Rainforest Assessments

Australian Tropical Rainforests. Science—Values—Meaning. L. J. WEBB and J. KIKKAWA, Eds. CSIRO, East Melbourne, Australia, 1990 (U.S. distributor, International Specialized Book Services, Portland, OR). x, 185 pp., illus. $70. From a symposium, Townsville, Australia, Aug. 1987.

For biologists and non-biologists alike, tropical rainforests symbolize the pinnacle of biological complexity that unfettered nature can attain. Elaborate examples of mimicry, highly evolved specializations, and intricate interspecific associations all somehow perpetuated in ancient forests on some of the world's poorest soils contribute to the impression that rainforest ecosystems are not only complexly balanced but extremely fragile.

Building on a long tradition of tropical field study, results now emerging from studies of the Australian tropical rainforest are helping to revise our view of the structure and balance of rainforest communities. At the same time Australians are engaged in a heated debate over the future of those forests. In northeastern Queensland scientists and forest managers argue whether we now know enough to manage the remaining stands of old-growth forest and whether the scientific justification for the preservation of wild laboratories overrides the short-term social and economic benefits of continued exploitation. If Australian society cannot agree on priorities for keeping the remaining forests intact, how is it to be done in other countries with greater human pressures, fewer resources, and smaller political infrastructures? *Australian Tropical Rainforests* is as much a statement about public ethics and respect for biotic and cultural diversity as it is an introduction to the biology of the forest.

These collected papers, proceedings from the 57th Congress of the Australia New Zealand Association for the Advancement of Science, attempt to pull together two related but disparate themes: they provide an introduction to the evolutionary and ecological history of one of the world's most intensely studied rainforests, and they examine the role of tropical rainforest in the collective human consciousness. Following an introduction by Webb, the book is organized into four sections: The Depths of Time, Natural Processes, Values and Meaning, and Perspectives for the Future. The contributors are largely Australian biologists, natural resource managers, and sociologists in academic and government posts with a sprinkling of philosophers from abroad.

To their credit, the authors largely avoid the common temptation to offer a smorgasbord of natural history curiosities as evidence of unique evolutionary processes in tropical rainforests. These discussions consider organizing questions (Are rainforest species more highly specialized than those of other ecosystems?) in the light of available data and multiple hypotheses. They treat topics in forest history, impacts of aboriginal people, effects of disturbance on plants and vertebrates, ecological specializations, plant-animal interactions, decomposer communities, and nutrient cycles. They are not in-depth reviews for the specialist but carefully worked introductions to rainforest ecology for the nonprofessional reader. As such they are scantily illustrated, but they are well referenced and present many useful insights.

As a case in point, consider whether a tropical rainforest is in fact a complexly balanced, fragile ecosystem. Three chapters by E. M. Truswell, by D. Walker, and by N. Horsfall and J. Hall describe a historically fluid forest community. They document sporadic biological exchanges with northern regions, a continual shuffling of species assemblages under changing climatic regimes and the impacts of aboriginal people, and the recent (10,000 years ago) reestablishment and subsequent fragmentation of rainforest into the areas it now occupies. In the light of this paleobotanical evidence (some of the best available for any tropical rainforest), the model of tropical forest as an ancient, stable configuration of species whose interactions have been fine-tuned by millions of years of coevolution warrants reexamination.

Fully a third of the book wrestles with the philosophical, social, and political significance of rainforests. The chapter by Webb, an eminent student of Australian vegetation, is a statement, achieved as much through poetry as through argument, of "the cultural function of science to explain what this mysterious world really is and means" (p. 115). Some chapters, however, are philosophical discourses for which the Australian rainforest is but an example.

I found the chapter by J. R. Engel particularly intriguing. Engel argues for a public ethic based on a metaphor of community that encompasses at once the natural and the human worlds. He traces the metaphor to ecological and social movements in the (U.S.) upper Midwest early this century and expressed in Cowles's studies of plant community succession on the Indiana dunes and in the political ideals of social democracy that found voice in Chicago at the same time. The principles that ought to govern human interactions, freedom, equality, and unity in diversity, should inform our treatment of the nonhuman world as well. Only when the legitimacy of that metaphor becomes widely accepted does Engel see hope for the real preservation of the natural world.

Although *Australian Tropical Rainforests* is plagued with the unevenness of symposium volumes, Webb and Kikkawa's goal of melding science and philosophy to consider the history and future of rainforests is often successful and generally stimulating. It is an attempt that should be welcomed by both students of ecology and students of environmental politics.

JULIE S. DENSLOW
Department of Ecology, Evolution and Organismal Biology, Tulane University, New Orleans, LA 70118

Primitive Systems

Evolution of the First Nervous Systems. PETER A. V. ANDERSON, Ed. Plenum, New York, 1990. xxiv, 423 pp., illus. $95. NATO Advanced Science Institute Series, vol. 188. From a workshop, St. Andrew's, Scotland, July 1989.

Though some "nervous system" features are broadly distributed among living organisms, the possession of a complete nervous system seems to be restricted to the various bilateral animal phyla (including the echinoderms) and to the two widely separated radiate phyla, the Ctenophora and the Coelenterata (Cnidaria). Even within the latter phylum, there are such significant differences in the nervous organization and physiology of the different classes that convergence rather than homology must be considered. And part of any definition of a nervous system must recognize and somehow quantify its primary role in the biology of the animal: the integration of the various cells and tissues into a single entity. Giant fibers can provide quick escape reflexes, motor systems control effectors, and sensory units and organs gather information. The nervous system as a totality puts it all together and lets the organism function as a

behavioral unit, even in forms such as siphonophores or corals, where a colony achieves (super)organismal status.

The scope of the workshop whence this volume came extended far beyond the coelenterates and ctenophores. Ion channels, currents, and signaling capabilities in such organisms as bacteria, yeast, protists, and slime molds are discussed from a variety of perspectives in an attempt to understand the early evolution of nervous systems in multicellular animals. There is a valuable chapter by Koopowitz that summarizes his pioneering work with flatworms and a brief report by Cobb on the status of work on the as yet largely enigmatic echinoderms. With a total of 30 chapters and 39 contributors, it might seem contrary to want even more breadth, but mention of the largely negative work with sponges would have been helpful, and it is a shame that the modern work on nematode worms is not covered. And although several authors refer to recent work on metazoan phylogenies from the molecular perspective, this very relevant material is also not represented. Perhaps its inclusion would have opened up the larger questions of neural homologies too much.

The book is divided into three sections: on intercellular communication, electrical excitability, and sensory mechanisms. Each concludes with a summary chapter or overview. Greenberg's overview of part 1 is particularly valuable in summarizing the previous contributions on coelenterate peptides and other neurotransmitters. The volume concludes with a provocative and valuable overview of the specific topic of the evolution of coelenterate giant axons by Mackie and a too short, yet interesting chapter, "Concluding Remarks," by the volume's editor.

This volume excels in the breadth and timeliness of its information. It is a valuable resource, both for the information it summarizes and for the unanswered questions it poses, recognizing the need to modernize our thinking about the evolution of nervous systems in the face of little, if any, hard evidence beyond contemporary life forms. Along with the continued investigation of the cellular and molecular aspects of nerve cells of every provenance, information is sorely needed about the interactions between different types of neurons in simple animals, and how in these interactions the animals' behavior is generated. If significant differences emerge between animals of ancient lineages, the questions posed in this stimulating volume can begin to be answered.

L. M. PASSANO
Department of Zoology, University of Wisconsin, Madison, WI 53706

Reaction Pathways

Intramolecular Motion and Chemical Reaction. I. M. MILLS, M. S. CHILD, and R. A. MARCUS, Eds. Royal Society, London, 1990. viii, 198 pp., illus. £40. From a meeting, London, Feb. 1990. Reprinted from the *Philosophical Transactions of the Royal Society of London*, series A, vol. 332, no. 1625 (1990).

The study of intramolecular motion has the rare characteristic of being both well established and currently hot. This book on the subject will be welcomed by specialists, and for nonspecialists it will be a challenging but worthwhile introduction to the field and to some of the outstanding researchers in it. The interest of this area is exemplified by the chapter written by Marcus, which describes a beautiful application and extension of the well-known Rice-Ramsperger-Kassel-Marcus (RRKM) theory of unimolecular rate processes. This theory dates back 40 years and is predated by 20 more years by RRK theory. RRKM theory, with important extensions by W. H. Miller, who is also a contributor to the book, along with phase space theory (developed by P. Pechukas, J. C. Light, and E. E. Nikitin in the mid-'60s) and the statistical adiabatic channel model (developed in the mid-'70s by M. Quack, who also wrote a chapter, and J. Troe) are elegant and deceptively simple statistical theories for the rate at which a molecule undergoes a chemical transformation, such as isomerization or dissociation into one of several products.

The foundations and underlying assumptions of these theories are now being critically examined with the methods of nonlinear dynamics and time-dependent quantum mechanics. At low levels of internal excitation, intramolecular motion is governed by linear forces, which means that the motion is regular and essentially separable. Interesting chemical transformations occur, however, when the motion becomes highly nonseparable and nonlinear. In this regime, intramolecular motion enters the realm of nonlinear dynamics, with its attendant issues of localization, irregular motion, the possible breakdown of the classical-quantum correspondence principle, and so on. Questions naturally arise about whether or not the dynamics is statistical and how to tell the difference in this highly nonlinear regime. These issues lurk, implicitly if not explicitly, in every chapter of the book, which is roughly equally divided between theory and experiment.

Most experiments probe the dynamics of intramolecular motion indirectly, either by high-resolution spectroscopy or by determination of the rates or product distributions of unimolecular reactions. The beauty and breadth of such studies are conveyed in chapters contributed by the laboratories of Schlag, Quack, Simons, Crim, Moore, Wittig, Dixon, and Welge. Experiments that probe the time-dependence of unimolecular processes are quite difficult owing to the very short period of a molecular vibration, typically in the femtosecond range. Some exciting studies of this type have been done by Zewail and co-workers, and the chapter by Gruebele, Roberts, and Zewail presents a very nice application of this type of study to the photodissociation of HgI_2.

Theory is also well represented in this book. In addition to the chapter by Marcus, there are excellent chapters on the state of the art in quantum mechanical calculations of vibrational energies and wavefunctions of triatomic molecules by Child, Carter and coauthors, and Tennyson and coauthors. A classical analysis of some highly excited states of H_3^+ by Pollak illustrates the power and appeal of classical ideas in understanding intramolecular motion.

I think it is obvious from the above that this book has excellent breadth. In a mere 198 pages it is not possible to cover the field, but that is not the book's intention. It is, as it stands, a real gem.

JOEL M. BOWMAN
Department of Chemistry, Emory University, Atlanta, GA 30322

Aspects of Magmatism

The Nature and Origin of Cordilleran Magmatism. J. LAWFORD ANDERSON, Ed. Geological Society of America, Boulder, CO, 1990. xii, 414 pp., illus. $65. Geological Society of America Memoir 174.

This volume is a potpourri of studies dealing with the setting, composition, and origin of plutonic and volcanic rocks at different localities in the western United States. Ten of the localities are in southern California, and the others are scattered northward to southeastern Alaska. In the preface, the editor summarizes the interpretations of the different authors but makes no attempt to synthesize them.

Heavy emphasis in almost all of the 23 papers is on evidence from geochemistry, including data on major, minor, and trace elements for whole rocks and minerals and isotopic data for strontium, neodymium, argon, oxygen, and lead. These data are used to interpret the ages of the rocks, their pressures (and depths) and temperatures during crystallization, the source materials for the magmas, the consanguinity of intru-