Chicken Foot Dissection

Category: Biology

Type: Class Experiment (60 min class)

Materials:

1	Chicken foot
1	Plastic tray
1	Pair of disposable gloves
1	Pair of scissors
1	Pair of tweezers
1	Razor blade

Caution: This activity uses razor blades!

How To:

First, examine your own hands and fingers, and see how they move. Hold your hand about 1'' above your wrist. What do you feel?

Place your hand flat on the table and raise each finger, one at a time.

Fold your middle finger under your hand and lay it on the table again. Try moving your fingers one by one again. What happens?

Move your fingers and count the number of finger bones (called phalanges) in your own hand. How many do you have?

Examine the chicken foot. What is the skin like? Is it like the skin on human feet? Why are they different? How many toe joints are there?

Look at the end of the foot.
What are these shiny white strands for? They're called tendons.

Cut the skin on the underside of the foot straight down the middle using a razor blade.

Make a small angled cut at the top of the long cut, first on one side.

Then make a similar cut on the other side.

Lay the chicken foot flat. The cut should look like

this photo; it will allow you to cut through the muscle more easily.

Use the razor blade to cut through the muscle and tissue to expose the tendons. Be careful!
Do not cut through the tendons.

The scissors can also be used to do this.

Count all the tendons. How many are there? What happens if you pull on them all at once?

Pull on all the tendons one by one to see what individual toes they control!

Is there one tendon that controls

Make the chicken toes make these formations by

all of the toe muscles?

finding the correct tendon or combination of tendons to pull on.

Find a tendon that makes one of the toes move side to side.

Cut the top of the foot down the middle, through the skin and muscle. What do you see?

Pull on the tendon and see what happens.

Turn the chicken foot over and cut the skin along the longest toe.

Use the scissors to cut through the tissue.

Use tweezers to expose the tendon. What does this tendon do?

Pull on it and see.

Dispose of the chicken foot in an outside trash can.

Fine Points:

→ Remind students to be careful and if they are unsure of what they are doing, tell them to ask for help!
→ In this lesson we focus mostly on the tendons and muscles. You can explore even further with older grades: students can look for ligaments and nerves.
→ You can do a similar activity with pig or goat feet.

Objectives:

During this activity students will:

1. Understand the definitions of anatomy and physiology.
2. Understand anatomical terms to describe parts of chicken feet.
3. Understand anatomical terms to describe parts of human feet and hands.
4. Define and discuss the functions of major structural parts of feet and hands.

Concepts Involved:

- Human feet and chicken feet are very complex in both structure and function.
- Muscles, tendons and ligaments run along above and below the bones to control the movements needed for walking, running, jumping, and standing still.
- Tendons attach the end of a muscle firmly to a bone. As muscles contract, they shorten and pull the tendon. The tendon, in turn, pulls the bone and makes it move.
- Joints allow bones to move.
- Ligaments hold bones to other bones at joints.

Focus Questions:

1. How is the skin of a chicken foot different than human skin?
2. What is a tendon and what is its function?
3. What is a muscle and what is its function?
4. What is a ligament and what is its function?
5. How does a ligament differ from a tendon?

Elaboration:

In this activity we are using chicken feet as a tool to visualize and learn about the structure of chicken feet, and in turn, human feet and hands. Why use a chicken foot? Well, a chicken foot is similar to the human foot because both are made up of lots of different cells and tissues, and many of those found in a chicken foot will also be found in a human foot, e.g. bones, ligaments, muscles and tendons. All of these

foot parts working together allow a chicken to do a variety of things such as walking, hopping, sitting, and standing. Chicken feet are complicated: each has 16 small bones.

The phalanges are the bones in fingers. They lie between joints known as knuckles. The human foot has 26 bones. The bones that make up the toes are also called phalanges. The big toe has 2 phalanges and the other 4 each have 3 phalanges. The human hand has 27 bones and 14 phalanges following the same pattern as the foot. Students could take off their shoes, but for ease we ask the children to compare the chicken foot to their hands, and to count the phalanges in their hand and the chicken foot.

One of the first things you'll see when you examine a chicken foot are tendons hanging from the open end of the foot. The chicken foot has long, easy-to-reach tendons, which make the foot ideal to use for this activity. Tendons are cords of tough tissue, made of parallel arrays of collagen fibers that are closely packed together. When you open a chicken foot and pull the tendons you can figure out how tendons help the toes to move. Tendons are known as connective tissue. They function as connectors between bone and muscle. Tendons attach muscle to bone so when a muscle contracts, the tendon and bone move along with it. Without tendons to connect muscles and bones it would be impossible for the body to move in the way it does.

When you cut open the chicken foot, you have to cut through fatty tissue to get to the tendons and muscles. In chickens, the majority of the power comes from muscles in the leg, but there are small muscles in the foot itself. The muscles are bundles of dark pink tissue that surrounds the bone. The muscles that we have in our arms and legs are skeletal muscles, meaning that they are voluntary muscles. We can control the actions and timing of voluntary muscles, e.g. our hands perform the dissection when we tell them to, or our feet kick a ball on demand. The heart is a muscle that we don't have much control over. Together with the bones and tendons, muscles make our body mobile.

Muscles and tendons work together in opposite (antagonistic) pairs to move a bone. One muscle contracts and pulls the tendon which in turn pulls the bone making it pivot on the joint. Meanwhile, another muscle relaxes to allow the bone to move.

This lesson can be further developed by looking at ligaments and nerves. Ligaments are the whitish tissue between the bones. By examining the bones of the chicken toes you can determine what the function of ligaments are. Ligaments are similar to tendons in that they are made of collagen and are a connective tissue. However, instead of joining muscles to bones, they join one bone to another bone. Nerves are really hard to find – small stringy tendrils connecting to muscles. If you have a microscope you may find some.

Links to k-12 CA Content Standards:

Grades k-8 Standard Set Investigation and Experimentation:
Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other strands, students should develop their own questions and perform investigations.

Grades k-12 Mathematical Reasoning:
1.0 Students make decisions about how to approach problems:

1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.
1.2 Determine when and how to break a problem into simpler parts.

2.0 Students use strategies, skills, and concepts in finding solutions:
1.1 Use estimation to verify the reasonableness of calculated results.
1.2 2.2 Apply strategies and results from simpler problems to more complex problems.
1.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
2.5 Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

3.0 Students move beyond a particular problem by generalizing to other situations:
3.1 Evaluate the reasonableness of the solution in the context of the original situation.
3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.
3.3 Develop generalizations of the results obtained and apply them in other circumstances.

Kindergarten Standard Set 2. Life Sciences.
Different types of plants and animals inhabit the earth. As a basis for understanding this concept:
2.a. Students know how to observe and describe similarities and differences in the appearance and behavior of plants and animals (e.g., seed-bearing plants, birds, fish, insects).
2.c. Students know how to identify major structures of common plants and animals (e.g., stems, leaves, roots, arms, wings, legs).

Grade 3 Standard Set 3. Life Sciences.
Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept:
3.a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.

Grade 7 Standard Set 5. Structure and Function in Living Systems
The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function. As a basis for understanding this concept:
7.a. Students know plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism.
7.c. Students know how bones and muscles work together to provide a structural framework for movement.

Grades 9-12 Standard Set 9. Physiology
As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment. As a basis for understanding this concept:
9.b. Students know how the nervous system mediates communication between different parts of the body and the body's interactions with the environment.