The Evolution of Dinosaurs: Much Conjecture, Little Evidence

Jerry Bergman*

Abstract

The evidence for dinosaur evolution was reviewed, along with the various theories of dinosaur evolution and the evidence for their support. Dinosaurs are commonly believed to have evolved from a small, crocodile-like animal; however, a review of the known fossils provides no evidence for dinosaur evolution from non-dinosaurs, despite the excellent and abundant dinosaur fossil record. This finding is very significant because the bones of many of the average- to larger-sized dinosaurs discovered to date are usually fairly well preserved due to their large size and thickness. Dinosaurs appear abruptly in the fossil record and disappear just as suddenly. The fossil findings for several major dinosaur species also were reviewed.

Introduction

Dinosaurs are "astonishing animals" that are a major topic of both popular interest and scientific study (Weishampel et. al, 2007, p. 7). The discovery of dinosaurs in the early 1800s radically challenged our view of the world, especially our view of the past (Croft, 1982, p. 12). Their study is an ideal area to evaluate evolution because an enormous amount of excellent fossil evidence exists. One reason for the excellent fossil record of dinosaurs is that their fossils are preserved better than those of most other animals (such as the smaller, hollow-boned birds) due to the dinosaur's large size and thick bones.

So far, based on the many thousands of nearly complete skeletons, plus multi-thousands of partially complete skeletons, around 400 to 700 different dinosaur species have been identified (Novacek, 1996). Furthermore, a large collection of teeth and even some soft tissues have been preserved (Hwang, 2005; Lingham-Soliar, 2008). Since abundant fossil evidence exists, if dinosaurs evolved from some primitive precursor, good fossil evidence for their evolution from their earlier ancestors should have been uncovered by now. However, the extant fossil evidence does not support their evolution from lower forms of life.

The popular meaning of the term "dinosaur" is "terrible lizard" because of their size and assumed ferociousness. They were all terrestrial reptiles—members of the archosauria clade that had scaly skin and hatched their young from eggs. A few were enormous in size, but most were around the size of bulls, and a few were as small as chickens. Dinosaurs were not only huge, but they also "were the first land animals … designed for speed and agility" (Haines, 1999, p. 14). Most were excellent runners on land, mostly up on their toes due to their hip and ankle construction.

Yet, in spite of the abundant fossil record, our "knowledge of dinosaurs is very fragmentary and much that has been written remains speculation," and "many authors have failed to differentiate between speculation and fact" (Croft, 1982, p. 9). Although much has been learned since these words were

* Jerry Bergman, Ph.D., Biology Department, Northwest State College, jbergman@northweststate.edu
Accepted for publication June 27, 2009

written, it is still true that we know comparatively little about dinosaurs, partly because most of our knowledge is based on footprints, bones, teeth, and a few body parts such as scales. These parts make up only about ten percent of the animal (Croft, 1982). The many major unknowns include their specific diet (although, judging on structures such as teeth, most types are classified as herbivores or carnivores) and whether they were ectotherms, or cold-blooded (the common view in the past), or endotherms, warm-blooded (the view that much accumulated evidence supports) (ex. DeYoung, 2000, pp. 94–98).

Dinosaur Taxonomy

Dinosaurs are part of the archosauria (ancient lizard) clade that includes thecodontians saurischians, ornithschians, crocodilians, and the flying pterosaurs (Weishampel et. al, 2007). The only members of the archosauria clade still alive today are crocodiles and alligators (Parker, 2000). Dinosauria is divided into two significantly distinct dinosaur families, those with birdlike hips that point downward and toward the tail, the *ornithischians*, and those with lizardlike hips that point downward and to the front, the *saurischians*. The saurischians include some small, slightly built reptiles and others that are large fierce animals believed to have evolved before dinosaurs. So far, all "attempts to relate these two types of dinosaurs to the Triassic pseudosuchians" are problematic because "there appears to be a puzzling overlap in time between the two groups," and, so far, "possible evolutionary links between them obstinately refuse to appear" (Cox, 1976, p. 314).

The saurischia are divided into the *theropods* (beast feet), which walked on two three-toed birdlike feet with sharp claws, and the *sauropods* (lizard feet), which walked on four feet and had small heads, long necks, and bulky bodies such as *apatosaurs* (Cranfield, 2002). The ornithischians were a very large and varied group (Parker, 2000). This classification also has come under fire. Forster (2000, 46) wrote that "most paleontologists now feel that we simply need to stop considering the Dinosauria as being composed of only the Saurischia and Ornithischia." Among the reasons is that paleontologists know almost nothing "about the early evolution of these creatures, and in particular, the evolution of the dinosaurs before the saurishian-ornithischian split" (Forster, 2000, p. 46). The taxonomy in paleontology that formed the basis of modern taxonomy was problematic from the beginning of the discovery of dinosaurs.

> As E.D. Cope and O.C. Marsh vied for the glory of finding spectacular dinosaurs and mammals in the American West, they fell into a pattern of rush and superficiality born of their intense competition and mutual dislike. Both wanted to bag as many names as possible, so they published too quickly, often with inadequate descriptions, careless study, and poor illustrations. In this unseemly rush, they frequently gave names to fragmentary material that could not be well characterized and sometimes described the same creature twice by failing to make proper distinctions among the fragments … both Cope and Marsh often described and officially named a species when only a few bones had been excavated and most of the skeleton remained in the ground (Gould, 1991, p. 87).

In spite of years of intensive effort, major disagreement still exists among the experts on dinosaur classification, which is one reason why determining their phylogeny is so difficult for paleontologists. The most recent taxonomy proposal is not based on evolution or fossil trees but cladistic analysis using 107 anatomical traits (Weishampel et. al, 2007). The fact is, how "closely related one fossil animal is to another is very much a matter of opinion" (Horner and Lessem, 1993 , p.128), and this is one reason why so much disagreement exists about their phylogeny. Another problem is about half of all putative species are known only by "a few teeth or bone scraps" (Horner and Lessem, 1993, p. 128).

The Origin of Dinosaurs

Dinosaurs were abundant in number and variety around the world by the Late Triassic (Forster, 2000, p. 49). Their variety and abundance coupled with a lack of any empirical evidence for their evolution has resulted in many phylogeny proposals. One of the most common phylogeny theories today is that dinosaurs evolved from an alligator-like reptile. Haines (1999) wrote that there is still much

> controversy about how and when dinosaurs evolved. But the most popular current theory has dinosaurs first appearing as small, two-legged carnivores in the mid-Triassic, around 235 million years ago with a combination of features that marked them as different (p. 14).

The Archosaura reptiles (from which some believe the dinosaurs have descended) are thecodonts that first appeared in the fossil record during the Triassic (Benton, 1984). Thecodonts, a term meaning "socket-toothed," were large, heavy crocodile-like animals that crawled low to the ground and on all four legs. They had long jaws and tails similar to crocodiles, and for this reason some argue that they were only a type of primitive crocodile.

Other experts argue that thecodonts were an offshoot or branch of the line that led to the dinosaurs. The theory is that a thecodont's (or some other Archosaur's) limb position evolved to allow the dinosaur precursors to walk in a more upright position until they eventually could walk on their back legs, becoming the dinosaurs that we know today from the fossil record. This speculation is not directly based on evidence but is the most plausible conjecture postulated for dinosaur evolution because all other possibilities are even less tenable. No fossil evidence exists for this widely accepted theory, or for any of the other less accepted theories.

Another candidate for the earliest direct dinosaur ancestor is a house-cat-sized animal named *Lagosuchus*, believed by evolutionists to have lived 235 million years ago in Argentina (Horner and Lessem, 1993). Some paleontologists speculate that "Lagosuchus or one of its relatives may have been the ancestor of the dinosaurs" because they possessed "many of the features thought to be present in [the] oldest dinosaurs" (Forster, 2000, p. 44). From the fragmentary remains recovered so far, Forster (2000) concludes that Lagosuchus is "probably not the ancestor" of dinosaurs but "is at least closely related to the ancestors of the dinosaurs" (p. 45). Others argue that yet some other Archosaur that appeared in the late Permian, many of which strongly resemble crocodiles, were their ancestor (Richardson, 2003, pp. 40–41).

One theory popular for years is that some amphibian crawled out of the water, adapted to land, and eventually evolved into the *Crocodylotarsi* (crocodile ankle) that later evolved into the dinosaurs and the *Ornithosuchia* (bird-crocodile), which became the crocodilians (ex. Forster, 2000, p. 44). Furthermore, the thecodontians are theorized to have given rise to theropods, which gave rise to the saurischians, then the sauropods, camosaurs and coelurosaurs (Croft, 1982). The thecodontians also gave rise to the ornithischians, which gave rise to the ornithopods, and stegosaurs. From these groups evolved pachycephalosaurs, hadrosaurs, ceratopsians, and ankylosaurs (Croft, 1982).

In 1990 three widely accepted hypotheses of carnosauria (meat-eating dinosaurs) origins existed. One hypothesis was that prosauropods were direct descendants from certain thecodontians. Another hypothesis is that carnosaurs were one monophyletic group called theropoda, which evolved from Podokesauridae (Weishampel, 1990). Another theory is that carnosaurs evolved from a primitive coelurosaur-like animal, a group of birdlike dinosaurs. These many theories are all unconstrained by fossil evidence but rather rely on morphological comparisons and conjecture. Consequently, the imaginations of Darwinists are allowed great freedom in developing hypotheses. Some evolutionists reject all of these theories, concluding that dinosaurs evolved from some "unspecified quadrupeds" (Weishampel, 1990 p. 193).

The earliest known ornithischian dinosaur is *Pisanosaurus*, known by only one poorly preserved badly weathered fragmentary skeleton discovered by Galileo Scaglia in Argentina (Forster, 2000, p. 46). Only some jaw parts, a shoulder blade fragment, parts of the hind leg, and a few vertebrae were found. Based on the small, blunt teeth that lie side by side in the jaw, it was first judged to be a very early ornithischian (Forster, 2000). Although the teeth are characteristic of ornithischians, and not either herrerasaurids or saurischian dinosaurs, some paleontologists are not convinced that *Pisanosaurus* is even an ornithischian dinosaur. The fact that it was a small, lightly built creature only as large as a medium-sized dog indicates that it may not be a dinosaur at all, but rather an extinct animal of some other type. It is not known if it walked on two or four legs, but evidence suggests that it may have been bipedal (Forster, 2000).

So much controversy over dinosaur origins exists that some argue for diphyletic (having two separate) origins, others for three or four or more separate origins from different stem archosaurs (Fastovsky and Weishampel, 2005). In the 1970s a revolution in dinosaur origins occurred, uniting saurischians and ornithischians, two very different animals, as well as birds, into one clade, an idea finally widely accepted by the mid 1980s. Also, the group class Thecodontia has now been abandoned by many paleontologists. Although the monophyletic view now dominates, evidence for "multiple roots of Dinosauria might still exist and in fact may be more obvious now that the cover of 'Thecodontia' has been blown" (Fastovsky and Weishampel, 2005, p. 91). The reason for these disagreements is because these theories are based largely on speculation, not fossil evidence (Fastovsky and Weishampel, 2005).

The First Dinosaurs

Prosauropods

One of the first putative dinosaurs was the Prosauropoda, a group, of which 17 genera are now known (Forster, 2000, pp. 18–50). The problem with the Prosauropoda origins theory is that they were common at the end of the Late Triassic, both contemporaneously with, as well as *after*, the dinosaurs that they supposedly evolved into (Forster, 2000, p. 50). The herbivorous monsters with long necks, bodies, and tails appeared in large numbers around the world, causing paleontologists to conclude that "they must have evolved and spread very rapidly around the ancient world" (Forster, 2000). Forster (2000) concludes:

> Exactly what the ancestors of prosauropods were, what they looked like, and where the prosauropods evolved is still a mystery. Although the name prosauropod, meaning "before-sauropods," implies they were the ancestors of the enormous sauropods, paleontologists now believe they did not give rise to the sauropods. They were already too specialized to have developed into the sauropods. The prosauropods and sauropods instead shared a common, yet unknown, ancestor, giving them a first cousin relationship. (p. 50)

Herrerasaurus

One of the earliest known well-documented animals described as early pre-dinosaurs are rather small bipedal theropods called *Herrerasaurus* that evolutionists date back to the Late Triassic about 245 million years ago. *Herrerasaurus* were four or five feet tall but may have grown as large as ten feet long and up to 500 pounds. They ran on their hind legs and had huge teeth. Only one complete skeleton has been found, allowing a good picture of the animal (Forster, 2000). The lone complete skeleton is the earliest whole dinosaur skeleton known and was found in Argentina in 1988.

Because *Herrerasaurus* possess many dinosaur features shared by both Saurischia and Ornithischia, *Herrerasaurus* is considered by some their common ancestor, or at least related to their common ancestor. Others conclude that *Herrerasaurus* "wasn't a direct ancestor" of dinosaurs "but it's the best we've got from that time" (Horner and Lessem, 1993, p. 125). Because it does not have many dinosaurian features, other paleontologists have concluded *Herrerasaurus* were not even dinosaurs (Forster, 2000) but another extinct reptile that happened to have some traits common to both Saurischia and Ornithischia. This confusion "shows how little we know about the early evolution of the dinosaurs" (Forster, 2000, p. 46). Novacek (1996) summarized another theory of dinosaur evolution that argues,

> dinosaurs are part of a whole range of forms called archosaurs, where familiar lineages like crocodiles also eventually branched off. But the details of this story—namely which kinds of other archosaurs are clearly the closest kin of the dinosaurs—are not decisively known. It has been suggested that the nearest relatives of dinosaurs may have been some early forms of the winged "flying reptiles," the pterosaurs. Thus dinosaurs might be rooted in the unknown ancestor that also gave rise to the pterosaurs. (p. 81)

In other words, a birdlike flying reptile evolved into a dinosaur, and dinosaurs in turn later evolved into birds. This claim illustrates the major problems that exist for determining even a tentative evolutionary phylogeny.

Phylogeny

Because Dinosauria appear in large numbers in many parts of the world and no fossil record exists that documents their evolution, the whole field of dinosaur phylogeny is rife with speculation. One of the most heated proposals was removing dinosaurs from class Reptilia and placing it in a new class called Dinosauria, a major rethinking in paleontology (Weishampel, 1990).

A major problem is that, as so many dinosaurs are known only by fossil fragments, it is difficult to determine what species many belong to, not to mention whether they are a phylogenetic ancestor of some other animal (Forster, 2000). An example is the discovery of three species that some paleontologists concluded were not three *separate* species (*Herrerasaurus*, *Isehisaurus*, and *Frenguellisaurus*) but one species, namely *Herrerasaurus*. Furthermore, many paleontologists consider another putative primitive early dinosaur, the *Staurikosaurus*, to be a herrerasaurid as well. As Fastovsky and Weishampel (2005) conclude, "So far, we haven't yet identified who within Archosauria might have the closest relationship to Dinosauria" (p. 92).

Another major problem is that constructing phylogenic trees has proved so difficult that parallel evolution has been proposed to explain the existing conflicting tree hypothesis.

> Many similarities in structural features among end forms of different archosaurian lines have not been inherited as such from a common ancestor but have been independently acquired by members of the different groups. This, however, does not debar such characters from consideration as indications of relationship. Study of fossil forms increasingly indicates that there has been an enormous amount of parallelism in evolution (Romer, 1966, p. 136).

Much confusion has existed about dinosaur phylogeny for other reasons. An example is a dinosaur called *Iguanodon*, discovered in 1822. The find consisted of a few large teeth that were similar to iguana teeth, only much longer. For this reason the creature was named *Iguanodon*, meaning "iguana-tooth," and was believed to be a giant iguana. Later, a partial skeleton was discovered and a new reconstruction resulted in a ponderous, heavy creature with a large horn, indicating that the animal was a reptilian, a rhino, or a pachyderm equivalent.

More finds indicated limbs closer to a kangaroo than a pachyderm, producing a kind of chimera. Next, research by T. H. Huxley discovered the creature had a pelvis and hind limbs like a ground-dwelling bird similar to an emu. With more discoveries, it looked more like the picture we have of a *T. rex* today.

The Fossil Record

The fossil record indicates that dinosaurs were "extremely rare in the early part of the Late Triassic," but by the end of the Triassic entirely "new groups of dinosaurs" had rapidly "spread world wide in an ever-increasing array of species" without leaving a trace of fossil evidence (Forster, 2000, p. 49). The fact is that no one knows why this "ever-increasing array" of new species occurred, nor do we have any fossil evidence to document their evolution— "abrupt appearance" is the only term that can describe what the fossil record reveals. Based on an extensive study of the fossil record, Fastovsky and Weishampel (2005) concluded that the likelihood of determining the progenitor of any one lineage being fossilized is nil. Dinosaur bones are usually very easy to identify because they have several unique traits, such as an extra hole in their skull, grasping hands, and specialized anklebones,

> but it is dinosaurs' hips that are most distinctive. They had five fused sacral vertebrae that helped to create a very strong hip. Together with a specialized socket for the thigh bone, this gave dinosaurs their powerful upright posture. A long tail put their center of balance firmly over the pelvis, allowing them to run on two legs. This also freed their front limbs for catching food. All this was helped by a highly specialized skeleton. Many of their bones contained air sacs, like birds, and in the course of evolution they reduced many bones that were not absolutely necessary for structural strength. For their size, dinosaurs were probably surprisingly light (Haines, 1999, p. 14).

The process used to find a clade's ancestor is to use the hierarchy of characters in the cladogram to determine what features should exist in an ancestor. The next step is to find evidence of

> an organism that most closely matches the expected combinations of characters and character states. As we have seen, the likelihood of the very progenitor of lineage being fossilized is nil; however, we can commonly find representatives of closely related lineages that embody most of the features of the hypothetical ancestor (Fastovsky and Weishampel, 2005, p. 92).

The "first dinosaurs are known from a small number of mostly incomplete specimens that so far have been found in only two locations in South America" (Forster, 2000, p. 42). Unfortunately, only partial remains of one animal commonly speculated to be the dinosaur ancestor, *Lagosuchus* and its kin, have been discovered, so its status as the ancestor of the dinosaurs is highly speculative (Forster, 2000). Many other fossils are incomplete and/or badly damaged, requiring what is assumed to be a closely related animal called an analogy to fill in the missing parts (Shipman, 1986). Analogies are problematic because they require the assumption that two similar fossils can be compared in detail. If two fossils have certain bone similarities, the analogue method assumes that they are also similar in ways that cannot be compared due to lack of physical evidence. The next section looks at some specific examples.

Tyrannosaurus rex

The best-known dinosaur is *T. rex*, an 18-foot-tall, 42-foot-long 14,000-pound monster, the largest carnivore that has ever lived. It was classified as a therapod, a meat-eating, hollow-boned animal that can range in size from the Placodus and the ichthyosaur *Cymbospondylus*. All dinosaurs are postulated to have evolved from an animal the size of a chicken. So far 32 *T. rex* specimens have been located, half of which are close to complete (Weishampel et al., 2007). Horner and Lessem (1993, p. 124) wrote, "*T. rex* was the last and most spectacular product of dinosaur evolution. It was an experiment that can't be repeated."

Darwinists estimate that dinosaurs first evolved 225 million years ago, and *T. rex* 190 million years ago. How they know this from only 32 specimens is unknown. So far, not a single direct *T. rex* ancestor has been located. Potential ancestors, including *Coelophysis*, *Herrerasaurus*, *Eoraptor*, and *Allosaurus*, all have been eliminated by most experts as possible *T. rex* ancestors.

Two fossil specimens considered by some paleontologists to be the most primitive *T. rex* fossils are a dinosaur called Guanlong Wucaii (Xu et al., 2006). This dinosaur identified as a *T. rex* ancestral link from the teeth and pelvic structures is a nine-foot-long adult that had a head crest that was about 2.5 inches tall and as thin as a tortilla. The crest is believed to be an ornamental feature used to attract mates.

The leading experts, Horner and Lessem, admit the animal that the *T. rex* and the tyrannosaurids evolved from is not known: "maybe they came from the allosaur line of big predators, maybe they came from a common ancestor, along with the Troodontids, a man-sized group of dinosaurs with many birdlike features" (Horner and Lessem, 1993, p. 127). Horner and Lessem (1993, p. 127) admit that, although "you can imagine a hypothetical ancestral tyrannosaurid," no evidence of this hypothetical ancestor has ever been found. They conclude a logical *T. rex* dinosaur ancestor is a meat-eating creature, but "which one we can't say yet" (Horner and Lessem, 1993, p. 127).

Another very early dinosaur, *Ornithodesmus*, was first identified as a pterosaur (Parker, 2003). Further studies concluded it was not a pterosaur but rather a small dinosaur. Other fossils first identified as ornithodesmus have been regrouped back with the pterosaurs! Many other examples of dinosaur reclassification could be cited. Eight named and one unnamed species of Troodontidae exist, and four phylogenetic hypotheses have been proposed to explain their origins (Weishampel et al, 2007).

Clearly, the "evidence is limited and there continue to be many disagreements" in the field of dinosaur phylogeny, and often these disagreements are to the degree that it calls into question the basis of dinosaur macroevolution (Parker, 2003, p. 159). The enormous differences between pterosaurs and ornithodesmus illustrate the difficulty of even determining the type a set of dinosaur bone fragments belongs to, even if a complete skeleton, which is only five percent or less of the animal, exists. Identifying evolution transitional forms is even more difficult.

Another problem is that dinosaurs were not primitive as the word is normally defined. An example is the intelligent design of the eye of *T. rex*. It has been assumed that they had very poor, fussy vision, but recent research has shown that they were able to achieve very detailed images similar to that of many modern animals (DeYoung, 2000). Many other examples exist to show that dinosaurs were very well designed for their environment.

Horned Dinosaurs

Horned dinosaurs (ceratopids) were very successful animals that lived throughout the northern hemisphere (Norman and Wellnhofer, 2000). The ceratopians (horned-face) had shelf-like ridges or expanded areas around their skull edges and a sharp, narrow parrot-like beak (Parker, 2003). They ranged from the size of a pig to twice the size of large rhinoceroses, which they resemble. The best-known horned dinosaur, and one of the largest, was the *Triceratops*. *Triceratops*, meaning "three-horned face," is an ornithischian dinosaur that has a pelvis shape similar to that of birds, and a crownlike hat, plus three large horns, two on its head and one on its snout, providing the source of its name.

Since their horns preserve well and literally hundreds of remains of these dinosaurs have been uncovered, horned dinosaurs as a group are excellent examples useful to determine the limits of evolution. Although hundreds of *Triceratop* skeletons, many very complete, have been found since the first one was uncovered in 1855, no evidence of their evolution has ever been uncovered. This is especially problematic for Darwinists because it is the largest horned dinosaur known, and it is easily identified by its very unique skeletal traits, especially its distinctive skull and horns. In one location alone, thirty-two *Triceratops* skulls were recovered.

One theory is that they evolved from "bipedal ancestors not unlike *Psittacosaurus* or *Microceratops*," but the only evidence for this theory is their morphological similarity. Since no fossil evidence exists to support any evolution theory, this speculation remains assumption (Norman and Wellnhofer, 2000, p. 136). Parker concluded that horned dinosaurs "were, in general, a group that underwent relatively little evolution, as is evident from the many thousands of specimens that have been found in hundreds of sites" (2003, p. 373).

The fossil record shows that "the horned dinosaurs were relatively 'conservative,' a term used to describe a group that does not change very much from its original basic shape and form, despite a long time for evolution to occur" (Parker, 2003, p. 373). In other words, as is true of all dinosaurs, they appeared suddenly in the fossil record as fully developed, horned dinosaurs and did not change until they became extinct. They have been dated all the way to the very end of the dinosaur age. Norman and Wellnhofer (2000, p. 134) wrote that the evolutionary "relations of the so-called short-frilled ceratopids are not clear. Each is so distinct that kinship is not at all obvious."

Conclusions

Over 30 million dinosaur bones and parts, some in excellent states of preservation, have been identified, and although much speculation exists, not a single documented plausible direct ancestor has yet been located. All known dinosaurs appear fully formed in the fossil record. As Forster (2000, p. 42) admits, "much mystery remains about the origin of the dinosaurs." Several possible candidates for their ancestors have been suggested, but difficulties exist with all of them, and most are likely only extinct reptiles and not evolutionary links. Furthermore, confusion has reigned for more than a century over dinosaurian phylogeny in spite of the discovery of much fossil evidence.

For this reason, other methods have been utilized to determine their phylogeny. Since 1980 cladistic methods have revolutionized our views of their phylogeny. Computer algorithms also have been used to produce similarity comparisons, often using contemporaneously existing species that are limited in helping us to determine their evolutionary history.

Benton (1984, p. 142) concludes that so "many riddles remain unsolved" that "a single fossil find can sometimes provide us with exciting new evidence and provide all new theory." How dinosaurs "came to be" and what they are, are "questions pondered since the creation of the name by Sir Richard Owen just over 150 years ago" and are still being asked (Fastovsky and Weishampel, 2005, p. 87). We can conclude with the following observation, which is still true today:

> Although many pages have been written discussing the mystery of the extinction of the dinosaurs, almost as much uncertainty surrounds their origin—or origins. … the poor paleontologist searching for answers is therefore, in the origin of the dinosaurs, confronted with complexity where he hoped for simplicity, while in the replacement of the pseudosuchians by their varied offspring he meets a sudden (if delayed) simple event where he expected complexity (Cox, 1976, p. 3140).

The more paleontological discoveries that are made, the more we realize our knowledge is complete and still no ancestral form is found. As a result, paleontologists are forced to conjecture about their ancestors based on little evidence. In conclusion, no credible evidence exists for dinosaur evolution from a primitive precursor animal, supporting the creation model. Dinosaurs appear suddenly and evidently also went extinct rather suddenly.

Acknowledgments: I wish to thank Andrew Fabich, PhD, Jody Allen, RN, Joel Klenck, PhD, and John Upchurch for their feedback on an earlier draft of this manuscript.

References

Bakker, R.T., and P.M. Galton. 1974. Dinosaur monophyly and a new class of vertebrates. *Nature* 248:168–172.

Benton, M. 1984. *The Dinosaur Encyclopedia*. Aladdin, New York, NY.

Cox, B. 1976. Mysteries of early dinosaur evolution. *Nature* 264:314.

Cranfield, I. 2002. *The Illustrated Dictionary of Dinosaurs*. Salamander Books, London, UK.

Croft, L.R. 1982. *The Last Dinosaurs: A New Look at the Extinction of the Dinosaurs*. Haslam Printers Ltd, Chorley, Lancashire, UK.

DeYoung, D. 2000. *Dinosaurs and Creation*. Baker Books, Grand Rapids, MI.

Dixon, D. 2004. *The Pocket Book of Dinosaurs*. Salamander Books, London, UK.

Fastovsky, D.E., and D.B. Weishampel. 2005. *The Evolution and Extinction of the Dinosaurs*, 2nd edition. Cambridge University Press, New York, NY.

Forster, C. 2000. The first dinosaurs. In Silverberg, R. (editor), *The Ultimate Dinosaur*, pp. 41–52. Ibooks (A Division of Simon and Schuster), New York, NY.

Gould, S. 1991. *Bully for Brontosaurus*. Norton, New York, NY.

Haines, T. 1999. *Walking with Dinosaurs*. BBC Worldwide Ltd, London, UK.

Horner, J., and D. Lessem. 1993. *The Complete T. Rex*. Simon and Schuster, New York, NY.

Hwang, S.H. 2005. Phylogenetic patterns of enamel microstructure in dinosaur teeth. *Journal of Morphology* 266:208–240.

Lingham-Soliar, T. 2008. A unique cross section through the skin of the dinosaur *Psittacosaurus* from China showing a complex fibre architecture. *Proceedings of the Royal Society B*. 275(1636):775–780

Norman, D., and P.Wellnhofer. 2000. *The Illustrated Encyclopedia of Dinosaurs: An Original and Compelling Insight into Life in the Dinosaur Kingdom*. Salamander Books, London, UK.

Novacek, M. 1996. *Dinosaurs of the Flaming Cliffs*. Doubleday Anchor, New York, NY.

Parker, S. 2000. *The Encyclopedia of the Age of the Dinosaurs*. Pegasus, Surry, UK.

Parker, S. 2003. *Dinosaurs: The Complete Guide to Dinosaurs*. Firefly Books, Crescent Richmond Hill, Ontario, Canada.

Richardson, H.. 2003. *Dinosaurs and Prehistoric Life*. Dorling Kindersley, New York, NY.

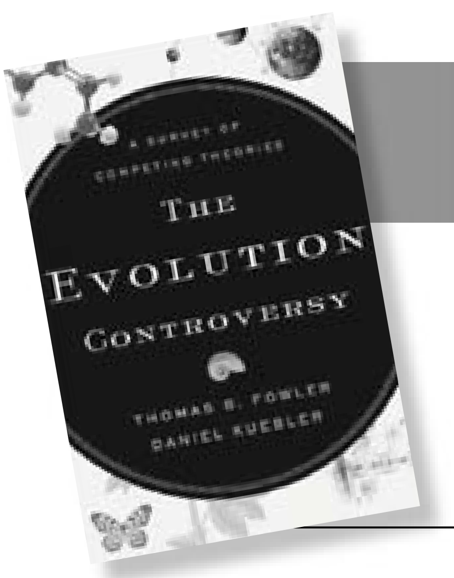
Romer, A. 1966. *Vertebrate Paleontology*. University of Chicago Press, Chicago, IL.

Shipman, P. 1986. How a 125 million-year-old dinosaur evolved in 160 years. *Discover* 7(10): 94–102.

Weishampel, D. (editor). 1990. *The Dinosauria*. University of California Press, Berkeley, CA.

Weishample, D., P. Dodson, and H. Osmolska (editors). 2007. *The Dinosauria*. University of California Press, Berkeley, CA.

Xu, X., J.M. Clark, C.A. Forster, M. Norell, G.M. Erickson, D.A. Eberth, C. Jia, and Q. Zhao. 2006. A basal Tyrannosauroid dinosaur from the late Jurassic of China. *Nature* 439:715–718.



Book Review

The Evolution Controversy: A Survey of Competing Schools

by Thomas S. Fowler and Daniel Kuebler

Baker Academic, Grand Rapids, 2007, 382 pages, $28.00.

Authors Fowler and Kuebler compare and contrast the various schools of thought regarding origins and the development of life on Earth. The book discusses biological issues; the origin of the universe, psychology, sociology, linguistics, and religion are left largely unaddressed. Similar books have had proponents write a chapter supporting their viewpoint and then have others critique the chapter. Fowler and Kuebler choose to evaluate each position themselves, giving the evidence pro and con for each.

The book begins with a brief history of the controversy, a review of the evidence, and the principle points of dispute. The next section discusses the major origin positions including the neo-Darwinian, creationist, intelligent design, and meta-Darwinian schools.

The neo-Darwinian camp claims that natural selection and mutations are sufficient to explain the development of life on Earth. The creationist school is represented by the young-earth position. God was active in establishing the original life-forms; change in morphology and genetics is limited within a comparatively brief time frame. Other creation positions such as theistic evolution and progressive creation are only briefly referenced. Intelligent design has much commonality with creation, emphasizing irreducible complexity, aside from the age issue. Lastly, the meta-Darwinian school includes macroevolution, punctuated equilibrium, exaptation, neutral theory, complexity theory, and endosymbiosis.

The final section deals with public policy issues and a summary of the four origins positions. One valuable feature of this book is its many summary tables. The volume also includes a helpful glossary of terms, a bibliography, and an index.

How does one present the various views on a contentious issue without taking sides? The authors claim "that this book is more objective than any other that we know of on the subject" (p. 15). They hold no theory as a priori truth and evaluate each on a strictly scientific basis. The authors state that no position must emerge as the winner. A host of prepublication reviewers have striven mightily to ferret out any hint of bias (pp. 16–17).

But bias does indeed creep in, beginning with the title, The Evolution Controversy. In the public's mind, evolution assumes that "common descent ... by natural forces alone are responsible for the emergence of all organisms" (p. 366). The first sentence of chapter 1 begins, "Charles Darwin's theory of organic evolution..." (p. 21). Since neo-Darwinism is the reigning consensus of the intellectual-academic establishment, other competing schools are constantly playing catch-up or reacting to this naturalist paradigm. Perhaps a more neutral title like The Origins Controversy would prepare the reader for an equal start at the opening gate. Each school should begin with a clean slate in presenting evidence. For example, the authors assume the validity of vast geological time without proving it, appealing to the authority of "the commonly accepted chronology" (pp. 84, 86).

The creationist chapter describes the major U.S. creation science organizations: The Institute for Creation Research, Creation Research Society, Answers in Genesis, Geoscience Research Institute, and Center for Scientific Creation (Walt Brown). Six major hurdles (pp. 195–196) are erected for creation science to be a viable alternative to evolutionism. They are the distant starlight problem, terrestrial evidence for a very ancient earth, radioisotope dating, the fossil record, uniformity of the genetic code (pseudogenes, synteny blocks), and similarities of physiology and function of organisms suggesting common ancestry of all life. Creationist answers to these problems are given and evaluated. For creation friendly readers of this section, a sense of frustration results because of the superficial examination of the evidence and arguments. While the authors strive for balance, it seems as if they pick and choose from the creationist literature, giving an uneven evaluation. One example is the treatment of the second law of thermodynamics (entropy) argument. The authors give the evolutionist "open system" response (pp. 225–226) without evaluating the creationist counterarguments. Introducing raw energy alone to an open system will not create complexity; a coded plan or template needs to exist for growth to take place. Another example of superficial handling concerns the RATE group findings. The first RATE book is referenced (p. 219), and the 2005 RATE conclusions are mentioned (p. 220), but the final research results are not evaluated.

Fowler and Kuebler do a reasonable job in presenting origins views in a fairly objective fashion. The primary merit of The Evolution Debate is its summary of arguments and counterarguments. However, many partisans of each school will be less than satisfied with their presentation and evaluation.

Don Ensign
densign8@dakotacom.net