CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34738

Project Title

Linking Expression and Function of FoxP2 in Adult Songbirds Using Operant Preference Testing

Abstract

Objectives/Goals

Mutations in the human gene, FOXP2, cause severe speech and language disorders in humans. This study examines the functional relationship between the transcription factor FoxP2, its impact on song quality of adult male zebra finches (Taeniopygia guttata) whose song learning parallels human speech learning, and conspecific communication in adulthood.

FoxP2 mRNA decrease when juvenile and adult birds sing alone (undirected song) and increase when adult male zebra finches sing a highly stereotyped song in courtship (directed song). Male zebra finches sing to court females and females can discriminate between undirected and directed songs. I hypothesized that FoxP2 overexpression directly improves the quality of undirected songs making them more preferable to the female but can also be detrimental to the quality of directed songs.

Methods/Materials

I use an adeno-associated virus (AAV) to increase FoxP2 in Area X of adult male zebra finches to assess whether FoxP2 overexpression improves the quality of songs. I use an operant feedback preference test that requires the female bird to fly to a specific side of the cage to elicit playback of a particular song by interrupting an infrared beam. Repeated triggering of the same stimulus relative to the other indicates a preference for that song type.

Results

Constitutively high FoxP2 caused male undirected song (UD) to be more preferable than undirected song prior to FoxP2 overexpression and male directed song (FD) to be less preferable than directed song prior to FoxP2 overexpression.

Conclusions/Discussion

My experiments suggest females are able to detect the changes FoxP2 causes in song. FoxP2 directly enhances communication between songbirds by making the undirected song sounds more like the directed song. However, the female does not always prefer the more stereotyped song and thus FoxP2 overexpression may be detrimental to conspecific communication. These preferences affirm the idea that FoxP2 is active in adults and is important for mediating vocalizations throughout the lifetime of the animal and not just during song learning. Overall, these tests help us understand the role of FoxP2 in communication between songbirds and thus the significance of this gene in typical and atypical human speech and its relationship to human language disorders.

Summary Statement

This study examines the functional relationship between the transcription factor FoxP2, its impact on song quality of adult male zebra finches whose song learning parallels human speech learning, and conspecific communication in adulthood.

Help Received

Used lab equipment at UCLA under the supervision of Dr. Stephanie White; Used MatLab code from Dr. Sarah M.N. Woolley from Columbia University

Preliminary