the authors suggest that significant constraints may be imposed by pedogenesis—and though they acknowledge the hypothesis has little or no supporting evidence and is not currently testable they suggest (p. 84) that it may have heuristic value in interpreting life histories in an evolutionary context. Arguments of this form signal critics of the evolutionary approach that the time is ripe to attack. In other cases, the theory is presented in such a way that only those already versed in it have a hope of following the argument. The authors present interesting and important data on sex ratio and sex-specific dispersal patterns in *Antechinus*, but the review of sex allocation theory that was meant to set the stage for those data is less than clear and omits some major references.

Evolutionary Ecology of Marsupials is the most current review of marsupial ecology, bringing together both well- and little-known work, presenting detailed data with broad vision. Even if it fails occasionally to complete arguments deeply or convincingly, no other volume does so much. Both professionals and graduate students will find it a fascinating, welcome addition to the literature.

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Host-Parasite Coevolution

Ecology and Genetics of Host-Parasite Interactions. D. ROLLINSON and R. M. ANDERSON, Eds. Academic Press, Orlando, FL, 1985. xii, 266 pp., illus. $45. Linnean Society Symposium Series, no. 11. From a symposium, Keele, U.K., July 1984.

The coevolution of parasites and their hosts is sometimes viewed as a gene-for-gene arms race that matches increases in virulence by the parasite against increases in resistance by the host. However, a commensal relationship may evolve if selection favors parasites with reduced virulence and hosts with increased tolerance. The 14 papers in this symposium volume are concerned with various aspects of host-parasite associations, focusing on genetic and ecological factors that may affect coevolutionary patterns. Reviews cover diverse research programs encompassing experimental epidemiology, natural history, immunology, genetics, and theoretical ecology. Recent advances in the theoretical ecology of host-parasite associations are reviewed by May. Mathematical models developed in collaboration with Anderson reveal a variety of conditions under which a parasite may regulate the abundance of its host in steady state, in cyclic oscillations, or in chaotic fluctuations. May also combines population dynamics with population genetic models by involving both frequency-dependent and density-dependent effects. Anderson and Crombie have examined age-related changes in schistosome infections of snails and mice. Their study represents a powerful blend of experimentation and mathematical modeling.

The volume contains several field studies that attempt to address various aspects of coevolutionary models. Kennedy questions the existence of equilibrium population dynamics on the basis of his studies of helminth parasites of fish in a large lake. He claims that the parasites do not affect the abundance of their fish hosts, but he apparently equates such regulation with a steady-state equilibrium, one of several coevolutionary outcomes discussed by May. Hudson, Dobson, and Newborn find that theoretical models based on parasite prevalence are capable of predicting stable versus fluctuating populations of red grouse. Unfortunately, this and other field studies are limited in the temporal and spatial scales they sample, and thus their interpretation regarding coevolutionary models is unclear.

Experimental epidemiology of hosts and parasites provides a more tractable approach for testing coevolutionary models. Levin and Lenski review the benefits of bacteria and phage systems for modeling host-parasite associations. The existence of lytic and lysogenic phages permits the modeling of both mutualistic and antagonistic associations. I found this paper one of the most stimulating and informative contributions in the book. Scott reviews her well-conceived experimental studies of a monogenean trematode and its guppy host. Continuous immigration of uninfected fish is necessary to sustain the parasite population.

Also notable are several papers that focus on genetic variability of parasites and their hosts. Barrett questions the existence of gene-for-gene coevolution in nature, claiming that evidence for this phenomenon derives from agricultural systems that favor simple qualitative genetic responses by parasites to resistant varieties. Two papers review population genetic studies of parasites or parasite vectors. Although considerable genetic polymorphism has been demonstrated in several vector species, comparable studies of the parasites are limited by the difficulties in sampling and culture. Genetic analyses of the mammalian immune response to parasitic infection are the subject of three papers. Blackwell provides an excellent review of her genetic dissection of the mouse immune response to leishmaniasis. This detailed work reveals a complex developmental process controlling a multilocus immune response. It should be apparent that to assess the validity of gene-for-gene versus quantitative genetic models for host-parasite coevolution more work of this quality needs to be done with other microparasitic and macroparasitic diseases of plants and animals.

Overall, this book is stimulating and informative. Most important, I learned how very much we do not understand about the genetics and ecology of host-parasite coevolution. Several papers concerning mathematical models and immunogenetics are not for the fainthearted, but parasitologists can gain considerable insight into these exciting research directions. The book does not offer many new insights for population geneticists or evolutionary ecologists, but it should serve its stated purpose if it encourages these scientists to adopt host-parasite systems in experimental studies. I was surprised that none of the authors addressed the potential contribution that quantitative-genetic and developmental-genetic methodologies could make in this area of research. The covariance structure and developmental constraints of key traits involved in host-parasite associations must be known if realistic coevolutionary models are to be developed. Are parasite virulence and transmissibility positively or negatively related? What are the costs of increased host resistance to other life history traits such as age-specific fecundity and survival? It is to be hoped that biometrical and developmental approaches will provide a better bridge between ecological and genetic information.

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Active Galactic Nuclei

Astrophysics of Active Galaxies and Quasi-Stellar Objects. JOSEPH S. MILLER, Ed. University Science Books, Mill Valley, CA, 1985. viii, 519 pp., illus. $30. From a workshop, Santa Cruz, CA, July 1984.

This important volume covers the output of the Seventh Santa Cruz Workshop on Astrophysics, which was held to honor Donald Osterbrock on his 60th birthday. It is an excellent collection of papers that will prove to be essential reading for all serious students of active galactic nuclei in the second half of the 1980's. In an introduction to infrared studies Rieke notes that, as was appropriate given the occasion and the location of the workshop, the optical region was the subject most discussed, with the result