

Anatomy and Physiology
Chapter 6: The Muscular System

Name: _____

Objectives- By the end of this chapter I will be able to:

1. Describe similarities and differences in the structure and function of the three types of muscles tissue, and indicate where they are found in the body.
2. Define muscular system.
3. Define and explain the role of the following: endomysium, perimysium, epimysium, tendon, and aponeurosis.
4. Describe the microscopic structure of skeletal muscle and explain the role of actin- and myosin- containing myofilaments.
5. Describe how an action potential is initiated in a muscle cell.
6. Describe the events of muscle cell contraction.
7. Define graded response, tetanus, isotonic and isometric contractions, and muscle tone as these terms apply to a skeletal muscle.
8. Define oxygen deficit and muscle fatigue, and list possible causes of muscle fatigue.
9. Define origin, insertion, prime mover, antagonist, synergist, and fixator as they relate to muscles.
10. Demonstrate or identify the different types of body movements.
11. List some criteria used in naming muscles.
12. Name and locate the major muscles of the human body (do not have to write this one out)
13. Explain the importance of a nerve supply and exercise in keeping muscles healthy.
14. Describe the changes that occur in aging muscles.

Objectives continued- Answer each of the objectives on a separate sheet of paper to demonstrate content mastery. Attach answers to back of packet.

Notes Outline

- I. Muscular system
- II. Characteristics of muscles
- III. Comparison of skeletal, cardiac, and smooth muscles
- IV. Microscopic anatomy of skeletal muscles
- V. Types of muscles contractions
- VI. Muscle tone
- VII. Effect of exercise on muscles
- VIII. Muscles and body movement
- IX. Types of muscles
- X. Naming skeletal muscles
- XI. Head and neck muscles

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1. Nine characteristics of muscle tissue are listed below. Identify the type of muscle by checking the appropriate box(s).

Description	Smooth	Cardiac	Skeletal
Involuntary			
Banded appearance			
Longitudinally and circularly arranged layers			
Dense connective tissue packaging			
Figure-8 packaging			
Coordinated activity to act as a pump			
Moves bones and facial skin			
Referred to as muscular system			
Voluntary			

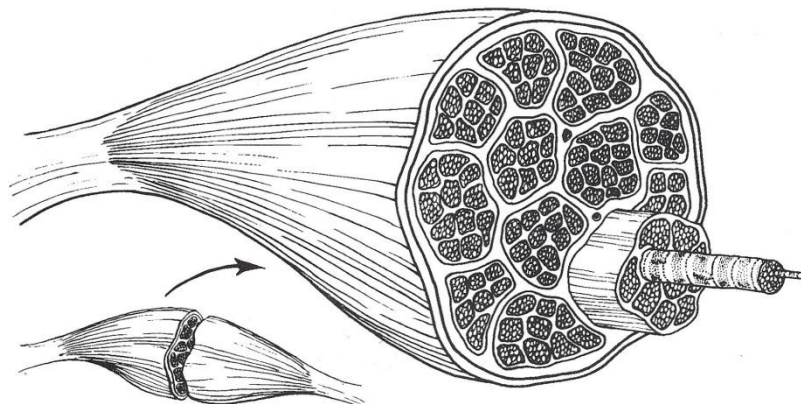
myofilament, myofibril, perimysium, sarcolemma, sarcomere, sarcoplasm, tendon

1. Connective tissue surrounding a fascicle _____
2. Connective tissue ensheathing the entire muscle _____
3. Contractile unit of muscle _____
4. A muscle cell _____
5. Thin connective tissue investing each muscle cell _____
6. Plasma membrane of the muscle cell _____
7. A long, filamentous organelle found within muscle cells that has a banded appearance _____
8. Actin- or myosin-containing structure _____
9. Cordlike extension of connective tissue beyond muscle, serving to attach it to the bone _____
10. A discrete bundle of muscle cells _____

2. Regarding functions of muscle tissue, circle the term in each of the groupings that does not belong with the other terms.

- A. Urine, Food stuffs, Bones, Smooth muscle
- B. Heart, Cardiac muscle, Blood pump, Promotes labor during birth
- C. Excitability, Response to a stimulus, Contractility, Action potential
- D. Ability to shorten, Contractility, Pulls on bones, Stretchability
- E. Maintains posture, Movement, Promotes growth, Generates heat

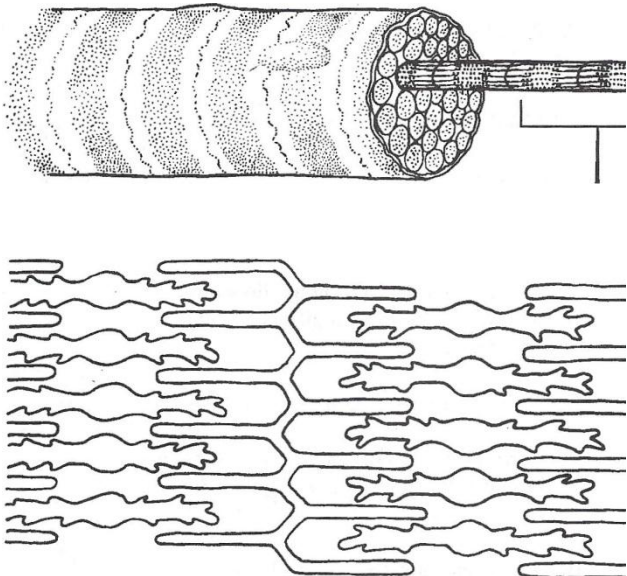
4. Color each of the following:
Endomysium, Epimysium, Fiber, Myofibril, Perimysium, and tendon



3. Identify structures by matching the descriptions. Use the following words:
endomysium, epimysium, fascicle, fiber,

5. Below is a small portion of a relaxed muscle cell. First, select different colors for the structures listed below. Label an A band, an I band, and a sarcomere. .

- Myosin
- Actin filaments
- Z disc



Draw a contracted sarcomere and label same structures, as well as light and dark bands.

6. Looking at your diagram of a contracted sarcomere from a slightly different angle, which region of the sarcomere shortens during contraction- the dark band, the light band or both?

7. Complete the following statements relating to the neuromuscular junction.

A motor neuron and all of the skeletal muscle cells it stimulates is called a _____ . The axon of each motor neuron has numerous endings called _____. The actual gap between an axonal ending and the muscle cell is called a _____. Within the axonal endings are many small vesicles containing a neurotransmitter substance called _____. When the _____ reaches the ends of the axon, the neurotransmitter is released, and it diffuses to the muscle cell membrane to combine with receptors there. Binding of the neurotransmitters with muscle membrane receptors causes the membrane to become permeable to sodium, resulting in the influx of sodium ions and _____ of the membrane. Then contraction of the muscle cell occurs.

8. Number the following statements in their proper sequence to describe the contraction mechanism in a skeletal muscle cell. Step 1 has already been identified.

1.	Acetylcholine is released into the neuromuscular junction by the axonal terminal
	The action potential, carried deep into cell, causes the sarcoplasmic reticulum to release Ca ions
	The muscle cell relaxes and lengthens
	Acetylcholine diffuses across the neuromuscular junction and binds to receptors on the sarcolemma
	The Ca ion concentration at the myofilaments increases; the myofilaments slide past one another , and the cell shortens
	Depolarization occurs, and action potential is generated
	As Ca is actively reabsorbed into the sarcoplasmic reticulum, its concentration at the myofilaments decreases

9. The following statements refer to a muscle cell in the resting state just before polarization. Complete each statement below using the table.

A	Activation of the Na-K pump which moves K into the cell and Na out of the cell	E	Relative ionic concentrations on the two sides of the membrane during rest
B	Na diffuses out of the cell	F	Electrical conditions
C	Inside the cell	G	K diffuses out of the cell
D	Outside the cell	H	Na diffuses into cell

There is a greater concentration of Na _____, and there is a greater concentration of K _____. When the stimulus is delivered, the permeability of the membrane is changed, and _____, initiating the depolarization of the membrane. Almost as soon as the depolarization wave begins, a repolarization wave follows it across the membrane. This occurs as a _____. Repolarization restores the _____ of the resting cell membrane. The _____ is (are) reestablished by _____

10. Complete the following statements by choosing the correct response from the key choices.

Fatigue	Muscle cell	Muscle tone
Isotonic contraction	Isometric contraction	Whole muscle
Tetanus	Few motor units	Many motor units
Repolarization	Depolarization	

1. _____ Is a continuous contraction that shows no evidence of relaxation
2. A(n) _____ is a contraction in which the muscle shortens and work is done
3. To accomplish a strong contraction, _____ are stimulated at a rapid rate
4. When a weak but smooth muscle contraction is desired,

_____ are stimulated at a rapid rate.

5. When a muscle is being stimulated but is not able to respond because of "oxygen debt" the condition is called _____
6. A(n) _____ is a contraction in which the muscle does not shorten, but tension in the muscle keeps increasing.

11. Using the following terms select one of the three ways that muscle cells replenish their ATP supplies

- A. *Coupled reaction of creatine phosphate and ADP*
- B. *Anaerobic glycolysis*
- C. *Aerobic respiration*

1. _____ Accompanied by lactic acid formation
2. _____ Supplies the highest ATP yield per glucose molecule
3. _____ Involves the simple transfer of a phosphate group
4. _____ Requires no oxygen
5. _____ The slowest ATP regeneration process
6. _____ Produces carbon dioxide and water
7. _____ The energy mechanism used in the second hour of running in a marathon
8. _____ Used when the oxygen supply is inadequate over time
9. _____ Good for a sprint

12. Briefly describe how you can tell when you are repaying the oxygen deficit.

13. Which of the following occur within a muscle cell during oxygen debt? Place an X in correct choices

	Decreased ATP		Increased ATP
	Increased lactic acid		Decreased oxygen
	Increased oxygen		Decreased CO ₂
	Increased CO ₂		Increased glucose

14. Complete the following statements. Insert your answer in the blanks.

Standing on your toes as in ballet is _____ of the foot. Walking on your heels is _____. Winding up for a pitch in baseball is _____. To keep your seat when riding a horse, the tendency is to _____ your thighs. In running, the action at the hip joint is _____ in reference to the leg moving forward and _____ in reference to the leg in the posterior position. When kicking a football, the action at the knee is _____. In climbing stairs, the hip and knee of the forward leg are both _____. You have just touched your chin to your chest; this is _____ of the neck. Using a screwdriver with a straight arm requires _____ of the arm. Consider all movements of which the arm is capable. One often used for strengthening all the upper arm and shoulder muscles is _____. Moving the head to signify “no” is _____. Action that moves the distal end of the radius across the ulna is _____. Raising the arms laterally away from the body is called _____ of the arms.

15. Use the terms provided below to describe the manner in which muscles interact with other muscles. *Antagonist, Fixator, Prime mover, Synergist*

1. Agonist _____
2. Postural muscles for most part _____
3. Stabilizes a joint so that the prime mover can act at more distal joints _____
4. Performs the same movement as the prime mover _____
5. Reverses and/or opposes the action of a prime mover _____
6. Immobilizes the origin of a prime mover _____

16. Several criteria are applied to naming of muscles. Match the criteria that pertain to each muscle. Some may have more than one answer

_____ Gluteus maximus	A. Action of muscle
_____ Adductor magnus	B. Shape of muscle
_____ Biceps femoris	C. Location of muscle's origin and or insertion
_____ Transversus abdominis	D. Number of origins
_____ Extensor carpi ulnaris	E. Location of muscle relative to a bone or body region
_____ Trapezius	F. Direction in which the muscle fibers run relative to some imaginary line
_____ Rectus femoris	G. Relative size of the muscle
_____ External oblique	

17. Identify major muscles described below: *Buccinator, frontalis, Masseter, Orbicularis oculi, Orbicularis oris, sternocleidomastoid, Temporalis, Trapezius, Zygomaticus*

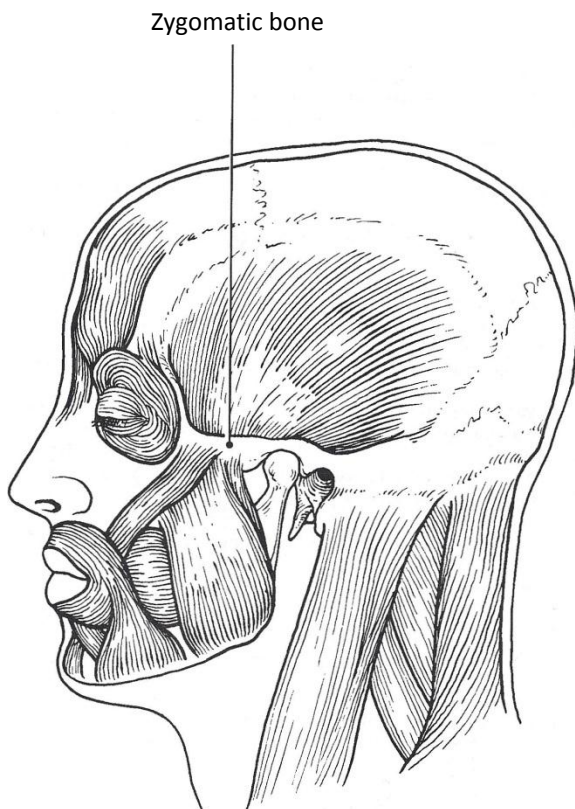
1. Used in smiling _____
2. Used to suck in your cheeks

3. Used in winking _____
4. Used to form the horizontal frown crease on forehead _____
5. The “kissing” muscle _____
6. Prime mover for jaw closer

7. Synergist muscle for jaw closure

8. Prime mover of head flexion; a two-headed muscle _____

18. Color code and label each muscle: *Buccinator, Frontalis, Masseter, Orbicularis oculi, Orbicularis oris, Sternocleidomastoid, Temporalis, Trapezius, Zygomaticus*

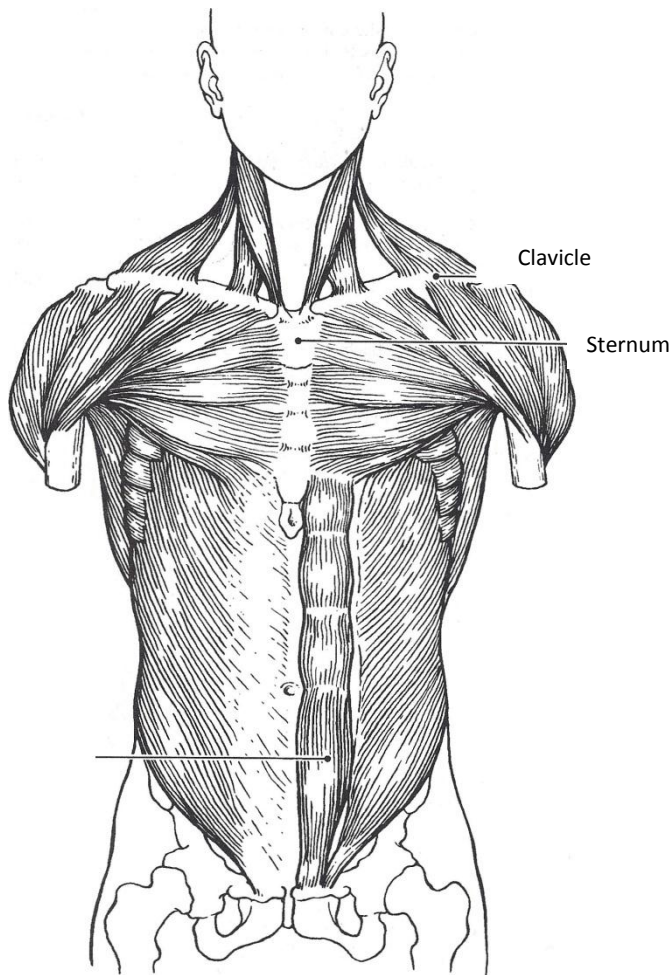


19. Identify major muscles described below; *Deltoid, Diaphragm, external intercostal, external oblique, Internal intercostal, Internal oblique, Latissimus dorsi, Pectoralis major, Rectus abdominis, Sternocleidomastoid, Transversus abdominis*

1. The name means “straight muscle of the abdomen” _____
2. Prime mover for shoulder flexion and adduction _____
3. Prime mover for shoulder abduction _____
4. Part of the abdominal girdle; forms the external lateral walls of the abdomen _____
5. Acting alone, each muscle of this pair turns the head toward the opposite shoulder

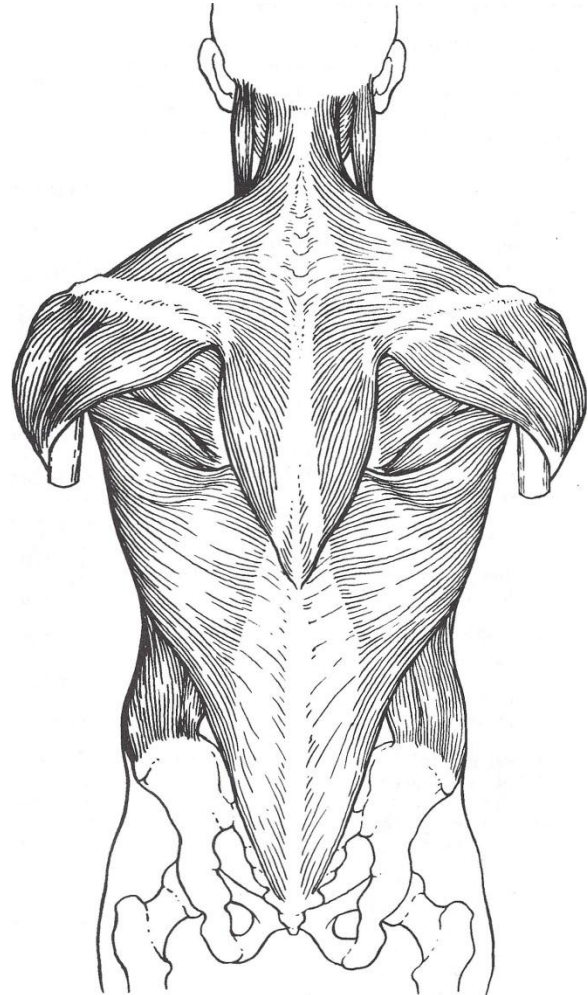
6. Besides the two abdominal muscles (pairs) two muscle pairs that help form the natural pelvic girdle _____, and _____
7. Deep muscles of the thorax that promote the inspiratory phase of breathing _____
8. An unpaired muscle that acts with the muscles name immediately above to accomplish inspiration

20. Color code and label each of the following, on the picture below; *sternocleidomastoid, Deltoid, Pectoralis major, rectus abdominis, external oblique*



- Fleshy muscle forming part of the posterior abdominal wall that helps maintain upright posture

22. Use the following terms to color code and label the picture below; *trapezius*, *deltoid*, *latissimus dorsi*, *quadratus lumborum*



21. Identify the following using the words below; *Deltoid*, *Erector spinae*, *External oblique*, *Gluteus maximus*, *Latissimus dorsi*, *Quadratus lumborum*, *Trapezius*

- Muscle that allows you to shrug your shoulders or extend your head _____
- Muscle that adducts the shoulder and causes extension of the shoulder joint _____
- Shoulder muscle that is the antagonist of the muscle just described _____
- Prime mover of back extension; a deep composite muscle consisting of three columns _____
- Large paired superficial muscle of the lower back _____

23. Identify the following below using the key words; *adductors*, *biceps femoris*, *fibularis muscles*, *gastrocnemius*, *fluteus maximus*, *gluteus medius*, *hamstrings*, *iliopsoas*, *quadriceps*, *rectus femoris*, *sartorius*, *semimembranosus*, *semitendinosus*, *soleus*, *tibialis anterior*, *bastus intermedius*, *vastus lateralis*, *vastus medialis*

1. Hip flexor, deep in pelvis; a composite of 2 muscles

2. Used to extend the hip when climbing stairs _____
3. “Toe dancer’s” muscle; a two-bellied muscle of the calf _____
4. Inverts and dorsiflexes the foot

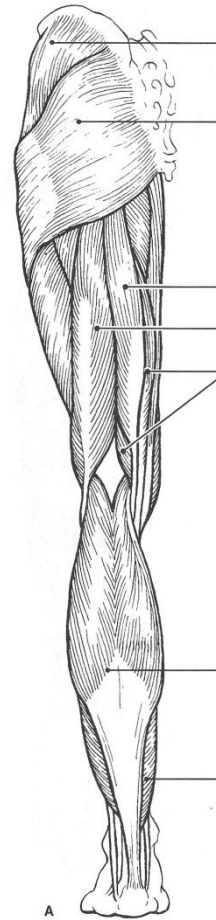
5. Muscle group that allows you to draw your legs to the midline of your body, as when standing at attention

6. Muscle group that extends the knee

7. Muscle group that extends the thigh and flexes the knee _____
8. Smaller hip muscle commonly used as an injection site _____
9. Muscle group of the lateral leg; plantar flex and evert the foot

10. Straplike muscle that is a weak thigh flexor; the “tailors muscle”

11. Like the two-bellied muscle that lies over it, this muscle is a plantar flexor



24. Using the following pictures label where the leader lines indicate, color code them as well.

25. Identify the muscles described below; *Biceps brachii*, *deltoid*, *extensor carpi radialis*, *extensor digitorum*, *Flexor carpi ulnaris*, *flexor digitorum superficialis*, *triceps brachii*

1. Wrist flexor that follows the ulna

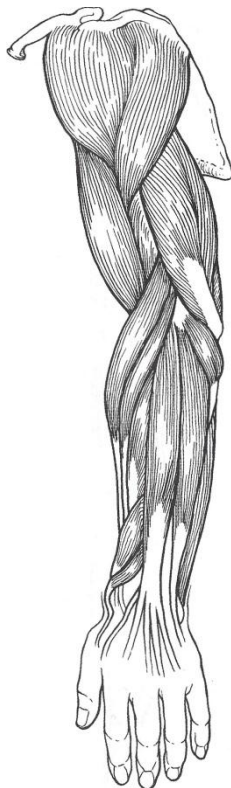
2. Muscle that extends the fingers

3. Muscle the flexes the fingers

4. Muscle that allows you to bend (flex) the elbow) _____
5. Muscle that extends your elbow

6. Powerful shoulder abductor, used to raise the arm overhead

26. Color and label the following picture below using these terms; *deltoid*, *biceps brachii*, *triceps brachii*, *extensor digitorum*, *flexor carpi ulnaris*



27. During an overambitious workout, a high school athlete pulled some muscles by forcing his knee into extension when his hip is already fully flexed. What muscles did he pull?

28. In an emergency appendectomy, the incision was made at the lateral edge of the right iliac abdominopelvic region. Was the rectus abdominis cut?

29. Gregor, who works at a pesticide factory, comes to the clinic complaining of muscle spasms that interfere with his movement and breathing. A blood test shows that he has been contaminated with organophosphate pesticide, which is an acetylcholinesterase inhibitor. How would you explain to Gregor what this means?

Define Chapter 6 Vocabulary

1. Muscle fibers
2. Skeletal muscle
3. Endomysium
4. Perimysium
5. Fascicle
6. Epimysium
7. Aponeuroses
8. Smooth muscle
9. Cardiac muscle
10. Sarcolemma
11. Myofibrils
12. Light (I) band
13. Dark (A) band
14. Sarcomeres
15. Myofilaments
16. Thick filaments
17. Myosin
18. Cross bridges
19. Thin filaments
20. Actin
21. Sarcoplasmic reticulum
22. Motor unit
23. Axon
24. Axon terminals
25. Neuromuscular junctions
26. Neurotransmitter
27. Acetylcholine
28. Synaptic cleft
29. Action potential
30. Graded response
31. Creatine phosphate
32. Aerobic respiration