Chapter 8

Muscular System: Skeletal Muscles of the Body

INTRODUCTION

This chapter continues our study of the muscular system by examining the distribution of muscles throughout the body. We learned in Chapter 7 the primary function of muscle: to provide movement of body parts. We also learned skeletal muscle is attached to the periosteum of bones by way of tendons, which typically arise from a muscle at both ends. Between these tendons is the body of the muscle, called the belly. Movement is produced when the muscle contracts, pulling a moveable bone toward a stationary bone. The point of attachment of a tendon to the stationary bone is called the origin, and the point of attachment of the other tendon to the moveable bone is called the insertion. Usually, the origin is proximal and the insertion is distal. In this chapter you will be studying the major muscles of the body by learning their name, location, origin and insertion, and primary action. The actions that are possible across the joints of the body are listed in Table 1.

OBJECTIVES

At the completion of Chapter 8, you should be able to:
1. Identify the muscles listed by their location.
2. Identify the origin and insertion of each muscle.
3. Identify the primary action of each muscle.
Table 1: The movements, or actions, that are possible between two opposing bones.

<table>
<thead>
<tr>
<th>Movement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>a decrease in the angle between two opposing bones.</td>
</tr>
<tr>
<td>Extension</td>
<td>an increase in the angle between two opposing bones.</td>
</tr>
<tr>
<td>Dorsiflexion</td>
<td>raising the toes toward the ankle.</td>
</tr>
<tr>
<td>Plantar flexion</td>
<td>lowering the foot (standing on the toes).</td>
</tr>
<tr>
<td>Hyperextension</td>
<td>an increase in the angle beyond the straight position.</td>
</tr>
<tr>
<td>Abduction</td>
<td>movement away from the midline.</td>
</tr>
<tr>
<td>Adduction</td>
<td>movement toward the midline.</td>
</tr>
<tr>
<td>Circumduction</td>
<td>circular movement to inscribe a &quot;cone&quot;.</td>
</tr>
<tr>
<td>Rotation</td>
<td>movement around a central axis.</td>
</tr>
<tr>
<td>Supination</td>
<td>turning the palms or face upward.</td>
</tr>
<tr>
<td>Pronation</td>
<td>turning the palms or face downward.</td>
</tr>
<tr>
<td>Elevation</td>
<td>raising a part above another.</td>
</tr>
<tr>
<td>Depression</td>
<td>lowering a part below another.</td>
</tr>
<tr>
<td>Inversion</td>
<td>turning the sole of the foot inward.</td>
</tr>
<tr>
<td>Eversion</td>
<td>turning the sole outward.</td>
</tr>
<tr>
<td>Protraction</td>
<td>movement of a part forward.</td>
</tr>
<tr>
<td>Retraction</td>
<td>movement of a part back to its original position.</td>
</tr>
</tbody>
</table>

ACTIVITIES

1. Head and Neck Muscles

Muscles of the head and neck move the head at the atlantooccipital joint and the atlantoaxial joint, move the jaw at the temporomandibular joint, and move the face to provide facial expressions. They include the following, which you should identify on a model, wallchart, or study from the diagrams in your text. As you study each muscle, perform the action described and feel the tension resulting; try to identify each muscle in this way. Also, label Figures 8-1 and 8-2 as you proceed.

A. Orbicularis oris: surrounds the opening of the mouth. Its origin is indirectly from the maxilla and mandible, and it inserts on the skin and subcutaneous tissue surrounding the lips and mouth. Action: it closes the lips while compressing them against the teeth.

B. Orbicularis oculi: surrounds the eye. Its origin is from the frontal bone, maxilla, and lacrimal bone, and it inserts on the skin surrounding the orbit. Action: it closes the eyelid.

C. Zygomaticus major: a small muscle in the cheek. It originates from the zygomatic bone and inserts on the skin near the mouth and orbit. Action: it draws the angle of the mouth upward and outward, as in smiling and laughing.

D. Buccinator: a small muscle in the cheek inferior to the zygomaticus. Its origin is from the maxilla and mandible, and its insertion is blended with the orbicularis oris. Action: the "trumpet muscle", it compresses the cheeks during chewing and helps expel air from the mouth.
E. **Masseter**: the large muscle at the angle of the lower jaw. Its origin is from the zygomatic arch of the maxilla, and it inserts on the angle and coronoid process of the mandible. Action: it elevates the mandible, as in closing the mouth while chewing. Clench your teeth to feel this muscle at the angle of the jaw.

F. **Temporalis**: a large muscle at the temples of the head. Its origin is from the temporal bone and its insertion is on the coronoid process and ramus of the mandible. Action: it elevates the mandible, as in closing the mouth while chewing.

G. **Sternocleidomastoid**: the V-shaped muscles on the anterior side of the neck. It originates from the sternum and clavicle and inserts on the occipital bone and the mastoid process of the temporal bone. Action: it turns the head from side to side when they contract individually; when they contract together the head flexes to the chest.

H. **Platysma**: a thin, flat muscle that lies superficially over much of the neck. Its origin is from fascia covering the pectoralis major and deltoid muscles (described below), and its insertion is on the mandible and skin of the face. Action: it depresses the mandible, pulls the lower lip and mouth downward.

### Self-Test:

**A.** Complete the following statements from the information above and in your text.

1. Winking your eye at a friend requires the primary action of the ______ muscle.
2. A muscle that may be called the "smiling muscle" is the ______.
3. The lump at the angle of your jaw that forms when your teeth are clenched closed is actually the ______ muscle.
4. The muscle of the neck that enables you to turn your head to the right or left is the ______.
5. The ______ muscle is located at the temple of the head and assists in closing the mouth.

### 2. Shoulder and Arm Muscles

Muscles of the shoulder and arm move the upper appendages. Identify the following shoulder and arm muscles on a model, wallchart, or study from the diagrams in your text and Figs. 8-1 and 8-2. As you study the muscles, you should perform the action described and feel the tension of the muscle you are identifying on yourself.

**A. Deltoid**: the triangular muscle over the top of the shoulder. Its origin is from the clavicle, and spine and acromion process of the scapula. It inserts on the deltoid tuberosity of the humerus. Action: it flexes, medially rotates, and abducts the upper arm at the shoulder.
B. **Supraspinatus**: a small muscle on the posterior side of the shoulder in the supraspinous fossa of the scapula. It originates from the supraspinous fossa and inserts on the humerus. Action: it abducts the humerus at the shoulder joint. You cannot feel this muscle.

C. **Infraspinatus**: a triangular muscle inferior to the supraspinatus. Its origin is from the infraspinous fossa of the scapula and its insertion is on the humerus. Action: it laterally rotates the humerus at the shoulder joint. You cannot feel this muscle.

D. **Subscapularis**: a deep muscle on the anterior side of the scapula. Its origin is from the subscapular fossa of the scapula and its insertion is on the humerus. Action: it medially rotates the humerus. You cannot feel this muscle.

E. **Teres major**: a deep muscle inferior to the infraspinatus. Its origin is from the scapula and its insertion is on the humerus. Action: it adducts and medially rotates the humerus. You cannot feel this muscle.

F. **Biceps brachii**: the large muscle on the anterior surface of the upper arm. Its origin is from two regions of the scapula, and inserts on the radius. Action: it flexes the forearm at the elbow and supinates the hand.

G. **Brachioradialis**: a long, thin muscle on the lateral aspect of the forearm. It originates from the humerus and inserts on the radius. Action: it flexes the forearm at the elbow.

H. **Brachialis**: a flat muscle that lies deep to the biceps brachii. Its origin is from the humerus and it inserts on the ulna. Action: it also flexes the forearm at the elbow.

I. **Triceps brachii**: the large muscle on the posterior surface of the upper arm (opposite the biceps brachii). Its origin is from three sources: the scapula, and two regions of the humerus. It inserts on the humerus. Action: it extends the forearm at the elbow.

J. Flexors of the hand and digits: the muscles on the anterior aspect of the forearm flex the hand and digits. They include, from medial to lateral, the flexor carpi ulnaris, the flexor digitorum superficialis, the palmaris longus, and the flexor carpi radialis.

K. Extensors of the hand and digits: the muscles on the posterior aspect of the forearm extend the hand and digits. They include, from medial to lateral, the extensor carpi ulnaris, the extensor digitorum, the extensor carpi radialis, and the extensor pollicis brevis.
Self-Test:
B. From the information above and in your text, complete the following statements about muscles of the shoulder and arm.

6. The muscle on top of your shoulder that you can feel when you abduct your upper arm is the

7. Of the infraspinatus, subscapularis, supraspinatus, and teres major, which is on the anterior surface of the scapula?

8. The large muscle on the anterior side of the upper arm that flexes the arm at the elbow is the

9. The muscle that is opposite the biceps brachii in location and action is the

10. The muscle that flexes the hand at the wrist and is on the medial side of the forearm is the

3. Trunk Muscles

The muscles of the trunk region include the muscles of the abdomen and back that help move the appendages and the vertebral column. You should identify the following trunk muscles using models and wallcharts, or studying the diagrams in your text and labeling Figures 8-1 and 8-2. As in the previous activities, you should perform the actions and feel the muscle tension on yourself as well.

A. **Pectoralis major**: the large muscle of the chest. It originates from the head of the clavicle and from the sternum, and inserts on the humerus. Action: it adducts and medially rotates the humerus.

B. **Pectoralis minor**: a smaller muscle deep to the pectoralis major. Its origin is from the third, fourth, and fifth ribs and its insertion is on the coracoid process of the scapula. Action: its pulls the scapula downward and elevates the ribs during forced expiration.

C. **Rectus abdominis**: a long, thin muscle in the center of the abdomen that gives athletes the "washboard" appearance. It originates from the pubis bone and the symphysis pubis, and inserts on the xiphoid process of the sternum and costal cartilages of the fifth through seventh ribs. Action: it flexes the trunk.

D. **External oblique**: the large flat muscle that wraps superficially around the lower back and sides of the trunk. Its origin is from the lower eight ribs and its insertion is on the iliac crest and linea alba (midventral line of fascia) by a broad aponeurosis. Action: it flexes and laterally rotates the trunk.

E. **Internal oblique**: a large flat muscle deep to the external oblique. It originates from the iliac crest and inserts on the lower three or four ribs. Action: it flexes and laterally rotates the trunk.
F. **Transverse abdominis**: a flat muscle deep to much of the internal oblique. It originates from the iliac crest and inserts on the linea alba and pubis bone. Action: supports abdominal viscera.

G. **External intercostals**: a superficial series of small muscles between the ribs. They originate from the inferior border of a rib and insert on the superior border of the rib above. Action: elevate the ribs, thereby expanding the thorax during inspiration.

H. **Internal intercostals**: a deep series of small muscles between the ribs. They extend in the opposite direction as the external intercostals. Action: decrease the intercostal space, thereby reducing the thorax during expiration.

I. **Serratus anterior**: the muscle below the axilla (armpit) that appears like a serrated knife. Its origin is from the upper eight ribs and its insertion is on the scapula. Action: protracts and fixes the scapula against the chest wall.

J. **Trapezius**: the large, trapezoid-shaped muscle over the upper back and neck region. It originates from the occipital bone, and from the spinous processes of the seventh cervical and all twelve thoracic vertebrae. It inserts on the clavicle, the acromion process of the scapula, and the spine of the scapula. Action: it retracts the scapula toward the vertebral column; rotates the scapula upward; elevates the shoulder; and extends and bends the neck laterally.

K. **Latissimus dorsi**: the large, flat muscle of the lower back. It originates from the iliac crest, lower three or four ribs, and lower six thoracic vertebrae. It inserts on the humerus. Action: it adducts, extends, and medially rotates the humerus.

L. **Erector spinae**: also known as the sacrospinalis, it is a group of deep back muscles beneath the latissimus dorsi and trapezius. They extend from their medial origins at the iliac crest, ribs, and vertebrae to their more lateral insertions on the ribs, vertebrae, and temporal bone. Action: extend the vertebral column.

M. **Rhomboids**: actually two separate muscles, major and minor, that lie deep to the trapezius in the upper back region. They extend between their origins between the seventh cervical and fifth thoracic vertebrae to their insertions on the scapula. Action: they draw the scapula medially.
Self-Test:
C. Complete the following statements about trunk muscles from the information above and in your text.

11. Of the pectoralis major, the pectoralis minor, the external intercostals, and the transverse abdominis, the muscle that moves the humerus is the ________________.

12. The ________________ extends between the pelvis and the sternum and enables you to perform "sit-ups" by flexing the vertebral column.

13. The large muscle of the upper back that acts upon the scapula, shoulder, and neck is the ________________.

14. The extensive, flat ________________ of the lower back region inserts on the humerus.

15. A group of deep back muscles that enable you to straighten your back after bending over is the ________________.

4. Pelvic Muscles

Muscles of the pelvis generally support the hip joint and move the thigh. You should identify these muscles using models and wallcharts, or study the diagrams in your text and labeling Figures 8-1 and 8-2. Again, practice performing the actions described for each muscle and feel the tension.

A. **Gluteus maximus**: the largest and most powerful superficial muscle in the body, it occupies the buttox region. It originates mainly from the ilium, sacrum, and coccyx and inserts on the femur. Action: it extends and laterally rotates the thigh at the hip joint.

B. **Gluteus medius**: located deep and slightly lateral to the gluteus maximus. Its origin is from the ilium and its insertion is on the femur. Action: it abducts and medially rotates the thigh at the hip joint. It can be felt along the side of the hip as you abduct your leg against a stationary table.

C. **Gluteus minimus**: a small muscle deep to the gluteus medius. Its origin is from the ilium and its insertion is on the femur. Action: it functions with the gluteus medius as it abducts and medially rotates the thigh. Because of its deep location you cannot feel this muscle.

D. **Piriformis**: a deep muscle within the pelvis that is partly posterior to the hip joint. Due to its deep location it cannot be felt. It originates from the sacrum and inserts on the femur. Action: it laterally rotates and flexes the thigh.
5. Leg Muscles

The muscles of the leg include the muscles of the thigh, which move the leg at the hip joint and knee joint; and the muscles of the foreleg, which move the leg at the knee joint and the foot at the ankle joint. Identify the following leg muscles using models and wallcharts, or study the diagrams in your text and labeling Figures 8-1 and 8-2. Again, feel the tension in your own muscles as you perform the actions described.

A. Adductor muscles: a group of muscles on the medial side of the thigh that adduct the thigh at the hip joint. They include the following, from lateral to medial:

1. Adductor brevis: the most lateral of the adductor muscles, it is also the smallest. Its origin is from the pubis bone and its insertion is on the femur.

2. Adductor magnus: a larger muscle medial to the adductor brevis. It originates from the pubis and ischium and inserts on the femur.

3. Adductor longus: the largest of the three adductors, it extends to a superficial area of the thigh medial to the adductor magnus. It originates from the symphysis pubis and inserts on the femur.

B. Quadriceps femoris: a group of four powerful muscles that occupy the anterior side of the thigh. They combine at their distal end to form a thick tendon that envelopes the patella, which serves as their tendon of insertion. All four muscles extend the leg at the knee joint.

1. Rectus femoris: the most anterior and superficial of the four. Its origin is from the ilium, and it flexes the thigh at the hip in addition to extending the leg at the knee.

2. Vastus medialis: the muscle medial to the rectus femoris. Its origin is from the shaft of the femur.

3. Vastus lateralis: the muscle lateral to the rectus femoris. It also originates from the shaft of the femur.

4. Vastus intermedius: a muscle immediately deep to the rectus femoris. It originates from the shaft of the femur as well.

C. Hamstring muscles: a group of three distinct muscles located on the posterior side of the thigh. Each hamstring muscle flexes the leg at the knee and extends the thigh at the hip.

1. Biceps femoris: on the lateral side of the thigh's posterior aspect, where its tendon of insertion can be easily felt as you tense your thigh muscles while sitting. Its origin is from two sources: the ischium; and the linea aspera of the femur. It inserts mainly on the head of the fibula.
2. **Semitendinosus**: located medial to the biceps femoris, its large tendon of insertion can also be felt by tensing the thigh muscles while sitting. It originates from the ischium and inserts on the tibia.

3. **Semimembranosus**: a large flattened muscle partially deep to the biceps femoris and medial to the semitendinosus. Its origin is from the ischium and its insertion is on the tibia.

D. **Gracilis**: a flat muscle on the medial side of the thigh. It originates from the pubis and inserts on the tibia. Action: it flexes and medially rotates the thigh, and also adducts the thigh.

E. **Sartorius**: a long, narrow muscle that wraps diagonally across the anterior surface of the thigh. Its origin is from the ilium and its insertion is on the tibia. Action: it flexes the leg at the knee and the thigh at the hip.

E. **Tensor fascia latae**: a thin muscle on the superior lateral surface of the thigh. It originates from the iliac crest and inserts into the iliotibial tract, which is a strong band of fascia that continues down the lateral aspect of the thigh to eventually insert onto the tibia. Action: it flexes and medially rotates the thigh at the hip and extends the leg at the knee.

F. **Gastrocnemius**: the prominent superficial muscle of the calf. It originates from two sources: the medial condyle of the femur; and the lateral condyle of the femur. It inserts onto the large, thick Achilles' (calcaneus) tendon, which continues downward to insert on the calcaneus of the foot. Action: it plantar-flexes the foot at the ankle, and flexes the leg at the knee.

G. **Soleus**: a flattened muscle immediately deep to the gastrocnemius. Its origin is from the fibula and tibia, and it inserts in common with the gastrocnemius onto the Achilles' tendon. Action: it plantar-flexes the foot.

H. **Tibialis anterior**: a narrow muscle on the anterior surface of the calf. Its origin is mainly from the tibia, and its inserts on the first metatarsal of the foot. Action: it dorsiflexes and inverts the foot.

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**Self-Test:**

D. Complete the following statements below about pelvic and leg muscles, using the information above and in your text as reference.

16. A powerful pelvic muscle that extends the thigh at the hip joint is the 

17. The muscles that adduct the thigh at the hip are located on the _________ aspect of the thigh.

18. The muscle of the quadriceps femoris group that acts upon two joints is the _________

19. The biceps femoris _________ the leg at the knee.

20. The soleus shares its insertion on the Achilles' tendon with the _________
Self-Test:
E: Match the muscle in Column I with their corresponding characteristics in Column II.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>21. masseter</td>
<td>A. expands the thorax</td>
</tr>
<tr>
<td>22. sternocleidomastoid</td>
<td>B. flexes the vertebral column</td>
</tr>
<tr>
<td>23. deltoide</td>
<td>C. on the medial side of the thigh</td>
</tr>
<tr>
<td>24. biceps brachii</td>
<td>D. plantar-flexes the foot</td>
</tr>
<tr>
<td>25. brachioradialis</td>
<td>E. on the lateral aspect of the forearm</td>
</tr>
<tr>
<td>26. triceps brachii</td>
<td>F. closes the mouth while chewing</td>
</tr>
<tr>
<td>27. extensor carpi radialis</td>
<td>G. primary flexor of the arm at the elbow</td>
</tr>
<tr>
<td>28. rectus abdominis</td>
<td>H. V-shaped muscle in the neck region</td>
</tr>
<tr>
<td>29. external intercostals</td>
<td>I. superficial muscle of the lateral trunk</td>
</tr>
<tr>
<td>30. external oblique</td>
<td>J. on the posterior side of the upper arm</td>
</tr>
<tr>
<td>31. latissimus dorsi</td>
<td>K. extends the knee and flexes the thigh</td>
</tr>
<tr>
<td>32. biceps femoris</td>
<td>L. extends the hand at the wrist</td>
</tr>
<tr>
<td>33. rectus femoris</td>
<td>M. on top of the shoulder</td>
</tr>
<tr>
<td>34. gracilis</td>
<td>N. flexes the knee and extends the thigh</td>
</tr>
<tr>
<td>35. gastrocnemius</td>
<td>O. lower back that adducts the humerus</td>
</tr>
</tbody>
</table>