ization. Features that apply to one taxon are not fully generalizable to others. In the opening chapter Sehnal *et al.* make the case that the key to understanding the diversity and evolution of metamorphosis and its endocrine control lies in a comparative cladistic analysis of endocrine and developmental mechanisms. They are obviously correct. The remainder of this volume, preoccupied with molecular details of model systems and eschewing a comparative approach, suggests that the community of developmental endocrinologists is not yet ready to hear this plea. But the development Sehnal *et al.* call for is inevitable, because once we are done describing the shared primitive characters of the molecular mechanisms of metamorphosis we will be forced to deal with the things that make animals different, both in development and in evolution. We look forward to descriptions of such studies in *Metamorphosis IV,* which should appear in about 2010.

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Amphibian Biology. Volume 2, Social Behaviour, HAROLD HEATWOLE AND BRIAN K. SULLIVAN, eds. Surrey Beatty & Sons Pty Ltd, Chipping Norton, 1994, xi + 299 pp., iilustr., subject and taxonomic indexes, $75.00 (ISBN 0-949324-60-4 cloth).

This second installment in the continuing *Amphibian Biology* series focuses on behavioral studies of anurans and caudates. In the tradition of the *Biology of the Reptilia* series, the editors have assembled a collection of authors generally regarded as experts in their respective fields to review a selection of specific topics. While the title of the current volume suggests attention to a wide range of behavior directed towards conspecifics, the vast majority of the 7 chapters deal with reproductive and mating behavior. Each of the contributions provides an encyclopedic review of the current work in he field.

Halliday and Tejedo ("Intrasexual selection and alternative mating behavior") concentrate on studies of competition within sexes and make a solid attempt to assimilate the varied data in terms of specific hypotheses that are supported. Sullivan, Ryan and Verrell ("Female mate choice and mating system structure") offer a palatable overview of sexual selection theory that is complete enough to allow the reader to evaluate the empirical results presented. This chapter is divided into separate discussions of anuran and caudate systems, which makes it a bit difficult to see the generalities, but the authors do an excellent job of relating both taxa back to the conceptual framework. The taxonomic distribution and diversity of parental care behavior is exhaustively reviewed by Crump ("Parental Care"). A truly Herculean amount of information is presented, but it is well organized into a variety of tables and accounts. Blaustein and Walls ("Aggregation and kin recognition") discuss the empirical evidence that amphibians discriminate between related and unrelated individuals. Most of these data come from experimental studies that are described in excruciating detail. There remains a conspicuous lack of evidence that kin recognition plays a role in aggregation behavior in nature. A variety of studies of anuran calling behavior are covered by Gerhardt and Schwartz ("Interspecific interactions and species recognition"). Most of the highlighted work comes from the authors' own studies of acoustic, spatial and temporal separation among taxa of call characters. Mathis and colleagues ("Aggression and territoriality by salamanders and a comparison with the territorial behaviour of frogs") attempt to lend cohesion to the range of studies of territorial behavior in salamanders by offering an heuristic model of the evolution of territoriality. The bulk of the information presented concerns salamanders, but an attempt is made to compare with anuran systems. The lone work focusing on proximate mechanisms of behavior was contributed by Houck and Woodley ("Field studies of steroid hormones and male reproductive behaviour in amphibians"). Perhaps due to the lack of empirical research conducted in this area, this chapter parts with the others by focusing on conceptual issues in endocrine control of behavior and the integration of proximate and ultimate mechanisms of behavior. Houck and Woodley's chapter culminates with a prospectus for further research that should help define the future of this subdiscipline.

Because many of the chapters deal with the general topic of sexual selection as mediated through behavior, some of the divisions between them seem forced. Great pains have been taken to avoid redundancy between the chapters, with mixed success. The discussion of alternative mating behavior proceeds without mention of mate choice, likewise the discussion of mate choice and mating system structure avoids a discussion of intrasexual competition. Nonetheless, both chapters highlight the importance of operational sex ratio (OSR) in determining patterns of intra- and intersexual selection, and interpret the available data in terms of OSR. Conversely, the separate discussions of intrasexual competition and territoriality succeed in covering different ideas without the conspicuous omission of related information. Throughout the chapters, data stemming from studies of caudates and anurans are treated separately. Few attempts are made to integrate the results of these taxonomic groups (though the discussion of territoriality and aggression stands out), leaving the reader with the impression that we can understand each independently but little is to be gained by integrating studies of both groups. This may be a general manifestation of the taxonomic biases of individual researchers, a feature made clear by the specific examples highlighted in each chapter. The complete lack of reference to caecilians is conspicuous throughout the volume, but not unexpected given our state of knowledge of the behavior of this group.

One striking conclusion from the information presented in this volume is that most studies of amphibians still lack direct demonstration of the fitness consequences of variation in behavior in a natural context. From parental care to kin recognition to territoriality, behavioral variation is interpreted in an adaptive context. Virtually all of these explanations of patterns of variation and adaptive value stem from unexamined as-

sumptions about the functionality and importance of behaviors. Surely, one productive direction for the future of behavioral research in amphibians and other taxa will be to directly test some of the predictions of adaptive value presented in these chapters.

Overall, this volume does an excellent job of reviewing the empirical literature from amphibian systems. The reader will find few conceptual advances, and novice readers may find the divisions within and among chapters somewhat distracting. For behavioral biologists seeking to expand their taxonomic horizons and for amphibian biologists with an interest in ecological studies of behavior, this will be a valuable resource.

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Narrow Roads of Gene Land, The Collected Papers of W. D. Hamilton. Volume I: Evolution of Social Behavior. W. H. FREEMAN. 1996. 552 pages, 58 illustrations. $25.95 paperback. (ISBN: 0-7167-4530-5).

Since the 1960's the study of evolutionary aspects of social behavior has enjoyed a stunning rise in popularity, in large part because of W. D. Hamilton. Prior to his contributions, explanations for the evolution of social behavior presented special problems because it was not clear how many acts expressed within animal societies benefit the individual as well as the group. Explaining acts such as altruism, a behavior that is taxonomically widespread, was even worse; such behavior seemed to hurt individuals while benefiting the group. George Williams and John Maynard Smith, and later Richard Dawkins, convinced most animal behaviorists that "group thinking" should be replaced by "individual advantage," but what possible individual advantage could be associated with self-sacrifice, celibacy, or providing protection to unrelated individuals? This problem stumped Darwin; Fisher and Wright didn't even provide impenetrable mathematical models; Haldane came close, but didn't get it right (Hamilton, 1975). Not until the publication of Hamilton's seminal papers (Hamilton, 1964a,b) was the issue resolved. These two papers, which gave us kin selection, inclusive fitness, and an inordinate fondness for the social insects, provided empiricists with a testable theoretical framework. However, Hamilton is more than the father of kin selection. This collection of his papers through 1980 shows us why we should pay attention to whatever he has to say and why his ideas are considerably more diverse and fascinating than the 1964 papers alone.

Part I of Hamilton's collected papers provides us with his publications on the evolution of social behavior. (His work on sex and parasites since 1980 will be collected into part II and is to be published in 1997.) Purchasing collected works has always struck me as somewhat odd, thanks to the Xerox corporation, but I can heartily recommend this volume on several levels. First, minor errors that appeared in the original works have been corrected. Thus, we get an accurate account of what Hamilton meant to say rather than continuing to perpetuate errors. While this may depreciate the historical value of the collection, it makes it extremely valuable for those who might want to "discover" Hamilton for the first time. Second, such a collection provides us with easy access to some of his more obscure (but still important) works. I, for one, had never read his 1971 contribution on the 'Prisoner's Dilemma' or his chapter on the innate social aptitudes of humans (Hamilton, 1975), even though both contain ideas that are directly related to my own research. Finally, Hamilton makes this an invaluable volume for anyone interested in the social context of science by providing each chapter (paper) with a description of how and what he was thinking at the time the papers were written. This book is a bargain.

The autobiographical introduction to each paper is not just a few pages that set the story. Rather, some are fairly long and many are well-referenced (one has 48 notes, most of which are references to related literature or work that has occurred since the original paper was published). It is here that Hamilton alerts us to any corrections (typos, minor errors in calculations or formulas, mistakes regarding social insects) that have been made. But it is also in these introductions that we learn how his collaborations came about, how he was influenced by others (especially Price and May), and how personal events shaped his work. The personal events make for fascinating reading. For example, we learn that Hamilton's first published paper (Hamilton, 1963) was actually written after his better-known 1964 papers. Further, we are told that this paper was submitted to the *American Naturalist* (after the requisite rejection from *Nature*) because he felt that the "hope of receiving my Ph.D. at the time seeming to founder" and he needed a publication to justify his time in graduate school. So we also learn that Hamilton is not always correct. In several of the introductions Hamilton relates portions of the tragic fate of his friend George Price. Before Price committed suicide he invented the covariance approach to selection, was the first to apply game theory to social interactions, and stimulated much of Hamilton's own work in the 1970's. Other introductions provide insights into the politics of science, and we learn how to get a paper published in *Nature* (collusion) and get the job of our choice (fame). All of the introductions make each paper more personal and easier to follow and made me want to read even those that I had read before.

Hamilton joins Darwin, Fisher, and Wright as one whose works are more often cited than read (something that has even been documented in Hamilton's case; see Seger & Harvey, 1980.). This can now be corrected. Hamilton has much to say on social behavior, social insects, senescence, sex, figs, and dispersal. Even more is to come on sex and parasites. This volume should be on the shelf of every graduate student interested in evolution, population genetics, or behavior. Hamilton's works provide a road map not only for some of the most exciting topics (many still under investigated) in evolutionary studies of animal behavior, but also show how ideas develop and should be pursued despite ad-