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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