

Vertebrate evolution

Problems in Vertebrate Evolution. Edited by S. Mahala Andrews, R. S. Miles and A. D. Walker. Pp. xi+411. (Academic: London and New York, 1977.) £18.50; \$36.10.

THIS volume of thirteen papers by vertebrate palaeontologists is a mark of their respect and regard for Professor Stanley Westoll on the occasion of his retirement. The subjects covered are, like his own interests, centred on fishes but extend also into the functional anatomy of tetrapods.

The commonest theme is the problem of comparative anatomy, in the sense of the search for the methods of establishing homology between structures in different groups, and also the application of these methods. Schaeffer develops the interesting and basic hypothesis that the dermal skeleton is always the result of an interaction between the epithelium and the underlying mesenchyme, and that its different manifestations (as enameloid, enamel, dentine or membrane bone) are merely the results of changes in the timing, duration or number of steps in the series of morphogenetic events. In another important paper, Patterson concludes that, contrary to current belief, there is no interchangeability between membrane bones and cartilage bones (though the two may fuse together), and that superficial "dermal" bones must be distinguished from membrane bones, the latter ossifying deep in the mesoderm. Ørvig gives a comparative survey of the superficial dermal structures, tooth-like in appearance though not in position or function, that he calls odontodes. Gardiner and Bertram discuss the braincases of two new palaeoniscids and conclude that the ventral cranial fissure represents the gap between the ossifications in the trabecular-polar bar and the basal plate. Thomson discusses the ontogeny of cosmine, and suggests that the porecanal system of Palaeozoic fishes had an electroreceptive function. Finally, Whiting returns to the problem of the identification of the cranial nerves of cephalaspids, and provides considerable evidence that Stensiö's numbering of these should be revised.

The often bewildering interplay between ontogeny, functional anatomy and phylogeny is well shown by Panchen's work on the variety of vertebral structure in early tetrapods, and by Mahala Andrews' paper on the implications of some new features in the axial skeleton of *Latimeria*—since we still know virtually nothing of it as a living creature, its frequent mention

as a "living fossil" in popular articles is rather ironic! On a related topic, Parrington suggests that intercentra were retained in the neck of cynodonts to increase the flexibility of this region. Finally, Walker provides some new ideas on the vexed question of the relationships between the functional morphology of the pelvic girdles of birds and dinosaurs (and, by implication, the relationships of their owners).

There are three papers primarily concerned with systematic work. Miles and Young describe new ptyctodontid placoderms from Australia, and provide arguments for a new classification of placoderms in which the arthrodires (*sensu stricto*) and antiarchs are closely related to one another. Jarvik finds a surprising degree of similarity between the detailed cranial anatomy of *Acanthodes* and that of living sharks, and

suggests that these two groups are far more closely related than had been thought. Finally, Carroll explores the implications of his recent work on the earliest known (Permo-Triassic) lizards, discussing the basic adaptive pattern and early evolution of the group; he also suggests that sphenodontids are more closely related to the lizards than to the rhynchosaurs.

The volume has an attractive format and a good index. None of the papers in it are trivial, most are well-written (though occasionally blemished by imperfect proof-reading), and the volume deserves a place on the bookshelf of anyone working on the comparative anatomy and evolution of fishes.

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Ultraviolet photoelectron spectroscopy

Principles of Ultraviolet Photoelectron Spectroscopy. By J. Wayne Rabalais. Pp. xv+454. (Wiley Interscience: New York and London, 1977.) \$36; £22.50.

THIS is really a very good book which will be useful to photoelectron spectroscopists for many years to some—no mean achievement in such a rapidly changing research field. The author has not fallen into the trap of undue concentration on spectra of specific molecules or indeed of paying special attention to particular research areas within the ultraviolet photoelectron spectroscopy (PES) field. Rather, there has been a deliberate policy of concentrating on the fundamental principles of the various effects which are encountered in PES and for once the book's title is a true reflection of the content. In my opinion, the author was also correct in concentrating on the vacuum ultraviolet aspects of photoionisation electron spectroscopy, a subject which provides direct information on the electronic structure of molecular ions, rather than diluting the contents in an attempted comprehensive electron spectroscopy text.

The detailed content of the book is significantly different from that found in existing texts, and the degree of overlap is remarkably low. A suitably short introduction is followed by a brief but adequate chapter on experimental methods. Chapter three is a useful one in that it brings together, in a mathematical way, a number of related topics such as photoionisation, Franck-Condon factors, isotope effects, selection rules and configuration inter-

action. The next chapter deals with the theoretical methods used to describe and quantify ionisation from closed-shell molecules. This chapter is adequate, although a colleague thought that a discussion of the more recent molecular orbital methods such as the *ab initio* many body approach, the equations of motion method and the application of time-independent perturbation theory to the problem of calculating ionisation energies could have been included to advantage.

The next three chapters are ones which are not standard content in books on PES and for this reason are especially useful to researchers in the field. Chapter five deals with the special aspects of ionisation from open-shell molecules in a mathematical fashion, and includes a good account of the vector-coupling method for open shells. Chapter six deals with the theory of photoionisation cross-sections in as reasonable a way as is at present possible, since considerable development work is still required in this area. The following chapter deals with the interpretation of photoionisation cross-sections and angular distributions within the limits of our present day understanding.

Chapter eight is a detailed account of spin-orbit coupling in molecular ions and chapter nine is concerned with configurational instability of molecular ions—basically, the Jahn-Teller and Renner effects. On balance, the topics in chapter nine are discussed in rather more detail than one might justify from their importance in experimental PES. The last two chapters are more conventional and are basically concerned with experimental results and their interpretation.

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