



# STEM Detective Lab

We investigate STEM projects for you.



## BigBot Instruction Sheet

### Overview

BigBot is our over-sized version of its counterpart, the BrushBot. With just a few supplies from your local dollar store, this activity can take your students' BrushBot skills to the next level.

If you haven't already completed the BrushBot activity with your students, check out our blog post, "[The Case of the Vibrating BrushBot](#)", for an in-depth look at our version of the classic BrushBot. In this post, we explain how we chose the materials we used, common issues we uncovered during our investigation, and tips on how to fix those issues.

**Note:** During our investigation, we discovered that only four out of the five electric toothbrushes we purchased from the local dollar store worked. You may want to purchase an extra toothbrush or two, especially if this is a class project.

### Supplies

- Electric toothbrush - battery & motor included.
- 2 x 3-inch piece of electrical wire
- Vegetable brush
- AA Battery holder
- 2 Instant Tacky sticky dots
- Electrical tape
- Accessories – Googly eyes and decorative foam

### Tools

- Glue Gun
- Wire Strippers
- Wire Cutters
- Soldering Iron & Solder
- Small Saw
- Electrical Tape

### Challenge

Once your students have successfully built their BigBot, have them test their over-sized BrushBot on a variety of surfaces. Through experimentation, have them analyze their findings and report back on which surface worked best and why.

## Step 1: Test



### 1.1 Battery and Motor

Insert the battery into the electric toothbrush and turn it on. When you feel the toothbrush vibrate, you know both the battery and the motor work.

**Note: Always test all electronic and moving parts before you use them and anytime you modify them.**

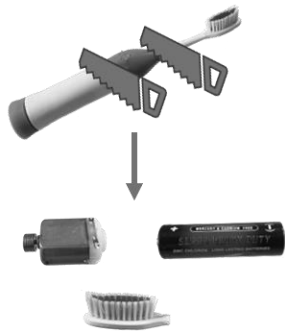
---

## Step 2: Preparation



### 2.1 Wires

Use a pair of wire strippers to remove enough of the rubber insulation to expose a ¼-inch – ½-inch of bare wire from both ends of the 3-inch strips of wire and the ends of the two wires attached to the AA battery holder.



### 2.2 Toothbrush

Use a small saw to remove the top and bottom sections of the electric toothbrush just above and below the brush's internal motor.

Carefully tap the motor out of the remaining plastic tube. Remove the spring if it's still attached.

You should now have a vibrating motor, an AA battery, and a spare toothbrush head.



### 2.3 Retest the Motor

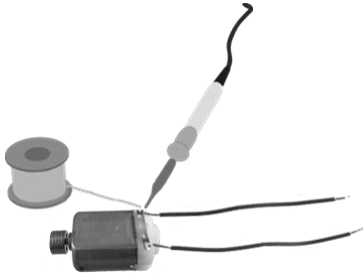
Hold one end of the first wire to the positive (+) end of the AA battery while you hold the other end of that wire to one of the copper contacts on the motor.

Hold one end of the second wire to the negative (-) end of the AA battery while you hold the other end of that wire to the other copper contact on the motor. When you feel the motor vibrate, you know nothing broke when you disassembled your toothbrush.

If you don't feel the motor vibrate, double-check that you're holding the wires correctly. The bare ends of the wires must be in contact with the copper contacts and the battery at the same time to make the connection between the battery and the motor. You may need help holding the wires in place.

If you still don't feel the motor vibrate, start over with a new toothbrush, and be careful as you remove the motor from the toothbrush handle.

### Step 3: Assembly



#### 3.1 Solder the 3-inch Wires to the Motor

Use the soldering iron to solder one end of the first 3-inch piece of wire to one of the motor's copper contacts.

Use the soldering iron to solder one end of the second 3-inch piece of wire to the motor's other copper contact.



#### 3.2 Test the Soldered Wires

Once you solder the two 3-inch pieces of wire to the copper contacts, hold the other end of each wire to the battery, one at each end. You need to be sure that the bare section of each wire is touching one end of the battery.

When you feel the motor vibrate, you know you've soldered the motor's copper contacts correctly. If you don't feel the motor vibrate, you will need to resolder the wires.



#### 3.3 Connect the Motor to the AA Battery Holder

Twist the bare wire at the unused end of one of the motor wires to the red (+) battery holder wire.

Twist the bare wire at the unused end of the other motor wire to the black (-) battery holder wire.

**Note:** Polarity, the direction the current flows in an electrical circuit, doesn't matter with this motor, so it doesn't matter which end of the battery the motor wires connect to.

#### 3.4 Secure the Wires

Wrap the connected wires with a small strip of electrical tape so the wires don't come loose when the motor vibrates. The electrical tape will hold better if you stretch each strip of tape before using it.



#### 3.5 Test the Connection Between the Motor and the AA Battery Holder

Place an AA battery into the battery holder. Again, you should be able to feel the motor vibrate. If not, remove the electrical tape and retwist the wires until a connection is made. Once the motor vibrates, reapply the electrical tape around the ends of the wires.



Remove the battery from the holder so you can finish building your BigBot.

### Step 3: Assembly cont.



#### 3.6 Attach the Motor and Battery Holder to the Vegetable Brush

Use the glue gun to attach the battery holder to the top of the vegetable brush.

Use the glue gun to attach the motor to the very end of the vegetable brush so the weight at the end of the motor isn't obstructed by the brush.



### Step 4: Finish



#### 4.1 Decorate

Attach the googly eyes and decorative foam at the front of the vegetable brush. You can also add any additional accessories you may have to add character to your BigBot.

**Congratulations, you just finished building your very own BigBot. Place the AA battery back in the battery holder and watch the big guy go.**