Lesson 5.1: Learning the Key Terms

Directions: Place the letter of the best definition next to each key term.

1. agonist
2. antagonist
3. aponeurosis
4. concentric
5. contractility
6. eccentric
7. endomysium
8. epimysium
9. extensibility
10. fascicle
11. irritability
12. isometric
13. muscle fiber
14. perimysium
15. peristalsis
16. sarcolemma

A. an individual skeletal muscle cell
B. contraction accompanied by lengthening of a muscle
C. the delicate membrane surrounding each striated muscle fiber
D. role played by a skeletal muscle acting to slow or stop a movement
E. the outermost sheath of connective tissue that surrounds a skeletal muscle
F. a connective tissue sheath that envelops each primary bundle of muscle fibers
G. a type of contraction that results in shortening of a muscle
H. a bundle of muscle fibers
I. role played by a skeletal muscle to cause a movement
J. a wave of symmetrical squeezing of the digestive tract walls that occurs during digestion
K. a type of contraction that involves no change in muscle length
L. the ability to contract or shorten
M. the ability to respond to a stimulus
N. a flat, sheetlike fibrous tissue that connects muscle or bone to other tissues
O. a fine, protective sheath of connective tissue around a skeletal muscle fiber
P. the ability to be stretched
Lesson 5.1: Study Questions

Directions: Answer the questions below on a separate sheet of paper. Studying the answers will help you prepare for the chapter test.

1. What are the three main categories of muscle fibers?
2. Describe the structure of each of the three muscle fiber categories.
3. How are involuntary and voluntary muscle distinguished?
4. Why is an individual skeletal muscle cell referred to as a muscle fiber?
5. Which qualities of a skeletal muscle fiber can change as a person ages?
6. Where is smooth muscle found?
7. What are some functions of smooth muscles?
8. In terms of location, how do cardiac muscles differ from skeletal and smooth muscles?
9. What is the main function of cardiac muscles?
10. How do skeletal and smooth muscles differ in terms of fatigue?
11. Which of the three muscle categories are controlled involuntarily?
12. Although the three muscle types are different, they share four behavioral properties. What are they?
13. Which of the four behavioral characteristics is unique to muscle tissue?
14. Describe what happens to the biceps if someone is given a weight too heavy to manage.
15. What is the difference between an agonist and an antagonist?
16. Muscles represent what percentage of total body mass?
17. How do muscles produce heat?
Lesson 5.1: The Organization of a Skeletal Muscle

Directions: Label the figure with the appropriate callouts from the list provided.

1. blood vessel
2. epimysium
3. fascicle
4. perimysium
5. tendon
6. bone
7. fascia
8. muscle fiber
9. endomysium
### Lesson 5.2: Learning the Key Terms

**Directions:** *Use the terms listed below to fill in the sentence blanks.*

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>acetylcholine</td>
<td>A neurotransmitter chemical that stimulates muscle.</td>
</tr>
<tr>
<td>axon terminals</td>
<td>Cross bridges function as connections between the heads of myosin filaments and receptor sites on the actin filaments.</td>
</tr>
<tr>
<td>motor unit</td>
<td>A type of muscle fiber arrangement, fibers do not cross each other along the length of the muscle.</td>
</tr>
<tr>
<td>sarcomeres</td>
<td>The neuromuscular junction is the link between an axon terminal and a muscle fiber.</td>
</tr>
<tr>
<td>action potential</td>
<td>The synaptic cleft is a tiny gap that separates the axon terminal and muscle fiber.</td>
</tr>
<tr>
<td>all-or-none law</td>
<td>Tetanus is a sustained, maximal level of muscle tension that occurs with high-frequency stimulation.</td>
</tr>
<tr>
<td>axon</td>
<td>The electric charge produced in nerve or muscle fiber by stimulation is the action potential.</td>
</tr>
<tr>
<td>fast-twitch</td>
<td>Slow-twitch muscles contract quickly.</td>
</tr>
<tr>
<td>parallel</td>
<td>A(n) parallel muscle fiber arrangement has each fiber attaching obliquely to a central tendon.</td>
</tr>
<tr>
<td>pennate</td>
<td>A single motor neuron and all of the muscle fibers that it stimulates is called a(n) pennate.</td>
</tr>
<tr>
<td>tetanus</td>
<td>A(n) tetanus is a nerve that stimulates skeletal muscle tissue.</td>
</tr>
<tr>
<td>neuromuscular junction</td>
<td>A(n) neuromuscular junction is a long, thin fiber connected to the motor neuron cell body.</td>
</tr>
<tr>
<td>all-or-none law</td>
<td>The all-or-none law states that the fibers in a given motor unit always develop maximum tension when stimulated.</td>
</tr>
<tr>
<td>motor neuron</td>
<td>Slow-twitch muscles contract slowly and are fatigue-resistant.</td>
</tr>
<tr>
<td>sarcomeres</td>
<td>Offshoots of the axon, branch out to connect with individual muscle fibers.</td>
</tr>
<tr>
<td>cross bridges</td>
<td>Units composed of actin and myosin, contract inside the muscle fiber.</td>
</tr>
</tbody>
</table>
Lesson 5.2: Study Questions

Directions: Answer the questions below on a separate sheet of paper. Studying the answers will help you prepare for the chapter test.

1. What does muscle tissue need in order to develop tension?
2. What is the neuromuscular system?
3. How many skeletal muscle fibers does a single motor neuron supply impulses to? Why might this number vary?
4. What is the function of an axon?
5. What happens when a nerve impulse reaches the end of an axon terminal?
6. What provides the energy for creating the action potential in muscle?
7. What are actin and myosin?
8. Why is simultaneous activation of many motor units necessary for the muscle to develop maximum tension?
9. Describe in chemical terms what happens when a muscle fiber returns to its resting state.
10. What is the difference between slow-twitch and fast-twitch muscle fibers?
11. Type IIb muscle fibers contract more rapidly than any other fiber type. What is the consequence of this rapid contraction?
12. Explain muscle fiber architecture. What are the two major categories of muscle fiber arrangement in the human body? Describe the architecture of each.
13. What is the advantage of pennate fiber architecture?
14. What does parallel fiber architecture do well?
15. Runner A and Runner B are competing in a short sprint. Runner A has exceptional muscular power, but only average muscular strength. Runner B has exceptional muscular strength, but only average muscular power. Based on the information given, which runner do you think will win the race and why?
16. What is muscular endurance? Does its definition vary?
17. Identify some factors that can affect the rate at which a muscle fatigues.
Lesson 5.3: Learning the Key Terms

Directions: Place the letter of the best definition next to each key term.

_____ 1. abduction  
_____ 2. adduction  
_____ 3. circumduction  
_____ 4. dorsiflexion  
_____ 5. eversion  
_____ 6. extension  
_____ 7. flexion  
_____ 8. hyperextension  
_____ 9. insertion  
_____ 10. inversion  
_____ 11. lateral rotation  
_____ 12. medial rotation  
_____ 13. opposition  
_____ 14. origin  
_____ 15. plantar flexion  
_____ 16. pronation  
_____ 17. radial deviation  
_____ 18. supination  
_____ 19. ulnar deviation

A. movement of a body segment closer to the body in the frontal plane
B. movement of the top of the foot toward the lower leg
C. muscle attachment to a relatively fixed structure
D. backward movement of a body segment past anatomical position in the sagittal plane
E. forward movement of a body segment away from anatomical position in the sagittal plane
F. rotation of the hand toward the little finger
G. rotation of the hand toward the thumb
H. movement that returns a body segment to anatomical position in the sagittal plane
I. muscle attachment to a bone that tends to move when the muscle contracts
J. downward motion of the foot away from the lower leg
K. touching any of your four fingers to your thumb; this movement enables grasping of objects
L. movement of a body segment away from the body in the frontal plane
M. outward (lateral) movement of a body segment in the transverse plane
N. movement in which the foot’s sole is rolled outward
O. lateral rotation of the forearm (palm up)
P. inward (medial) movement of a body segment in the transverse plane
Q. a body segment’s rotational movement such that the end of the segment traces a circle
R. medial rotation of the forearm (palm down)
S. movement in which the sole of the foot is rolled inward
Lesson 5.3: Study Questions

Directions: Answer the questions below on a separate sheet of paper. Studying the answers will help you prepare for the chapter test.

1. Approximately how many skeletal muscles are there in the body?
2. What does it mean that many muscles are arranged in “agonist-diagonist pairs”?
3. What is the difference between the origin and the insertion ends of a muscle?
4. What is the frame of reference for all movement of the body?
5. Name the three major planes of the body that are used to describe body movement.
6. How many sagittal plane movements are there, and what are their names?
7. Describe each of the sagittal plane movements.
8. Describe the difference between abduction and adduction. Along which plane of the body do these movements occur?
9. Name at least four front plane movements.
10. Transverse plane movements generally involve which type of movements?
11. What are the special terms used to describe medial and lateral rotation of the forearm?
12. What are multiplanar movements? Give an example of a multiplanar movement.
13. Identify the three categories of head and neck muscles.
14. Which muscles are responsible for providing stability to the vertebral column and maintaining an upright posture?
15. The glenohumeral joint provides little or no stability; what does it depend on to prevent dislocation?
16. Give some examples of activities that rely specifically on upper limb muscles, and how these muscles enable the movements required for each activity.
17. Which lower limb muscle enables flexion of the leg at the knee?
18. Describe the location and primary function of the gastrocnemius.
Lesson 5.3: Directional Movement Terminology

Directions: Label the figure with the letter of the appropriate callouts from the list provided.

A. extension  F. flexion  L. sagittal plane movements  P. pronation
B. eversion  G. medial rotation  M. multi-plane movement  Q. inversion
C. plantar flexion  H. adduction  N. dorsiflexion  R. transverse plane movements
D. frontal plane movements  I. radial deviation  O. lateral rotation  S. abduction
E. circumduction  J. supination  K. hyperextension  T. ulnar deviation
## Lesson 5.3: Identifying Muscles of the Lower Limb

**Directions:** Fill in the chart below with the letters of the corresponding muscles, locations, and primary functions. A term, location, or function is provided for each item.

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hip Muscles</strong></td>
<td></td>
</tr>
<tr>
<td>1. _______</td>
<td>external buttocks; connects pelvis to femur</td>
</tr>
<tr>
<td><strong>Gluteus medius</strong></td>
<td></td>
</tr>
<tr>
<td>3. _______</td>
<td>abduction and medial rotation of leg</td>
</tr>
<tr>
<td>4. _______</td>
<td>flexion of leg at hip</td>
</tr>
<tr>
<td>5. _______</td>
<td>anterior-medial thigh</td>
</tr>
<tr>
<td>6. _______</td>
<td></td>
</tr>
</tbody>
</table>

| **Knee Muscles**                                                                                     |
| 8. _______ | anterior thigh; connects ilium and proximal femur to tibia            |
| **Hamstrings**                                                                                       |
| 10. _______ |                                                                         |
| 12. _______ | long, straplike muscle that crosses anterior thigh obliquely; connects ilium to proximal tibia |

| **Ankle/Foot Muscles**                                                                 |
| 14. _______ | plantar flexion of foot, flexion of leg at knee                         |
| 15. _______ |                                                                         |
| 16. _______ | underlies gastrocnemius on posterior calf; connects fibula and tibia to calcaneus |
| **Tibialis anterior**                                                                                  |
| 17. _______ |                                                                         |
| 18. _______ |                                                                         |
| 19. _______ |                                                                         |

---

A. Quadriceps  
B. Soleus  
C. Adductor muscles  
D. Gluteus maximus  
E. Sartorius  
F. Gastrocnemius  
G. Iliopsoas  
H. directly under maximus; connects ilium of pelvis to femur  
I. long, straplike muscle that crosses anterior thigh obliquely; connects ilium to proximal tibia  
J. anterior lower leg; connects tibia to tarsal and metatarsal bones of foot  
K. anterior groin; connects ilium and lower vertebrae to femur  
L. prominent muscle on posterior calf; connects femur to heel bone via Achilles tendon  
M. posterior thigh; connects ischium to tibia and fibula  
N. plantar flexion of foot  
O. flexion of leg at knee  
P. extension and lateral rotation of leg  
Q. dorsiflexion and inversion of foot  
R. adduction and medial rotation of leg  
S. extension of leg at knee
Lesson 5.4: Learning the Key Terms

Directions: Use the terms listed below to fill in the sentence blanks.

- contusion
- hernia
- muscular dystrophy (MD)
- shin splints
- delayed-onset muscle soreness (DOMS)
- muscle cramps
- myositis ossificans
- tendinitis
- muscle strain
- tendinosis

1. Inflammation of a tendon, _____________________________ is usually accompanied by pain and swelling.
2. A(n) _____________________________ is an injury occurring when a muscle is stretched beyond its accustomed limits.
3. In _____________________________, a calcium mass forms within a muscle three to four weeks after a muscle injury.
4. Resulting from an impact, the bruising or bleeding within a muscle is a(n) _____________________________.
5. Believed to be caused by microtears in the tendon connective tissue, _____________________________ is degeneration of a tendon.
6. Moderate to severe muscle spasms that cause pain are _____________________________.
7. _____________________________ follows participation in an activity, and involves microscopic tears in the muscle tissue that cause inflammation, pain, and swelling.
8. Characterized by progressively worsening muscle weakness and loss of muscle tissue, _____________________________ is a group of disorders.
9. Pain localized to the anterior lower leg is referred to as a(n) _____________________________.
10. A(n) _____________________________ is a balloon-like section of the abdominal cavity lining that protrudes through a hole or weakened section of the abdomen muscles.
Lesson 5.4: Study Questions

Directions: Answer the questions below on a separate sheet of paper. Studying the answers will help you prepare for the chapter test.

1. What is a muscle strain?
2. Strains are classified as Grade I, II, or III. Outline the differences between each type.
3. Why are hamstring injuries so problematic?
4. What is the difference between a strain and a sprain?
5. In what aspect does a contusion differ from a strain?
6. Describe a muscle cramp and identify some possible causes.
7. What makes delayed-onset muscle soreness (DOMS) different from muscle cramps?
8. What is tendinitis and what causes this injury?
9. In what areas of the body does tendinitis most commonly occur?
10. What is the relationship between tendinitis and tendinosis? How do they differ?
11. What is epicondylititis?
12. The -itis suffix is often found in words used to discuss injuries or sicknesses. What does it mean?
13. What kind of injuries are tennis players and young baseball players susceptible to?
14. What muscles may be involved in shin splints?
15. Who does lower back pain (LBP) happen to more often: physically active children or sedentary children?
16. Identify some risk factors for LBP.
17. What are the treatment goals for a patient with muscular dystrophy?
18. Many hernias do not necessitate treatment. In what case does a hernia require treatment?
Chapter 5: Analyzing Movement

Directions: Find a video clip online of a sports play or a dance. Using terms you learned in the chapter, analyze and describe the muscles used to achieve specific movements. Explain the properties of each muscle, including behavioral characteristics of the muscles, the agonist or antagonist relationships, contractions, torque, or muscular endurance necessary. Also, identify planes along which the athlete’s body is moving. Finally, identify any possible injuries the athlete might suffer based on his or her movements. Is muscle strain possible? Maybe a muscle contusion is likely? Write your description below using time markers from the video (“at 1:12, the dancer kicks his left leg high in the air…”).
Chapter 5 Lab Investigation: Muscles

Purpose
In this activity you will look at the microanatomy of muscle cells, and you will identify muscle locations on your body.

Background
Tendons can be felt through the skin. Muscle contractions can be observed and felt as skin movement.

Materials
your textbook, your body

Procedure
Muscle Cell Microanatomy

To answer the following six questions, refer to the muscle tissue drawings above.

1. In which drawing(s) are the cells striated?

2. In which drawing(s) are the cells spindle-shaped?

3. In which drawing(s) are the cells branched?

4. In which drawing(s) do the cells have only one nucleus?

5. Which drawing(s) shows smooth muscle tissue?

6. Which drawing(s) shows voluntary muscle tissue?

Muscle and Tendon Identification: Upper Limb

1. Place the fingers of your left hand on the dorsal surface of your right forearm at the distal end of the radius and ulna.

2. Wiggle your fingers. Feel your tendons move and watch your skin move at the proximal end of the radius and ulna.

3. Where are the muscles that are causing your fingers to move located?

4. On the ventral surface of your right elbow, find the biceps tendon that inserts on the radius. Follow the tendon to the biceps brachii.

5. Wrap your left hand around your right upper arm so you are touching both the biceps brachii and the triceps brachii.

6. Flex and extend your forearm.
7. Which muscle flexes your forearm? 
____________________________________________________________________

8. Which muscle extends your forearm? 
____________________________________________________________________

**Muscle and Tendon Identification: Head**

1. Place your hands on the posterior ends of your mandible. Clench your teeth together. Feel the muscle contract.

2. Place your hands at your temples and again clench your teeth. Do you feel movement? 
Name the two muscles that you just located, that are involved in clenching your teeth:

3. 
____________________________________________________________________

4. 
____________________________________________________________________

5. Find your sternocleidomastoid muscle, slightly posterior and inferior to your ear, and the trapezius muscle in the back of your neck. Flex and extend your head.

6. Which muscle flexes the head? 
____________________________________________________________________

7. Which muscle extends the head? 
____________________________________________________________________

**Muscle and Tendon Identification: Lower Limb**

1. While sitting in a chair, locate your Achilles tendon, just proximal to your heel. Follow it to the gastrocnemius muscle.

2. Feel your Achilles tendon as you dorsiflex and plantar flex your foot.

3. During which movement is your Achilles tendon stretched tight and elongated? 
____________________________________________________________________

4. During which movement does it feel like your Achilles tendon is shorter? 
____________________________________________________________________

5. Feel the dorsal side of your knee, lateral and medial, to find the hamstrings. How many can you feel? 
____________________________________________________________________

6. Flex your lower leg. What group of muscles causes this movement? 
____________________________________________________________________

7. Place your hand on the ventral surface of your upper leg and extend your lower leg. Feel for movement.

8. What group of muscles caused the movement described in #7? 
____________________________________________________________________

**Conclusions**

*Select the correct answer from the two choices.*

1. Contractions of muscles that can be felt as tendon movement on the dorsal surface of the forearm cause the fingers to (flex, extend).

2. Contractions of muscles that can be felt as tendon movement on the ventral surface of the forearm cause the fingers to (flex, extend).

3. Contractions of muscles on the dorsal surface of the neck cause head (flexion, extension).

4. Contractions of muscles on the ventral surface of the neck cause head (flexion, extension).

5. Contractions of muscles on the ventral surface of the leg cause lower leg (flexion, extension).

6. Contractions of muscles on the dorsal surface of the leg cause lower leg (flexion, extension).
Chapter 5 Practice Test

**Completion:** Carefully read the following statements. Write the term that completes the statement in the spaces provided.

1. _________________ is the only human tissue capable of shortening, or contracting.

2. A single motor neuron and all of the muscle cells that it stimulates is a(n) _______________.

3. Movement of a body segment away from the body along the frontal plane is _______________.

4. _________________ is a disorder characterized by progressively worsening muscle weakness and loss of muscle tissue.

5. The _________________ states that the fibers in a given motor unit always develop maximum tension when stimulated.

**True/False:** Indicate whether each statement below is true or false by circling either T or F.

6. Skeletal muscle is also known as striated muscle and voluntary muscle.

7. The two major categories of muscle fiber arrangement are parallel and perpendicular.

8. The frame of reference for all bodily movement is the anatomical position.

9. Muscular dystrophy can be cured if detected early in life.

10. Children who are more physically active are more likely to have lower back pain than sedentary children.

**Multiple Choice:** Circle the correct answer.

11. Which of the following is not one of muscle tissues’ four common behavioral characteristics?
   A. extensibility
   B. irritability
   C. elasticity
   D. mobility

12. What is the neurotransmitter that stimulates muscle?
   A. actin
   B. myosin
   C. acetylcholine
   D. tetanus

13. An endomysium is a ____________.
   A. skeletal fiber type
   B. muscle tissue
   C. muscle function
   D. sagittal plane movement

14. The primary function of the gluteus maximus is to ______.
   A. adduct, flex, extend, and rotate the arm
   B. flex the forearm
   C. extend and laterally rotate the leg
   D. adduct and medially rotate the leg

15. Which of the following is not seen as a risk factor for lower back pain?
   A. sitting prolonged periods
   B. working with two hands
   C. performing heavy manual labor
   D. smoking cigarettes

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Matching: Match each key term to its definition by writing the letter of the definition in the spaces provided.

____ 16. irritability  A. the ability to respond to a stimulus
____ 17. fascicle  B. units composed of actin and myosin that contract inside the muscle fiber
____ 18. extension  C. the link between an axon terminal and a muscle fiber
____ 19. action potential  D. touching any of the four fingers to the thumb; this enables grasping of objects
____ 20. neuromuscular junction  E. the electric charge produced in nerve or muscle fiber by stimulation
____ 21. antagonist  F. role played by a skeletal muscle acting to slow or stop a movement
____ 22. sarcomeres  G. pain localized to the anterior lower leg
____ 23. shin splint  H. a bundle of muscle fibers
____ 24. muscle strain  I. an injury occurring when a muscle is stretched beyond its accustomed limits
____ 25. opposition  J. movement that returns a body segment to anatomical position in the sagittal plane

Art Labeling: Locate each of the following items on the drawing by placing the corresponding letter on the blanks provided.

A. Anterior view

A. \[\text{______} \]
B. \[\text{______} \]
C. \[\text{______} \]
D. \[\text{______} \]
E. \[\text{______} \]

B. Posterior view

A. \[\text{______} \]
B. \[\text{______} \]
C. \[\text{______} \]
D. \[\text{______} \]
E. \[\text{______} \]

____ 26. humerus  _____ 31. biceps brachii
____ 27. brachialis  _____ 32. scapula
____ 28. pectoralis major  _____ 33. sternum
____ 29. triceps brachii  _____ 34. deltoid
____ 30. latissimus dorsi  _____ 35. brachioradialis

Short Answer: Answer the following questions using what you have learned in this chapter.

36. Describe muscle fiber architecture.

37. The muscles of the lower limb are well designed for specific activities. What are some of these activities?