

changed since volume 3 was published, and Hill partially explains this in a preliminary note to volume 4. Repeatedly throughout these volumes, Hill has ignored, confused, and, on the flimsiest evidence, contradicted Hershkovitz's excellent work.

Fortunately the generic and higher categories of the cebids are comparatively clear. Few would argue with Hill's generic groupings. *Chiropotes* certainly deserves generic distinction from *Pithecia*, and *Brachyteles* from *Ateles* (though it is certainly closer to *Ateles* than to *Lagothrix*—not halfway between as Hill states). *Alouatta*, *Aotus*, and *Callicebus* have been placed in separate subfamilies, and there are some grounds for this. In the hardly significant but annoying matter of spelling, Hill has elected to use *Aotes* rather than *Aotus*. Personally I cast my vote for *Aotus*, the spelling that Humboldt, the original describer, finally settled on, and the one that, in the century and a half that have followed, has been adopted by the majority of workers, including almost all of the taxonomists who are best qualified to judge.

The structural and general biological data which make up the bulk of these volumes are organized under descending taxonomic categories. This, while natural and useful for certain purposes, results in a great deal of repetition and necessitates some laborious searching on the part of the reader. For example, data on the common marmoset will be found in volume 1 under the discussion of primates in general, in volume 2 in the section on the "haplorhines" in general, and in volume 3 at five different levels—under the successive categories of Pithecoidea, Platyrrhini, Hapalidae, *Hapale*, and *jacchus*. The nature of evolution and a natural taxonomy make this arrangement well-nigh inevitable, and the index, with its main entries indicated by boldface type and illustrations by asterisks, helps the reader find his way through this complex and repetitive scheme. But a more detailed index, one that provides a breakdown of the large number of page references into subtopics, would be helpful. The reader in search of information on the common marmoset, to use the same example, must make an arduous search through an unrelieved series of more than 200 page references to *Hapale* and Hapalidae, without a suggestion about the kinds of information to which they lead.

It is a melancholy task to review the portions of these volumes that deal with anatomy. On one hand, Hill should be credited with assembling a massive catalog of details from a large proportion of the primate literature including a very sizable contribution from his own dissections. On the other hand, the assemblage represents such a disproportioned and unassimilated collection of minutiae that there is a serious question whether they will satisfy many real needs. They are too frequently unrelated to any biological significance—functional, developmental, or evolutionary. An incredible number of misstatements are made, of which the following are a few samples: platyrrhines have only two sacral vertebrae; there is a ninth cervical nerve; the spleen is an endocrine gland; *Cebus* is "a slow-moving non-prehensile-tailed climber"; and there has been "a phylogenetic rise from marmosets to Man." Quantitative data are limited to a few raw measurements. Schultz's incomparable data, to cite one example, are either unused or misused. In repeated instances, excellent papers from recent decades, even after being cited, are ignored for some slight and antiquated 19th century ones. The illustrations, which should bear a large share of the burden of communicating anatomical principles and details, are in many cases, especially those of muscles and nerves, worse than useless. Many would not be acceptable from an elementary student in a comparative anatomy course: muscles float flatly in space, unattached to their origins or insertions; nerves take incredible courses—the obturator nerve dorsal to the sacroiliac joint, for example, and the radial between the coracobrachiales or through the quadrilateral space. That they inaccurately reflect the text (to say nothing of reality) must strike even the casual user. Just why so many clear and sometimes beautiful illustrations from the literature had to be redrawn is not clear; the result often strips them not only of beauty and clarity but sometimes of essential meaning.

Even the most inexpert primatologist should detect signs of haste and carelessness in what at first glance look like solid, scholarly examples of book making—particularly in the scores of misspellings; in the haphazard use of umlauts and hyphens in authors' names; in the unreliable table of contents; in the erratic use of type faces and style of headings throughout the text; in

the poor cropping and wasteful use of space in certain of the plates; in the wide discrepancies between text and distribution maps, with both often being in error; in the annoying omission of titles of papers in the bibliography; and in the general inadequacy and inaccuracy of labeling in many of the illustrations. I cannot let pass an opportunity to correct one error that pains me personally. Hill correctly quotes a statement that I made to him about the striking contrast between the genitalia of the juvenile and adult female *Brachyteles*, and he clearly prints the photographs that I sent him, but labels them as two views of an adult!

Although these carping criticisms must be made, they must also be viewed in perspective. These volumes are a unique contribution to our reference shelves. They should be in every institution concerned with primates. They will be constantly turned to for all sorts of basic information, and they will often yield complete and accurate answers or they will point the way to more detailed references. I am eager to acknowledge my own gain from going through these volumes; even in the case of animals I know well in the field and in the laboratory, Hill has called my attention to unnoticed details, suggested new insights, and directed me to sources I had not yet encountered. It is easy to find faults in such wide-ranging works, but it must be remembered that with unrealistically high standards, these much-needed projects would never be undertaken.

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Lower Bagshot Flora

The Lower Tertiary Floras of Southern England. vol. 2, *Flora of the Pipe-Clay Series of Dorset (Lower Bagshot)*. Marjorie Elizabeth Jane Chandler. British Museum (Natural History), London, 1962, xii + 176 pp. Illus. Plates. £8 8s.

Forty years ago, J. S. Gardner reproved students of British paleobotany with the comment that "though rich in Tertiary fossil plants we are behind every other country similarly rich, in describing and identifying them." The present monograph is the second of a series, by M. E. J. Chandler, that is

dedicated to erasing Gardner's still valid reproach.

Volume 1 of *The Lower Tertiary Floras of Southern England* commenced with study of Paleocene plant fossils and new collections from the Lower Eocene London Clay. Volume 2 considers Middle Eocene remains from freshwater sediments lying above London Clay in the Hampshire Basin. It concentrates, as will the remaining volumes of the series, on carbonaceous fruits and seeds recently collected by Chandler, rather than on the impressions that attracted pioneer paleobotanists.

The body of the monograph (145 pages) presents detailed systematic descriptions of 86 species in some 64 named genera, representing 40 families (or major sections of families), whose remains have been recovered from the Lower Bagshot Beds. Angiosperms predominate; only two families of ferns and one of gymnosperms are represented. The accompanying 29 plates are of high calibre, and they include over 800 photographs of specimens taken by Chandler herself.

Compared with the London Clay materials, the Bagshot collections are small, the specimens lack fine details of structure, and they are often crushed or damaged: the possibilities for taxonomic determinations are correspondingly rather poor. In view of these circumstances, establishing 22 new species, some on as few as three specimens, most on only a single specimen, seems questionable practice. Seven new species of *Vitis* alone are named, mostly from single examples.

A brief introduction reviews the geology of the plant-bearing sediments and the general characteristics of the flora. Data on the age and stratigraphy of the Bagshot Beds was also provided in volume 1. The physiognomy, habitat, and modern distribution of Lower Bagshot families and genera are summarized on pages 14 through 18. Most of the Lower Bagshot families occur in the London Clay, although seven (Polypodiaceae, Cyperaceae, Capparidaceae, Rosaceae, Thymelaeaceae, Styracaceae, and Caprifoliaceae), are new to the Eocene of Britain. The Lower Bagshot flora reconfirms the presence of Indo-Malayan vegetation in south-east England during the Tertiary. Under the impetus of a stable climate, a tropical-subtropical forest apparently maintained itself in that area for some time.

Volumes 1 and 2 in the current

series by Chandler, and doubtless those to come, provide detailed information on Tertiary paleoecology, plant evolution, and migration. Thus they are significant references for paleobotanists as well as for evolutionists and phytogeographers.

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Stimulus and Behavior

Nerve Cells and Insect Behavior. Kenneth D. Roeder. Harvard University Press, Cambridge, Mass., 1963. xi + 188 pp. Illus. \$4.95.

Some of us have been lucky enough to be in a laboratory during a period when we felt, nay, when we *knew*, that a secret of Nature was being unraveled, that new relationships were being discovered and understood. There is an electric tension in the air, an exhilaration, so that the 24 hours in a day are not enough to work, to experiment, to calculate, and we become impatient with our own limitations of energy. This is "contagious excitement," and it can be found in this little book.

Roeder is a careful scholar, a facile writer, but above all, he is an excited scientist, and with his book, he infects the reader with this excitement. This is not surprising, for the central topic with which he deals is of intrinsic interest to all of us, scientists and non-scientists alike. And the source of the excitement is simply this: the students of nerve physiology, animal behavior, animal orientation, and psychology share a growing feeling that a real understanding of the cellular basis of organism behavior may be achieved. We can state this more bluntly: there is promise that we will reach a basic understanding of the workings of the brain.

Roeder does not say this; indeed, in a carefully written chapter (chapter 7, "Discrimination") he shows clearly how far we are from understanding the functioning of a single nerve cell, much less that of an entire nervous system. But, in a thoughtful summation of the different methods of approach and the utilization of new techniques of analysis, he shows the promise that the interplay of knowledge gleaned from different methods of approach may circumvent those gaps in our knowledge

which cannot be filled in at the present time. There is extrapolation and speculation here, with which many workers may not agree, but in their proper context they indicate the exciting possibilities.

The title does not indicate the book's scope, for this is not a specialized account of a narrow field of investigation. Indeed, the opening chapter is a brilliant generalization of why biological systems are what they are and the place of stimulus-impulse-behavior relationships as a fundamental biological process. There are particulars and technicalities, of course, but the reader never loses sight of the woods for the trees. For example, details about the morphology of nerve activity, and about the techniques used to measure nerve activity and behavior patterns, are interesting. But the reader is fascinated when he is able to "see" the world through the typanic membrane of the noctuid moth and to understand the moth's behavior as a consequence of its contact with its bat-filled world. And it is important to understand that it is the morphological simplicity of this system which gives the advantage to insect material as an object of study for nerve cell-behavior relationships.

Roeder has written a good book, thoughtful and penetrating, with flashes of humor. It should be educationally rewarding to scientists and nonscientists alike.

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Chemical Botany

The Organic Constituents of Higher Plants. Their chemistry and interrelationships. Trevor Robinson. Burgess, Minneapolis, Minn., 1963. iv + 306 pp. Illus. \$6.75.

Higher plants contain a wondrous array of organic compounds. The plant is able to synthesize a much larger and more diverse group of substances than the animal, a fact usually unappreciated by many biologists and chemists. Robinson has surveyed the organic compounds in higher plants with respect to occurrence, isolation, characterization, and metabolic pathways. The following subjects are considered: carbohydrates, water-soluble organic acids, aromatic compounds, saponifiable lipids, miscellaneous unsaponifiable lipids, volatile