

Erica Moon
Undergraduate
LSU Health Sciences Center, New Orleans, LA

Mentor: XiaoChing Li, PhD
LSU Health School of Medicine, Neuroscience Center of Excellence

“Learning experience shapes neuron structure and gene expression in the song circuit during the critical period”

BACKGROUND: Neurodevelopmental disorders such as Autism Spectrum Disorder affects many individuals across the globe. These individuals often experience impairments in cognition, social interaction, and language. Studying the song development in juvenile zebra finches serves as an excellent model to study language development in humans as zebra finches have a well-developed and similar vocal learning process to humans. In the zebra finch's brain, we study Area X, an avian homolog of the basal ganglia of mammals. To understand the plasticity of the song circuit in response to learning experiences, we examined neuronal structure and the expression of the FOXP2 gene of zebra finches at different ages.

OBJECTIVES: This study aims to identify morphological changes of neurons and FOXP2 gene expression in Area X in response to the learning environment of zebra finches.

METHODS: A previous lab member prepared virus-labeled neurons and used immunohistochemistry to stain the brain sections of juvenile zebra finches at 45, 60, and 100 days (d) of age. A confocal microscope was used to image the samples. I used the filament function of Imaris 9.2.1 to measure dendrite length, spine density, spine length, and spine head volume. OlyVIA was used to open and convert the confocal images into Tagged Image File Format (TIFF). ImageJ was used to quantify the intensity of FOXP2.

RESULTS: Four 60d birds were analyzed for neuronal structure. Group 1, consisting of two birds, had an average dendrite length of 36.1 μm while Group 2 was 41.6 μm . Group 1 had an average spine density of 1.50 spines per 10 μm of dendritic length and Group 2 measured to be 2.39 per 10 μm of dendritic length. Group 1's average spine length was 1.09 μm and Group 2's measurement was 1.37 μm . The average spine head volume of Group 1 was 0.036 μm^3 and Group 2 measured to be 0.020 μm^3 . Next, comparing the FOXP2 gene expression in Area X, the 45d bird had an average mean gray value of 602.2 while the 60d and 100d birds had a value of 950.2 and 411.9, respectively. Outside Area X, the birds had an average mean gray value of 391.1, 387.6, and 296.4 for the 45d, 60d, and 100d birds, respectively.

CONCLUSIONS: Because this is a double blind study and our data is preliminary, we will continue to analyze more dendrites and FOXP2 gene expression to collect more data and have a higher statistical power. Ultimately we aim draw a conclusion on the effect of a song tutor on neuron structure and the regulation of the FOXP2 gene.