labor in economic development. However, the use of traditional ethnographic research for generalizing across broad economic sectors is problematic, and the field would benefit from more definitive hypotheses and empirical methods as it moves into this new territory. Yet the value of economic anthropology is revealed, for instance in Acheson's chapter on the management of common-property resources. Drawing on ethnographic work in both developed and underdeveloped societies, he shows how understanding local-level management systems can help us out of the theoretical impasse of the tragedy of the commons.

The two concluding chapters of the book are theoretical in character. In discussing Marxism, Plattner (who is not of Marxist persuasion) observes that anthropology's attraction to Marxism stems from common orientations (especially to holism and history) and from the pervasiveness of Marxism outside the United States. Marxism holds more value for broad generalizations than for fine-grained research, and it has not persuaded anthropologists to abandon the cultural evolution framework. Its generalizations seem rather distant from the rich variety of economic behavior described elsewhere in the book. Gladwin's chapter relating anthropology and economics brings the book full circle back to the debate between substantivists and formalists, although it is not cast in this framework. As theory, this is the book's most important and original chapter. It disputes conventional distinctions between economics and anthropology, such as that based on the scale at which the respective disciplines set their sights. Gladwin's conclusion that much is shared is somewhat belied by previous chapters. Though her hierarchical decision model is a theoretically elegant vehicle to connect culture and rational choice, its inability to deal with behavioral gradients, its inattention to interhousehold variation, and its potentially extreme data requirements may limit its use by other anthropologists.

This is a useful book, especially as one of the infrequent benchmarks in one of anthropology's major subfields. Perhaps the most striking disclosure of the book is the relative weakness of the political economy approach that has been ascendant in the field since 1965. In weighing the Marxist paradigm against the behavioral paradigm of culturally constrained rational choice, this book demonstrates the latter's success in dealing more cogently with a wider array of phenomena. Anthropologists are being drawn into new research arenas, as they were in the formative phase of economic anthropology. The strength of more conventional research topics is based on a well-established social typology, but this typology is not very applicable to the new areas of research. The discipline has not completed the needed theoretical and methodological transition, but this book shows a great deal of excitement as ethnographers probe new territory.

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Evolution and Adaptation

Complex Organismal Functions. Integration and Evolution in Vertebrates. D. B. WAKE and G. ROTH, Eds. Wiley-Interscience, New York, 1989. xiv, 451 pp., illus. $122. Life Sciences Research Reports, vol. 45. From a workshop, Berlin, F.R.G., Aug.–Sept. 1988.

The first problem with this book is its title. Complex organismal functions? Integration? What does it mean? It is clear from the introduction that contributors struggled with these and many other definitional questions.

Dahlem workshops are, after all, strangely structured conferences, which bring together a small number of distinguished scientists from disparate disciplines. Participants are expected to produce background papers beforehand. At the workshop they divide up into groups to contemplate those papers. Each group's mission is to produce a position paper, chronicling the insights gained from its discussions and culminating in suggestions for future research. Needless to say, these collective efforts often get bogged down just because the participants approach the topics from such different angles.

Here, then, is what I think the book's title means. "Complex organismal functions" are those features of organisms that most folks call "adaptations." "Integration" refers to the linkage between a function or activity of one part of an organism and a function or activity of another part of the same organism. This linkage could be an obligatory mechanical coupling, like the synchronization of respiration with footfall pattern during locomotion in cursorial mammals, to use an example discussed at length in the book. Or, to use another, it could be the relationship of mastication to middle-ear structure in the evolutionary transition from reptile to mammal. It also refers to linkages that result from developmental constraints.

The "evolution" in the title refers predominately to historical evolution, the diversity of life as studied retrospectively, rather than to the consequences of genetic perturbations explored at the molecular level. Genetics gets mentioned here and there, but evolution at the molecular level is discussed only in passing and in a rather hypothetical way by but a few of the contributors.

It may be worth pointing out that there are two divisions within the contemporary study of historical evolution. One school studies evolutionary trees, the patterns of diversification—that is, phylogeny. They are the systematists. The other school studies the specific designs of organisms, sometimes explicitly (more so in recent years than in the past) and usually implicitly relating observed variation to fitness. This school encompasses those evolutionists who call themselves functional morphologists and comparative physiologists.

It is surprising how separate the two schools can be. There are many productive systematic evolutionists who don't give a damn about the function of organisms. Similarly there are some whiz-bang functional morphologists and physiologists elucidating the grandeur of life with only the foggiest idea how the organisms they study are related to each other.

This is where this book comes in. The contributors were assigned the task of exploring the relationship between the designs of organisms and their subsequent evolution. To what extent do specific features of organisms—because of their complexity and integration with other functions—constrain further evolution? What constitutes evolutionary constraint in the first place? On the other hand, to what extent does the appearance of a new feature subsequently promote high rates of speciation in a clade? And how does one identify such "key innovations"? These issues require concurrent consideration by both schools within evolutionary biology. Developmental biology has a role here as well.

Although that was what this Dahlem conference was principally about, a wealth of other topics are covered in the book. The four working groups concentrated on, respectively, feeding systems, locomotion and respiration, viviparity, and a grab bag of the more controversial issues in evolutionary biology today, ranging from ontogeny recapitulating phylogeny to species selection. In each section there are chapters contributed by scientists in fields as diverse as neurobiology, endocrinology, ecological physiology, and paleontology.

In reading the book I think I profited most from the efforts of the authors to define their terms and justify their approaches. Some of the currently popular (and not so popular) jargon in evolutionary biology that gets scrutinized includes hierarchies, key innovation, ontogenetic repatterning, heterochrony, structuralism/functionalism, internalist/externalist, symmorphosis, the replicative autogenetic model, correlational selection, selective ratchets, ontogenetic ratchets, species selection, and recapitulation. Even the concept of viviparity gets a working over.

A decade ago S. J. Gould and R. C. Lewontin published their now famous paper "The spandrels of San Marcos and the Panglossian paradigm: A critique of the adaptationist programme" (*Proc. R. Soc. London B* **205**, 581 [1979]). There they assaulted sociobiology by attacking an often naive presumption of those who speculate about adaptive significance, namely that all conspicuous features of living organisms are necessarily the perfected products of natural selection. Gould and Lewontin were going at the philosophical roots of sociobiology but in so doing put many evolutionary biologists, particularly morphologists, on the defensive. To morphologists trying to understand adaptation in the vernacular sense, the scoundrels of San Marcos had gone on an anti-adaptationist pogrom. The word "adaptation" has been shunned during the past decade by many, including some contributors to this volume.

As an evolutionary biologist interested in vertebrate design, I was pleased to see in this book that adaptationists' speculation has survived the 1980s. This book is full of rich scenarios for the evolution of complex organismal functions (=adaptations), even if the word "adaptation" didn't quite make it into the title. If there is a single dictum subscribed to by all the contributors, it is that one *can* legitimately speculate about adaptations and their evolutionary significance, *but* to be credible such speculation must be done within a tight phylogenetic framework, where the phylogeny is richly supported by characters other than those under study.

In the final analysis, though, Dahlem workshop reports don't work very well as books, even when compared with those generally unreadable entities, conference proceedings, that invade our library shelves. The breadth of ideas presented—a predictable result of the nature of the workshop—means that a reader must be exceptionally knowledgeable to follow all topics covered. It also means that some first-class review articles included in the reports may be hidden from their mainstream fields. Two examples from this book are the chapters by the embryologist R. P. Elinson on egg evolution and the neurobiologist G. Székely on the neuronal structures controlling tetrapod locomotion. But there are many more.

Few people are likely to read this book in its entirety. Yet there are enough interesting papers in it to make it worth flipping through for any vertebrate biologist with a passing interest in evolution, even if not caught up in the issue of "integration of complex organismal functions."

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Low Probabilities

Large Deviations. JEAN-DOMINIQUE DEUSCHEL and DANIEL W. STROOCK. Academic Press, San Diego, CA, 1989. xiv, 307 pp. $34.95. Pure and Applied Mathematics, vol. 137.

The theory of large deviations comprises the art of estimating with some precision the probabilities of certain rare events. In such estimates there is usually a parameter having some physical significance and the model, the event, or sometimes both depend on this parameter. As the parameter gets large the event in question becomes less and less probable, and one is interested in knowing as precisely as possible the exact rate at which its probability goes to zero.

Such problems arise in different contexts. For example, an insurance company might want to know the probability of a certain catastrophic loss. The Scandinavian school developed the large-deviation method in the 1930s for this purpose. Sometimes one may have to compare two rare events and determine which is likely to occur first if one waits long enough. There are several concepts in statistical mechanics that can be interpreted in terms of large deviations of one type or another.

What makes the theory of large deviations particularly attractive is that the probability of the event of interest is often exponentially small in the natural parameter with an exponential constant that can be exactly evaluated. Moreover, this constant has an appealing physical interpretation involving entropy of some sort. This close physical connection has made the subject particularly attractive to mathematicians and physicists in recent years.

The present book by Deuschel and Stroock investigates several natural contexts in which large deviations arise. Though there is no universal theory that encompasses all these situations, there are some general principles or themes that keep coming up. Convex analysis, Laplace asymptotic formulas, and relative entropy are some of these. The early chapters of the book are devoted to some of the standard examples: Cramer's theory for sums of independent random variables and Sanov's theory on the large deviations of the empirical distribution. The first example is the more elementary, but one can see the relative entropy come up naturally in the second. The large deviations of Wiener measure and the related theory of Ventcel and Freidlin on small random perturbations of dynamical systems are a remarkable example of the success of the theory. These are also dealt with carefully in the early chapters of the book.

The later chapters deal with large deviations of the occupation measures of Markov chains and processes. This theory was developed by Donsker and Varadhan and independently to a lesser extent by Gartner. Here ergodic properties of a Markov process play an important role and logarithmic Sobolev inequality and hypermixing are crucial analytical tools.

The interested reader might profit by going through additional material, especially with regard to connections with equilibrium statistical mechanics. References 39, 73, and 93 are possible sources for this material.

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Protein Structures

Prediction of Protein Structure and the Principles of Protein Conformation. GERALD D. FASMAN, Ed. Plenum, New York, 1989. xiv, 798 pp., illus. $95.

The ultimate solution to the "protein folding problem" will be the elucidation of the "second genetic code" relating the amino acid sequence of a protein to its secondary, tertiary, and quaternary structures. Although there is as yet no indication that a general solution is forthcoming, considerable progress has been made, and this volume of 20 chapters by some of those most active in the field is meant to bring it to the attention of a wider audience, at the same time making available many of the computer programs that have been developed.

Many different aspects of the subject are presented here. When the "energy" minimization approach (discussed here by Mackay *et al.*) was found to be impractical, attention shifted to using known structures to elucidate empirical rules of protein structure. Initial efforts attempted to predict simply the segments of secondary structure (α-helices, β-strands, and reverse turns), on the assumption that these regular local structures were determined primarily by the intrinsic tendencies of the individual residues, plus interactions with neighboring residues in the sequence. The results were initially impressive but failed to improve substantially; generally, about 60% of residues can be