Chapter Five

Muscular System – Part I

Day One:

Today, your child should complete their reading and practice problems for the week.

Below are the supplies for this week's lab:

Protective gloves and goggles
Scissors
Sharp knife
Paper towels
Tweezers or a toothpick
Uncooked whole chicken wing (not "party wings" or wing sections)

National Science Education Standards covered this week:

12CLS1.6 Cells can differentiate, and complex multicellular organisms are formed as a highly organized arrangement of differentiated cells.

Definitions

abduction	movement away from the midline of the body
adduction	movement toward the midline of the body
biceps	muscles which attached to both the shoulder and elbow joints within our upper arm; responsible for the act of lifting objects
deltoids	a group of muscles on your shoulders ; responsible for abduction, horizontal abduction and adduction; flexion/extension, and medial/lateral rotation
erector spinae	a group of muscles located on each side of the spinal column along the lumbar, thoracic, and cervical regions; extends the back to a straightened position
extension	increasing the angle between two bones
flexion	decreasing the angle between two bones
gastrocnemius	calf muscle; assists the hamstrings to flex the knees
gluteals	buttocks; a group of three muscles which move the hip joints and are responsible for the lateral rotation of the hip
hamstrings	group of muscles in the posterior side of the upper leg; responsible for extension of the hip and flexion of knee joints
hyperextension	extension of a joint beyond its normal range of motion
internal and external obliques	muscles within the abdomen responsible for the flexion of the spine and allows the body to bend from side to side
latissimus dorsi (lat)	a large muscle located on the back; responsible for extension, adduction, and medial rotation at shoulder joint
pectoralis major	muscles found in your upper chest ; responsible for adduction, horizontal adduction, flexion/extension, and medial rotation at the shoulder joint
quadriceps	a group of four muscles in the anterior side of the upper leg; responsible for extension of the knee joint and flexion of hip

rectus abdominus	one of several muscles found in the abdomen; anterior to the spine and responsible for its flexion
rotation	turning around an axis
scapula	shoulder blades
sternocleidomastoid (SCM)	two muscles located on the side of the neck responsible for rotation, flexion, and lateral flexion of head/neck
trapezius	muscles found towards the upper posterior area of neck and are connected to the scapula; responsible for rotation, extension and lateral flexion of head/neck
triceps	muscles in the upper arm which allow us to lower objects through the motions of the elbow and/or shoulders

Sample questions to ask your child after completing the weekly reading.

Moving your head back to its resting position is known as what type of body movement?

Moving the head back to its resting position would be considered extension.

How are abduction and adduction different?

Abduction involves the movement away from the midline of the body while adduction is a movement towards the midline of the body.

What muscles control the flexion and extension of the elbow?

The biceps cause the flexion of the elbow while the triceps control its extension.

What two muscles are responsible for the adduction of the shoulder and what group of muscles control its abduction?

The latissimus dorsi and pectoralis major both control the adduction of the shoulder while the deltoids are responsible for its abduction.

Day Two:

Your child should check their work on the practice worksheets today with the answer key on the next page.

In addition, your child should read the lab activity and start collecting all of the necessary materials!

Answer Key for Practice Problems

Vocabulary Review

1) quadriceps
2) erector spinae
3) deltoids
4) latissimus dorsi (lat)
5) gluteals
6) gastrocnemius
7) flexion
8) hamstrings
9) extension
10) abduction
11) adduction
12) pectoralis major
13) trapezius
14) triceps
15) biceps
16) obliques
17) rectus abdominus
18) scapula
19) rotation
20) sternocleidomastoid (SCM)

Multiple Choice/True False

1) C
2) D
3) D
4) E
5) A
6) T
7) F

Application Questions

The muscles that flex the head also oppose extension of the neck. In an accident causing hyperextension of the neck, these muscles could be stretched and torn. The muscle that flexes the head is the sternocleidomastoid. The trapezius would not be damaged as it extends the head.

Automobile headrests are designed so that, if adjusted correctly, the back of the head hits the headrest during a rear-end accident, thereby preventing hyperextension of the neck.

Day Three: Lab Activity

Your child should have already read through this lab and has been reviewing all of this week's vocabulary words.

Collect your supplies for the lab:

Protective gloves and goggles
Scissors
Sharp knife
Paper towels
Tweezers or a toothpick
Uncooked whole chicken wing (not "party wings" or wing sections)

The Dissection of Dinner

*Is **that** where a chicken nugget comes from?*

The similarities between a chicken wing and a human arm will be examined.

Materials:

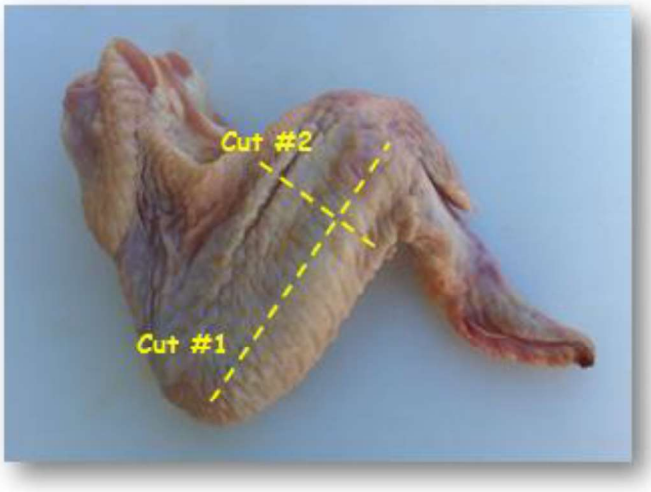
Protective gloves and goggles
Scissors
Sharp knife
Paper towels
Tweezers or a toothpick
Uncooked whole chicken wing (not "party wings" or wing sections)

Procedure:

Put on your goggles and gloves.

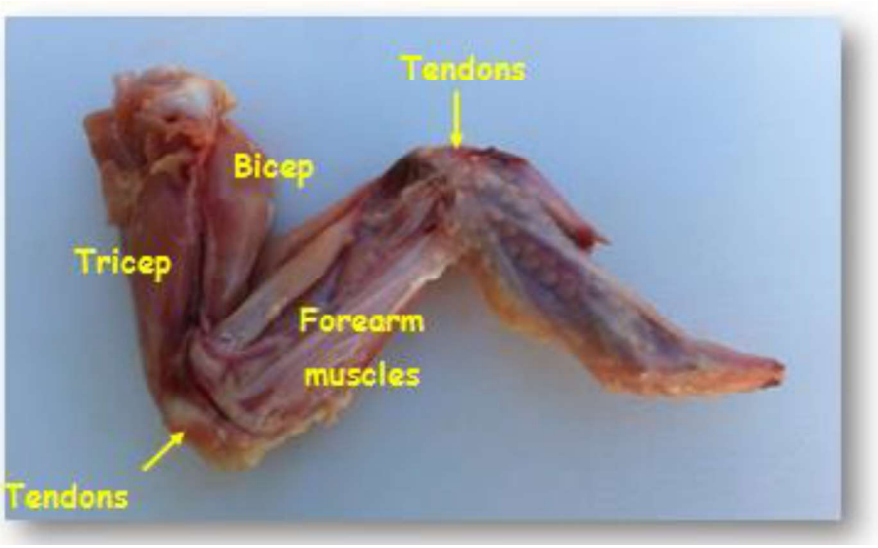
Rinse the wing with water and dry it completely. Compare your wing with the following image and identify the major parts of the limb:

Slip the scissors between the skin and muscle tissue at the end of the forearm. Cut the skin along the forearm and the lower arm. Then make two perpendicular cuts from the first cut you made towards the middle of the forearm. Use the following picture as a guide:



Peel back the skin making certain not to damage any of the tissues of the wing. You may have to use the knife to gently cut through any tissues which attach the skin to the muscles.

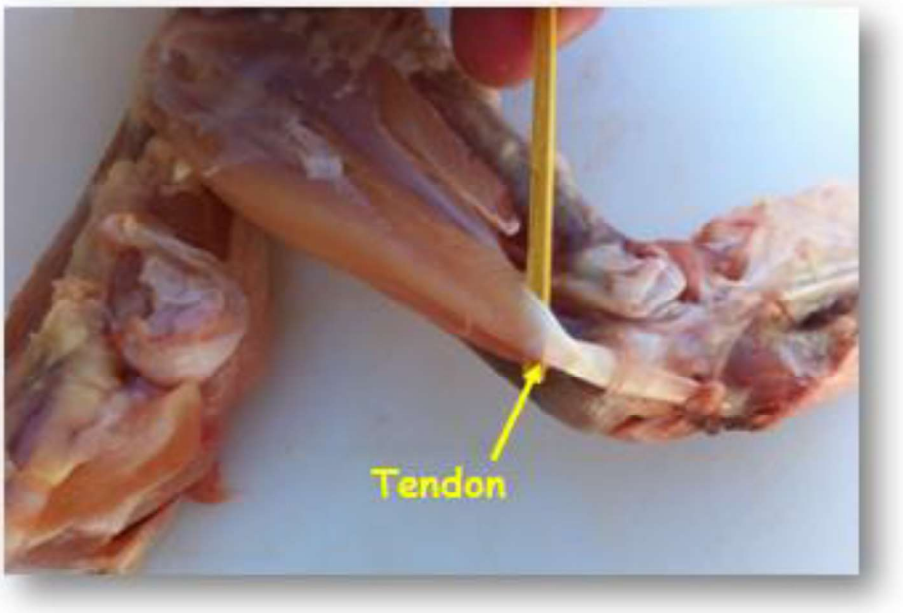
Your chicken wing should look similar to this:



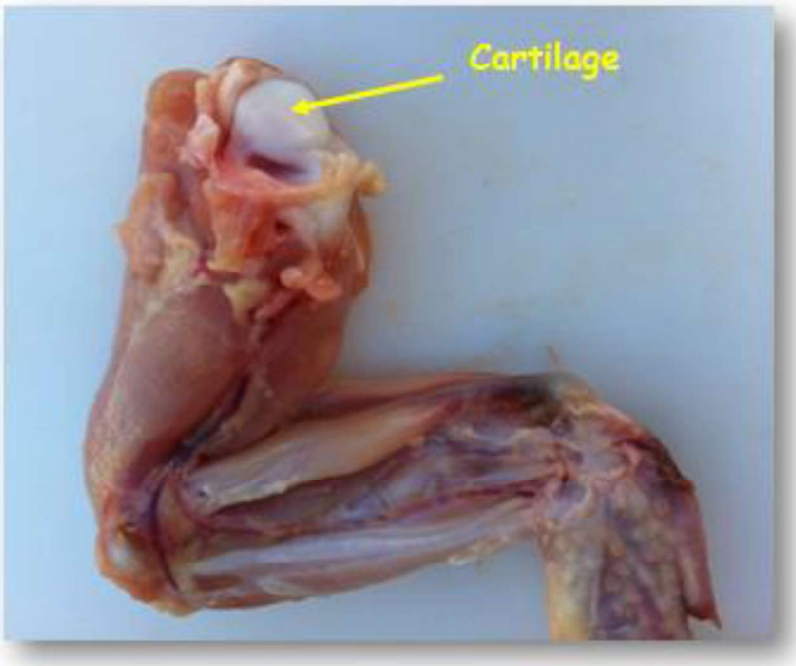
The biceps and triceps of your chicken wing act very similarly to those found within the human arm. Pull on the biceps of the wing and you will notice the forearm will be pulled closer to the upper arm. Pulling on the triceps will extend the forearm once again.

Look for yellowish-colored clumps of tissue that will likely be attached to the skin. This is **adipose tissue**, otherwise known as fat.

Run the tweezers/toothpick along the length of the bicep and tricep muscles towards the elbow joint. Here you will find a **tendon** which will be a white, tough, fibrous material attaching the muscle tissue to bone. Pulling on each tendon will reveal how the wing can move as well.

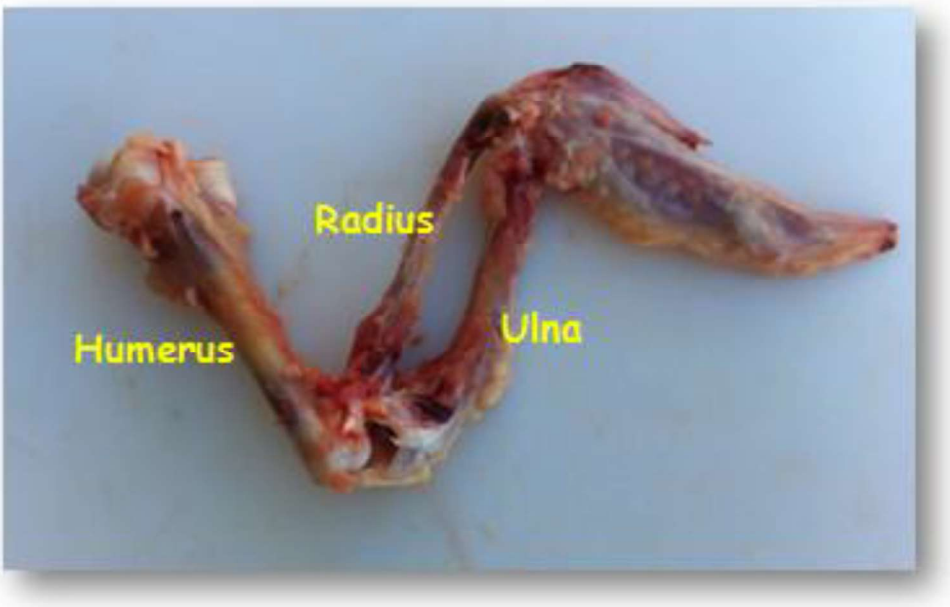


Examine the elbow joint of the wing. Move the upper and lower wing back and forth and pay close attention to a shiny white substance that attaches the bones together. These are the **ligaments** and cover the entire joint surface. The ligaments will be the hardest for you to identify as they are highly interconnected with several tendons around each joint.



Between the bones within the elbow joint you will find another white and shiny substance known as **hyaline cartilage**. This substance may seem slippery to the touch and is a common feature within synovial joints.

Using the scissors, remove the muscles from the upper and lower arms. Locate the **humerus, radius, ulna** and tendons of the forearm and triceps as shown in the following picture:



Two more observations can be made at this time. First, scrape the side of the bones with your tweezers and you should notice a thin and tough fabric surrounding the bone. This is the **periosteum** and is the outermost protective covering of our bones. Second, choose one of the bones in the forearm and break it in half. Inside you will find a hollow opening filled with a red gel inside. This is the **red marrow** of a long bone.

When you are done examining your wing, throw the remains away and wash all equipment in hot, soapy water along with your hands as well.

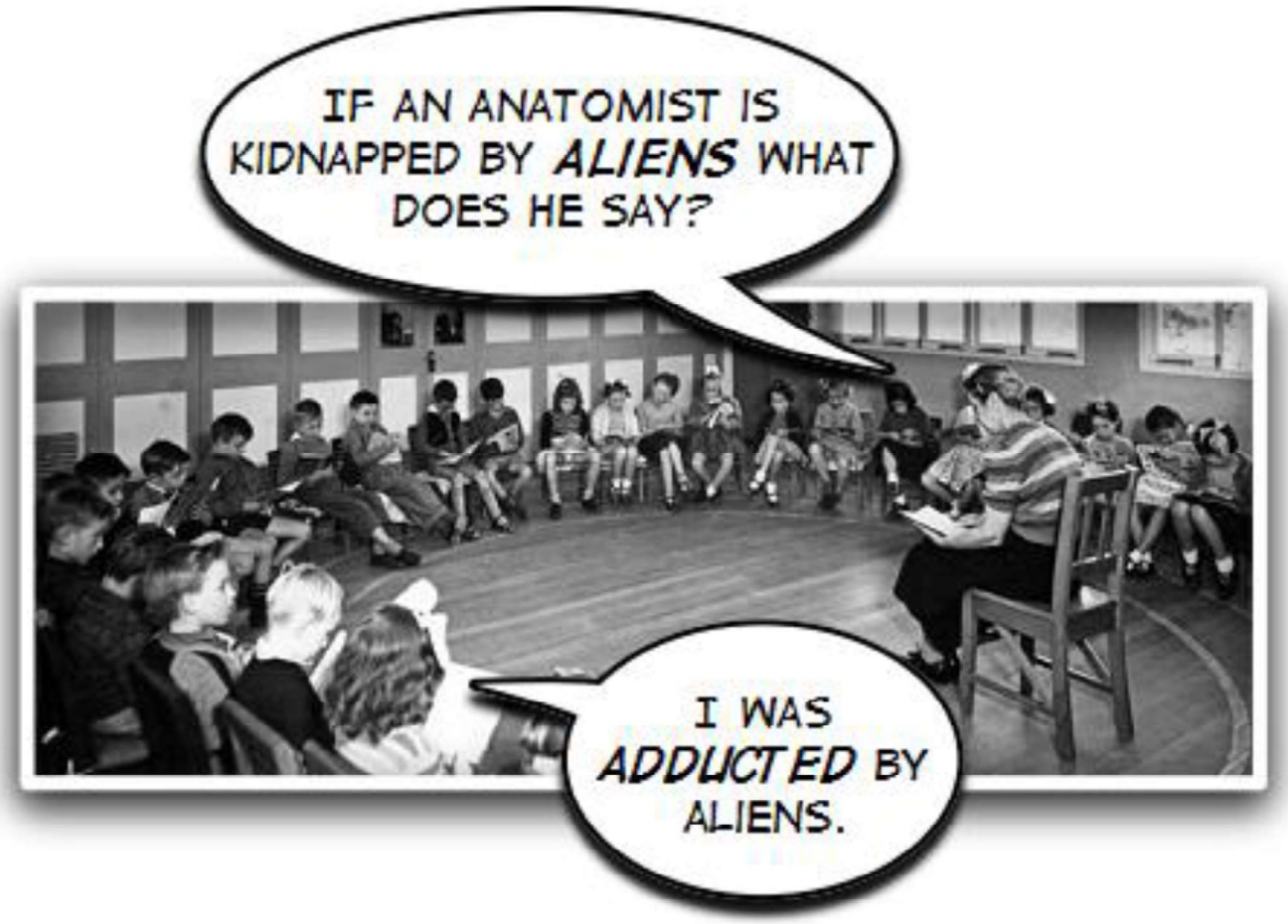
Explanation:

Most students of anatomy and physiology have one eternal question for their instructor, "Are we going to have to dissect anything?" With the increasing cost of dissection equipment and specimens, one can find the dissection of chicken wings as a cheap and relatively efficient model for the human arm.

The similarities between a chicken wing and the human arm are somewhat easy to observe. Both have the equivalent of an upper arm, a forearm, and a "hand." The alula, a freely-moving digit on the wing even resembles that of a human thumb. A single large bone in the upper arm resembles the humerus of a human arm, as do the two long bones of the lower arm which resemble the radius and ulna. The structure and function of all the various tendons, ligaments, and cartilage are very much the same as well.

Chapter Six

Muscular System – Part II



Day One:

Today, your child should complete their reading and practice problems for the week.

Below are the supplies for this week's lab:

Materials for the roast chicken:
1 roasting chicken (~4lbs or 1.8kg)
1 tablespoon table salt
¼ teaspoon pepper
1 tablespoon olive oil
½ cup chopped onion
¼ cup chopped celery
6 garlic cloves
1 bay leaf
1 large pinch of rosemary
2-3 tablespoons apple cider or white vinegar

Additional materials:
Dutch oven or large stock pot with lid
Large spoon and knife
Fine-wire strainer
Container with lid for drippings
Foil
Baking dish or carving board for chicken
Meat thermometer

National Science Education Standards covered this week:

12CLS1.4 Cell functions are regulated. Regulation occurs both through changes in the activity of the functions performed by proteins and through the selective expression of individual genes. This regulation allows cells to respond to their environment and to control and coordinate cell growth and division.

Definitions

acetylcholine	chemical released by muscle fibers to diffuse calcium ions into myofibrils thereby causing a muscle contraction
actin	long thin strands of protein attached to the walls of each sarcomere that are pulled by myosin to cause the contraction of muscle tissue
arrector pili muscles	small bundles of smooth muscles attached to the bulb and root of a hair follicle
calcium ions	a particle of calcium which has lost two of its electrons
endomysium	a protective connective tissue surrounding each muscle fiber
epimysium	layer of connective tissue covering an individual skeletal muscle
fascicle	bundles of 10-100 muscle fibers (cells) within each skeletal muscle
goosebumps	pockets of warm air trapped between hair follicles within the epidermis of the skin
myofibrils	hundreds of long protein chains found within muscle fibers (cells)
myosin	long thick strands of protein resting between strands of actin within the center of a sarcomere; responsible for pulling actin strands together during a contraction
perimysium	a protective connective tissue surrounding the fascicle
sarcomeres	small segments along a myofibril that are responsible for the contraction of a muscle
sliding filament theory	the shortening of the sarcomere and the subsequent contraction of the entire muscle fiber

Sample questions to ask your child after completing the weekly reading.

What part of a skeletal muscle forms the primary component of a tendon?

The epimysium

Name the connective tissue layers of a skeletal muscle beginning with the outermost layer.

Epimysium, perimysium, and endomysium

When you flex your biceps, what causes the muscles to appear to have grown in size?

The overlapping of actin and myosin filaments within the skeletal muscles of the bicep during flexing causes the muscle to appear to be larger than normal.

In terms of contractions, what is different between skeletal and smooth muscles?

Skeletal muscle contraction are voluntary and are induced by nerve cells. This is a fast contraction that is not sustainable for long periods of time and can fatigue if used excessively. This is much different from smooth muscles which are involuntary and require no stimulation from nerve cells. These contractions are much slower, indefinitely sustainable, and generally do not fatigue.