

Dinosaur classification in a tumult

Michael J. Oard

I have often wondered which characteristics biologists and paleontologists use to classify present-day and fossil organisms. I learned early that dinosaurs were classified by their hip bones. From this they were divided into two major groups: the lizard-hipped dinosaurs, the Saurischia, and the bird-hipped dinosaurs, the Ornithischia.^{1,2} This classification has lasted over 130 years. The two major branches within this classification supposedly evolved from a common ancestor. Then the lizard-hipped dinosaurs diverged into the sauropods and theropods (left side of figure 1).

However, many scientists have disputed this classification, declaring it to be an oversimplification and probably wrong.^{3,4} For instance, ornithopods had a lot of characteristics similar to theropods, such as being bipedal. Moreover, there were many differences between sauropods and theropods, such as their eating habits and walking pattern. Sauropods were quadrupedal herbivores, while theropods were bipedal carnivores. Theropods, which supposedly gave rise to birds, are classified with the lizard-hipped dinosaurs. Herrerasauridae were also difficult to classify. Sometimes they were even classified

outside Dinosauria.⁴ Herrerasaurids are among the earliest dinosaurs found in the Late Triassic of South America. Moreover, ornithischians such as the stegosaurs, ceratopsians, and ankylosaurs have a unique anatomy. Padian says they are weird.⁵ They are missing in what are considered the oldest Late Triassic rocks but are widespread in the Jurassic and Cretaceous.

Dinosaurs no longer classified according to hips

Recently, this classification system has been turned on its head. Hips are no longer the most important variable. Affecting this change was a stunning research project that was done at the University of Cambridge by a Ph.D. student, co-authored by his two thesis advisors. The results have also been widely reported, including in the *New York Times*.⁶ Mr Baron, the author of this study, scoured museums for three years. Using a computer program called TNT, he chose 457 ‘diagnostic’ anatomical features of the bones, analyzing 32 billion family trees or combinations of traits. This new classification claims to have built the best possible tree. It objectively compares simple morphological variables in a procedure called cladistics. The new classification system is radically different from the old:

“The results of this study challenge more than a century of *dogma* and recover an unexpected tree topology that necessitates fundamental

reassessment of current hypotheses concerning early dinosaur evolution, palaeoecology and palaeobiology [emphasis added].”⁷

The procedure supposedly has no assumptions. However, Padian points out that one has to decide what is a convergent feature⁸ (i.e. one having nothing to do with common ancestry) and which feature has evolutionary value.⁴

The cladistics analysis resulted in placing theropods with ornithischians and placing sauropods with the questioned taxon, Herrerasauridae (right side of figure 1). This is a puzzling aspect of the cladistics analysis as stated by Padian:

“Also puzzling is Baron and colleagues’ finding that the primitive-looking herrerasaurids, from the South American Triassic, are the sister group of the sauropods. This line is not strongly supported, but it is intriguing. Herrerasaurids were carnivores, and they are usually linked to or included within the carnivorous theropods.”⁹

Baron *et al.* simply suggest that the above classification is an example of the independent evolution of the same trait, known as convergent evolution. A similar issue occurs with carnivory, which would have evolved independently in herrerasaurids and theropods.

The results will be controversial, but the analysis used the largest database in the world. Baron *et al.* charge that previous cladistics analyses were flawed. As a result, they had to

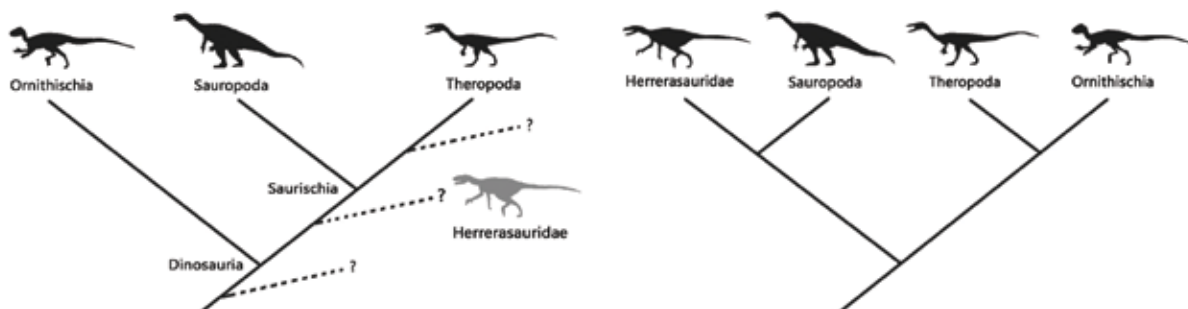


Figure 1. The traditional dinosaur evolutionary tree (left) and the revised dinosaur evolutionary tree⁴

incorporate different traits and refrain from using others. Padian suggests that scientists may have to accept the new classification, but he warns that critics will carefully scrutinize the trait analysis, which seems subjective and open to circular reasoning. A rigorous analysis of why some traits were used and others were not has not been published, but it is required.¹⁰

Origin of dinosaur problems

Fossils of dinosaurs are said to be as old as 230 Ma, but the new cladistics analysis indicates that the origin of dinosaurs would have been about 247 Ma. The original dinosaur was thought to have been small and bipedal with grasping hands, but the new analysis questions this:

“However, a number of key issues remain hotly contested, including the ancestral dinosaur’s body plan, size, stance, method of locomotion and diet, as well the clade’s center of origin.”¹¹

The authors also suggest that dinosaurs may have originated in the Northern Hemisphere and not in the Southern Hemisphere as widely believed.

Creation science implications

Looking back at the previous classification, Baron *et al.* can now say that ever since the classification system was developed in 1888, researchers have simply assumed it to be true and used it to classify, relying on its numerous assumptions:

“... but those studies that concentrated on the earliest divergences within a clade have been limited to include only a handful of the relevant taxa and incorporate numerous a priori assumptions regarding the relationships within and between the higher taxonomic groups.”⁷

The new result shows how arbitrary the previous classification system was, and it reveals that even

cladistics analysis can be manipulated to favour the consensus. The addition of new variables or reanalyzing old data can sometimes result in very different results, as Padian is quoted as saying: “It shows that with just a slightly new analysis you can overturn results.”¹⁰

The origin of dinosaurs is still a problem for the evolutionary model; it does not explain the large gaps between dinosaur types.

Deciding which traits are convergent and not to be included in the cladistics analysis and which traits are of evolutionary importance still appears to be a subjective exercise and open to circular reasoning. This is demonstrated by the claimed evolution of small grasping hands in bipedal dinosaurs and by the multiple origins of both carnivory and herbivory.

It is still safe to conclude that dinosaurs were specially created, and that they defy an evolutionary sequence or classification. Each kind is unique with distinctive properties, some of which may also have been created in other kinds. Dinosaurs represent an orchard of life, with variation among multiple created kinds, and not a tree of life.

References

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5. Padian, ref. 4, p. 494.
6. Wade, N., Shaking up the dinosaur family tree, *nytimes.com*, 22 March 2017.
7. Baron *et al.*, ref. 3, p. 501.
8. Convergent evolution is the idea that similar structures in widely different organisms not related by evolution evolved separately and independently and are similar because of a similar environment.
9. Padian, ref. 4, p. 495.
10. Gramling, C., Ma, where did they put *T. rex*? *Science* **355**:1249, 2017.
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