Letters

Bird origins: problem solved, but the debate continues…

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The discovery of a primitively pentadactyl avian manal ground state [1] will not dampen the debate about bird origins, because 'birds are dinosaurs'; therefore, the digital mismatch must be made to accommodate this cladogram. Explanations [1] include: (1) homeotic digital frame shift; and (2) assuming theropods ancestral to birds had digits II–IV.

Unfortunately, both are unsupported by evidence. (1) Homeotic frame shifts ignore highly constrained evolutionary change in limb development, negative genetic pleiotropic effects of deleterious mutations, and the nagging question of why a dramatic, unparsimonious, 'expensive' evolutionary shift would occur when the avian hand was primitively pentadactyl. Contra Galis *et al.*[1], there is no demonstrable homeotic frame shift in the feet or hands of living or extinct birds [2]. Frame shift hypotheses therefore involve special pleading and the necessity of 'evolutionary origami'. (2) A salient synapomorphy of Dinosauria (assuming monophyly?) is unique asymmetrical postaxial digital reduction, producing a theropod I–III, grasping, raking hand. In Fig. 1, the hand of a 14-day ostrich embryo is shown compared to late Triassic basal theropod *Herrerasaurus* and prosauropod *Plateosaurus*.

If 'the most recent known ancestor of birds with a pentadactyl hand lived in the late Triassic Period' [3] (220 million years ago), then, contra Larsson and Wagner [3], this age is not congruent with a theropod origin of birds. In spite of the current popularity of a theropod–bird nexus, if one key complex synapomorphy is falsified, all other synapomorphies might be reduced to the status of homoplasy because, in such highly derived systems, it might be impossible to tease out homology from convergence. The riddle of bird origins will persist until discovery of new Triassic–early Jurassic fossils.

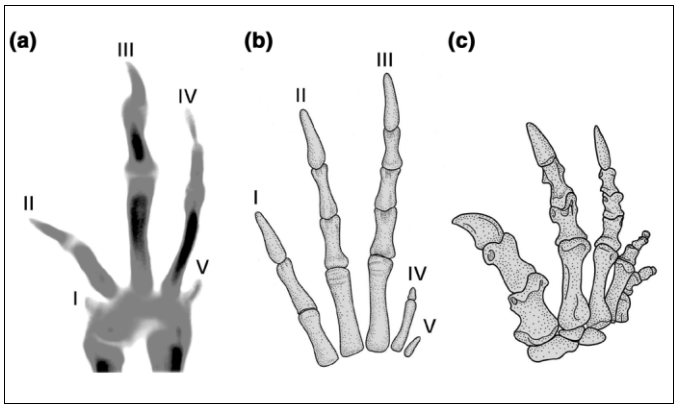

Fig. 1. Hands of (a) 14-day-old ostrich embryo; (b) *Herrerasaurs*; and (c) *Plateosaurus*.

References

1 Galis, F. *et al.* (2002) An old controversy solved: bird embryos have five fingers. *Trends Ecol. Evol.* 18, S0169-5347(02)00018-6

2 Feduccia, A. (2002) Pseudo-homeosis in avian feet. *Trends. Ecol. Evol.* 17, 256

3 Larsson, H.C.E. and Wagner, G.P. (2002) Pentadactyl ground state of the avian wing. *J. Exp. Zool. (Mol. Dev. Evol.)* 294, 146–151

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