can species that have attracted researchers interested in interpreting behavior and ecology from an evolutionary perspective. Thus, Olympic marmots, hoary marmots, yellow-bellied marmots, and woodchucks, each of which Barash has himself observed, are the star species. In addition to rereporting his own previously published data and drawing on published studies of other researchers, Barash reports on his unpublished studies and reinterprets his previous work. The hitherto unpublished data are particularly welcome, as Barash has not published material from his marmot studies since 1981. The new information includes data he collected during 994 hours of observation of woodchucks from 1971 to 1973. Readers searching specifically for this material will, however, be somewhat frustrated, as it is scattered throughout the book and woodchucks are not listed in the index except sporadically under other headings. Fortunately the book is well written and informative, so reading through large sections to glean specific information is rewarding.

Though about a quarter of the book is devoted to rereporting of his earlier work, Barash gives minimal reference to the earlier publications. For example, the discussion of greeting (pp. 79–84) is taken verbatim, along with three figures, from Barash's 1973 publication in Animal Behaviour Monographs, of which there is no citation. The only material not from that publication is photographs of marmots engaged in greetings that were the source for the earlier drawings. Readers who have read the original articles will experience a sense of déjà vu at many points. The comprehensive coverage of studies spanning four North American and one European species between 1967 and 1986 will, however, be convenient for readers previously unfamiliar with Barash's work.

This book is not a collection of anecdotes, but rather is intended for the serious reader interested in marmot social behavior and ecology in particular and the development of general theories on the evolution of sociality within a taxonomic group in general. Enough explanation of concepts such as kin selection, intrasexual competition, and parent-offspring competition is given to convey the context in which the data are being interpreted. Although the book is written from a sociobiological perspective, Barash does not force the data to his predictions, admits when the data contradict them, provides alternative explanations even when the data are in accordance with them, and adjusts for confounding variables that may be responsible for apparent agreement between expectation and observation. Furthermore, he notes where sample sizes are so small that biological conclusions are weak or tentative. Barash avoids simple interpretations and delves into the complexity of identifying factors underlying behavioral and ecological phenomena. For example, in accounting for why females of the montane species sometimes skip two consecutive years of reproduction, Barash considers the effects that weather and habitat may have on food availability, in addition to the effects of density of conspecifics, which in turn may be influenced by the age, social status, reproductive status, and kin relationship of those animals to the nonreproductive female.

The book is well organized, with a logical progression of topics. It begins with a brief account of taxonomy and distribution, then takes up behavior in general, social and reproductive behavior, kinship associations, and population biology, and concludes with a discussion of the evolution of sociality in marmots. The last, presenting a refinement of a hypothesis Barash first presented in *Science* in 1974, also compares and contrasts the selective pressures thought to drive sociality in marmots with those proposed in the 1980s by other workers for ground-dwelling squirrels. The text flows well, in part because information about the statistical tests used and their results is presented in footnotes (purists may wish the test statistic and degrees of freedom were also included). The list of summary and conclusions ending each chapter permits quick review of its contents. The black-and-white photographs liberally sprinkled through the initial chapters help convey a sense of marmot behavior that cannot come from words alone. Among the few minor errors in the book are the consistent misspelling of the names of L. Rayor and K. Holekamp.

Young marmots initiating greetings with their mothers. *Top*, Olympic marmot; *bottom*, yellow-bellied marmot. [From *Marmots: Social Behavior and Ecology*; photographs by D. P. Barash and courtesy of U.S. National Park Service, respectively]

This book serves several purposes. It provides a readable compendium of information, some of which is otherwise unavailable, on the behavior and ecology of marmots, it exemplifies the utility of studying several closely related species to generate theories on the evolution of sociality, and it identifies species and topics that would be particularly fruitful for future researchers to follow.

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Bee Biology

Ecology and Natural History of Tropical Bees. DAVID W. ROUBIK. Cambridge University Press, New York, 1989. x, 514 pp., illus. $69.50. Cambridge Tropical Biology Series.

This is a unique book in its view of tropical biology as seen from the perspective of bees. Studies such as this one take on added importance as tropical habitats rapidly disappear; the interactions and associations described here may not exist for much longer. Roubik has drawn together themes of ecology and natural history in this thorough treatment of tropical bees. His book is also valuable because it is the first broad review of bee biology since Michener's classic *The Social Behavior of the Bees*, published in 1974, and contains much new information on this important group of insects. In fact, social bees predominate in Roubik's book as well as in Michener's, perhaps because relatively little is known about solitary tropical bees. The section on predators, parasites, and pathogens of bees is particularly novel, and the long section on community ecology provides much useful information concerning the structure of tropical bee communities. *Tropical Bees* contains notably complete index and reference sections and some spectacular illustrations, particularly those done by Camargo. There also are great adaptation "stories" here, to remind us of how exotic the tropics can be, such as the accounts of meat-eating bees and bees whose nests survive under water for much of the year.

Roubik's scholarly book is not for the casual reader, however; the writing is dense, tending toward overly detailed descriptions that can make for tedious reading. In some places this book meanders, particularly when Roubik wanders from descriptive nat-

ural history into more rigorous ecological and evolutionary theory. This is not surprising, however, since tropical ecosystems are complex and resistant to generalizations and neat theoretical packaging. There is a long appendix with black-and-white pictures of tropical bee genera; unfortunately, the photographs are difficult to distinguish from each other. Nevertheless, Roubik's enthusiasm for his subject is easy to perceive; this will clearly be an important book, not only for bee biologists but for anyone interested in studying and conserving the intricate world of tropical ecosystems.

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Biological Repair

Electric Fields in Vertebrate Repair. Natural and Applied Voltages in Vertebrate Regeneration and Healing. RICHARD B. BORGENS, KENNETH R. ROBINSON, JOSEPH W. VANABLE, JR., and MICHAEL E. MCGINNIS, with Colin D. McCaig. Liss, New York, 1989. xxiv, 310 pp., illus. $69.50.

This book covers a subfield of what falls under the broad heading of biological effects of external energy fields. This area of science often suffers from irreproducible experiments, confusion stemming from reports of both beneficial and harmful effects, unscrupulous exploitation of medical implications, and paradigms without plausible mechanisms. The subfield is covered here in a clear and rigorous manner.

The emphasis of the book is on the relationship between changes at the morphological level and some externally measurable low-level direct-current electric field. It begins with a very brief but colorful history of bioelectricity, including its use in medical practice, and a practical description, given in intermediate detail, of techniques of measuring weak direct-current fields generated outside of tissues by the tissues themselves. It then gives a somewhat dry but otherwise broad treatment of the general phenomenology of regeneration and repair and the electrical currents produced during the process, as well as of how external fields modify it. Chapter 2 covers regeneration following wounds in amphibian limbs and how it is influenced by externally applied fields as well as how the regenerating tissue causes a field around itself. Chapters 3 and 4 cover nerve repair, and chapters 5 and 6 cover wound healing in skin and electricity in bone, respectively.

The chapter on bone electricity and its medical implications is interesting for its frank evaluation of the literature. This includes an extensive discussion of known artifacts, inconsistencies, critical shortcomings in experimental procedures, weak interpretations, and faulty reasoning. Though there is no restraint in name-naming and finger-pointing, the tone is instructive rather than vindictive. What the discussion conveys about science could be invaluable to historians and philosophers of science, fraud-busters, lawyers, and anyone wondering how progress occurs in spite of human fallibility.

The book is not perfect. There is a noticeable repetition of thoughts and ideas, and the use of some medical jargon will hinder understanding by the non-specialist. The authors hold generally rigorous standards with regard to interpretation of the literature, but their speculations are somewhat superficial and closed-ended. They have left me with the impression that much remains to be unraveled in this subfield.

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