

Activity 4.2.1: Muscle Rules

Introduction

All movement in the human body, from wiggling a toe or swimming a mile to eating and digesting a sandwich, is the result of muscle action. In previous lessons, you have learned about connective and nervous tissue. In this unit, you will explore the structure and function of another incredible tissue -- the muscle.

When we think of muscles, we usually focus on the muscles that move our bones and allow us to move about the Earth; the tissues we see from the outside. But inside the amazing human, you will find other types of muscle tissue that work silently to move substances around the body. Your heart keeps beating and your food continues to digest even when you fall fast asleep and close your conscious mind for the day. Without muscle moving blood or distributing nutrients from food, the human machine would power down.

There are 206 bones in the human body, but over 600 skeletal muscles allow our bodies to move in different directions. Over sixty of these muscles are found in your face alone. You use forty of these muscles every time you frown, but only twenty muscles when you smile. The human body is even built to make it easier to be happy than to be sad.

Skeletal muscles are attached to bones with tough cords or sheets called *tendons* and these bones meet other bones at junctions called *joints*. The contraction or shortening of muscles pulls on bone and moves the body.

In this activity, you will observe and compare the structure and function of the three types of muscle tissue. You will explore the structure of skeletal muscle both by looking at slides and by creating a model of a muscle unit. Before you move on to building actual muscle groups, a series of demonstrations will help you see that the placement of muscles on bones follows specific patterns and rules. These rules will later help you construct specific muscle groups on your Maniken®.

Equipment

* Computer with Internet access
* Prepared slides of muscle tissue – *Carolina Biological Supply*  Muscle Types Set
* Microscope
* Laboratory journal
* Colored pencils
* Terra cotta clay
* Wire tool or wooden knife
* Spaghetti
* Plastic wrap
* Pencil
* Anatomy in Clay® Maniken®
* Reference textbook (optional)

Procedure

Part I- Types of Muscle Tissue

1. Work with your partner to research the three types of muscle tissue: skeletal muscle, smooth muscle and cardiac muscle.
2. In your laboratory journal, describe what it means if a muscle is striated and what it means if a muscle is said to be under voluntary control.
3. Create a comparison table (shown below) in your laboratory journal. Each box should be approximately 2” x 2”. Use information from your research to fill in the chart. Leave the histology box blank until you begin your microscope work.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type of muscle | Striations? (Y/N) | Voluntary? (Y/N) | Location in Body | Function in Body | Histology |
| Skeletal Muscle |  |  |  |  |  |
| Smooth Muscle |  |  |  |  |  |
| Cardiac Muscle |  |  |  |  |  |

1. Use a microscope to view a prepared slide of each type of muscle tissue under both high and low power.
2. Using colored pencils, draw what you see under high power in the histology column of your table. Use a reliable website to help you label what you see.
3. Answer questions 1-2.

Part II: Building Muscle

In Lesson 1 of this unit, you looked at the function of joints. Joints work together with skeletal muscle to move the human body. In the remainder of Lesson 2, you will focus on the structure of skeletal muscles, build these muscles on your Maniken®, and visualize the amazing ability of skeletal muscle to contact and shorten. But before we look at function, let’s explore structure.

1. Follow your teacher’s instructions to build a spaghetti muscle.
2. As you unwrap the muscle and return a fascicle, or group of muscle fibers to each group, review key vocabulary words.
3. In your laboratory journal, draw a diagram of muscle. The following components should be labeled and identified.

* Endomysium
* Epimysium
* Perimysium
* Fascicle
* Tendon
* Muscle cell/fiber (myofibril)

1. Use information from the construction of the spaghetti muscle, diagrams provided by your teacher, textbooks or from reliable Internet sites to guide your drawing.
2. Answer conclusion questions 3-4.

Part III: Muscle Rules

Now that you have learned about muscle structure, let’s start to think about function. We know what muscles help our skeletal system move, but how are these tissues oriented on our bodies? What are the rules that muscle live by?

1. Follow your teacher’s instruction to build two simple muscles on the arm of your model.
2. As you work through each step of the process, make sure to write each muscle rule in your laboratory journal. Add notes or examples to help you remember the concept.
3. Note that the name of a muscle gives you clues about the makeup of that muscle. Each muscle is given a Latin name based on one or more of its features. Take a look at the following muscle names and brainstorm what you can tell about these muscles simply by their names. Analyze specific words in the name, roots in the name and relationships to bones you have already studied. Brainstorm ideas in your laboratory journal. Each pair of muscles represents a different way in which muscles can be named.

* Trapezius and Rhomboid minor
* Gluteus maximus and Gluteus minimus
* Frontalis and Temporalis
* Orbicularis Oculi and Transverse abdominis
* Flexor Carpi Ulnaris and Extensor digitorum longus
* SternoCleidomastoid and Brachioradialis
* Biceps Brachii and Triceps Brachii

1. Describe the muscle feature that is being used in each naming scenario. For example, you have probably figured out that trapezius and rhomboids are named for their shapes. The trapezius muscle is shaped like a trapezoid and the rhomboids are shaped like rhombuses. See if you can find a pattern in the remaining pairs.
2. Discuss your findings with the class. Work together to create a list of muscle features used in naming. Report your findings in your laboratory journal.
3. Answer the remaining conclusion questions.

Conclusion

1. Describe the differences you see in the three types of muscle tissues.
2. What does it mean when we say a muscle contracts involuntarily? Describe one body function that is linked to an involuntary muscle contraction.
3. Describe how the structural makeup of a muscle contributes to the muscle’s ability to do its job.
4. Using your knowledge of tissues, what type of tissue do you think makes up the three layers of membrane you encountered in your muscle?
5. Explain how you know which attachment of a muscle is the origin and which attachment is the insertion.
6. Your mom comes back from the doctor and says she has pulled her tibialis anterior. She knows you are taking Human Body Systems and asks you to tell her about her injury. Based on the classroom discussion, what can you deduce about this muscle?
7. When you are cold, your muscles begin to contract involuntarily and cause you to shiver. Why do you think this occurs? How does the contraction of muscles help the body maintain homeostasis?