



OSTRICH ALBERT FRONEMAN

# FLYING ostriches

New Zealand groups, the moas and kiwis, should have diverged next, about 80 million years ago, leaving the rheas, tinamous, emus and cassowaries to be the most recent radiation. However, we have suspected for some time that kiwis are more closely related to emus and cassowaries than moas, and recent studies using ancient DNA suggest that the moas were closest to the South American tinamous.

The final nail in the coffin of a Gondwana radiation of giant ratites is the finding that Madagascar's elephant birds were in fact sister to the kiwis. This is very unlikely from a biogeographic perspective, strongly suggesting that both groups evolved from flying ancestors that dispersed between Madagascar and New Zealand well after the break-up of Gondwanaland. Mitchell and his colleagues infer that flightlessness evolved at least six times during the radiation of palaeognath birds, and gigantism at least five times. They conclude that the similarity between all the large, flightless ratites results from

convergence rather than all having a large, flightless ancestor.

Large herbivorous ratites probably evolved independently on each continent following the catastrophic extinction event at the end of the Cretaceous Period some 66 million years ago. The extinction of the dinosaurs created new opportunities for large herbivores, and the ratites were among the first groups to exploit this vacant niche. Mammals appear to have been slow to adapt, with few large species evolving for about 10 million years after the extinction event.

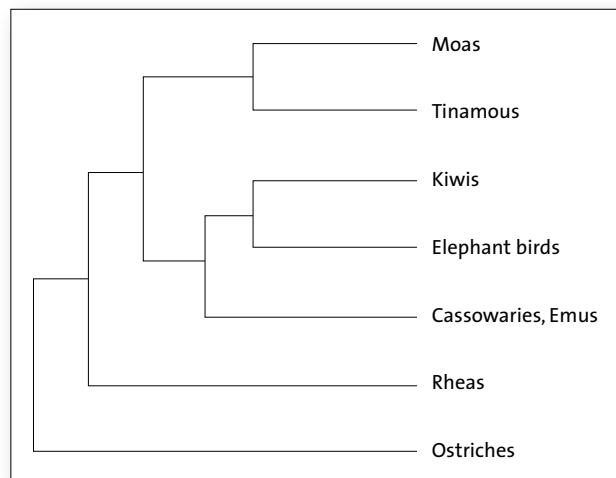
Further support for the widespread dispersal of flying palaeognath birds comes from the discovery of fossil remains of large, flightless ratites in Europe and North America following the demise of the dinosaurs. In New Zealand and South America where there were secondary invasions of palaeognaths, the later group to arrive remained small and, in the case of the tinamous, retained the ability to fly.

PETER RYAN

The occurrence of large, flightless, herbivorous birds on all the southern continents is often presented as evidence of the importance of continental drift in evolution: ostriches in Africa, elephant birds in Madagascar, rheas in South America, emus and cassowaries in Australia and New Guinea, and moas in New Zealand. However, a recent study by Kieren Mitchell and colleagues (*Science* 344: 898–900) has turned this idea on its head.

The Ancient DNA lab at Adelaide University was able to reconstruct virtually the entire mitochondrial genome from sub-fossil bones of two genera of elephant birds, and compare these with sequences from all other palaeognath birds, including kiwis and tinamous (flying birds found in South America that superficially resemble gamebirds).

If the radiation of ratites was linked to continental drift, ostriches should have been the first group to diverge, because Africa was the first continent to split off Gondwanaland, more than 100 million years ago. Elephant birds should be sister to ostriches, because Madagascar also separated at about this time. The two



A tree showing the similarity in genetic sequence data among palaeognath birds. The branching pattern does not match the break-up of Gondwanaland, suggesting that large, flightless, herbivorous birds evolved independently in Africa (ostriches), South America (rheas), Australasia (emus and cassowaries), New Zealand (moas) and Madagascar (elephant birds).

**CONGRATULATIONS** The three lucky-draw prizewinners of a copy of the *Ultimate Companion* giveaway sets (March/April 2014 issue) are: Haroldina Jonker, Randburg; Denise Collie, Craighall Park; Carolyn Masterton, Germiston, all in Gauteng.