Book Reviews

Phylogenetic Studies

Interrelationships of Fishes. Papers from a symposium, London, June 1972. P. H. GREENWOOD, R. S. MILES, and COLIN PATTERSON, Eds. Published for the Linnean Society of London by Academic Press, New York, 1974. xvi, 536 pp., illus. + plates. $31. Zoological Journal of the Linnean Society, vol. 53, suppl. 1.

In phylogenetic studies of vertebrates, the fishes have long proved the most intractable of subjects. Despite countless explorations of the primary relationships between the major groups and of the course of evolution within such complex groups as the Agnathans or Osteichthyes, progress "from the gradal to the clade," as one of the editors of the volume reviewed here once jocularly put it, has been difficult and slow. It has been hampered by a paucity of genuinely early and primitive forms and a surfeit of highly evolved forms in both the fossil and Recent records. That the situation has suddenly changed is due to four principal factors. First in importance is the paper by Greenwood, Rosen, Weitzman, and Myers (*Bull. Am. Mus. Nat. Hist.* **131**, No. 4 [1966]) in which the outline of a totally new classification of teleosts was presented. This stimulated enormous interest in the subject as a whole. Second is the paper by Patterson (*Philos. Trans. Roy. Soc. Lond. Ser. B* **247**, No. 739 [1964]) on fossil acanthopterygians from the English Chalk which, together with his later papers, has set a new standard for the study of fossil actinopterygians. Third, a large number of workers in this field have taken up the ideas of Hennig (*Phylogenetic Systematics,* University of Illinois Press, 1966) and thereby begun the attempt to develop a conceptual framework for the study of phylogenies based on as complex and incomplete a record as that of fishes. Fourth is the influence on a group of younger paleontologists of the technical accomplishments of the "Swedish School" led by E. A. Stensiö. Recent progress and interest in this field has been so marked that already Greenwood, Miles, and Patterson have judged it timely to produce the present work, the result of a symposium to which speakers were invited specifically to provide a "comprehensive review" of the interrelationships of fishes. Not surprisingly, definitive statements are still not possible in some cases, but the book is the distillation of a remarkable effort and will set standards for years to come.

The agnathans and placoderms are not covered, and progress here has been slowest of all. On the early chondrichthyans there is only a tantalizing essay by Zangerl that awaits full description of his new Paleozoic materials. Compagno, however, presents the sort of comprehensive overview of elasmobranch relationships that has been urgently needed for a long time. The contribution by Miles on acanthodians is exemplary as an exposition of rigorous argumentation. The paper by Andrews on crossopterygians is also interesting for its methodology, but this reviewer cannot accept without reservation her premises that the choana is primitive and that the rhipidistian dermal skull roof pattern is nonadaptive. Gardiner (dealing with the paleoniscid braincase and primitive osteichthyan characteristics), Schaeffer (in a concise review of chondrostean relationships), Bjerring (with his elaborate reconstructions of putative embryological components in the coelacanth endocranium), Miles, and Andrews all deal to a greater or lesser extent with the problems of the interrelationships of the major osteichthyan groups and it is evident that further trips around this particular mulberry bush will be unrevealing without the addition of entirely new material. In the meantime, the consensus view remains that Crossopterygii are most closely related to Dipnoi, that the Osteichthyes are a monophyletic group, and that the Osteichthyes and Acanthodii might be linked together (as the confusingly named Teleostomi). It is within the Actinopterygii that the most dramatic progress has been made. There are excellent reviews by Schaeffer, Jessen, Patterson, Greenwood, Nelson, Forey, Nybelin, and Roberts on chondrosteans, holosteans, osteoglossomorphs, clupeomorphs, elopomorphs, and ostariophysans together with more broad studies by Nybelin and by Rosen, who presents a long and detailed examination of the relationships of the "higher euteleosteans." All of these are individually excellent but perhaps one may single out as a major result of the opus the final demise of the grade in consideration of actinopterygian relationships. In this respect the contribution of Patterson on holosteans is extremely significant even though there is still a great deal that is unknown about this group.

Apart from the value of the individual papers, the work as a whole results from and reflects a concern with fundamental principles in the study of phylogeny and particularly with questions of methodology. Therefore in many cases the differences of approach and conclusions between authors (for example Gardiner and Bjerring or Jessen and Patterson) are as interesting as the results per se. The more general reader may find these differences and also the inevitable proliferation of new terms bewildering. It is therefore somewhat disappointing that the editors, who have thought more about these problems than almost anyone else, did not contribute an introductory or concluding essay in which the fascinating general questions in the development of a scientific methodology for phylogeny were discussed with particular reference to this immensely productive set of studies.

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Cyanophytes

The Blue-Green Algae. G. E. FOGG, W. D. P. STEWART, P. FAY, and A. E. WALSBY. Academic Press, New York, 1973. viii, 460 pp., illus. + plates. $24.

The authorship of a balanced biological monograph of a genus, family, or phylum is a challenge frequently beyond the competence of a single author. The common refuge is the multiauthored review volume, often originating from a symposium and lacking comprehensiveness, unity, or insight. When a monograph does appear that is prepared by a small group of collaborators who have worked together and have been masters of the subject for years, the result is a joy. Such an achievement is this happy overview of the blue-green algae.

Blue-green algae have been on Earth

for 3.2 billion years but have been studied for less than 200. Their place in the literature of microbiology is incommensurate with their importance to the biosphere. Knowledge of them is scattered, of varied quality, and difficult to collate. The authors succeed well in tying recent advances to the prescient observations and speculations of older workers in the field. This is especially so in the discussion of cellular structure, a subject of current excitement stemming from the replacement of inadequate optics and instrumentation by the electron microscope and adequate analytical tools. The reader is able to assess interpretations of electron photomicrographs in the light of the classical observations and experiments pertaining to the prokaryotic nature of the blue-green algae. The discovery and description of the gas vacuoles and vesicles as well as the new insight into the structure and function of heterocysts make absorbing reading.

With respect to physiology and biochemistry, the authors have provided an easily assimilated digest of current knowledge about photosynthesis, chemosynthesis, heterotrophy, respiration, and nitrogen metabolism and have skillfully related data from other organisms to data peculiar to the blue-green algae. This section, however, requires careful attention and may be considered heavy reading by all but experts.

In the sections dealing with the ecological impact of the blue-green algae in marine and freshwater environments, the volume adequately illuminates problems that are unsatisfactorily resolved. Far too little is known about the individual species—which number over 1500 in the Cyanophyta—to permit total understanding. What information is summarized does nothing to dispel the impression that these organisms play a far greater ecological role than previously suspected.

A reviewer is hard put to find any significant contribution to the field that has been omitted from the over 1000 references in the bibliography. Readers will be disappointed by the absence of an author index, and the inclusion of so much literature has made unavoidable the cryptic style so annoying in the *Annual Review* series. This is nevertheless relieved by a wealth of insight into the problems and frequent reference to unpublished data. Occasionally contradictions between observations and accepted interpretations are inadequately explored—as in the case of the location of the phycobilins in the thylakoids—but such flaws are rare. The authors treat contradictory information in an objective fashion without denigrating the contributions of those whose views have been superseded. By rejecting erroneous hypotheses of their own, they treat conflicts with a good humor rare in scientific writing. For the phychologist or student this is a thoroughly competent and graceful text. The professional phycologist will want it at his elbow.

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Invertebrates

Biology of the Turbellaria. Papers from a symposium, Chicago, Dec. 1970. NATHAN W. RISER and M. PATRICIA MORSE, Eds. McGraw-Hill, New York, 1974. xxviii, 530 pp., illus. $25. McGraw-Hill Series in the Invertebrates.

This compilation is designated "Libbie H. Hyman Memorial Volume" and consists of amplified versions of papers read at a symposium held in her memory at the AAAS meetings in 1970. Thirteen of the 23 authors are European.

Seldom has a zoological symposium been organized with such concern for broad, scholarly, and thorough coverage. Rather than being simply a review of past research, this volume contains an abundance of new material. Karling properly sets the pace with an introductory chapter on the anatomical affinities of turbellarian orders. Detailed anatomy is at its best in a remarkable chapter by Bedini and Papi on the electron micrography of the turbellarian epidermis. Other anatomical material is contained in chapters on sperm biology and fertilization and on copulatory organs in the Polycystididae.

Physiology is represented by a chapter bringing comparative digestive physiology up to date and accounts of the nerve plexus in polyclads, neurosecretion (*sic*) in freshwater planarians, and inhibition of planarian regeneration.

The largest portion of the volume is ecologically oriented, with chapters on such topics as salt-marsh Turbellaria, Texas cave flatworms (fascinating reading!), Black Sea littoral species, polyclad reproductive ecology, distribution of Japanese freshwater species, competitive planarian ecology, and an impressive long chapter by Ball on the phylogeny and biogeography of freshwater triclads.

Three chapters are devoted to phylogenetic curiosities and descriptions of new taxa: Rieger on Kytorhynchidae, a new typhloplanid family; Sterrer and Rieger on Retronectidae, a new catenulid family; and Poulter on *Pericelis hymanae*, a new polyclad species from Hawaii.

There are unusual chapters on the genetics of fissioning in planarians and on reproduction as a function of age in *Dugesia*, and a short history of the study of Turbellaria in North America. Riser concludes with an epilogue consisting of brief comments on significant items not discussed in the volume, as well as speculations about future turbellarian research, especially on marine species.

Some of the original manuscripts submitted were too long for the volume, and the editors worked diligently to bring them down to reasonable length. There are only a few typographical errors, but the publishers apparently "forgot" the frontispiece and "lost" figure 12 on page 267. On the other hand, they have produced a volume that contains only the finest illustrations. Line drawings, graphs, and electron micrographs are all excellent.

Appropriately, this book contains a short biography and a complete bibliography of Libbie Hyman. She would have been graciously pleased to know that this outstanding work is dedicated to her.

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Bases of Salt Tolerance

Structure and Function of Plant Cells in Saline Habitats. New Trends in the Study of Salt Tolerance. Translated from the Russian edition (Moscow, 1970) by A. Mercado. B. Gollek, Transl. Ed. Halsted (Wiley), New York, and Israel Program for Scientific Translations, Jerusalem, 1973. vi, 284 pp., illus. $30.

Intensified water use has led to deterioration of water quality, evidenced in irrigated areas by marked increases in salinity. Agriculture would benefit greatly if the salt tolerance of crop plants could be increased significantly, for saline waters could then be used more efficiently. To improve salt tolerance we need to know the mechanisms by which salinity injures plants, the