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Introduction

Many people asked us about how to interface electrodes with our JAGA device that has a Millmax-connector. We by no means are a company that is specialized in electrodes however we provide a general guideline on how to prepare electrodes that will work for our device. Please note that every lab builds electrodes differently and some also purchase many different types of electrodes, this document should only be a guideline. This instruction was provided by Prof. Tom Zhou at Medical University of South Carolina.

Electrodes can be either *arrays* or *bundle*. Arrays are wires placed in a grid arrangement. It is harder to make and mostly must be purchased from a company (\$50-\$250). Bundles can be made in a lab. Electrodes can be “fixed” or “driveable”. Driveable electrodes have a screw that you can turn to advance the electrode deeper into the brain with every recording session. These are best as you get new neurons every time you record. Labs with advanced skills use these and there are existing papers:

- (<http://www.ncbi.nlm.nih.gov/pubmed/21613588>)
- (<http://www.jove.com/video/1094/micro--drive--array--for--chronic--in--vivo--recording--drive--fabrication>)

Fixed electrodes for spike recording are easier to make and can be tried in a new lab. The below is the instruction for fixed-electrodes for spike-recording.

How to make Fixed Electrodes

1. Purchase formvar-insulated nichrome wire from A-M systems. They have 3 diameters-18, 25, 50 micron. The exact diameter does not seem to matter much in terms of recording quality. However in areas where the density is higher one should use thinner ones (18 or 25 micron). <https://www.amsystems.com/s--102--nichrome.aspx>
2. Cut a guide cannula from 31 gauge polyimide tubing, purchase from Amazon (http://www.amazon.com/dp/B000FMYW2K/ref=biss_dp_t_asn). The cannula will be glued to the electrode interface board (EIB). The pictures shown.
The top 5 mm of the guide will overlap the EIB and can be secured with the crazy glue. The bottom of the guide will extend past the bottom of the EIB, with the exact amount depending on the depth of the brain region. i.e. for the brain region 5mm deep, you may want at least 5mm deep + extra 1-2 mm due to the thickness of the skull.
3. Cut 8 or 16 wires (depending on the channels of JAGA you use). Pass them all through the polyimide guide. This should be done under a microscope. Glue the wires in place with 1mm protruding from the bottom of the guide. These are the recording ends and can be trimmed with sharp scissors to

ensure the same length. The glue should be cyanoacrylate glue (crazy glue) and should be applied to the TOP of the guide, which is NOT the end that goes into the brain. Wait until this dries.

4. Insert the wires into the EIB board. The holes are numbered 1,2, ...16 corresponding to the JAGA channels. Only one wire should go into each hole.
5. Purchase a pack of unpainted stainless steel insect pins. The diameter should be just barely bigger than the holes in the EBI (0.015"). So use a #1 insect pin which has 0.016". (<https://www.bioquip.com/Search/WebCatalog.asp?category=1200&prodtype=1>) The part # is 1208S1. Get the unpainted pins. Note: Holes for the EIB have some variations. So order ~1000 insect pins of different sizes to choose from. So that you will always have a pin that fits any holes of the EIB pin.
6. Cut off 3mm of the tips using a wire-cutter. You will only use the TIP and throw away the rest of the pin.
7. Push one pin tip into each hole of the EIB trapping the wire between the pin and the edge of the hole. You must push the pin just hard enough to scrape off the formvar insulation, but not too hard to break the wire. It takes some practice to get the pressure right. Once you have all 16 (or how many number of channels you use) wires into the holes, apply some dental cement over the pin to lock them in place

