FLASHCARDS FOR

Bones, Joints, and Actions of the Human Body

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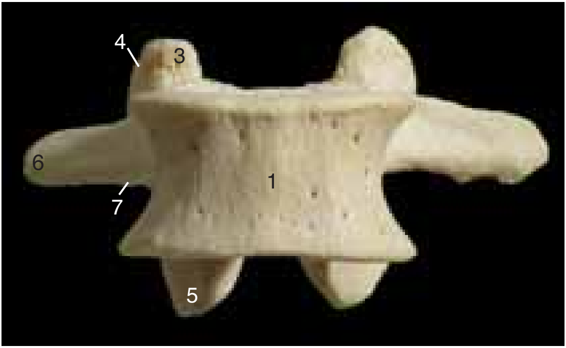
Superior

Right



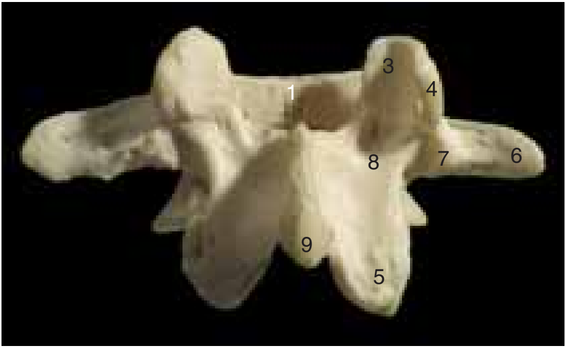
Left

Inferior

A

Superior

Left



Right

Inferior

B

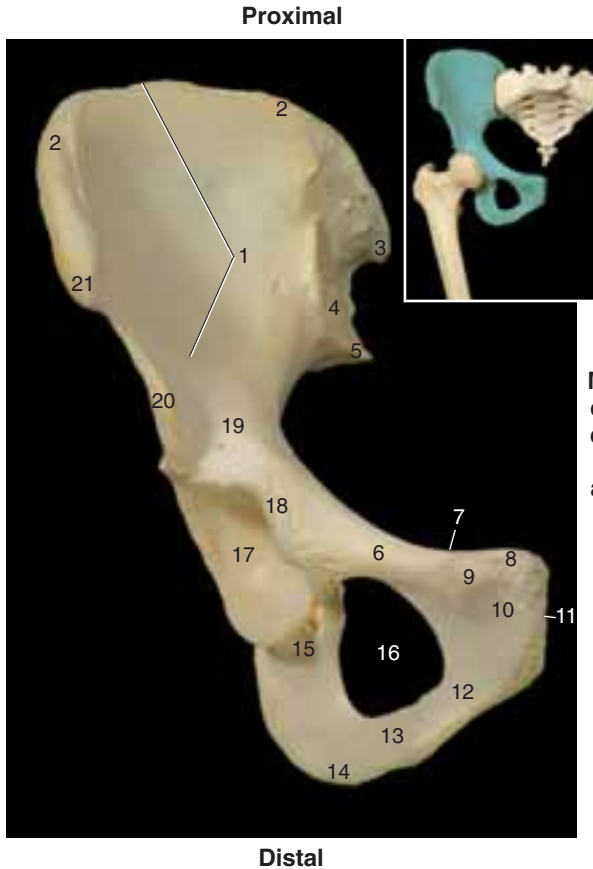
Typical Lumber Vertebra (L3)—Anterior and Posterior Views

AXIAL SKELETON

A, Anterior view
B, Posterior view

1. Body
2. Pedicle *(not seen)*
3. Superior articular process/facet
4. Mamillary process
5. Inferior articular process/facet
6. Transverse process (TP)
7. Accessory process
8. Lamina
8. Spinous process (SP)
10. Vertebral foramen *(not seen)*

Kinesiology **PAGE 108, Figure 4-31CD**

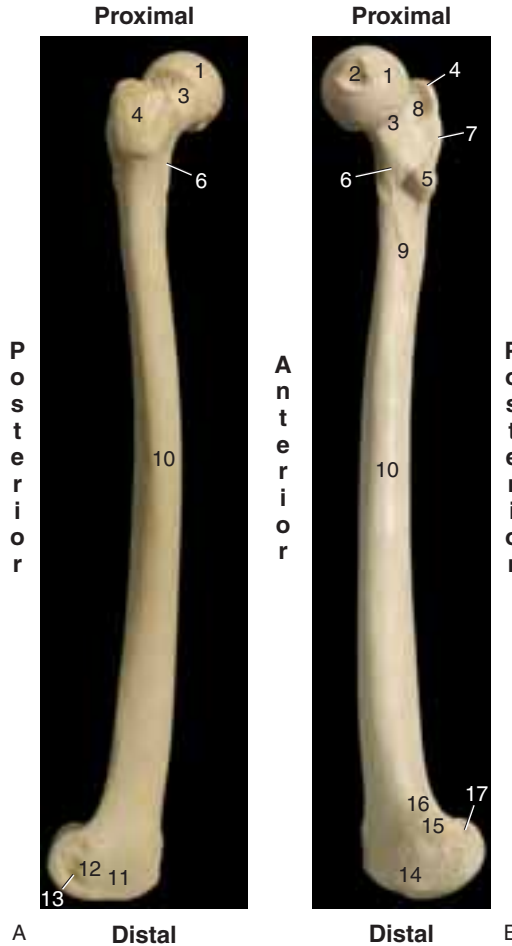


Right Pelvic Bone—Anterior Views

APPENDICULAR SKELETON, LOWER EXTREMITY

1. Wing of ilium (iliac fossa on internal surface)
2. Iliac crest
3. Posterior superior iliac spine (PSIS)
4. Articular surface for sacroiliac joint
5. Posterior inferior iliac spine (PIIS)
6. Superior ramus of pubis
7. Pectineal line of pubis
8. Pubic crest
9. Pubic tubercle
10. Body of pubis
11. Articular surface for pubic symphysis
12. Inferior ramus of pubis
13. Ramus of ischium
14. Ischial tuberosity
15. Body of ischium
16. Obturator foramen
17. Acetabulum
18. Rim of acetabulum
19. Body of ilium
20. Anterior inferior iliac spine (AIIS)
21. Anterior superior iliac spine (ASIS)

Kinesiology **PAGE 118, Figure 4-40AB**



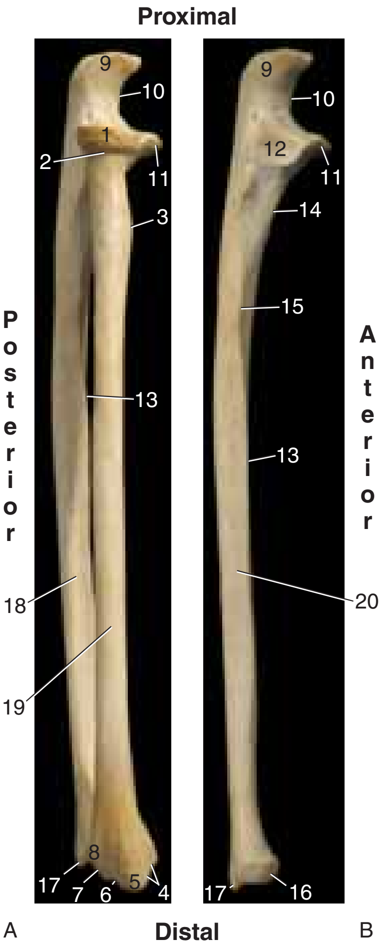
Right Femur—Lateral and Medial Views

APPENDICULAR SKELETON, LOWER EXTREMITY

A, Lateral view
B, Medial view

1. Head
2. Fovea of head
3. Neck
4. Greater trochanter
5. Lesser trochanter
6. Intertrochanteric line
7. Intertrochanteric crest
8. Trochanteric fossa
9. Pectineal line
10. Body (shaft)
11. Lateral condyle
12. Lateral epicondyle
13. Groove for popliteus tendon
14. Medial condyle
15. Medial epicondyle
16. Adductor tubercle
17. Impression for lateral gastrocnemius

Kinesiology **PAGE 123, Figure 4-45AB**



Right Radius/Ulna—Lateral Views

APPENDICULAR SKELETON, UPPER EXTREMITY

A, Lateral view of the radius and ulna articulated.
B, Lateral view of just the ulna.

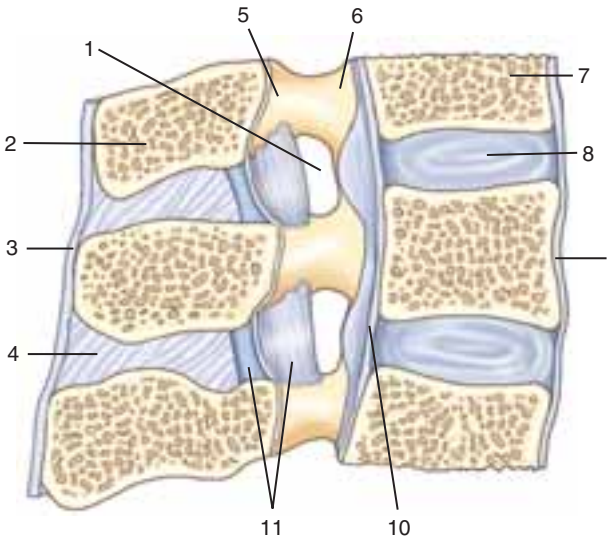
Landmarks of the Radius:

1. Head
2. Neck
3. Radial tuberosity
4. Grooves for the abductor pollicis longus and extensor pollicis brevis
5. Styloid process
6. Groove for the extensor carpi radialis longus
7. Groove for the extensor carpi radialis brevis
8. Dorsal tubercle

Landmarks of the Ulna:

9. Olecranon process
10. Trochlear notch
11. Coronoid process
12. Radial notch
13. Interosseus crest
14. Tuberosity
15. Supinator crest
16. Head
17. Styloid process
18. Ulna (lateral surface)
19. Radius (lateral surface)
20. Ulna (lateral surface)

Kinesiology **PAGE 148, Figure 4-70AB**

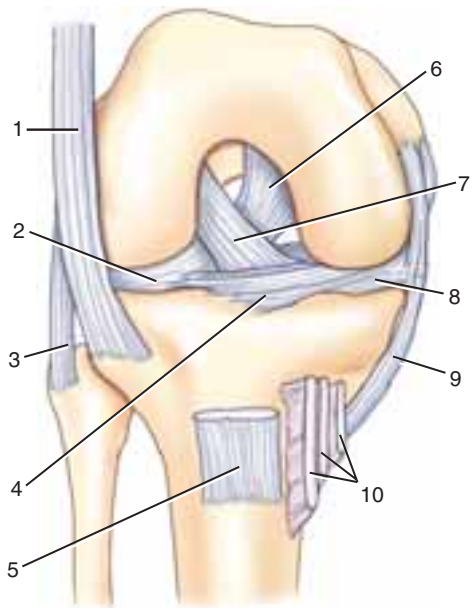


Sagittal cross-section view

1. Intervertebral foramen
2. Spinous process
3. Supraspinous ligament
4. Interspinous ligament
5. Lamina
6. Pedicle
7. Body
8. Intervertebral disc
9. Anterior longitudinal ligament
10. Posterior longitudinal ligament
11. Ligamentum flavum

Anterior ligaments of the spine limit extension; posterior ligaments of the spine limit flexion.

Kinesiology **PAGE 246, Figure 7-19A**



Knee Joint #1

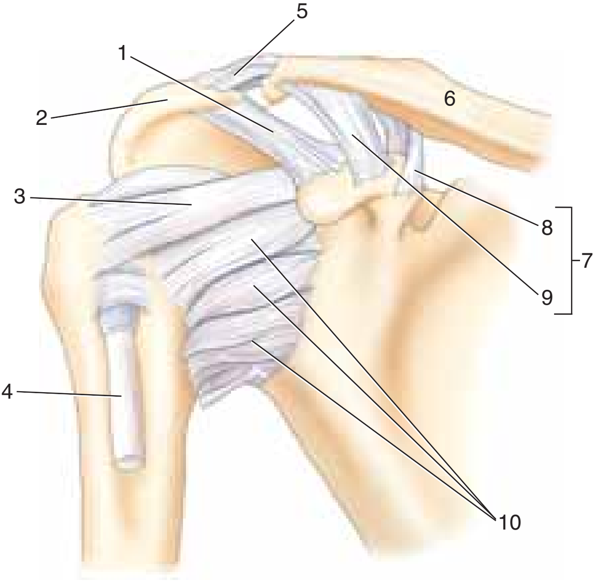
Anterior view (in flexion)

1. Iliotibial band
2. Lateral meniscus
3. Lateral collateral ligament
4. Transverse ligament of meniscus
5. Patellar ligament
6. Posterior cruciate ligament
7. Anterior cruciate ligament
8. Medial meniscus
9. Medial collateral ligament
10. Pes anserine insertion (semitendinosus, sartorius, and gracilis)

Structural classification: Modified hinge synovial joint
Functional classification: Biaxial diarthrotic joint

The knee joint is the largest joint in the human body.

Kinesiology **PAGE 319, Figure 8-24A**



Anterior view

1. Coracoacromial ligament
2. Acromion process
3. Coracohumeral ligament
4. Biceps brachii tendon
5. Acromioclavicular ligament
6. Clavicle
7. Coracoclavicular ligament (#8-9)
8. Conoid ligament
9. Trapezoid ligament
10. Glenohumeral ligaments

Structural classification: Plane synovial joint
Functional classification: Nonaxial diarthrotic joint

The AC joint allows motion within one side of the shoulder girdle between the scapula and clavicle.

Kinesiology **PAGE 378, Figure 9-18**

A

B

Mover Muscles

A, Flexion:
- Sternocleidomastoid
- Anterior scalene
- Middle scalene
- Longus colli
- Longus capitis

B, Extension:
- Trapezius (upper)
- Splenius capitis
- Splenius cervicis
- Erector spinae group (iliocostalis, longissimus, spinalis)
- Transversospinalis group (semispinalis, multifidus, rotatores)
- Levator scapulae
- Rectus capitis posterior major (C1 only)
- Interspinales

Flexion 45 degrees **Extension** 70 degrees

Sagittal plane actions around a mediolateral axis.

Reverse actions:
Actions of the spine are usually thought of as the more superior aspect of the spine moving relative to a fixed inferior aspect. The reverse actions would be the lower neck flexing or extending relative to the upper neck.

Kinesiology **PAGE 260, Figure 7-33AB**

A

B

Posterior Tilt and Anterior Tilt of the Pelvis at the Hip Joint

Mover Muscles

A, Posterior tilt:

Biceps femoris (long head)
Semitendinosus
Semimembranosus
Gluteus maximus
Gluteus medius (posterior fibers)
Gluteus minimus (posterior fibers)
Adductor magnus

B, Anterior tilt:

Psoas major
Iliacus
Rectus femoris
Sartorius
Tensor fasciae latae
Gluteus medius (anterior fibers)
Gluteus minimus (anterior fibers)
Pectineus
Adductor longus
Gracilis
Adductor brevis

Sagittal plane actions around a mediolateral axis.

Reverse actions:

❒ Pelvis posterior tilt: Extension of the thigh at the hip joint.
❒ Pelvis anterior tilt: Flexion of the thigh at the hip joint.

Kinesiology **PAGE 294, Figure 8-7AB**

A

B

Pronation and Supination of the Forearm at the Radioulnar Joints

Mover Muscles

A, Pronation:

- Pronator quadratus
- Pronator teres
- Brachioradialis
- Flexor carpi radialis
- Palmaris longus
- Extensor carpi radialis longus

B, Supination:

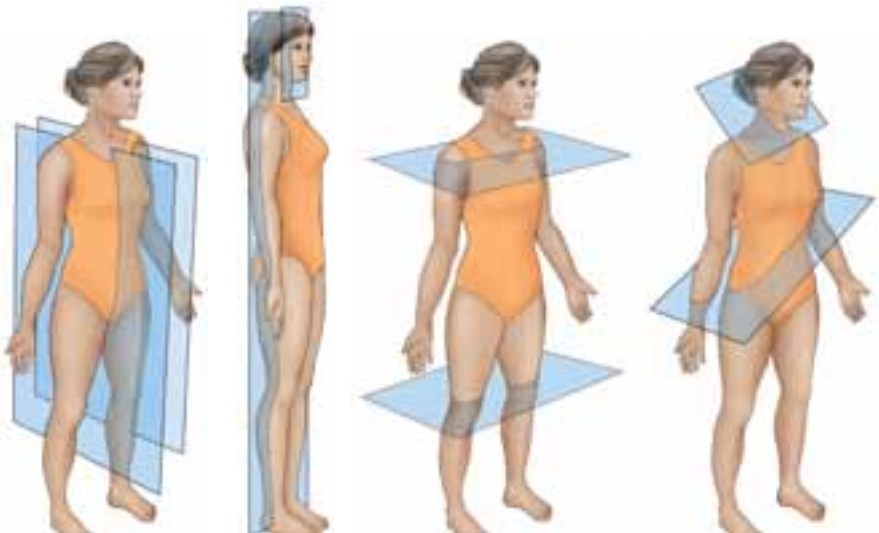
- Supinator
- Biceps brachii (entire muscle)
- Brachioradialis
- Abductor pollicis longus
- Extensor pollicis longus
- Extensor indicis

Pronation 160 degrees **Supination** 0 degrees

Transverse plane actions around a vertical axis.

Reverse actions:
The radius is usually considered to be the mobile bone with these actions. The reverse actions would be motion of the ulna relative to a fixed radius. (This occurs when the hand, and therefore the radius, is fixed.)

Kinesiology **PAGE 387, Figure 9-26AB**



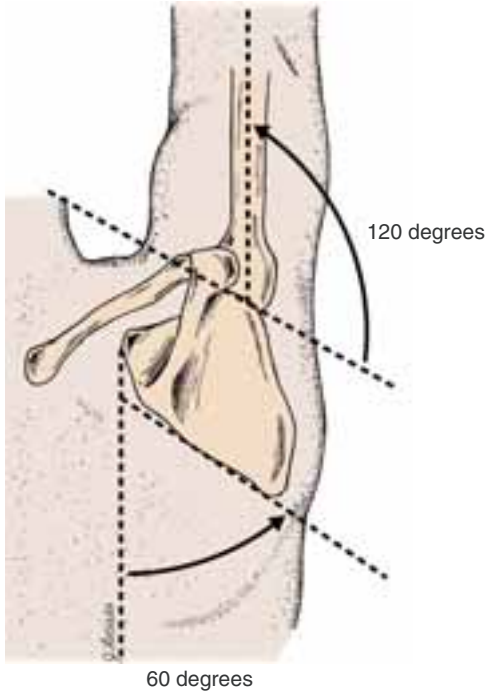
Planes

- ❒ A plane is a dimension of space within which motion can occur.
- ❒ Three dimensions to space (three-dimensional space) exist; hence three cardinal planes exist.
- ❒ The three cardinal planes are the sagittal, frontal, and transverse planes.
  - ❒ A sagittal plane divides the body into left and right portions (Figure A).
  - ❒ A frontal plane divides the body into anterior and posterior portions (Figure B).
  - ❒ A transverse plane divides the body into upper (superior/proximal) and lower (inferior/distal) portions (Figure C).
- ❒ Note that the sagittal and frontal planes are oriented vertically, and the transverse plane is oriented horizontally.
- ❒ Any plane that is not perfectly sagittal, frontal, or transverse is an oblique plane (Figure D). An oblique plane is actually a mixture of two or all three of the cardinal planes.
- ❒ An infinite number of sagittal, frontal, transverse, and oblique planes is possible.
- ❒ Note: The frontal plane is also known as the coronal plane; the transverse plane is also known as the horizontal plane.

Questions:

1. What plane divides the body into left and right portions?
2. What cardinal plane is horizontal?
3. What is an oblique plane?

Kinesiology **PAGES 24-25, Section 2.8, Figure 2-7ABCD**



Courtesy Joseph E. Muscolino

Questions:

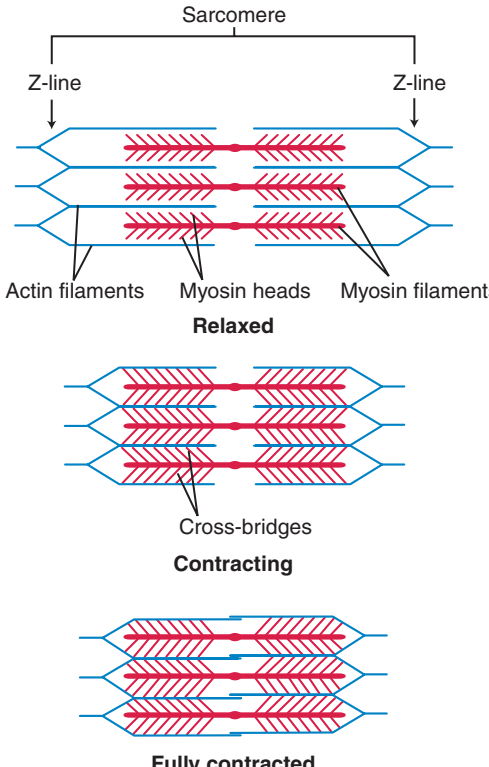
1. What is scapulohumeral rhythm?
2. What scapular motion accompanies abduction of the arm at the GH joint?
3. What scapular motion accompanies medial rotation of the arm at the GH joint?

❒ When a small degree of arm movement is needed, motion may occur solely at the glenohumeral (GH) joint. However, if any appreciable degree of arm motion is necessary, the entire complex of shoulder joints must become involved. The result is that arm motion requires coupled joint actions of the scapula and clavicle. This pattern of coupled actions is called scapulohumeral rhythm.

Following is a list of the scapular actions at the scapulocostal (ScC) joint that couple with motions of the arm at the GH joint.

❒ Flexion of the arm at the GH joint couples with protraction and upward rotation of the scapula at the ScC joint.
❒ Extension of the arm at the GH joint couples with retraction and downward rotation of the scapula at the ScC joint.
❒ Extension of the arm at the GH joint beyond neutral (i.e., extension beyond anatomic position) couples with upward tilt of the scapula at the ScC joint.
❒ Abduction of the arm at the GH joint couples with upward rotation of the scapula at the ScC joint (see Figure). (For more details on scapulohumeral rhythm that occurs with abduction of the arm, see the *Spotlight* feature on this topic in this section of the textbook.)
❒ Adduction of the arm at the GH joint couples with downward rotation of the scapula at the ScC joint.
❒ Medial rotation of the arm at the GH joint couples with protraction of the scapula at the ScC joint.
❒ Lateral rotation of the arm at the GH joint couples with retraction of the scapula at the ScC joint.

Kinesiology **PAGES 379-382, Section 9.6, Figure 9-19B**



Questions:

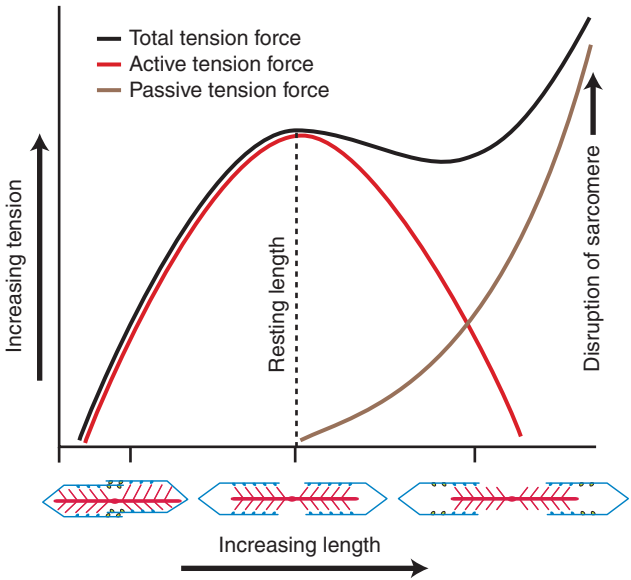
1. What defines a muscle as contracting?
2. In which direction does a myosin cross-bridge pull the actin filament?
3. The presence of what substance in the sarcoplasm results in muscle contraction?

Sliding Filament Mechanism

- ❒ The mechanism that explains how sarcomeres shorten is called the sliding filament mechanism because, during shortening of a sarcomere, the actin and myosin filaments slide along each other.
- ❒ In essence, the steps of the sliding filament mechanism are as follows:

1. A message is sent from the nervous system that tells muscle fibers to contract.
2. This message causes the sarcoplasmic reticulum to release stored calcium into the sarcoplasm (cytoplasm).
3. These calcium ions attach to the actin filaments, exposing actin-filament binding sites.
4. Myosin heads attach to these exposed binding sites of the actin filaments, creating cross-bridges between the myosin filaments and the actin filaments. The presence of cross-bridges defines a muscle as contracting.
5. Each myosin-actin cross-bridge then bends, creating a pulling force that pulls the actin filament in toward the center of the sarcomere.
6. These cross-bridges then break, reattach to the next binding sites of the actin filaments, and bend, further pulling the actin filaments in toward the center of the sarcomere.
7. This process occurs over and over again as long as the nervous system sends to the muscle the message to contract.
8. Since the actin filaments are attached to the Z-lines of the sarcomere (the boundaries of the sarcomere), the Z-lines are pulled in toward the center of the sarcomere.
9. When Z-lines are pulled in toward the center of the sarcomere, the sarcomere shortens.
10. To relate this concept to the bigger picture of how a muscle works, an important point to realize is that, when all the sarcomeres of a myofibril shorten in this manner, the myofibril shortens; when all the myofibrils of a muscle fiber shorten, the muscle fiber shortens; when enough muscle fibers of a muscle shorten, the muscle shortens, exerting a pulling force on its bony attachments; if this pulling force is sufficiently strong, the bones are pulled toward each other, creating movement of the body parts within which the bones are located. Hence, via the sliding filament mechanism, muscles can create movement of body parts!

Kinesiology **PAGES 429-430, Section 10.6, Figure 10-10ABC**



Questions:

1. What is the length-tension relationship curve?
2. At what point in a muscle's length is the active length-tension relationship curve greatest?
3. Which type of tension of a muscle continues to increase as the muscle length increases beyond its resting length?

Length-Tension Relationship Curve

- The length-tension relationship curve is a graph that compares the length of a sarcomere with the percentage of maximal contraction that the sarcomere can generate. Because a muscle is effectively composed of many sarcomeres, the relationship between the length and tension of a sarcomere can be extrapolated to the relationship between the length and tension of an entire muscle.
- The red line only considers the active tension as the length of a muscle changes. The shape of this curve is a bell curve wherein the greatest tension is when the muscle is at resting length.
  - The lessened active tension when a muscle is shortened is called shortened active insufficiency; the lessened active tension when a muscle is lengthened is called lengthened active insufficiency.
- The brown line only considers the passive tension as the length of the muscle changes.
  - This increased passive tension of a muscle as it lengthens is called passive tension and is the result of the natural elasticity of the tissue.
- The black line considers both the active tension and the passive tension (i.e., the total tension) of a muscle as its length changes.
  - We see that the overall tension of the muscle increases from a shortened length to resting length. Most of the tension in this range of the muscle's length is the result of increasing active tension.
  - The pulling force then stays fairly high beyond resting length for quite some time. Most of the tension in this range of the muscle's length is the result of increasing passive tension.

Kinesiology **PAGE 555, Section 15.5, Figure 15-5**