Chicken Wing Lab: Tissues and Muscular System

Background

Skeletal muscle is the most abundant tissue in the body of healthy adults, comprising anywhere from about 30 to 50% of total body mass. The amount of muscle mass varies due to age, sex, and physical activity. For example, adolescent males have a dramatic increase in the amount of muscle mass because of rising levels of testosterone which targets skeletal muscle cells and causes them to hypertrophy (grow). In contrast, both men and women lose muscle mass in old age, whereas relative proportions of body fat increase. At every stage of life, females have more body fat than males and correspondingly less muscle relative to body mass. Elite athletes have low levels of fat compared to lean body mass, most of which is muscle. The amount of muscle is important because it relates to more than just movement—it plays a role in homeostasis of blood sugar, body temperature and energy balance.

Movement occurs when muscle cells (fibers) shorten, or contract. At the molecular level, the motor proteins myosin and actin interact to pull the ends of cells closer together. A whole muscle such as the biceps brachii is comprised of millions of cells that work together to pull on connective tissue and bone and produce movement at joints.

An entire muscle is covered with a saran wrap-like connective tissue sheath called the epimysium, or deep fascia. Within the muscle, bundles of cells (fascicles) are surrounded by thin layers of connective tissue (perimysium) that serve as pathways for nerves and blood vessels. Individual fibers are further packaged in layers of endomysium. The connective tissue permits penetration of tiny blood vessels that supply the energetically demanding cells. In addition, recent research suggests that mechanical forces transmitted through connective tissue interact with the sarcolemma (plasma membrane) and cause physiological changes in the cell, including stimulation of protein synthesis. The endomysium, perimysium, and epimysium converge to form thick, ropelike structures, the tendons, which connect the muscles to bones.

Pre-Lab Questions

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What factors contribute to variation in muscle mass?</td>
</tr>
<tr>
<td>2. What proteins are responsible for movement?</td>
</tr>
<tr>
<td>3. Describe the four connective tissue components in a skeletal muscle.</td>
</tr>
<tr>
<td>4. Create a list of safety precautions and skills that should be used when working in groups and in a lab.</td>
</tr>
<tr>
<td>5. List (at least three) ways the muscular, skeletal and integument systems interact.</td>
</tr>
</tbody>
</table>
Purpose
The purpose of this exercise is to practice manipulating dissecting equipment and become familiar with organs and tissues found throughout the body of animals.

Background Information
A bird’s wing is made up of groups of tissues and organs working together to perform a job. Before beginning the dissection, review the functions performed by the tissues and organs.

- **Skeletal muscles** are attached to bones.
- **Skin** is the membranous tissue that forms the outer covering of the body that provides a protective barrier from the outside environment.
- **Muscle tissue** is composed of bundles of skeletal muscle fibers. When these tissues expand and contract they produce motion in the wing.
- **Fatty tissue**, when stored on the underside of the skin, helps to keep the body warm, cushion and protect other body tissues, and stores vitamins A, D, E, and K.
- **Blood vessels** are the arteries, veins, and capillaries, which transport blood throughout the body. Capillaries are too small to be seen without a microscope. Arteries have thicker walls than veins.
- **Tendons** are especially strong connective tissue that attaches skeletal muscle to bones.
- **Cartilage** helps prevent neighboring bones from grinding against each other.
- **Bone** provides structural support and manufactures red blood cells.
- **Nerves** are the bundles of fibers that transmit sensory stimuli and motion impulses.
- **Ligaments** are strong bands of connective tissue that connect two bones together.

Chicken Wings are homologous to the upper limb of humans; that is, they have many of the same structures.

Procedure
Materials
1. One raw chicken wing for each student. Chicken wings can be purchased at the local supermarket in the ‘inexpensive’ family pack.
2. Scissors
3. Paper plate
4. Tweezers or forceps

Sequence of Steps
Read the description of each of the tissues or organs and then begin the dissection for that particular tissue/organ. In the box provided, sketch an illustration of each tissue/organ listed in this lab.
**SKIN** – The skin is the external covering of the entire wing. The skin will have a web-like appearance between the bones. Look for evidence that the skin was covered with feathers. Cut a slit in the skin covering the largest bone and joint.

Which joint in your body corresponds to this joint in the chicken wing?

________________________________________________________________________

How does skin provide nonspecific defenses against infection?________________________________________________________________________
________________________________________________________________________

**CONNECTIVE TISSUE** – First lift a corner of the skin and, with tweezers or forceps, peel it back gently from the muscle. Notice the shiny, thin, membrane that surrounds the muscle and attaches the muscle to the skin. What is this connective tissue layer called?

__________

**MUSCLE TISSUE** – Note the pink-orange bundles of fibers attached to the bone. This is skeletal muscle tissue.

**FATTY TISSUE** – Continue to peel back the skin slowly and gently until you locate a tissue between the skin and muscle that is yellow in color and greasy to the touch. If no fatty tissue can be found there, find a thick piece of skin and proceed to cut through it to see if there is any fatty tissue. If the lab is utilizing store-bought chicken wings, it is possible that little or no fat can be observed.

**BLOOD VESSELS** – With the skin peeled back, scan the surface of the skeletal muscles for thin red tubes. These are blood vessels. Arteries and veins might also be located in bundles of connective tissue with nerves.

**TENDONS** – Look at the top of the large bone. Notice the shiny white piece of connective tissue that attaches skeletal muscle to bone. These are tendons.
**CARTILAGE** – Examine the top of the large bone. Locate a pearly white hard tissue found at the ends of the long bones. This is cartilage.

**BONE** – Cut through the muscle with your scissors to expose the hard white bone. Bones are hard (but not solid) tissue made up primarily of calcium and phosphorus. The scissors will not be able to cross-sect the bone. Ask the instructor to cut the bone. Look into the cross-section of the bone; the mass of red tissue is red marrow. It is the red marrow that manufactures red blood cells. Notice the bone surrounding the red marrow. The bone itself is not solid, but is an asymmetrical lattice work of calcium and phosphorus.

**NERVES** – Nerves are usually found buried deep within an organism, often lying close to long bones. Sometimes an artery, vein, and nerve are held together in one bundle of connective tissue. Gently peel the muscle from the long bone and search carefully for a thin white threadlike tissue. This is a nerve. If this does not work, look for a bundle of connective tissue containing blood vessels. Gently pry it apart and search for the nerve.

**LIGAMENTS** – Cut through the skin and muscle down to the joint between the long bone and the center bone. Locate the strong white bands of connective tissue that connect the two bones together at the joint. This is a ligament.

Notice the attachment points of the muscles. The origin is nearer the chest, whereas the insertion is on the forearm bones, distal to the elbow joint.
Straighten the chicken wing and hold it horizontally above the tray. Pull on each of the muscles and note the movement that each muscle causes. Turn the wing upside down and bend the joints. Again pull on each muscle and note how the bones move.

Observations (Describe what happened when you pulled on each muscle):

_________________________________________________________________________________________________
_________________________________________________________________________________________________

CLEAN UP!!

Check your understanding: Answer the following questions based on your dissection of the chicken wing

1. List five specific tissues that you examined in the chicken wing. Then describe the structure and function of each.
2. What have you learned about how the muscular, skeletal and integument systems interact?
3. How do the structures of the human and animal body (such as muscle tissue, fatty tissue, skin, etc) help keep the internal environment relatively stable?