Lab #14H  The Muscular System

Pre-Lab Discussion

Muscle tissue consists of groups of cells that are specialized for contraction. In the body, muscle tissue is usually organized into organs called muscles. Muscle contains connective tissue, nerves, and blood vessels in addition to muscle tissue. Although the term muscle often refers to the entire organ, it is also frequently used to refer to muscle tissue alone. There are three different types of muscle tissue in the bodies of humans and other vertebrates: skeletal, smooth, and cardiac.

Skeletal muscles are attached to bones, cover the skeleton, give shape to the body, and make movement possible. The individual cells in skeletal muscle are often called fibers rather than cells because they are long and thin and quite different in structure from typical cells. Skeletal muscle fibers are larger than most cells (as much as 40 cm in length!), contain many nuclei, and have transverse stripes that are visible when fibers are viewed under a microscope. Because of these stripes, or striations, skeletal muscle is called striated muscle. Skeletal muscle is also known as voluntary muscle because it is under conscious control.

Smooth muscle is very prominent in the walls of the stomach, intestine, and urinary bladder. Smooth muscle also occurs in the walls of blood vessels, in glands, and in the skin. The cells of smooth muscle are spindle-shaped, have individual nuclei, and are not striated. Smooth muscle is also called involuntary muscle because it is not under conscious control.

Cardiac muscle is found only within the walls of the heart. Like smooth muscle, cardiac muscle is not under conscious control—it is a type of involuntary muscle. Like skeletal muscle, cardiac muscle is striated—the cells in cardiac muscle are striped. Cardiac muscle cells contain one nucleus and form branching fibers with adjacent cardiac muscle cells.

In this investigation, you will observe prepared slides of the three types of muscle cells. You will also examine a chicken wing to observe its muscle structure.

Problem

How is the human muscular system organized?

Materials

Prepared slides of skeletal, smooth, and cardiac muscle

Microscope  Dissecting Kit

Whole chicken wing

Dissecting Tray

Adapted from Muscular System, Prentice-Hall, Inc.
Procedure A. Examining Three Types of Muscle Cells

1. Observe a prepared slide of skeletal muscle under low power of the microscope, switch to medium, and finally high power.
2. Count the number of nuclei that are contained within one skeletal muscle fiber. Note whether this cell has striations (stripes). Observe the cell shape. Classify the skeletal muscle as voluntary or involuntary. Record the information in the appropriate place in the data table.
3. In the appropriate place in the Observations, sketch a few skeletal muscle fibers that you observed under high power. Label the nucleus, cell membrane, cytoplasm, and striations. Record magnification of the microscope.
4. Repeat steps 1 through 3 for a slide of smooth muscle.
5. Repeat steps 1 through 3 for a slide of cardiac muscle.

Procedure B. Examining Muscle in a Chicken Wing

1. Rinse the chicken wing under running water. Dry it thoroughly with a paper towel and place in dissecting tray.

2. Remove the skin from the chicken wing. With forceps, grasp the skin near the shoulder and pull the skin away from the underlying muscles. Use scissors to cut the skin along the entire length of the chicken wing. CAUTION: Be careful when cutting with sharp instruments. Cut in a direction away from the body. Make sure to cut the skin exactly as shown in figure 1. Note: Be careful not to cut through underlying muscle with scissors.

3. Carefully pull off the skin. Observe the fascia, the transparent connective tissue that surrounds the muscles and hold the muscles to the skin. With a probe, gently separate the fascia from the skin. Note: The skin covering is difficult to remove at the joints. Work carefully, using scissors to remove the skin. Remove the skin up to the second joint. It is not necessary to remove the skin from the wing tip. Cut away the excess skin around the second joint. Discard the skin according to teacher instructions. Note: You may want to wash your hands and the chicken wing at this time.

Figure 1

http://www.manhattan.k12.ca.us/staff/pware/labs/ChickenWingDissection.pdf

Adapted from Muscular System, Prentice-Hall, Inc.
4. Observe the muscles in the chicken wing. Observe the tendons, the shiny white cords of connective tissue at the ends of the muscle. Tendons attach muscle to bone.

5. Grasp the wing by the shoulder and the wing tip. As you bend and straighten the wing, notice how the muscles contract and move. Locate and identify antagonistic muscles, which are pairs of muscles that work in opposition to each other. Thoroughly wash hands with soap and water.

6. In the appropriate place in Observations, sketch the muscles and bones of the chicken wing. Label the bones; humerus, ulna, and radius, the muscles; biceps brachii, and triceps, as well as the tendons.

7. Examine figure 2, which shows the muscles and bones of the human arm. The elbow joint which is a hinge joint, similar to the joint in the chicken wing. On figure 2, locate the tendons that attach muscles to bones. As a muscle contracts, the attachments either remain stationary or move. The attachment end that moves is called the insertion. The attachment end that remains stationary is called the origin. Locate the origin and insertion in the chicken wing.

8. Dispose of chicken wing according to teacher instruction. Wash, dry and put away the dissecting tools you used as part of the investigation. Wash and dry hands thoroughly.
### Observations

#### Data Table

<table>
<thead>
<tr>
<th>Type of Muscle</th>
<th>Number of Nuclei per Cell</th>
<th>Striations</th>
<th>Cell Shape</th>
<th>Voluntary or Involuntary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skeletal</td>
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<tr>
<td>Smooth</td>
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<tr>
<td>Cardiac</td>
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Magnification __________  Magnification __________  Magnification __________

Skeletal Muscle  Smooth Muscle  Cardiac Muscle

Chicken Wing

Adapted from Muscular System, Prentice-Hall, Inc.
Analysis and Conclusions

1. a. How are skeletal muscle tissue and smooth muscle tissue similar?

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b. How are they different?

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2. How does smooth muscle tissue differ from the other two types of muscle tissue?

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3. Where in the body are each of the three types of muscle tissue found?
   
a. Skeletal muscle tissue______________________________

   b. Cardiac muscle tissue______________________________

   c. Smooth muscle tissue______________________________

4. What enables the chicken wing to move?

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5. How might injury to one of the muscles in the antagonistic muscle pair affect movement?

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Critical Thinking and Application

1. What effect will tearing a tendon have on its corresponding muscle? How could this situation be repaired?

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2. Suppose smooth muscles rather than skeletal muscle were attached to the skeleton and given *voluntary* control. How might the movement of the skeleton be affected?

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3. Why would a bird be unable to fly if there was some damage to the nerve in the wing?

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http://www.istockphoto.com/file_thumbview_approve/5804755/2/istockphoto_5804755-chicken-cartoon.jpg