

ics in one place and becomes a proponent in another; Churchill undergoes the same transformation; speakers before the society are referred to as "Dr. Clouston" or "Dr. Mott" with their first names never proffered; and unidentified abbreviations abound, leaving the unfortunate reader to decide what it could possibly mean to "call an A.G.M." or "work for the L.C.C." The weaknesses of the book are unfortunate, for its strong parts are sufficiently sophisticated to warrant the judgment that if the author (and the editor) had spent more time on it it could have been the definitive work on the subject.

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Vertebrate Structures

Problems in Vertebrate Evolution. Papers from a symposium, London, Jan. 1976. S. MAHALA ANDREWS, R. S. MILES, and A. D. WALKER, Eds. Published for the Linnean Society of London by Academic Press, New York, 1977. xii, 412 pp., illus. \$36.10. Linnean Society Symposium Series, No. 4.

If this symposium has a less apparent overall theme than is usual in the Linnean Society's symposia it is perhaps a tribute to the breadth of researches undertaken by T. S. Westoll, the dedicatee. Westoll's interests have spanned a wide range of primitive fishes, and he has given special attention to the fish-tetrapod transition. Because Westoll's contributions have been fundamental it is unfortunate that a bibliography of his papers is not included in this volume. The quality of the papers presented in the book is high, however, and some are fundamental contributions. They may be grouped by subject into four categories: the nature of calcified tissues, the anatomy of Paleozoic fishes, the postcranial skeleton of coelacanths and tetrapods, and relationships of placoderms, acanthodians, lizards, and birds.

The papers dealing with calcified tissues should find a wide audience, for they are all important summaries. Bobb Schaeffer demonstrates the importance of interactions between epithelial and mesenchymal tissues in the dermal skeleton of fishes. The differences between cellular and acellular bone, enamel and enameloid, and bone and dentine arise from shifts in the timing and duration of particular morphogenetic processes; past speculations on which member of each of these pairs is the more

primitive are weakened. Of particular interest is Schaeffer's discussion of the involvement of neural crest material in (probably) all dermal calcifications.

Tor Ørvig summarizes knowledge of odontodes, discussing the ontogeny, function, derivatives, and phyletic history of these toothlike structures of the dermal skeleton (often called dermal denticles). Ørvig believes odontodes to be the precursors of the dermal skeleton, as well as one of its major components.

Keith Thomson discusses the biology of cosmine, a hard tissue of the skeleton found in a variety of fossil fishes. He shows that in crossopterygians cosmine is an active tissue undergoing extensive resorption and deposition related to such phenomena as mineral storage and protection. Cosmine also contains the minute network of the pore-canal system, which appears to have been electroreceptive, differing from electroreceptors of living fishes in being integrated primarily within the canal network rather than being under more direct control of the central nervous system.

Colin Patterson has studied the relationships between endoskeletons and exoskeletons of vertebrates and found no instances of interchangeability between the two. He reviews delamination theory and finds most applications of it to be unspecific; the only direct attempt to apply it cannot withstand criticism. Patterson's overall conclusion is that the dermal and endoskeletons have always been distinct, as far as is documented in known animals, and that theories postulating the induction of one by the other are readily falsified.

One of the most extensive summary papers in this book is by Alec Panchen, who reviews the complexities of tetrapod vertebrae. Although Panchen's results are essentially negative, his approach is explicit and the paper is a classic review of this difficult problem; a clear discussion of the differences in ontogenetic, anatomical, and serial homology among various vertebral structures is given. Panchen concludes that there is phylogenetic continuity between vertebral structures of osteolepid crossopterygians and those of temnospondyl labyrinthodonts and postulates a separate origin, within crossopterygians, for the anthracosaur-reptile groups. Microsaurs are not lepospondyls; the vertebral structure of living amphibians provides no evidence concerning their affinities with Paleozoic groups.

The other papers are all of interest to vertebrate morphologists and paleozoologists but in general deal with more specific problems of anatomy and relation-

ships. H. P. Whiting reidentifies cephalaspids cranial nerves and modifies Stensiö's classic account of them somewhat; the result is that the cephalaspids show an even closer similarity to petromyzontid lampreys, the pride stage in particular. Brian Gardiner and A. W. H. Bartram demonstrate homology in cranial anatomy of primitive palaeoniscoids and crossopterygians; these two major groups of bony fishes thus seem more closely related than some workers (notably Jarvik) have supposed. Roger Miles and G. C. Young revise the curious placoderms, Erik Jarvik sees similarities of acanthodian fishes to elasmobranchs, S. M. Andrews reinterprets the axial skeleton of *Latimeria* and compares it with that of tetrapods, Alick Walker provides an alternative to the currently well-documented theropod origin of birds, Robert Carroll finds the origins of lizards within particular eosuchians but sees *Sphenodon* as a separate issue of that group, and F. R. Parrington interprets retention of neck intercentra in reptiles as providing the kind of flexibility offered by opisthocoelous or flattened cervicals in later mammals.

There are few typographical errors in this satisfying volume, and the overall enthusiasm of the articles, surely due in part to the authors' pleasure in honoring Westoll, makes it one of the more interesting and readable recent volumes in the field of vertebrate morphology and evolution.

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Membrane Biology

Electrical Phenomena at the Biological Membrane Level. Proceedings of a meeting, Orsay, Oct. 1976. E. ROUX, Ed. Elsevier, New York, 1977. xvi, 566 pp., illus. \$65.50.

Most of the material in this collection of papers is available elsewhere in published form, and some has been superseded by more recently reported work. On the whole, however, the juxtaposition of diverse, loosely connected topics is useful, particularly for someone trying to survey several fields of current interest quickly. I found the volume introduced me to interesting lines of work relevant to my own interests, and I suspect it will serve the same purpose for others. That, after all, is one of the things a good symposium should do.

There are papers on lipid monolayers and bilayers, theoretical discussions of