column completely surrounds and encases the spinal cord. It transmits the weight of the rest of the body to the lower limbs and to the ground when a person is standing, supports the bodyôs weight for locomotion and protects the spinal cord and the roots of the spinal nerves. With its muscles and joints the vertebral column is capable of being rigid and flexible. The vertebral column is flexible because the cervical, thoracic, and lumbar vertebrae can move slightly.

Anatomy of the Thorax

The thorax cage contains and protecting the principle organs of respiration and circulation. Its shape is narrow above and broad below. The posterior surface is formed by the twelve vertebrae, and the posterior part of the ribs. The anterior surface is flattened and curves outward. The Diaphragm closes in the opening forming the floor of the thorax. The thorax consists of the sternum, and ribs. In females the thorax differs from males, its capacity is less, the sternum is shorter. The front of the thorax contains the sternum a dagger-shaped bone. It is made up of three parts, at the top the handle-shaped is called the **manubrium,** in the middle is a blade-like called **the body**, and at the bottom the pointed end is the **xiphoid process**. The ribs or costae are what shape the thorax; there are twelve pairs, which are divided into three types, true, false, and floating.

True Ribs-first seven pairs and connect directly to the sternum

False Ribs-three pairs which do not connect directly to the sternum but are linked together by cartilage bands.

Floating Ribs-last two pairs which do not connect to the sternum.

Anatomy of the Upper Extremities

The extremities of limbs are those long joints appendages of the body that are connected to the trunk by one end and free on the other end. The upper pair connects with the thorax through the shoulder. The bones by which the upper limbs attach to the trunk are named the shoulder girdle. The shoulder girdle is formed by the scapula and clavicle. The bones of the upper extremity consist of those of the shoulder girdle of the arm, the forearm, and the hand.

Shoulder Girdle Bones;

Clavicle-a stick like bone or collarbone, in the front area of the shoulder.

Scapula-large triangular shape bone in the back.

Upper Arm Bones;

Humerus-a long bone attached to the shoulder girdle.

Forearm or Lower Arm; Two bones make up this area.

Ulna-which is located on the side of the forearm toward the little finger.

Radius-which is located on the side toward the thumb.

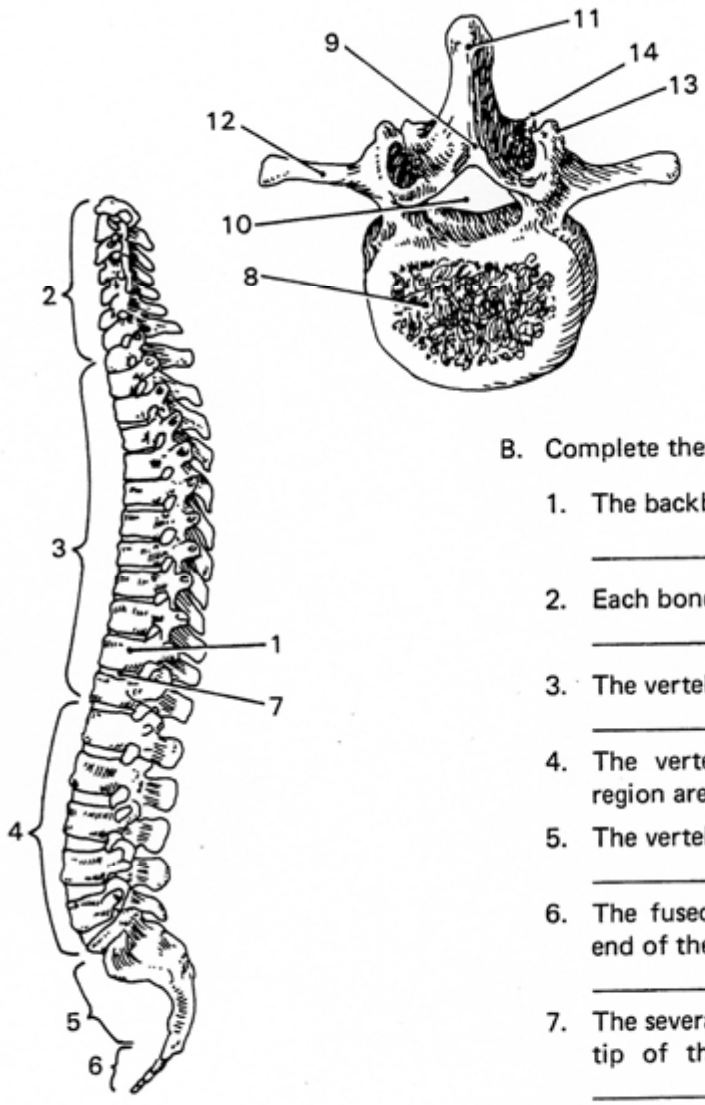
Wrist and Hand Area

Carpal-small bones that give flexibility to the wrist. There are 8 bones arranged in two rows of four bones.

Metacarpals-bones that form the palm of the hand, there are five bones that make up this area of the hand.

Phalanges-bones that form the fingers and thumb, each of the four fingers contains three phalanges, while the thumb has only two.

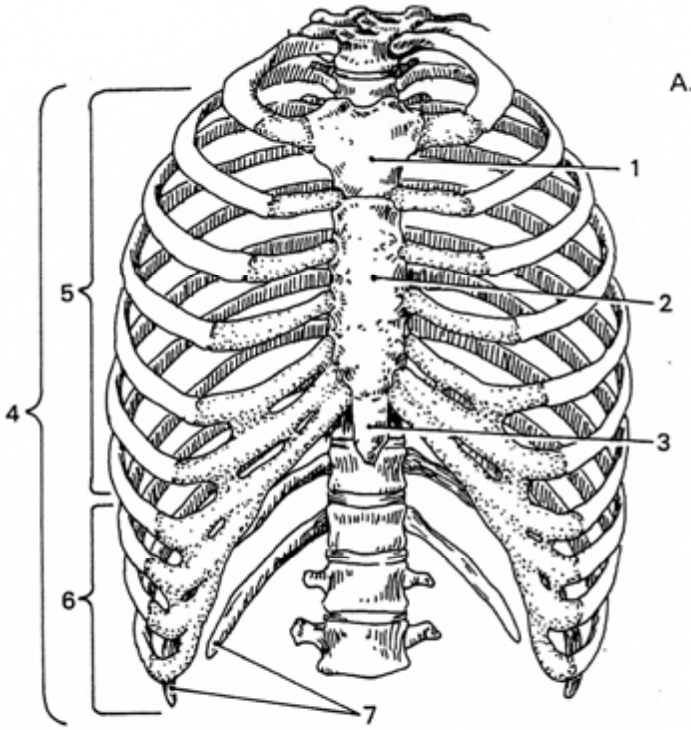
Anatomy of the Spine



B. Complete these statements:

1. The backbone is called the _____ _____ .
2. Each bone of the backbone is called a _____ .
3. The vertebrae in the neck region are called _____ vertebrae.
4. The vertebrae immediately below the cervical region are the _____ vertebrae.
5. The vertebrae of the lower back region are called _____ vertebrae.
6. The fused triangular-shaped bone at the lower end of the vertebral column is called the _____ .
7. The several small vertebrae attached to the lower tip of the sacrum are collectively called the _____ .
8. Vertebrae are separated by _____ _____ .
9. The body of the vertebra and its arch are jointed to form the _____ _____ .
10. The process at the back of the vertebra is the _____ process.
11. The process on each side is the _____ process.
12. The processes with the smooth surfaces which form a union with other bones are called the _____ processes.
13. The junction of two bones is called _____ .

Anatomy of the Thorax



A. Identify the numbered structures in Figure 5:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

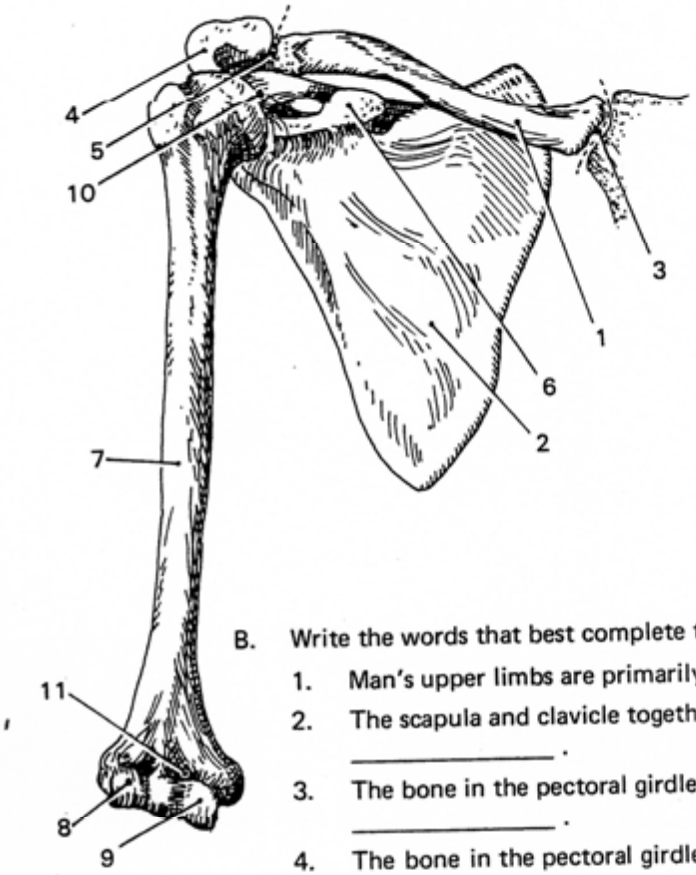
B. Use the words below to complete these statements:

costae	manubrium	false	floating
true	sternum	body	xiphoid process

1. A dagger-shaped bone which forms the front of the thorax is the _____ .
2. The blade-like part of the sternum is the _____ .
3. The uppermost part of the sternum is the handle of the dagger, the _____ .
4. Pointed and sharp, the _____ forms the tip of the dagger.
5. Twelve pairs of _____ arise from the twelve vertebrae.
6. _____ ribs are those which arise from the thoracic vertebrae and connect directly to the sternum.
7. By contrast, _____ ribs are indirectly linked to the sternum by cartilage bands.
8. The two last pairs of ribs are small and do not connect to the sternum, so they are called _____ ribs.

Anatomy of the Upper Extremities

Figure 6



A. Identify the numbered structures in Figure 6:

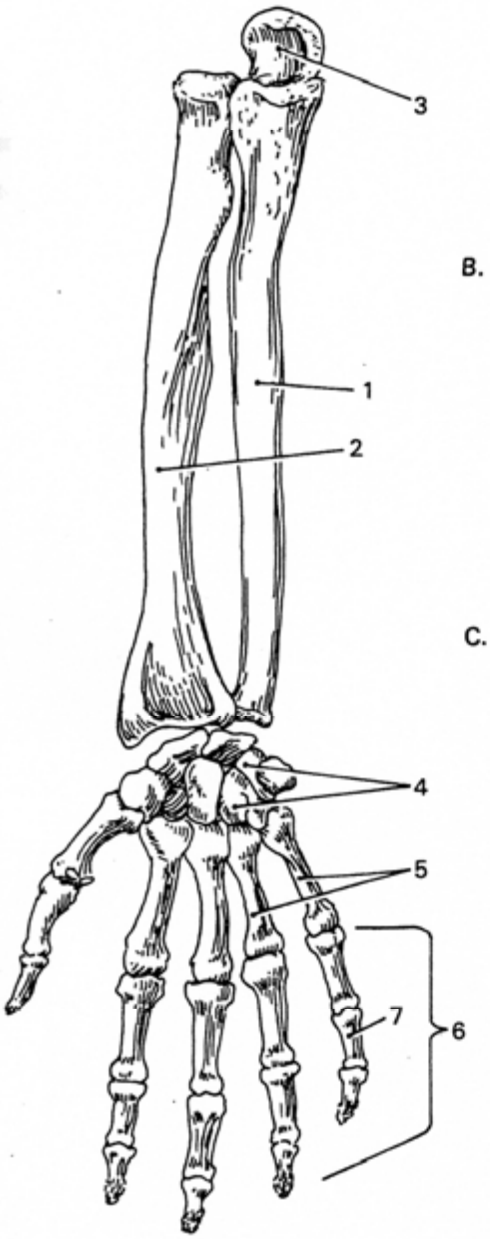
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____

B. Write the words that best complete these statements:

1. Man's upper limbs are primarily for _____ and _____.
2. The scapula and clavicle together are called the _____ _____.
3. The bone in the pectoral girdle on the ventral side of the thorax is the _____.
4. The bone in the pectoral girdle on the dorsal side of the thorax is the _____.
5. The point of attachment of the clavicle to the sternum is called the _____.
6. The point of articulation between the scapula and clavicle is called the _____ _____.
7. The two important processes of the scapula are the _____ and the _____ _____.
8. The long bone of the upper arm is the _____.
9. The smooth, knob-like portion at the end of the humerus is the _____.
10. The pulley-shaped portion at the end of the humerus is the _____.
11. One end of the humerus articulates with the _____ _____ of the scapula.
12. At the distal end of the humerus, the fossae are called _____ and _____.
13. The coronoid fossa is in the _____.
14. The coracoid process is part of the _____.

Anatomy of the Upper Extremities

Figure 7



A. Identify the numbered structures in Figure 7:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

B. Briefly define the *following words:*

1. articulate _____
2. proximal _____
3. distal _____
4. ventral _____
5. dorsal _____
6. anterior _____
7. posterior _____
8. fossa _____
9. process _____

C. Complete these statements:

1. The bone of the forearm on the side toward the thumb is _____ .
2. The bone of the forearm on the side toward the little finger is _____ .
3. The point of the elbow is the _____.
4. The wristbones are the _____ bones.
5. The bones of the palm of the hand are the _____ bones.
6. The bones in the fingers are the _____.
7. The single bone in each finger is a _____ .
8. The wristbones, as a group, are known as the _____ .

Lesson Four

Anatomy Lower Body Skeleton

The skeleton system of the lower body consists of 62 bones. The lower body skeleton contains the pelvic girdle, hip, thigh, leg, and the foot.

Anatomy of the Pelvic Girdle

The pelvis is composed of several large flattened bones that form a ring which function as a major support structure of the human skeleton. It has adapted to allow manôs upright posture and gait. The sacrum which is a flattened fusion of bones from the spinal column, forms the posterior aspect of the pelvic ring and is the base of support of the upright spinal column. Coccyx is attached below the sacrum. The pelvic is a fusion of three bones: the ilium, ischium, and pubis. The ring formed by the pelvis supports abdominal contents, contains the birth canal in women and allows passage of excretory canals. The iliac crest is the outer uppermost margin of the ilium and is the sharp points of muscular attachments. The ischial tuberosity serves as the attachment for the hamstring muscles and is the major weight-bearing structure for sitting. The connection point of three bones in the pelvis ilium, ischium, and pubic form the acetabulum, which is the socket that acts as the receptacle for the hip joint.

Anatomy of the Hip and Thigh

The hip is the articulation of the lower extremity with the body. Like the shoulder, it is a ball-and-socket joint but is has far more structure stability in its design. The articulation of the femur with the pelvis forms the hip joint, the ball is the femoral head. Below the head, the femur narrows into the femoral neck. Distal to the neck the bones widens into two large prominences the lesser trochanter (medial) and the greater trochanter (lateral). The socket of the joint is called the acetabulum. Three extremely strong ligaments surround the joint anteriorly and posteriorly and reinforce the capsule. The ligaments are iliofemoral, ischiofemoral which are anterior and the pubofemoral which is posterior. The thigh extends the length of the femur and contains the great muscles that power bipedal locomotion.

Anatomy of the Leg

The skeleton of the leg consist of three bones: the patella, a bone placed in front of the knee: the tibia, and the fibula. The patella is a flat triangular bone situated at the anterior part of the knee joint. The tibia is slightly cup shaped at its proximal end and generally cylindrical through most of its shaft. Anteriorly the tibia is protected only by skin through most of its length and is vulnerable to direct impact. The fibula is longer slender bone lying laterally to the tibia. A limited weight-bearing bone it serves primarily for muscle attachment.

Anatomy of the Foot

The skeleton of the foot is composed of 26 bones. Its function is weight-bearing and as a contact point between the body and terrain in locomotion.

Bones of the Foot:

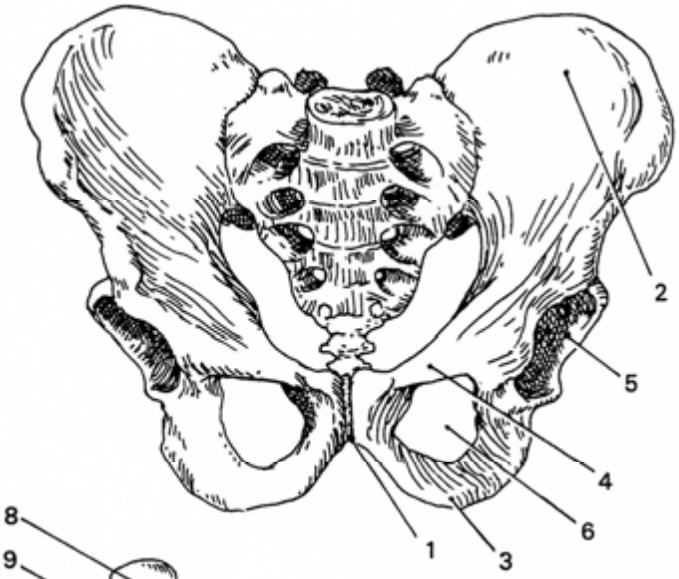
Tarsal bones-seven bones containing the calcaneus which is the heel bone.

Metatarsal bones-five bones

Phalanges bones-arranged in the same manner as those in the hand. The bones are shorter and their movement is more limited than those in the fingers. The big toe has only two phalanges, while each of the other toes has three phalanges.

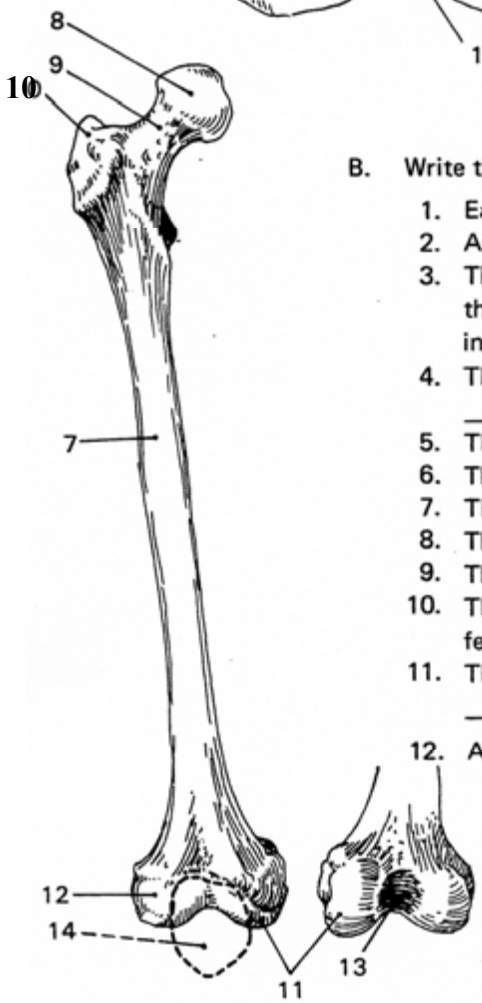
Anatomy of the Pelvic Girdle, Hip, and Thigh

Figure 8



A. Identify the numbered structures in Figure 8:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____

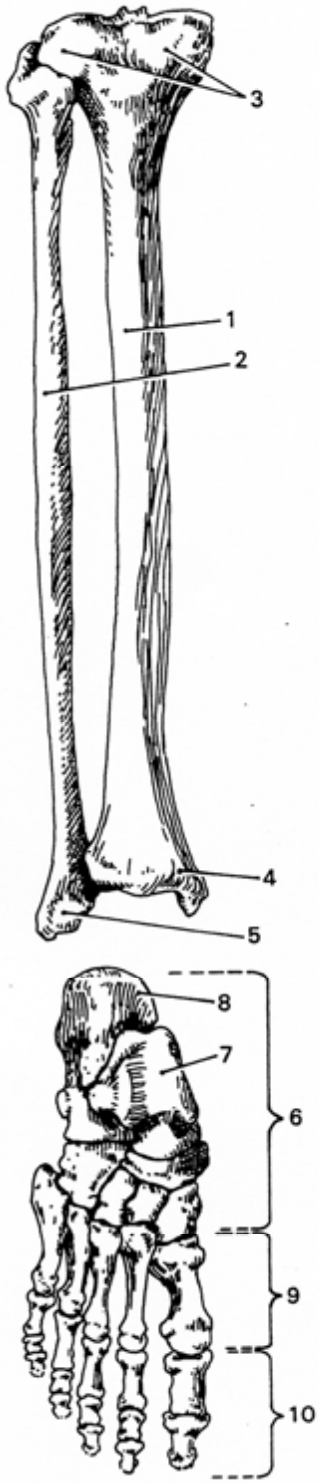


B. Write the words that best complete these statements:

1. Each hipbone is really _____ smaller bones.
2. Another name for hip socket is the _____ .
3. The pelvis is composed of the _____ _____ in the front and side and the _____ and _____ in the back.
4. The two hipbones are joined in front by a cartilage called the _____ _____ .
5. The word *pelvis* means _____ .
6. The lower portion of the pelvis is called the _____ pelvis.
7. The upper portion of the pelvis is called the _____ pelvis.
8. The largest foramen in the body is the _____ foramen.
9. The longest bone in the body is the _____ .
10. The projection at the junction of the neck and body of the femur is called the _____ _____ .
11. The distal end of the femur has two prominences called the _____ _____ and the _____ _____.
12. Another name for kneecap is _____ .

Anatomy of the Leg, and Foot

Figure 9



A. Identify the numbered structures in Figure 9:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

B. Match each term to its definition:

tibia	_____	1. flattened surface at proximal end of tibia
two	_____	2. long, thin, outside bone of leg
three	_____	3. plural form of phalanx
phalanges	_____	4. uppermost and central tarsal bone
condyles	_____	5. inside bone of leg
lateral malleolus	_____	6. projection at distal end of tibia
medial malleolus	_____	7. projection at distal end of fibula
calcaneus	_____	8. bones of the foot
talus	_____	9. bones of the hand
tarsal bones	_____	10. the heel bone
carpal bones	_____	11. number of phalanges of big toe
fibula	_____	12. number of phalanges of little toe

Lesson Five

Muscle

Almost all body systems and most organs have some muscular elements. Muscles may be classified as skeletal or special. Skeletal muscle forms the major muscles mass of the body. It is composed of approximately 400 individual muscles, widely different in both form and size. In the human muscle constitutes 40 to 50 percent of the body weight. It is called skeletal muscle because it attaches to the bones of the skeleton. It is also called voluntary muscle because all skeletal muscle is under direct voluntary control of the brain and can be contracted or relaxed at will. It is frequently called striated muscle because it has characteristic striped or striation under the microscope. Skeletal muscles are under the direct control of the nervous system and respond to a willed command as in the movement of an arm or leg. Nerves pass directly from the spinal cord to all skeletal muscles. Movement are voluntarily initiated and involuntarily coordinated. When the normal nerve supply is lost a voluntary muscle can be neither contracted nor relaxed and becomes limp and useless.

Special Muscles

Special muscles are not part of skeletal muscular system. The involuntary muscles carry out much of the automatic work of the body. This type of muscle is called smooth muscle.

Gastrointestinal systems, bladder-involuntary muscles

Diaphragm-both involuntary and voluntary

Cardiac muscle-involuntary muscle

Muscle Composition

A skeletal muscle consists of many thousands of single muscle cells. A single muscle cell is termed muscle fiber because it threadlike shape. Variation in the length and diameter of fibers is seen in adults. Skeletal muscle fibers grow in length and diameter from birth to adulthood. Fiber diameter can be increase by physical training (weightlifting and strength training). Muscle fiber is the basic structural unit of the muscle but the smallest functional unit is termed the motor unit.

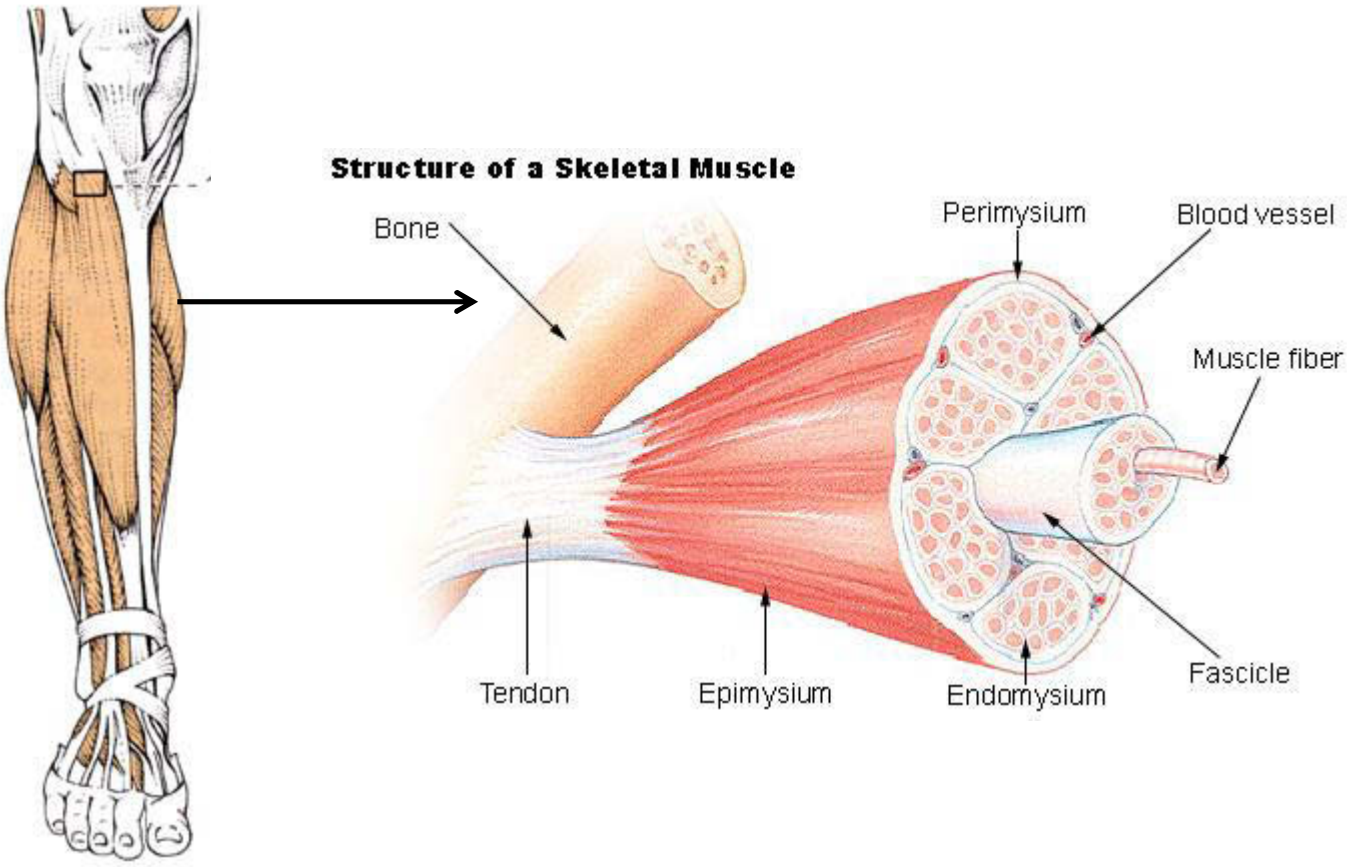
Muscle Fiber Types

Slow-twitch fibers are fatigue resistant. Used for long lasting low level force production. Long distance runners, cyclist, rowers, and cross country skiers have a greater amount of slow twitch fibers.

Fast-twitch fibers used for explosive type activity and generate much force over a short period of time. Power athletes such as throwers, sprinters, and jumper have more fast twitch fibers.

Tendons

Most skeletal muscle attach directly to bones by tendons. Tendons provide a tough, elastic connecting structure between muscle and bone. Tendons located distally or toward the end of a limb away from the body are larger than tendons located close to the body.



Muscle Terminology

Contractile Component-the ability of muscle to develop tension when stimulated.

Concentric-involving shortening of a muscle.

Eccentric-involving lengthening of a muscle.

Static Contraction-no movement of skeleton occurs and the muscle neither shortens or lengths.

Dynamic Contraction-involves movement and consists of either a concentric or an eccentric contraction.

Motor Unit-single motor neuron and all of the fibers which it connects.

Slow Twitch Fibers-a fiber that reaches peak tension relatively slowly.

Fast Twitch Fibers-a fiber that reaches peak tension relatively quickly.

Agonist-role played by a muscle acting to cause a movement.

Antagonist-role played by a muscle generating torque opposing that generated by the agonists at a joint.

Stabilizer-role played by a muscle acting to stabilize a body part against some other force.

Neutralizer-a muscle acting to eliminate an unwanted action produced by an agonist.

Prime Mover-a muscle primarily responsible for causing a joint action.

Hypertrophy-muscle getting larger.

Atrophy-muscle getting smaller.

Origin-muscle attachment which anchors (the end nearer the center of the body).

Insertion-the attachment for force application to the moving bone (the end of the muscle farther away from the center of the body).

Muscle Classification

Longitudinal-This is a long strap like muscle whose fibers lie parallel to its long axis. Two examples are Rectus Abdominus on the front of the abdomen and the Sartorius which slants across the front of the thigh.

Quadriate or Quadrilateral-muscles of this type are four sided and are usually flat. They consist of parallel fibers. Example is the Rhomboid muscle between the spine and scapula.

Trianglar or Fan Shape-a flat type muscle whose fibers radiate from a narrow attachment at one end to a broad attachment at the other end. Example the Pectoralis Major on the front of the chest.

Fusiform or Spindle Shape-a rounded muscle which tapers at either end. It may be long or short, large or small. Example are the Brachials, and Brachioradials muscle of the upper extremity.

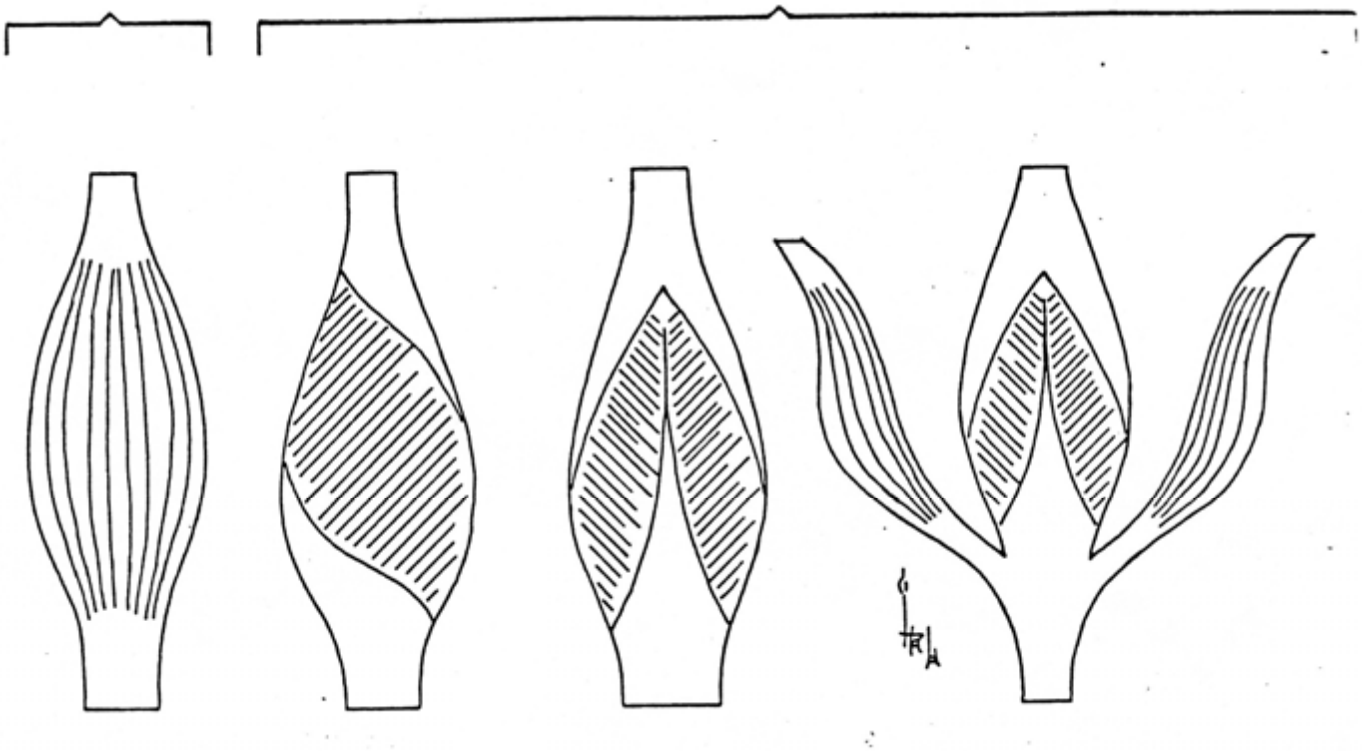
Penniform or Feather-Like-type of muscle with a series of short parallel fibers extend diagonally from the side of a long tendon, giving the muscle an appearance of a wing feather. Example Extensor Digatorum Longus.

Bipenniform-a double penniform muscle. A long central tendon with the fibers extending diagonally in pairs from either side of the tendon. Example Rectus Femoris of the leg and thigh.

Multipenniform-type of muscle with several tendons present with the muscle fibers running diagonally between them. Example middle portion of the Deltoid muscle of the shoulder and upper arm.

Muscle Variations

Identify the muscle classification and what type of muscle it is.



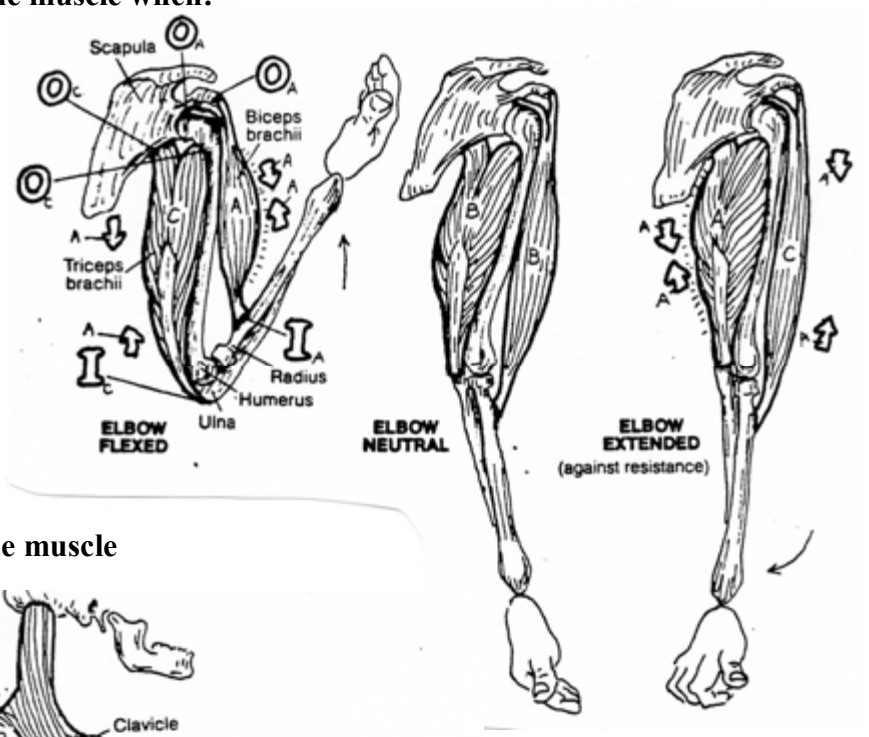
Muscle Action at the Elbow Joint

Color in the action of the muscle when:

Contracted-(A)

Relaxed-(B)

Stretched-(C)



On this Picture color the muscle

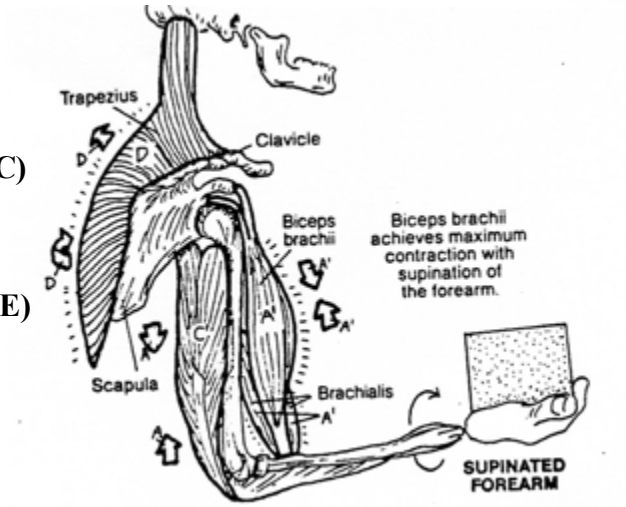
Terms:

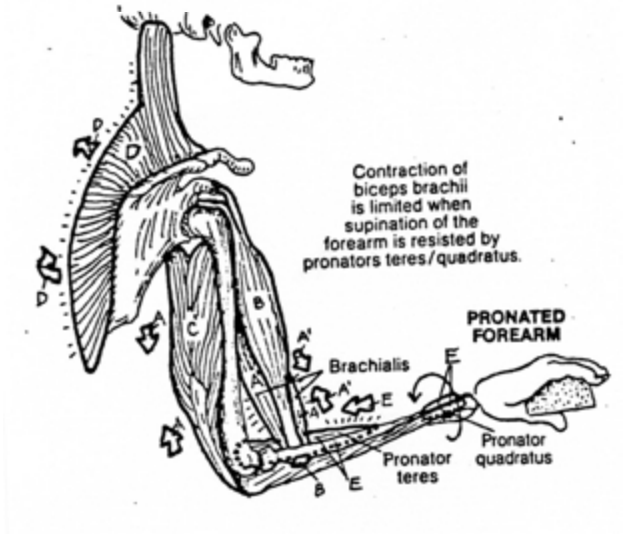
Agonist-(A)

Antagonist-(C)

Fixator-(D)

Neutralizer-(E)





Lesson Five-Questions

1. Involuntary muscles do what type of work?

2. What can be increased by physical training?

3. Muscle is what percent of the body weight?

4. Fast twitch fibers are used for what type of activity?

5. There are how many skeletal muscles in the human body?

6. What grows form birth to adulthood!

7. Skeletal muscles are attached to bones by what?

8. What passes from the spinal cord to all muscles?

9. What type of fiber is low level force production?

10. What are the two classifications of muscles?

11. A muscle cell is called what?

12. The smallest functional unit of a muscle fiber is called?

13. Tendons located at the ends of a limb are what size?

14. The skeleton muscle is controlled by what system?

15. Cardiac muscle is what type of muscle?

Lesson Six

Upper Body Muscles

The muscular system of the upper body consists of the muscles of the neck, spine, trunk, shoulder, upper arm, forearm, and hand.

Muscles that move the Head

The head movement results from the action of paired muscles in the neck and upper back. These muscles are responsible for flexing extending and rotating the head. The main muscle for this movement is the sternocleidomastoid which is a long muscle in the side of the neck.

Muscles that move the Pectoral Girdle and Trunk

The muscles that move the pectoral girdle are closely associated with those that move the upper arm. A number of these chest and shoulder muscles connect the scapula to nearby bones and act to move the scapula upward, downward, forward and backward. Muscles that move the pectoral girdle included the following Trapezius, Rhomboids, Levator Scapular, Serratus and Pectoralis.

Muscles of the Abdominal Wall

Although the walls of the chest and pelvic region are supported directly by bones those of the abdomen are not. Instead, the anterior and lateral walls of the abdomen are composed of broad, flattened muscles arranged in layers these muscles connect the rib cage and vertebral column to the pelvic girdle. Contraction of these muscles decreases the size of the abdominal cavity and increases the pressure inside.

Muscles that move the Upper Arm and Shoulder

The upper arm is one of the more freely movable parts of the body. Its many movements are made possible by muscles that connect the humerus to various regions of the pectoral girdle, ribs, and the vertebral column. Shoulder stabilizing is the function of four muscles that constitute the **"Rotator Cuff"** these are the supraspinatus, infraspinatus, teres minor and subscapularis.

Muscle that move the Forearm

Most forearm movement is produced by muscles that connect the radius or ulna to the humerus or pectoral girdle. A group of muscles located along the anterior surface of the humerus act to flex the elbow, while a single posterior muscle serves to extend this joint.

Muscles that move the Wrist, Hand, Fingers

Many muscles are responsible for wrist, hand, and finger movements. They originate from the distal end of the humerus and from the radius and ulna. The two major groups of these muscles are flexors on the anterior side of the forearm and extensors on the posterior side.

Muscles That Move The Spine

The major movements of the spine are flexion, extension, abduction, adduction, rotation outward and rotation inward. Flexion is bending forward and extension is straightening up. Abduction is bending sideward and adduction is straightening up. Rotation outward is twisting the spine laterally and inward rotation is twisting it medially.

Notice that muscles are paired like twins. Before, one was in the right leg and the other in the left leg. Now, one is on one side of the spine and the other is on the opposite side. So for the spine, if a muscle can abduct, then the twin can adduct. If one can rotate outward then the twin can rotate inward. To be brief, let's just use flex, extend, abduct and rotate. Notice, too, which bones are moved: the head or h, the cervical (neck) vertebrae or cv, the thoracic (rib) vertebrae or tv, the lumbar (lower back) vertebrae or lv.

The psoas major and minor are muscles on the anterior aspect of the spine. They are attached to the lumbar vertebrae and to the femur. They flex and abduct the spine (lv).

(so'as)

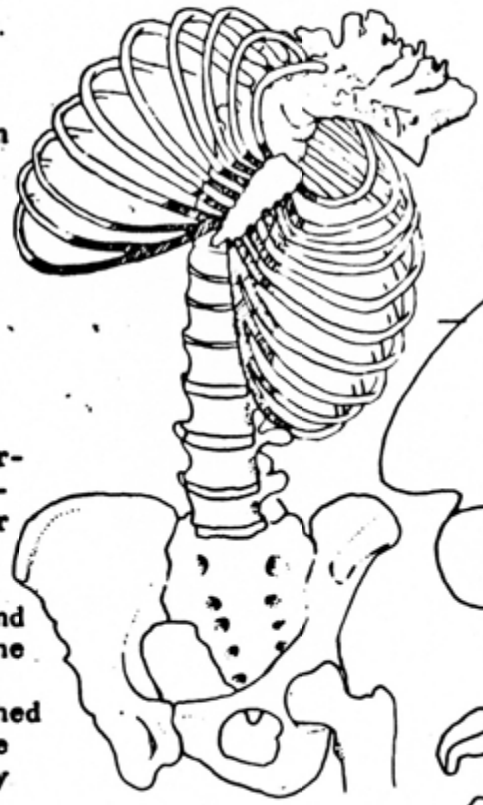


Figure 18A

The rectus abdominis is a muscle on the anterior aspect of the spine. It is attached to ribs 5 through 7 and to the pubis. It flexes and abducts the spine (tv, lv). (rek'tus ab-dom'i-nis)

This wrestler flexes and abducts his spine (tv, lv) to take down the opponent.

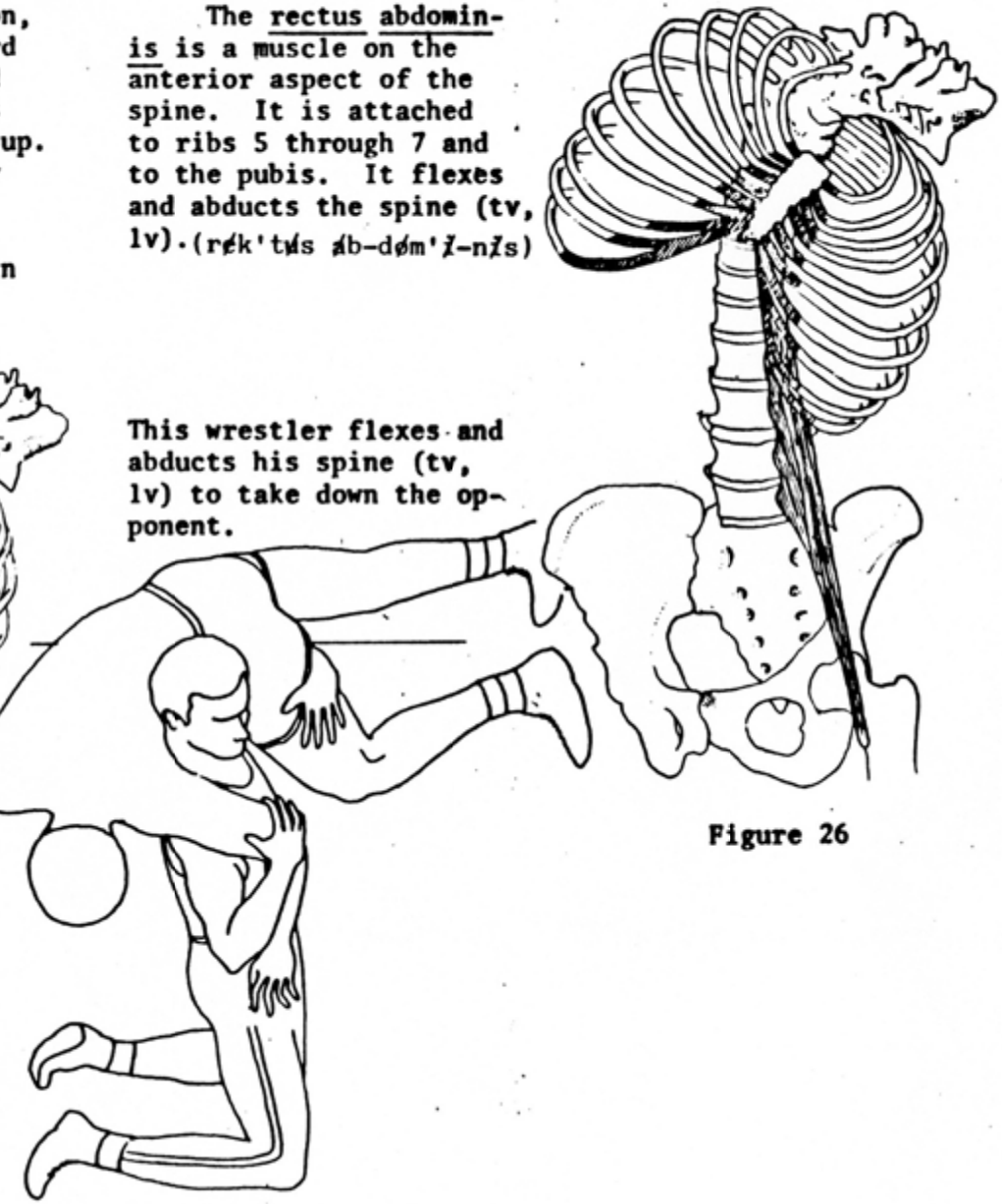


Figure 26

Muscles That Move The Spine

The obliquus internus abdominis is a muscle on the lateral aspect of the spine. It is attached from ribs 10 through 12 and connective tissue to the crest of the ilium. It flexes, abducts and rotates the spine (tv, lv).

(øb-li'kwøs ĭn-tur'nøs ǽb-døm'ĭ-nĭs)

This sit-up is done by flexing, abducting and rotating the spine (tv, lv).

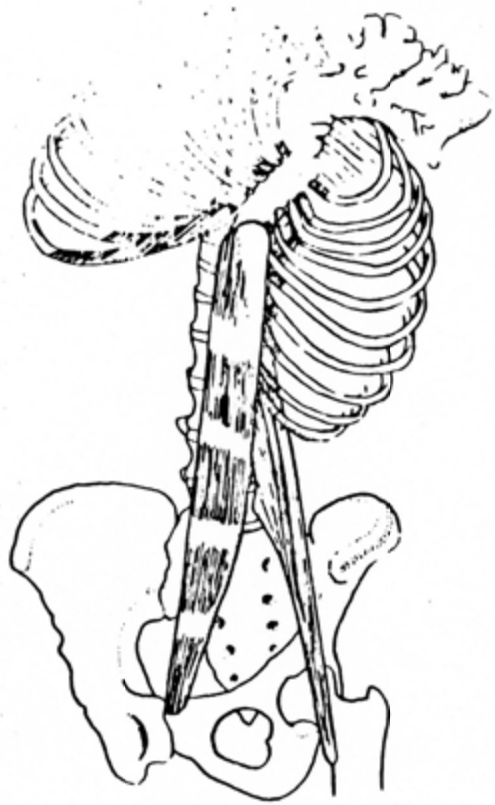
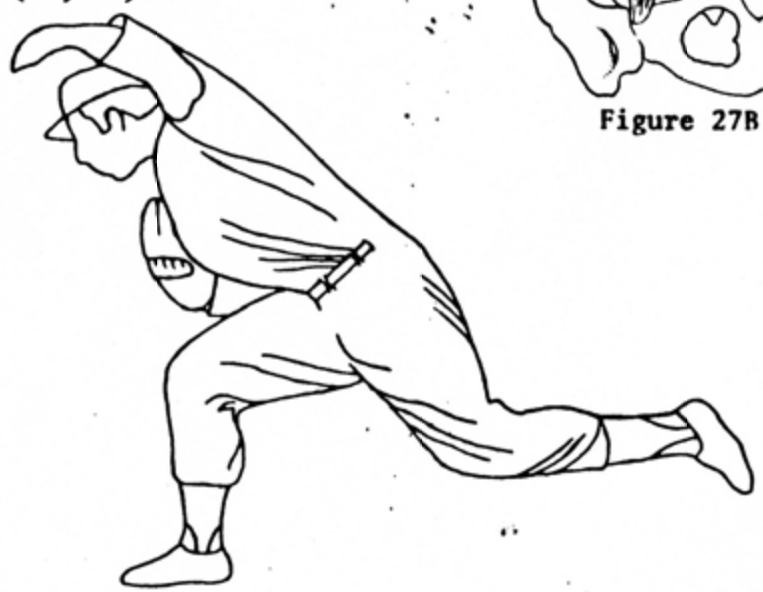


Figure 27A

The obliquus externus abdominis is a muscle on the lateral aspect of the spine. It is attached to ribs 5 through 12, the crest of the ilium and the connective tissue (aponeurosis) by the rectus abdominis. It flexes, abducts and rotates the spine (tv, lv).

(øb-li'kwøs ex-tur'nøs ǽb-døm'ĭ-nĭs)

Pitchers flex, abduct and rotate the spine (tv, lv).



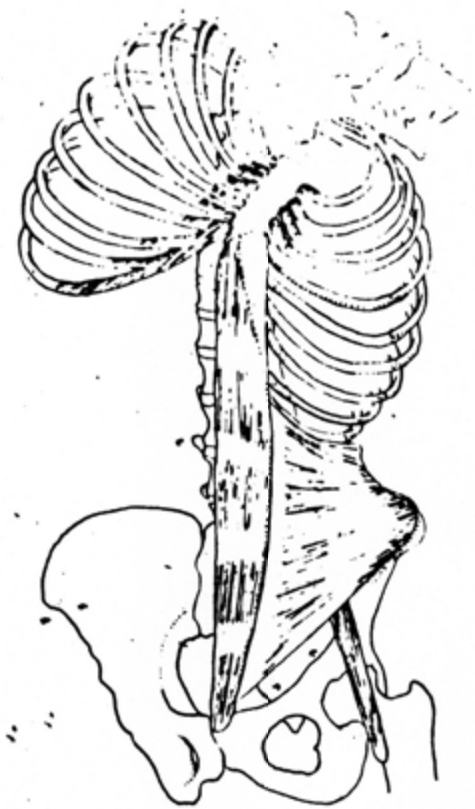


Figure 27B

Muscles That Move The Spine

The sternocleidomastoideus is a muscle on the lateral aspect of the spine. It is attached from the skull to the sterum and the clavicle. It flexes, abducts and rotates the spine (h, cv).

(stur-no-kli-do-mas-toi'de-us)

This wrestler resists by flexing, abducting and rotating his head and neck.

Figure 30

The hyoids are muscles on the anterior aspect of the neck. They all are attached to the hyoid bone. The ones above also are attached either to the temporal bone or to the mandible. The ones below are attached to the sternum and scapula. They flex the spine (h, cv). (hi'oid)

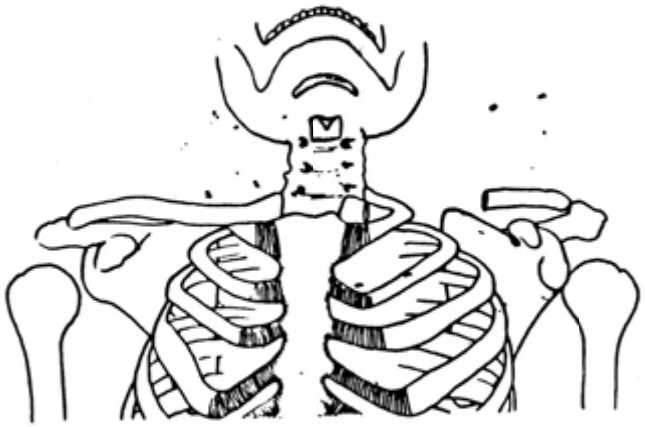
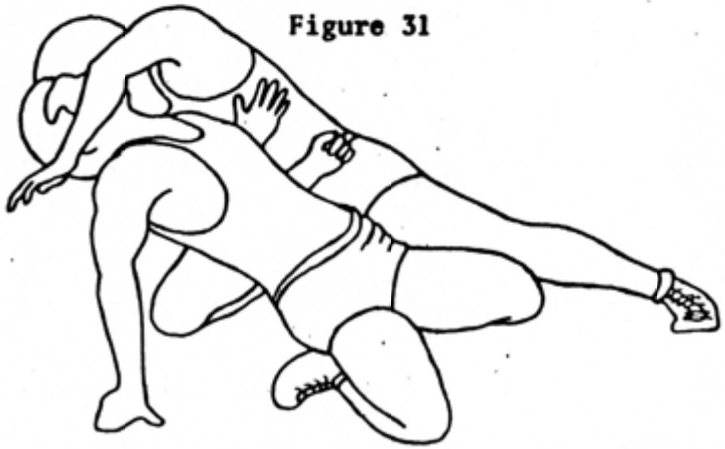


Figure 31

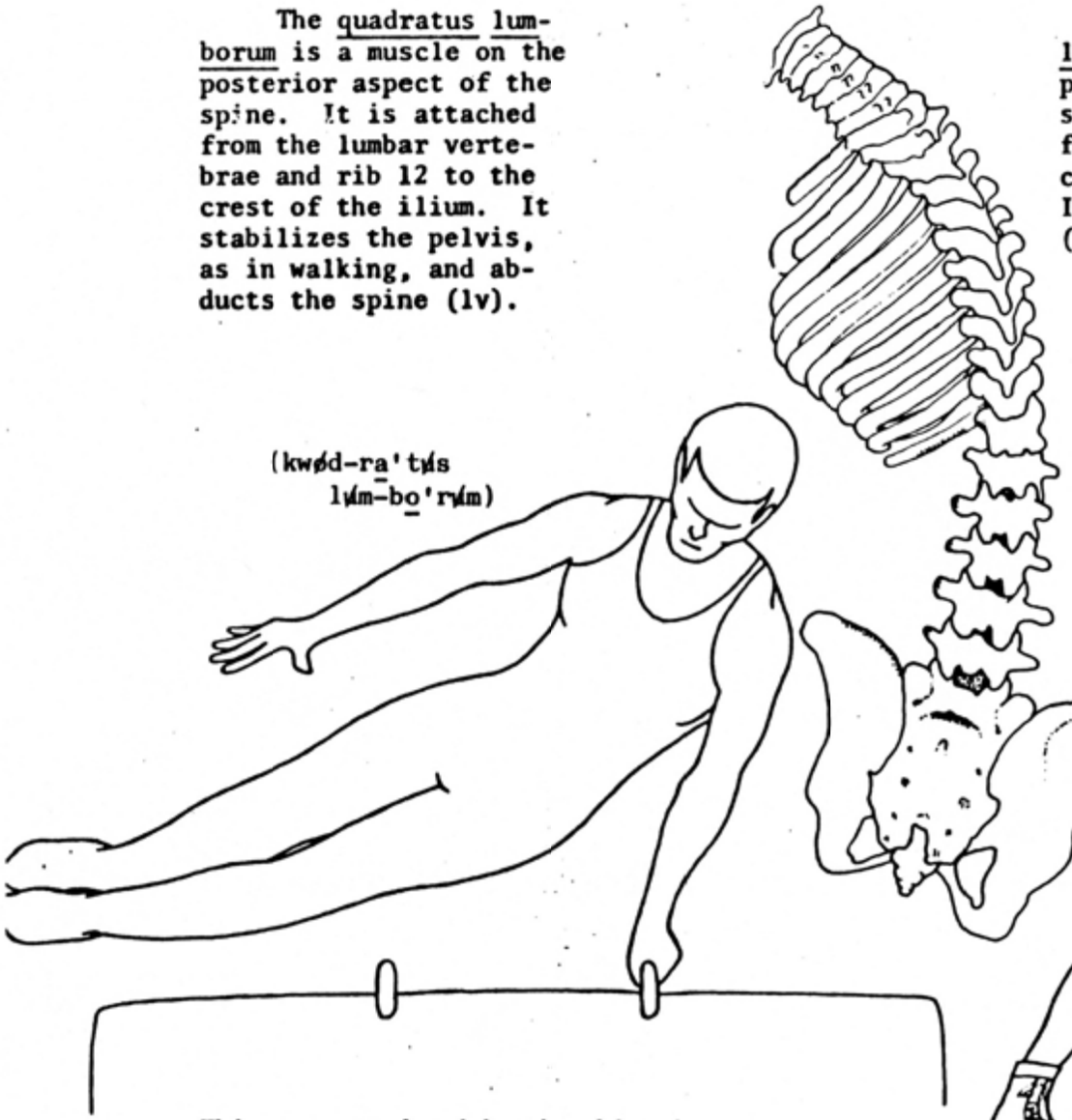


This wrestler resists by flexing his head and neck.

Muscles That Move The Spine

The quadratus lumborum is a muscle on the posterior aspect of the spine. It is attached from the lumbar vertebrae and rib 12 to the crest of the ilium. It stabilizes the pelvis, as in walking, and abducts the spine (lv).

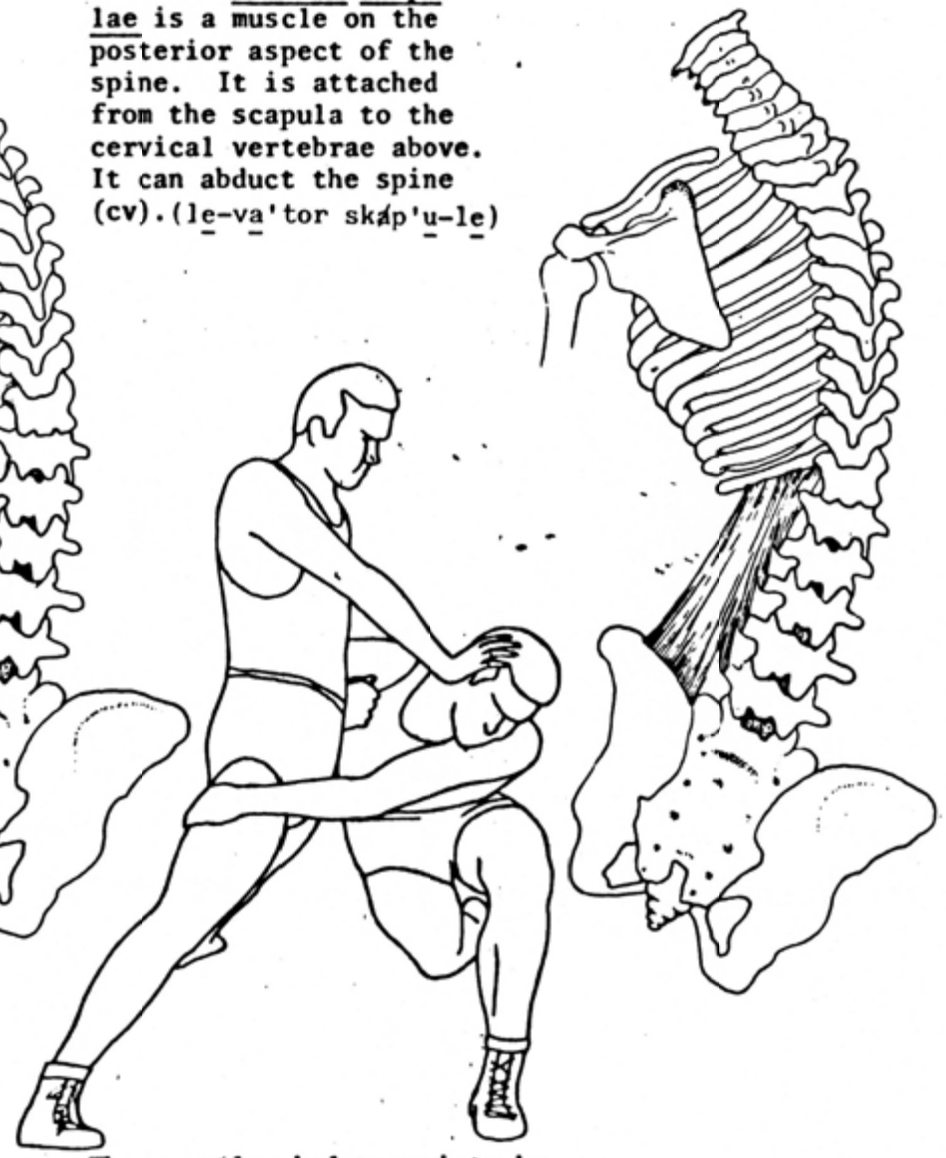
(kwød-ra'tus lum-bo'rum)



This gymnast is abducting his lumbar vertebrae on the sidehorse.

Figure 32

The levator scapulae is a muscle on the posterior aspect of the spine. It is attached from the scapula to the cervical vertebrae above. It can abduct the spine (cv). (le-va'tor skap'u-le)



The wrestler below resists by abducting his spine (cv).

Figure 33

Muscles That Move The Spine

Muscles For The Figures

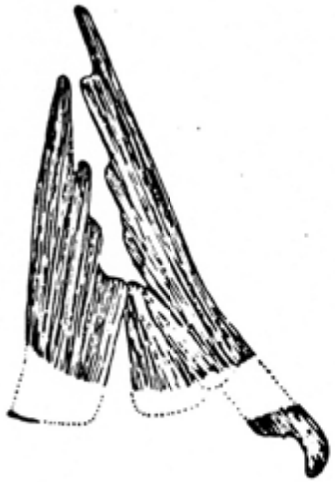
18A

26

27A

27B

28



29

Muscles That Move The Spine

Muscles For The Figures (contin.)

30

31

32

33

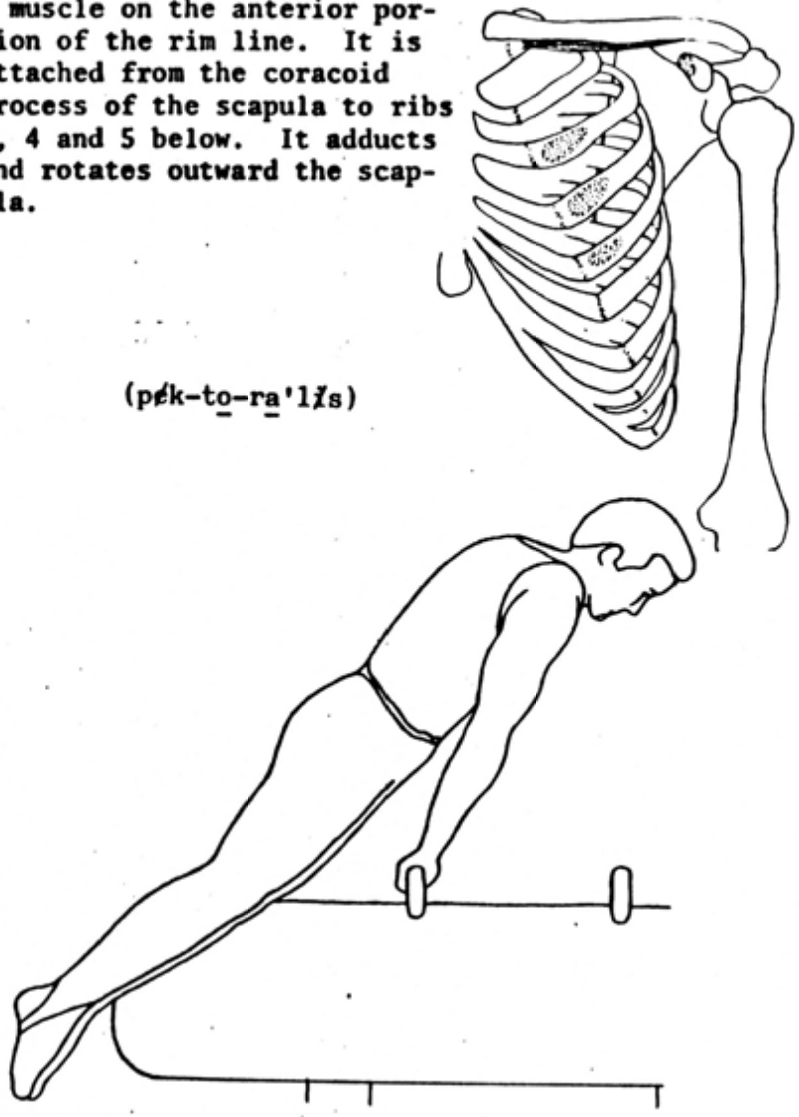
34A

34B

Muscles That Move The Shoulder Girdle At The Sternum

The pectoralis minor is a muscle on the anterior portion of the rim line. It is attached from the coracoid process of the scapula to ribs 3, 4 and 5 below. It adducts and rotates outward the scapula.

(pek-to-ra'lis)

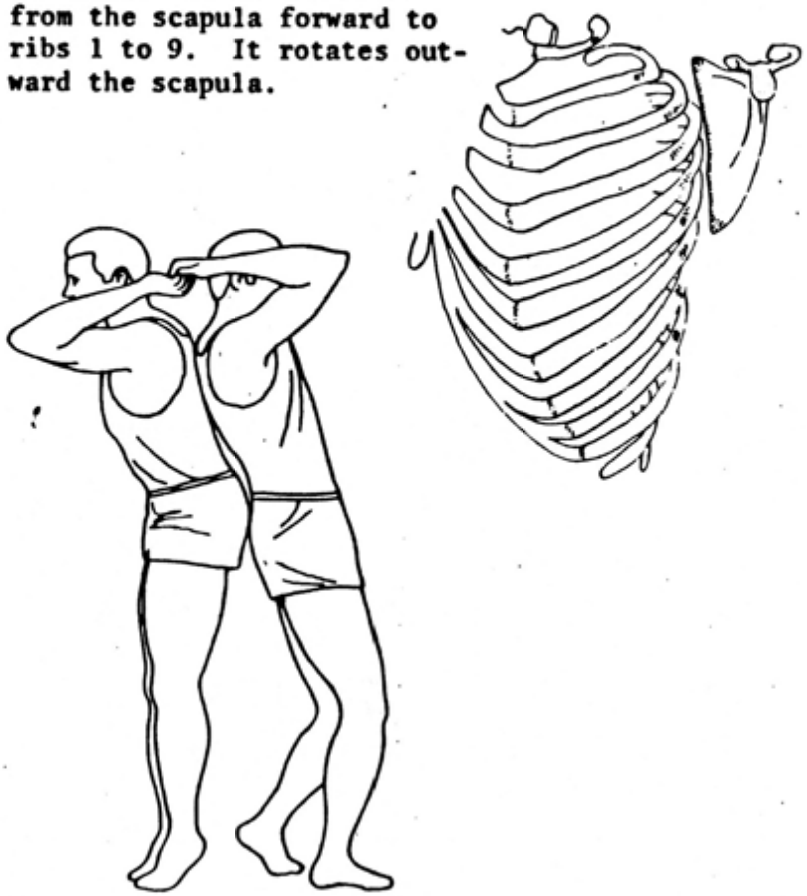


This gymnast adducts and rotates outward his scapulae as he performs on the side horse.

Figure 61

The serratus anterior is a muscle on the anterior aspect of the rim line that goes along the vertebral border of the scapula and faces the ribs. It is attached from the scapula forward to ribs 1 to 9. It rotates outward the scapula.

(se-ra'tus)



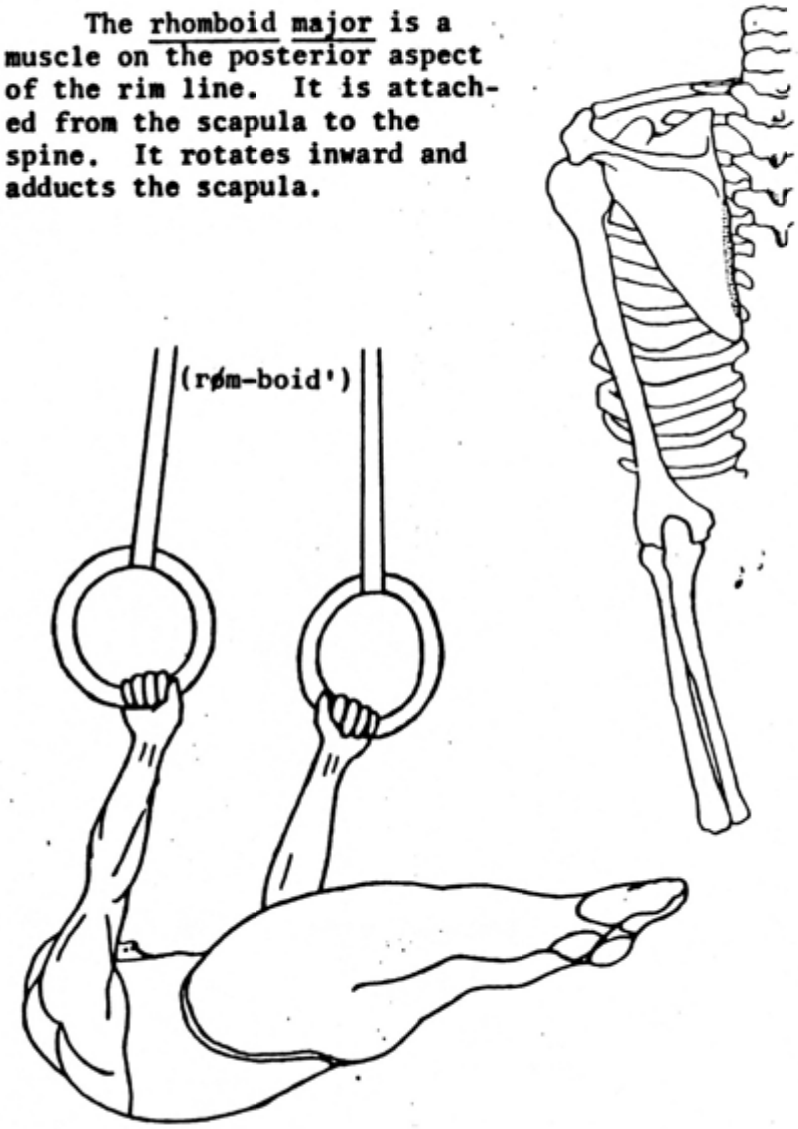
The scapulae of both men outward rotate as the man on the right prepares for a backward somersault over the back of his partner.

Figure 62

Muscles That MOve The Shoulder Girdle At The Sternum

The rhomboid major is a muscle on the posterior aspect of the rim line. It is attached from the scapula to the spine. It rotates inward and adducts the scapula.

(rǿm-boid')

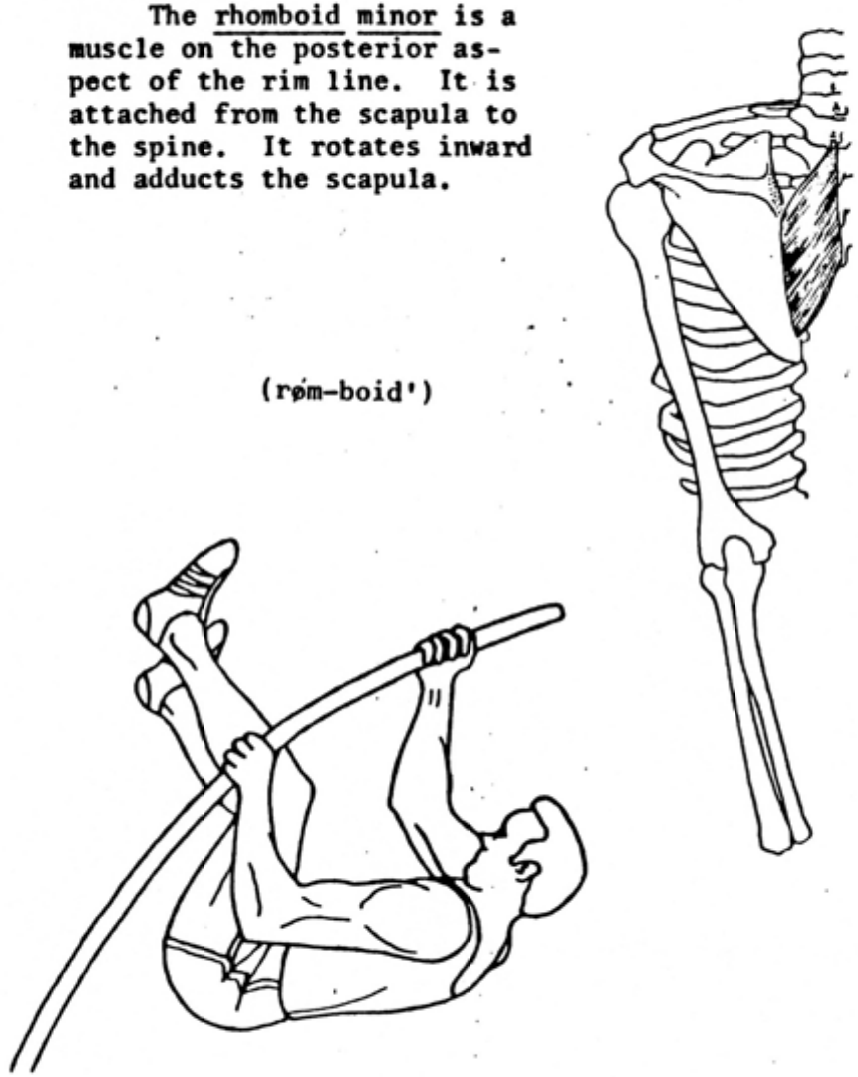


This gymnast rotates inward and adducts his scapulae as he does a front lever on the flying rings.

Figure 63A

The rhomboid minor is a muscle on the posterior aspect of the rim line. It is attached from the scapula to the spine. It rotates inward and adducts the scapula.

(rǿm-boid')



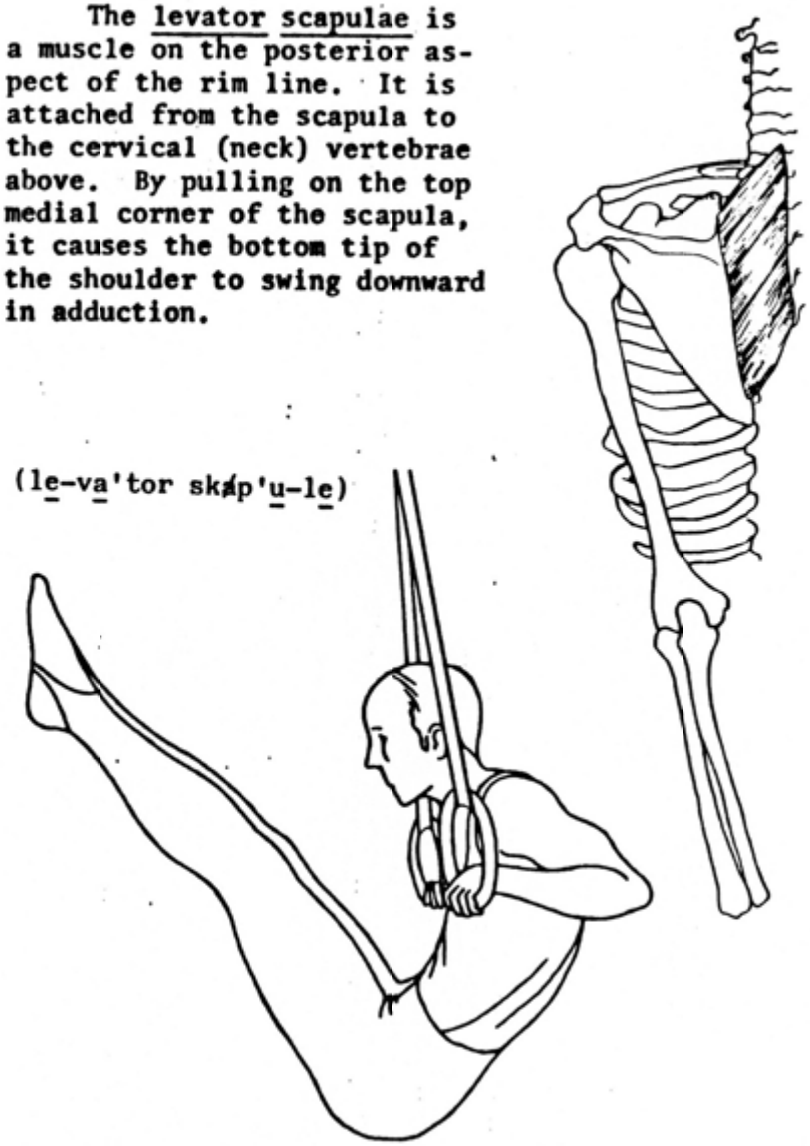
This pole vaulter is rotating inward and adducting his scapulae.

Figure 63B

Muscles That Move The Shoulder Girdle At The Sternum

The levator scapulae is a muscle on the posterior aspect of the rim line. It is attached from the scapula to the cervical (neck) vertebrae above. By pulling on the top medial corner of the scapula, it causes the bottom tip of the shoulder to swing downward in adduction.

(le-va'tor skap'u-le)

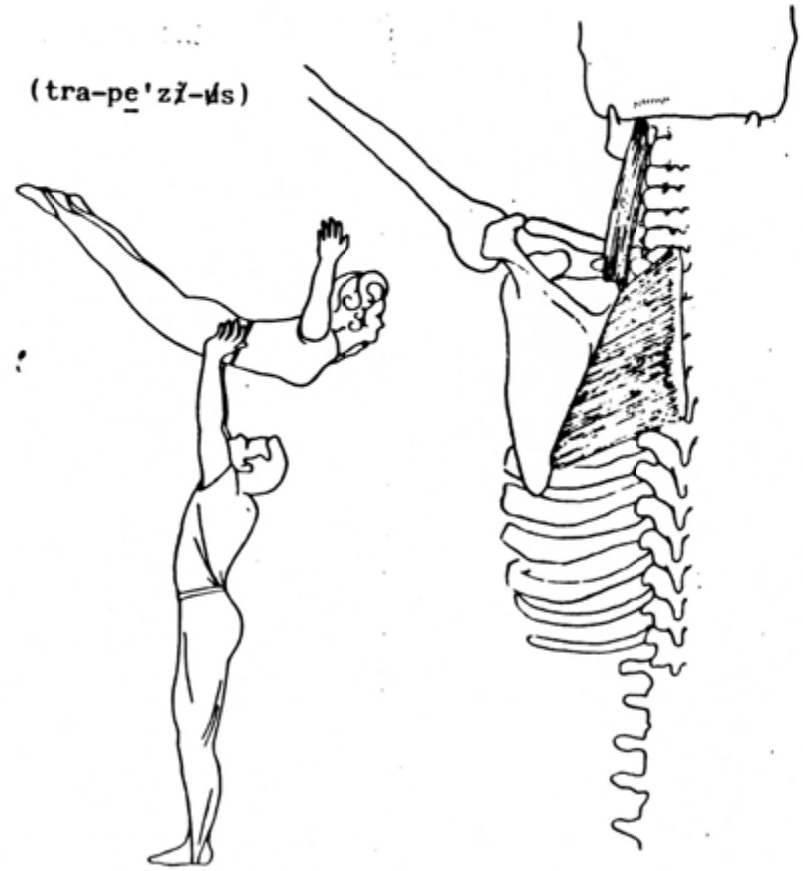


This gymnast adducts his scapulae as he rises upward on the rings.

Figure 33

The superior trapezius is a muscle on the posterior rim line. It is attached from the scapula to the skull and vertebrae above. It abducts the scapula.

(tra-pe'zī-us)



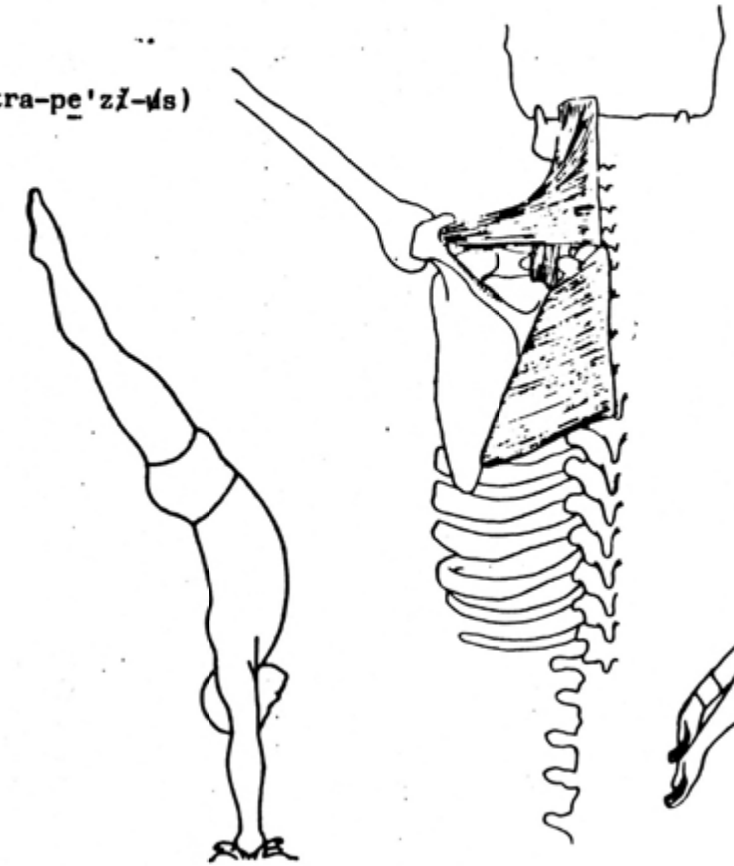
The gymnast below abducts his scapulae (the gymnast above rotates inward her scapulae).

Figure 64

Muscles That Move The Shoulder Girdle At The Sternum

The medial trapezius is a muscle on the posterior rim line. It is attached horizontally from the scapula to the vertebrae. It abducts and rotates inward the scapula.

(tra-pē'zĭ-ŭs)

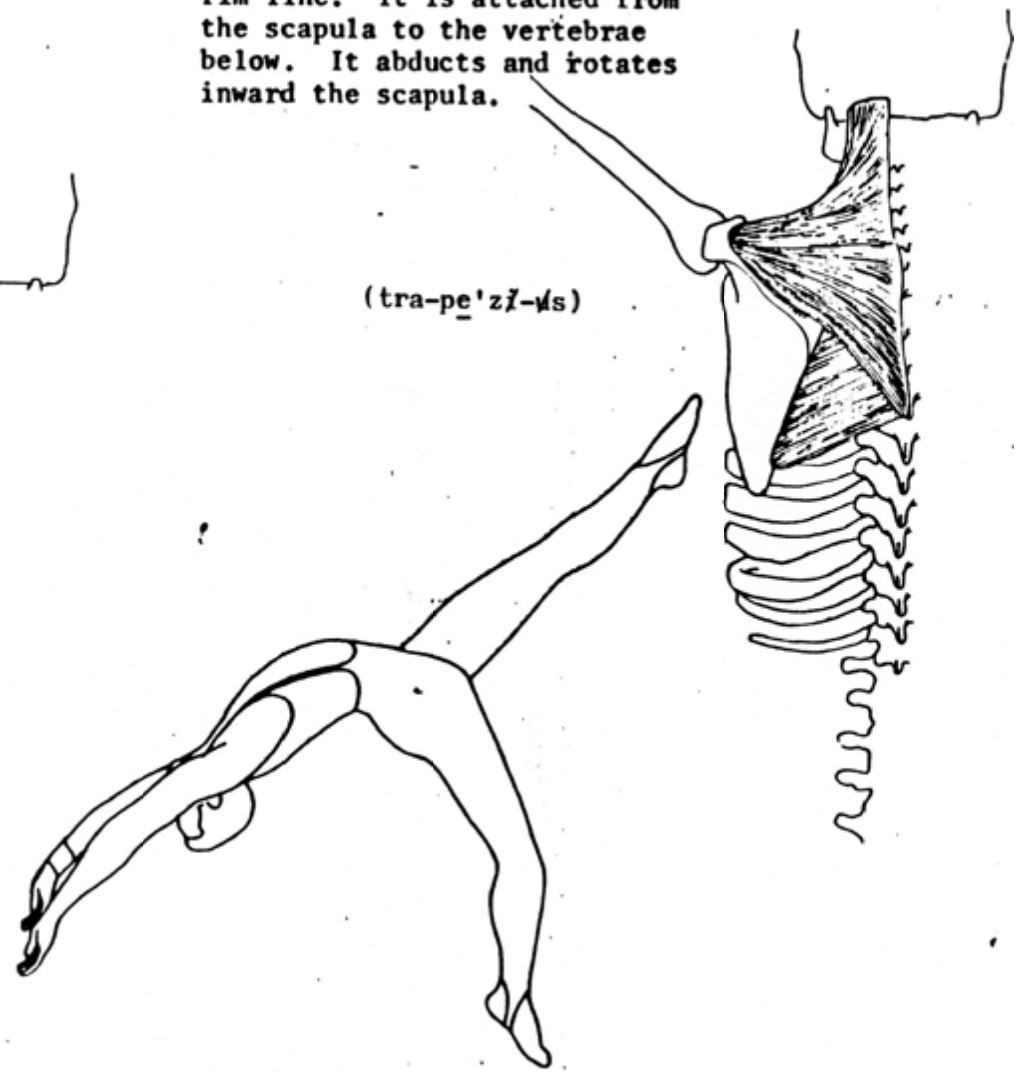


This diver abducts and rotates inward his scapulae.

Figure 65A

The inferior trapezius is a muscle on the posterior rim line. It is attached from the scapula to the vertebrae below. It abducts and rotates inward the scapula.

(tra-pē'zĭ-ŭs)



This gymnast abducts and rotates inward his scapulae as he completes a handspring.

Figure 65B

Muscles That Move The Humerus At The Shoulder

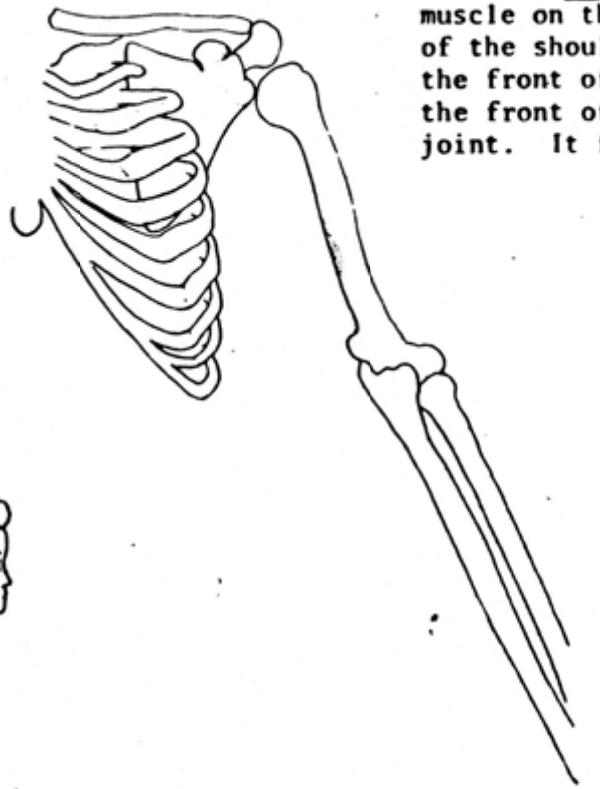
This last group of muscles attach the humerus to the joint fossa, or close to it.

The coracobrachialis is a muscle on the anterior aspect of the shoulder. It attaches the front of the humerus to the front of the shoulder joint, the coracoid process of the scapula. It flexes the humerus.

(kør-a-ko-bra-kĭ-a'lĭs)

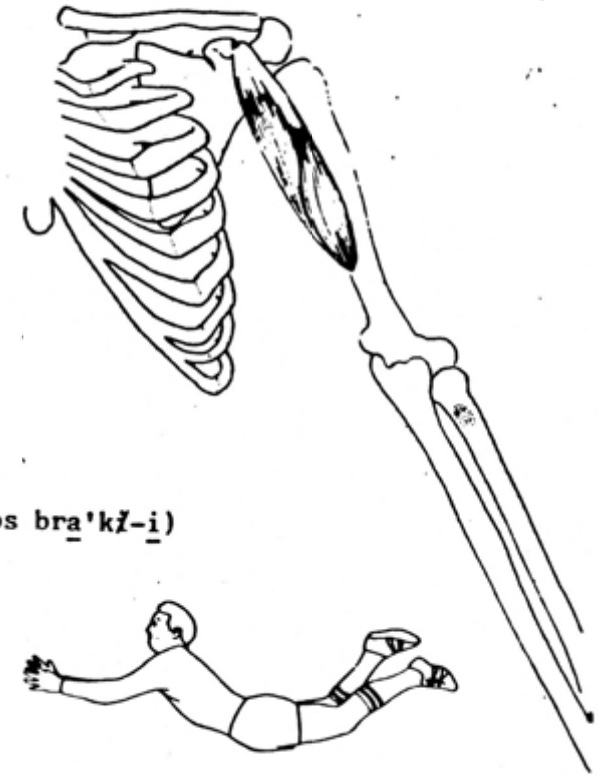
This bowler will flex her humerus to deliver the ball.

Figure 59



The biceps brachii is a muscle on the anterior aspect of the shoulder. It attaches the front of the forearm to the front of the shoulder joint. It flexes the humerus.

(bi'seps bra'kĭ-i)

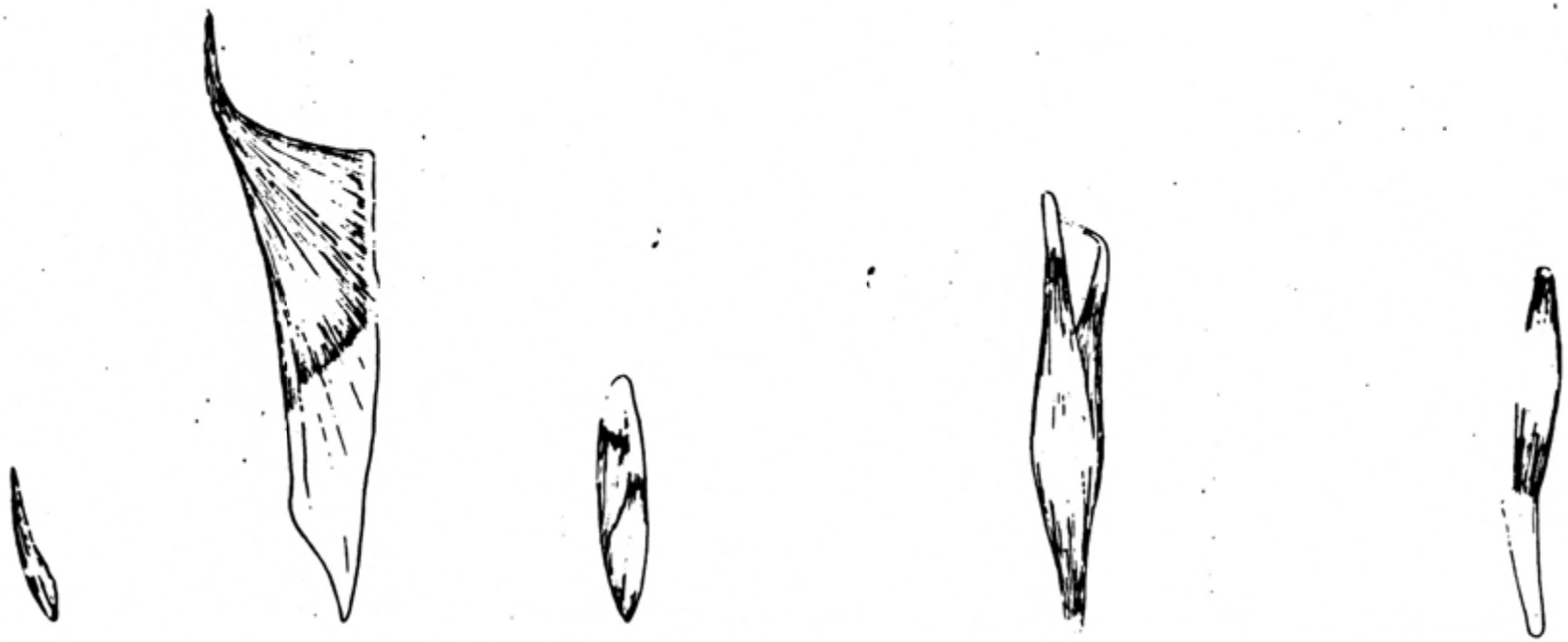


This rugby player makes a diving pass by flexing both humeri.

Figure 45A

Muscles That Move The Humerus At The Shoulder

Muscles For The Figures (contin.)



57 58 59 45A 47A

Muscles That Move The Shoulder Girdle At The Sternum

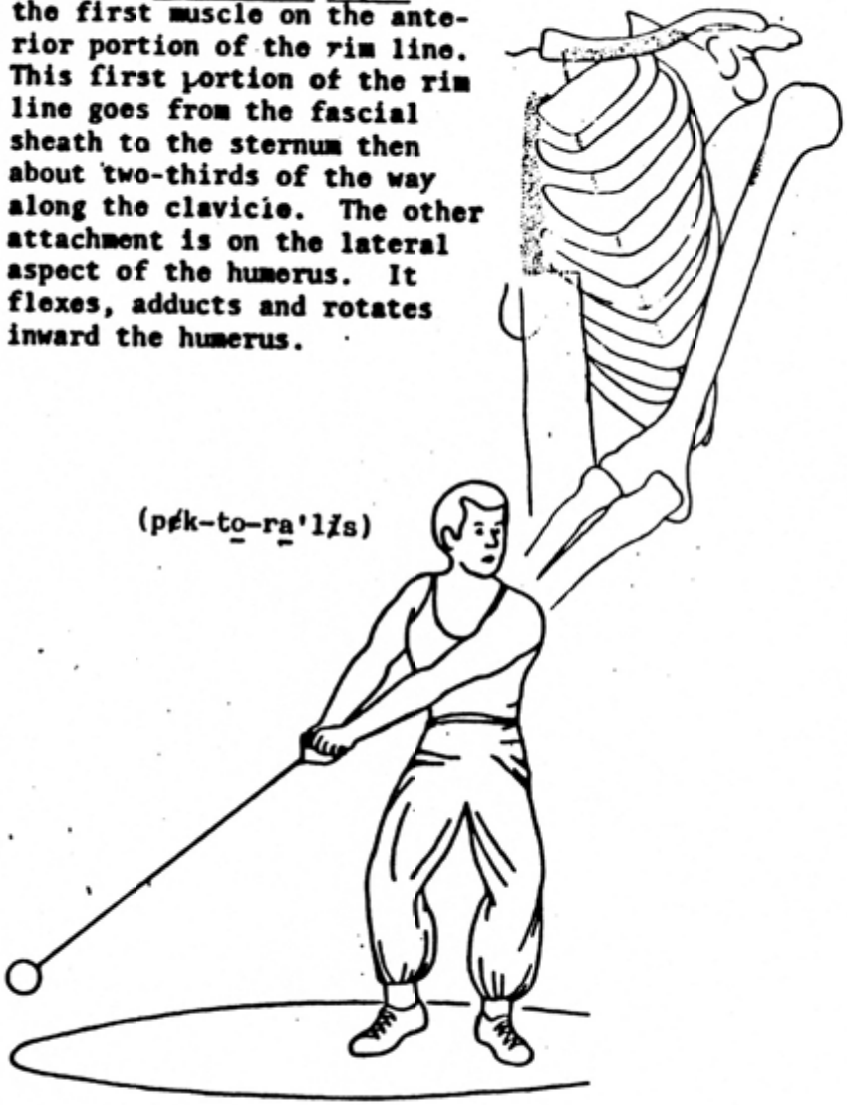
Muscles For The Figures

60 61 62 63A 63B 33 64 65A 65B

Muscles That Move The Humerus At The Shoulder

The pectoralis major is the first muscle on the anterior portion of the rim line. This first portion of the rim line goes from the fascial sheath to the sternum then about two-thirds of the way along the clavicle. The other attachment is on the lateral aspect of the humerus. It flexes, adducts and rotates inward the humerus.

(pek-to-ra'lis)

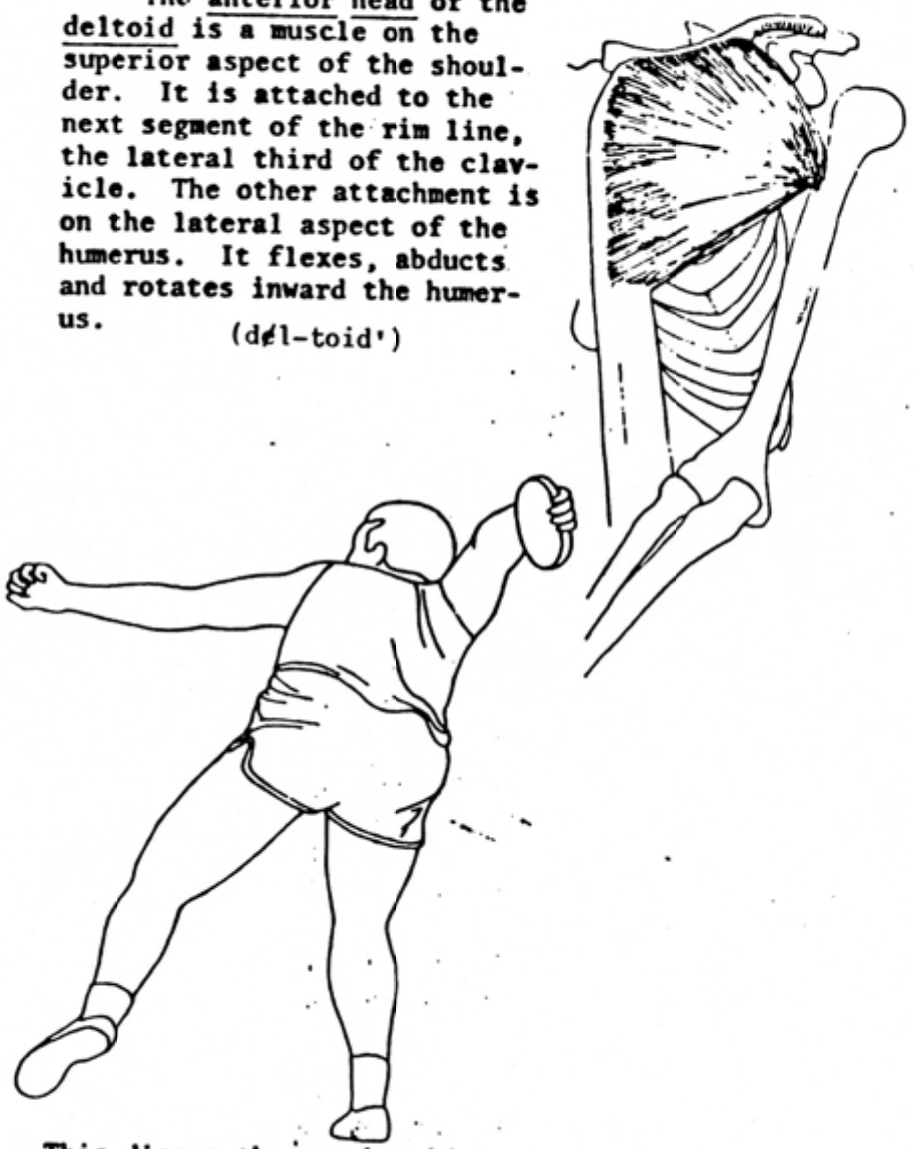


This athlete will throw the hammer by flexing, adducting and rotating inward his right humerus.

Figure 50

The anterior head of the deltoid is a muscle on the superior aspect of the shoulder. It is attached to the next segment of the rim line, the lateral third of the clavicle. The other attachment is on the lateral aspect of the humerus. It flexes, abducts and rotates inward the humerus.

(del-toid')

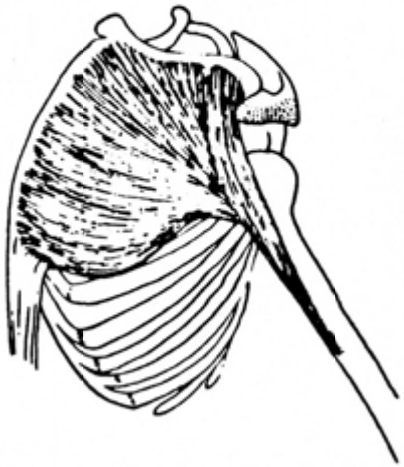


This discus thrower has his humerus rotated inward and will abduct and flex the humerus to complete the throw.

Figure 51

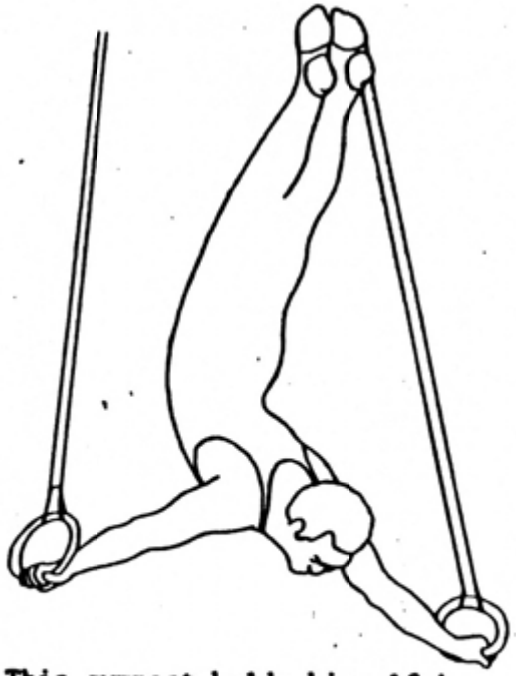
Muscles That Move The Humerus At The Shoulder

The medial head of the deltoid is a muscle on the superior aspect of the shoulder. It is attached to the next segment of the rim line, the lateral portion of the scapula that forms the bony tip of the shoulder. The other attachment is on the lateral aspect of the humerus. It abducts the humerus.



The posterior head of the deltoid is a muscle on the superior aspect of the shoulder. It is attached to the spine of the scapula, the next segment of the rim line, and to the lateral aspect of the humerus. It extends, abducts and rotates outward the humerus. (del-toid')

The concept of the rim line will be continued with the latissimus dorsi in this chapter and with muscles in the next chapter. We next go to the idea of the envelope.



This gymnast holds himself in an inverted flying cross by abducting his humeri.

Figure 52

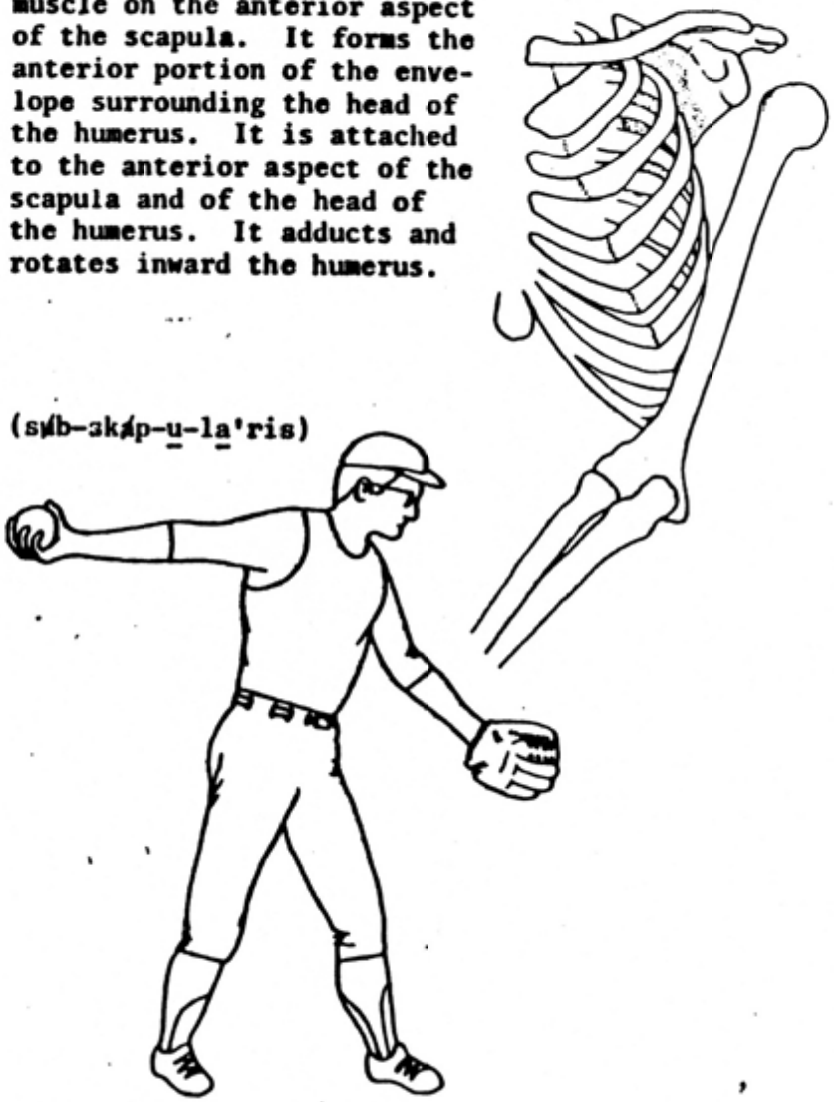
This tennis player is extending, abducting and outward rotating his humerus in preparation for a smash.

Figure 53

Muscles That Move The Humerus At The Shoulder

The subscapularis is a muscle on the anterior aspect of the scapula. It forms the anterior portion of the envelope surrounding the head of the humerus. It is attached to the anterior aspect of the scapula and of the head of the humerus. It adducts and rotates inward the humerus.

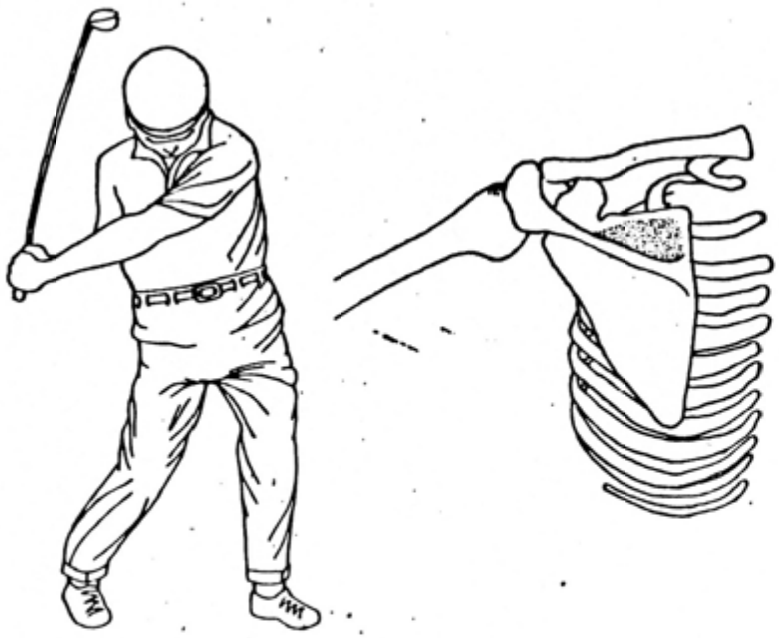
(sʌb-skʌp-u-la'ris)



This softball pitcher will adduct and rotate inward (as he flexes) the humerus.

Figure 54

The supraspinatus is a muscle on the superior aspect of the shoulder. It forms the superior portion of the envelope surrounding the head of the humerus. It is attached to the superior aspect of the scapula and, by going under the tip of the shoulder, to the superior aspect of the humerus. It abducts the humerus. (su-pra-spi-na'tʌs)



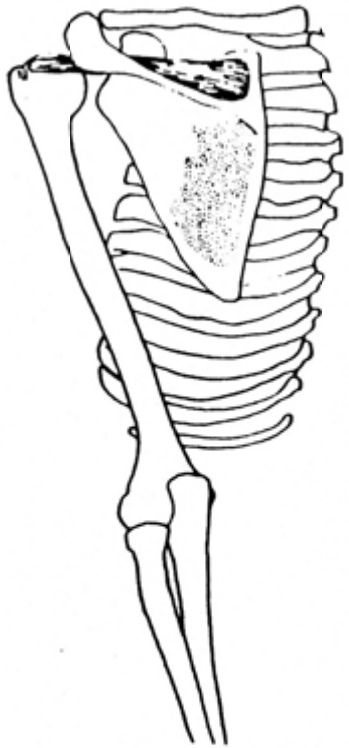
This golfer will abduct his left humerus to hit the ball.

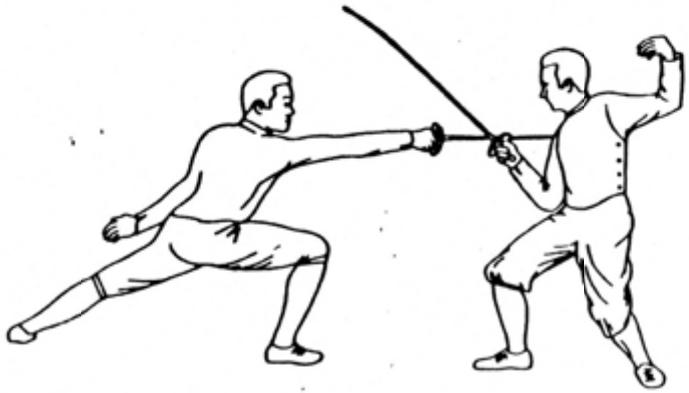
Figure 55

Muscles That Move The Humerus At The Shoulder

The <u>infraspinatus</u> is a muscle on the posterior aspect of the shoulder. It forms a posterior portion of the envelope surrounding the head of the humerus. It is attached to the posterior aspect of the scapula and of the head of the humerus. It extends and rotates outward the humerus.

(ĭn-fra-spi-na'tŭs)



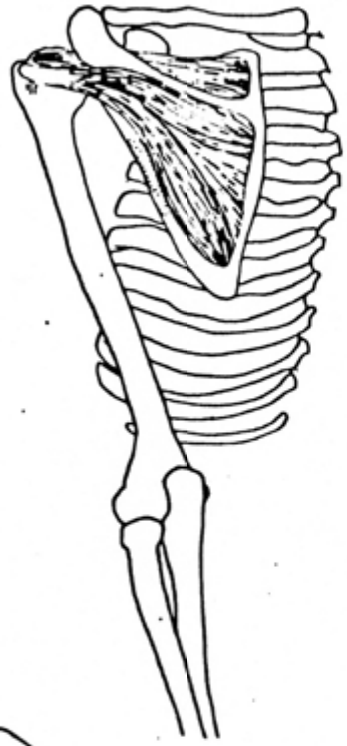


The fencer on the right extends and rotates outward his humerus to parry.

Figure 56A

The <u>teres minor</u> is a muscle on the posterior aspect of the shoulder. It forms a posterior portion of the envelope surrounding the head of the humerus. It is attached to the posterior aspect of the scapula and of the head of the humerus. It extends and rotates outward the humerus.

(te'rez)



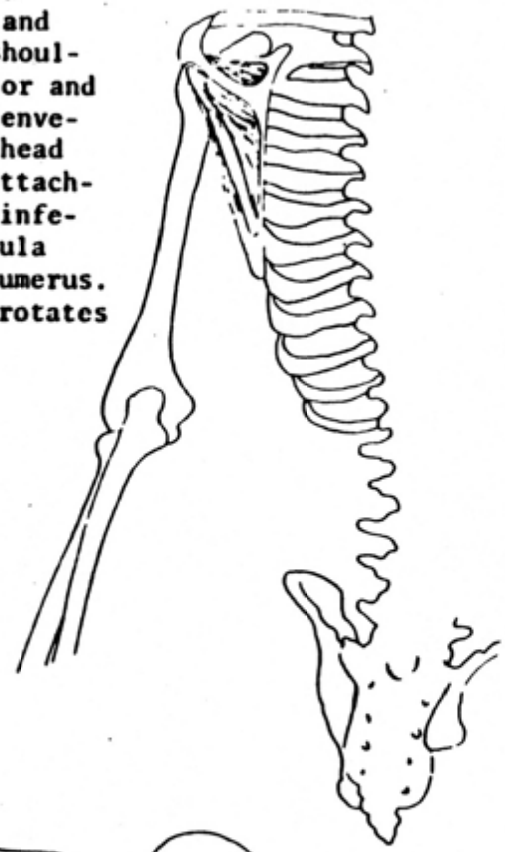
The judoka extends and rotates outward his right humerus to throw his opponent.

Figure 56B

Muscles That Move The Humerus At The Shoulder

The teres major is a muscle on the posterior and inferior aspect of the shoulder. It forms a posterior and inferior portion of the envelope that surrounds the head of the humerus. It is attached to the posterior and inferior aspects of the scapula and of the head of the humerus. It extends, adducts and rotates inward the humerus.

(te'rez)

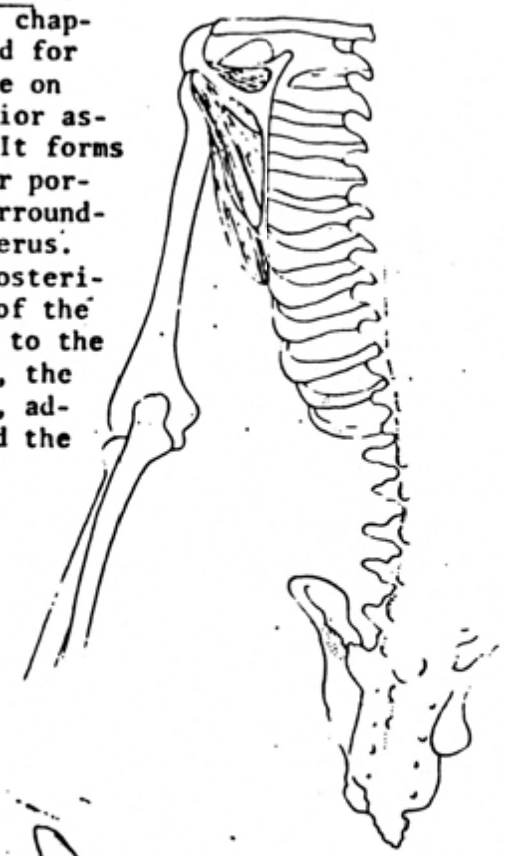


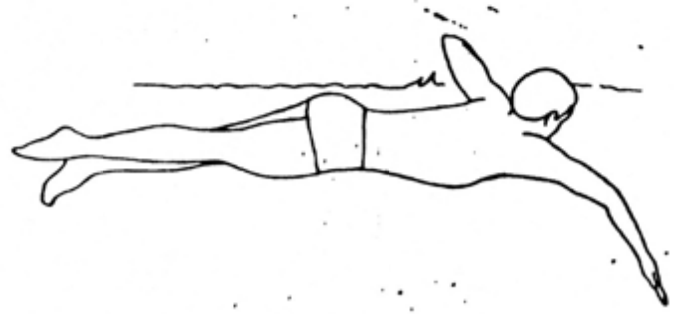
This butterfly swimmer has just extended, adducted and rotated inward the humeri.

Figure 57

The latissimus dorsi is the last muscle in this chapter for the envelope and for the rim. It is a muscle on the posterior and inferior aspect of the shoulder. It forms a posterior and inferior portion of the envelope surrounding the head of the humerus. It is attached to the posterior and inferior aspect of the head of the humerus and to the last portion of the rim, the lower back. It extends, adducts and rotates inward the humerus.

(la-tĭs'ĭ-mus dor'si)





This freestyle swimmer is extending, adducting and rotating inward his right humerus.

Figure 58

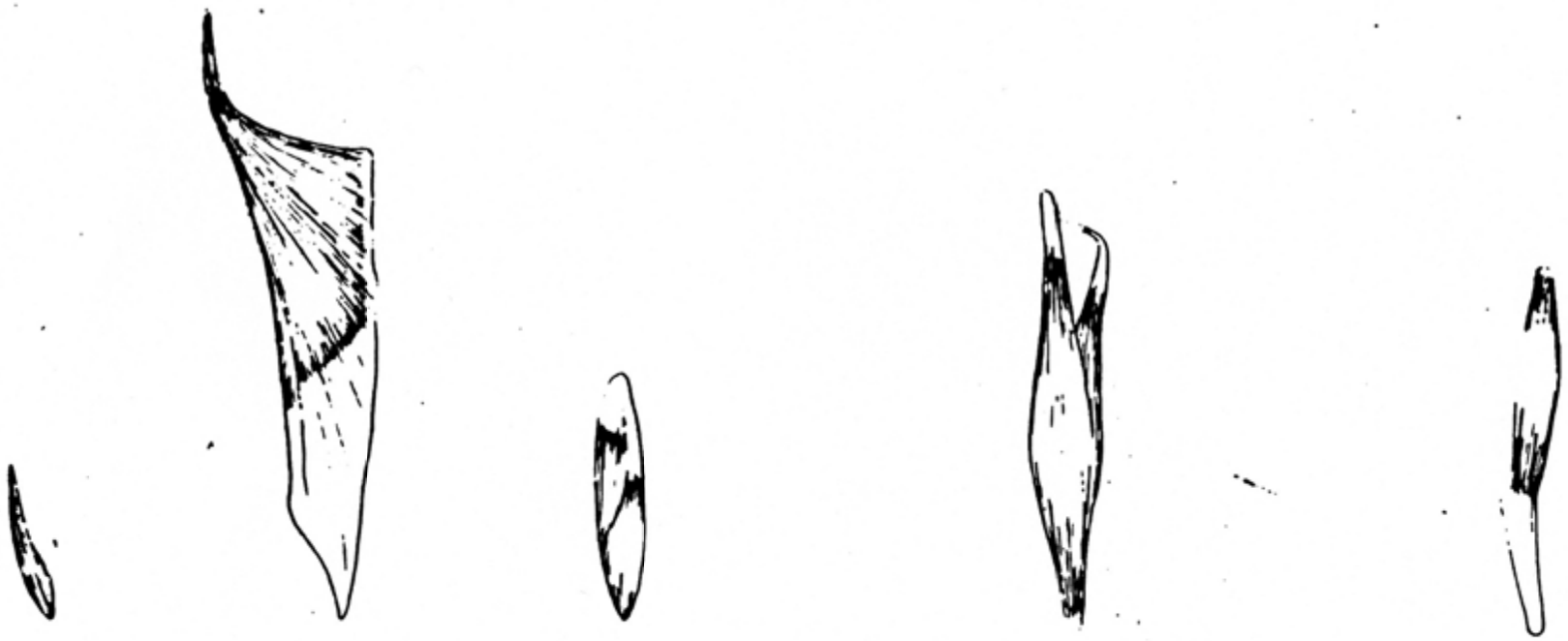
Muscles That Move The Humerus At The Shoulder

Muscles For The Figures

50 51 52 53 54 55 56A 56B

Muscles That Move The Humerus At The Shoulder

Muscles For The Figures (contin.)



57 58 59 45A 47A

Muscles That Move The Forearm At The Elbow

The major movements of the forearm at the elbow are flexion, extension, outward rotation and inward rotation. Flexion is moving the forearm forward and upward toward the humerus. Extension is straightening the forearm. Outward rotation is turning the long axis of the forearm to point the thumb laterally. Inward rotation is pointing the thumb medially. The joints between the radius and the ulna permit the rotation movements.

The brachioradialis is a muscle on the anterior aspect of the arm. It is attached to the distal end of the humerus and to the distal end of the radius. It flexes the forearm.

(bra'kĭ-o-ra-dĭ-a'lĭs)

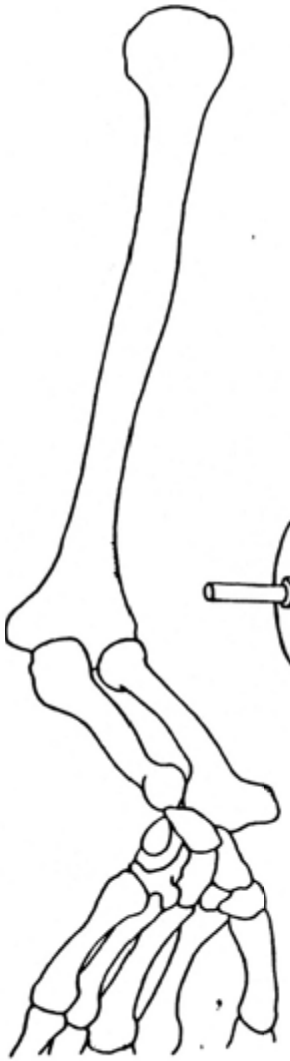
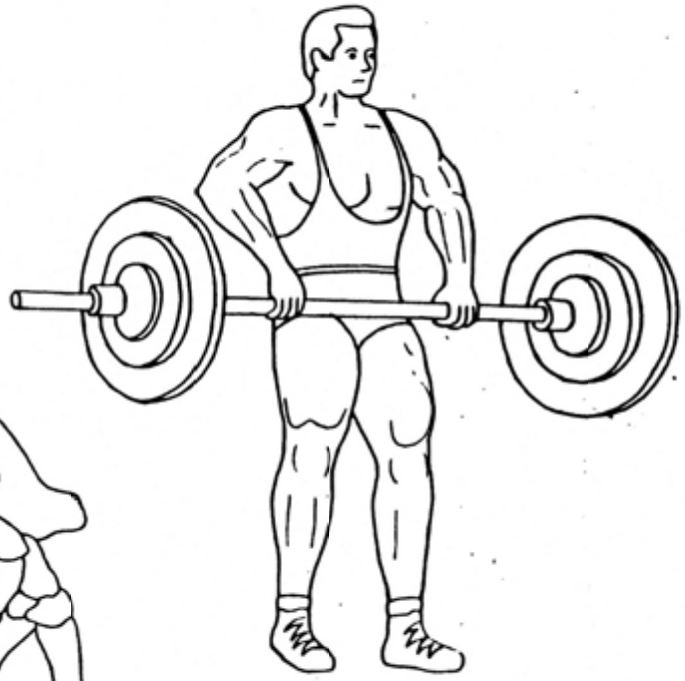


Figure 44A

The brachialis is a muscle on the anterior aspect of the arm. It is attached to the humerus and to the proximall end of the ulna. It flexes the forearm.

(bra-kĭ-a'lĭs)



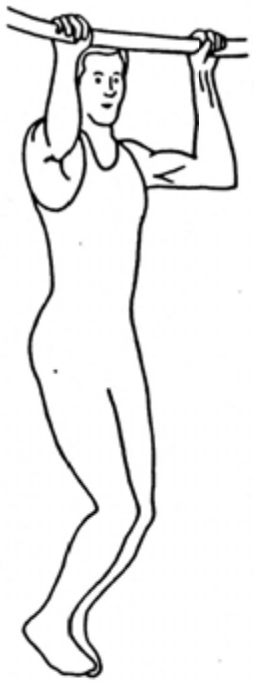
This weightlifter flexes his forearms as he lifts the barbell from the floor.

Figure 44B

Muscles That Move The Forearm At The Elbow

The biceps brachii is a muscle on the anterior aspect of the arm. It is attached to the coracoid process and glenoid fossa of the scapula and to the radius. It flexes the forearm.

(bi'seps bra'kī-i)

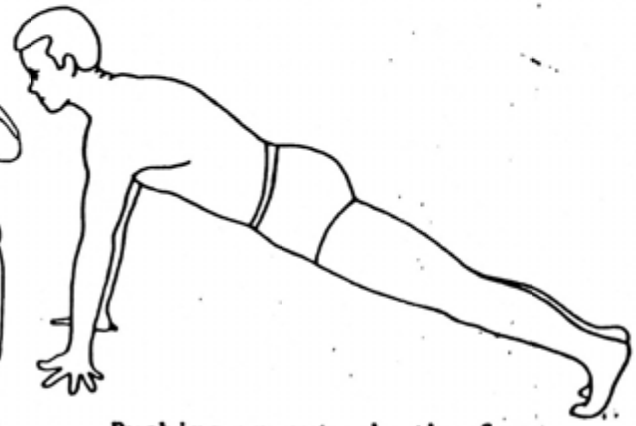


The gymnast flexes his forearms as he lifts himself toward the high bar.

Figure 45

The anconeus is a muscle on the posterior aspect of the arm. It is attached to the humerus and to the ulna. It extends the forearm.

(ang-ko-ne'ŭs)



Pushing up extends the forearms.

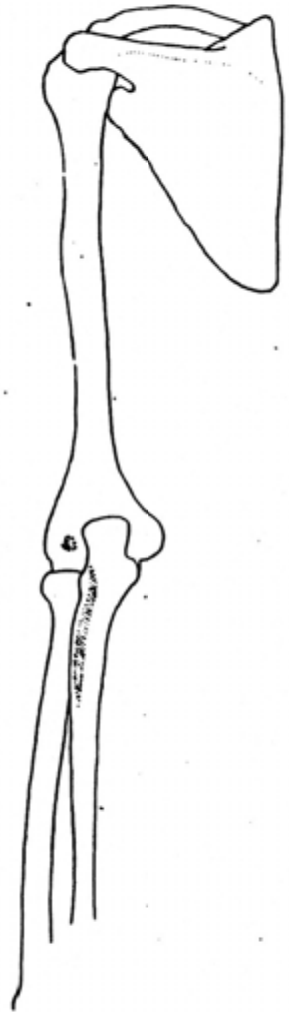
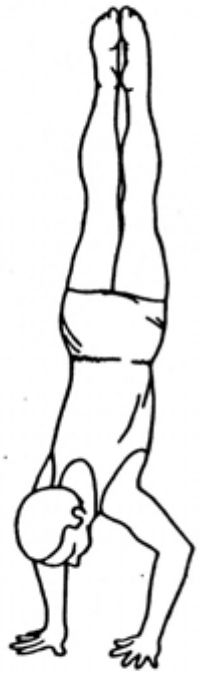


Figure 46A

Muscles That Move The Forearm At The Elbow

The medial head of the triceps brachii is on the posterior aspect of the arm. It is attached to the humerus and to the ulna. It extends the forearm.

(tri'seps bra'kī-i)



This gymnast does a handstand by extending the forearms.

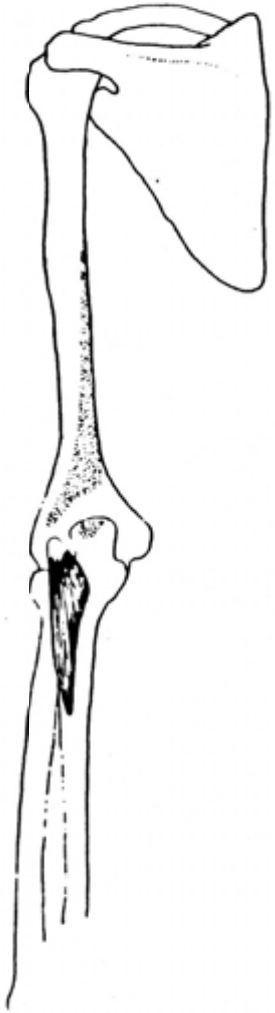
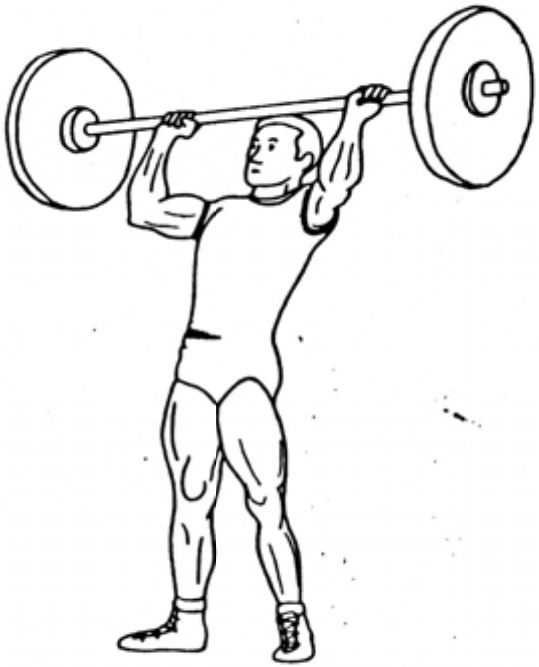


Figure 46B

The lateral head of the triceps brachii is on the lateral aspect of the arm. It is attached to the humerus and to the ulna. It extends the forearm.

(tri'seps bra'kī-i)



This weightlifter is extending his forearms to press the barbell over his head.

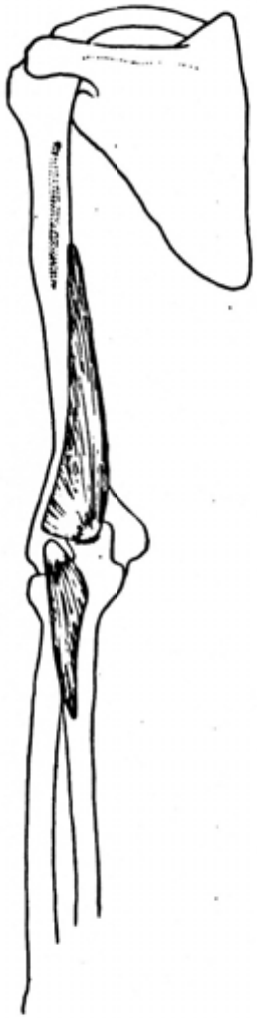
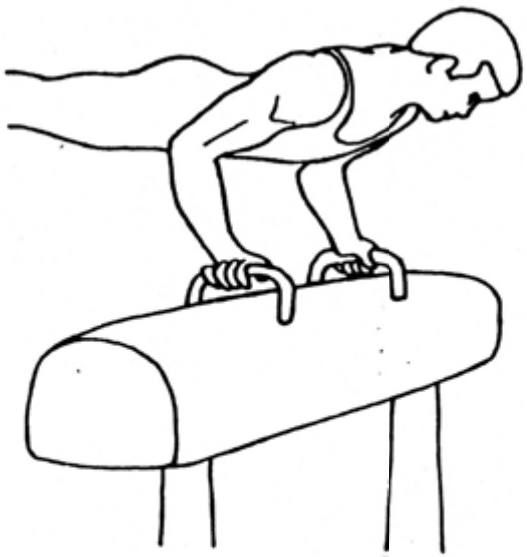


Figure 46C

Muscles That Move The Forearm At The Elbow

The long head of the triceps brachii is on the posterior aspect of the arm. It is attached to the scapula and to the ulna. It extends the forearm.

(tri'seps bra'kI-i)



This gymnast contracts the extensors of the forearm to support himself on the horse.

Figure 47

The supinator is a muscle on the anterior aspect of the forearm. It is attached to the anterior aspect of the ulna, and from behind the radius, to the lateral aspect of the radius. If the radius is pulled across the front of the ulna (as in inward rotation), then the supinator can pull the radius back to a position parallel with the ulna thus outward rotating (supinating) the forearm.

(su-pI-na'tor)

This tennis player begins to outward rotate his forearm to hit the ball.

Figure 48
Lateral view.

Muscles That Move The Forearm At The Elbow

The pronator quadratus is a muscle on the anterior aspects of the ulna and the radius. If the radius is parallel to the ulna (as in outward rotation), then the pronator quadratus can pull the radius across the front of the ulna thus inward rotating (pronating) the forearm. (pro-na'tor kwød-ra'tus)

This bowler inward rotated his forearm to spin the ball for a hook.

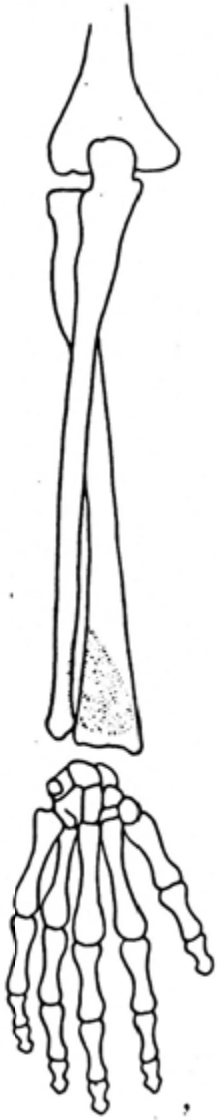
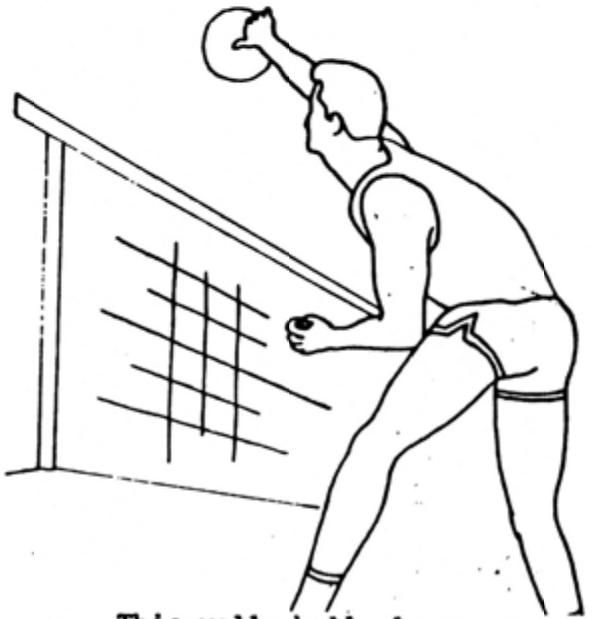


Figure 49A
Rear view.

The pronator teres is a muscle on the anterior aspect of the arm. It is attached to the anterior aspect of the humerus and to the lateral aspect of the radius. If the radius is parallel to the ulna (as in outward rotation), then the pronator teres can pull the radius across the front of the ulna thus inward rotating (pronating) the forearm. (pro-na'tor te'rez)

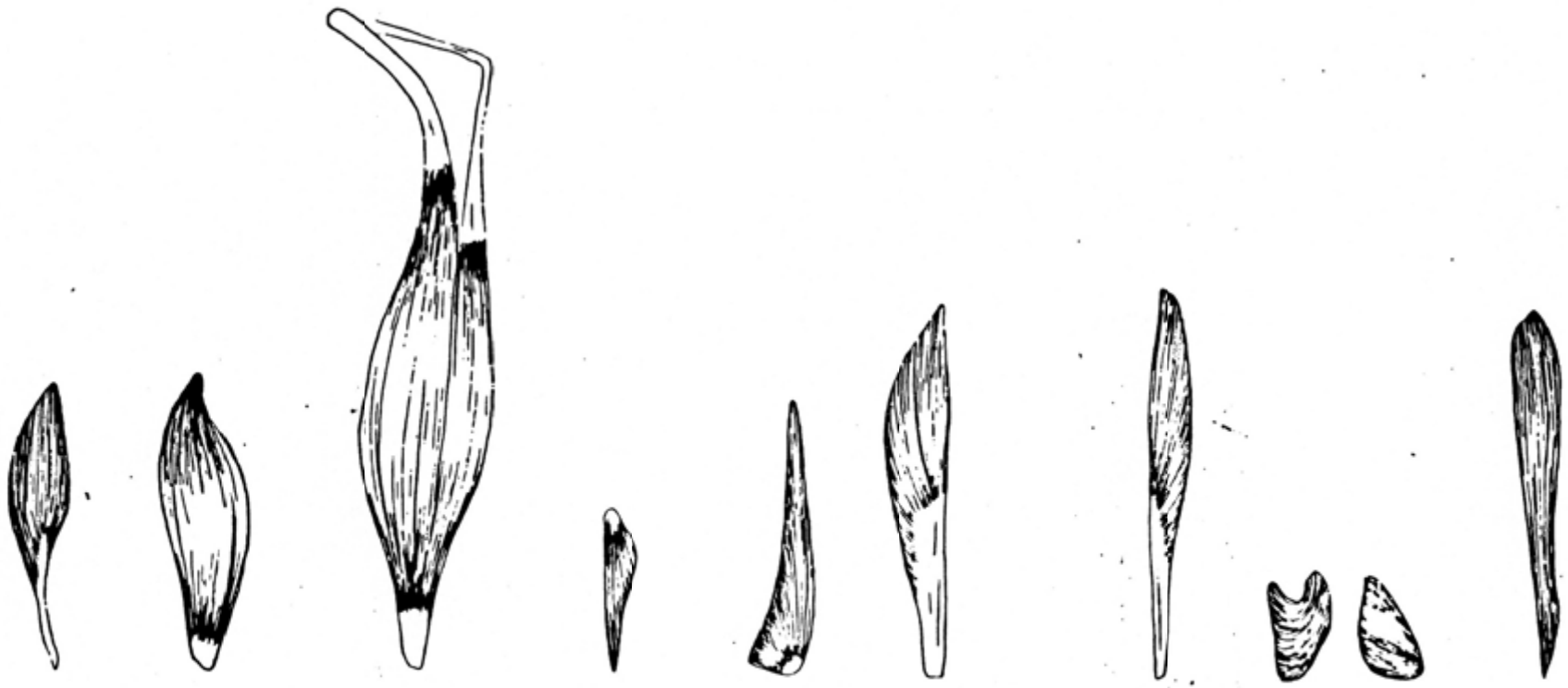


This volleyball player rotates inward his forearm as he spikes to his right.

Figure 49B
Front view.

Muscles That Move The Forearm At The Elbow

Muscles For The Figures



44A 44B 45 46A 46B 46C 47 48 49A 49B

Lesson Seven

Lower Body Muscles

The muscular system of the lower body consists of the muscles of the hip, thigh, lower leg, ankle, foot, and toes.

Muscles acting on the Hip joint and Thigh

The muscle that move the hip and thigh are attached to the femur and to some part of the pelvic girdle. They can be separated into anterior and posterior groups. The muscles of the anterior group act primarily to flex the thigh; those of the posterior group extend, abduct, or rotate it. The muscle around the hip must with stand large amounts of weight. In walking the load on the hip is 2.5 to 5.0 times body weight in standing the load is about 4 times the body weight. The strength and endurance of these muscles determine the length of the stride and the consistency of the stride in running. These muscles are important in kicking, walking, running and jumping. These are some of the strongest muscles in the body.

Muscles acting on the Knee joint

The muscles that act on the knee connect the tibia or fibula to the femur or to the pelvic girdle. They can be separated into two groups those that cause flexion at the knee and those that cause extension at the knee. These muscles support the weight of the entire body; they also effect the posture and normal walking. The static role of the muscle around the knee is to prevent the buckling of the knee, as in all running and jumping exercises. They also flex the hip joint, and the other function is in stabilizing the knee joint. Injury to these muscles rapidly leads to a loss in muscle mass and tone. The control of motion in the knee is largely lost. Exercises that strength these muscles protect the joint from the demands made by the weight of the body.

Muscle that move the Ankle, Foot, and Toes

A number of muscles that function to move the ankle, foot and toes are located in the lower leg. They attach the femur, tibia, and fibula to various bones of the foot and are responsible for a variety of movements. Moving the foot upward (dorsiflexion) or downward (plantarflexion) and turning the sole of the foot inward (inversion) or outward (eversion). Walking in the erect posture requires strong calf muscle to counterbalance the entire weight of the body. The muscles of the calf are instrumental in running and jumping; they lift the heel off the ground and help to ñpush upò at the ankle joint. The muscles of the calf, the Achilles tendon and the calcaneus form a functional unit of importance to standing, running and jumping through its control of plantar flexion. The Achilles tendon is the strongest tendon in the human body it transmit the muscular power of the foot lever. It can with stand a tremendous amount of load. The Achilles tendon in some athletic events can be exposed to about 25 times body weight.

Chapter 4. Muscles That Move The Femur At The Hip

The major movements of the femur at the hip are flexion, extension, abduction, adduction, outward rotation and inward rotation. Flexion is moving the femur forward and upward and extension is moving it downward and backward. Abduction is moving the femur laterally and upward and adduction is moving it downward and medially. Outward rotation is turning the long axis of the femur to point the toes laterally and inward rotation is pointing the toes medially.

The iliacus is a muscle on the anterior aspect of the hip. It is attached to the ilium and to the femur. It flexes the femur.

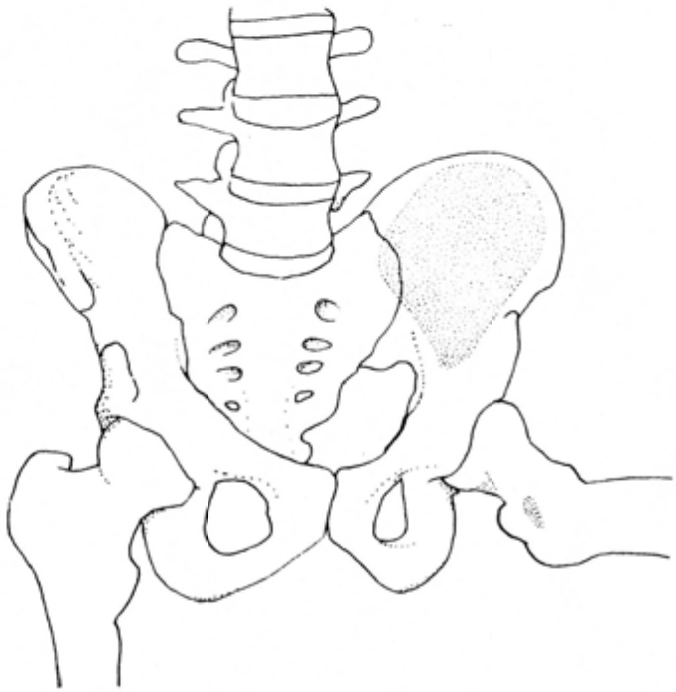
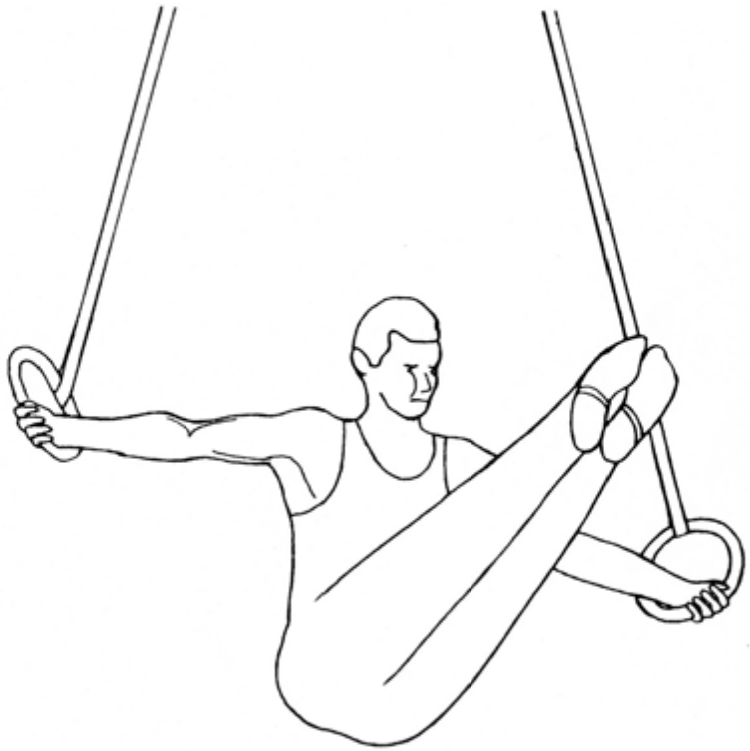


Figure 17

(ĭ-li'a-kŭs)



This gymnast flexes both femurs as he does an L-cross on the flying rings.

Muscles That Move The Femur At The Hip

The psoas major and minor are muscles on the anterior aspect of the hip. They are attached to lumbar vertebrae and to the femur. They flex the femur.

(so'as)

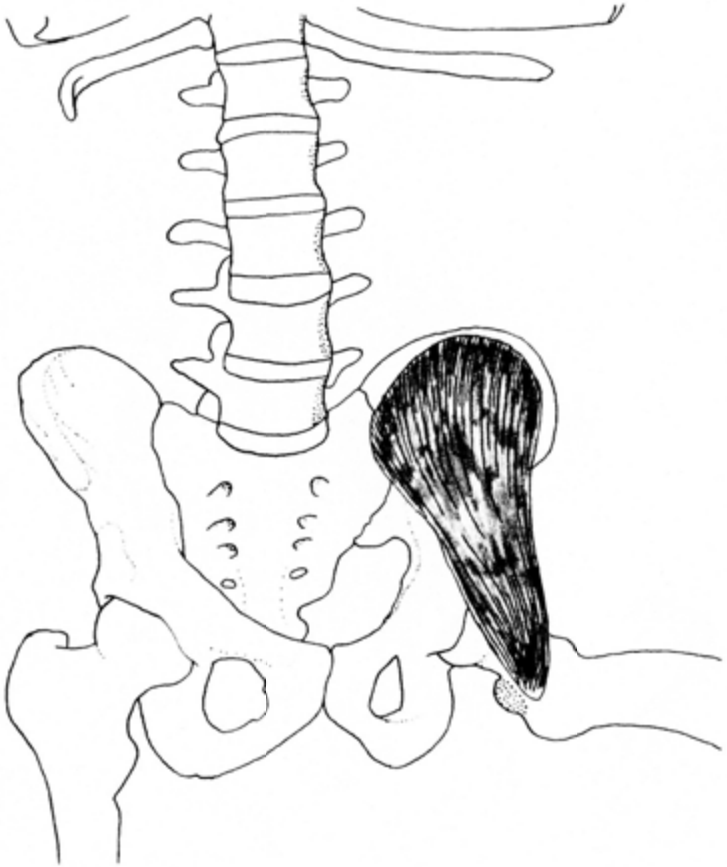


Figure 18

This sprinter is flexing his right femur.

Muscles That Move The Femur At The Hip

The pectineus is a muscle on the anterior aspect of the hip. It is attached to the pubis and to the femur. It flexes the femur.

(pĕk-tĭn'ē-ŭs)

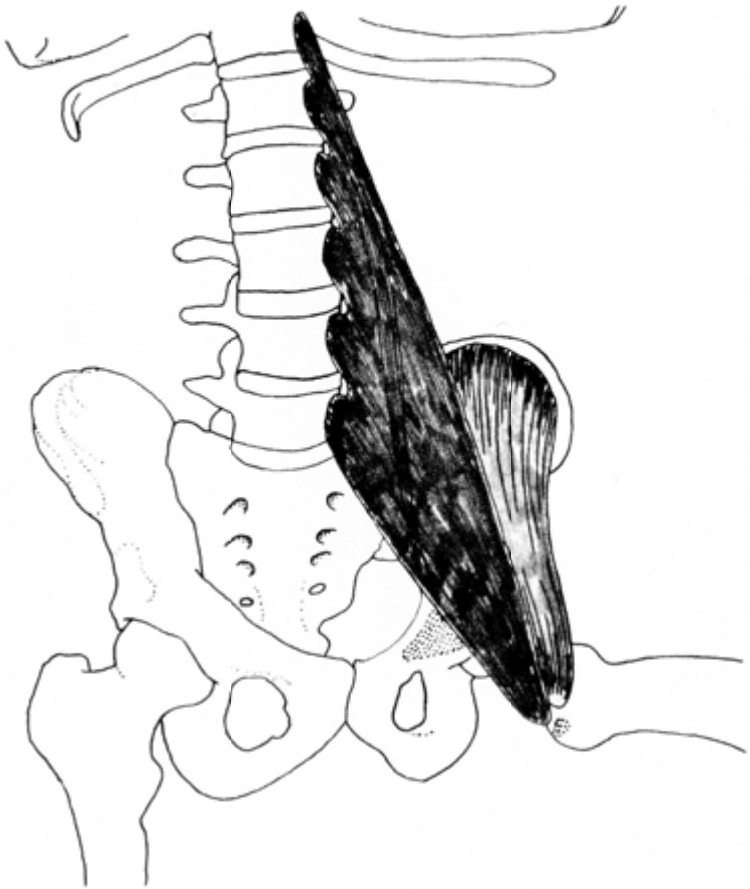


Figure 19

This running broad jumper is flexing his right femur as he launches his jump.

Muscles That Move The Femur At The Hip

The rectus femoris is a muscle on the anterior aspect of the hip. It is attached to the front of the ilium and to the tibia by way of the patella. It flexes the femur.

(rĕk'tŭs fĕm'o-rĭs)

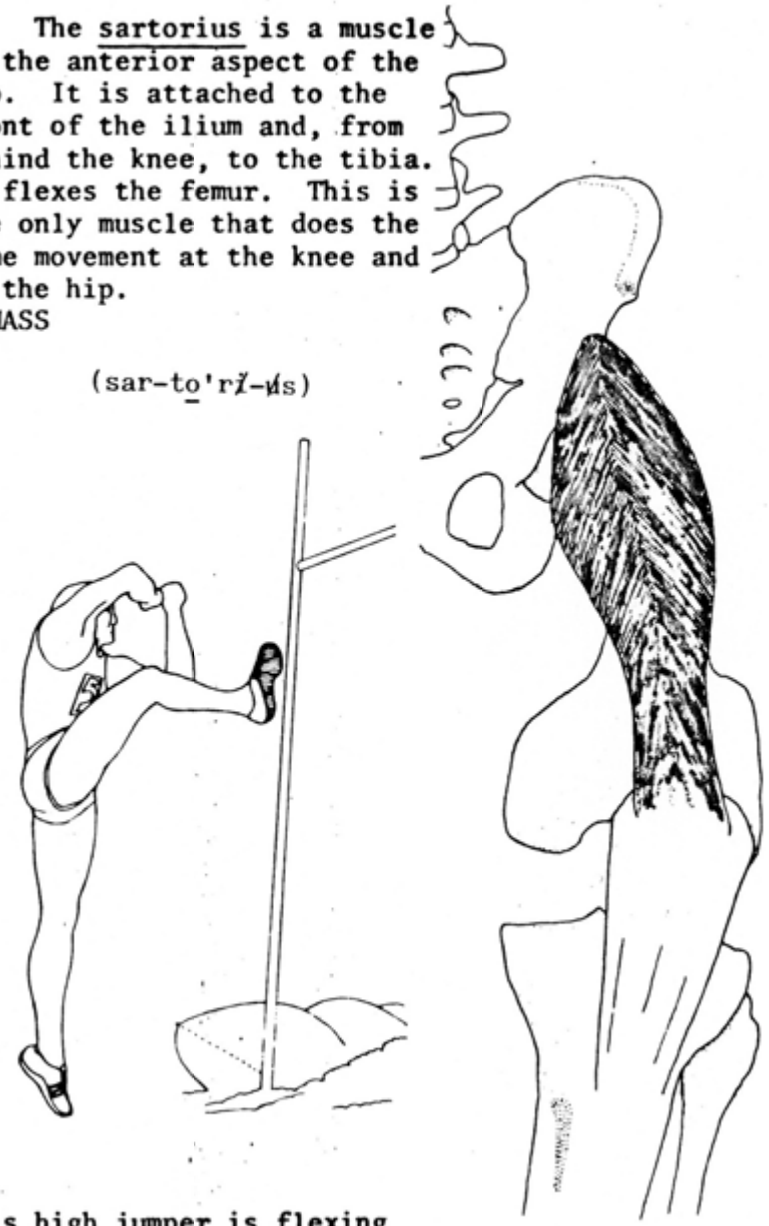
This rugby player kicks the ball by flexing his right femur.

Figure 10A

The sartorius is a muscle on the anterior aspect of the hip. It is attached to the front of the ilium and, from behind the knee, to the tibia. It flexes the femur. This is the only muscle that does the same movement at the knee and at the hip.

MASS

(sar-to'rĭ-ŭs)



This high jumper is flexing his right femur.

Figure 15A

Muscles That Move The Femur At The Hip

The gluteus minimus is a muscle on the lateral aspect of the hip. It is attached from the ilium forward to the front of the greater trochanter (the upper bony knob) of the femur. It abducts and rotates inward the femur.

(gloo-te'ŭs mĭn'ĭ-mŭs)

Figure 21A

This skiier abducts and rotates inward his left femur to begin a turn to his right.

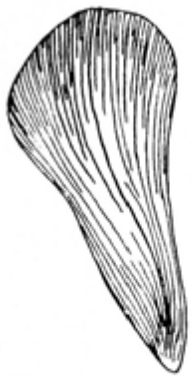
The gluteus medius is a muscle on the lateral aspect of the hip. It is attached from the ilium forward in a twist to the greater trochanter of the femur. It abducts and rotates inward the femur.

(gloo-te'ŭs me'dĭ-us)

Figure 21B

Muscles That Move The Femur At The Hip

Muscles For The Figures



17

18

19

10A

15A

20

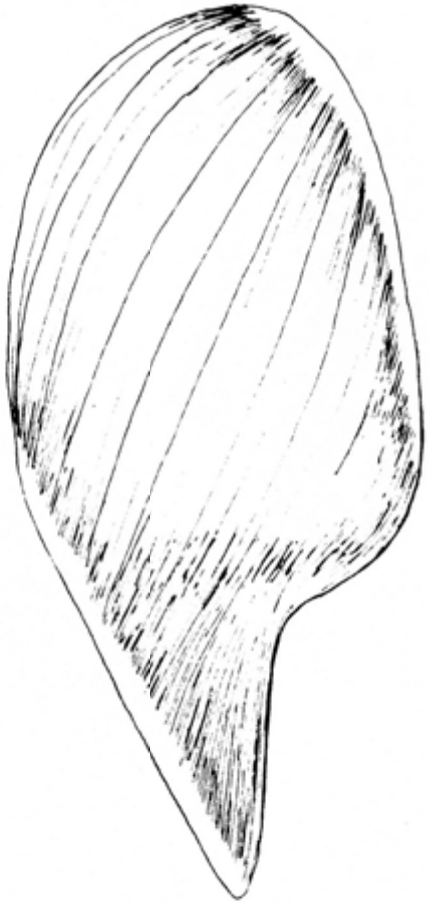
Muscles That Move The Femur At The Hip

Muscles For The Figures (contin.)

21A

21B

22



23

Muscles That Move The Femur At The Hip

The gluteus maximus is a muscle on the posterior aspect of the hip. It is attached to the ilium and sacrum above and to the femur below. It extends the femur and rotates it outward.

(gloo-te'ŭs măk'sĭ-mŭs)

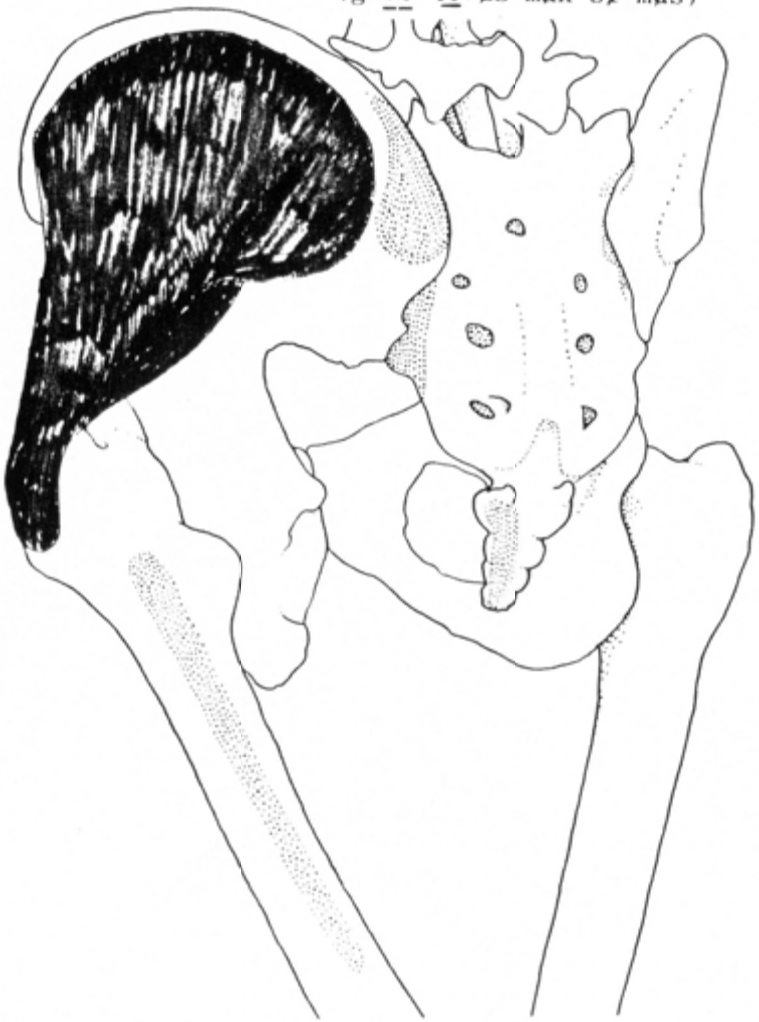


Figure 23

This hockey player extends his right femur and rotates it outward to skate fast.

Muscles That Move The Femur At The Hip

The semitendinosus is a muscle on the posterior aspect of the hip. It is attached to the ischium and to the tibia. It extends the femur.

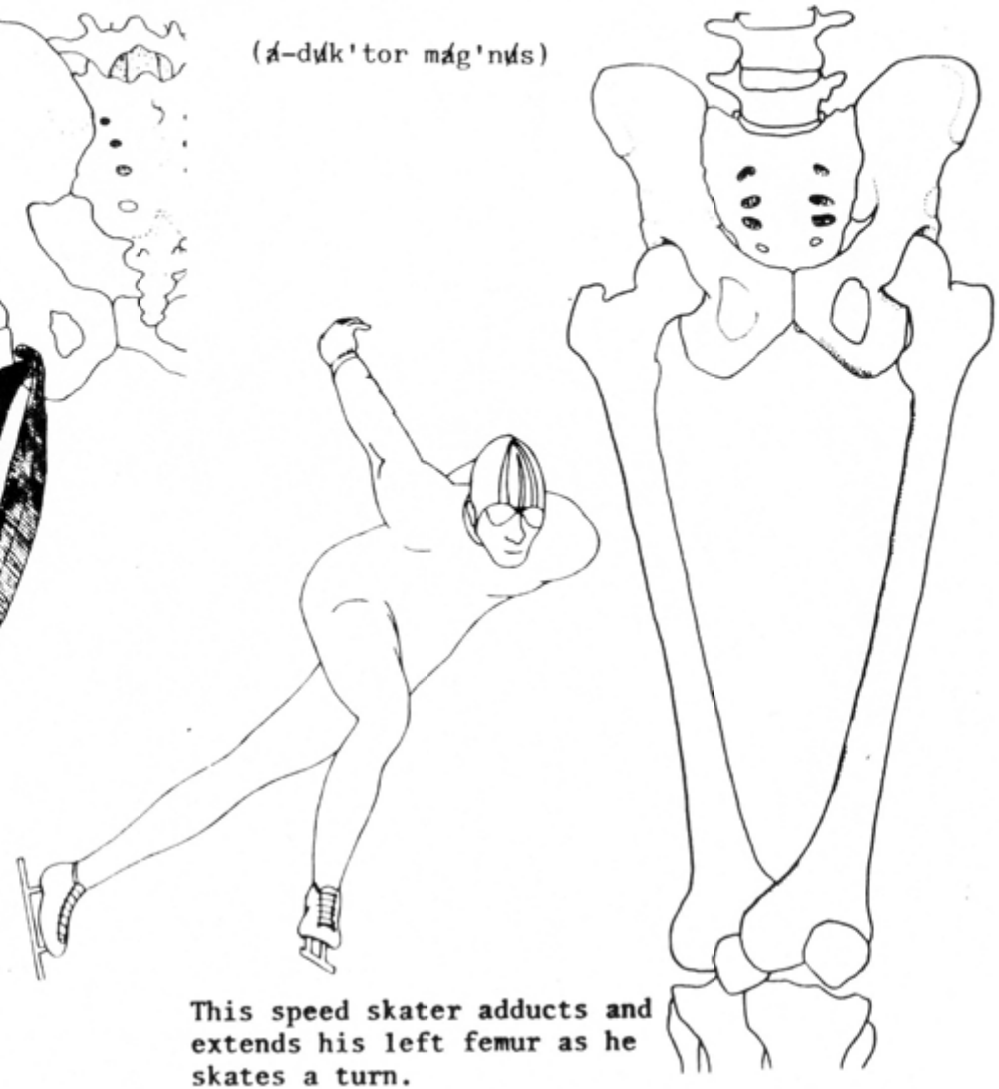
This cross-country skier propels himself by thrusting with his skies and his poles. He has just finished a thrust by extending his right femur.

(sem-i-ten-di-no'sus)

Figure 12D

The adductor magnus is a muscle on the medial aspect of the hip. It is attached to the pubis (and ischium) above and to the back of the femur below. It adducts and extends the femur.

(a-duk'tor mag'nus)



This speed skater adducts and extends his left femur as he skates a turn.

Figure 24

Muscles That Move The Femur At The Hip

The adductor minimus is a muscle on the medial aspect of the hip. It is attached to the pubis and to the femur. It adducts the femur.

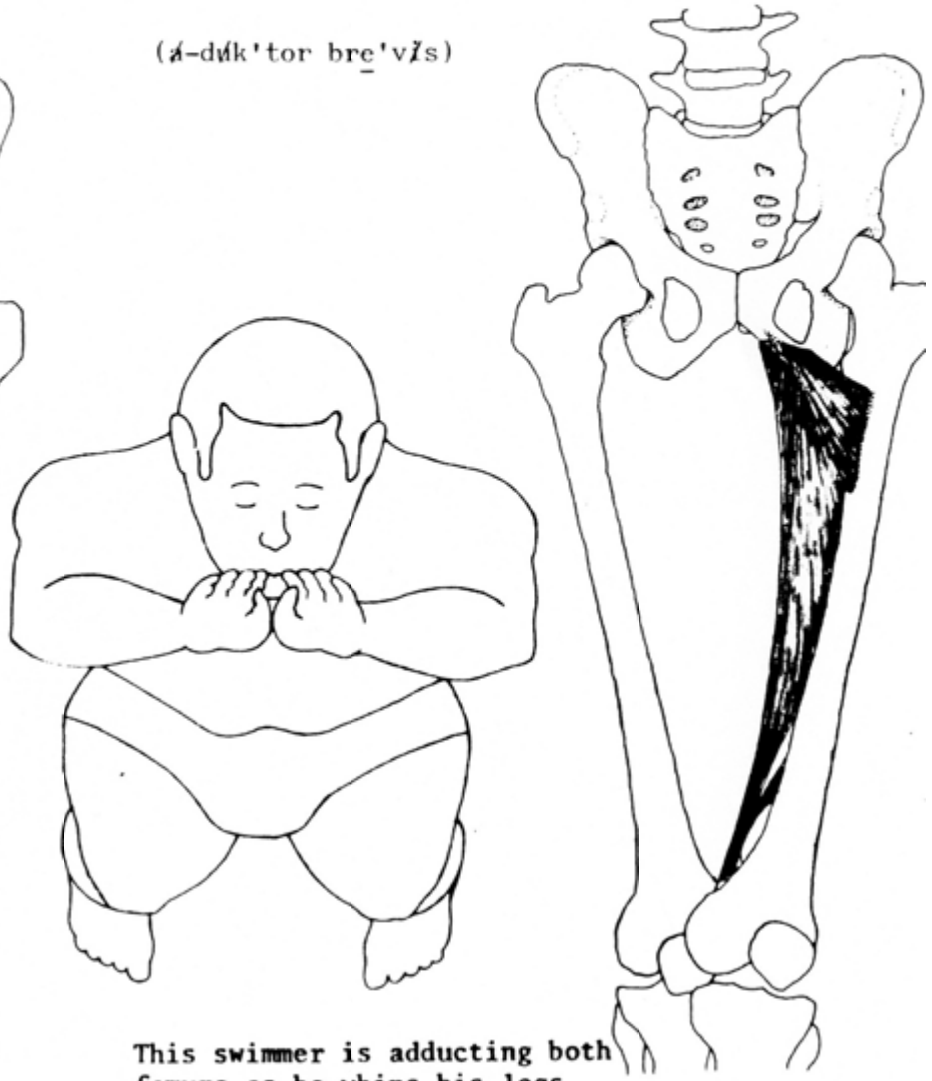
(ǎ-dŭk'tor mĭn'ĭ-mŭs)

This gymnast is ready to adduct both femurs to land with feet together.

Figure 25A

The adductor brevis is a muscle on the medial aspect of the hip. It is attached to the pubis and to the femur. It adducts the femur.

(ǎ-dŭk'tor brē'vĭs)



This swimmer is adducting both femurs as he whips his legs together in the breast stroke kick.

Figure 25B

Muscles That Move The Femur At The Hip

The <u>adductor longus</u> is a muscle on the medial aspect of the hip. It is attached to the pubis and to the femur. It adducts the femur.

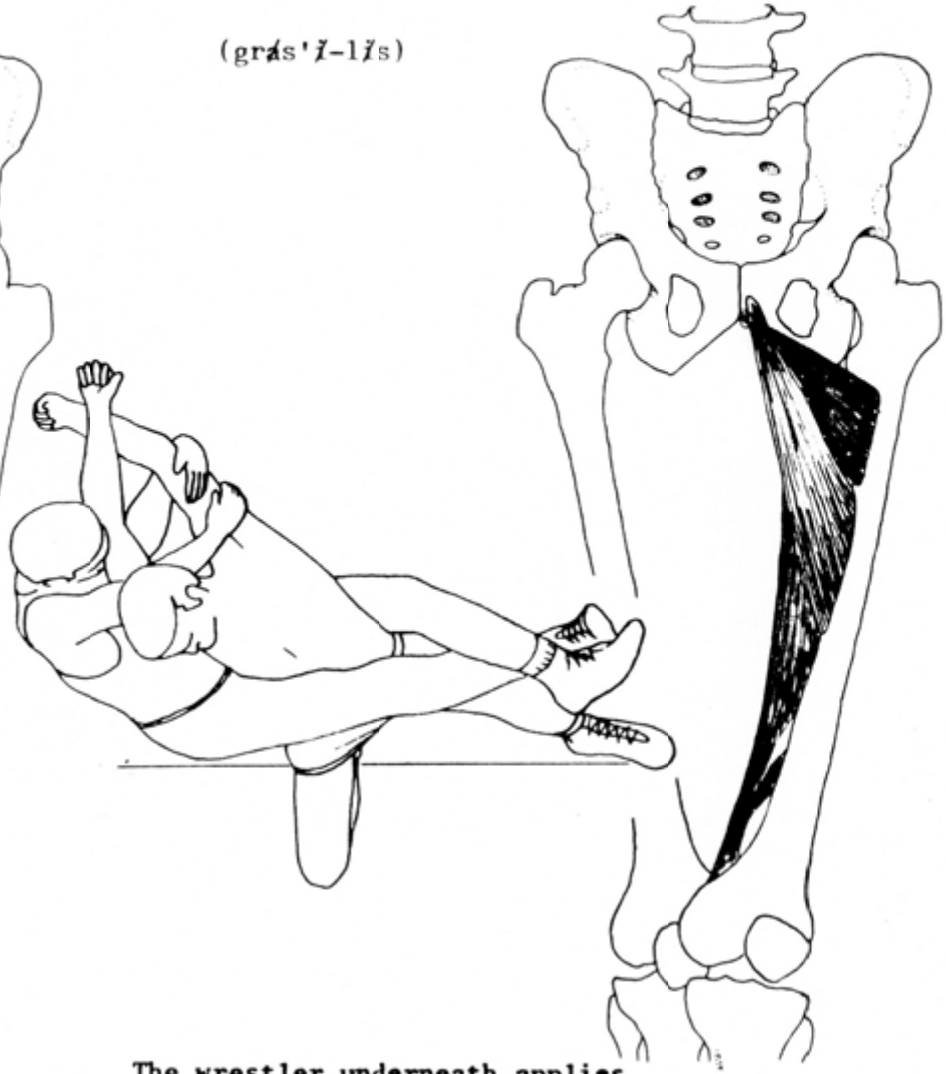
(ə-dʌk'tor lɔng'gʌs)

In preparation for a takedown, the judoka facing us adducts his right femur to sweep the adversary's leg outward.

Figure 25C

The <u>gracilis</u> is a muscle on the medial aspect of the hip. It is attached to the pubis and to the tibia from behind the knee. It adducts the femur.

(grəs'ĭ-lĭs)



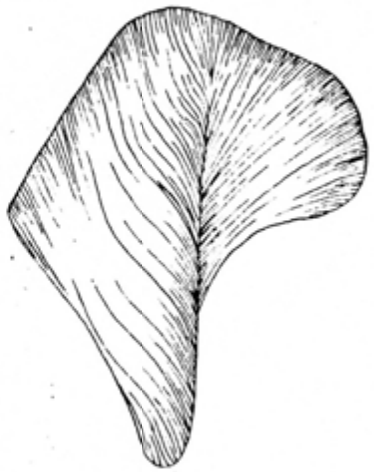
The wrestler underneath applies a scissors hold by adducting both femurs.

Figure 16A

Muscles That Move The Femur At The Hip

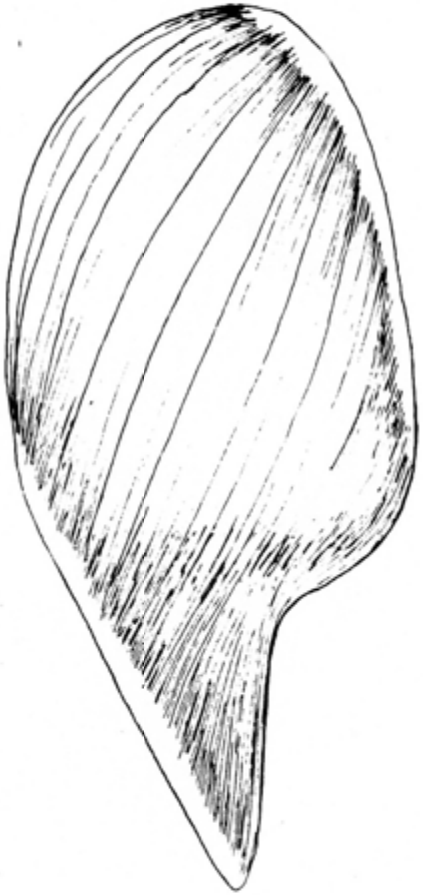
Muscles For The Figures (contin.)

21A



21B

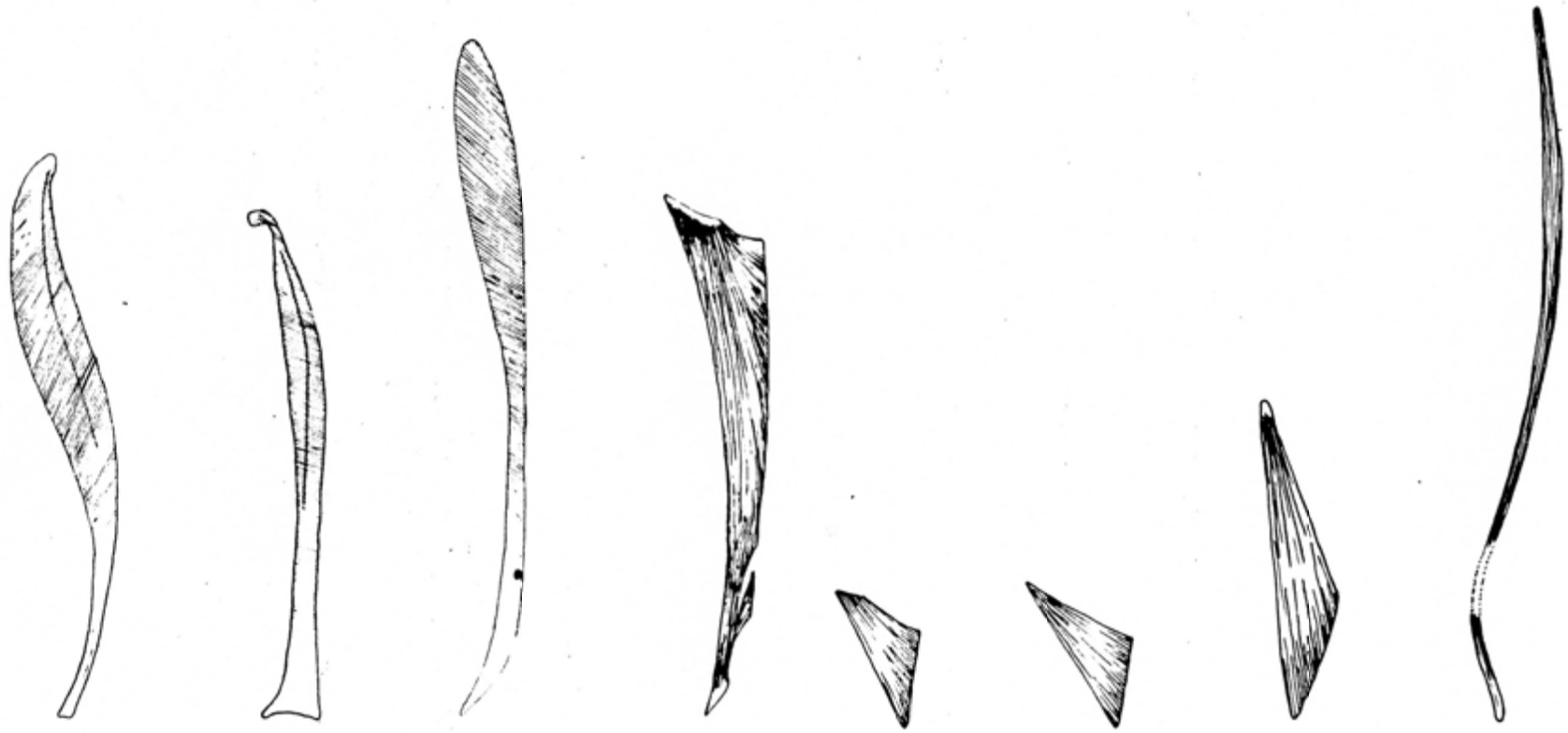
22



23

Muscles That Move The Femur At The Hip

Muscles For The Figures (contin.)



14A 12C 12D 24 25A 25B 25C 16A

Muscles That Move The Foreleg At The Knee

The major movements of the foreleg at the knee are flexion, extension, outward rotation and inward rotation. Flexion is moving the foreleg upward and backward toward the femur and extension is moving it downward and forward away from the femur. Outward rotation is turning the long axis of the foreleg to point the toes laterally and inward rotation is pointing the toes medially. The foreleg must be flexed to about 90 degrees, without bearing weight in order for inward or outward rotation to take place.

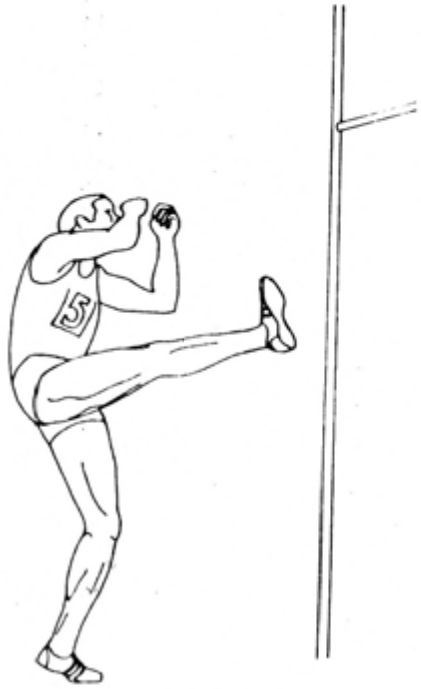
The vastus medialis is a muscle on the anterior aspect of the thigh. It is attached to the femur and to the tibia by way of the patella. It extends the foreleg.

(vás'tus me-dĭ-a'lĭs)

Figure 9A

The vastus intermedius is a muscle on the anterior aspect of the thigh. It is attached to the femur and to the tibia by way of the patella. It extends the foreleg.

(vás'tus ĭn-ter-me'dĭ-us)



This high jumper is extending his left foreleg to launch his jump.

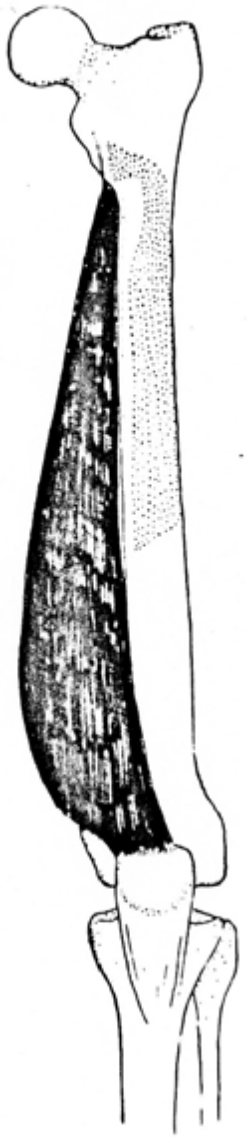


Figure 9B

Muscles That Move The Foreleg At The Knee

The vastus lateralis is a muscle on the anterior aspect of the thigh. It is attached to the femur and to the tibia by way of the patella. It extends the foreleg.

The vastus medialis, the vastus intermedius and the vastus lateralis together are called the vasti.

(vás'tus lát'ē-ra'lis)

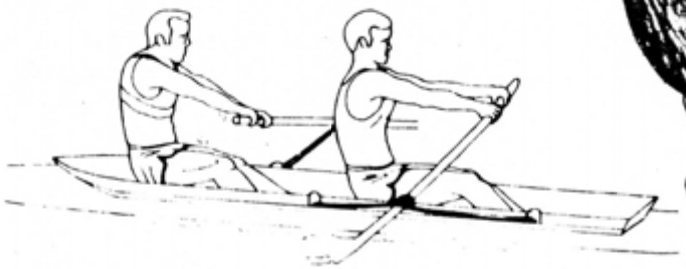
This field hockey player is extending her right foreleg.

Figure 9C

The rectus femoris is a muscle on the anterior aspect of the thigh. It is attached to the front of the ilium and to the tibia by way of the patella. It extends the foreleg.

The rectus femoris and the three vasti are called the quadriceps femoris.

(rek'tus fem'o-ris)



These rowers are extending both forelegs at the same time.

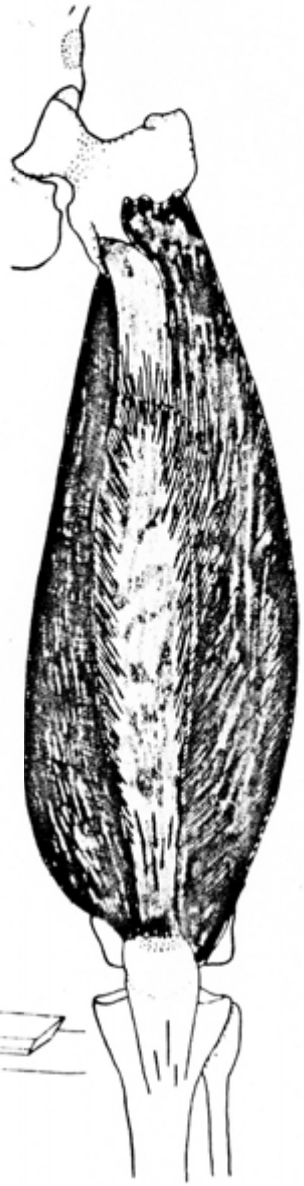
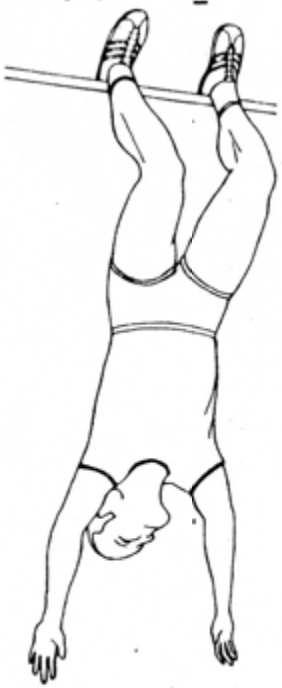


Figure 10

Muscles That Move The Foreleg At The Knee

The popliteus is a posterior muscle. It is attached to the femur and to the tibia. It flexes the foreleg and rotates it inward. From the extended or locked position, the popliteus is effective at unlocking the knee to begin flexion.

(pŏp-lĭt'e-ŭs)



This gymnast is flexing his forelegs to hang by his heels.

Figure 11

The semimembranosus is a posterior muscle. It is attached to the ischium and to the medial side of the tibia. It flexes the foreleg and rotates it inward.

(sĕm-ĭ-mĕm-bra-no'sŭs)

At the end of the thrust, the speed skater flexes his left foreleg and rotates it inward.

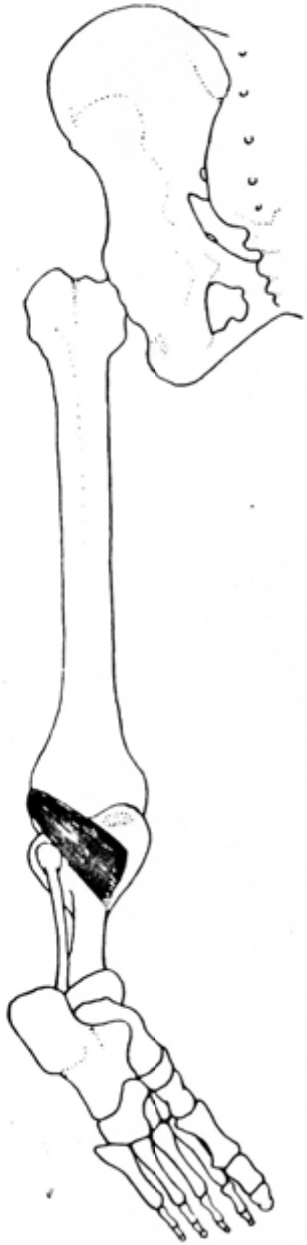


Figure 12A

Muscles That Move The Foreleg At The Knee

The semitendinosus is a posterior muscle. It is attached to the ischium and to the medial side of the tibia. It flexes the foreleg and rotates it inward.

The semimembranosus and the semitendinosus are called the medial hamstrings.

(sém-ĭ-tén-dĭ-no'sŭs)

This ballet dancer leaps then flexes his right foreleg and rotates it inward.

Figure 12B

The short head of the biceps femoris is a posterior muscle. It is attached to the back of the femur and to the head of the fibula. It flexes the foreleg and rotates it outward.

(bi'seps fém'o-rĭs)

This hurdler is flexing his left foreleg and rotating it outward to clear the hurdle.

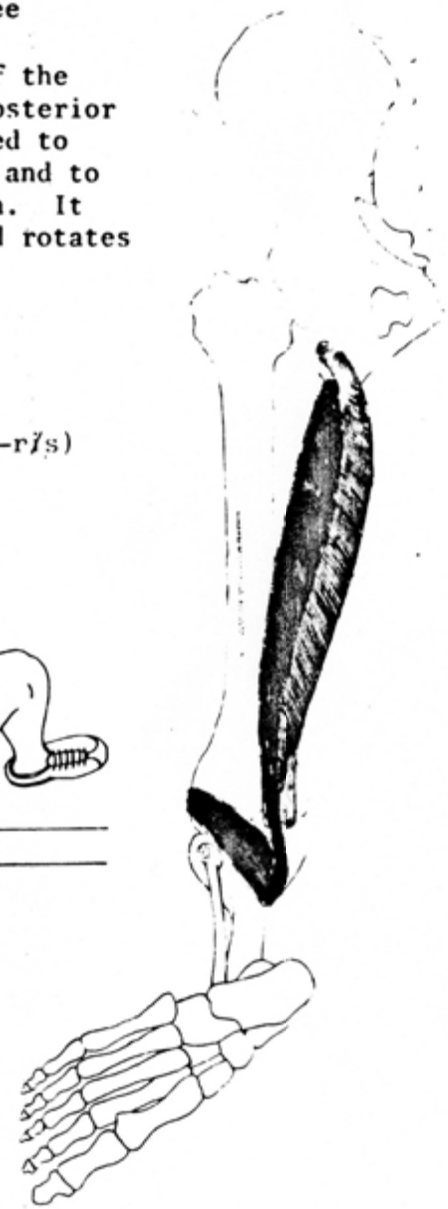


Figure 13

Muscles That Move The Foreleg At The Knee

The long head of the biceps femoris is a posterior muscle. It is attached to the ischium and to the head of the fibula. It flexes the foreleg and rotates it outward.

The short head and the long head of the biceps femoris are called the lateral hamstrings.

(bi-'seps fém'o-rĭs)

This swimmer flexes both forelegs and rotates them outward in preparation for the breast stroke kick.

Figure 14

The plantaris and gastrocnemius are posterior muscles. They are attached to the femur and to the calcaneus. They flex the foreleg.

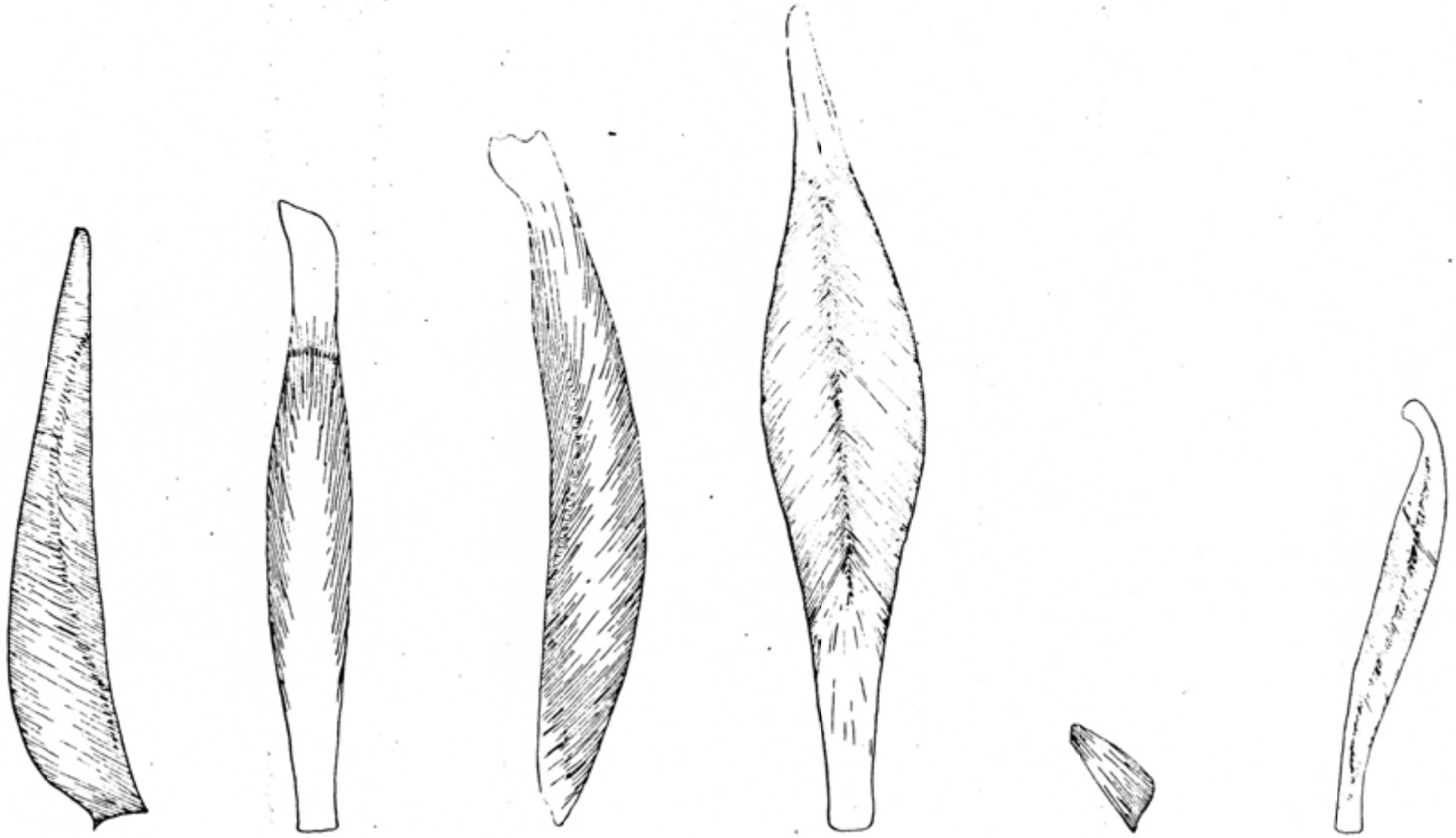
(plán-ta'rĭs
gás-trŏk-ne' mĭ-ŭs)

This soccer player is making a heel kick by flexing his left foreleg.

Figure 8C

Muscles That Move The Foreleg At The Knee

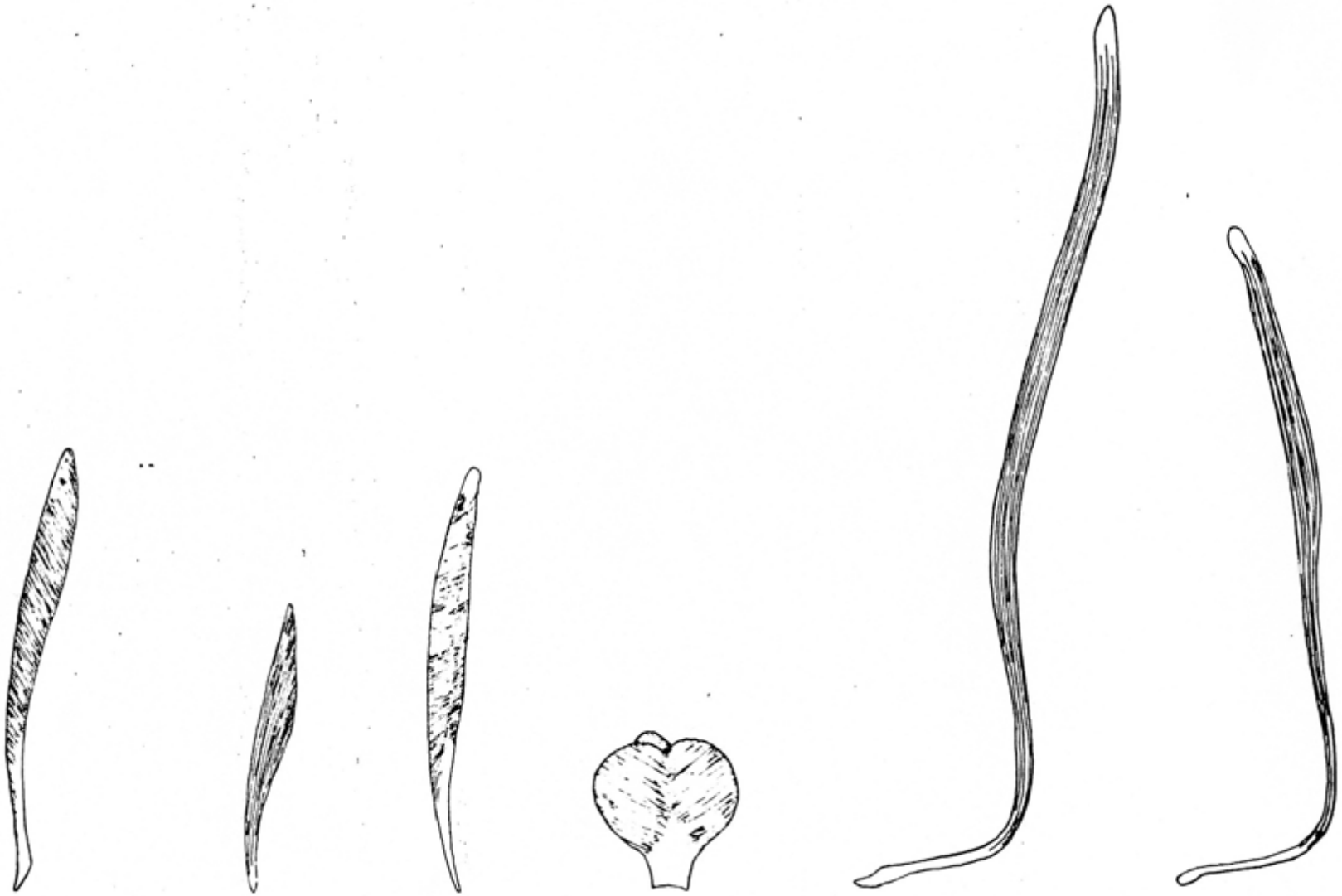
Muscles For The Figures



9A 9B 9C 10 11 12A

Muscles That Move The Foreleg At The Knee

Muscles For The Figures (contin.)

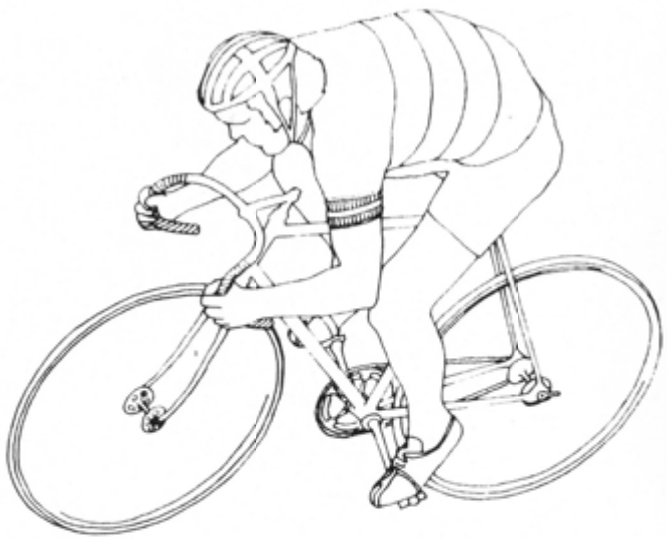


12B 13 14 8C 15 16

Muscles That Move The Foreleg At The Knee

The sartorius is attached to the front of the ilium, crosses over to the medial side of the thigh and, from behind the knee, to the front of the tibia. Although an anterior muscle, remember that it goes to the tibia from behind the knee. It flexes the foreleg.

(sar-to'rĭ-ŭs)

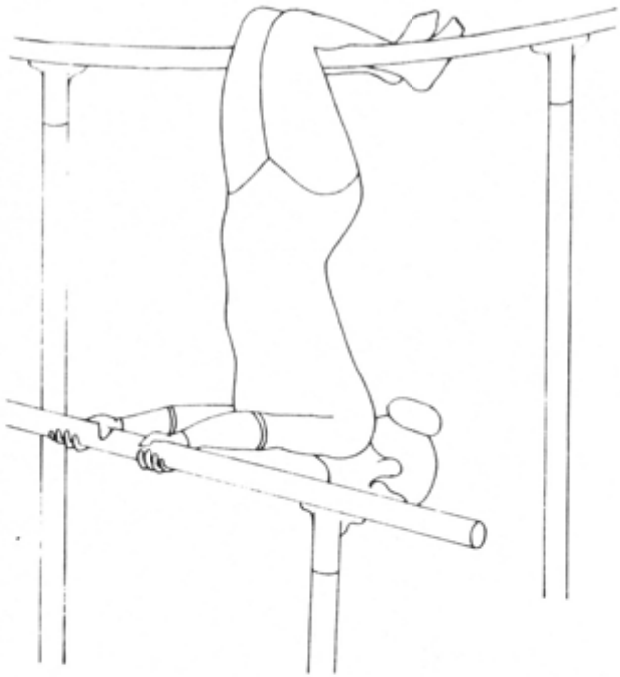


Toe clips let the racing cyclist pull up as well as push down on his pedals. He is flexing his left foreleg.

Figure 15

The gracilis is a medial muscle. It is attached to the pubis and, from behind the knee, to the front of the tibia. It flexes the foreleg.

(grăs'ĭ-lĭs)



This gymnast is flexing both forelegs to support herself inverted on the uneven parallel bars.

Figure 16

Muscles That Move The Foot At The Ankle

The plantaris is a posterior muscle. It is attached to the back of the femur (thigh bone) and to the back of the calcaneus. It extends the foot.

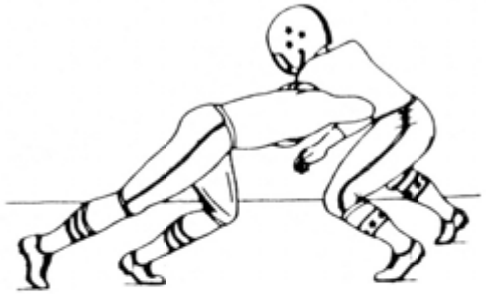
(plǽn-ta'rĭs)

This batter is extending both feet in the run to first base.

Figure 8A

The gastrocnemius is a posterior muscle. It is attached to the back of the femur and to the back of the calcaneus. It extends the foot.

(gǽs-trŏk-ne'mĭ-ŭs)



This block in American football shows both feet extending.

Figure 8B

Muscles That Move The Foot At The Ankle

The flexor hallucis longus is a posterior muscle. It is attached to the back of the fibula and passes behind the joint and under the foot to the end of the great toe. It extends the foot.

(flek'sor hal'u-sis long'gus)

This basketball player extends his rear foot to jump as he attempts a hook shot.

Figure 6B

The soleus is a posterior muscle. It is attached to the back of the tibia and to the back of the calcaneus (heel bone). It extends the foot.

(so'le-us)

This pole vaulter extends his rear foot as he begins his vault.

Figure 7

Muscles That Move The Foot At The Ankle

The tibialis anterior is a muscle on the anterior aspect of the foreleg. This muscle is attached to the front of the tibia and to the base of the first metatarsal (the long bone behind the big toe). It flexes and adducts the foot.

(tĭb-ĭ-a'lĭs ăn-ter'ĭ-or)

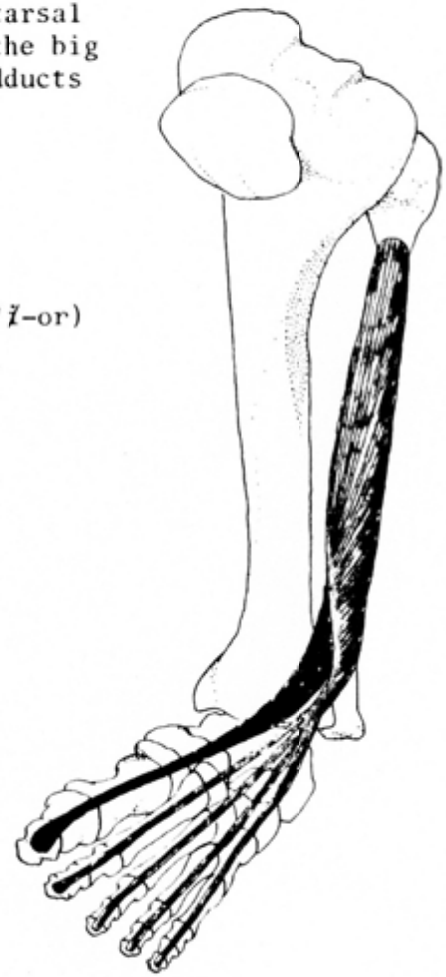
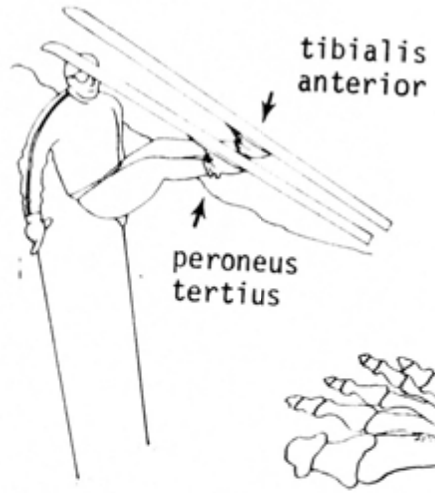


Figure 2

The peroneus tertius is a muscle on the lateral (outside) aspect of the foreleg. "Perone" is Greek for "fibula." This muscle is attached to the fibula and passes in front of the joint to the base of the fifth metatarsal (the long bone behind the little toe). It flexes and abducts the foot.

(pĕr-o-ne'ŭs tur'shĭ-ŭs)



This double-pole jump turn in Alpine skiing is done by flexing and adducting the left foot (Figure 2) and by flexing and abducting the right foot (Figure 3).

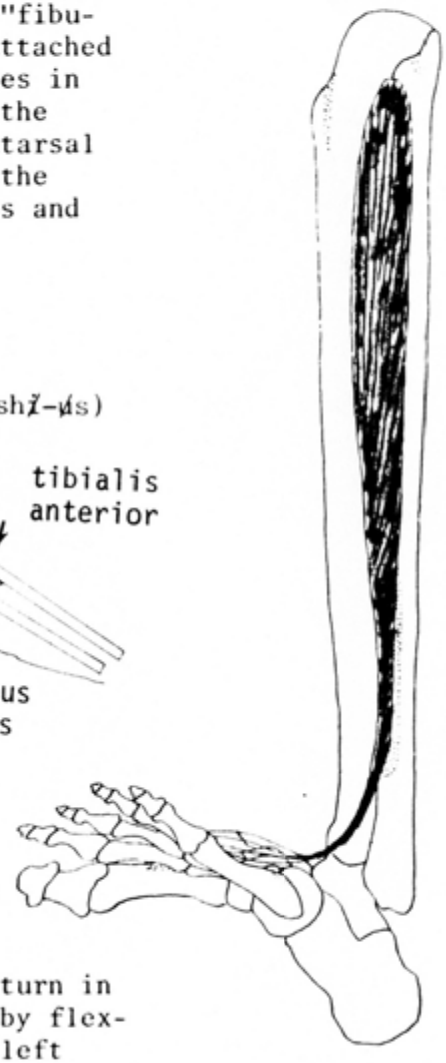


Figure 3

Muscles That Move The Foot At The Ankle

The tibialis posterior is a posterior muscle. It is attached to the back of the tibia and passes behind the medial (inside) malleolus and under the foot to the three middle metatarsals. It extends and adducts the foot.

(tĭb-ĭ-ā'lĭs pos-tēr'ĭ-or)

This basketball player is extending and adducting his right foot as he dribbles around his opponent.

Figure 5

The flexor digitorum longus is a posterior muscle. It is attached to the back of the tibia and passes behind the joint and under the foot to the ends of the four lesser toes. It extends the foot.

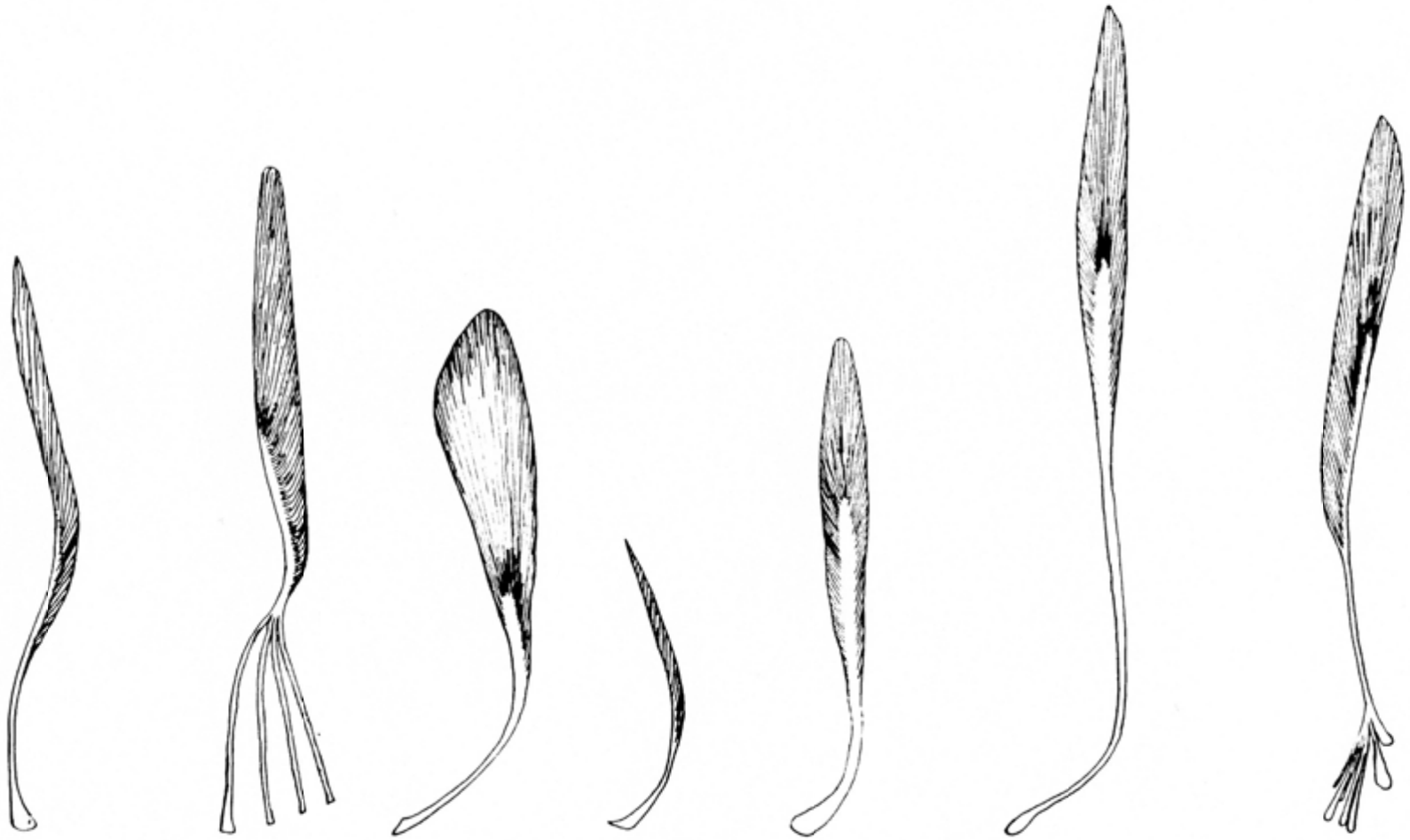
(flĕk'sor dĭj-ĭ-tō'rum lŏng'gŭs)

The volleyball player is extending both feet to jump while making a high, lateral pass.

Figure 6A

Muscles That Move The Foot At The Ankle

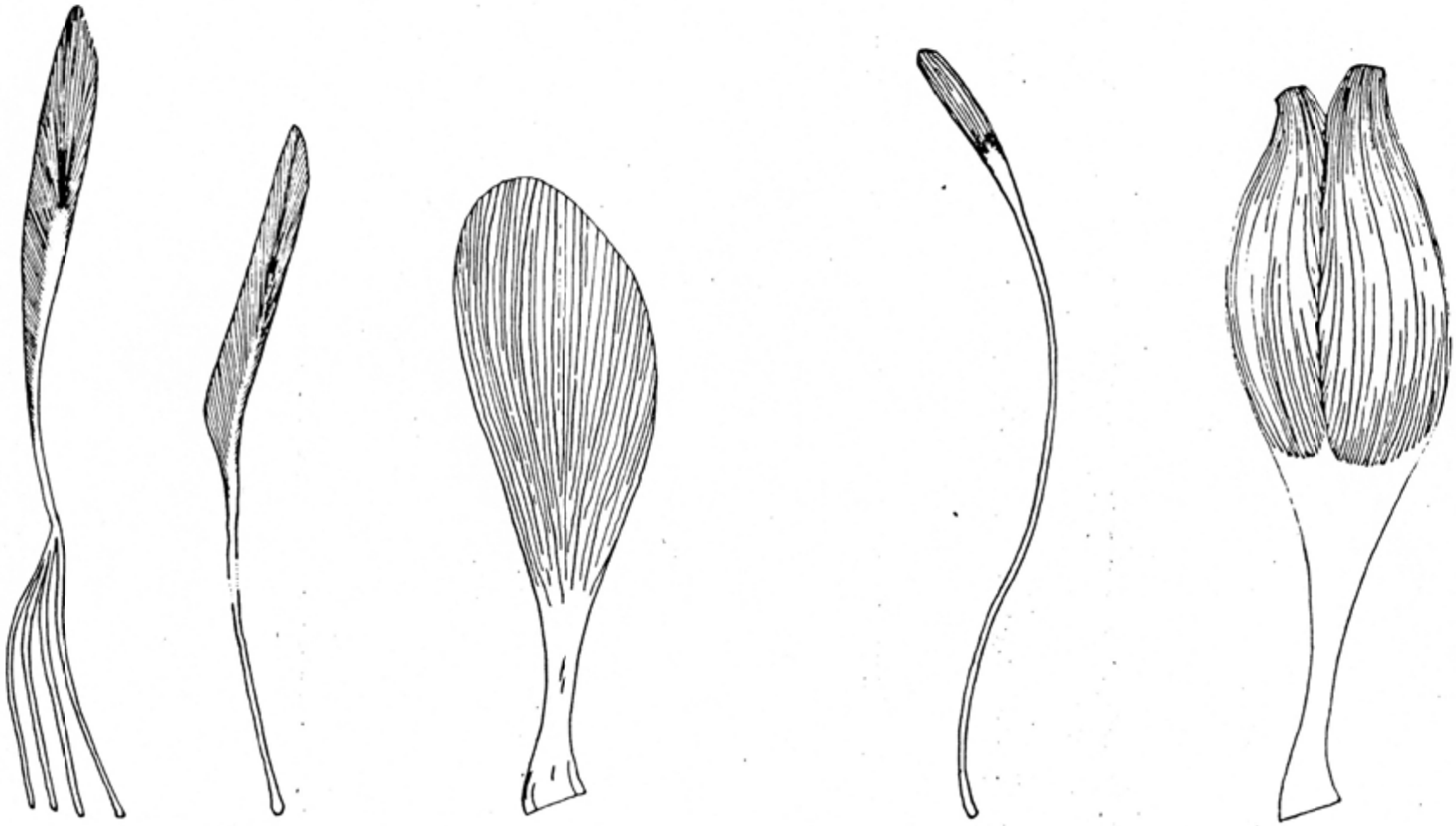
Muscles For The Figures



1A 1B 2 3 4A 4B 5

Muscles That Move The Foot At The Ankle

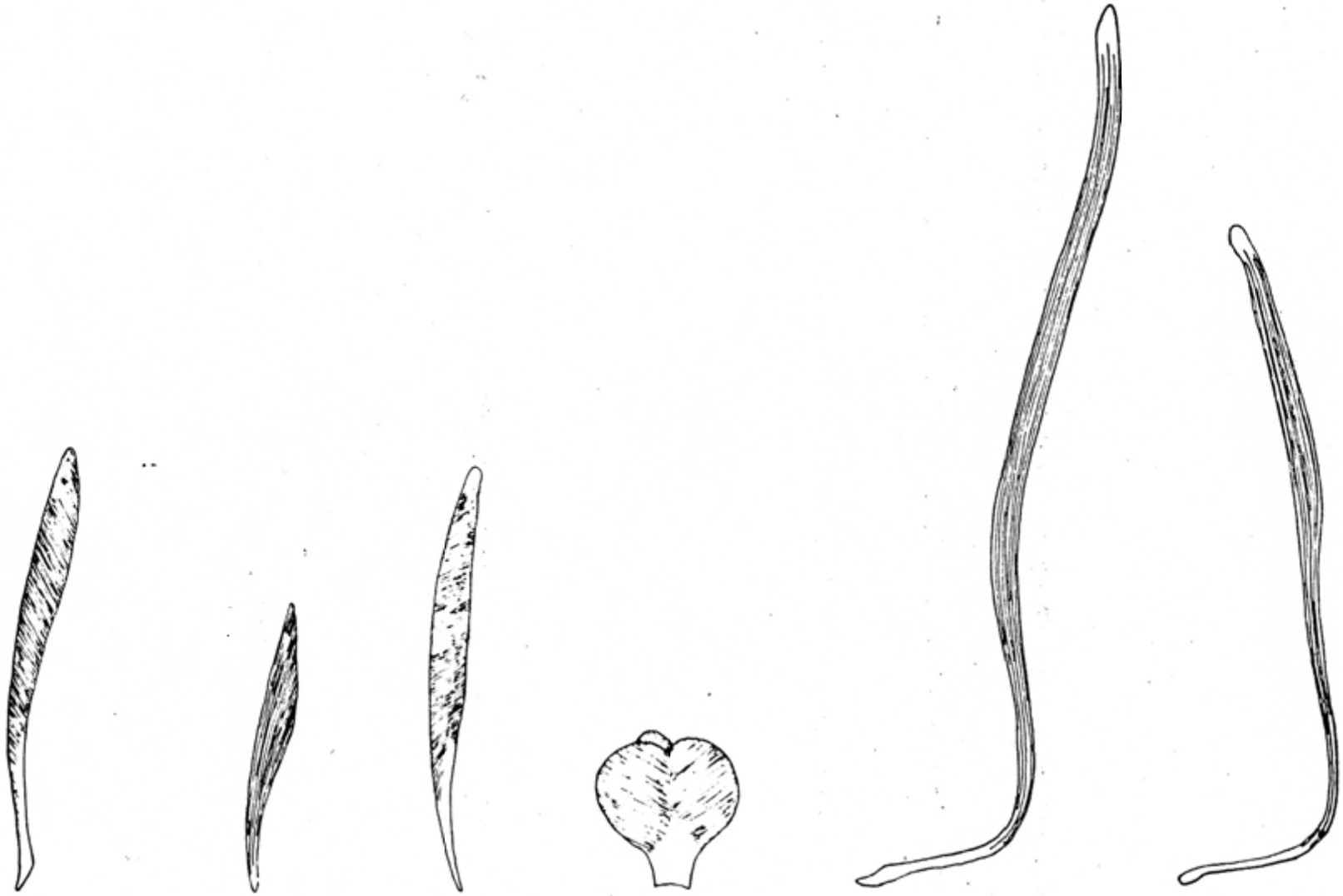
Muscles For The Figures (contin.)



6A 6B 7 8A 8B

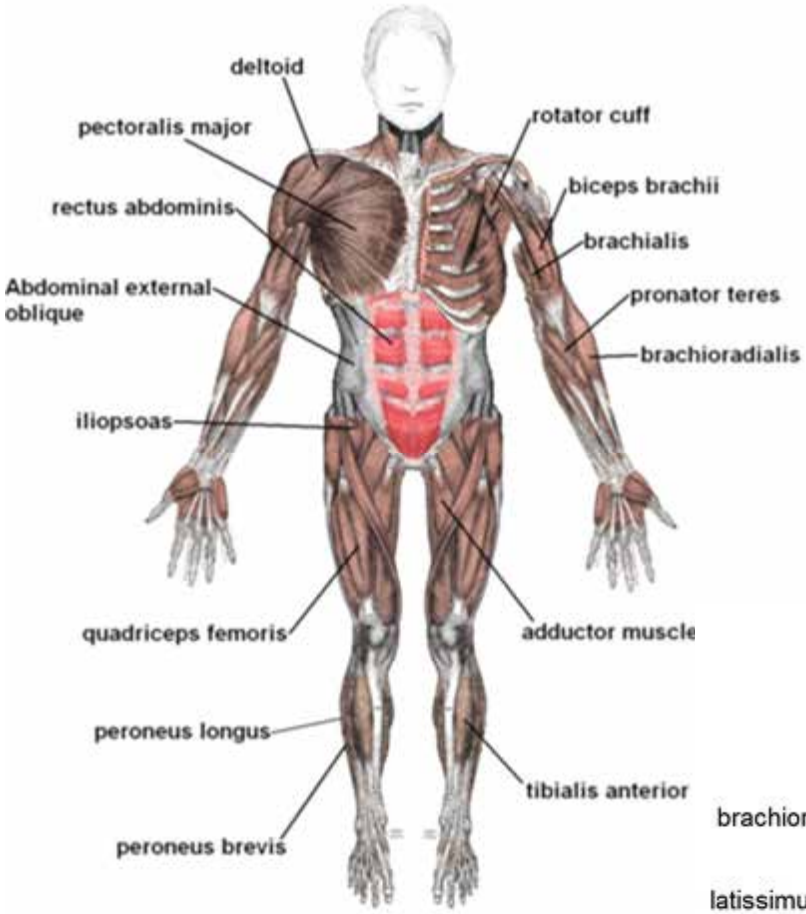
Muscles That Move The Foreleg At The Knee

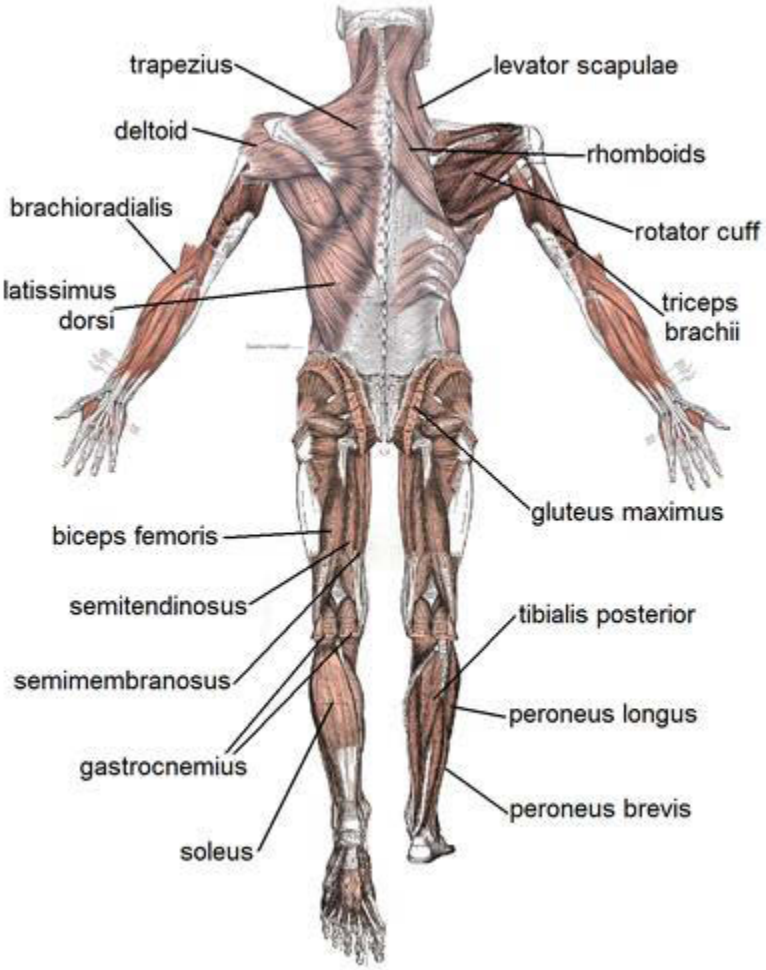
Muscles For The Figures (contin.)



12B 13 14 8C 15 16

Anatomy Muscles





Lesson Eight

Principles of Muscle Adaptation

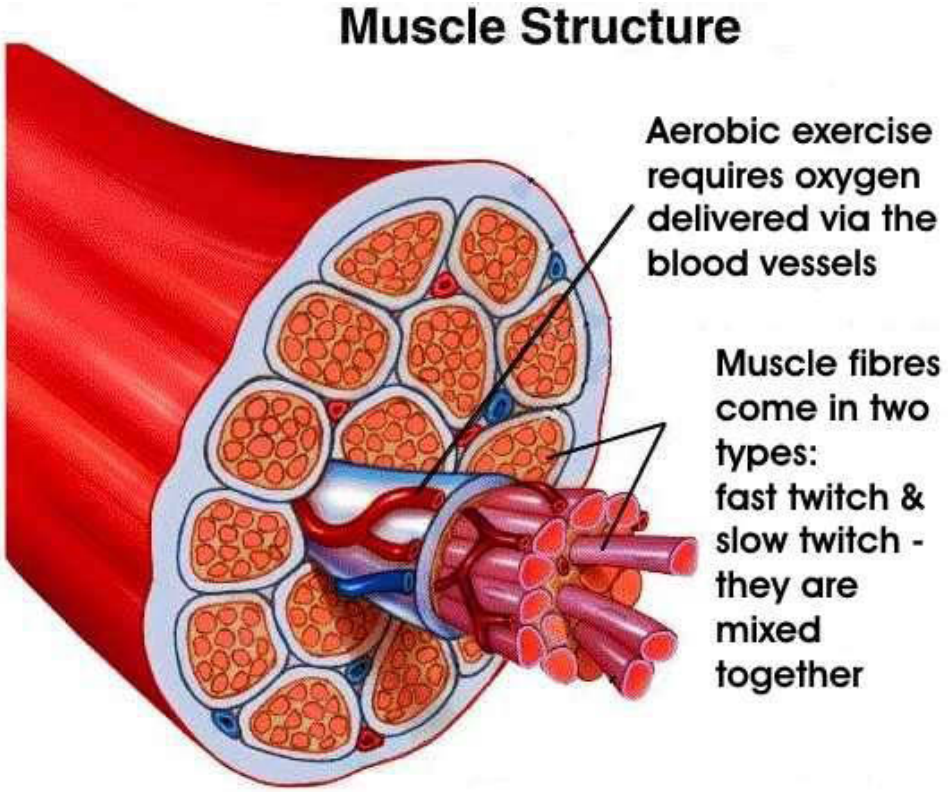
The physiological process by which the body adapts to the exercise is called **adaptation** to training. The adaptation to training ultimately determines whether a resistance training program is effective and whether an athlete is capable of a higher level of physiological function or performance.

Adaptation Principles are depended on the greater the degree of adaptation to the training process, the greater the potential for high levels of performance. The objective of any well-organized training plan is to introduce adaptations that improve performance.

The largest changes take place early in training and then slow down as training continues.

One of the most prominent adaptations is the enlargement of muscles. Sport scientists, athletes, and coaches all agree that a properly designed and implement strength training program leads to muscle growth.

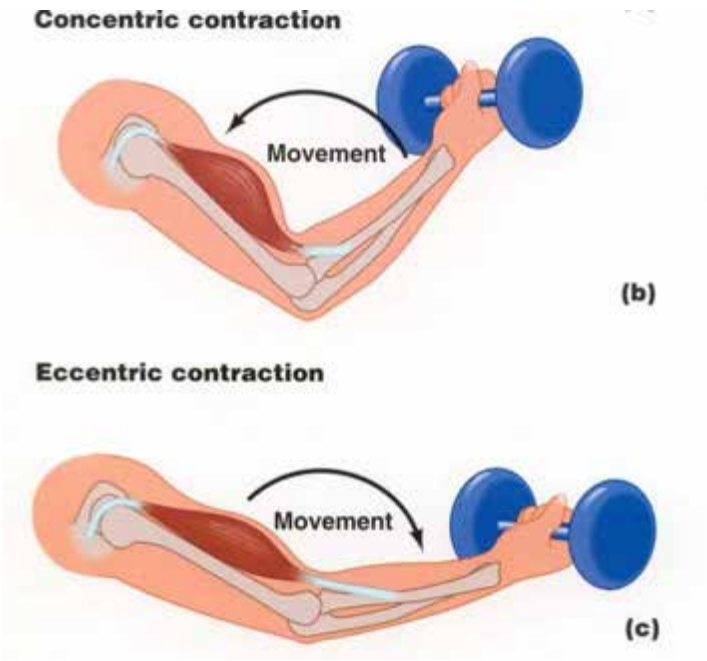
The process of muscles getting larger is called **Hypertrophy** where muscles fibers increase their size.



Looking at the whole muscle, its growth is going to vary due to the extent of the loading and the activation of the muscle fibers. It is also going to depend on the movement of each muscle in relation to the exercise.

In general terms the larger the muscle then the stronger it is. This is related to type of resistance program design for the various aspect of training for sports or body building. The primary goal for any strength program is to produce hypertrophy, an increase in muscle size because regardless of all other factors strength will increase with muscle growth.

Hypertrophy takes eight to twelve weeks to occur. Upper body muscle may have a greater hypertrophic response than lower body muscles, due to the anti-gravity nature of the lower body muscles.

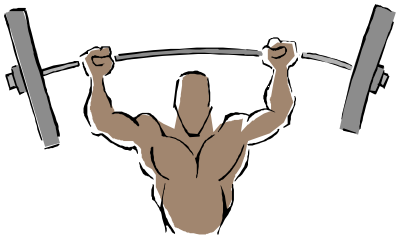


Muscle Adaptation Improvement

How the muscle is trained and its response to the sequence of training will affect the training outcome for the desired results of the strength training program. Improvement is possible only if the athlete observes this sequence.

Increase stimulus (load) → Adaptation → Performance Improvement

The objective is to progressively and systematically increase the training stimulus (intensity, volume of training loads, and frequency of training) to induce superior adaptation and improve performance.



Lack of stimulus → Plateau → Lack of Improvement

If the load is always the same level, adaptation occurs in the early part of training followed by a plateau (stagnation) without any further improvement.

Excessive Stimulus → Maladaptation → Decrease in Performance

If the stimulus is excessive or overly varied the athlete will be unable to adapt and maladaptation will occur.

Muscle Fiber Types

Muscle is made up of two fiber types based on how fast they contract or how much endurance they possess.

Slow Twitch Fibers-Type 1

Fast Twitch Fibers-Type 2

Characteristics of Muscle Fiber Types

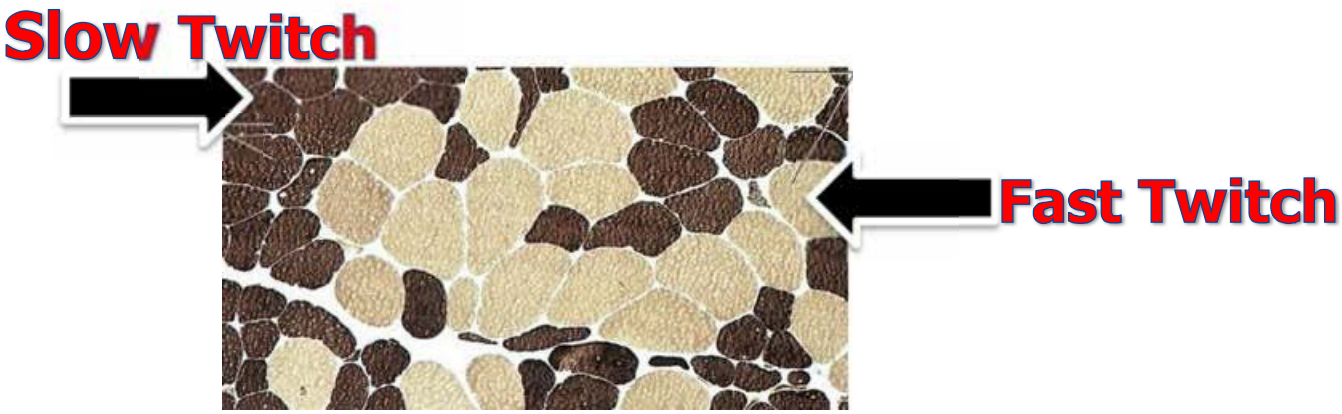
Fast Twitch Type 2 Anaerobic

- Fast Fatigue
- Develops short force contractions
- Speed and power
- Recruited only during high-intensity work

Slow Twitch Type l Aerobic

- Slow Fatigue
- Develops long continuous contractions
- Endurance
- Recruited during low and high intensity work

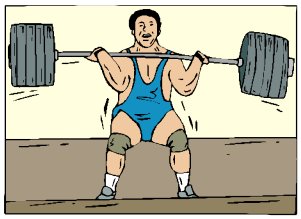
Fiber types can vary within the muscle and between different muscles. Generally the arms have a higher percentage of fast twitch fibers than the legs.



Muscle Fiber Adaptation to Training

Training can affect the type of muscle fiber within the muscle, and cause a decrease of one type or another and change the outcome of the performance for the athlete depending on the sport.

Explosive strength training has the potential to increase Type 2 fiber size. Which demonstrates to the athlete the ratio of Type 2 to Type 1 muscle fiber content is greater in weightlifters than in power lifters and bodybuilders.



Endurance training can shift the muscle fiber content towards more of a Type 2 to Type l fiber breakdown an increase the reliance on an aerobic muscle response.

Speed training, sprint performance is significantly correlated with the athleteôs percentage of Type 2 fibers. Sprint training can increase Type 2 fiber content in the athleteôs muscles. It appears that the development of Type 2 fiber contents for sprint training can be hindered or slow down if endurance training is included in the training plan.

Scientific data suggest that the type of training has the potential to dictate the type of changes within the skeletal muscle.

Task Cards

Muscle Adaptation Improvement

1. Design a resistance training program looking at the three sequences that effect athleteôs development.
   - Increase Stimulus
   - Lack Stimulus
   - Excessive Stimulus

2. Describe how two of the programs present short comings for athleteôs physical development.

Muscle Fiber Adaptation to Training

1. Design a training plan that address:
   - Explosive Strength Training
   - Endurance Training
   - Speed Training

Lesson Nine

Nutrition

Nutrition is the process by which the body uses food for growth and health. Nutritional needs vary throughout life, depending on age, sex, activity levels, and diseases. The food you eat provides you with over 50 nutrients essential to life. Nutrition performs three basic functions relative to energy processes.1) Some nutrients serve as an energy source. 2) Some nutrients are needed to regulate the processes whereby energy is produced in the body. 3) Some nutrients are used to form the structure of and provide the growth and development for various body tissues that produce energy. The nutrients you eat are grouped into six different classes: carbohydrates, fats, proteins, vitamins, minerals, and water.

Carbohydrates

Carbohydrates serve as a source of energy. Carbohydrates provide energy and allow protein to be used for other activities. Carbohydrates are the primary component of many types of foods. The recommended number of servings per day of breads and starches is 6-11 possibly higher if your caloric needs are greater. By adding 3-5 servings of vegetables and 2-4 servings of fruits you are choosing a diet rich in complex carbohydrates. Carbohydrates come in a variety of forms, often known as sugars and starches. Carbohydrates are one of the main energy sources for fueling muscles. Approximately 60-70% of your calories should come from carbohydrates.

Fats

Fat provide energy too, but are also part of the structure of most cells. Fats perform several functions, and a certain amount of fat is required in your diet. Fat serves as an energy source, and provide essential fatty acids (substances needed by the body). Fat also aids in the absorption and transport of fat-soluble vitamins, such as A, D, E ,and K. There are several types of fat in the food we eat. Cholesterol and saturated fats may raise blood cholesterol levels. Monounsaturated and polyunsaturated fats may help lower blood cholesterol levels.

Protein

Protein has a variety of roles: It is necessary for tissue formation, growth, and development, it is necessary for the formation of enzymes to regulate energy production and under certain conditions, it may be used as an energy source. Protein is important in building, repairing, and maintaining tissues. Protein also produces enzymes which causes beneficial chemical reactions in the body. Protein needs vary throughout a personôs life and are highest during rapid growth periods, such as childhood and pregnancy. Proteins are made of various amino acids. The human body can manufacture certain amino acids. Other essential amino acids must be supplied in the diet. Complete proteins contain all of the essential amino acids.

Vitamins

Vitamins serve primarily to regulate a variety of processes by working with enzymes. Most vitamins are chemical substances that body does not manufacture so you must obtain them through your diet.

Minerals

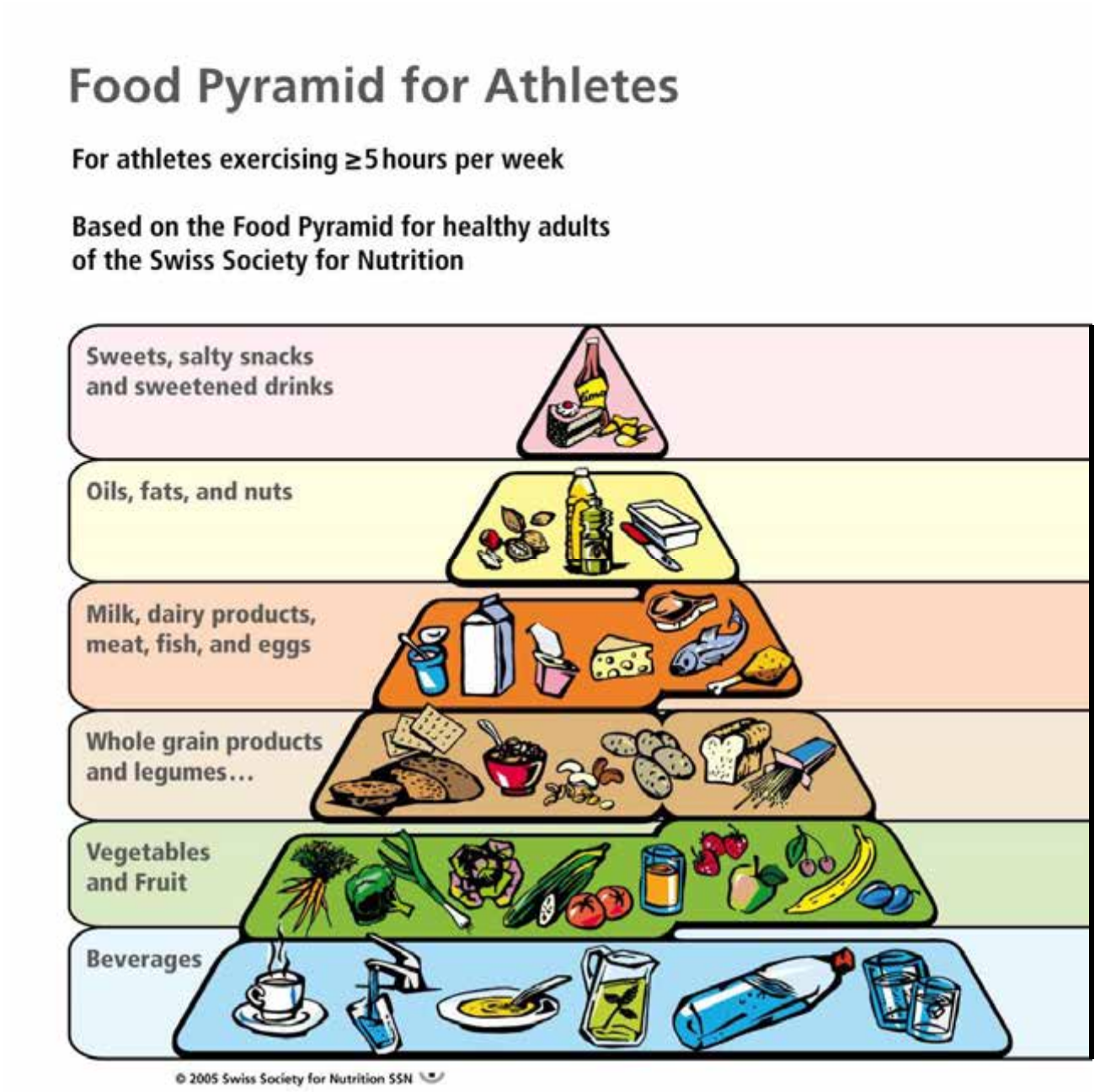
Minerals are involved in the regulation of metabolism but some contribute to the structure of your body. Minerals do not provide energy.

Fluid

Fluid is the most important nutrient for athletes. The bodyôs need for water is second in importance only to its needs for oxygen. The main function of fluid for the athlete is regulating body temperature. Fluid works as a coolant. Temperature and humidity influences how much fluid you need. Water weight accounts for approximately 55-60% of body weight. A 10% loss of body water may pose significant health risks. A 20% loss of body water may result in death. Water is the medium for all body fluids, such as blood, digestive juices, perspiration, and urine. Water aids in regulating body temperature. Water plays a key role in our energy systems, blood, muscle, and organs need water to function.

Food Pyramid for Athletes

The food pyramid for athletes is based on the food pyramid designed and developed by the Swiss Society for Nutrition.



Nutrition for Athletes

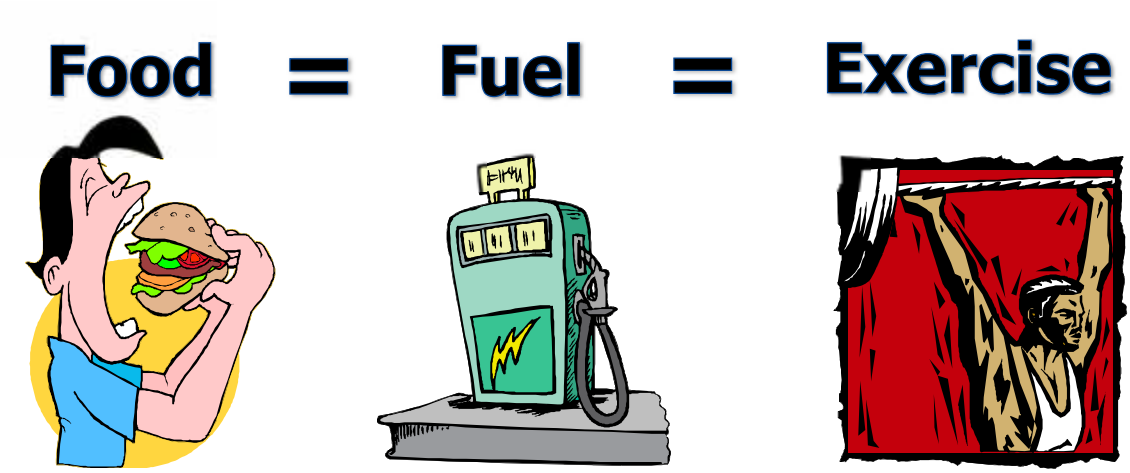
The requirements of the athlete for energy and for individual nutrients are different in different sports, and will be influenced very much by the total training load during any workout. The amount and type of food and drink that any athlete consumes, as well the time they consume these nutrients, affects the output of the energy systems that athletes need for exercise.

Energy Demands for Athletes

All exercise imposes an increase energy demand on the muscles. If the muscles are unable to meet the demands, the exercise cannot be performed at a high level. If body weight and performance levels are to be maintained during periods of intense training the high rate of energy expenditure (calories burned) must be matched by an equally high energy intake (calories consumed).

Food = Fuel = Exercise

The measure of energy, or calories, often has a negative connotation. Without the consumption of food and the transformation of the energy contained in that food into biologically useful energy, life would not be possible. Athletes should think of energy and calories in positive terms because energy is needed to fuel activity.



Guide to Burning Calories

Calories

A Calorie is the approximate amount of energy needed to raise the temperature of on gram of water by one degree Celsius.

cal

cal is 1 small calorie

Calorie Recommendation 14-18 Years Old

2,200 CAL

1,800 CAL

ENERGY BALANCE

MAINTAIN WEIGHT DEPENDS ON:

6 Factors

Age
Body Weight
Gender

Activity Energy Expenditure (AEE)- The amount of calories that you are typically burning to complete your daily activities.

Resting Energy Expenditure (REE)-The amount of calories you need to maintain your basic body systems and body temperature at rest each day.

Total Energy Expenditure (TEE)- Simply add the REE and AEE together to get the total amount of calories you burn each day.

To determine your amount of calories go to: www.athleticperformancesystems.com free tools section.

Nutritional Principles for Strength Training

These fundamental principles will help the strength athlete maintain and develop the muscle mass needed to improve their training performance. These principles are called **"The Big 8"**.

1. The body must be provided with sufficient energy to meet their physical needs. The energy requirement will be largely determine by the training load.

2. Appropriate nutritional balance among the various essential nutrients must be maintained.

3. The choice of foods must meet the nutritional requirements for different periods of training preparing for competition, during competition and during recovery phase after competition.

4. Vitamins and minerals play a key role in regulating metabolic process and any deficiency will impair performance during training and competition.

5. Dietary influences on the metabolic environment in the recovery phase will affect the extent of recovery from training and competition.

6. A varied diet is essential to provide all the nutrients needed by the athlete in the adequate amount.

7. The diet must be chosen to include food stuffs that will provide all of the essential nutrients that are easily digested and not cause gastrointestinal problems during competition.

8. Where there is a need to increase body mass, in the form of lean tissue and specifically in the form of muscle the diet must contain sufficient amount of carbohydrates and protein and other nutrients to ensure that the increase requirement is met.

Anabolic Steroids: What are they?

Anabolic Steroids are synthetic hormones. Hormones are chemicals made by endocrine glands, which are secreted into the blood and thereby carried throughout the body. Hormones travel through the bloodstream to many receptor sites in all our body systems. These receptor sites react to normal hormones to provide healthy growth and development. Hormones are either protein-based such as human growth hormone or steroid derived such as testosterone. Testosterone is often called **"male"** hormone because, especially after puberty, males have much more testosterone in their bodies than female do. It provides **"anabolic" (building)** effects, which is why males generally have larger, more muscular body builds than females. Testosterone also produces **"androgenic"** muscular effects. This is why males generally are aggressive, speak with deep voice, grow beards and exhibit other masculine traits.
The full name of these drugs is anabolic-androgenic steroids: anabolic means tissue building, androgenic refers to male sex characteristics and steroids refers to the class of drugs. Athletes use anabolic steroids to enhance their performance by drastically increasing their levels of the male hormone testosterone. The theory is that anabolic or tissue-building effects increase strength and muscle mass. Athletes tend to ignore the androgenic portion, which is most responsible for the side effects of these drugs.

History of Steroids

Developed in the 1930s anabolic steroids are used to treat rare diseases in males whose bodies donôt produce enough testosterone. These drugs are also used for conditions such as rare typeôs anemia and kidney disease. Many new anabolic steroids were made by changing the way the chemical were put together so certain effects were stronger. However, the anabolic effects could not be completely separated from significant side effects. The experimental use of anabolic steroids began among West Coast body building in the late 1940s and early 1950s. Since then body building has been strongly and consistently linked to steroid use.

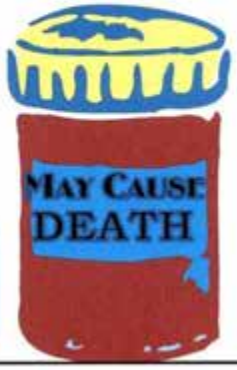
Steroid Danger for Teenagers

The younger a person is, the more damaging drug abuse can be. Physical development can change when body chemistry reacts to any chemical that doesnôt help natural growth and development. Natural hormones make a teenagerôs body mature into an adult body. Anabolic steroids are hormones that will alter the natural process. Hormones level adjustment caused by these drugs can create radical physical, mental, and emotional changes.

ANABOLIC STEROIDS

SIDE EFFECTS

WARNING



Steroids effects in Men

Male Problems

Baldness
Breast Development
Shrinking of the Testicles
Infertility
Increase risk for Prostate Cancer

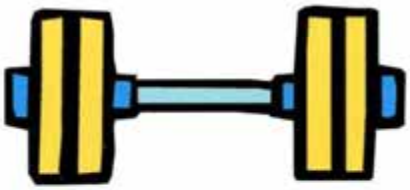
Steroids effects in Men and Women

Psychological Problems

Paranoid Jealousy
Extreme Irritability
Delusion
Impaired Judgments
Aggression
Violence

Physical Problems

Severe Acne
Liver Damage
High Blood Pressure
Cholesterol Problem
Kidney Failure
Trembling
Fluid Retention
Jaundice



Steroids effects in Women

Female Problems

Growth of facial hair
Male Pattern Baldness
Deepened Voice
Reduce Breast

Side Effects for Teens

Stroke
Psychiatric Problems
Liver Cancer
Bone Growth Closure

Acne
Heart Attack
Arrhythmia
Pancreatitis

Task Cards

Lesson Nine

1. List each food that is a Carbohydrate, Fat, and Protein.

2. List 5 vitamins and identify which ones is water soluble or fat soluble.

3. List 5 types of minerals and their functions.

Lesson Nine

Go to www.athleticperformancesystems.com go to the free tool section.

1. Determine the number of calories you should have based on your age, height, and weight.

2. Determine the number of calories for Carbohydrates, Protein, Fat and the amount of fluids for you.

3. Using the information on Energy Balance formula: Determine how many calories you should consume and the number of calories you burn playing your or any sport.

Lesson Ten

Muscular Strength

Strength can be defined as the ability to apply or to resist force. The force you exert in a maximal voluntary contraction depends on number of factors such as the number of contracting fibers, their contractile state (length and fatigue) and the mechanical advantage of the body lever system. Larger fiber equals more force; the stretched muscle exerts more force; the unfatigue muscle exerts more force; and mechanical factors magnify force or speed. Other factors affect strength the sex of the individual the age and fiber type. Not until 12 to 14 years of age, boys are not much stronger than girls. Thereafter, the average male gains an advantage that persists throughout life. The reason for this difference is due to the increase in the male sex hormone testosterone at puberty. The average male has 10 times the testosterone found in the average female. Testosterone is an anabolic (grows increase) steroid that helps muscles get larger. Strength reaches a peak in the early 20ôand declines slowly until age 55 or above. When strength is used it hardly declines at all even into the 60òs.

Training before your teens leads to improvements that are mostly due to changes in the nervous system.

Training during your teens and after improvements are you nervous systems and in the muscle tissue. Training at any age will improve or maintain strength. Strength also effect muscle fiber type, the larger faster contracting fast twitch fibers have a greater potential for the development of tension. People with higher percentage of faster twitch fibers have a greater potential for force development. Strength training improves the capabilities of both slow twitch and fast twitch fibers.

Muscular Power

Muscular power is the muscleôs ability to release muscular force quickly and explosively. Power is the result of strength and speed and is the most obvious characteristic of a successful athlete. Power can change if the strength or speed components are altered. Studies have shown that Olympic style lifts require the highest power output of any human movement measured to date. A power program involves fewer exercises, heavier weight loads, fewer sets, fewer repetitions, and longer recovery intervals.

Strength Training

A strength training program is a complex process that requires the recognition and manipulation of seven program variables.

These seven program design variables will determine the outcome for the athlete in regards to their performance capabilities.

1. **Needs Analysis**
2. **Exercise Selection**
3. **Training Frequency**
4. **Exercise Order**
5. **Training Load and Repetitions**
6. **Training Volume**
7. **Rest Periods**

Needs Analysis

The needs analysis is a two part process which looks at the sport and the athleteôs needs and goals.

The characteristics of the sport will provide the design requirements; these are the areas of importance.

- Body and limb movement patterns and muscles involved.
- Strength, power, hypertrophy and muscular endurance needs.
- Common joint and muscle injury sites.

The athleteôs needs are what are their current condition level and their training background.

- Type of training program.
- Length of participation in previous training program.
- Degree of exercise technique experience.

Exercise Selection

This involves choosing the correct exercise for the resistance training program. Exercises are divided into core and assistance based on the size of the muscle area involved.

Core Exercises- One or more of the larger muscle areas.

- **Chest**
- **Shoulder**
- **Back**
- **Hip**
- **Thigh**

Assistance Exercises- Movement of smaller muscle or a single joint action.

- **Biceps**
- **Triceps**
- **Abdominals**
- **Calf**
- **Neck**
- **Trapezius**
- **Forearm**
- **Lower Back**
- **Lower Leg**

Training Frequency

The number of training sessions completed in a one week period the frequency of training is determine by the level of experience of the athlete.

- **Beginner 2-3 sessions per week**
- **Intermediate 3-4 sessions per week**
- **Advance 4-7 sessions per week**

Exercise Order

This is the sequence of resistance exercise performed during one training session. Exercises are arranged so that the athlete can complete a set with proper exercise technique.

Upper-Lower Body Exercises (Alternated) - This method alternates upper-body exercise with lower body exercises.

Push and Pull Exercises (Alternated)- This method alternates pushing exercises bench press, shoulder press, and triceps extension, with pulling exercise lat pull down, bent-over row, bicep curl. A push-pull arrangement ensures that the same muscle group will not be used for two exercises.

Training Load and Repetitions

A load is the amount of weight lifted for an exercise. This is the most important part of any resistance training program**. Repetition is the number of times an exercise can be performed**.

Training Volume

Volume or volume load describes the total amount of weight lifted in a training session, and a **set is a group of repetitions sequentially performed before stopping to rest.** Volume is calculated by multiplying the number of sets by the number of repetitions times the weight lifted per repetition. Example: 2 x 10 x 50 lb. = 1,000 lbs.

Rest Periods

Time dedicated to recovery between sets and exercises. The length of rest period between sets and exercises is depended on the training goal and the athletes training status. The amount of rest allowed between sets is related to the load.

- **Strength 2-5 minutes Rest Period**
- **Power 2-5 minutes Rest Period**
- **Hypertrophy 30 seconds- 1.5 minutes Rest Period**
- **Muscular Endurance less than 30 seconds**

Training Session Plan

Determine the outcomes that you desire to experience from the strength training plan. Remember no program will allow you to reach your goals unless you training hard, train smart and eat sensibly those are the only guarantees to having a successful outcome.

Medical Clearance

Participating in sports or any strength training program athletes must obtain medical clearance.

Introduction

Describe the training objectives for the day and how the goals will be achieved.

Warm-up

Prepare the body for physical activity. The warm-up elevates the body temperature, muscles, tendons, ligaments and other tissues, which prevents or reduces sprains and strains. Specific warm-up for resistance training perform a few repetitions with lighter loads before the performance loads.

Correct Form and Body Position

Proper lifting technique is an important factor in performance improvement and prevention of injury. The form or technique of lifting must be stressed, especially during the early years of strength training.

Breathing Points

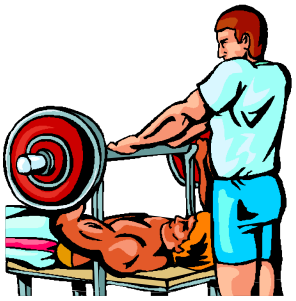
- Take a breath with every repetition.
- Exhale during the lifting phase.
- Inhale during the lower phase.

Spotting

Spotting is the practice of having one or more individuals presented to assist the lifter. A spotter should be at least as strong and at least as tall as the athlete.

Lifts that need Spotters

Free weights or dumbbells lifts that are performed over head with the bar on the back or over the face, should involve one or more spotters.



Spotters Responsibilities

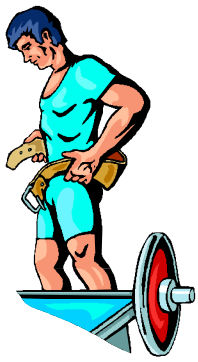
- Be alert; Focus your attention on the lifter.
- See that the weights are evenly distributed and collars secured.
- Know how many repetitions will be attempted.
- Communicate while youôre spotting. But minimize idle chatter to avoid distracting the lifter.
- Assume a ready position with solid base of support.
- Use two hands in an under hand position to spot or assist the lifter.
- If the lifter fails the attempt, guide the bar smoothly until itôs safely secured in a rack or other stable position.

Knowing how much and when to help an athlete is an important aspect of spotting. Make sure the athlete and the spotters understand each other, and what words will be used to let the spotter know to take the bar when trouble develops with the lift.

Weightlifting Belts

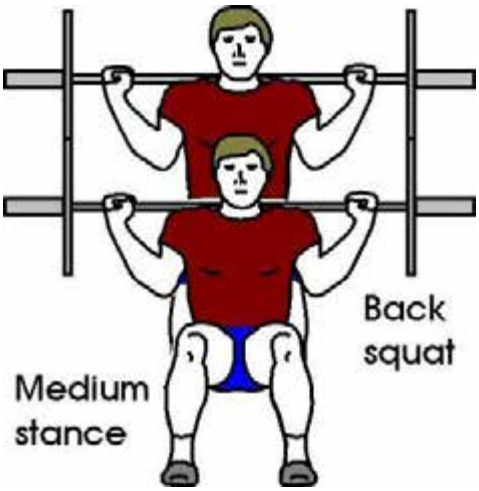
A weight belt should be worn when performing exercises that place stress on the lower back and during lifts that involve near maximal or maximal loads.

No weight belts is needed for exercise that do not stress the lower back or for exercises that do stress the lower back but use light loads.



Lower Body Lift and the Sports the Lift Benefits

Squat



Area of the Body Worked

Gluteal Quadriceps

Hamstrings

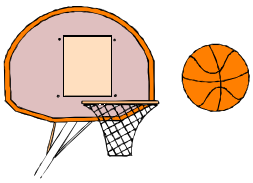
Starting Point

Position the bar on your shoulder and trapezius muscle. Your hands and feet should be shoulder width apart. Grasp the bar with close grip with palm facing out.

Lift Movement

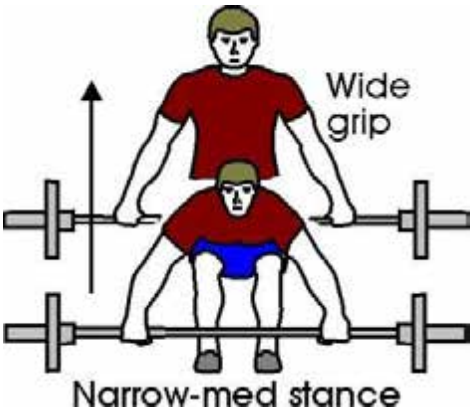
Keeping the back straight bend the hips back toward the wall and then bend at the knees. Keep your knees behind the toes as you reach parallel with the thighs. Keep the bodies tight and in control do not bounce or relax the legs. Rise up by extending the hips and knees. Keep the knees aligned over the feet don't shift inward or outward with the knees.





Lower Body Lift and the Sports the Lift Benefits

Deadlift



Area of the Body Worked

Back Thighs

Hips

Starting Point

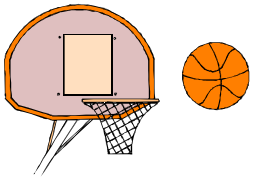
Squat down, the hips are lower than shoulders. Grasp the bar with an overhand grip palms facing down. Arms are outside the knees and elbows fully extended and point out to the side. Bar is in front of the shins and over the balls of the feet. Knees are behind the toes.

Lift Movement

Extend the knees and hips slowly and under control. Do not let the hip rise before or faster than the shoulders. Elbows are fully extended, shoulders over or slightly ahead of the bar. Keep the bar close to the body. Continue to extend the hips and knees until the body reaches an upright position. Hold for a second; slowly flex hips and knees to the downward position under control. Touch the plates to the floor. Then repeat.

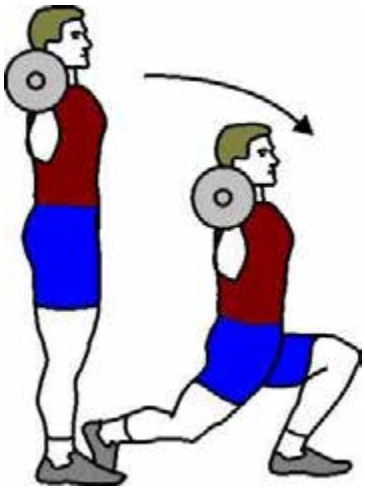






Lower Body Lift and the Sports the Lift Benefits

Lunge



Area of the Body Worked

Quadriceps Gluteal

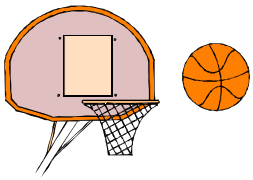
Hamstrings Hip Calf

Starting Point

Position the bar on the shoulder and trapezius muscle. Hands should be shoulder width apart. Grasp the bar with a closed grip palms facing out. Dumbbells grip the bar with the fingers and hold the dumbbell to your side with the arms slightly bent.

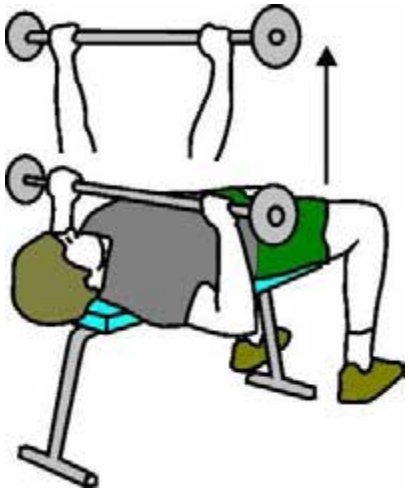
Lift Movement

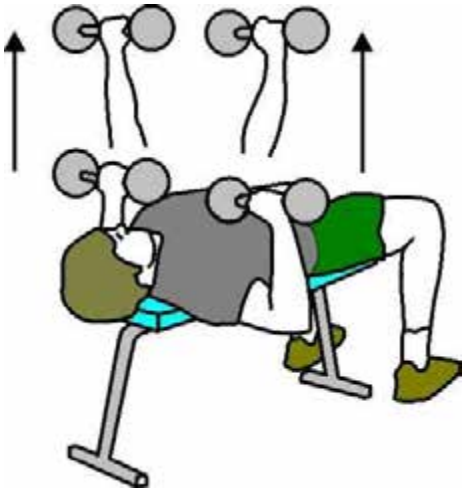
Step forward with one leg you're left or right one. Keep the torso erect and arms tight. Head facing forward and eyes looking straight ahead. Toes pointed straight. Knees should not pass the toes. Back leg knee does not touch the ground. Lift up without bending the waist to the standing position. Repeat the motion with the other leg.


Upper Body Lift and the Sports the Lift Benefits

Bench Press





Area of the Body Worked

Chest

Upper Arms

Shoulders

Starting Point

Lie face up on a flat bench. Feet planted flat on the floor. Grasp the barbell or dumbbell with an overhand grip. Hand placement on the bar is measured with an extended thumb placed at the smooth part of the bar. The hands are placed a thumb distance from the smooth part of the bar. Your thumb should be should be wrapped around the bar with a hook grip.

Lift Movement

Unrack the bar and slowly lower it toward your chest. Keep your wrist aligned with your elbow and elbows pointed out to your side. When the bar just touches your chest press up explosively, driving the weight away from you.

Upper Body Lift and the Sports the Lift Benefits

Bent-Over Rowing

Area of the Body Worked

Upper Back Upper Arms

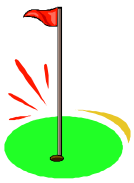
Shoulders

Starting Point

Hold the barbell or dumbbell using an overhand grip. Hands are shoulder width apart and arms are extended. Feet are shoulder width apart with a slight bend at the knees. Bend forward from the hips keep the torso just above parallel to the floor and chest lifted. Allow the bar or dumbbell to hang at full elbow extension.

Lift Movement

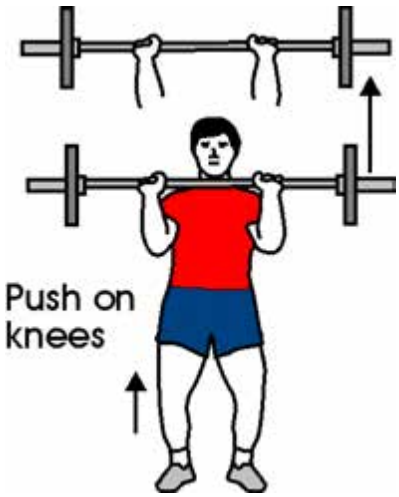
The exercise begins by pulling the bar or dumbbells towards the torso. Elbows should point away from the sides of the body with the wrist kept straight. Avoid momentum to pull the bar or dumbbells, use slow controlled full range of movement. Don't round or hunch shoulders. Pull the bar or dumbbells up until it touch the chest. Slowly lower the bar to the starting point.





Upper Body/ Lower Body Lift and the Sports the Lift Benefits

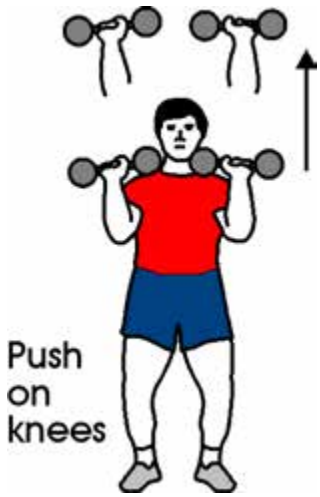
Push Press



Area of the Body Worked	
Upper Back	Upper Arms
Shoulders	Hamstring
Quadriceps	Calf

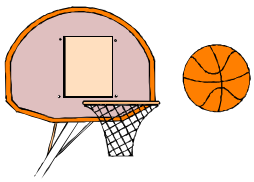
Starting Point

Hold a barbell or dumbbell across your chest with a palm out grip. Stand erect with the feet hip width apart and the toes pointed slightly outward.



Lift Movement

Bend slightly at the knees and then explode upward onto the balls of your feet simultaneously pressing the bar overhead. Hold this position for a second before returning to the bent knee position.


Task Cards

Lesson Ten

1. Identify the muscles that are developed for the six lifts.

    - Lower Body-Squat, Deadlift, Lunge
    - Upper Body-Bench Press, Bent-over rowing
    - Upper Body/Lower Body- Push Press

Lesson Ten

Using the information from Lesson 8 and Lesson 10.

Develop an 8 week strength training workout program for an athlete.

Describe the sport the athlete is preparing to play.

Determine the lifts, the reps, sets, and the weight lifted based on their body weight.

Answer Key

Lesson Three-Anatomy Upper Body Skeleton

Page 19 Complete these statements:

1. Vertebral column
2. Vertebra
3. Cervical
4. Thoracic
5. Lumbar
6. Sacrum
7. Coccyx
8. Intervertebral discs
9. Vertebral foramen
10. Spinous
11. Transverse
12. Articular
13. Articular

Color the different parts of the spine picture

Lesson Three-Anatomy Upper Body Skeleton

Page 20 Identify the number structures in figure 5:

1. Menubrium
2. Body
3. Xiphoid process
4. Rib cage
5. True ribs
6. False ribs
7. Floating ribs

Part B-Answer the questions from the list of words. Questions 1-8

Color the different parts of the Thorax picture

Lesson Three-Anatomy Upper Body Skeleton

Page 21 Identify the numbered structures in figure 6:

1. Clavicle
2. Scapula
3. Sternoclavicular joint
4. Acromion
5. Acromioclavicular joint
6. Coracoid process
7. Humerus
8. Capitulu
9. Trochlea
10. Glenoid cavity
11. Coronoid fossa

Part B

1. Grasping and holding
2. Pectoral girdle
3. Clavicle
4. Scapula
5. Sternoclavicular joint
6. Acromioclavicular joint
7. Acromion and coracoid process
8. Humerus
9. Capitulum
10. Trochlea
11. Glenoid cavity
12. Olecranon and coronoid
13. Humerus
14. Scapula

Color the different parts of the upper extremities picture

Lesson Three-Anatomy Upper Body Skeleton

Page 22 Identify the numbered structures in figure 7:

1. Ulna
2. Radius
3. Olecranon
4. Carpal bones
5. Metacarpals
6. Phalanges
7. Phalanx

Part B Define the words

Part C Complete the statements

Color the different parts of the upper extremities arm and hand picture.

Lesson Four-Anatomy Lower Body Skeleton

Page 25 Identify the numbered structures in figure 8:

1. Symphysis pubis
2. Ilium
3. Ischium
4. Pubis
5. Acetabulum
6. Obturator foramen
7. Femur
8. Head
9. Neck
10. Greater trochanter
11. Medial condyle
12. Lateral condyle
13. Intercondylar fossa
14. Patella

Part B Write the words that complete these statements:

1. Three
2. Acetabulum
3. Hipbones, sacrum, coccyx
4. Symphysis pubis
5. Basin
6. True
7. False
8. Obturator
9. Femur
10. Greater trochanter
11. Medial condyle and lateral condyle
12. Patella

Color the different parts of the pelvic girdle, hip, and thigh picture.

Lesson Four-Anatomy Lower Body Skeleton

Page 26 Identify the numbered structures in figure 9:

1. Tibia
2. Fibula
3. Condyles
4. Medial malleolus
5. Lateral malleolus
6. Tarsal bones
7. Talus
8. Calcaneus
9. Metatarsal bones
10. Phalanges

Part B Match each term to its definition:

1. Condyle
2. Fibula
3. Phalanges
4. Talus
5. Tibia
6. Medial malleolus
7. Lateral malleolus
8. Tarsal bones
9. Carpal bones
10. Calcaneus
11. Two
12. Three

Color the different parts of the leg and foot picture.

Lesson Five-Muscle

Page 31

Identify the muscle classification and what type of muscle it is.

Page 32 Muscle Action at the Elbow Joint

Color in the action of the muscle

Color the muscle

Page 35

Answer the questions 1-15

Lesson Six- Upper Body Muscle

Four Muscle Packets

Cut, color, and paste the muscles to the pictures.

Then put the completed muscles packets in a 3 clip folder to turn in.

Lesson Seven- Lower Body Muscle

Four Muscle Packets

Cut, color, and paste the muscles to the pictures.

Then put the completed muscles packets in a 3 clip folder to turn in.

Lesson Eight- Task Card on Page 99

Lesson Nine- Task Card on Page 108

Lesson Ten- Task Card on Page 121