Book Reviews

Views on an Evolutionary Question

Arthropod Phylogeny. A. P. GUPTA, Ed. Van Nostrand Reinhold, New York, 1979. xx, 762 pp., illus. $32.50.

Are the arthropods a grade or a superclade? In other words, did several Precambrian and Paleozoic lobopod worms independently sclerotize their bodies to give a similar grade of metazoan organization, or can we envisage a common ancestor giving rise to all known arthropods via a series of functionally plausible intermediates? This book, which aims to throw light on this question from a wide variety of sources, is divided into four sections: Paleontology (one chapter), Embryology and Development (three chapters), Sense Organs (two chapters), and Anatomy, Morphology, and Physiology (seven chapters). Of the 13 contributors eight favor a monophyletic origin, three are uncommitted, and only two (Anderson and Manton) believe arthropods to be polyphyletic.

Boudreaux, writing on the intersegmental tendon system, first outlines the features basic to the arthropod groundplan and goes on to depict a hypothetical ancestral arthropod. How much is learned, however, by portraying such a generalized creature when the portrayal has no predictive power to explain the processes or mechanisms by which the separate groups arose? and would it have been more fruitful to ask, granted sclerotization occurred, what other features thought to be basic to arthropods arise as an inevitable consequence? It may turn out that the options available to any sclerotized animal are so few as to make convergence automatic.

The considerable and in some ways unique evidence paleontology can afford on the subject is reviewed extensively by Bergström. Whether some of his suggestions will command acceptance is, however, uncertain. Bergström's recognition of the "trilobitomorphs" on the basis of a single character—a spinose lamellate lateral appendage—merely reinforces the conclusion that this is an artificial group without claim to taxonomic coherence. The flood of information arising from restudy of the Burgess Shale (Middle Cambrian) and other arthropods makes it clear that the origins of "trilobitomorphs" are widely separated. A number of these arthropods simply do not fit into any known category, and attempts to force such species to belong to, or act as bridges between, known groups will only hinder our ultimate understanding of arthropod phylogeny. Furthermore, many Paleozoic arthropods urgently require redescription. It is no criticism of Bergström that he introduces such creatures, but as for instance with *Aglaspis spinifer*, which has now been shown not to be a chelicerate (Briggs *et al.*, *Palaeontology* **22**, 167–180 [1979]), circumspection is required.

Paleontological solecisms appear elsewhere in the volume. *Burgessia* is declared by Clarke (pp. 484, 486) to be a trilobite, but in fact its affinities are uncertain. Paulus, in what is generally an excellent review of eye structure, opens his chapter (p. 299) by noting that trilobites have four median eyes. This fact will come as a surprise to trilobites and trilobite workers alike, and it must be doubted whether the primitive complement in arthropods is four median eyes. The most conspicuous failure to keep abreast of paleontological developments comes from Callahan, who in the book's most idiosyncratic chapter writes on insect antennae. Callahan wholeheartedly adopts the phylogenetic scheme of Sharov despite the intense criticism this theory has received. His resurrection (p. 271) of Sharov's erroneous notions on *Opabinia* (see also Paulus, p. 355) is particularly untimely in view of its recent redescription by Whittington. Callahan's adherence to these outmoded ideas gives one a scant feeling of security when assessing his unorthodox proposals regarding the functioning of insect antennae.

Many of the chapters are largely review essays, and the book contains a wealth of information. Particularly useful, if exhaustive, discussions are given by Matsuda on abnormal metamorphosis, Clarke on visceral anatomy, and Gupta on hemocytes. Matsuda's chapter in particular suffers from excessive recapitulation. This is a pity, for his final conclusions make some vital points on the macroevolutionary potential of hormonal control: here we have a mechanism to affect an entire population through environmental change. Clarke is aware of, but does not entirely resolve, the problems of deciding whether the simplicity of some small arthropods is genuinely primitive or the result of processes such as progenetic pedomorphosis which yield far more limited phyletic information. Unlike most authors who favor some sort of annelid ancestor for the arthropods, Clarke looks to the aschelminthes—an idea that has remained dormant for many years.

In general there is little overlap of subject matter between authors, although the consecutive chapters on embryology by Anderson and Weygoldt adopt markedly different stances. Anderson gives a particularly authoritative and lucid discussion, and, as Weygoldt admits (p. 117), some of his alternative proposals present difficulties. Anderson's chapter and Manton's on hexapods stand out as the most distinguished contributions. The chapters on sperm transfer and spermatophores (Schaller) and sperm ultrastructure (Baccetti) are also valuable reviews. Schaller's is noncommittal on questions of phylogeny, but it is interesting to compare the phylogenetic scheme proposed by Baccetti with those based on more familiar information. Tombes surely deserves praise for his candid admission that the evidence present in his succinct contribution on the neuroendocrine system does not as yet permit an unequivocal statement about arthropod phyletics.

In conclusion, *Arthropod Phylogeny* is a storehouse of information, but with the exception of a few chapters it requires a great deal of wading through to pick out the most plausible options in arthropod phylogeny. In appearance it suffers from disappointing reproduction of some line drawings, especially in Manton's chapter, and an unduly large number of misprints. Several writers emphasize that there are crucial areas of ignorance, and whatever else this book achieves it will focus attention on these gaps in our knowledge.

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