

Instructor's Guide to:

Prosthetic Leg

In this activity students will build an above the knee prosthetic leg using only the materials provided to them. This activity is very scientific and doesn't leave much room for creativity. It can be integrated into 5-12 grade students' studies of the human body, particularly the musculoskeletal system.

Because this activity involves a lot of sawing, students are especially responsible for their measurements and cannot complete their projects without the help of an instructor. To prepare for the activity, the instructor must purchase a wooden mannequin or another toy which would be easy to work with. At Tufts we used an 8.5" tall hardwood mannequin, which can be purchased at most art supply stores. This mannequin will be the amputee. A hack saw, a detail screw driver, and a metal rod 3mm in diameter will be needed in addition to the materials listed on the activity sheet.

Amputation

Since it would be dangerous to have students using hack saws, the amputations are totally in your control. Your amputations will take some time so make sure you plan in advance; if you have a large class, you may want to get some help in this part. It is also up to you how many students will be working on each mannequin. It is easier to prepare if students work in groups, but this will cause problems in the classroom since it only takes one student to do.

Because transfemoral amputations are more common in the real world than transtibial, this activity will be using a transfemoral amputee, but instructors are welcome to change this. Just know that a change would mean much less work in terms of the prosthetic since it will not involve the knee joint. A transtibial amputation, on the other hand, would be easier on the teacher since it is simple to break the lower leg off of many plastic figures or to disconnect the lower leg from the mannequin by unscrewing the knee.

For the transfemoral amputation it helps to draw a line where you will be making your cut. Make sure the cut is high enough that a knee would realistically fit in line with the opposite knee. When you have cut through all the wood, you must unscrew the hip to release the spring that runs down the thigh along with the severed leg. The entire limb will fall off at this time. To restore the top of the thigh, you must run a small rubber

band tightly down the middle. Screw the rubber band into the hip where the spring used to be, pull it tightly through the leg, and tie a knot. Fill in around the rubber band with Model Magic™, letting the knot sit outside. Use Krazy glue to secure the knot to the dry Model Magic™. If the wood is rough from your cut, you may wish to sand it down or to cover the end with a thin layer of Model Magic™.



Prosthetic by Part

Instructors should suggest that students work on the prosthetic limb by part. The suggested order would be as follows.

Knee

Check that students' knees are tight but still able to bend and do so smoothly.

Socket

The creation of the socket will be difficult for some students, particularly those with poor motor skills. Check that all students have the latex glove tightly over the leg before they start anything.

Help students to cut the glove to let the knot out and to glue the knee to the latex, and make sure everything is dry before allowing the students to continue. Encourage students to build from the top rather than the bottom and to use as little Model Magic as possible so that the socket doesn't come too far out from the leg. When they have finished, help students glue the ring to the outside of the Model Magic™ of the socket.

Lower Leg

Students must show their instructor their design drawn to scale and provide their measurements before they can build the lower leg. The instructor may need assistance in cutting the rod to the sizes specified by the students. Plan on having to cut all of the rods by the next class period. You should use a hack saw for the cutting, and it is best to clamp the rod to a table to keep it steady as you cut. Check at a local Home Depot – sometimes the workers there are willing to cut rods to size for you since they have the tools to do it easily. This could save you a lot of time.

Ankle

Your ankle doesn't have to move – many true prosthetics have stationary ankles. You may instruct students to use a bead as an ankle for the look of one or to create the ankle and foot as one out of extra model magic, or out of clay for something stronger. There is a lot of room for variations.

Foot

Have students mold a foot similar to the existing foot in size and shape. You may actually have them press their mannequins' feet into the clay and model it off of that.