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

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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). Females can discriminate between undirected and directed songs during courtship. We 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. We 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. Females preferred their mate's undirected song produced following surgical FoxP2 overexpression to their mate's undirected song produced prior to surgical FoxP2 overexpression suggesting FoxP2 directly enhances communication between songbirds by making the undirected song sounds more like the directed song. However, females preferred their mate's directed song before rather than after FoxP2 overexpression suggesting overexpression of FoxP2 may be detrimental to conspecific communication. 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.

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