

# Bristle Bots – Robot engineering – USC Science Outreach

Materials:	Amount per Trial:
Tooth Brush Heads	1
Button Batteries	1
Motor	1 Vibrating pager motors
Double Sided Tape	1 Roll per school
Football	1 per school
String	1 3Foot piece per school
Hot Wheel Tracks	2 Tracks per School

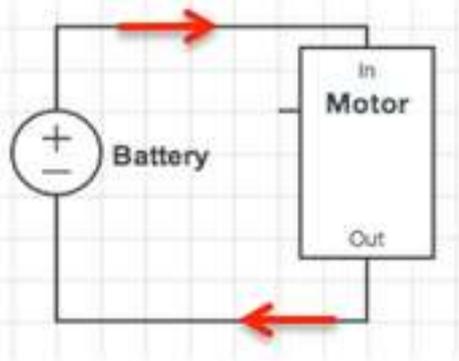
The goals of this experiment are to introduce the idea of robotics, and how all technology we use uses a combination of electrical and mechanical engineering = robot engineering!

## White Board Pictures + Discussion (~10 min)

**\*\* During the discussion, have Scouts prepare strips of tape for each table – this should make the experiment go smoother.**

**Review circuits by asking students to describe what they learned about them last week. Draw the image below with the following explanation:**

When circuit loops are “closed,” electricity can flow in one direction from a **battery** (energy source) to a **motor** (a load). If the loop is “broken,” the electricity cannot reach the motor!



**Today, using the battery and motor of a circuit, we will create our own system called a Bristle Bot! Draw the image below, explaining what each part does.**



**Battery** – this stores **potential energy** that can power your circuits and all the electronics that you use! (For instance, your phone)

**Motor** – this motor is designed to make vibrations that will travel through the toothbrush. It changes the **potential energy** into **kinetic energy**.

**Toothbrush** – The motor vibrations travel through the bristles of the toothbrush, causing them to move in a wave-like pattern.

***Demonstrate the vibration motion through a bristle by holding a string with one hand and shaking it violently.***

Students should see the bottom tip of the string move randomly! Point it out to them. This collective motion in the toothbrush bristles transforms the energy from the battery into complex movement, causing the bristles to act like miniature insect legs that propel the bot forward.

***When we put electricity from the battery and the mechanics of bristle motion together, we enter a special field called robotic engineering!***

## Work in Groups of 3 (~20-25 min)

***Have Scouts spread out among the class and make sure that everyone progresses through the experiment at the same rate. Be cautious with materials, some may break easily!***

1. Cut off tooth brush head
2. Solder or tape one terminal of the motor to the base of the button battery.
3. Using a 1/3” piece of tape, tape the motor to the back side of the tooth brush head such that the motor hangs off the top.
4. Bend un-soldered terminal of motor to touch the top of the battery
5. Watch the bristle bot go!
6. Adjust the center of gravity to maintain balance as the bot moves. You can do this by moving the motor location or shifting the battery weight.
7. Assemble two equal tracks side by side
8. Have each group compete in a drag race!