

Your task is to design an elbow and shoulder!

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? Let's think about it...*

There are several joints along your arm including your knuckles, wrist, elbow, shoulder. With this activity, we are going to focus on your elbow and your shoulder. *If you had to explain the difference between your elbow and your shoulder, what would you say?* How do these two joints allow your arm to move in different ways?

Your elbow and your shoulder represent two different types of joints. **Joints** are the areas of your body where two parts of your skeleton (bones) come together. Your elbow is an example of a hinge joint. **Hinge joints** only have one direction of movement. Your shoulder is a **ball and socket joint**, which allows for a greater range of motion.

Use the pictures below, as well as additional research you can complete online with adult supervision to answer the question: *how would you describe the way the bones come together in each joint?*



Step Two: Select Your Materials

When you build your joints, you have to think about the components of a joint. First, there are the bones. Bones are hard and stiff. Second, there are ligaments and tendons. **Tendons** connect muscles to bones whereas **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?

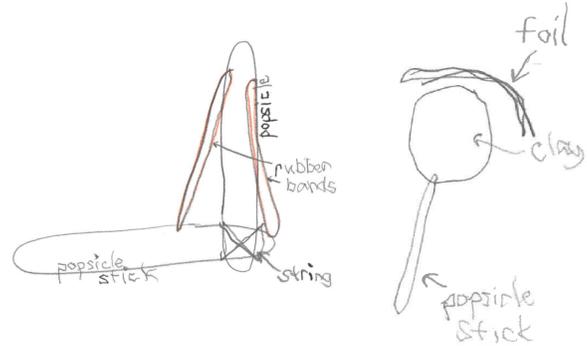
1. **What materials would you like to use to represent your bones?** Consider how these bones are shaped. If they are long and straight, a ruler or pencil might work. If they have a rounded end, a clay or styrofoam ball might be better. If they are flat, maybe use cardboard or aluminum foil.
2. **What 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 Joints

Collect the materials you will use to create your elbow and shoulder. Remember that you want the joints you make to function the same way as an elbow and shoulder in a human body. 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 Joints

As you build, remember to test your built joints against real elbows and shoulders periodically to ensure they are moving in similar ways. Even if you struggle to make your joints, 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!



For inspiration watch [Succeed by Failing: Failure Points \(Crash Course Kids 42.1\)](#)

Reflection questions:

1. What are additional examples of hinge and ball & socket joints in your body?
2. Why do you think your shoulder has a greater range of motion (i.e. it can move in more directions) than your jaw? (Hint: What do you use your shoulder and jaw for?)
3. We explored two types of joints found in the human body. Are there others? (To explore joints further, check out this resource from [Nemours KidsHealth](#)).

Step 5: Sharing Your Elbow & Shoulder on Instagram or email.

We want to see your elbow and shoulder! 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