be approved by the Chairman of the Friday evening session, the tapes not be copied for sale and one complete copy be sent at CRS expense to the Chairman of the Friday evening session.

The financial report by Klotz was given as follows: it was passed that the Treasurer consult with the auditor on a voucher system of payments to be shared with the Financial Committee for possible implementation in the future.

It was passed that we enlarge the Board to 16 members. It was passed that the six incumbents (Boylan, DeYoung, Gish, Kaufmann, Williams, Zimmerman) along with Russell Humphreys and Robert Gentet be nominated for the 92/93-94/95 Board. The top six vote-getters will be elected for a three-year term while the last two vote-getters be nominated for a one-year term with eligibility to be nominated again the next year for a three-year term.

The following were elected as officers: President—W. Frair, Vice President—E. Chaffin, Secretary—D. Kaufmann, Treasurer—J. Meyer, Financial Secretary—P. Zimmerman, Membership Secretary—G. Wolfrom.

It was passed that anyone requesting access to our archives at the Concordia Historical Institute at St. Louis be required to get written permission from the President of CRS.

It was passed that our 1992 Board Meeting be 9-11 April at Ann Arbor, Michigan.

It was passed that Wolfrom be authorized to purchase an IBM compatible computer system for $5830.

The Board acknowledged the 28 years of service of Bill Rusch to the Society. The Board on behalf of the CRS recognized Dr. Rusch's retirement from the Board as the end of an era during which he provided exceptional leadership to the formation and development of CRS. His influence on the cause of creationism is reflected by hundreds of students who are now dedicated to creationism.

It was passed that the President write a letter to the Editor of the *Scientific American* protesting the disqualification of Forrest Mims for a position because of his creationist views.

The meeting was adjourned at 1520 hours.

David A. Kaufmann, Secretary

DINOSAUR UPDATE

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Abstract

The authors summarize a National Science Foundation-sponsored workshop on the Biology of Dinosaurs, conducted by J. Michael Parrish. a leading paleontologist. Current ideas and uncertainties about dinosaurs are discussed. Possible creationist research areas are noted.

Introduction

During March, 1991 we attended a workshop on the Biology of Dinosaurs at Northern Illinois University, DeKalb. The meeting was sponsored by the National Science Foundation and was designed especially for college professors. There was no acknowledgement of an awareness of non-evolution views of dinosaur origins, existence, and demise. However we were surprised and encouraged by the openness of the group to question much of the traditional evolutionary dinosaur "doctrine," and especially to question many of the new claims published in the last decade. Not that the concept of evolution was in question, just its mechanism and evidence! The following report gives our impressions of the workshop and related literature.

Technical Literature Resources

The primary suggested text for the course was *The Age of Dinosaurs* by Kevin Padian (1989). This work is the product of 13 contributing experts in dinosaur biology and covers in considerable detail the current data and speculation on such subjects as taxonomy, behavior, physiology, anatomy, ecology, extinction, tracks and trackways. The stated goal of this publication is to form ". . . the basis of an increased number of dinosaur courses in college and university curricula" (Preface). Thus, the text, and indeed the entire conference was geared toward giving undergraduate college teachers the background necessary to teach a rigorous course in biology, using dinosaurs as the integrating theme. A reasonably detailed, technical bibliography makes the text a valuable resource not only for teachers, but also for researchers who may want access to the most recent, significant literature in the field.

Current Controversies

Dinosaurs are being studied by more experts than ever before; graduate schools of paleontology are crowded. There is fundamental, emotional debate in a large number of areas. We see this as a healthy sign that dogmatism regarding dinosaur fossil interpretation within the professional community is in decline. The reader should not assume, however, that this openness necessarily extends in all cases to actual skepticism of evolution itself. The following are some of the controversial areas where diversity of opinion reigns:

Classification The details of the supposed dinosaur family tree are interpreted differently by nearly every researcher. Phylogenetic systematics or cladistics now often involve extensive data sets and sophisticated statistical analysis by high-speed computers. The new taxonomies have largely replaced older classifications, and show great variation depending on who does the study.

At the base level, the group of Thecodonts are no longer thought of as dinosaurs, but as the ancestors of

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dinosaurs, crocodiles, and birds. In fact, this term which was part of the standard evolutionary tree a quarter century ago is now declared off limits by some (see Padian, 1989, p. 18). Rowe (1989, p. 100) notes, "We have yet to discover anything that might reasonably be thought of as the ancestral theropod . . ." Major gaps still appear today in dinosaur taxonomy, just as in the past.

South America, especially Brazil and Argentina, is now looked at as the "cradle" of dinosaur origin. However, do not look any time soon for consensus among evolutionists regarding the fine details of dinosaur evolution! As Parrish noted in the course, "As we find more specimens, things are not necessarily getting clearer, but they are certainly getting more interesting!"

Metabolism Were particular dinosaurs endothermic (warm-blooded) or ectothermic (cold-blooded)? That is, did they have internal thermostats; and if so, what was the set-point? There are multiple arguments for both sides (see for example, Bakker, 1975.) One suspects that some advocates for endothermism are seeking an evolutionary dinosaur link with birds which have a high and precise internal thermostat setting. From the fossil evidence, it appears that a number of thermal strategies may have been used, including those which are primarily behavioral (i.e., basking in the sun to warm up and seeking shade to cool.)

Diet Were particular dinosaurs carnivores, herbivores or omnivores? Paleontologists now recognize that teeth and claws are not always definitive diagnostics of diet. Such implements might be needed for eating tough vegetation as well as flesh. *Tyrannosaurus rex (T. rex)* is still pictured as the ultimate carnivore, and is commonly called a "land shark." *T. rex* is interpreted as a vicious predator that rammed into the side of its prey with gnashing teeth. With a behavior similar to that of the present day Komodo Dragon, it may have then backed away from its large, potentially-dangerous prey and waited for it to weaken or to die due to blood loss or infection.

Anatomy Did various dinosaurs move with a sprawling gait like lizards with legs spread out to the sides? Or were the legs erect, perhaps like horses? Museum models can be found of identical dinosaur species exhibiting either stance. The correct posture for many groups is unclear.

Some of the Hadrosaurs (duck-billed dinosaurs) had a large single curved horn-like structure above their heads. Analysis shows this crest *may* have been a resonance chamber connected with the animal's air passage. The calculated frequency of this "singing" dinosaur is 85 Hz, a bass sound that would carry over large distances. Some have suggested a bassoon-like tone! It is thought that other very peculiar, enlarged nasal and cranial cavities may have contained poison sacks, but the precise function of many is still a mystery.

Did dinosaur tails drag, or were they held out straight and horizontal? The recent variety in published dinosaur illustrations shows the need for more careful biomechanical analysis of these creatures. Tail-drag prints and ossified tail tendons are being studied to better understand actual dinosaur appearance.

The conference revealed many other uncertainties in current dinosaur illustrations. Speaker Parrish, an expert on fossil skulls, acknowledged that dinosaur skull reconstruction is often based on "wishful thinking." Apparently in dinosaur cranial preservation, as in the preservation of the skulls of supposed pre-human ancestors, the pressure of the overlying sediments may cause distortion and render precise measurements of cranial dimensions and capacities *speculative* at best. In recent dinosaur reconstructions, the line between research and artistic license has clearly become blurred.

Birds, Feathers, and Dinosaurs Creationists have written many articles on *Archaeopteryx*, the supposed dinosaur-bird transition. Papers in the *Creation Research Society Quarterly* include those by Akridge (1979), Brown (1980), Lubenow (1980), and Trop (1983). Some evolutionists continue to claim that particular dinosaurs had feathers and this has been promoted in reconstructions of *Iguanodon.* This is clearly a biased attempt to establish an evolutionary dinosaur-bird relationship. Leading scientist J. H. Ostrom (1976) believes that birds are actually small, carnivorous dinosaurs of theropod origins. There has been a significant attempt to press this dogma in the popular media. For example, Bakker (1986, p. 462) in his book *Dinosaur Heresies* makes the following evangelistic appeal to the evolutionary faithful:

> Let dinosaurs be dinosaurs. Let the Dinsosauria stand proudly alone, a Class by itself. They merit it. And let us squarely face the dinosaurness of birds and the birdness of the Donosauria. When the Canada geese honk their way northward, we can say: 'The dinosaurs are migrating, it must be spring!'

Gauthier and Padian (1989, p. 121) assert, ". . . the origin of birds, once the most problematic of evolutionary 'missing links,' is now probably the best resolved major evolutionary transition known in all of paleontology." They also note (p. 125) that this concept can be effectively indoctrinated into students using the following technique:

> The conclusion reached by these studies is that birds *are* dinosaurs, not just descended from them . . . This realization is an especially effective one to bring to students, who delight in knowing that they eat dinosaur at Thanksgiving, have dinosaur baths in their backyards, and occasionally go out for dinosaur McNuggets.

In contrast, L. D. Martin (1983) holds to an evolution of birds from crocodile-like ancestors. In spite of pictures to the contrary (see for example, Bakker, 1980, p. 310), *no* dinosaur has yet been found with feather evidence, or even with large surface pores that could support feathers.

Padian (1991, p. 9) also claims that the newly-found fossil bird from the Cretaceous sediments of China is not a challenge to *Archaeopteryx* but was in fact 10 million years younger and was the earliest-known bird with tree-living adaptations. Nevertheless, he acknowledges that ". . . Chinese stratigraphy is often difficult to correlate precisely with rock sequences known outside of China . . ." Just how much stratigraphic realignment may be needed to establish the Chinese bird into the supposed evolutionary tree is not stated, but one wonders how much of this gerrymandering

goes on behind the scenes. For example, with regard to the Early Jurassic fauna, Padian (1989, p. 12) notes ". . . the discoveries of recent years have been due not so much to new collecting as to stratigraphic realignment." Gauthier and Padian seem offended by the announcement from Chaterjee of a find called Protoavis. Assuring the reader that it will not substantially change the bird evolutionary tree, they nevertheless lament ". . . already the creationist press has seized upon Dr. Chatterjee's preliminary claims to mock the competence of paleontologists and their inferences about the fossil record" (Gauthier and Padian, 1989, p. 129).*

Stegosaurus Plates It is now agreed by most that Stegosaurus had a single row of bony, back plates down the middle of its back instead of the traditional double row. There are several possible functions of these extensions: cooling radiators, warming solar collectors, defense, or sexual selection. Bakker (1980, pp. 226-234) suggests that the plates were moveable and could be flipped down to ward off predators attacking from the side.

***T. rex* Forelimbs** It appears that the forelimbs of *T. rex* were too short to reach its mouth as an aid in eating. Some experts therefore believe the forelimbs were used to disengage the mouth after attacking prey. Others believe the short muscular arms helped the animal get up from a lying position. Only eight *T. rex* fossils have been found thus far.

Related to the *T. rex* forelimb problem are the large thumb spikes of the *Iguanodon.* When first discovered a century ago, the spikes were placed on the animal's nose! Some have now suggested that these thumb spikes were used to puncture prey. It is interesting that secular researchers characteristically look immediately for purpose and function in dinosaur studies. This is in marked contrast to the hunt for vestigial organs by physiologists and anatomists working on presently existing organisms (see Bergman and Howe, 1990, for an excellent, in-depth evaluation of the vestigial organ problem from a creationist perspective). Of course, evolutionists give credit to natural selection rather than created design.

Reproduction Many contrasting, imaginative ideas have been given to explain the reproductive strategies of heavily-armed, heavily-spiked dinosaurs! The trend is to ascribe "sexual display" function to any visible external structure whose function is unknown. Padian (1989, p. 4) summarizes that the crest on the head of the duckbill dinosaur has "been variously interpreted as a snorkel, an air-storage chamber, a butting organ, a honker, a device to enhance smelling and a sexual display organ." He goes on to suggest, tongue in cheek, "Besides, in paleontology, if you don't know what a structure is for, the fall-back answer is always 'sexual display'."

Extinction A clear, secular explanation for the demise of dinosaurs is still lacking. The meteorite hypothesis, presented with a flurry in 1980 (see Alvarez et al., 1980) no longer receives total support (see for example Alvarez et al., 1990). There are several basic problems with this popular view. *First,* possible impact sights for a large meteorite have proliferated, but none has gained wide acceptance. The recently reported evidence of a huge impact crater in the Yucatan penninsula (see Beatty, 1991, for a highly-readable popular account of this possible discovery) is a strong contender at the present time and will no doubt receive considerable popular support in the media in the months to come. It has not received universal acceptance among evolutionists at the present time, however. The above article (Alvarez et al., 1990, p. 40) quotes Virgil Sharpton of the Lunar and Planetary Institute as saying, "But we shouldn't be any less critical just because it's convenient."

Second, the much-touted iridium concentration in the Cretaceous/Tertiary clay layer is not as sharply defined as first reported. *Third,* some dinosaur groups went extinct well before the end of the Cretaceous; others will surely be found extending into the Paleocene. Thus there is not really a unique extinction point in the fossil record.

Periodic extinctions based on returns of the "Death Star," Nemesis, have been largely discounted. For a review of the original book by Raup on this subject see Lillo (1987). There is no clear evenly-spaced, cyclic-time correlation with the postulated nature of extinction in the fossils of the world.

Archibald (1989, p. 164) notes that there have been in excess of 85 different theories put forth to explain the demise of dinosaurs. He further states that, "If anything is clear from these various theories, it is that we may never be able to identify a *single* cause for dinosaur extinction." Clearly, a great deal of ink will spill over this issue before it reaches anything close to a consensus of opinion. It still remains one of the most fascinating problems in biology.

Current Interest Areas

Beyond the debated areas, dinosaur studies are active in other specific directions, as shown by the frequency of technical articles. Of course, the most recent ideas are not necessarily the correct ones ! Some of the special interest topics are:

Taphonomy Defined as the death conditions and arrangement of animal remains, this specialty relates to the orientation of individual bones in sedimentary rock as well as mass death assemblages. Clearly, because of the many hints of association with catastrophic flood events, this discipline is at the center of creationist interests. Mass graves of dinosaurs are extensive in some parts of the world. Dinosaur National Park in Utah and Dinosaur Provincial Park in Alberta are well-known examples.

High-Latitude Dinosaurs Evidence for dinosaurs is found in the Antarctic as well as Alaska (see for example Parrish et al., 1987) These polar regions experience long periods of darkness and relative cold. This gives rise to possibilities of dinosaur migration, hibernation, or torpor (sluggish, inactive state). On the other hand, high-latitude dinosaurs may provide indications of past moderate world-wide climates.

Dinosaur Era Over geologic time, the tenure of dinosaurs on earth is expanding in both directions,

*Editor's Note: For a most interesting exchange between an evolutionist and a creationist on this subject see Padian, K. 1989. "Protoavis"? *CRSQ* 25:201-202 and Calais, R. C. 1989. Response to Padian. *CRSQ* 25:202-207.

presently backward beyond middle Triassic and forward into the late Cretaceous and beyond. As dinosaur evidence proliferates in the geologic strata, the creationist model of dinosaur history can only be strengthened.

Diversity New species of dinosaurs are found regularly. The number of known dinosaur species has increased by 25-33% during the past two decades. The growing variety of animals shows rich diversity with unique features such as horns, crests, frills, and with an ever-increasing number of fundamental missing links. Chure (1989, p. 180) refers to ". . . unsuspected structural features that almost defy explanation" and to ". . . discoveries that hint that dinosaurs are likely much more structurally diverse than we suspect" (pp. 175, 189). As the number of specimens increases, unknown factors of special creation interest such as growth rates and diets may be clarified.

Social Behavior The primitive reputation of dinosaurs is rapidly disappearing. The behavioral complexity of these creatures has been revealed by the discovery of nest sites that were apparently reused year after year. Some of the nests still hold up to 30 petrified eggs (see for example, Homer, 1984). Herding instincts are shown by "nurseries" of multiple nests, and by large groups of parallel tracks. In many instances it is still not clear who was predator and who was prey. A study of tooth marks on bones might clarify this problem but few such studies have been published to date.

Locomotion and Track Sites Studies on the biomechanics of dinosaurs have just begun (for a recent review see Gillette and Lockley, 1989). Much of the data is derived from the abundant dinosaur tracks, in which creationists have had great interest for many years (see Rosnau et al., 1989). Gillette and Lockley (1989, p. 135) note that the mechanism by which tracks are preserved is poorly understood. They are found in great abundance at some sites in certain formations which may be very extensive in area. The existence of regional "megatracksites" covering up to 30 km^2 near Moab, Utah, are the focus of considerable current interest. Trampling of the substrate by herds of dinosaurs has been so extensive in some areas that it has been given the name "dinoturbation" and is the focus of some current work in sedimentology (see Gillette and Lockeley, 1989 for a summary of current studies in this fascinating field).

Molecular Paleontology The search goes on for dinosaur DNA fragments. The best chance may be high-latitude specimens, where the remains are more mummified and less calcified. It is very difficult to imagine that relatively-fragile DNA strands could be preserved intact for a minimum of 70 to 80 million years. Thus, the discovery of dinosaur DNA fragments in dinosaur remains would be of immense interest to creation scientists.*

Prospects and Challenges in the Future of Dinosaur Studies

There are few if any areas of dinosaur biology which are not of considerable interest in the creation/evolution controversy. We believe that the following may be of special interest in the years ahead:

1. Because evolutionists presuppose that birds must have specialhad a genetic link to lower forms, their frantic scramble to keep *Archaeopteryx* on its perch will no doubt produce much controversy, as well as media hype to strengthen the faithful and convert the wayward (for an excellent review of evolutionary thinking on *Archaeopteryx* see Wellenhofer, 1990). Nevertheless, feathers, the single diagnostic characteristic of birds, will continue to be a major stumbling block to evolutionary ancestory. The publication on details of Protoavis may be released before our paper appears and will no doubt fuel much controversy.

2. Dinosaur extinction scenarios will likely proliferate and will be popular subjects on TV natural-history programs as well as in science journals. Creationists should also give attention to this problem. What is the relationship of dinosaur tracks, not only to the underlying substrate and other adjacent tracks, but also to mass death assemblages? What can we learn from high lattitude fossil finds? Can mass dinosaur gravesites and megatrack sites be correlated with the Genesis Flood? Is there any possibility that either marine or terrestrial dinosaurs could have survived the Flood in large numbers to repopulate the post-Flood world? Could extinction and associated mass graves then have followed due to a deteriorating environment caused by meteorite impacts or volcanic activity? Should the major dinosaur fossil-bearing sediments be considered as Flood deposit, or were they actually post-Flood remnants?

3. What can creationists learn about the limits of variation and the nature of the Genesis "kinds" within the Dinosauria? Can modern taxonomic approaches be incorporated into creationist models, not only of the dinosaurs but of all taxa, both living and extinct? What are the limits of the Genesis "kinds" in the modern world?

4. Dinosaur footprints, long of considerable interest to creationists, need to be studied in much more detail. Techniques of image enhancement and substrate analysis must be developed for specific application to dinosaur footprint correlations with possible human footprints. In a major constructive challenge to creationists, Waisgerber has sagely observed (Rosnau et al., 1989),

> . . . the search for anachronistic evolutionary fossils and their footprints should be continued by creation scientists and hopefully others. If the Leakeys can spend years searching for evolutionary remains in Olduvai Gorge, Kenya, Africa, then creationists have every right and responsibility to spend years investigating the Glen Canyon Group of Formations.

5. Popularization of dinosaur studies through the media has provided evolutionists with a major evangelistic tool. Animated dinosaur exhibits produced by the Dinomation Company will continue to be a major attraction at natural history museums across the country. There is great need for a cadre of well-trained creationists to challenge these evolutionary propaganda

*Editor's Note: Also it is amazing to have surface dinosaur tracks preserved for millions of years. See Williams, E. L. 1990. Ichnofossils exposed to the elements. *CRSQ* 27:76 and Waisgerber, W. 1990. Reply to Williams. *CRSQ* 27:76-77.

ploys in the media, in creation conferences and in secular classrooms.

6. The extent and nature of attempts at stratigraphic realignment to salvage the evolutionary tree must be given careful attention. That is, we must determine and report how much of current stratigraphic studies is legitimate and how much is derived from the need to support evolutionary presuppositions.

7. The role of presuppositions in all origins interpretations must be carefully examined. How much of our present "understanding" of dinosaur biology depends on data and how much depends on presuppositions? For example, Chure (1989, p. 179) notes:

> Lewin (1988) has presented an intriguing account of how biases and preconceptions have shaped interpretation of hominid fossils and how this has often resulted in statements . . . that went far beyond the specimens in hand. . . . In reading Lewin's book I was struck by the similarity to dinosaurian studies. Once thought to be nothing more than giant lizards, dismal evolutionary dead ends waiting to be supplanted by the mammals, dinosaurs are now viewed as evolutionary successes. . . . Although the former view put recognizable and undue constraints on interpreting dinosaur biology, the clear and present danger of the latter view is not always recognized. In our zeal to rehabilitate the dinosaur, might we not go too far. . . . Are preconceptions once again driving our interpretations of the fossils?

Thus, the problem of presuppositions is recognized, even by some evolutionists.

Creation Research Society Research Station and Dinosaur Studies

The CRS research station near Chino Valley, AZ, can play a significant part in developing a creationist model for dinosaur biology. Located in north-central Arizona just below the Mogollon Rim of the Colorado Plateau, the station will be ideally situated to perform extensive surveys in the dinosaur country just a few hours away. Creationist field research and laboratory studies and analysis are greatly needed in these challenging fields.

Conclusion

Paleontology is one of the most fascinating and rapidly changing fields of science. The present time might be called the "age of dinosaurs" because of the flood of new data. Those who speak and write about dinosaurs should be aware of current thinking. Even experts in the field have a difficult time keeping up with the literature. A careful examination of the field will indicate that the creationist view of dinosaurs, including their existence in recent earth history, remains strong.

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> The issue is one of fact. Is the actual universe amenable to the laws of science, or is it not? Of course the truth is that it partly is, and partly isn't. One of the consequences of too much of the modern scientific training upon us is that we finally come to the point where we mistake the Uniformity of Nature, which is only the expression of a hope, for the statement of a fact. Mr. Millikan is typical of a great many scientists in his determination to force upon us the dogma, Science works. He will scarcely consent to the qualification, sometimes.
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