

## CHAPTER 8

# The Muscular System

**T**he muscular system is often referred to as the “power system,” and rightfully so, because it is this system that provides the force necessary to move the body and perform many organ functions. Just as an automobile relies on the engine to provide motion, the body depends on the muscular system to perform both voluntary and involuntary movements. Walking, breathing, and the digestion of food are but a few examples of body functions that require the healthy performance of the muscular system.

Although this system has several functions, the primary purpose is to provide movement or power. Muscles produce power by contracting. The ability of a large muscle or muscle group to contract depends on the ability of microscopic muscle fibers to contract within the larger muscle. An understanding of these microscopic muscle fibers will assist you as you progress in your study to the larger muscles and muscle groups.

Muscle contractions may be one of several types: isotonic, isometric, twitch, or tetanic. When skeletal or voluntary muscles contract, they provide us with a variety of motions. Flexion, extension, abduction, adduction, and rotation are examples of these movements that provide us with both strength and agility.

Muscles are also used to keep the body healthy and in good condition. Scientific evidence keeps pointing to the fact that the proper use and exercise of muscles may prolong longevity. An understanding of the structure and function of the muscular system may, therefore, add quality and quantity to our lives.

### TOPICS FOR REVIEW

Before progressing to Chapter 9, you should familiarize yourself with the structure and function of the three major types of muscle tissue. Your review should include the microscopic structure of skeletal muscle tissue, how a muscle is stimulated, the major types of skeletal muscle contractions, and the skeletal muscle groups. Your study should conclude with an understanding of the types of movements produced by skeletal muscle contractions and the major muscular disorders.

**MUSCLE TISSUE**

Match each descriptive word or phrase to its related muscle type and write the corresponding letter(s) in the answer blank.

A. Skeletal muscle      B. Cardiac muscle      C. Smooth muscle

- A+B. 1. Striated  
B. 2. Cells branch frequently  
C. 3. Moves food into the stomach  
C. 4. Nonstriated  
A. 5. Voluntary  
B. 6. Keeps blood circulating through its vessels  
B+C. 7. Involuntary  
A. 8. Attaches to bone  
C. 9. Hollow internal organs  
C. 10. Visceral muscle

▶ If you had difficulty with this section, review pages 207-208.

**STRUCTURE OF SKELETAL MUSCLES**

Match each term on the left with its corresponding description on the right.

- |                         |  |
|-------------------------|--|
| <u>D.</u> 11. Origin    | A. The muscle unit excluding the ends  |
| <u>B.</u> 12. Insertion | B. Attachment to the more movable bone |
| <u>A.</u> 13. Body      | C. Fluid-filled sacs                   |
| <u>E.</u> 14. Tendons   | D. Attachment to more stationary bone  |
| <u>C.</u> 15. Bursae    | E. Anchor muscles to bones             |

**MICROSCOPIC STRUCTURE**

- |                             |  |
|-----------------------------|--|
| <u>E.</u> 16. Muscle fibers | A. Protein that forms thick myofilaments                             |
| <u>C.</u> 17. Actin         | B. Basic functional unit of skeletal muscle                          |
| <u>B.</u> 18. Sarcomere     | C. Protein that forms thin myofilaments                              |
| <u>A.</u> 19. Myosin        | D. Microscopic threadlike structures found in skeletal muscle fibers |
| <u>D.</u> 20. Myofilaments  | E. Elongated contractile cells of muscle tissue                      |

▶ If you had difficulty with this section, review pages 208-211.

## FUNCTIONS OF SKELETAL MUSCLE

Fill in the blanks.

21. Muscles move bones by pulling on them.
22. As a rule, only the insertion bone moves.
23. The insertion bone moves toward the origin bone.
24. Of all the muscles contracting simultaneously, the one mainly responsible for producing a particular movement is called the prime mover (or agonist) for that movement.
25. As prime movers contract, other muscles called antagonists relax.
26. The biceps brachii is the prime mover during flexing, and the brachialis is its helper or synergist muscle.
27. We are able to maintain our body position because of a specialized type of skeletal muscle contraction called tonic contraction.
28. Muscle tone maintains body posture by counteracting the pull of gravity.
29. A decrease in temperature, a condition known as hypothermia, will drastically affect cellular activity and normal body function.
30. Energy required to produce a muscle contraction is obtained from ATP.

## TYPES OF SKELETAL MUSCLE CONTRACTION

Circle the correct answer.

41. When a muscle contracts and no movement results, the contraction is:
- A. Isometric
  - B. Isotonic
  - C. Twitch
  - D. Tetanic
42. Walking is an example of which type of contraction?
- A. Isometric
  - B. Isotonic
  - C. Twitch
  - D. Tetanic
43. Pushing against a wall is an example of which type of contraction?
- A. Isotonic
  - B. Isometric
  - C. Twitch
  - D. Tetanic
44. Endurance training is also known as:
- A. Isometrics
  - B. Hypertrophy
  - C. Aerobic training
  - D. Strength training
45. Benefits of regular exercise include all of the following *except*:
- A. Improved lung functioning
  - B. More efficient heart
  - C. Less fatigue
  - D. Atrophy
46. Twitch contractions easily can be seen:
- A. In isolated muscles prepared for research
  - B. In a great deal of normal muscle activity
  - C. During resting periods
  - D. None of the above
47. Individual contractions "melt" together to produce a sustained contraction or:
- A. Twitch
  - B. Tetanus
  - C. Isotonic response
  - D. Isometric response
48. In most cases, isotonic contraction of muscle produces movement at a/an:
- A. Insertion
  - B. Beginning
  - C. Joint
  - D. Bursa
49. Prolonged inactivity causes muscles to shrink in mass, a condition called:
- A. Hypertrophy
  - B. Disuse atrophy
  - C. Paralysis
  - D. Muscle fatigue
50. Muscle hypertrophy can be best enhanced by a program of:
- A. Isotonic exercise
  - B. Better posture
  - C. High-protein diet
  - D. Strength training

▶ If you have had difficulty with this section, review pages 211-216.

## SKELETAL MUSCLE GROUPS

Match the function(s) to the muscles listed below and write the corresponding letter(s) in the answer blank.

- |             |             |                                  |
|-------------|-------------|----------------------------------|
| A. Flexor   | C. Abductor | E. Rotator                       |
| B. Extensor | D. Adductor | F. Dorsiflexor or plantar flexor |

- C. 51. Deltoid  
F.A.D. 52. Tibialis anterior  
F.B. 53. Gastrocnemius  
A. 54. Biceps brachii  
C. 55. Gluteus medius  
B.F. 56. Soleus  
A. 57. Iliopsoas  
A.D. 58. Pectoralis major  
B. 59. Gluteus maximus  
B. 60. Triceps brachii  
A.E. 61. Sternocleidomastoid  
B. 62. Trapezius  
D. 63. Gracilis

▶ If you had difficulty with this section, review pages 216-221 and 223.

## MOVEMENTS PRODUCED BY SKELETAL MUSCLE CONTRACTIONS

Circle the correct answer.

64. A movement that makes the angle between two bones smaller is:  
 A. Flexion  
 B. Extension  
 C. Abduction  
 D. Adduction
65. Moving a part toward the midline is:  
 A. Flexion  
 B. Extension  
 C. Abduction  
 D. Adduction
66. Moving a part away from the midline is:  
 A. Flexion  
 B. Extension  
 C. Abduction  
 D. Adduction
67. When you move your head from side to side as in shaking your head "no," you are \_\_\_\_\_ a muscle group.  
 A. Rotating  
 B. Pronating  
 C. Supinating  
 D. Abducting
68. \_\_\_\_\_ occurs when you turn the palm of your hand from an anterior to posterior position.  
 A. Dorsiflexion  
 B. Plantar flexion  
 C. Supination  
 D. Pronation
69. *Dorsiflexion* refers to:  
 A. Hand movements  
 B. Eye movements  
 C. Foot movements  
 D. Head movements

▶ If you had difficulty with this section, review pages 221-223.

## CHECK YOUR KNOWLEDGE

## Multiple Choice

Circle the correct answer.

- Which of the following statements about a motor unit is true?
  - It consists of a muscle cell group and a motor neuron.
  - The point of contact between the nerve ending and the muscle fiber is called the *neuromuscular junction*.
  - Chemicals generate events within the muscle cell that result in contraction of the muscle cell.
  - All of the above are true.
- What is movement of a part away from the midline of the body called?
  - Abduction
  - Adduction
  - Pronation
  - Plantar flexion
- According to the sliding filament theory of muscle contraction:
  - Muscle fibers contain thin myofilaments made of a protein called *myosin*.
  - Muscle fibers contain thick myofilaments made up of a protein called *actin*.
  - Thin and thick myofilaments move toward each other to cause muscle contraction.
  - All of the above are true.
- Which of the following statements is true of the hamstring group of muscles?
  - It includes the rectus femoris.
  - It flexes the knee.
  - It originates on the pubis.
  - All of the above are true.
- What happens if a given muscle cell is stimulated by a threshold stimulus?
  - It shows an "all or none" response.
  - It shows a tetanus response.
  - It shows a subminimal response.
  - None of the above is true.
- Which of the following statements about oxygen debt is true?
  - It is caused when excess oxygen is present in the environment.
  - It causes lactic acid buildup and soreness in muscles.
  - It can be replaced by slow, shallow breathing.
  - All of the above are true.
- What is a quick, jerky response of a given muscle to a single stimulus called?
  - Isometric
  - Lockjaw
  - Tetanus
  - Twitch
- Which of the following statements about muscle atrophy is true?
  - It decreases the size of a muscle.
  - It increases the size of a muscle.
  - Has no effect on muscle size.
  - None of the above is true.
- Which of the following occurs during isometric exercises?
  - Muscle length remains the same.
  - Muscle tension remains the same.
  - Muscle length shortens.
  - None of the above occurs.
- Which of the following statements about skeletal muscle contraction is true?
  - Its attachment to the more stationary bone is called its *origin*.
  - Its attachment to the more moveable bone is called its *insertion*.
  - Both A and B are true.
  - None of the above is true.

## True/False

If the statement is true, write "T" on the answer blank. If the statement is false, correct the statement by circling the incorrect term and writing the correct term in the answer blank.

- T     11. When a part is moved toward the midline, it is called *adduction*.
- T     12. In most cases, isotonic contraction of a muscle produces movement at a joint.
- Pronation   13. Dorsiflexion occurs when you turn the palm of your hand from an anterior to a posterior position.
- hypertrophy   14. Exercise may cause an increase in muscle size called atrophy.
- T     15. Isotonic contraction is an example of a contraction used while walking.
- T     16. If a muscle is overworked without sufficient rest, the result will be a decrease in muscle strength and fatigue.
- T     17. A bone of insertion moves toward the bone of origin.
- hypothermia   18. A condition in which the body temperature is drastically low is referred to as hyperthermia.
- T     19. Tetanic contraction is caused by a series of rapid stimuli.
- flexion   20. When the angle between two bones becomes smaller, it is called extension.

