The Taxa of Dinosaurs

The Dinosauria. DAVID B. WEISHAMPEL, PETER DODSON, and HALSZKA OSMÓLSKA, Eds. University of California Press, Berkeley, CA, 1990. xvi, 733 pp., illus. $85.

Perhaps more than any other vertebrate group, dinosaurs spark the imagination. Adding to the mystique has been an absence of technical reviews placing them in a modern systematic context. *The Dinosauria* is the first attempt to provide a compendium and comprehensive review of dinosaur systematics and taxonomy.

The book is divided into two sections. The first includes three chapters on dinosaurs generally. An initial chapter explores the origin of dinosaurs and their relationship to other groups. This chapter is largely a review of previous work, but diagnoses of the major groups using derived characters are provided, and alternative phylogenetic patterns, like the monophyly of the prosauropods, are discussed.

The second chapter, on dinosaur paleobiology, is a refreshing treatment of such issues as extinction, metabolism, diet, and behavior. These topics are prone to fantastic claims and exaggeration, but here the discussions are balanced and lack the dogmatic tone based on pure speculation often encountered. Chapters on carnosaur paleobiology and sauropod paleoecology that might have been included here seem to have snuck into the systematic sections.

The chapter on dinosaur distribution, by Weishampel, provides up-to-date information, listed according to continent within geologic age, concerning occurrences of dinosaur remains. Unfortunately, many of the most recent finds are referred to via personal communications—a situation sure to create headaches for later workers—and therefore must be viewed as preliminary at best.

The systematic sections that make up the core of the book are a mixed bag of 24 chapters of original quantitative systematic treatment and general review. Their strongest asset is that each includes a useful standardized taxonomic table. These tables provide a classification for each group down to the species level, list taxonomic synonyms, and include information on each taxon's geographic occurrence, stratigraphic position, and what anatomical elements it is known from.

In other respects the systematic sections are less illuminating. According to the editor, "Authors were challenged to apply cladistic methods of analysis to their groups, including the explicit identification of outgroups." The results are uneven, owing at least in part to the diversity of their authors' feelings about the nature of phylogenetic evidence and degree of familiarity with cladistic analysis.

A cornerstone of cladistic analysis is the examination of characters as phylogenetic evidence. Although discussed in the text, important characters are not always illustrated. Some authors include informative specimen drawings showing characters discussed in the text, but others simply display reconstructions of skulls or entire animals. Many of the illustrations lack scale bars.

The most serious problem with the book is a lack of data matrices showing character distributions for each of the taxa included. The distribution of homoplasy and the extent of missing data, both of which could have been indicated in data matrices, are extremely important in analyzing groups that have as patchy a fossil record as dinosaurs.

There are several inconsistencies between what the editors had in mind and what the authors actually did. For instance the editors "have avoided the use of quotation marks around paraphyletic taxa by using explicit statements about their status and then referring to them in the vernacular." I would have hoped that such care would extend to polyphyletic groupings as well, but in several chapters the classification listed in the table is at odds with the phylogeny presented. For example, Galton places *Lufengosaurus* as the sister taxon to *Plateosaurus* in his cladogram but presents it as part of a paraphyletic Melanosauridae in his table and in his text diagnoses it with the Plateosauridae. Such confusions regarding monophyly are found in several sections of the book.

The editors also called for the explicit identification of outgroups, but they are not indicated in many of the chapters, and where indicated they are often not properly dealt with. Rowe and Gauthier are the only contributors who make explicit not only what their outgroups are but the order of splitting relative to the ingroup.

Many authors do not provide evidence (in the way of shared derived characters) that support the monophyletic groupings shown in their classifications and phylogenies. Ostensibly the diagnoses of groups, with a few notable exceptions, do not differentiate between derived characters (characters supporting monophyly) and primitive similarities.

Inevitably, comparisons need to be made between this book and recent systematic treatments of other animal groups such as Estes and Pregill's *Phylogenetic Relationships of the Lizard Families* and Benton's *The Phylogeny and Classification of the Tetrapods*, which not only provide data matrices but discuss some of the difficulties encountered in the systematic analysis, entertain alternative hypotheses of relationship, and use state-of-the-art systematic procedures. In this light *The Dinosauria* comes up short. The nonempirical tone and the lack of systematic rigor in most of the sections make the systematic analyses disappointing. Nevertheless, *The Dinosauria* succeeds in providing an overview of dinosaur taxa, paleobiology, and distribution that will form a starting place for more ambitious systematic efforts.

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Structure of Chromosomes

Chromosome Banding. A. T. SUMNER. Hyman, Boston, MA, 1990. xiv, 434 pp., illus. $65.

The discovery of how to resolve bands along mammalian chromosomes heralded the era of modern cytogenetics. Now the exuberant bandwagon days have waned, supplanted in both resolution and verve by a new generation's genome sequencing. At this historical transition comes a timely summing up by the most tenacious of the original bandmasters. With 100 figures, 2000 references, and 28 tables, this work chronicles a complete technological era from 1968 to 1989. The theme is always "What can we know about chromosome structure as revealed by banding?" Every banding mechanism is described; C-banding, G-, R-, Q-, T-, G-11, C_d-, N-, Ag-NOR, replication, fluorochrome, decondensation, nuclease, and immunological bandings are detailed, not in the manner of a lab manual, but as a window on chromosome organization. Cytochemical mechanisms of each technique are thoroughly discussed, with each author's opinion carefully cataloged. Like Thucydides, Sumner puts his opinions aside and writes from above. He indicates the field's successes and failures and the big questions still remaining. The cytochemical mechanism of almost every technique remains disconcertingly in doubt. That such once-burning questions, now unfashionable and unfundable, will remain unresolved underscores the era's end.

Sumner extends the taxonomy of banding to all phyla, including insects and plants. What species show G-bands, replication bands, fluorochrome bands, base composition isochores, and meiotic chromomeres is completely referenced, and evolutionary relationships are clearly indicated. The meaning of heterochromatin and its heteromorphisms is similarly reviewed. For academic, but not medical, cytogeneticists, this book