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Book Review: Interrelationships of the Platyhelminthes

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Book Review: *Interrelationships of the Platyhelminthes*.—D. T. Littlewood and R. A. Bray (eds.). London, England : Taylor and Francis Publishing Co., 2001. 365 pages. The Systematics Association, Special Volume, Series 60. ISBN: 0748409033. $125.00 (hard cover).

When news of this volume first came out, those of us who study various groups of flatworms were excited because at last we would be able to get, in one place, a summary of the phylogenetic/evolutionary relationships of our beloved dorsoventrally flattened, mostly relatively small, semicosmopolitan, free-living and symbiotic, acoelomate worms. It is obvious to me, but many people might ask: Why would anyone be interested in flatworms? In fact, with a sales rank in July 2001 at Amazon.com of 1,183,669 it is a pretty good bet that *Interrelationships of the Platyhelminthes* is not headed for the laypersons' best seller list. However, that does not mean that systematists with broad interests should not snap up copies as fast as they can. This is because this book represents the first general and phylogenetically based summary for biologists interested in relationships among most of the major groups comprised in the phylum Platyhelminthes. The work is a major step beyond the initial and precladistic summaries of Hyman (1951) and Grassé (1961) and represents a massive expansion of the overview of flatworms found in Brusca and Brusca (1990).

Interrelationships of the Platyhelminthes was derived from papers presentedby researchers interested in the origin, evolution, and diversity of flatworms at a meeting (of the same name) held in London in 1999 and sponsored by the Linnean Society of London. Littlewood and Bray conceived of the idea and, to their credit, arranged the symposium and brought in most of the participants on grant funds. The participants presented papers at the symposium, and afterwards the contributing authors submitted their papers for inclusion in the current volume. The 49 contributors were asked by the editors to summarize their work instead of presenting results of new studies; however, it is unclear what this request actually accomplished: Most of the papers presented do show original and new results.

There is so much information in this book that it would take a very long review to mention all the strengths and weaknesses of each chapter; however, I touch on each chapter with at least a few comments. The book is composed of four sections: Early Origins and Basal Taxa; Free-Living Groups; Symbionts and Parasites; and Characters and Techniques. In each section, contributing authors' papers are presented as a chapter. For phylogenies that are presented, most chapters also include the corresponding character matrices. Reading through the complete book, I was struck by the lack of a general taxonomic consistency; that is, the editors apparently made no effort to attempt a generalized nomenclature at the higher levels, which makes the papers particularly difficult to interpret. If you are intimately familiar with the groups, this is not a problem, but for beginning (or even somewhat advanced) students of the Platyhelminthes, it is difficult to understand the group names without referring directly to Brusca and Brusca (1990), Levin (2001), or another consistent reference. Another deficiency is that the general form of the cladograms lack consistency, making it difficult to proceed from one chapter to the next without having to stop to figure out the format of presentation of the data. One small paragraph in each section telling what these animals are and where they might be found would have assisted the reader in becoming oriented. Of course, if you did not have a specialty in this area, one might ask, why read such a book anyway? And so I forge ahead with the review….

Section I, Early Origins and Basal Taxa, contains four chapters. Chapter 1, by Tyler, "The early worm: Origins and relationships of the lower flatworms," gives a summary of the hypotheses of relationships and position of the Platyhelminthes relative to the other metazoan groups. One conclusion is that, as yet, there is no consensus on the overall monophyly of the group. Another conclusion Tyler presents, citing others working in the field, is that progenesis was the evolutionary process by which the flatworms arose. He also recommends more investigations into the deep phylogeny of the metazoa to see whether the flatworms come out in a clade or not. Chapter 2, by Raikova, Reuter, and Justine, covers the phylogeny and systematics of the Acoelomorpha. Conclusions of these authors are that immunoreactivity, spermiogenesis, and axial microtubules (basic ultrastructural studies) shed some light on the overall relationships among the "Acoelomorpha." This was informative in that many of the structures of diverse groups were shown to be homologous, thus indicating a clade-level connectivity by way of structural synapomorphies. Chapter 3, by Lundin and Sterrer, deals with a small group of marine flatworm-type organisms, members of the order Nemertodermatida, a monophyletic group sharing a common ancestor (in most analyses) with the Acoela. These authors present a phylogeny of the group based on morphological characters. Chapter 4, by Rieger, presents a phylogeny of the Macrostomorpha, which, unless you know what constitutes the group, remain obscure even after reading the chapter. A few handmade trees are presented.

Section II, Free-Living Groups, also contains four chapters. Chapter 5, by Curini-Galletti, treats the Proseriata. This chapter gives a sense of the diversity, geographic distributions, and general systematic position of the Proseriata. Curini-Galletti then compares molecular data generated by others with his own morphologically based phylogeny. A more detailed topological comparison would have been useful, but the overall message of this chapter was that more work needs to be done. Chapter 6, by Baguna *et al.*, is titled,

"Molecular taxonomy and phylogeny of the Tricladida." This chapter deals with the planarians, which (besides some parasitic species) are probably the most well known group of flatworms. Datasets used in this analysis included 72 taxa, of which about 20 species were in the in group. Sequence data included data from the cytochrome oxidase I gene and 18s rDNA. It is interesting that a total evidence tree was not built, but the authors concluded with a "new phylogenetic hypothesis" for the Tricladida, using a combination of morphology and molecular characters. Chapter 7, by Sluys, deals with one family of triclads, the Dugesiidae, from a morphological perspective. The analysis was conducted on 39 (mostly binary) morphological characters representing data accumulated on 84 taxa. Chapter 8, "The Prolecithophora," is by Jondelius *et al.*, who use molecular (18s rDNA) characters as well as ultrastructural morphological characters to generate a "starting point for future studies" given that the final tree shown is mostly a big polytomy.

Section III, "Symbionts and Parasites," contains 10 chapters. Chapter 9 is a treatment of the Temnocephalida by Cannon and Joffe. The authors indicate that a more complete knowledge of this group of ectoparasitic worms might lead to a better understanding of the origins of parasitism in the other, more specialized, flatworms. The more than 100 species of Temnocephalida are grouped by an unambiguous synapomorphy of multiple syncytial plates. The authors present a phylogeny of 19 taxa (recognized genera in the group) based on 38 morphological characters. Integrating the knowledge base of the whole group was an interesting outcome of this analysis and showed the Temnocephalida to have a probable age of about 100 million years. Chapter 10, by Boeger and Kritsky, covers the class classically called the Monogenea, here called the Monogenoidea (I thought the ending-oidea was a superfamily designation). The authors make a plea for the use of this name, in the sense that nonspecialists might mistake the old classification of the monogenes with the new phylogenetic schemes that have been produced. These authors make a convincing argument from their analyses of representatives of 53 families and 66 homologous series of morphological characters that the Monogenoidea is a monophyletic group. Chapters 11–14 deal with various phylogenetic analyses of the cestodes (tapeworms, in general terms). Although the group consists of about 14,000 described species in 14 orders, Xylander, in chapter 11, developed and presented hypotheses showing monophyly of the group. Chapter 12, by Hoberg *et al.*, includes a total evidence approach at the order-level that provides an interpretation of the phylogeny of the Eucestoda. An excellent addition to this study is the optimization of the hosts of the cestodes onto the total evidence tree of the tapeworms; this is very useful for anyone with interests in the origin and subsequent diversification of the true tapeworms or the Eucestoda. Chapter 13, by Mariaux and Olsen, includes a discussion of the level of integration of molecular analyses in phylogenetic studies of cestodes from the past to the present. We leave the tapeworms with chapter 14 by Caira *et al.*, who present a large-scale morphological analysis of many species of cestodes of elasmobranchs. Many polytomies show up here, which can be expected because of the very large number of species and genera included in the analysis.

Chapters 15–18 set out to define the relationships among the digenetic trematodes (and similar organisms), with Chapter 15, by Rohde, which deals with the small group of flatworms known as the Aspidogastrea. Rohde presents two different hypotheses for the origin of parasitism in the flatworms. Chapters 16–18 cover the Digenea, probably the second most speciose group of internal metazoan parasites, with the nematodes holding the top spot in this category. In Chapter 16, Cribb *et al.*, cover the Digenea, using both morphological and molecular characters in a phylogenetic analysis. Chapter 17, by Tkach *et al.*, includes an analysis of the Plagiorchiata (a subgroup of the digenes) with both molecular and morphological data. The results indicate that the suborder, as classically known, is polyphyletic; the schistosomes are at the base of the tree; and the group has two or three main lineages in the group. Chapter 18, by Snyder *et al.*, covers a single family—the Schistosomatidae—and shows the separate trees that were built by using morphological or molecular characters.

Section IV, "Characters and Techniques," contains nine chapters. Chapter 19, by Rohde, concerns the use of Protonephridia as phylogenetic characters (excellent drawings of the protonephridia of many taxa of flatworms are included). A phylogenetic analysis was done but, curiously, no graphical representation of it was presented, leaving the reader to try to figure out the relationships of the taxa analyzed from a list of taxa and their bootstrap values. Watson, in chapter 20, analyzed sperm in the Rhabdocoels from transmission electron micrographs; the micrographs reproduce very well in the book and will be useful for anyone with interests in the field of spermatology. Justine, in chapter 21, took the sperm analysis further and produced some trees for various groups of the mostly parasitic forms (monopisthocotyleans) and a couple of cestode groups. He concluded that these characters, if more widely known for other species, would be very useful for tree construction. Chapter 22, by Reuter and Halton, looked at neurobiology of the flatworms with some excellent color photo-graphs showing the nerve nets of Microstomum. They also provide a current review of the neuroactive substances in flatworms. Beveridge, in chapter 23, carefully outlined the use of life-cycle characters in studies of the evolution of the cestodes. He optimized the life-cycle characters of the cestodes onto previously published cestode trees. Telford, in chapter 24, looked at embryology and genes coding for development as characters that might show the true relationships of the platyhelminths to other metazoan groups.

The closing chapters cover analyses of small subunit rDNA of the whole platyhelminth group by Littlewood and Olsen (chapter 25) as well as morphological (spermiogenesis) and molecular analyses (using 18S rDNA and 28S rDNA) by Joffe and Kornakova (chapter 26). The book concludes with a review of supertree construction methods and an attempt by Wilkinson *et al.*, (chapter 27) to create a supertree of the phylum Playthelminthes by using both "taxon substitution" and "matrix representation with parsimony" methods.

In summary, the book provides both experts and beginning students of the flatworms with a wonderful source for phylogenetic analyses of the group. The book contains many excellent drawings and color photographs of structures from diverse species that would be difficult to glean from the primary literature. This book represents a huge amount of work by the 49 authors who contributed to this effort. The literature cited section is 41 pages long and is arranged alphabetically after the last chapter. The book ends with a useful index.

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