

The first seven chapters of the book are devoted to an introduction to the methodology involved in the study of the paleoecology of the function of extinct organisms, population structure, and community ecology. Also present are three helpful introductory chapters explaining some principles of evolution, genetics, and ecology and giving a good introduction to marine science. They are of generally high quality, though I found the explication of population growth and selection coefficients somewhat unclear and much of it unnecessary for the discussions that followed. The discussions of paleoecology are well balanced between introductory principles and extensive, if somewhat selective, use of examples chosen from the literature. One thing lacking is a presentation of the elegant multivariate techniques (factor analysis, Markov chains) that have been developed in recent years to reconstruct properties of ancient environments, as opposed to their use in the classification of communities and provinces.

Perhaps the most effective contribution of the book is Valentine's attempt to unify the history of the biosphere and to decompose it into an organized structure that may be studied at different scales of time, space, and taxonomy. This approach can only have a salutary effect upon present and future students of paleoecology. The book is at once a textbook and a treatise on the principles of the study of the history of life. These two purposes occasionally work against each other but generally result in a stimulating and interesting presentation. Valentine certainly justifies his statement, "The fossil record deserves to be taken very seriously."

JEFFREY LEVINTON

*Department of Earth and Space Science,
State University of New York,
Stony Brook*

How People Move

How Man Moves. Kinesiological Studies and Methods. SVEN CARLSÖÖ. Translated from the Swedish edition (Stockholm, 1972) by William P. Michael. Heinemann, London, 1973 (U.S. distributor, Crane, Russak, New York). viii, 198 pp., illus. \$10.75.

Scandinavians have long maintained an interest in the scientific investigation of exercise, sports, gymnastics, and other movements. Sven Carlsöö has continued this tradition. The English

translation and expansion of his book *Människans rörelser* should be read by all interested in just what occurs in our muscles and joints when we sit still or move about.

After an all-too-brief introduction to the development and organization of movement, a clear account is given of the sophisticated application of strain gauges in dynamometers, force plates, and accelerometers to measure what happens outside the body. What goes on inside, and in particular which muscle does what and when and how effectively, is described from experiments with surface and internally injected electrodes which together with the appropriate electronics can detect and display the electrical activity as single motor units become recruited until the firing of all the fibers occurs in maximal activity. Although, surprisingly, which muscles are actively engaged when a person is walking normally has not been fully established, the rise and fall of the activities of 60 of them (30 on each side) are described in fascinating detail. To swing one arm upward uses 18 muscles, but a golf swing requires 46, all working together in (one hopes) an exquisitely coordinated fashion.

All sorts of interesting things can be found in this remarkable book. For instance, there are quantitative studies of the chance of slipping on different surfaces and the angle of the step that can prevent this. Most people know by experience that, in general, very tiny steps are safest, but this book records careful measurements under many conditions. There are even studies of the most efficient way to lift bread in a factory. Under the words "How Man Moves" on p. 166 is a picture of a working woman, and whereas on p. 90 the line drawing of the figure at a typewriter is clearly a male, the evidence given on p. 179 was obtained from women. This shows that in high-speed typing the nervous system cannot optimize properly, so that when using an electric typewriter rapidly, the finger muscles perform approximately 100 times more work than is necessary.

Clearly in this book, as on many other occasions, to quote the old saying, "man" embraces "woman." But why leave this to the imagination in a book on How People Move?

R. E. DAVIES

*Department of Animal Biology,
University of Pennsylvania,
Philadelphia*

Behavior

Habituation. HARMAN V. S. PEEKE and MICHAEL J. HERZ, Eds. Academic Press, New York, 1973. Two volumes. Vol. 1, Behavioral Studies. xii, 290 pp., illus. \$15. Vol. 2, Physiological Substrates. xii, 216 pp., illus. \$22.50.

These volumes reflect the considerable attention habituation has recently attracted from scientists of varying backgrounds, including ethologists, psychologists, and neurophysiologists. Habituation has been most simply defined as a waning of the response elicited by a repeated or constant stimulus, with the proviso usually added that this waning not be the result of altered properties of sensory receptors or effectors (such as adaptation, damage, or fatigue). Because it is stimulus-specific, persists over time, and is mediated by the central nervous system, habituation is often considered a primitive form of learning. Frequently, the rationale given for studying habituation is that the results may be applicable to more complex forms of learning not as amenable to detailed analysis.

Peeke and Herz have collected articles that represent quite well the interdisciplinary nature of research on habituation. The topics include the relation of habituation to conditioning, habituation at different phylectic levels both in the laboratory and in natural settings, and mechanisms of habituation in intact animals as well as in "model systems" such as the feline spinal cord. The range of subjects is such that even those whose primary research interest is in some aspect of habituation will find much that is new to them. Of particular interest in this regard is the chapter by Pakula and Sokolov, which describes a great deal of work, generally unavailable in English, on neuronal mechanisms of habituation in gastropods.

Two features of these volumes, however, may significantly detract from their potential usefulness, particularly for the nonspecialist. First, many of the chapters, which from their titles might be expected to be general surveys, are instead detailed descriptions of previously published experiments performed in the authors' laboratories. Such chapters may be interesting to the specialist, but they often present a biased view to the general reader. One of the several exceptions is Graham's scholarly review of habituation of responses mediated by the autonomic nervous system.

The second problem arises from the lack of an adequate introduction. The diversity of approaches to habituation requires that common threads, if indeed there are any, be explicitly pointed out. For example, both the decrease in number of Protozoa contracting to a repeated vibratory stimulus and the waning of the mobbing response of chaffinches to a stuffed owl are called habituation. It would be of considerable help if the value of grouping such disparate phenomena were made clear.

Granted, this is an extremely difficult problem; but the lack of explicit organization is manifested in other ways. For example, in the very brief preface, the reader is given the definition of habituation cited above. Then, in the first chapter (coauthored by the editors with Wyers), it is said that decreased gill withdrawal in the sea hare, *Aplysia*, to repeated stimulation of the mantle shelf can be called habituation only after demonstration of response restoration following a strong stimulus (dishabituation). Faced with such inconsistencies so early on, the reader might well feel better served if a clear introduction to the basic issues had been included in the preface.

Peeke and Herz, then, have provided a timely collection of papers in a field of intense research activity. My disappointment on reading these volumes can be attributed less to what they are than to what they could have been.

PAUL B. FAREL

Department of Physiology,
School of Medicine,
University of North Carolina,
Chapel Hill

The Heritage of Galen

Galenism. Rise and Decline of a Medical Philosophy. OWSEI TEMKIN. Cornell University Press, Ithaca, 1973. xx, 249 pp., illus. \$15. Cornell Publications in the History of Science.

This small book, based upon the Messenger Lectures given by Temkin at Cornell University in 1970, is the product of a lifetime of study of Galen and more particularly of the Galenic tradition through late antiquity and the middle ages. Distinguished by broad learning, it encloses within its modest number of pages a remarkably comprehensive survey of scholarship about Galen and Galenism from the 2nd to the 17th century.

Temkin has chosen to consider the

philosophy of Galen rather than Galen's medical theories, therapeutic practices, or contributions to anatomy and physiology. As a philosophy, Galenism was a historical phenomenon comparable with Platonism or Aristotelianism. But what was Galen's medical philosophy, if it is to be distinguished from his medicine and his science? Temkin suggests that it was the set of attitudes Galen adopted in his study of health and disease—a Platonic vision of truth, an emphasis on accuracy of observation, as in Galen's anatomical studies and physiological experiments, and on the breadth of experience to be gained from travel. Galen upheld the Hippocratic belief that the treatment of disease must be based on a knowledge of nature. Galen's philosophy also contained a strong moral element—respect for the Creator, self-discipline, moderation, and charity. Moreover, he considered himself an exemplar of such virtues. Yet for all Galen wrote, Temkin points out, we know little about the man himself. Temkin shows that in the centuries after Galen's death the writers who systematized his works were most interested in descriptions of medical diagnosis and therapy, namely, those things which would be most immediately useful in the practice of medicine. In the 12th century the translators of Galen's works from the Arabic showed a similar practical bent, so that during the middle ages Galen was known through his short practical treatises, while his longer scientific and philosophical works remained untranslated and almost unknown. The practical nature of medieval interest in Galen creates a difficulty for Temkin's earlier definition of Galenism as Galen's philosophy, because Temkin's discussion of Galenism in the middle ages is largely a discussion of Galenic medical ideas, that is, of Galenic medicine. Similarly when in the 16th century Paracelsus attacked Galen, he was attacking Galenic medicine rather than a system of philosophy.

The role of Galen's anatomy in the 16th century poses a particularly difficult historical problem. Temkin notes that Galen had been "especially insistent on establishing facts" in anatomy, yet his anatomy was criticized by Vesalius because it was based on the dissection of animals, rather than on the human body. Yet at the beginning of his career Vesalius read the new published Latin translations of Galen's *De usu partium* and *De anatomicis administrationibus*. From Galen's works Vesalius learned

how to dissect and how to describe anatomical structures. Furthermore, if Galen used animals to illustrate human anatomy, so too did Vesalius. Vesalius may be considered to have applied Galen's methods to the study of human anatomy and therefore perhaps to have been Galen's greatest pupil. If so, modern anatomy might be considered a continuation of the Galenic anatomical tradition. Certainly Galen's anatomical works continued to be read through the 16th century. William Harvey cited Galen's *De usu partium* in the introduction to *De motu cordis*, and from other references it is clear that he had read Galen widely. Temkin points out (p. 153) that Harvey's methods of experimental demonstration were not dissimilar to those used by Galen but that Harvey's discovery of the circulation of the blood had the effect of destroying the whole connected system of ideas embodied in Galen's physiology. Temkin thus raises the question of the historical relationship of old science to new science. It is at once the most fundamental and the most subtle and complex question in the history of science and medicine. Temkin suggests that what was attacked and what was destroyed during the 16th and 17th centuries was Galen's authority. Many of Galen's ideas persisted even into the 19th century.

LEONARD G. WILSON

Department of the History of Medicine,
University of Minnesota, Minneapolis

Books Received

Automatic Computational Techniques in Civil and Structural Engineering. E. Litton. Halsted (Wiley), New York, 1973. xii, 372 pp., illus. \$19.50.

Automation of Clinical Electroencephalography. Proceedings of a conference. Peter Kellaway and Ingemar Petersen, Eds. Raven, New York, 1973. viii, 318 pp., illus. \$21.50.

Bacterial and Fungal Diseases of Plants in the Tropics. George F. Weber. University of Florida Press, Gainesville, 1973. xviii, 674 pp., illus. \$22.50.

Bibliography on Geophysical, Geochemical, and Geological Effects of Nuclear Events. T. C. O'Callaghan, Ed. General Publishing Services, Alexandria, Va., 1973. iv, 48 pp. Paper, \$5. Bibliographies in Science Series, No. 1.

Biogeography. An Ecological and Evolutionary Approach. C. Barry Cox, Ian N. Healey, and Peter D. Moore. Halsted (Wiley), New York, 1973. viii, 184 pp., illus. Paper, \$9.95.

The Brain Changers. Scientists and the

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