BOOK REVIEWS

Ceratopsians

The Horned Dinosaurs. A Natural History. PETER DODSON. Artwork by W. D. Barlowe and R. Walters. Princeton University Press, Princeton, NJ, 1996. xiv, 346 pp., illus., + plates. $35 or £23.

In the days of my childhood, which now appear as remote as the Mesozoic Era, it was inconceivable to approach the wonderful sculpted *Triceratops* standing majestically on the Smithsonian Mall without thinking immediately of Uncle Beazley, star of *The Enormous Egg*. What child didn't fantasize about hatching and raising his own pet dinosaur? And of the possibilities (*Tyrannosaurus*, a perennial favorite otherwise, might have turned on its owner at any minute), the stately *Triceratops*, with its protecting horns and a ready-made seat behind the great frill, fit the bill perfectly. Many of us who now study dinosaurs as adults never dreamed we'd grow up to do just that; some of us, including the author of this new book, always knew we would.

The ceratopsians, or horned dinosaurs, were Cretaceous herbivores known mostly for their great bony frills behind the head, their horns over eyes and nose, and their hooked upper beaks formed by a unique bone called the rostral. Like the duck-billed hadrosaurs, they had no teeth in front, but their cheek teeth were combined by the hundreds into a single beveled grinding and shearing surface in each quadrant of the jaw, which must have made them very effective vegetarians. The group includes not only the huge, spectacularly varied horned and frilled types; in fact, the first ceratopsians were small and probably mostly bipedal, with no horns and almost no frills at all. They seem to be most closely related to the dome-headed pachycephalosaurs, with whom they originated from generalized ornithopod dinosaur stock, probably in the Early Cretaceous.

Ceratopsians evolved into two major lineages: the centrosaurs, generally with shorter frills, large nose horns, and small eye horns (*Monoclonius*, *Styracosaurus*), and the chasmosaurs, who tended to sport larger frills, smaller nose horns, and larger eye horns (*Torosaurus*, *Pentaceratops*). Curiously, *Triceratops*, the most famous horned dinosaur, is somewhat anomalous: its horns securely pronounce it a chasmosaur, but it has a short frill that, unique among ceratopsians, is solid and thick, with no fenestrae. It was also the last known of the lineage, surviving to just below the Cretaceous-Tertiary boundary in Montana.

The horned dinosaurs are among the best-represented in the fossil record, with the number of known specimens per genus often ranging from the hundreds to the tens of thousands. It is perhaps surprising that no general work has ever been published about them, but the deficit is now redressed by Dodson's engaging, witty, and erudite new book. It is a labor of love by an admitted "ceratophile" (his term), an anatomist particularly skilled in biometrics, the quantification and analysis of variation that is so important in interpreting the diversity of fossil vertebrate remains in any kind of objective way. Dodson made his mark in the 1970s by determining that a gaggle of nine genera and 13 species of duck-billed dinosaurs could be reduced biometrically to two genera and three species, if one admitted the inevitability of juvenile specimens and the probability of sexual dimorphism among the lot. The same acumen is applied to this review of the horned dinosaurs, which are tackled here in the terms of their diversity and how we have come to know it. The historical development of each subgroup and genus is charted as new specimens were found, diagnoses changed, and names invented, combined, and often sunk. Along the way we are treated to a grand array of stories about early as well as more recent collectors, many of whom have often been overlooked. Dodson lays out the history, the evidence, and the conclusions (including his own) but always allows the reader plenty of room for judgment. The prose is graceful and never overly serious, and the footnoted asides are informative and amusing, so that even chapters on topics as dry as the necessary skeletal anatomy and principles of classification will be palatable to the non-specialist.

The issues in ceratopsian paleobiology are a microcosm of those for any extinct group. Over time, the initial enthusiasm for treating each new bone fragment as representing a new species waned, and attention focused less on splitting and more on grouping taxa as anatomy became better known and evolution became a guiding principle in taxonomy. The skeleton behind the ceratopsian head generally shows far less variability than the skull does, and after much soul-searching it has been generally accepted that the principal function of all this cranial ornamentation was for sexual display (though there is ample evidence of wounds inflicted in aggression). Such devotion of biologic energy to mating and territory implies a certain degree of sociality, supported also by mass graves of thousands of monospecific individuals who perished at once in a flood or other disaster (these are now known for several ceratopsian species). We now have growth series for several forms, and Dodson squarely advocates the view that sexual dimorphism, ontogeny, and normal populational variation account for most of the apparent diversity.

The book is strongest on anatomy and history. Less strong, perhaps, are the treatments of phylogeny, about which a great deal is now coming together, and of the distribution of these taxa through the rock column. Phylogeny and stratigraphy provide strong tests of each other's hypotheses, and it would be interesting to know to what degree the vertical distribution of ceratopsian lineages in the rocks matches their evolutionary patterns derived solely from anatomical features. In place of this, Dodson tests biometrically the cladistic hypotheses of character distributions and polarities on which current phylogenies are based, revealing broad agreement but not much new insight into evolutionary patterns. As Dodson notes, there is still much work to do on these wonderful creatures, and it is a pleasure to have his own substantial contributions summarized amid such a nice review and synthesis as this book.

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Contractile Mechanisms

Biochemistry of Smooth Muscle Contraction. MICHAEL BÁRÁNY, Ed. Academic Press, San Diego, 1996. xxvi, 418 pp., illus., + plates. $115 or £22.

The mechanism of muscle contraction has been studied extensively with skeletal muscle as a model for more than 40 years, following a number of critical findings: the identification of myosin as an adenosine triphosphatase by Engelhardt; the identification of actin-myosin as a contractile component by Szent-Györgyi; and the sliding-