SWEducational

ACTIVITY PACKET

Biomedical Engineering Edition

WHAT IS BIOMEDICAL ENGINEERING?

Biomedical Engineers create devices to help patients, doctors, and other people in the health profession. Just a few things that biomedical engineers do include designing prosthetics, keeping x-ray scanners and other medical machines working, and creating artificial organs.

Photo Raffle

Do you like prizes? How about showing off your project work? Send in a photo of your **completed Biomedical Engineering activity** through the Google form on the classroom! You'll see your project featured on the class page, and even be entered into a raffle for the chance to win a prize!

Get your cameras ready and stay tuned...these photo raffles will be in every summer packet!

ACTIVITY 1: PROSTHETIC HAND

IMPORTANT TERMS

Joints: a joint is the connection where two pieces are held together

- In the body it is where two or more bones meet or where something can bend.
- Some joint examples are elbows, wrists, or even the knuckles in your hand.
- Can you think of any other types of joints?

Body Movement(s): when you move one part on your body

- Some body movements include turning your head, lifting your arm, or kicking out your foot.
- Biomedical engineers help create devices that help people perform body movements that they would not be able to do on their own.

Body Part: a part of the body

- Can you name a body part that helps you breathe? What about a muscle or a bone?
- Biomedical engineers often create devices or equipment for different body parts.

Prosthetic: an artificial device to replace a missing or injured body part.

- Some examples of prosthetics that biomedical engineers design are prosthetic arms, legs, and hands.
- For this activity you will be creating your own prosthetics!

ACTIVITY INSTRUCTIONS

Today, we will be making a prosthetic hand using three main items. Biomedical engineers create replacements for body parts so today, you will create your own prosthetic hand that can move similar to real hand movements.

SUPPLIES

Before collecting supplies, double check with an adult that your materials are okay to use!

- Sturdy paper (printer paper, construction paper, or card stock paper)
- Drinking straws (paper or plastic)
- One jumbo-sized straw (boba straws or smoothie straws - paper or plastic)
- Scissors
- Yarn or string
- Tape
- Something you can write with (pencil, pen, colored pencil, highlighter, etc.)

STEPS

1. Grab a piece of paper and trace an outline of your hand using what you can write with (pencil, pen, etc.). Don't forget to also trace a small part of your wrist. Then with scissors, carefully cut out the outline.

2. Put your hand back on the outline and mark the places where your fingers bend. These are your joints. Below shows a picture of where to mark, if you are not sure.

3. Fold the paper downwards at the places with the markings where the fingers bend.

4. Grab your standard straws and using the scissors, carefully cut it to the size of the length between your markings. Once you get to your knuckles, cut your straws into about 2 inches each cut. For the jumbo-straw, cut it about the size of your thumb. Ask an adult if you need any help with cutting the straws. Lastly, tape the straws onto the hand. The jumbo straw will be taped onto the wrist. An example of what it may look like is below.

5. Grab your yarn or string. Using your scissors, carefully cut 12 inch pieces 5 times. Be sure to make a big knot at one end of each piece, if you can.
6. Starting from the fingers, put one piece of string or yarn through one finger. Then, do the same for the rest of the yarn or string with the other fingers. Have them all meet at the wrist. If you weren't able to tie a knot or if the knot is going through the fingertips, you can tape it to the straw to the top of the finger so it doesn't go through and stays outside of the straw.

7. Now it's time to test out and experiment with your prosthetic hand. Pull on the strings individually and watch your prosthetic hand come alive.

ACTIVITY 2: ELBOW AND MUSCLE

IMPORTANT TERMS

Muscle: a part of your body that controls the movement of the body

- There are three types of muscle tissues: cardiac, skeletal, and smooth
- Some muscle areas are your biceps (the area from your shoulder to the elbow), your soleus (located in the lower back leg), or your abdominal (located around the stomach).
- Can you think of any other types of muscles?

Bones: hard pieces that help support the body and to protect body organs

- Bones are living, growing, and changing parts of our bodies.
- Biomedical engineers may often design three-dimensional x-rays machines that scan a visual of the bones in our bodies.
- Can you name a bone that is in your body?

Tendons: body tissue that connects muscles to bones in the body

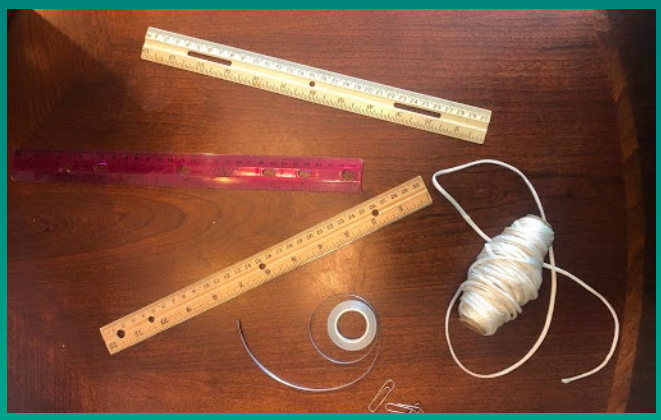
- An example of a tendon is the achilles tendon, which connects the calf muscle to the heel bone.
- In this activity, you will be working on the muscle in your arm.

ACTIVITY INSTRUCTIONS

Today, we will be making a simulation of an arm. The rulers will represent the three bones in your arm and the strongs represent your muscles and tendons that move those bones. Biomedical engineers need to know how the muscles in your body works so that the devices they make will work properly!

SUPPLIES

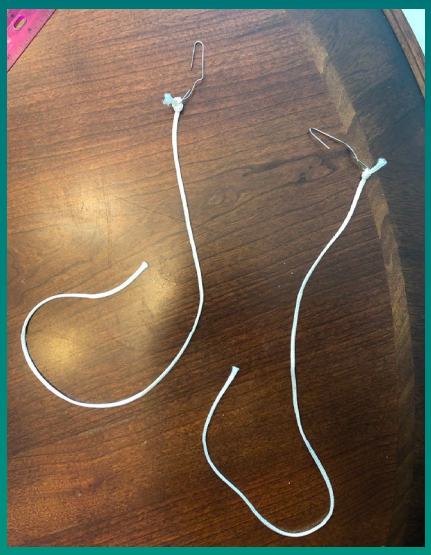
- Before collecting supplies, double check with an adult that your materials are okay to use!
- 3 rulers with small holes (also can cut out cardboard to make a ruler shape)
- 3 paper clips
- 2 pieces of ribbon or string about 2 feet long
- Something to fasten the rullers together (maybe a brad or another small piece of string)
- A piece of tape



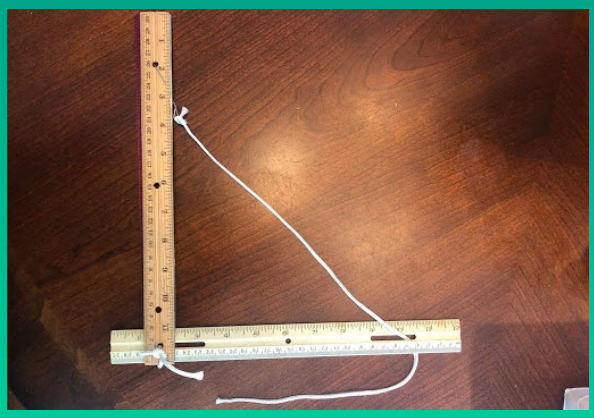
STEPS

1. Stack all three rulers on top of each other and attach them at one end. Arrange them so that the middle one is vertical and the other two are horizontal and pointing to the left. These rulers represent the three bones in your arm.

2. Make a hook on two of the paper clips and then tie one paper clip to each end of the two strings.

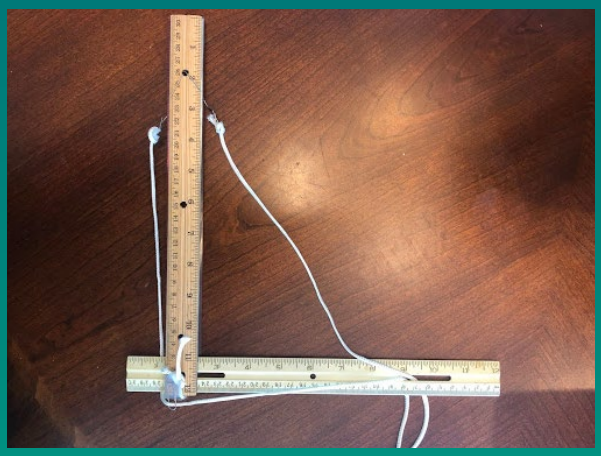


3. Hook one of the paperclip strings through the leftmost hole in the two horizontal rulers and then thread the end through the top hole on the vertical ruler.

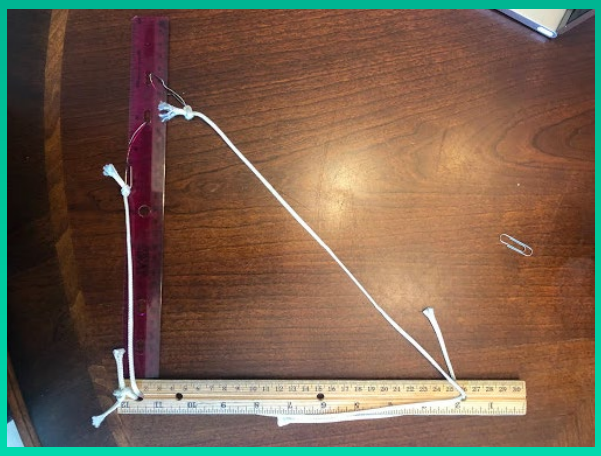


4. Tape the third paper clip to the right end of the horizontal rulers.

5. Hook the second paperclip string to a hole on the left end of the horizontal rulers. (It can be the same hole as the first one). Then thread the string through the paper clip and then through a hole on the vertical ruler.



6. Now its done! Try pulling on the different strings. This will represent how the muscles in your arms move the different bones in your arm!
7. If yours is not working very well (like mine) try and put the string through different holes, or thread the string though a hold instead of the third paper clip and see if this works better!



OTHER LINKS AND VIDEOS

- What is Biomedical Engineering Video:
  https://www.youtube.com/watch?v=3CpHUimhR0k
- Another What is Biomedical Engineering Video:
  https://www.youtube.com/watch?v=KQm-gfobUm8
- Why Biomedical Engineering Video:
  https://www.youtube.com/watch?v=960ZB3dLrLU
- Biomedical Engineering Description:
  https://wiki.kidzsearch.com/wiki/Biomedical_engineering

CAL POLY ENGINEER SPOTLIGHTS

SAMANTHA

Ironman is my favorite superhero, and he inspired me to use math and science to build machines that could strengthen people, and in turn they could help others. That is my superpower. My superpower came in handy when my team and I built a leg for a wounded warrior. He lost his leg in war, and now he spends time playing with his kids on the beach. But walking on the beach with his prosthetic (fake) leg became difficult. We delivered with a fully functioning leg made from metal, rubber, and a strong yet flexible material called carbon fiber. As a biomedical engineer, I am fulfilled because I help put smiles on deserving people's faces everyday!

CATIE

I love biomedical engineering because you learn and use a variety of tools that will solve medical problems in order to help so many people. I think the human body is super fascinating and the medical devices are even cooler. Medical devices can range from pacemakers which control a patient's heart rate to prosthetics, a replacement for a missing body part. I am part of a club at Cal Poly where I get to make medical devices that will directly affect the people in the community. One of these devices includes a custom bike seat for a Cal Poly student that will relieve the pain in her hip when she bikes. Our hope is to allow her to ride her bike without enduring so much pain. The best part about being a biomedical engineer is playing a part in improving the quality of people's lives.

KRISTIN

I love biomedical engineering because of all of the amazing things you can do within the field. From creating new devices to help improve people's lives to researching new medicines to treat diseases, there are so many great opportunities. I have loved all the different projects I have had the opportunity to work on including neurovascular stroke therapies and cardiovascular devices to improve mitral regurgitation.