

## Book Reviews

*Parasite Biodiversity*. By R. Poulin and S. Morand, pp. 216. Smithsonian Institution Books, Washington D.C., 2004. ISBN 1 58834 170 4. US\$50.00.  
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Readers approaching this book should not expect a review of the diverse forms of parasitic organisms or a series of illustrations of the extraordinary adaptations parasitism has provided. This is a book of theory and graph, of generalization and synthesis. It is aimed at a broad audience, with the hope that the reader 'when later gazing at a bird gliding overhead, will see not just the bird, but will also see (or at least imagine!) the flying assemblage of parasite species'.

The nine chapters cover a range of factors which may impact on the diversity of parasites. It is perhaps strange that the authors discuss the subject of quantification of diversity and diversity indices in the last chapter. The earlier chapters take species richness as the measure of diversity, but only in Chapter 9 do the authors point out the shortcomings of this measure and the theoretical importance of phylogeny in assessing diversity.

The first chapter discusses the state of knowledge, emphasizing the ubiquity of parasites and the fact that so many of the species are known from their original description alone. The second chapter explores the techniques and caveats in estimating parasite diversity. The authors make the point that diversity can be overestimated if host-induced phenotypic variability is not taken into account. One of the papers quoted as reporting host-induced variation, however, is one of my own (Bray and des Clers, 1992) where, in fact, we indicated that there are probably several 'cryptic' species present, a conclusion supported by subsequent molecular evidence (Lumb *et al.* 1993; Bray *et al.* 1999). To be fair to the authors, they also point out that 'cryptic' species will cause underestimates of diversity. I reckon that this is likely to be a greater confounding factor than host-induced variability, such that most estimates based on morphology will be underestimates.

The third chapter applies epidemiological theory to parasite diversity, that is, diversity determinants in ecological, rather than evolutionary, time. They reckon that the small amount of evidence available indicates that epidemiological theory, especially as relating to such factors as host density or sociality, can predict parasite species richness particularly in parasites with a direct life-cycle. Chapter 4 discusses the host as a determinant of parasite

diversity, whether by co-evolution, host switching, within host speciation or extinction. They draw the parallel between hosts and islands and apply MacArthur and Wilson's ideas on island biogeography. After a discussion of various host traits, from body-size to host-genetics and all imaginable factors between, we discover that the drivers of diversity are multifactorial and may never be fully understood.

The fifth chapter suggests that parasitism *per se* may favour diversification and discusses the features of parasitism that may be involved (note an error on p. 98, line 18, conspecific should read congeneric). The number of hosts in the life-cycle and specificity at each stage may appear important, but not in nematodes where the diversity of those with complex and simple life-cycles does not differ. Chapter 6 tackles the subject of biogeography, in its widest context, presenting some surprising and enigmatic results, e.g. diversity is higher in parasites of temperate than in tropical freshwater fish. Chapter 7 reviews the factors lowering the parasite risk of extinction, which apparently include low host specificity and the ability to drop hosts from the life-cycle. Chapter 8, in contrast to the remainder of the book, considers parasite diversity as a driver of host evolution.

As the authors point out, many conclusions are based on rather inadequate supporting evidence, or the support is weak. Because of this it might be said that the book is premature but, on the other hand, this might be considered a stimulus to students to study these aspects of parasite biology. Many chapters or passages could, almost unchanged, suggest a programme of study, and be of particular value in the design of field-work and collecting strategies or experiments. In summary, this relatively short book is a useful counterweight to the more conventional reviews of parasite diversity, and should interest (but not necessarily convince) all workers who would like to understand why parasitism is such a successful way of life.

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*The Geographic Mosaic of Coevolution.* By J. N. Thompson, pp. 443. University of Chicago Press, USA, 2005. ISBN 0 226 79762 7. £20 (US\$28).

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It could be argued that much of evolution is really coevolution. Organisms do not exist in an ecological vacuum, but as parts of a network of interacting species. A given species may compete with others for access to prey species used as food, while itself serving as food to predator and parasite species. Natural selection will drive reciprocal evolutionary changes between interacting species. Across its geographical range, a species will encounter different local networks, since the same set of species do not co-occur everywhere. Thus, coevolutionary outcomes will vary in space, forming a geographical mosaic shaped by local adaptation and gene flow. This is the theme of John Thompson's new book, in which the author develops a conceptual framework for the study of coevolution.

The book is a sequel to Thompson's 1994 *The Coevolutionary Process*, and picks up where the previous one left off (the majority of references in the new book are post-1994). The first part of the book begins with a discussion of the attribute of species that provide the raw material for long-term coevolution on constantly changing landscapes. Species tend to be phylogenetically conservative in the way they interact with other species. Yet, each species is a collection of genetically-differentiated populations that specialize their interactions on only a few other locally important species, so that the outcome of interactions differ from locality to locality. These are the fundamental species attributes that fuel the

dynamic spatial mosaic of coevolution. This first half of the book then goes on to explore the role of local adaptation in maintaining the mosaic, present an overview of the mosaic theory of coevolution, and summarize the forms of evidence indicating that interactions are coevolving. The second part of the book evaluates the various hypotheses and predictions set within the context of the geographical mosaic of coevolution. Here the parasitologists will encounter familiar concepts such as gene-for-gene coevolution, frequency-dependent selection and the Red Queen hypothesis. Finally, the book ends with a chapter on applied coevolutionary biology. This is a call to arms, an appeal to ecologists and evolutionary biologists to apply coevolutionary thinking to the major environmental problems faced by society, including loss of biodiversity and the emergence of new pathogens.

So what is in this book for parasitologists? The very intimate nature of the host-parasite association makes it an excellent candidate for coevolutionary studies. Disappointingly, there are relatively few empirical examples drawn from the literature on classical host-parasite interactions. Other types of interactions are better-represented, such as the associations between phytophagous insects and their plant hosts. But this is only a reflection of the author's background and expertise, and it does not detract from the important message of the book. Indeed, at the conceptual level, the geographical mosaic theory of coevolution has a lot to offer to parasitologists. It provides a comprehensive framework for the study of host-parasite interactions. Local populations of a parasite species each interact with different host communities and different sets of competing parasite species, under different environmental conditions, and yet remain linked within a metapopulation structure. This spatial variation in coevolutionary circumstances across a parasite's geographical range can only yield different local outcomes in the evolution of parasite virulence or host resistance. Thompson proposes a research programme designed specifically to tackle this spatial variation. I highly recommend his book as inspirational reading for all practicing parasitologists and advanced graduate students.

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