



parrots & falcons are sister to passerines

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In 2008, Shannon Hackett and a veritable who's who of avian systematists published an evolutionary tree for birds in the esteemed journal *Science* (320: 1763–68). At the time, it was based on an unprecedented 32 000 base pairs of nuclear sequence data from 169 birds across the avian tree. One of their most surprising findings was that parrots, falcons and seriemas are the sister groups to passerines and that, by extension, falcons are not closely related to other raptors. Given the lack of support for this relationship from more traditional analyses, most ornithologists have taken a 'wait and see' approach, preferring to retain more traditional phylogenies until further evidence emerges.

Next-generation sequencing has now provided that support. Alexander Suh and colleagues (2011, *Nature Communications*, 1448) searched the complete genome sequences of the chicken and Zebra Finch for retroposons, the so-called 'jumping genes' that are inserted almost at random throughout the genome. Because the same gene sequence is highly unlikely to be copied to the same place twice, these retroposons provide strong evidence for common ancestry rather than convergent evolution.

The authors then compared approximately 200 000 retroposon sites among a suite of bird species to search for those

sites that varied among the major branches of the avian tree.

Their results support Hackett's phylogeny, and reaffirm the broader pattern of avian radiation. The palaeognaths (ratites and tinamous) are basal, but share six retroposon sites with all other birds, indicating that birds form a natural group. The neognaths are divided into the galloanserae (ducks and gamebirds) and the neoaves (all other birds). The initial radiation of the neoaves contains the only contradictory retroposon evidence, supporting previous molecular evidence of a rapid radiation at the base of the neoavian tree. Given the less than one in a billion odds of the same insertion happening at the same place twice, the most likely explanation is that the neoavian radiation occurred rapidly, with incomplete lineage sorting accounting for the unresolved pattern. Similar results have been found in other rapidly evolving radiations.

Within the neoaves, there was support for Hackett's 'landbird clade', comprising the raptors, seriemas, owls, trogons, mousebirds, woodpeckers, barbets, honeyguides, rollers, bee-eaters, hornbills and passerines (as distinct from all the aquatic birds, shorebirds, bustards, mesites, turacos, swifts, hummingbirds, doves, sandgrouse, cuckoos and nightjars). Interestingly, the mousebirds emerged as basal within this landbird clade. But their most exciting result was the strong support

This Rosy-faced Lovebird and White-throated Canary are more closely related than previously thought.

for the close relationship between falcons, seriemas, parrots and passerines – exactly the same pattern reported in Hackett's paper.

Surprisingly, they found many unique retroposons within this group, providing the first strong evidence for their relationships. Seriemas are basal to the group, followed by the falcons, with the parrots sister to the passerines. This result suggests that the ability to learn vocalisations evolved only twice in birds: in the hummingbirds and the common ancestor of parrots and passerines. It also suggests that the evolution of vocal learning occurred much earlier than previously thought, perhaps even before the end of the Mesozoic era that saw the demise of the dinosaurs 66 million years ago.

The largely independent support provided by the transposon data for Hackett's broad phylogeny suggests that the time has come to consider adopting their radical restructuring of the avian tree of life. Whether this will translate through to field guides is another matter. It might be the final straw that pushes many field guides to group birds that appear similar, rather than those that actually share a common ancestry.

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