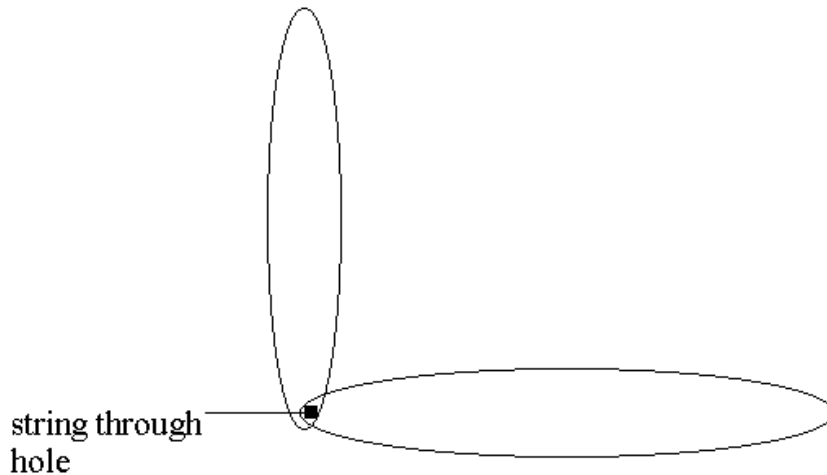


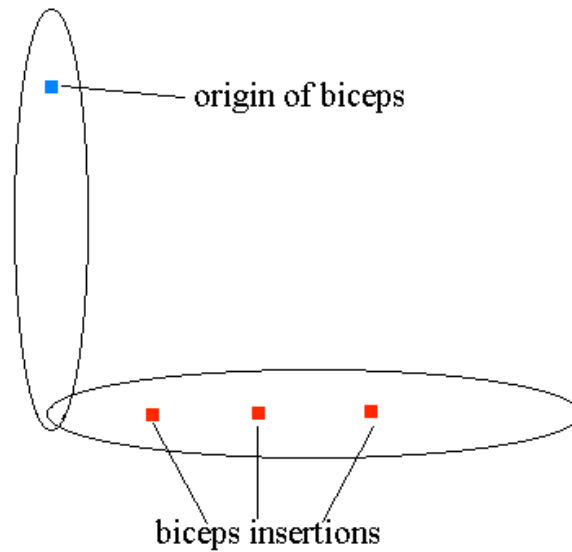
Materials: Popsicle sticks, something to punch holes in the popsicle sticks, string, metric ruler, protractor.

Goal: To model the elbow using popsicle sticks and string and discover how third class levers apply to the body.

Method: Fix two popsicle sticks together like so:



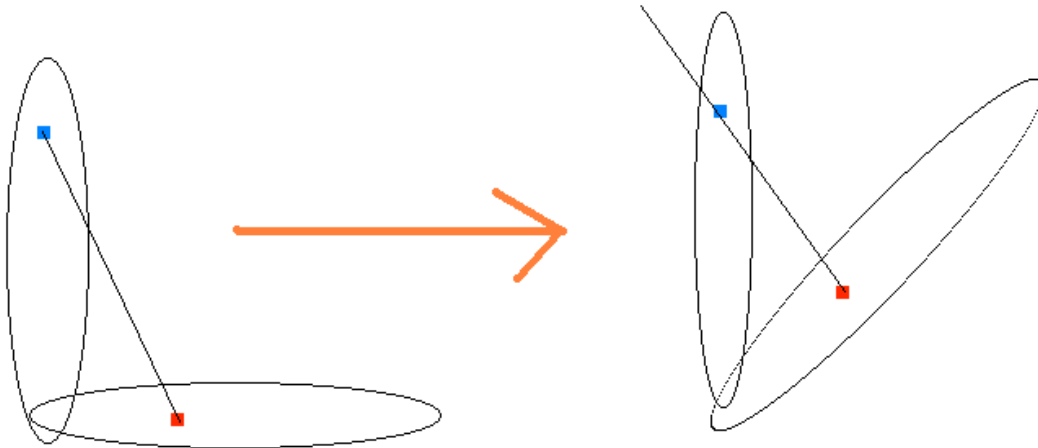
Next make a mark on the Popsicle stick humerus. This mark will represent the origin of the biceps on the humerus. Also, make three holes in your Popsicle stick radius, which we will use as possible insertions of the biceps muscle. Your Popsicle stick elbow should look like this:



Now, tie a string through each of the biceps insertions. Make sure it is long enough to reach the biceps origin. The string represents the biceps muscle.

Now we are going to see how changing the biceps insertions effects angular displacement.

To do this we are going test each insertion. Flex the elbow so that the radius is 90 degrees to the humerus. Place the string from the first insertion on the biceps origin. Measure 4cm down the length of the string. Now pull the string through the origin the whole 4cm. Measure how much the angle changes. Repeat for each insertion, pulling the string exactly 4cm through the origin. See diagram below.



You should discover the following pattern. The closer the insertion is to the elbow, the greater the angular displacement for a given force. By pulling the string exactly 4cm through the origin, we have simulated how the same force would affect different insertions. A muscle generates force by shortening, so essentially by keeping the distance you pull the string constant, you have kept the amount of muscle shortening, and consequently force, constant.

This lesson is intended to be a simple demonstration of how the elbow works. You can make mock ups and whatever size you want. I am currently working on using 2" X 4" boards as levers for demonstration purposes.

Any questions please email lucas.delezene@asu.edu