



Tech Note

Technique for Making A Suction Electrode

Extracellular Suction Electrode

1. Obtain the following items to make your own suction electrode (Figure A- 1 on page 1): a soldering iron; solder; a wire stripper; a wooden-handled dissecting pin; an alcohol burner; a can or tube of contact or plastic cement; a fine flat file; emery cloth; electrical tape; a popsicle stick; two pieces of chlorided silver wire (0.005" dia, 5" long); three feet of shielded, two-conductor, insulated cable; three color-coded connectors that will mate to the connectors on the input cable for the amplifier; three feet of flexible plastic tubing (20 gauge Tygon or PE 100); an 18-gauge needle, a 3-way stop cock, a 3cc syringe, a 1cc tuberculin syringe; glass micropipette tip.
2. Connectors and electrodes need to be attached to the ends of the shielded, two-conductor cable. Take one end of the cable and carefully strip 5 inches of insulation off the end. Minimize the number of strands of braided shielding cut during the removal of the insulation. Avoid cutting the conductor wires under the braided shielding.
3. Unbraid the 5 inches of exposed shielding. Pull the conductor wires aside. Gather all the strands of the shielding in a bundle and twist them together. Solder a small alligator clip to the end of the twisted shielding.
4. Strip a quarter of an inch of insulation off the end of each conductor wire. Solder a piece of the chlorided silver wire to the end of each wire. Figure 1: Typical suction electrode assembly.

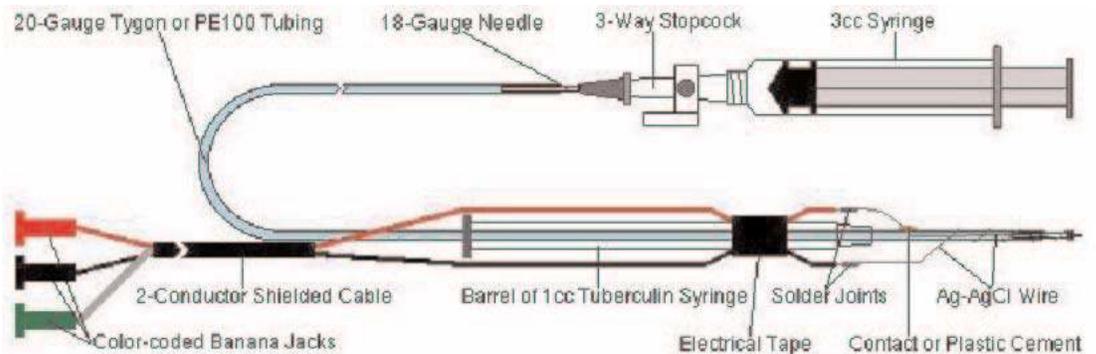


Figure 1. Typical suction electrode assembly.

5. Take the other end of the cable and carefully strip 3 inches of insulation off the end. Again, minimize the number of strands of braided shielding cut during the removal of the insulation. Avoid cutting the conductor wires under the braided shielding.
6. Unbraid the 3 inches of exposed shielding. Pull the conductor wires aside. Gather all the strands of the shielding in a bundle and twist them together. Solder a color-coded connector, that mates with the connector on the input cable of the amplifier, to the end of the twisted shielding. Since the shielding is the ground wire, the connector is usually color-coded green.

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7. Strip a quarter of an inch of insulation off the end of each conductor wire at this end of the cable. Solder a color-coded connector to the end of the each conductor wire. A red connector is usually put on the wire conducting the signal from the recording electrode. On this suction electrode assembly, the recording electrode will be the silver wire that is inside the lumen of the suction tubing. A black connector is usually put on the wire connected to the indifferent or reference electrode, which is a silver wire wrapped around the outside of the electrode tip.

8. Heat the tip of the dissecting pin in the flame of the alcohol burner. Use the heated tip to poke a small hole in the side of the plastic tubing that is about 3 inches from the end of the tubing and angled toward the end at 45 degrees.

9. Remove the plunger from the 1cc tuberculin syringe. Find the end of the plastic tubing without the hole. Push this end of the tubing through the hole in the front end of the 1cc syringe barrel until the tube exits the rear of the syringe barrel. Push and pull the tubing through the syringe barrel until the small angled hole in the side of the tube is about half of an inch from the front of the syringe barrel.

10. Find the silver electrode that is designated as the recording electrode by being color-coded to the red conductor wire or connector. Push the tip of this electrode wire through the hole in the side of the plastic tubing. Keep the solder joint of the electrode to the conductor wire about a quarter of an inch away from the hole in the tubing.

11. Mix up the contact or plastic cement. Use the popsicle stick to place a drop of cement over the hole in the tubing to create an air-tight seal around the silver electrode wire going through the hole. Make sure the cement does not drip into the lumen of the tubing and block it. Contact and plastic cement usually dries to the touch in 10 to 15 minutes.

12. Once the hole is sealed, cut the end of the silver recording electrode so that a quarter of an inch of the wire is sticking out of the end of the tubing.

13. Use the flat file and emery cloth to remove the point and smooth the tip of the 18-gauge needle. Once smoothed, push the tip of the needle into the other end of the plastic tubing.

14. Attach the 3-way stopcock to the 18 gauge needle, and the 3cc syringe to the 3-way stopcock.

15. When the nerve has been isolated, determine the diameter of the tip of the glass micropipette needed to fit the nerve. Snap the tip of the micropipette at the correct diameter, and fire-polish the tip to remove and jagged edges.

16. Place the glass micropipette over the wire sticking out the end of the plastic tubing. Push the micropipette into the plastic tubing to make a tight seal. The silver wire should be sticking a short distance into the glass micropipette.

17. The silver wire that is the indifferent or reference electrode is wrapped around the outside of glass micropipette and part of the plastic tubing supporting the micropipette. The tip of the indifferent electrode should be as close as possible to the tip of the glass micropipette, but, the positive and negative electrodes and their connectors must not touch each other!

Chloriding Silver Wire

1. Obtain the following items to chloride your own silver wire: a 9V transistor battery; a 9V transistor battery connector with color coded lead wires; two small alligator clips; a 200 ml beaker; 175 ml of 3M KCl; 1 roll of silver wire (0.005" dia); a #2 pencil; dental wax or clay; forceps.

2. Attach an alligator clip to the each lead of the 9V transistor battery connector.

3. Pour the 3MKCl solution into the beaker.

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4. Wrap a length of the silver wire around the pencil to form a coil of ten turns. At one end of the coil, there should be a straight segment about 1.5" long. Make two coils for each chloriding session.
5. Put two 1" long beads of dental wax or clay on opposite sides of the rim of the beaker.
6. Attach a coil of silver wire to each lead of the battery connector by clamping the straight segment of the wire in the jaws of the alligator clip.

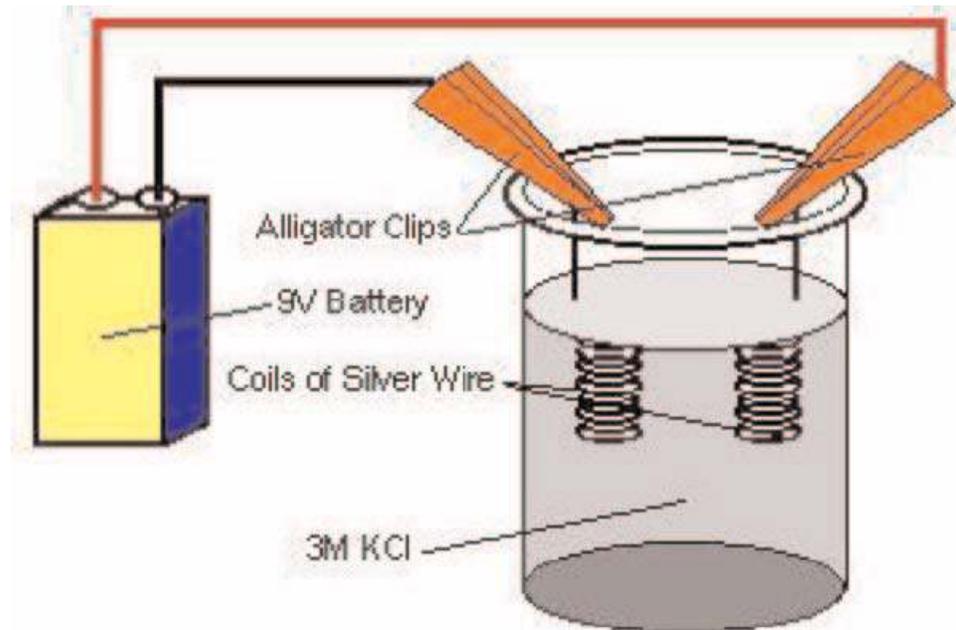


Figure 2: Set up to chloride silver wire.

7. Position each alligator clip in the wax or clay on opposite sides of the rim of the beaker, so that the two wire coils are in solution (Figure 2). It is important that one wire coil does not touch the other, and that the alligator clips or the lead wires of the battery connector are not in solution!
8. Attach the 9V transistor battery to the battery connector. The solution near the coils will bubble and the coils will change color during the chloriding procedure. Chloride the coils for 8 minutes.
9. Disconnect the 9V battery from the connector. Reverse the chloriding process by putting each coil of silver wire on the other alligator clip. Use the forceps to hold a coil as it is removed from an alligator clip and moved to the other.
10. Re-position the alligator clips on the wax and the wire coils in the solution. Attach the 9V battery to the connector and chloride the wire coils in this polarity for another 8 minutes.
11. At the end of the second 8-minute period of chloriding. Put the wire coils back on the alligator clips to which they were initially attached and chloride the coils in this configuration for 5 minutes.
12. Finally, reverse the chloriding of the coils, as performed in Steps 9 and 10, for 5 minutes. At the end of the 5 minutes, disconnect the battery, remove the wire coils from the clips, and rinse the coils with deionized water.
13. The coils of chlorided silver wire are now ready to be used as electrodes.