Chapter 9 The Muscular System

Chapter Outline

Module 9.1 Overview of Skeletal Muscles (Figures 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7; Table 9.1)

A. **Structure of a Skeletal Muscle**. The shape, size, placement, and arrangement of fibers in a skeletal muscle contribute to the function of that muscle. Form follows _____ **(Figures 9.1, 9.2, 9.3; Table 9.1)**.

1. **Fascicles and Muscle Shapes**. **What are fascicles?** _____

_____

_____

The following are the different arrangements in which fascicles are found in the human body **(Figure 9.2)**:

a. The_____arrangement forms a strap-like muscle with evenly spaced fascicles where muscle and tendon are the same width **(Figure 9.2a)**.

b. The_____arrangement forms a broad, triangular-shaped muscle that tapers down into a single tendon **(Figure 9.2b)**.

c. The_____arrangement forms a muscle where the fascicles attach to the tendon at an angle, giving it a feather-like appearance **(Figure 9.2c)**.

d. The_____arrangement, a pennate variation, features fascicles that are only attached to one side of the associated tendon

e. The_____arrangement, a pennate variation, features fascicles that are attached to both sides of the associated tendon.

f. The_____, a pennate variation, features several regions of fascicles joined by connective tissue where each section contributes to form a single tendon.

g. _____ are circular fascicle arrangements that surround body openings **(Figure 9.2d)**.

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h. The_____arrangement is found in muscles that wrap around another structure such as a bone **(Figure 9.2e)**.

i. The_____is a muscular shape where the muscle midsection or belly is thicker than each tapered end **(Figure 9.2f)**.

2. **Summarize how muscles are named**. _____

_____

_____

_____

The following highlights some examples of how muscles have been named **(Table 9.1)**:

a. Muscles can be named based on their_____using the directional terms introduced in chapter 1 in combination with Greek and Latin word roots (chapter 1).

b. Muscles can be named based on the_____structures where they are attached.

c. Muscles can be named by the_____that they perform when contracted, which includes **flexors**, **extensors**, **adductors**, **abductors**, **and levators**.

B. **Functions of Skeletal Muscles (Figures 9.3, 9.4, 9.5, 9.6, 9.7)**

1. **Movement and other functions**: muscle contractions are involved in more than just the movement of bones at joint. **What are the other functions of muscle contraction?**

a. Skeletal muscle contractions generate_____as a byproduct, which can be used as a homeostatic mechanism for maintaining body temperature.

b. Contraction of the diaphragm muscle is a vital function associated with the_____system.

c. Skeletal muscles attached to the skin of the face allow for facial expression while muscles in the throat assist with_____.

d. Sphincters composed of skeletal muscle allow_____control over the opening and closing of body openings.

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2. **Functional groups of muscles**: it generally takes the cooperation of several individual muscles working as a group to perform a movement or **action**. The following terms define the roll of different muscles in a group **(Figure 9.3)**:
    a. **Describe the function of agonists**. _____
    _____
    b. **Describe the function of antagonists**. _____
    _____
    _____
    c. **Describe the function of synergists**. _____
    _____
    _____
    d. **Describe the function of fixators**. _____
    _____
    _____
3. **Muscle origin and insertion**. Skeletal muscles begin and end at distinct anatomical locations **(Figure 9.4)**.
    a. The_____is the anchoring point on a bone, where the skeletal muscle "originates from", which is typically not involved directly with the movement of a joint.
    b. The_____is moving end of the muscle whose tendon attaches to a bone or other structures usually on the far side of a joint.
4. What are the three components of a **lever system?** (1) _____ _____, (2)_____, and (3) _____. Changing the configuration of these variables leads to the following lever classes **(Figure 9.5)**:
    a. A **first-class lever** exists where the fulcrum sits between the load and applied force. **In what direction is the load moved relative to the applied force?** _____ _____ **(Figure 9.5a)**
    b. A **second-class lever** exists where the fulcrum is found at one end of the lever, the applied force is found near the other end and the load is

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situated somewhere in between. **In what direction is the load moved relative to the applied force?** _____ _____ **(Figure 9.5b)**

c. A **third-class lever** exists where the fulcrum and applied force are close to one another at one end of the lever and the load is found near the other end. **In what direction is the load moved relative to the applied force?** _____ _____ **(Figure 9.5c)**

d. A lever system where the fulcrum is located farther away from the applied force works at a mechanical_____, which allows a small force to move a large load over a short distance.

e. A lever system where the fulcrum is located close to the applied force and the load is further away works at a mechanical _____, which reduces the load it can move. The load can be moved faster over a greater distance however.

5. A review of the superficial anterior and posterior skeletal muscles can be found in **Figures 9.6** and **9.7**, respectively.

Module 9.2 Muscles of the Head, Neck, and Vertebral Column (Figures 9.8, 9.9, 9.10, 9.11, 9.12, 9.13; Tables 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8)

A. **Muscles of Facial Expression**. This group of muscles commonly insert into the skin and connective tissue of the face to produce subtle changes in the structure of the face **(Figure 9.8; Table 9.2)**.

1. The_____is a large sheet of connective tissue that links the smaller frontalis and occipitalis muscles to form the epicranius. The main action of the epicranius is to raise the eyebrows and skin of the forehead **(Figure 9.8)**.
2. The following muscles move the skin and tissue around the_____: the **orbicularis oris**, **levator palpebrae superioris**, and **corrugator supercilii**.
3. The following muscles are involved in the movement of the_____and surrounding skin: the **zygomaticus major**, **zygomaticus minor**, **levator labii superioris**, and **risorius**.

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4. **What is the action of the orbicularis oris?** _____

_____

_____

5. The following muscles are involved in facial expressions that convey negative emotions: the **depressor** _____, **depressor** _____ _____, and the **mentalis**.
6. The _____ muscles compress the cheeks and are involved in manipulating food while chewing.
7. The _____ is a broad, flat sheet of muscle covering the anterior neck. **What is the action of platysma?** _____

_____

B. **Extrinsic Eye and Orbit Muscles**. Each eye has six muscles attached to its outer surface, which allows for quick and accurate movements that direct our vision **(Figure 9.9; Table 9.3)**.

1. The four rectus muscles include the following: **superior**, **inferior**, **medial** and **lateral rectus muscles**, named for the straight line they take from origin in the posterior orbit to their more anterior insertion on the eye itself.
    a. **In what direction does the superior rectus move the eyeball?**

    _____

    In what direction does the inferior rectus move the eyeball?

    _____

    b. **In what direction does the lateral rectus move the eyeball?**

    _____

    In what direction does the medial rectus move the eyeball?

    _____

2. The two remaining muscles are the **superior** and **inferior oblique muscles**, so named because they attach to the eye at an angle.
    a. The **superior oblique** runs from its origin in the posterior eye through a common tendinous ring that also surrounds the posterior bellies of each rectus muscle, through the _____, which serves as pulley, just before the muscle inserts into the anterior eyeball. **In what direction**

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does the superior oblique move the eyeball? _____

_____

b. The **inferior oblique** doesn't originate from the posterior orbit, but from the anterior and medial aspect of the orbit and runs underneath the anterior eyeball to insert into the posterior and lateral aspect of the eyeball. **In what direction does the inferior oblique move the eyeball?** _____

_____

C. **Muscles of the Head and Neck**. This regional group of muscles not only moves the head and neck but allows for chewing and swallowing as well **(Figures 9.10, 9.11, 9.12; Tables 9.4, 9.5, 9.6, 9.7)**.

1. **Muscles of chewing** or mastication either close the_____or elevate the _____**(Figure 9.10; Table 9.4)**.
    a. **Name two powerful muscles that elevate the mandible for biting and chewing**:_____,_____**(Figure 9.10a)**.
    b. **What muscle assists the masseter and temporalis with elevation and pulls the mandible forward (protraction) and side-to-side with the lateral pterygoid? (Figure 9.10b)** _____
    c. The **lateral pterygoid** allows forward and side-to-side motion and also allows for protraction of the_____.
2. **Muscles of swallowing**, once the chewing muscles have closed the mouth, can be broken down into the muscles involved in pushing food to the back of the oral cavity and those that initiate swallowing in the throat (pharynx), which pushes food into the esophagus **(Figure 9.11, Tables 9.5, 9.6)**:
    a. The **digastric**, **stylohyoid**, **mylohyoid**, and **geniohyoid** muscles push food towards the_____**(Figure 9.11a, b)**.
    b. The tongue is composed of the **genioglossus**, **hyoglossus**, and styloglossus muscles manipulates food that is more easily swallowed then pushes this bolus towards the_____as well.
    c. The **sternohyoid**, **sternothyroid**, **omohyoid**, **thyrohyoid**, and pharyngeal constrictor muscles are all involved in initiating_____in the pharynx **(Figure 9.11c)**.

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3. **Muscles that move the head and neck** include the following muscles: the _____, _____, and _____ _____ muscles **(Figure 9.12; Table 9.7)**.

D. **Muscles of the Vertebral Column** are critical for both locomotion and posture and include the following muscle groups and their distinct members **(Figure 9.13; Tables 9.8)**:

1. **Where are the erector spinae located?** _____ _____ **What is the function of erector spinae?**

_____

The erector spinae includes the following distinct muscles **(Figure 9.13a, c, d)**:

a. The _____ is the most medially situated muscle group sitting on either side of the vertebral column. The group includes: the **spinalis capitis**, **spinalis cervicis**, and **spinalis thoracis** muscles.
b. The _____ group, just lateral to the spinalis group, includes the following: the longissimus capitis, longissimus cervicis, and longissimus thoracis muscles.
c. The _____, the most lateral group, includes the following: iliocostalis cervicis, **iliocostalis thoracis**, and **iliocostalis lumborum** muscles.

2. The transversospinal group, deep to the erector spinae, includes the following muscles: _____, _____, and _____ muscles, which have similar actions as the erector spinae group **(Figure 9.13b)**.
3. The **quadratus lumborum** is a large deep muscle. **What is the action of quadratus lumborum?** _____

_____

Module 9.3 Muscles of the Trunk and Pelvic Floor (Figures 9.14, 9.15, 9.16; Tables 9.9, 9.10, 9.11)

A. **Muscles of the Trunk** include the following muscles grouped together by anatomical proximity, function, or both **(Figures 9.14, 9.15; Tables 9.9, 9.10):**

1. **List the muscles of respiration**. _____, _____ _____, and _____ (**Figure 9.14; Table 9.9)**.

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2. **List the abdominal muscles**._____, _____ _____,_____, and_____**(Figure 9.15; Table 9.10)**.
    a. The rectus abdominis is found within a connective tissue covering called the **rectus sheath**.
    b. The_____is a line connective tissue found in the abdominal midline, which separates left and right abdominal rectus muscles.

B. **Muscles of the Pelvic Floor**, **Urogenital Diaphragm**, **and Perineum** include the following structures **(Figure 9.16; Table 9.11)**:
    1. The pelvic floor consists of bilateral **levator ani** muscle groups consisting of the _____,_____, and _____ muscles **(Figure 9.16a)**.
    2. The urogenital diaphragm which transmits the urethra and vagina in females from the pelvic cavity to the perineum consists of the following muscles **(Figure 9.16b)**:
        a. The_____**urethral sphincter** muscle allows for voluntary control of urination.
        b. The **deep transverse perineal** and **superficial transverse perineal muscles** provide support to the pelvic region.
        c. The_____**anal sphincter** muscle allows for voluntary control of defecation.
    3. The_____and_____muscles are found in the perineum, which is located between the upper thighs where both male and female genitalia reside **(Figure 9.16c)**.

Module 9.4 Muscles of the Pectoral Girdle and Upper Limbs (Figures 9.17, 9.18, 9.19, 9.20; Tables 9.12, 9.13, 9.14, 9.15, 9.16)

A. **Muscles of the Shoulder and Arm**. This anatomical region includes muscles associated with the following: the pectoral girdle (scapula and clavicle), the arm (humerus), the forearm (radius and ulna), and the hand **(Figures 9.17, 9.18, 9.19, 9.20; Tables 9.12, 9.13, 9.14, 9.15, 9.16)**.

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1. **Muscles that move the scapula** include the following: the **serratus _____**, **pectoralis_____**, **trapezius, levator scapulae, rhomboid_**, **and rhomboid__(Figure 9.17; Table 9.12)**.
2. **Muscles that move the humerus** include the following: **pectoralis _____**, **latissimus dorsi, teres_____**, **coracobrachialis, teres _____supraspinatus, infraspinatus, and the subscapularis;** the last four muscles form the rotator cuff group **(Figure 9.18; Table 9.13)**.

B. **Muscles of the Arm**, **Forearm**, **and Hand**: These muscles are found in layers that can be arranged by origin, anterior or posterior forearm, and by their actions (flexion = flexor; extension = extensor, for example), and where they insert **(Figures 9.19, 9.20; Tables 9.14, 9.15, 9.16)**.
   1. Wrist flexors of the anterior forearm include the following muscles: **flexor carpi ______**, **palmaris_____**, and **flexor carpi _____ (Figure 9.19a)**.
      a. Finger and thumb flexors of the deep anterior forearm include the following muscles: **flexor digitorum superficialis, flexor digitorum profundus,** and **flexor pollicis longus**.
      b. Muscles that_____the forearm include the **pronator teres** and the **pronator quadratus**.
      c. The forearm muscle involved in supination is the_____.
   2. Wrist_____of the posterior and lateral forearm include the following muscles: the **extensor carpi radialis longus, extensor carpi radialis brevis and** the **extensor carpi ulnaris (Figure 9.19b)**.
      a. Muscles that extend the_____and_____include: the **extensor digitorum, extensor indicis, extensor digiti minimi, extensor pollicis longus,** and the **extensor pollicis brevis**.
   3. The following muscles are found in the hand where they move the thumb and fingers: the **abductor pollicis brevis, lumbricals, palmar interossei,** and **dorsal interossei (Figures 9.19a-c, 9.20)**.

Module 9.5 Muscles of the Hip and Lower Limb (Figures 9.21, 9.22; Tables 9.17, 9.18)

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A. **Muscles that Move the Thigh and Knee**. These muscles can be arranged by the location of their origin and by their actions **(Figures 9.21, 9.22, 9.23, 9.24, 9.25; Tables 9.17, 9.18, 9.19, 9.20)**:

1. The following anterior muscles flex the thigh at the hip: the _____ and_____**(Figure 19.21a)**.
    a. The following medial thigh muscles adduct the thigh: the **adductor magnus, adductor longus,** and the **adductor brevis (Figure 9.21a, c)**.
    b. The **pectineus** and **gracilis**, found in the medial thigh,_____the thigh and assist with hip and knee_____**(Figure 9.21a, d)**.
2. The **quadriceps femoris** muscle group, located in the anterior thigh includes the following muscles **(Figure 9.21a, b)**: the_____, _____,_____, and the _____.

    What is the function of this group? _____
3. The **gluteal muscle** group, found on the posterior pelvis includes the following muscles **(Figure 9.22a, b, c)**: the_____, _____, and_____.
4. **What is the function of this group?** _____

    _____
5. The following deep, posterior muscles laterally rotate the thigh **(Figure 9.22c, d)**: the **piriformis, obturator internus, gemelli, quadratus femoris,** and the **obturator externus**.
6. The hamstring muscle group (hamstrings) includes the following muscles **(Figure 9.22a)**: the_____,_____, and the _____. **What is the function of this group?**

    _____

B. **Muscles that Move the Ankle and Foot**. These muscles can be grouped by the movements that they facilitate **(Figures 9.23, 9.24, 9.25; Tables 9.19, 9.20)**:

1. **Muscles that move the foot and toes** include the following **(Figures 9.23, 9.24; Table 9.19)**:

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a. The **tibialis anterior** and **extensor digitorum longus**, found on the anterior leg, are the main muscles that _____ the foot at the ankle. The **flexor hallucis longus** assists with _____ of the foot but is main action is great toe (hallux) extension **(Figure 9.23)**.

b. The triceps surae muscle group includes the _____, _____, and plantaris **(Figure 9.24)**. **What is the function of this group?** _____

c. The following muscles, found on the lateral leg, allow for foot eversion: the **fibularis** _____ and **fibularis** _____.

d. The following muscles are found deep to the triceps surae group: the **tibialis posterior** allows for foot inversion, the **flexor hallucis longus** flexes the great toe, and the **flexor digitorum longus** flexes toes 2–5.

2. The following muscles that move the toes are found within the foot**:** the flexor digitorum brevis, the lumbricals, the plantar interossei, and the dorsal interossei **(Figure 9.25; Table 9.20)**.

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