

I. INTRODUCTION

- A. The muscular system allows for **movement**.
 - 1. External motion of the arms and legs
 - 2. Internal motion including the movement of the digestive system, the **cardiovascular** system, and the respiratory system
- B. Different types of muscles allow for both external and **internal** movement.

II. OVERVIEW

- A. Muscle is a general term for all contractile tissue.
 - 1. Contraction—muscle tissue becomes **short** and thick because of a nerve impulse.
 - 2. **Relaxation** occurs when impulse ends
 - 3. Alternating contraction and **relaxation** causes **movement**.
- B. Muscle tissue is constructed of bundles of these fibers, approximately the thickness of human hair.

III. TYPES OF MUSCLES

A. **Skeletal Muscle**

- 1. Attached to **bones**; provide movement for the body
- 2. Tendons—fibrous tissues that attach skeletal muscles to **bones**
- 3. Striated-look striped
- 4. **Voluntary**—movement is controlled by conscious thought
- 5. Contraction and relaxation
 - a. Contraction—**shortening** of muscle
 - b. All movement is a result of contraction of primary movers and **relaxation** of opposing muscles.
- 6. Types of movements

	Movement	Description
a	Rotation	<u>Circular</u> movement that occurs around an axis
b	Abduction	Movement <u>away</u> from the midline
c	Adduction	Movement <u>toward</u>
d	Extension	<u>Increasing</u> the angle between two bones connected at a joint
e	Flexion	<u>Decreasing</u> the angle between two bones

7. Movement at the cellular level

	Cellular Movement	Fill in the Blanks
a	Muscle Fibers	<ul style="list-style-type: none"> i. Each muscle cell is an elongated fiber. ii. Several muscle fibers can be bundled together to form a specific muscle segment.

b	Sarcomeres	<ul style="list-style-type: none"> i. Sarcomeres are the functional contractile units of each fiber. ii. Each sarcomere has two types of threadlike structures called thick and thin myofilaments. iii. Thick myofilaments are made up of the protein myosin. iv. Thin myofilaments are made up of the protein actin.
c	Muscle Contraction	<ul style="list-style-type: none"> i. Acetylcholine, a neurotransmitter, is released from the nervous system. ii. This causes contraction by causing myosin heads to bind to actin filaments (crossbridge formation). iii. Energy is needed for contraction and relaxation. <ul style="list-style-type: none"> a. ATP (adenosine triphosphate)
d	Muscular Fuel	<ul style="list-style-type: none"> i. Oxygen and glucose to make ATP ii. Glycogen stored in muscle can be converted to glucose. iii. Fat can be stored for energy. iv. Muscle blood supply and color. <ul style="list-style-type: none"> a. Higher demand muscles also have a greater blood supply to carry much-needed oxygen. b. The greater blood supply gives them a darker color.
e	Muscles and Body Temperature	<ul style="list-style-type: none"> i. Muscles produce heat. ii. Producing heat is important in maintaining body temperature. iii. Shivering
f	Rigor Mortis	<ul style="list-style-type: none"> i. When a body dies, all the stored calcium is unable to be pumped back out of the muscles. ii. Excess calcium remains in the muscles throughout the body and causes muscle fibers to shorten and stiffen the whole body. iii. Shortage of ATP also contributes.

B. Smooth Muscle

1. Also called visceral **muscle**
2. Found in hollow organs (except heart) and tubes, such as blood vessels
3. Involuntary muscles; slower than skeletal muscles
4. Action
 - a. **Enlarging** the diameter of a blood vessel is called vasodilation.
 - b. **Decreasing** the diameter of a blood vessel is called vasoconstriction.
 - c. Sphincters—close and open tubes

C. Cardiac Muscle

1. Found in the wall of the **heart**
2. Involuntary

3. Fibers are shorter and receive a richer supply of blood than any other muscle in the body.
4. Intercalated disks—link fibers; causing one fiber to contract and then pull the next one into a contraction, creating a domino effect
5. Cardiac muscles do not **regenerate** themselves, leading to scarring.

IV. MUSCLE TONE

- A. Tonus (muscle tone)—partial contraction of a muscle with resistance to stretching
- B. **Hypertrophy**—increased muscle size
- C. **Atrophy**—muscle wasting from disuse

V. COMMON MUSCULAR SYSTEM DISORDERS

- A. Myalgia: pain or tenderness in a muscle
- B. Fibromyalgia: mainly affects **women** under 40 but is not fully understood; symptoms include aches, pains, and muscle stiffness with specific tender points; cause is unknown but is linked with chronic fatigue syndrome.
- C. Paralysis: partial or total loss of function in **voluntary** muscles; can be either flaccid or rigid paralysis
- D. Spasm or cramp: involuntary sudden and violent contraction of a muscle for a prolonged period of time
- E. Sprains: tears or breaks in **ligaments**
- F. Strains: actual tears in **muscles** or tendons
- G. Shin splints: inflammatory condition of the extensor muscles and surrounding tissues of the lower leg; often found in **runners**
- H. Hernia: tear in the muscle wall through which an **organ** of the body protrudes
- I. Tendinitis: inflammation of **tendons**
- J. Electromyography: a diagnostic test in which a muscle or group of muscles are stimulated with an electrical impulse, causing contraction, allowing the strength of the contraction to be measured
- K. Neuromuscular disorders
 1. Myasthenia gravis
 - a. Gradually increasing profound **muscle** weakness
 - b. Drooping eyelid frequently the first symptom
 2. Muscular dystrophy
 - a. Inherited muscular diseases
 - b. Muscle fibers **degenerate**
 - c. Progressive muscular weakness occurs
 3. Guillain-Barré syndrome
 - a. Disorder of the **peripheral** nervous system that causes flaccid paralysis and the loss of reflexes
 - b. Ascends from the feet and progressing to the head
 - c. Paralysis peaks in 10 to 14 days and then subsides gradually
 4. Tetanus
 - a. Creates rigid paralysis, and any minor stimulus causes muscles to go into a major spasm
 - b. Caused by toxins produced by a **bacteria** found in the ground and can be spread by any type of puncture, not just a rusty nail
 5. Botox
 - a. Botulism is a potentially deadly disease resulting from **food** poisoning with the *Clostridium botulinum* bacteria.

- b. Science can utilize botulinum toxins for medical and cosmetic treatment.
- c. Small amounts of botulinus toxin are injected into facial muscles to stop previously untreatable facial twitching by paralyzing the muscles.
- d. Toxin also is used to treat wrinkles without surgery; known as **Botox** injections.

Test Your Knowledge 7-1 Page 147

Multiple Choice:

1. C 2. D 3. B 4. C

Test Your Knowledge 7-2 Page 151

List the Correct Body Movement:

1. Rotation
2. Flexion or Adduction
3. Extension or Abduction
4. Agonist or Primary Mover
5. Point of Origin

Test Your Knowledge 7-3 Page 155

Fill in the Blanks

1. Actin
2. Calcium; ATP
3. Sarcomere
4. Acetylcholine
5. Myosin; Actin

Test Your Knowledge 7-4 Page 158

Fill in the Blanks

1. Hamstrings
2. Quadriceps; Pelvis; Patella and Tibia
3. Sternocleidomastoid
4. Gastrocnemius
5. Biceps Brachii; Triceps Brachii
6. Hamstrings

Review Questions:

Multiple Choice:

1. A 2. B 3. D 4. B 5. C 6. B 7. B

Fill in the Blanks

1. Spasm/Cramp
2. Paralysis
3. Hernia
4. Glycogen
5. Myalgia
6. Biceps Brachii

Short Answer

1. The three major muscle types are skeletal, cardiac, and smooth. The diaphragm (and dozens of others) is a skeletal muscle. Cardiac muscle is found in the heart wall. Examples of smooth muscle are the walls of the respiratory and digestive systems and the walls of blood vessels.



