AbstractID: 7404 Title: Development of Image Guidance Methods for Deep Brain Stimulation

Purpose: To develop and employ novel image guidance methods for targeting in the stereotactic functional procedure of deep brain stimulation (DBS) in regions that are poorly defined with anatomic imaging using a deformable atlas and functional imaging.

Method and Materials: An image guidance system was developed to enhance targeting for stereotactic DBS surgeries. An atlas of the structures in the basal ganglia was created from the Schaltenbrand-Bailey series of histologically stained sagittal and axial sections. By defining a surface that connects each plane, a voxelized binary atlas was created and smoothed to reduce inconsistencies. A set of programs were created using Matlab to allow for user driven linear atlas deformation to match the atlas with patient specific anatomy and landmarks. An additional set of programs were created to record intraoperative microelectrode recording (MER) maps and to visualize these maps through sagittal and coronal cuts in the patient deformed atlas. To add additional functional information, a high resolution functional MRI (fMRI) protocol was developed that allows for localization of motor, sensory, language, and emotional regions in the basal ganglia. Software to visualize the deformed atlas, MRI and fMRI all together was created to allow for target definition and planning based off multiple sources of information simultaneously.

Results: The developed atlas-based image guidance system has been used as a clinical tool for several months and now allows physicians the ability to deform an anatomic atlas to patient specific anatomy and also obtain and view electrode tracks through the atlas in oblique angles. fMRI data on initial subjects has shown good qualitative agreement with expected physiological locations and MER maps in patients.

Conclusion: This work allows for improved targeting in DBS based off the simultaneous usage of a 3D deformed atlas, microelectrode recording maps, and fMRI data.