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BOOK REVIEW . . .

Parascript: Parasites and the Language of Evolution, by D. R. Brooks and D. A. McLennan. Smithsonian Institution Press, Washington, D.C. 1993. 429 p. Hardcover \$69.00; Paper \$25.00.

Parasitology suffers from an image problem, a perception that it constitutes a largely descriptive discipline that has seldom offered anything substantive to other areas of the biological sciences. How is it that the most integrative of the biological disciplines, where a firm knowledge of the factors that determine the associations of hosts and parasites are requisite, has almost become universally regarded as a minor player in the realms of systematics, evolutionary biology, biogeography, and ecology? Parasitology has a rich tradition in these areas (Klassen 1992a, 1992b) but more recently has shifted from these foundations to seemingly more sophisticated and technologically driven arenas. Ever-increasing degrees of specialization have tended to fragment what once was a cohesive science and have promulgated the view by some that systematics in particular has not been a significant component of "modern parasitology" nor has it contributed significantly beyond the discipline. However, as with other areas of the biosciences (e.g., ornithology [Siegel-Causey, 1992]) parasitologists have been largely unaware of the transformation and revolution that has been changing the theoretical and explanatory power of systematics. Thus the publication of *Parascript* by D. R. Brooks and D. A. McLennan appears at a critical juncture, where parasitologists are continuing a tradition of significant empirical and theoretical contributions and are directly supporting a rejuvenation of biosystematics and parasite evolutionary biology.

Parascript is written in 4 chapters with a voluminous appendix of 160 pages that constitutes the current phylogenetic data base for the parasitic protozoa, platyhelminths, nematodes, and acanthocephalans. The authors have stated that their purpose is to outline a concerted effort to delineate phylogenetic relationships among diverse taxa, utilize this data base to examine current conventions and unifying concepts in parasite evolution, and outline working hypotheses as a stimulus to future research with phylogenetic reconstruction serving as the foundation. Brooks and McLennan unabashedly and effectively present a case for the pivotal role of phylogenetic analysis and reconstruction for a range of studies in ecology, biogeography, and evolution. This is a book that concentrates on the parasite rather than the host, continually emphasizing that parasite evolution can be evaluated when removed from the context of the host.

The first chapter provides an historical perspective for this influential and rapidly expanding field (with implications and applications far beyond the confines of traditional parasitology). It summarizes the state of the field with its roots in the work of von Ihering and the programs of the American and German schools extending to the 1940s, emphasizing the historical analysis by Klassen (1992a, 1992b). The term "parascript" was coined by Manter (1966) to describe the "... language of parasites which tells of themselves and their hosts both of today and yesteryear ..." in

recognition of the intricate ecological, evolutionary and biogeographic histories associated with the development of host-parasite assemblages. The advent of phylogenetic systematics (Hennig, 1966) constituted the keystone for the initial attempts at deciphering this complex language. However the history of phylogenetics in parasitology extends only to 15 yr ago with publication of the initial papers by D. R. Brooks. It is clear that this is a young science, one that is developing rapidly and at the forefront of what will happen in contemporary and historical ecology, evolutionary biology and biogeography.

The second chapter, "Parascript," examines the mechanics of Manter's language by reviewing a range of studies of parasite-host systems in marine, aquatic and terrestrial communities. Emphasis is placed on patterns of geographic and host association among parasite clades evaluated within the framework of phylogenetic systematics. Readers are introduced to the explanatory power of Brooks' parsimony analysis (BPA) (see Wiley et al., 1991) in examining the historical development of the often perplexing patterns of parasite biogeography and host-parasite evolution (with the dual components of coevolution and colonization). The message here is that "... phylogenetic relationships of parasites can be reconstructed based upon characters of the parasites themselves, thus freeing evolutionary biologists from the specter of circular reasoning in assessing the relationships among hosts and geography during the course of parasite evolution."

The third chapter, "Adaptation and Adaptive Radiation of Parasites," examines the conventional wisdom, or myths and metaphors, of parasitology but from the context of sister groups within a comparative phylogenetic foundation. Host specificity, parasites as degenerate organisms, and a range of concepts about adaptation are evaluated. We also find here, some of the first empirical considerations that indeed patterns of speciation in parasitic organisms apparently do not differ from their free-living counterparts. Empirical evidence does not support the notion that parasites are adaptively simplified for the parasitic life style. Additionally, it is clear that host specificity can be uncoupled from parasite speciation and as an indicator of phylogenetic congruence between parasites and hosts. Many of the classical paradigms of parasitology are contradicted by empirical evidence revealed in phylogenetic analysis.

The final chapter, "Evolutionary Biology," once again emphasizes that the biology of the parasite and not the host is the key to elucidating parasite evolution. The take home message is important and powerful: in essence the modes and mechanisms of evolution are the same for parasitic and free-living taxa. This sets the conceptual framework for the application of parasite-host assemblages as model systems. Many interesting questions can be couched in terms of phylogeny for parasite and host groups. Although all questions need not be considered in these terms, the logical and robust hypotheses that can be developed in a comparative framework suggest its utility from the micro- to macroevolutionary levels and across the subdisciplines of ecology, biogeography, biodiversity, and behavior.

In the appendix, "The Phylogenetic Database," the state of information available on major parasitic groups is reviewed succinctly and made available to a wide audience. The volume of comparative morphological data amassed for the parasitic platyhelminths (Cercaria) is unparalleled for any major taxonomic group (invertebrate or vertebrate taxa). Phylogenetic systematic analyses of Cercaria have resulted in the most highly corroborated hypotheses for the evolution of any major taxon of free-living or parasitic organisms. Concordance of hypotheses based on independent data sets is beginning to support an understanding of higher level relationships among the Digenea + Aspidobothrea, Monogenea, Gyrocotylidae, Amphilinidea, and the Eucestoda. Among many of these taxa, phylogenetic analysis has extended to the level of families, genera, and species. Classifications developed from these relationships are highly predictive and for the first time reflect the natural hierarchical order of evolution. As an extension of this burgeoning data set, it is now possible to assess critically a range of fundamental questions and concepts in parasitology (indeed the foundation for *Parascript*). Potential and exciting research programs in parasite systematics, historical ecology, and biogeography are apparent, and for parasite systematists fertile areas are identified that should lead well into the next century.

Major gaps in knowledge are also evident from the voluminous appendix that covers much of the available phylogenetics literature devoted to parasitic organisms. Acanthocephala remains an enigmatic group but one that appears particularly tractable for phylogenetic analysis. Likewise Nematoda has not received extensive attention, such that a number of areas are identified where considerable and significant work could be accomplished. Molecular biologists should note the substantial empirical base that exists for integration with the expected contributions from protein electrophoresis and nucleotide sequence analysis.

Graduate students and those who have been reluctant to delve into this arena will find that *Parascript* provides a concise and powerful review of the development of the field and identifies the major players in parasitology and their contributions. It alleviates the immediate need to ramble through a scattered literature, although all interested readers certainly will want to consult the original sources. It assumes that readers will have some fundamental understanding of phylogenetic methods and does not pretend to be a primer for cladistics (see Wiley et al., 1991). However, this book places systematics at center stage, summarizes the work by a small but active group of parasitologists, and promotes a firm foundation for major advances.

This is a challenging book—it challenges us to review our conventional wisdom about the central paradigms of parasitology from a new perspective. It promotes a more critical focus for research in almost any area of parasitology and promises to pull parasitology back into the mainstream of evolutionary biology. Although some will inevitably find the contents of this book controversial, it decidedly provides a convergence for some very interesting and fundamental questions in evolutionary biology. These are topics that can be addressed only by parasitologists in a phylogenetic framework. Such approaches can only lead to a resurgence in recognition for the discipline and the considerable gems we have to offer. In the immortal words of Lee Iacocca, one can "lead, follow or get out of the way." D. R. Brooks and D. A. McLennan have produced an influential and important text that represents the future.

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