Mapping Electrode Paths in the Inferior Colliculus

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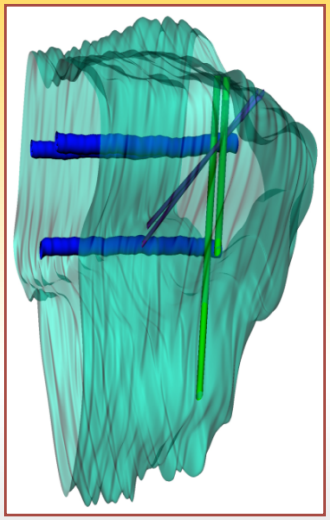
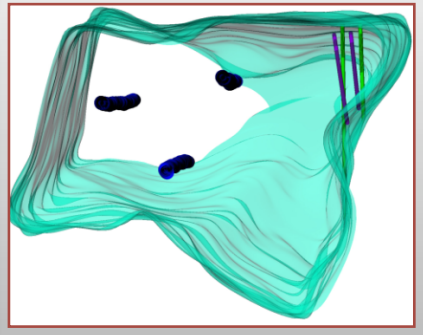
Introduction

Sound surrounds us in everyday life, but to those with a hearing deficit the world seems quiet. Understanding how the auditory system works is essential to creating new devices that will help the percent of the population living in a silent world. The structure of the auditory system that I will be exploring is the Inferior Colliculus (IC). One reason the IC is an important area of study is because it has a strict frequency map. The research of this project will mainly focus on understanding the plasticity induced in the IC from electrical stimulation. This can be related to changes observed in the IC of patients with auditory midbrain implants.

Aim

The goal of the experiments is to be able to shift the frequency maps of the IC to further understand IC plasticity and to also develop a shifting strategy to be used in future studies. My specific part of the project aims to help determine the exact location of electrode placements during stimulation.





Methods

Dyed electrodes will be used on Ketamine anesthetized guinea pigs to stimulate the brain, in the IC region. Results will be read in the form of frequency maps to help better understand brain plasticity. What is missing form a large part of the literature of plasticity is anatomical information that can be related to the functional differences of the regions of interest. When electrodes were placed, it was just an educated guess to get the sites of interest. Actual locations are needed to create a usable shifting paradigm. Finding these locations is my main focus. Once the recordings are done, the brain will be fixed in formaldehyde and sent to histology for slicing. Pictures will be obtained from imaging each slice under the microscope. I will use a computer program, called Rhino, to trace each individual slice and electrode locations. With the tracings, Rhino is able to create 3D renderings of the brain and the location of the electrodes. This model gives an accurate placement of the electrodes that show where recordings were taken. Overlaying many reconstructions can help to determine what areas are more efficient at shifting the frequency maps.

Results

Over the course of the summer I was able to create 4 guinea pig brain reconstructions. This information on electrode locations with help the graduate student understand her findings. After many reconstructions a “normal” brain was chosen and all other reconstructions will be scaled to that brain. This is so the results will be normalized across experiments. The methods of normalization is a future part of this work. I have started helping with the normalizations and will continue with this part of the research in the upcoming year. One of the reconstructions, shown above, had one 45 degree angle bi-shank electrode placement (purple) and then a second vertical bi- shank placement (green). The angle of entry is in reference to the bottom image where the IC is in the top right.