

Your task is to design an elbow!

Step One: Get inspired!

Oftentimes before scientists and engineers can build something new, they have to complete an investigation. That is what we will be doing today. We will first investigate how our elbows and knees work in order to get ideas for how to build our own. *So, have you ever wondered how you can move your arms and legs? Let's think about it...*

Find your elbows and your knees. These parts of your body are examples of **joints**. Joints are the areas of your body where two parts of your skeleton (bones) come together. You have other joints on your body but today we will just focus on these two. Move your arms and your legs and think about these questions:

1. *How do your elbows and knees help your body move?*
2. *What would happen if you did not have either elbows or knees?*

Once you have talked about your ideas, it is time to get building! We are challenging you to build your very own elbow! The goal is to use objects from around your home to build a joint that moves in the same way as an elbow.

Step Two: Choose your Materials

There are some aspects of an arm that we want you to think about as you are building your elbow. First, there is the upper arm (which includes a bone called the humerus) and the forearm (which includes two bones called the radius and ulna). The upper arm and forearm meet at the elbow. Second, there are **tendons** that connect muscles to bones and **ligaments** that hold bones together. Even though tendons and ligaments hold things together, they are not the same. While tendons stretch and snap back into place, ligaments do not.

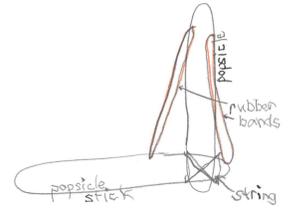


So what does this mean?

1. *What material would you like to use to represent your bones?* The bones in your arm are long, thin and fairly straight. Would things like popsicle sticks, rulers, or pencils work?
2. *What materials would work for tendons, which can be stretched and snap back into place?* Rubber bands, hair ties or uninflated balloons might work.
3. *What material would work for ligaments, which hold bones together?* Tape or string could be options.

Step Three: Designing Your Elbow

Based on the materials that you have selected, draw a picture of how you would use them to make an elbow. Remember how an elbow moves. When does the elbow stop moving up (towards your forearm)? How far can someone typically *extend* their elbow, or open the joint so that the forearm is far away from the upper arm?



Remember to draw a picture of your ideas first. Engineers draw out their ideas to think through their designs and share their creations with others. For an extra challenge, label your design based on how you are using your materials.

Step Four: Building Your Elbow

Use your materials to build your elbow. Remember you want the elbow you build to work like the real thing! Consider testing your built elbow against a real elbow periodically to ensure they are moving in similar ways. Even if you struggle to make your elbow, keep at it!



If you need help...

- Consider collaborating with those around you!
- Think about more or different materials you can use.
- Take a short break and give yourself time to rest and think of new ideas!

(Here's a fun [Sesame Street video](#) on the power of "yet")

If you'd like to explore this type of joint more, consider watching this [PBS Kids video](#).

Step 5: Sharing Your Elbow on Instagram or email.

We want to see your elbow! With permission from your parents, or guardian, share a picture of your elbow for our instagram page. Direct messaging or emailing an image of your challenge gives us the written consent to redistribute the image on our [website](#) and official instagram page.

Instagram: @sciencecircuswhittier **Email:** sciencecircuswhittier@gmail.com

