

kovitz in using the name *Dama* (for generations always applied to distinctive Old World deer) for the American deer that everyone else calls *Odocoileus*. This compounds confusion and is an obvious case of a situation in which official sanction of the practically universal usage should be sought.

At just one or two points the authors have injected personal views, and the result is not always happy. The worst example is a passage, initialed "E.R.H.," which seeks to justify inclusion of gibbons and apes in the Hominidae. "E.R.H." argues that previous family separation was made "because of an assumed wide gap in intelligence," which is at best an inadequate statement of the case. He then expresses the astonishing opinion that "the gap in intelligence between some microgeographic races of man and some races of apes is . . . no wider than that between genera in some other families, for example, that between the two genera *Canis* and *Dusicyon* of the family Canidae." This is only one spot in a large work, but it is too egregious to be passed over in silence.

In view of some advertising for which the authors are not responsible, general students and nonprofessional readers should be advised that their purposes will almost certainly be better served by any of several less expensive books on North American mammals. For its own properly intended audience, the professional mammalogists, this publication truly deserves the frequently misused adjective *indispensable*. Henceforth no one can work at the technical level in this field without reference to Hall and Kelson.

G. G. SIMPSON

American Museum of Natural History
and Columbia University

Fundamentals of Ecology. Eugene P. Odum. Saunders, Philadelphia, 1959. xviii + 546 pp. Illus. \$7.50.

The popularity of this well-written text is attested to by this thoroughly revised and enlarged second edition, which appears less than six years after publication of the first edition. The "statement-explanation-example" treatment of principles has been retained.

The three parts, "Basic ecological principles and concepts," "The habitat approach," and "Applied ecology," have been enlarged by 74, 14, and 41 pages, respectively. There are 41 additional figures. Much of the text has been rewritten to incorporate more recent thinking.

As in the first edition, the ecosystem approach is emphasized. Most of the sections have been enlarged, in particular those on the ecosystem, energy rela-

tions, the biotic community, and phytosociology. Some new sections have been added, such as those on biogeochemical cycles and ecological indicators. The new chapter on radiation ecology is comprehensive, clear, and most important at this time.

I have a few—perhaps trivial—criticisms: The extensive use of exclamation points may be somewhat irritating to some readers; the useful term *stand* has apparently been omitted; the "sand sage grassland community" occurs more widely than is stated on page 27; and the section on phytosociology is very brief.

The science of ecology has been criticized, often unjustly, for cumbersome terminology. In this book the meaning of concepts is not lost in unnecessary, abstruse words. Commendable, also, is the procedure of precisely defining words that are used widely in a general sense to explain their meaning in a more specific ecological sense—for example, *community*, *competition*, and *population*.

HERBERT C. HANSON

Department of Biology,
Catholic University of America

Physics of Meteor Flight in the Atmosphere. Ernst J. Opik. Interscience, New York, 1958. viii + 174 pp. Illus. Cloth, \$3.85; paper, \$1.95.

The title clearly defines the scope of this book. By treating only the physical phenomena associated with the flight of high-speed objects through the earth's upper atmosphere, the author has been able to present an exhaustive, theoretical treatise covering most of the possible combinations of circumstances involved in this problem. The main purpose of the physical theory of meteors is "to predict the variation of mass, velocity, luminosity, and ionization along the meteor trajectory."

In the first three chapters the author provides the necessary introductory material by (i) defining the problem, (ii) briefly describing the characteristics of those regions of the upper atmosphere in which meteoric phenomena take place, and (iii) classifying and describing meteoric particles and phenomena. The primary divisions in the theoretical problem are made on the basis of whether the molecular mean free path in the upper atmosphere is large or small as compared with the size of the meteoric particle, and whether the particle is solid iron, solid stone, or a "dustball" skeleton of cosmic dust.

In the next three chapters the details of energy transfer, particle dynamics, and ablation are presented. The large

number of possible processes at work in the disintegration of the various meteoric particles is treated efficiently by the author, with the aid of a very large number of tables. In chapters 7 and 8, the formation of heat, light, and ionization in the coma near the particle and in its wake is described. The final chapter, "Some applications," treats briefly the "dustball" characteristics of certain sporadic and shower meteors.

Opik is well known for his extensive theoretical and experimental work on meteoric phenomena over the past 37 years. He writes with considerable authority on this subject. There is some tendency, however, to state as fact certain interpretations upon which there is no general agreement.

Meteoric phenomena not treated in this monograph include the astronomical characteristics of meteors and the physics and applications of radio reflections from meteor trails. In staying within the intended scope of this book, the author could not of course survey the extensive literature on radio detection of meteors. However, the results of some of these studies are applicable to his theoretical models—for example, the radio studies of trail diffusion, the size of the rapidly formed coma, particle deceleration, and turbulence. The author also treats only slightly the results of photographic studies of meteors and refers mainly to the earlier visual studies. Little or no specific mention is made of the application of meteoric phenomena to upper-atmosphere studies, radio communication, space-vehicle hazards, and ballistic vehicle reentry. However, the author has certainly been successful in his announced intention of providing a basis for further research on the physical theory of meteors.

VON R. ESHLEMAN

School of Engineering,
Stanford University

Science Students' Guide to the German Language. A. F. Cunningham. Oxford University Press, London, 1958. xiii + 186 pp. \$2.

This guide, although well printed, carefully worked out, and with many individual excellences, will probably not be of much assistance to Americans who are impelled to study German. The chapters are not organized to provide an orderly pedagogical progression into the grammar. Chapter 4, "Declension of nouns," treats only the singular inflection (one and a half pages) and includes no exercises; chapter 7, "Verbs" (ten pages, including exercises), lists the forms of 117 strong verbs and devotes a half page to detailed discussion of the

distinction between the weak and strong participles of *salzen* and *spalten*. On the other hand the chapters do not provide a complete treatment of a given grammatical category.

Grammatical exposition follows the traditional pattern, but many of the statements are so casual as to be misleading. Such statements as the following would find little favor with either traditionalists or with "modernists": "The Glottal Stop is the name given to a pause before a German word or syllable beginning with a vowel" (page 1); "In German, as in English, there are only three simple tenses, the Present, Past, and Imperative" (page 12); "All intransitive verbs of motion . . . are conjugated with 'sein'" (page 14).

The 80 pages of German selections, each running to approximately 350 words, seem to me well chosen. The physical sciences dominate this section, however; in 11 pages on bacteriology Cunningham gives a nod to biology.

GEORGE J. METCALF

*Department of Germanic Languages
and Literatures,
University of Chicago*

Biological and Biochemical Bases of Behavior. Harry F. Harlow and Clinton N. Woolsey, Eds. University of Wisconsin Press, Madison, 1958. xx + 476 pp. Illus. + plates. \$8.

This volume, dealing with a symposium held at the University of Wisconsin over three years ago, is more representative of what went into than of what came out of the meeting. The initial papers are presented, some attention is given to the other contributions, and there has been some updating through the inclusion of new references and findings, but the actual exchange that took place at the meeting has, unfortunately, been omitted. The result is a group of 17 chapters, by thoughtful and experienced men in a variety of fields, which run the gamut from moderately detailed reports of an individual's current research, through presentations that epitomize fairly completely the author's work and viewpoint, to broad and penetrating studies that grapple with the fundamental problems of biology and behavior. Incidentally, since "biochemical" is really included in "biological" to the same extent that "physiological" or "anatomical" or "embryological" are, and since only a couple of the articles consider the chemical factors involved, inclusion of *biochemical* in the title gives a slight distortion in emphasis—especially since much important work in the area of biochemistry has been omitted.

Despite such limitations, the volume is an admirable contribution to the growing *rapprochement* in studies of brain and behavior. The authors have written frankly, often self-critically, of themselves and their disciplines; most of them had clearly in mind the objective of arriving at an interdisciplinary understanding (some express marked reservations concerning the effectiveness of interdisciplinary teams in achieving this), and they have brought a wealth of experience and accomplishment to bear on the problems.

Many of the reports are indeed interdisciplinary in that the experiments involve a combination of behavioral and other biological techniques. In accord with the historical development in this area, the correlations are still overwhelmingly between behavior and anatomy, whether such correlations are determined by sectioning and staining or by locating electrical pulses with penetrating electrodes—a technique which Neff and Diamond often find more valuable. But the physiological properties of neurones and their connections may be more important than their locus, and the character of neural events more critical than their site. It is a pleasure to find a psychologist with the courage to eschew bondage to anatomical detail, as does Donald Meyer, in the face of overcommitment to serial sections on the part of so many workers. Perhaps the most completely formulated attack on the problem of anatomical patterns versus physiological states, and of specific connections versus global influences, is given by Roger Sperry in the excellent chapter on plasticity of the nervous system; but many other authors deal with parts of this problem and contribute important facts and interpretations.

Donald Hebb in his summarizing chapter, "Alice in Wonderland, or psychology among the biological sciences," writes with his usual verve and courage. After giving a good thumbnail sketch of the history of psychological thought-fashions (and aiming some good shillelagh blows at contemporaries who neglect the contents of the skull, on the one hand, or the actual performance of the organism, on the other), he takes a thoroughly sound position on the validity of studying phenomena at each level, from the molecular to the organismic or social. I do think Hebb is unduly pessimistic about the application of neurophysiological models to the explanation of behavioral phenomena (my own models are clearly superior to those he seems to be discussing!), but I forgive him for this, because he is so right on other points. He criticizes advisedly the trend toward straight-jacket training of graduate psychology students—apparent es-

pecially in the requirement that they "formulate an hypothesis," "design an experiment," and take a course on "how to do research" before they are turned loose in the laboratory.

The really heartening aspect of this volume is that such conferences are being held—that workers are crossing disciplinary lines, first to talk with one another and eventually to work together, even if they do not become masters of all trades or committed to membership in interdisciplinary teams. These are precious beginnings, the rivulets from which will rise great streams of research and application in behavioral science.

R. W. GERARD

*Mental Health Research Institute,
University of Michigan*

Nouveau traité de chimie minérale. vol. 11, group V, *Arsenic, antimoine, bismuth.* xxxix + 850 pp. Illus. 1958. Cloth, F. 8950; paper, F. 7750. vol. 14, group VI, *Chrome, complexes du chrome, molybdène, tungstène, hétéropolyacides.* xxxix + 1014 pp. Illus. 1959. Cloth, F. 10,700; paper, F. 9500. Paul Pascal, Ed. Masson, Paris.

A review of volumes 1 and 10 of this work appeared in *Science* of 1 March 1957 [125, 401 (1957)]; that of volume 3, in the 18 July 1958 issue [128, 138 (1958)]; and that of volume 4, in the 6 March 1959 issue [129, 636 (1959)].

Volumes 11 and 14 follow the format of the previously published volumes of this modern treatise on inorganic chemistry. It is expected that the entire treatise, consisting of 20 volumes, will be completed by 1960.

RALEIGH GILCHRIST

*Division of Chemistry,
National Bureau of Standards*

Mineralogy and Geology of Radioactive Raw Materials. E. William Heinrich. McGraw-Hill, New York, 1958. xiv + 654 pp. Illus. \$14.50.

This book, which offers an encyclopedic coverage of the vast literature concerned with radioactive raw materials, is particularly timely. It is the first of the books that have been published in this field to give an adequate and intelligent résumé of the mineralogy and geology of this important commodity. It will be especially useful for general reference and source material. The coverage of significant source data is nearly complete, and in general a good selection has been made of the evidence and interpretation presented by the original authors. Some bias is evident,