1. Types of Muscle Tissues

Match the types of muscle tissues with the words and phrases.

1) Skeletal  
2) Smooth  
3) Cardiac

1, 3  Striated  
2, 3  Single nucleus  
2, 3  Involuntary  
3  Intercalated disks  
3  Branching network

2  Walls of blood vessels  
3  Heart muscle  
2  Walls of digestive tract  
1  Skeletal muscles  
1  Easily fatigued

2. Structure of Skeletal Muscle

Write the terms that match the statements in the spaces at the right.

1) A bundle of fibers enveloped by connective tissue.
2) Binds all fasciculi together.
3) Connective tissue covering entire muscle.
4) Cordlike attachment of a muscle.
5) Sheetlike attachment of a muscle.
6) Plasma membrane of muscle cell.
7) Cytoplasm of a muscle cell.
8) Threadlike contractile elements.
9) Thinner protein filaments in myofibrils.
10) Thicker protein filaments in myofibrils.
11) Portion of a myofibril between Z lines.
12) Light and dark bands on myofibrils.
13) Attachment of motor axon to sarcolemma.
14) Depression in sarcolemma receiving axon tip.
15) Motor neuron and its attached muscle fibers.

3. Physiology of Muscle Contraction

a. Write the words that complete the sentences in the spaces at the right.

The axon tip of an activated motor neuron releases  
____1____ into the ____2____, where it combines  
with ____3____ on the sarcolemma. This stimulates  
the release of ____4____ from storage areas, which  
exposes the active sites on ____5____ filaments.  
Cross-bridges of ____6____ attach to the exposed ac-
tive sites and exert a power stroke, which pulls  
the ____7____ filaments and the Z lines toward the  
center of the A band. This process is rapidly re-
peated until ____8____ is complete.

1) Acetylcholine  
2) Synaptic cleft  
3) Receptors  
4) Calcium ions  
5) Actin  
6) Myosin  
7) Actin  
8) Contraction
b. Write the terms that match the statements in the spaces provided.

1) Decomposes acetylcholine. **Cholinesterase**
2) Combines with oxygen to store small amounts of oxygen in muscle cells. **Myoglobin**
3) Phase of cellular respiration that requires oxygen. **Aerobic**
4) Products of pyruvic acid breakdown when adequate oxygen is present. **CO₂, H₂O, energy**
5) Acid formed from pyruvic acid when adequate oxygen is not available. **Lactic acid**
6) Provides direct energy for muscle contraction. **ATP**
7) Process releasing energy from nutrients in cells. **Cellular respiration**
8) Chemical whose accumulation produces an oxygen debt. **Lactic acid**
9) Released from creatine phosphate to quickly re-form ATP. **High energy phosphate**

c. Write the terms that match the statements in the spaces at the right.

1) Smallest stimulus causing a contraction. **Minimal or threshold**
2) Activation of a muscle fiber causes a (all-or-none, graded) contraction. **All-or-none**
3) Primary cause of fatigue. **Lactic acid**
4) Type of contractions observed in whole muscles (all-or-none, graded). **Graded**
5) Smallest stimulus that activates all motor units of a muscle. **Maximal**
6) Activation of an increasing number of motor units in a series of contractions. **Recruitment**
7) Controls the number of motor units that are activated. **Nervous system**
8) State of constant, partial contraction. **Muscle tone**
9) State of constant, complete contraction. **Tetanus**

4. Actions of Skeletal Muscles

a. Write the terms that match the statements in the spaces provided.

1) Fixed end of a muscle. **Origin**
2) Movable end of a muscle. **Insertion**
3) Muscles opposing agonists. **Antagonists**

b. Write the names of the muscles that match the actions.

1) Closes and puckers lips. **Orbicularis oris**
2) Pulls angle of mouth upwards. **Zygomaticus**
3) Helps masseter raise the mandible. **Temporalis**
4) Compresses cheeks. **Buccinator**
5) Pair of neck muscles that flex head. **Sternocleidomastoid**
6) Pair of neck muscles that extend head.  
7) Innermost muscle of abdominal wall.  
8) Raises ribs during inspiration.  
9) Elevates clavicle and scapula.  
10) Draws scapula downward and anteriorly.  
11) Adducts and draws humerus across chest.  
12) Sheetlike muscle of lower back that adducts and extends humerus.  
13) Abducts, flexes, and extends humerus.  
14) Rotates humerus laterally.  
15) Assists deltoid in abducting humerus.  
16) Assists latissimus dorsi.  
17) Assists biceps brachii (two muscles).  

18) Extends forearm.  
19) Flexes and rotates forearm laterally.  
20) Flexes and abducts wrist.  
21) Flexes and adducts wrist.  
22) Extends fingers.  
23) Extends and adducts wrist.  
24) Extends and abducted wrist.  
25) Adducts, flexes, and rotates thigh laterally (two muscles).  

26) Abducts and rotates thigh medially.  
27) Extends and rotates thigh laterally.  
28) Flexes and abducts thigh.  
29) Flexes thigh only (two muscles).  

30) Flexes leg and thigh.  
31) Flexes leg and adducts thigh.  
32) Group of four muscles that extend leg.  
33) Three muscles that flex the leg and extend the thigh.  

34) Dorsiflexes and inverts foot.  
35) Flexes leg and plantar flexes foot.  
36) Extends toes and dorsiflexes and everts foot.  
37) Plantar flexes and everts foot.
5. Major Skeletal Muscles

Label the muscles and associated structures in the following diagrams by writing the names of the labeled parts in the spaces provided. After labeling, color-code the muscles to help you to distinguish them.

Head and Neck
1) Epicranial aponeurosis
2) Frontalis
3) Occipitalis
4) Epicranius
5) Masseter
6) Splenius capitus
7) Sternocleidomastoid
8) Temporalis
9) Orbicularis oculi
10) Zygomaticus
11) Buccinator
12) Orbicularis oris
13) Platysma

Anterior Trunk
1) Sternocecidomastoid
2) Pectoralis minor
3) Internal intercostal
4) Serratus anterior
5) Rectus abdominus
6) Internal oblique
7) Transversus abdominus
8) Trapezius
9) Deltoid
10) Pectoralis major
11) Linea alba
12) External oblique
13) Aponeurosis of external oblique
Posterior Trunk
1) Trapezius
2) Deltoid
3) Latissimus dorsi
4) Levator scapuli
5) Supraspinatus
6) Infraspinatus
7) Teres minor
8) Teres major
9) Rhomboideus major

Anterior Forearm
1) Biceps brachii
2) Brachialis
3) Brachioradialis
4) Extensor carpi radialis longus
5) Flexor carpi radialis
6) Palmarus longus
7) Flexor carpi ulnaris
Posterior Forearm
1) Triceps brachii
2) Brachioradialis
3) Extensor carpi radialis longus
4) Flexor carpi ulnaris
5) Extensor digitorum
6) Extensor carpi ulnaris

Anterior Thigh
1) Psoas major
2) Iliacus
3) Tensor fasciae latae
4) Sartorius
5) Rectus femoris
6) Vastus lateralis
7) Adductor longus
8) Adductor magnus
9) Gracilis
10) Vastus medialis
Posterior Thigh
1) __Adductor magnus__________
2) __Gracilis__________________
3) __Semiteudinosus____________
4) __Semimembranosus___________
5) __Gastrocnemius_____________
6) __Gluteus medius____________
7) __Gluteus maximus___________
8) __Biceps femoris_____________

Anterior Leg
1) __Peroneus longus____________
2) __Tibialis anterior___________
3) __Extensor digitorum longus__
4) __Patella____________________
5) __Patellar ligament___________
6) __Gastrocnemius______________
7) __Soleus_____________________
Lateral Leg
1) Biceps femoris
2) Gastrocnemius
3) Soleus
4) Peroneus longus
5) Calcaneal tendon
6) Vastus lateralis
7) Tibialis anterior
8) Extensor digitorum longus

6. Disorders of the Muscle System
Write the names of the disorders in the spaces provided.
1) Inflammation of connective tissues of muscles.
2) Involuntary, tetanic contraction of a muscle.
3) Antibodies attach to acetylcholine receptors, preventing normal stimulation of muscles.
4) Inflammation of muscle tissue.
5) A pulled muscle.
6) Abnormal increase of fibrous connective tissue in a muscle.
7) Viral disease that destroys motor neurons and paralyzes skeletal muscles.
8) Group of diseases characterized by the progressive degeneration of muscles.
9) A bacterial disease that prevents the release of acetylcholine from axon tips.
10) A bacterial disease commonly called “lockjaw.”
11) Sudden, involuntary weak contractions of a muscle or group of muscles.

<table>
<thead>
<tr>
<th>Disorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibrositis</td>
</tr>
<tr>
<td>Cramp</td>
</tr>
<tr>
<td>Myasthenia gravis</td>
</tr>
<tr>
<td>Myositis</td>
</tr>
<tr>
<td>Strain</td>
</tr>
<tr>
<td>Fibrosis</td>
</tr>
<tr>
<td>Poliomyelitis</td>
</tr>
<tr>
<td>Muscular dystrophy</td>
</tr>
<tr>
<td>Botulism</td>
</tr>
<tr>
<td>Tetanus</td>
</tr>
<tr>
<td>Spasms</td>
</tr>
</tbody>
</table>
7. Clinical Applications

a. The accumulation of lactic acid can make muscles sore. Would heat or cold applications be best to alleviate the soreness? **Heat**. Explain. ___Heat increases blood flow to the affected area which speeds up removal of waste products.___

b. While playing tennis, Jim had a sudden pain on the back of his left thigh. Was this a sprain or a strain? _____ A strain. _____ What muscles were probably involved? _____ Biceps femoris, semimembranosus & semitendinosus

c. Tom has been working out to build up his muscles. At the microscopic level, how does a muscle increase in size and strength? **Heavy exercise increases the number of myofibrils in muscle fibers (cells).**