

sands of enthusiasts. Let a thousand programs bloom; we will find ourselves a lot closer to the answers.

MICHAEL M. SEGAL
Department of Neurology,
Massachusetts General Hospital,
Boston, MA 02114
and Department of Neurobiology,
Harvard Medical School,
Boston, MA 02115

Thermophysiology

Temperature Biology of Animals. A. R. COSSINS and K. BOWLER. Chapman and Hall (Methuen), New York, 1987. x, 339 pp., illus. \$57.50.

Temperature is both the most pervasive of environmental variables that affect organisms and the simplest to measure. Together these facts have yielded a diverse and abundant literature, ranging from unadorned phenomenology to major advances in our understanding of organisms. Yet, although we now know more about the biology of temperature than about that of any other environmental variable, the very size of the literature has often defied attempts at summary and articulation of general principles. With this book, however, Cossins and Bowler have achieved an excellent synthesis.

The basic organization of the book differs little from that of the corresponding sections of textbooks of animal physiology and environmental physiology: chapters on the biophysics of temperature, thermal effects on animal function, thermoregulation in ectothermic and endothermic animals, and capacity and resistance adaptation. A final chapter, describing temperature effects on reproduction, development, and growth, is an unusual but welcome addition. The presentation within these chapters is what distinguishes this book from others. Although specialists will find it an excellent overview of the field, the book is intended for advanced students of physiology and for other biologists. A successful book for such an audience must strike a fine balance between facts and principles and between old data and new: too many data and the reader is overwhelmed, too much theoretical or general material and the reader becomes detached, too eclectic a selection of examples and the reader is misled. Cossins and Bowler are as much artists as scientific authors in achieving this balance. Each chapter emphasizes underlying principles and basic patterns, but every principle and pattern is illustrated by just the right number of examples. Moreover, Cossins and Bowler take

pains to present alternative interpretations of data, emphasize where conclusions are tentative, and stress where additional data are needed. Taxon-by-taxon summaries of phenomenology are fortunately few. Also remarkable is the balance struck among topics. Any given topic in the book (hypothalamic mechanisms of thermoregulation in mammals, biophysics of heat exchange, and molecular mechanisms of adaptation to high temperatures, for example) could well consume an entire book; Cossins and Bowler have an exquisite sense of when to leave one topic for the next.

The text is not without deficiencies and errors (for example, that "birds and mammals have separate origins from the reptiles"), and very recent advances (concerning metabolic arrest and heat-shock proteins, for example) are understandably absent. But *Temperature Biology of Animals* is an exceptional book, the best available work on this topic for the general reader, and should serve as a model of scientific exposition for the nonspecialist or student. Ecological physiology would be well served by comparable books dealing with the other major factors affecting animal life.

MARTIN E. FEDER
Department of Anatomy and
Committee on Evolutionary Biology,
University of Chicago,
Chicago, IL 60637

Neutrinos

Physics of Massive Neutrinos. FELIX BOEHM and PETR VOGEL. Cambridge University Press, New York, 1988. viii, 211 pp., illus. \$34.50.

Neutrinos have played a special role in the theory of elementary particle physics since their existence was first postulated by Wolfgang Pauli in 1930. This is primarily because neutrinos interact only through the weak interaction, which is usually overwhelmed by the other two forces important in particle physics, the strong and the electromagnetic. In the present "standard model," which describes all known phenomena in particle physics, the weak and electromagnetic interactions are unified into one, the electroweak. As is stated in the first chapter of this book, "The study of neutrino properties is one of the few avenues which could lead to new physics beyond the standard model, and this is the chief reason why the neutrino is such an interesting particle."

According to the standard model, there are three distinct neutrinos, each with zero rest mass and each a pure, stable state. A number of speculative ideas to extend the

standard model predict deviations from this picture. Since 1980 there has been a series of experiments designed to look with extreme sensitivity for indications of small neutrino rest masses or of mixing among the neutrino types. *Physics of Massive Neutrinos* was written to review this period of intense activity, both theoretical and experimental, in the area of neutrino properties.

The questions addressed in the book are of fundamental importance, and the answers draw on nuclear physics, particle physics, astrophysics, and cosmology. Do the three types of neutrinos share with the photon the property of zero mass and thus travel at the speed of light? If they have mass, do the neutrinos constitute the "dark matter" that is widely believed to provide the mass needed to close the universe? Are the neutrinos and antineutrinos distinct objects, or are they in fact just the right-handed and left-handed manifestations of the same particle? Is the observed deficit of solar neutrinos due to transformations among the various neutrino types? The authors deal with the theoretical significance of these questions, but they also take great care to explain the present status of experiments in neutrino physics and to indicate which future experiment might radically change our picture.

The reasons such a book is needed are clear. The field has expanded so dramatically in the last decade that graduate-level textbooks cannot keep up. In addition, because of the wide range of specialties related to neutrino physics, it is very difficult for someone new to the field to read the entire current literature without an organized, comprehensive review. This book provides such a review, with references to more specialized publications for those interested in pursuing particular topics. It is just the bridge needed between textbooks in nuclear or particle physics and the advanced literature.

MICHAEL S. WITHERELL
Department of Physics,
University of California,
Santa Barbara, CA 93106

Books Received

Basic Environmental Engineering. Text and Disk with 80 Programs. Henry R. Bungay. BiLine Associates, Troy, NY, 1988. Various paged, illus., + floppy disk in pocket. Spiral bound, \$24.50.

Computational Physics. R. D. Kenway and G. S. Pawley, Eds. Scottish Universities Summer School in Physics, Edinburgh, 1987. x, 483 pp., illus. £24. From a school, St. Andrews, Scotland, Aug. 1987.

Disputed Parentage. The Story of the Universe. G. M. Bergman. World Studies Press, Los Angeles, CA, 1988. xvi, 238 pp., illus. \$17.95.

The Engineering of Consent. Democracy and Authority in Twentieth-Century America. William Graebner. University of Wisconsin Press, Madison, 1987. xii, 262 pp., illus. \$26.50.