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Speech, Language, and the *FOXP2* Gene

Spoken language is a characteristically human trait and is presumed to be the prerequisite for the evolution of cultures. Speech entails the fine-scale control of the larynx (voice box) and mouth. Individuals who are heterozygous for mutations at the *FOXP2* locus have severe problems with language articulation and with forming sentences (Vargha-Khadem et al. 1995; Lai et al. 2001). This observation has provided genetic anthropologists with an interesting gene to study. Enard and colleagues (2002b) have shown that, although the *FOXP2* gene is conserved throughout most of mammalian evolution, it has a unique form in humans, having accumulated at least two amino acid-changing mutations just since our divergence from the common ancestor of humans and chimpanzees. These differences are significant, since human and chimpanzee forms of the Foxp2 protein differentially regulate more than 100 genes (Konopka et al. 2009).

In the mouse, the *Foxp2* gene is expressed in the developing brain, but its major site of expression is the lung (Shu et al. 2001). In humans, *FOXP2* is predominantly expressed in those brain regions that coordinate speech (i.e., the caudate nucleus and inferior olive nuclei); these sites are abnormal in patients with *FOXP2* deficiency (Lai et al. 2003). In the cortical regions regulating language and speech, the human-specific FoxP2 appears to promote the expression of these specific transcripts during brain development (Lambert et al. 2011). In birds, the Foxp2 protein is associated with song learning, and the experimental downregulation of *Foxp2* expression in certain areas of the brain prevents young male birds from imitating their species-specific song (Teramitsu and White 2006; Haesler et al. 2007). Although it is not certain that *FOXP2* is the most critical gene for human language acquisition, it seems to be very important for allowing the orofacial movements and grammar characteristic of human speech.

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