Preparing electrodes

July 2015 v.2.0

Introduction

Here, we provide a general guideline on how to prepare electrodes that will work with the JAGA device. Please note that every lab prepares electrodes differently, and one can purchase many different types of electrodes. Thus, this document is a guideline – a good place to start if you are new to electrophysiology – not a comprehensive guide by any means.

Electrodes can be either *array* or *bundle.*

Array electrodes have wires placed in a grid arrangement. They are difficult to make, and are commonly purchased from a company ($50-$250).

Bundle electrodes can be made in the lab. They can be *fixed* or *driveable*.

Driveable electrodes have a screw that you can turn to advance the electrodes deeper into the brain with every recording session. These electrodes are best as you get new neurons every time you record. Labs with the expertise use driveable electrodes, and here are some papers that describe how to make them.

1. http://www.ncbi.nlm.nih.gov/pubmed/21613588
2. http://www.jove.com/video/1094/micro--drive--array--for--chronic--in--vivo--recording--drive--fabrication
3. http://www.sciencedirect.com/science/article/pii/S0165027006000173

Fixed electrodes for spike recording are easier to make, and can be tried in a new lab. Here is an instruction for making fixed electrodes (provided by Prof. Tom Jhous at Medical University of South Carolina).

How to make Fixed Electrodes

1. Purchase formvar-insulated nichrome wire from A-M systems (https://www.a--msystems.com/s--102--nichrome.aspx). They have 3 diameters - 18, 25, 50 microns. The exact diameter does not seem to matter much in terms of recording

quality. However, in high-density areas, one should use thinner ones (18 or 25 micron wires).

2. Cut a guide cannula from 31-guage polyimide tubing. This can be purchased from Amazon (http://www.amazon.com/dp/B000FMYW2K/ref=biss_dp_t_asn). The cannula will be glued to the electrode interface board (EIB). Please see diagram shown below.

3. The top 5 mm of the guide will overlap the EIB and can be secured with Krazy 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 (*e.* for brain region that is 5mm deep, you may want at least 5 mm + extra 1-2 mm due to the thickness of the skull).

4. Cut 8 or 16 wires, depending on the number of channels you will be using. 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 (Krazy 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.

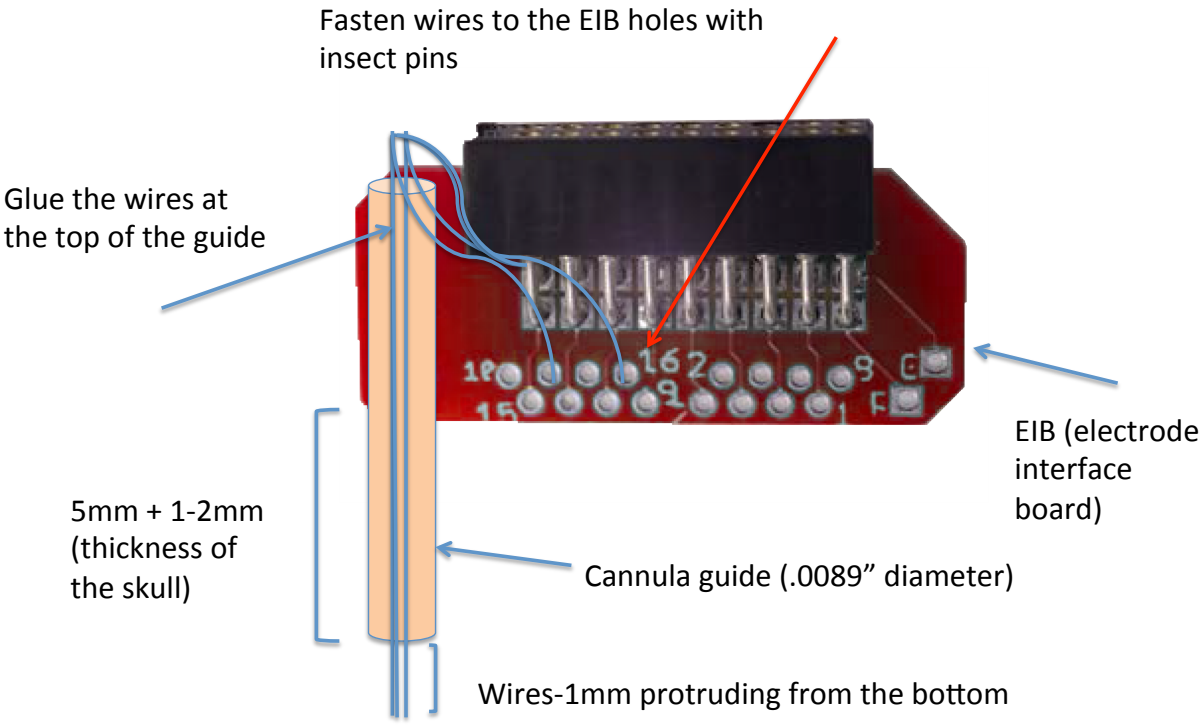
5. Insert the wires into the EIB board. The holes are numbered 1,2, …16, corresponding to the JAGA channels. Only one wire should go into each hole.

6. Purchase a pack of unpainted stainless steel insect pins (https://www.bioquip.com/Search/WebCatalog.asp?category=1200&prodtype=1). The diameter should be just barely bigger than the holes in the EBI (0.015 inch). I use the #1 insect pins, which are 0.016 inches in diameter. The part number for the #1 pins is 1208S1.

   Note: 1) Remember, get the unpainted pins. 2) Holes on the EIB have some variations. I recommend ordering few different sizes of insect pins in order to account for the variation.

7. Cut off 3mm of the pin tips using a wire-cutter. You will only use the TIP and throw away the rest of the pin.

8. 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 scape 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 however many number of channels you are using) wires positioned in the holes, apply some dental cement over the pin to lock them in place.


Fasten wires to the EIB holes with insect pins
Glue the wires at the top of the guide
EIB (electrode interface board)
5mm + 1-2mm (thickness of the skull)
Cannula guide (.0089” diameter)
Wires-1mm protruding from the bottom