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

<table>
<thead>
<tr>
<th>Description</th>
<th>Smooth</th>
<th>Cardiac</th>
<th>Skeletal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involuntary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banded appearance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinally and circularly arranged layers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dense connective tissue packaging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Figure-8 packaging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordinated activity to act as a pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moves bones and facial skin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Referred to as muscular system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voluntary</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Acetylcholine is released into the neuromuscular junction by the axonal terminal</td>
</tr>
<tr>
<td>2.</td>
<td>The action potential, carried deep into cell, causes the sarcoplasmic reticulum to release Ca ions</td>
</tr>
<tr>
<td>3.</td>
<td>The muscle cell relaxes and lengthens</td>
</tr>
<tr>
<td>4.</td>
<td>Acetylcholine diffuses across the neuromuscular junction and binds to receptors on the sarcolemma</td>
</tr>
<tr>
<td>5.</td>
<td>The Ca ion concentration at the myofilaments increases; the myofilaments slide past one another, and the cell shortens</td>
</tr>
<tr>
<td>6.</td>
<td>Depolarization occurs, and action potential is generated</td>
</tr>
<tr>
<td>7.</td>
<td>As Ca is actively reabsorbed into the sarcoplasmic reticulum, its concentration at the myofilaments decreases</td>
</tr>
</tbody>
</table>
9. The following statements refer to a muscle cell in the resting state just before polarization. Complete each statement below using the table.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activation of the Na-K pump which moves K into the cell and Na out of the cell</td>
<td>Na diffuses out of the cell</td>
<td>Inside the cell</td>
<td>Outside the cell</td>
<td>Relative ionic concentrations on the two sides of the membrane during rest</td>
<td>Electrical conditions</td>
<td>K diffuses out of the cell</td>
<td>Na diffuses into cell</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Fatigue</th>
<th>Muscle cell</th>
<th>Muscle tone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isotonic contraction</td>
<td>Isometric contraction</td>
<td>Whole muscle</td>
</tr>
<tr>
<td>Tetanus</td>
<td>Few motor units</td>
<td>Many motor units</td>
</tr>
<tr>
<td>Repolarization</td>
<td>Depolarization</td>
<td></td>
</tr>
</tbody>
</table>

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,

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

<table>
<thead>
<tr>
<th>Decreased ATP</th>
<th>Increased ATP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased lactic acid</td>
<td>Decreased oxygen</td>
</tr>
<tr>
<td>Increased oxygen</td>
<td>Decreased CO2</td>
</tr>
<tr>
<td>Increased CO2</td>
<td>Increased glucose</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Gluteus maximus</th>
<th>A. Action of muscle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adductor magnus</td>
<td>B. Shape of muscle</td>
</tr>
<tr>
<td>Biceps femoris</td>
<td>C. Location of muscle’s origin and or insertion</td>
</tr>
<tr>
<td>Transversus abdominis</td>
<td>D. Number of origins</td>
</tr>
<tr>
<td>Extensor carpi ulnaris</td>
<td>E. Location of muscle relative to a bone or body region</td>
</tr>
<tr>
<td>Trapezius</td>
<td>F. Direction in which the muscle fibers run relative to some imaginary line</td>
</tr>
<tr>
<td>Rectus femoris</td>
<td>G. Relative size of the muscle</td>
</tr>
<tr>
<td>External oblique</td>
<td>H. Location of muscle relative to some imaginary line</td>
</tr>
</tbody>
</table>
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
21. Identify the following using the words below; *Deltoid, Erector spinae, External oblique, Gluteus maximus, Latissimus dorsi, Quadratus lumborum, Trapezius*

1. Muscle that allows you to shrug your shoulders or extend your head

2. Muscle that adducts the shoulder and causes extension of the shoulder joint

3. Shoulder muscle that is the antagonist of the muscle just described

4. Prime mover of back extension; a deep composite muscle consisting of three columns

5. Large paired superficial muscle of the lower back

22. Use the following terms to color code and label the picture below; *trapezius, deltoid, latissimus dorsi, quadratus lumborum*
23. Identify the following below using the key words; *adductors, biceps femoris, fibularis muscles, gastrocnemius, flubeus maximus, gluteus medius, hamstrings, iliopsoas, quadriceps, rectus femoris, sartorius, semimembranousus, semitendinosus, soleus, tibialis anterior, vastus 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 that 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 an 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. Fasicle
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