



# Move Chicken Move

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**Grade Level:**

Middle-High School

## **Move Chicken Move How Do Muscles Move?**

### **Purpose:**

Students will learn about the movement and structure of muscles and how they work in an antagonistic pair.

### **Objectives:**

Students will be able to:

- Because of previous knowledge and exposure to the nervous, circulatory, and the muscle systems, examine the muscle structure of a chicken.
- Through examination of the chicken, be able to tell the similarities and differences between a joint, a tendon, and a ligament.
- Locate blood vessels and nerves.
- Gain an understanding of how myoglobin and the mitochondria work in muscle fibers and compare these red and white muscle fibers.
- Understand the meaning of how muscles work in an antagonistic pair.
- Gain a better understanding of myosin and actin filaments.
- Learn more about microscopes and how to use them through the use of the procedures below.

### **Materials:**

The students will work individually or divided into groups of three or four and document all information in their science journals.

- newspaper to cover work areas
- 1 whole chicken
- 1 roll of paper towels
- 1 box of plastic gloves
- 4 dissecting pans
- 4 microscopes
- 4 scalpels
- 8 dissecting pins
- 4 pairs of scissors
- 15-24 microscope slides
- 1 bucket of bleach water
- saline solution (2 tsp salt to 1 qt of 1 knife water)
- 2-4 plastic bags for discarding the chicken

### **Safety:**

Before proceeding with our observation, the students need to take caution in working with chicken and the bacteria that may be present. They all should wear plastic gloves and wash the chicken in a bleach and water solution for about five minutes. This solution can be placed in a bucket. At all times the students need to wear the gloves. Students also need to know how to safely handle the dissecting equipment.

### **Preparation and Activities for the Students and the Teacher:**

- This activity can be accomplished in a whole class setting or be broken into smaller labs for further in-depth study.
- In a group or whole class project do a KWL poster on muscles. What do they know, what questions do they have, and then complete what they have learned at the end of the activity.
- In groups, and on a large sheet of paper, have the students do a map of muscles and the three types of muscles found in the body.

### **Definitions:**

- *Smooth Muscles:* Involuntary muscles found in the internal organs. They control the movement of organs (gizzard) and blood vessels and have a slow and steady contraction. They also help move food through the digestive tract and control blood pressure.
- *Cardiac Muscles:* Strong contractions that rarely tire. They control the beating of the heart and are an involuntary muscle.
- *Skeletal Muscles:* Voluntary muscles make your skeleton move and are attached to the bones. Skeletal muscles are usually subdivided into white (contract quickly, tire easily, and are associated with fast twitch fibers that work in short bursts) and red (good endurance, lots of myoglobin and cytochromes that are associated with metabolism and allow continuous activity)
- *Involuntary:* You cannot choose to contract them. They work automatically.
- *Voluntary:* You choose to contract them quickly through thinking. Muscles are used for breathing and movements.
- *Antagonistic Pair:* means that they work together to provide movement and they work in opposing pairs.

An example of this is the bending and straightening of the triceps and biceps of the arm. Place your hand around the biceps and relax the arm.

Then bend the arm. Which muscle contracts and which muscle relaxes? How can you tell? Another example is to prevent the movement of the muscles from moving by making a fist. You are able to feel how antagonistic pairs work. Identify involuntary and the voluntary muscles of the body. This can be done with a T-chart. (Ex: voluntary / involuntary).

- *Slow-Twitch:* produces graded responses.
- *Fast-Twitch:* contracts faster.

To further understand twitching of the muscles, the students can be given a small 9-volt battery and wires along with a piece of muscle. The students, through electrical stimulation, can cause the muscles to contract. In this exercise the need of a fresh chicken or a chicken that is alive is an important part of this observation. Students must consult the Animal Care Committee.
- *Relaxation:* extends or straightens into its original length.
- *Contract:* muscles shorten and develop a force.

The students can design a model of the arm or leg with the use of paper, tape, wire, and balloons or rubberbands. They can use the paper to build the bones and the balloons or rubberbands to build the muscles.

- *Nucleus*: contains genes and DNA, called the central command center that regulates the cells functions.
- *Sarcomeres*: the contractile unit of myofibrils that repeat throughout the muscles.
- *Actin*: contractile protein that has thinner filaments.
- *Myosin*: contractile protein that has thicker filaments.
- *ATP (Adenosine Triphosphate)*: the energy produced from the breakdown of glucose and is the source of energy for all active organs.
- *Ca*: Calcium.
- *Myoglobin*: An oxygen storing protein.
- *Mitochondria*: Generates the energy supplying compound ATP that powers contractions, small, rod-shaped in the cell, and are called the powerhouse of the cell.
- *Tendon*: a tough white tissue called collagen attached to the ends of the bones. Make a fist and look for the tendon in your wrist. What do you feel and see?
- *Cartilage*: slippery white or blue substance found at the end of a bone.
- *Blood Vessel*: easy to break, red in color.
- *Nerves*: elastic band that is harder to break.
- *Joints*: where two or more bones meet, various types of joints.
- *Ligaments*: strong, elastic straps of tissue that keep the bones together at the joint.

#### **Procedure:**

Place your chicken in the bucket with the water and bleach combination. Soak the chicken for five minutes. While the chicken is soaking, cover a table with newspaper and have the students cover four desks with newspaper for group activities.

1. Each student needs plastic gloves at this time. Also, at this time pass out the student activity sheet and Science Journals. Extra paper will be needed to answer the questions. Remind them to read the procedure and activity sheet beforehand.
2. Remove the chicken, dry it off with paper towels, and then place on a table with newspaper. The teacher can then cut up the chicken with all the students participating.
3. Place your part of the chicken on the dissecting tray. Examine the tough tissue that covers the outside. What is present? Are there hairs or feathers present? What is this covering? Prepare a slide and draw what you see.
4. Carefully remove the skin pulling and cutting it away from the muscles. If needed, you may carefully use a scalpel or scissors.
5. What is the yellow mass found on the inside surface of the skin (fat)? Where are these masses located? What areas on the chicken have a greater amount of this mass?
6. Take a close look at the muscles in your chicken. Look at how they move. How do the joints bend? Do they work together or work separately? Can this same movement be found in other animals? How does this compare to what you know about human muscles?

7. With the use of dissecting tools, separate the bundles of pink muscle tissue that are surrounding the bones. Look at the tough white tissue that is at the ends of the muscle. It extends from the muscle ends to the bone. What is this tissue? What is its purpose?

8. With a scalpel, gently remove a small piece of muscle tissue from your piece of chicken. Set it in the microscope slide. You may have to add a drop of saline solution to keep your tissue moist.

9. Examine the muscle tissue under the microscope using low power. Try to focus on the portion of the slide where the muscle is very thin. Draw a diagram of the tissue that you see and label.

10. Switch the microscope to high power. Are there differences? What parts of the muscle fiber do you see? When completed, draw and illustrate your fiber.

11. Gently remove the rest of the muscles. Draw and label the muscle and its tendon on paper. What does it look like and feel like? Observe the thin white tissue that covers the muscle. This is called the connective tissue. Around this muscle is the connective tissue firm or loose?

12. Carefully open up all of the muscle tissue and the tendons. Look for blood vessels and nerves. How do they compare? What do they look like and feel like?

13. After clearing away all the muscle tissues and tendons on the bones, weigh the muscle fibers. Examine the joints in your piece of chicken. Look for the ligaments. With your hands, try to break the ligaments and separate the bones. Is this easy to do? Why?

14. When completed, answer the questions on the activity sheet using the information from your journal observation.

### **Care of the Muscles:**

Make the students aware that muscle training increases only the diameter of the existing muscle cells. No amount of training will increase the number of fibers in the muscle.

With training comes an improvement in circulation and metabolism. Sometimes these muscles malfunction because of poor health, drugs, steroids, diseases, and accidents.

How can you improve your muscular strength and muscular endurance? What is flexibility? How is this important to our muscles? What is the best all around exercise for the body?

1. Compare various sports and the muscles that are being used.

2. Make a poster showing your favorite exercise.

3. Design an experiment that would test for fatigue in an athletic and a non-athletic student.

4. Have the students make and design a fitness test.

**Assessment:**

1. Students will continually write in their journal their findings for each procedure.
2. Each group will also share information about their part of the chicken with the other groups. This could be a comparison of structures, the percentage of muscle fibers, the bone structure and/or fat content in the chicken, etc. Each group will share with the class by designing a poster, graph, chart, or other activity that will show what they learned.
3. Students will individually turn in their journals and student activity sheet with the questions and diagrams completed.
4. The students will individually design and make a model of their own arm with materials found in their home and display them for their parents on parents' night.

**Where to Go From Here:**

The study of muscle structure can be incorporated into many other subjects in the classroom.

1. Art: muscle drawings, sculptures, plaster of Paris or paper mache of an arm or leg.
2. Health: diet issues, exercises, diseases of the muscles, keeping our whole body healthy, foods that provide energy.
3. Language Arts: various books on understanding how our bodies work.
4. Social Studies: history of the Olympics.
5. Music: write a rap song that contains lyrics dealing with the human body.
6. Physical Education: What is physical fitness? The importance of various exercises and sports for an overall healthier you.
7. Math: use of the metric system, use of calculators, story problems, graphs, ratio and proportions, percentages, measurements of the body, calorie counting, measuring the density and mass of an arm or leg.  $\text{density} = \frac{\text{mass part}}{\text{volume whole}} \times 100 = \% \text{ volume whole}$
8. Science: build a chicken skeleton; look in current articles that are related to sports injuries.

**References:**

1. *Dorland's Illustrated Medical Dictionary*, (1985), W.B. Saunders Company.
2. Avedon, Don M., *Electronic Imaging Systems: Design, Applications and Management*, 1994, McGraw Hill, New York.
3. Bagshaw, Clive R., *Muscle Contraction*, 1993, Chapman and Hall, London, UK.
4. McArdle, William; Katch, Frank; and Katch, Victor, *Essentials of Exercise Physiology*, 1994, Lea and Febiger Publishing, Philadelphia, PA.
5. "Testing a Muscle's Design," *American Scientist Journal*, Volume 85, July-August 1997.

## **Move Chicken Move: How Do Muscles Move? Student Activity Sheet**

### **Chicken Anatomy**

Record all findings in your Science Journal. Make sure all the questions are answered. You may use extra paper to draw, label, and answer your questions.

1. Why does the chicken have an outside covering? What is its purpose?  
Could you compare this to a human? Are there differences and similarities?
2. When you looked at this covering under the microscope, what did you see?  
Explain and draw what you saw.
3. The fat layer that is found on the inside of the skin feels like? Why do some of the parts of the chicken have larger amounts of fat? How could this compare to humans?
4. Draw and label the muscle tissue, tendons, joints, cartilage and ligaments in your chicken piece.
5. What do we mean when we say that "muscles work in antagonistic pairs?"  
Explain and give an example.
6. Draw the muscle fibers that were seen under the low and high power of the microscope. What did you see?
7. Would there be differences or similarities if these were human muscles?  
Explain your answer.
8. If a chicken broke a bone in its body, or pulled a tendon, how would that affect the performance of the chicken?
9. Design a model of your arm with materials found in your home.