Activity: Body Movements (Joints, Muscles and Bones)

Materials

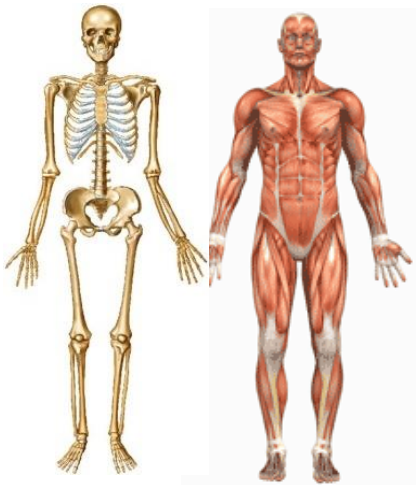
- 3 wooden craft sticks with notches

- 2 small black rubber bands

- 2 large rubber bands
- 1 black marker

Optional teaching materials: door hinge, stackable children's toy, and cell phone holder

Introduction



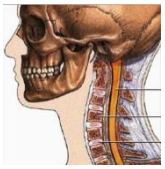
One field that bioengineers are very involved in is **biomechanics**, which is the study of how living beings, like humans, move by using a complex (but very structured) combination of bones, muscles and joints. These combinations allow us to bend, walk, run and stretch. Can you think of any other movements our muscles, bones and joints help us perform?

Did you know? Every muscle in the human body is controlled by signals coming from the brain. Muscles are connected to bone, and when muscles contract or relax, they cause the bone to move. The human body contains 206 bones and 640 different muscles!

Body Hinges

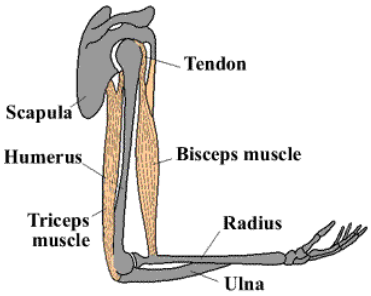
Play with the three different kinds of connector joints featured below. Discuss in a group the different kinds of movements the joints can make. Do they go backward, forward, or around in a circular motion? _____ Is motion restricted in some cases? _____

Which body part below do you think each connector resembles <u>the most</u>? Draw lines connecting the type of joint with its corresponding body part.

Car cell phone holder *Ball and socket joint* Circular movement		O	O	
Door hinge *Hinge joint* Bending back and forth in one plane		O	O	
Stackable toy *Pivot joint* Rotation around a central column		O	O	

Model Arm

In this activity, you will create a model of your arm and learn how your muscles and bones work together to move your arm. Some useful vocabulary:

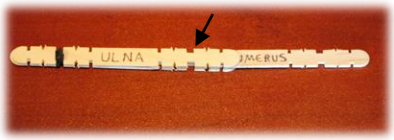
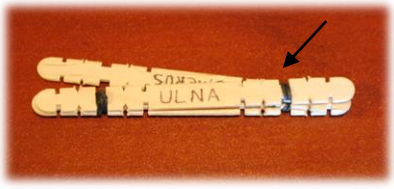


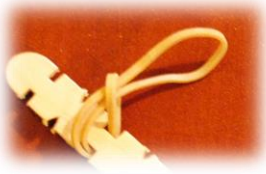
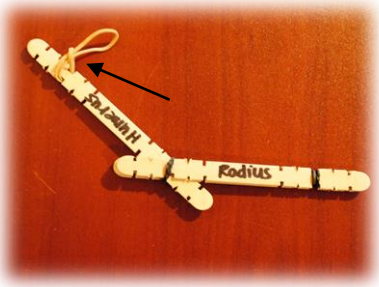
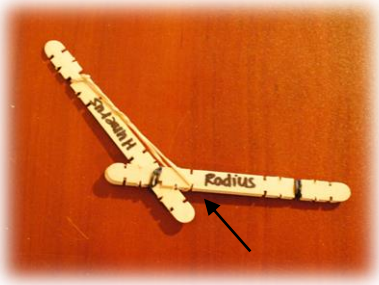
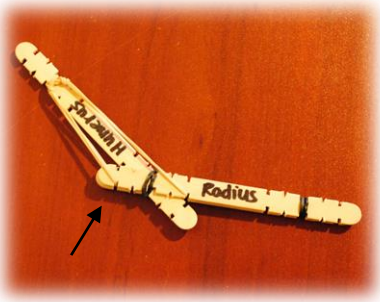
Muscle contraction: when the muscle is put under tension and becomes shorter and fatter. This effect generates the "pull" motion we use to move and lift objects.

Muscle relaxion: opposite of contraction. When the muscle is not under tension, it becomes longer and thinner.

Try contracting or tensing your biceps. Can you feel them getting shorter?

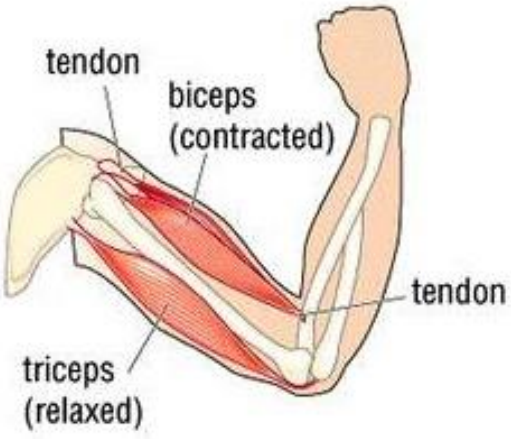
Steps to build a model arm:

1	Label three wooden craft sticks on both sides with the words "Humerus," "Radius," and "Ulna."	
2	Align the "Radius" and "Ulna" sticks on top of each other. Wrap a small rubber band four times on the third notch down from the end.	
3	Place the stick labeled "Humerus" between the "Ulna" and "Radius" sticks on the end not banded together. Make sure the third (largest) notch on all three sticks is in the same place.	
4	Wrap a small rubber band three times on the third notch down on the "Humerus" stick, which is on the third notch up on the "Ulna" and "Radius" sticks.	
5	Bend the "Humerus" stick 160º in relation to the other two.	
6	Wrap a small rubber band three times around the "elbow" again, the "elbow" being where all three sticks are banded together in the largest notch.	

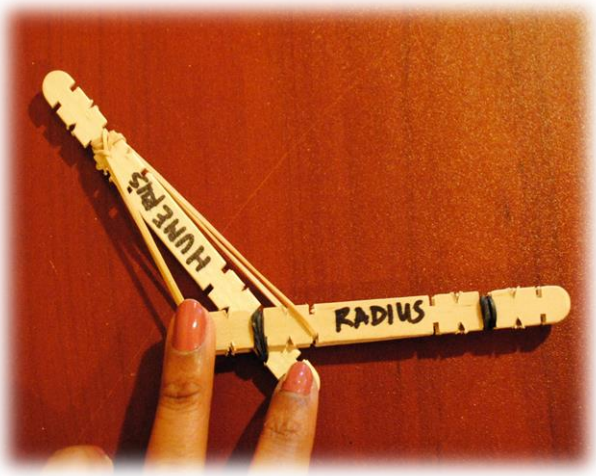
7	Next, take a big rubber band and make a loop at the top of the "Humerus." 	
8	Attach the long rubber band to the bottom of the joined sticks in the front.	
9	Take another large rubber band and make another loop at the top of the "Humerus" stick, but now, attach it to the bottom of the joined sticks at the **back**. The rubber band on the *inside* of the "L shape" is called the **biceps muscle**; the one on the *outside* is called the **triceps muscle**.	

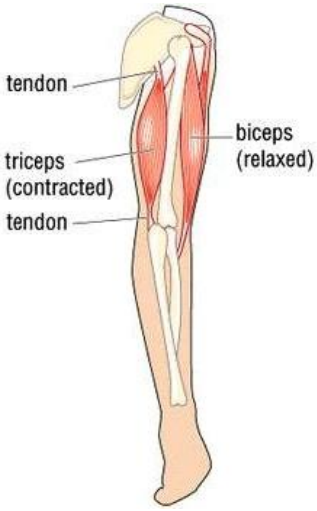
The biceps and the triceps are known as **antagonistic muscles,** or muscles that work together in pairs, each doing the opposite of the other**.** So, if one contracts, the other will relax. Try using your model and your own arm to figure out how antagonistic muscles work. Observe the change of shape of the rubber bands (muscles) as you move the notched craft sticks (bones).

Biceps contraction:



Triceps contraction:





Fill in the blanks below with the following words: *contracts, bones, shorter, relax* and *muscles*.

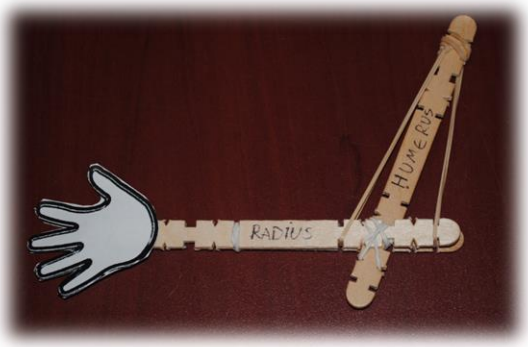
1. When my biceps contract, the muscle becomes _____.

2. When my biceps contract, my triceps _____.

3. When one antagonistic muscle relaxes, the other _____.

4. When my _____ contract, it causes my _____ to move too.

Optional: Below is a hand image template that can be glued to the "Radius"/ "Ulna" extremity:



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