



The iconoclastic & plastic beaks of finches

Dr. Jennifer Gee
Biology Department
U California, Riverside

The beak of the warbler finch (*Certhidea fusca*) is elongate, slender and pointed, conspicuously different from all of the other Darwin's finches. Despite its singular morphology, the warbler finch occupies a basal position in the Darwin's finch phylogeny, having arisen 2-3 million years before the other finch species. Thus, understanding beak development in the Warbler Finch is critical to explaining the evolution of all other beak types in Darwin's Finches. Curiously, the bananaquit (*Coereba flaveola*) occupies a similar phylogenetic and morphological space within its clade, a group of birds that are close relatives of Darwin's finches. Using these species, we investigate 1) **the molecular factors that give rise to pointed bills** and how much of this developmental program is shared among Darwin's finches. Beak size and shape can be highly heritable in birds such as Darwin's finches, but is not necessarily the case for all birds. In vertebrates including fish, mammals and lizards, response to mechanical stress is not only possible but necessary for normal jaw development. As a second focus, we ask 2) **whether environmental forces can alter beak shape** in postnatal Java finches (*Padda oryzivora*) and if so, how mechanisms of postnatal, mechanically-induced beak development compare to heritable factors that have been identified in Darwin's finches. Results suggest that pointed shape of the Warbler finch bill results from suppression of the molecular factors that are upregulated in the Ground Finches with broad and wide bills. Thus, the ancestor of the Warbler finch may have itself had a more typical Darwin's finch bill and a developmental program corresponding to this morphology. Further, we show that the genes involved with key bill dimensions across Darwin's finches with heritable bill shapes can be realized by mechanical rather than genetic induction and in postnatal rather than embryonic Java finches.

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