

STEAM Subject: Biology
Lab: Human Hand Model

Grades: 2-5

Learning objective:

Students will be able to

- develop a model of our hands
- identify the muscles and tendons involved in movements of the hand

ENGAGE:

Ask students the following questions:

- Have you ever thought about how amazing your hands are?
 - Hands allow people to do various complex activities like typing, painting, and playing instruments.
- The movement in your hands and fingers is controlled by your muscles. Where do you think the muscles responsible for moving your fingers are?
 - You may be surprised to find out that most of these muscles are in your forearm. In this lesson, you will find out why, and create a model of the human hand.

EXPLORE:

Before we explore how the human hand moves, let's take a look at what muscles are and what they do.

Muscles are responsible for movement in the body. They are composed of muscle cells (that look like this image). Notice the cells' long and tubular shape. The length is important because it allows for muscle contraction. When a muscle contracts, or squeezes, it goes from long to short. This generates a pulling force. What do muscles pull? Muscles pull on tendons. You can think of tendons as strings that run through your body. You have a tendon in each of your fingers, running from the fingertip to the muscles in the forearm. When you squeeze those muscles, you pull the tendons which move your fingers. Let's explore this idea more with an activity.

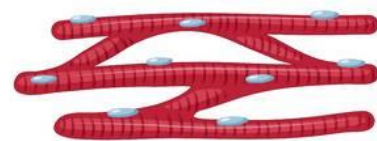
Types of Muscle Tissue



smooth muscle cells



striated muscle cells



cardiac muscle cells

Image source:

<https://us.123rf.com/450wm/brgfx/brgfx1807/brgfx180700352/115004028-stock-vector-types-of-muscle-tissue-illustration.jpg?ver=6>

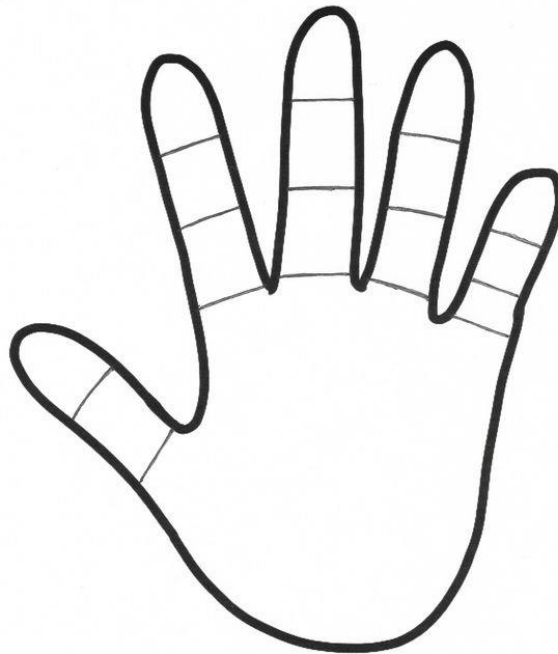
EXPLORE:
Human Hand Model Activity

Materials needed per student:

- Print out with Model Hand Template:
<https://i.pinimg.com/564x/f9/78/19/f978192fefa38b65ab346a644bf6c693.jpg>
- Tape or Hot Glue gun (**Adult supervision required**)
- 2 Drinking Straws (Paper Straws Recommended)
- String (about 50 inches)
- Scissors

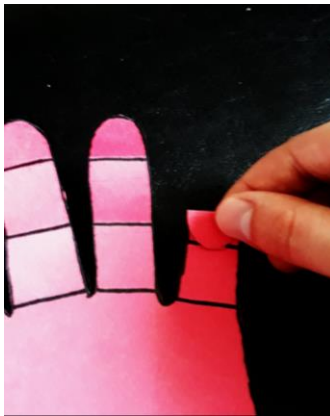
Directions:

1. Print the hand template and cut it out.



2. Examine the hand. Notice the 2 solid lines running through the thumb, and the 3 solid lines in each of the other fingers. These represent the knuckles, which the spots where your fingers bend. These are also known as joints. Fold the fingers along each of these joint lines.

All pictures in this portion of the activity are courtesy of EIS Biology Instructor Jared DiPrima.



3. Cut out a 1-inch long segment of a drinking straw. Tape it or hot glue it (**with adult supervision**) to the middle of the palm, near the bottom (Refer to picture below).



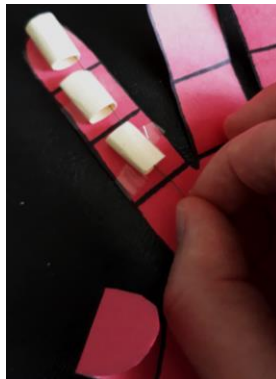
4. Notice the boxes created by the lines or “joints.” You will be cutting out a segment of a drinking straw for each of these 14 spaces (Refer to picture below for how to do this on the index finger). The spaces show where the bones of your fingers are located. You have two bones in your thumb and three in each of your other fingers. The pieces of straw will represent these bones in our model. When you cut your pieces of straw, make them smaller than the actual spaces (around $\frac{1}{2}$ inch, some may be smaller or bigger depending on the finger), so there will be room in between the pieces. Adhere them with tape or glue.



5. Cut five 10-inch pieces of string. Tape them to the backside of the hand, one at each of the fingertips.



6. Bring the string attached to the index finger over to the front. Run it through the 3 straw segments attached to the finger (Pictured below). Repeat on each of the fingers.



7. Next slide all five strings through the largest piece of straw that you taped or glued to the middle.



8. Pull on the strings and watch as the fingers bend down. Pull on different strings to control different fingers!



EXPLAIN:

Pull the strings and watch how the fingers in the model move. How is the movement similar or different to your own finger?

You can see that when you pull the string, the finger bends just like your real finger does.

The strings in this model work like tendons in your body. These “strings” would attach to muscles in the forearm. When the muscles are relaxed the strings remain long, and the fingers stand up straight. But when the muscles are squeezed they shorten and pull on these strings. This explains how the muscles in your arm control the movement in your fingers. Fingers cannot bend in the spaces where there are bones.

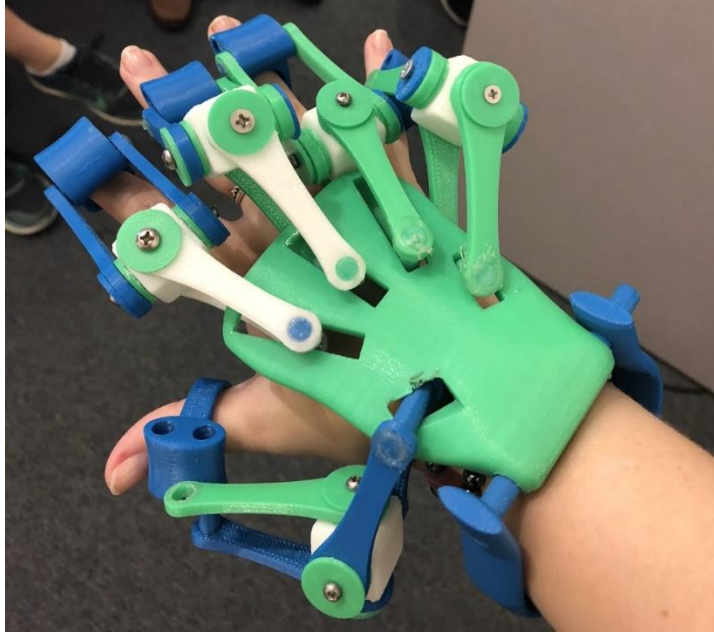
- **Review STEAM Vocabulary:**
 - **Muscle:** a type of tissue in your body that is made of long cells that can contract and generate movement.
 - **Tendon:** a string-like cord of tissue that attaches from a muscle to a bone or other part of the body
 - **Joint:** parts of your body that bend (like knuckles).

ELABORATE:

Watch a video about how 3D printed hands are revolutionizing the medical field:

<https://youtu.be/Ci8ijPGEKO8>

Look at this picture of a 3D printed hand model printed by EIS 3D Printing Instructor Angel Sanchez. Can you point out all of the joints in the hand?



EVALUATE:

- Ask students to demonstrate the function of the joints or knuckles using their models.
- Have students see if they can find and identify other joints or tendons in their body.

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