tools made on Levallois flakes indiscriminately with unretouched pieces (Nos. 79, 138, 157). Several further, though minor, points of irritation exist. Wymer perpetuates the fallacy that the categories "flakes with faceted butts" and "Levallois flakes" are synonymous and curiously uses the term "reverse" to mean dorsal surface, rather than ventral surface as is customary elsewhere. Figures are not located in order in the text. Given small samples, there are (as Wymer recognizes, p. 378) difficulties in distinguishing Middle Acheulean collections from Late Middle Acheulean collections by the criteria he proposes.

Other flaws are major. Wymer discusses relationships between the Boyn Hill and Lynch Hill terraces in some detail, using the former designation for the highest "terrace" at Maidenhead and the latter for a depositional phase on a lower bench (p. 211). Basing his decision on the occurrence of "more evolved" artifacts (of Late Middle Acheulean type) in the Boyn Hill "terrace" and of less evolved tools in the lower terrace, he concludes that the lower terrace is actually the older (pp. 243, 244, 392). Admittedly, a decision about the chronological relationships of these "terraces" cannot yet be made on geological grounds because the necessary field geology has not been done. However, no proposal that the relative ages of these formations be decided solely on the basis of contained Paleolithic artifacts is legitimate. Another serious defect is Wymer's readiness to accept minimal evidence, sometimes of a very unreliable kind, in tracing the geographic and temporal range of industrial complexes: the so-called Levalloisian industry is postulated to exist between Lechlade and Dorchester from the end of the Gipping into the Weichselian glaciation on the basis of two Levallois flakes, one a surface find (p. 87) and the other with "no exact provenance" (p. 95).

One is struck by the inadequacy of past geological and prehistoric investigations of Lower Paleolithic occurrences in this critical area. Wymer deserves to be commended both for his own contribution to the study of individual localities and for having produced this major attempt at synthesis in a region with such a highly complex and difficult depositional history.

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On Pollution Problems

Advances in Environmental Sciences. Vol. 1. JAMES N. PITTS, JR., and ROBERT L. METCALF, Eds. Wiley-Interscience, New York, 1969. viii, 358 pp., illus. $15.95.

This book is intended to be the first in a series of multiauthored books concerned with the study of the quality of the environment and with the technology of its conservation. The series is to serve as an aid to the established professional and also to encourage students to take up careers in this field.

This volume opens with a chapter entitled "Outline of environmental sciences." To the student who might be encouraged to enter the field, this review will probably be the most challenging and interesting in the book. In fact, environmental science and technology are today so fragmented that this chapter will be of value to most professionals in the field who are engaged in a very narrow specialty.

This chapter is followed by one on the legal aspects of pollution abatement and control at the federal level. It concludes with a discussion of the author's ideas with regard to the government's future role.

The third chapter deals with water pollution control and management. Like the first, it covers a tremendous subject in a few pages (30), but provides a readable review for someone who would like to see an overall picture of this important subject.

Three chapters scattered through the remainder of the book deal with the chemistry of air pollution. They will be of use primarily to the specialist, although they may also be of interest to graduate students in chemistry who are considering a career in air pollution research or control. Considerable knowledge of chemical kinetics and photochemistry is required to follow the discussion and arguments presented. In spite of these limitations, the three chapters should prove to be very valuable to chemists investigating photochemical smog, since they bring together information with regard to techniques and results which has been scattered through a large number of journals of various types.

Other chapters cover such subjects as biodegradable detergents, aeroallergens, and the catalytic removal of potential air pollutants from automobile exhaust. All of these are readily understandable to the generally well-educated reader.

For the most part the chapters are excellent, though not comprehensive, reviews rather than "advances." Perhaps this is appropriate for the first volume of such a series; however, it might be hoped that future volumes will be more concerned with recent developments. The series seems to be off to a good start and should fulfill the purposes described by the editors.

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The Growth of a Science

The Chemistry of Life. Eight Lectures on the History of Biochemistry. JOSEPH NEEDHAM, Ed. Cambridge University Press, New York, 1970. xxxii, 216 pp. + plates. $9.50.

This book is the outcome of a series of lectures delivered by biochemists of the University of Cambridge between 1958 and 1961, under the auspices of the history of science department. Joseph Needham has now collected and edited them, with an extensive introduction dealing with what might be called the prehistory of biochemistry, from the earliest times to about 1800. As might be expected, there is much here of Chinese as well as of Western thought and experiment, and Needham's extraordinary range of learning enables him to note many relations that few others could have perceived.

The chapters that follow are diverse in scope and approach. Robert Hill considers the growth of our knowledge of photosynthesis, dwelling chiefly on early work and speculation, before Lavoisier and Priestley. The vast and complex developments that have occurred since are covered in less than four pages, in which it is impossible to give more than hints of what actually occurred. Malcolm Dixon considers the history of enzymes and of biological oxidations; he provides a useful introduction which should be helpful to students of biochemistry, and others, in providing some perspective on the development of this central area of biochemistry. As Dixon notes, David Keilin's posthumous *History of Cell Respiration and Cytochrome* (1966) treats one of the two topics considered here (biological oxidations) in much greater depth.

E. F. Gale presents the development of microbiology in 22 pages. Inevitably this brief sketch of a vast field covers

much well-trodden ground. Here again Keilin's book treats a number of the same topics in more detail and examines the evidence more critically. Gale, however, provides some interesting perspectives; but, unlike all the other authors in this book, he cites no references. By contrast, the following article, by Kendal Dixon on the progress of neurology, is by far the longest in the book, and ends with five pages of references. It covers the subject from Vesalius to the present, and almost all readers will learn something new from it. There is inevitably little in it that could be called biochemical, although there is much of physiological and medical interest, until the late 19th century, when L. J. W. Thudichum necessarily becomes a central figure; but from then on one sees the gradual progress of neurochemistry, and its relation to the discoveries of the anatomists and physiologists, in a valuable presentation.

F. G. Young treats the evolution of ideas about animal hormones, with an interesting portrayal of the earlier work on internal secretions, throughout the 19th century, before the definitive formulation of the hormone concept by Bayliss and Starling. The later progress in the 20th century is also well presented. The next chapter, by L. J. Harris on the discovery of vitamins, is only 15 pages, half as long as Young's. It gives briefly the early history of scurvy, beriberi, and other deficiency diseases; but the latter half of the chapter becomes largely a short catalog of the numerous vitamins now known. One may question the statement (p. 162) that "the first real indication of the multiplicity of vitamins" came with the work of McCollum and Davis in 1915. Without depreciating the work of McCollum, one should note the simultaneous and equally important work of Osborne and Mendel in New Haven.

In the following chapter Mikuláš Teich of Prague, who, unlike all the other contributors except Needham, is a professional historian of science, explores some of the historical foundations of modern biochemistry. He has new and significant things to say about the notion of vital force, the relations of inorganic and organic chemistry in the time of Berzelius and Liebig, the development of the chemistry of nutrition, and the relations between chemistry and physiology in the 19th century. The closing chapter, by Sir Rudolph Peters, touches briefly on the life and work of some early isolated pioneers of biochemistry—W. H. Wollaston, Andrew Buchanan, H. Bence-Jones, A. B. Garrod and his still more notable son, A. E. Garrod, and A. Sheridan Lea, among others. All are interesting characters, and some are important; it is good to be reminded of them.

The book is enriched with a series of plates, most of them portraying investigators whose work is discussed in the text. Historians of science will find many parts of it useful and suggestive for further work; inevitably most of the articles, written by practicing scientists who are only incidentally concerned with the historical aspects of their subject, are somewhat sketchy and do not involve deep research into the original historical sources. Although one must note these limitations, this book can be recommended to biochemists and others who wish to obtain some perspective on how this field of science came to be what it is today.

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Madagascan Insectivora

The Tenrecs. A Study in Mammalian Behavior and Evolution. J. F. EISENBERG and EDWIN GOULD. Smithsonian Institution Press, Washington, D.C., 1970 (available from the Superintendent of Documents, Washington, D.C.). vi, 138 pp., illus. $3.25. Smithsonian Contributions to Zoology, No. 27.

The mammalian fauna of the island of Madagascar has been a source of interest to students of evolution for some time. Madagascar has a range of habitat types, and because of its isolation by about 250 miles of ocean from the coast of East Africa it has been a veritable natural laboratory for adaptive radiation in the mammalian orders present in recent times. Of those mammals endemic to Madagascar, perhaps none provide better raw material for studies of evolution and behavior than the insectivores of the family Tenrecidae. This book presents the results of two years of fieldwork on the Madagascar tenrecs in addition to study of captive animals at the U.S. National Zoological Park. The authors discuss the general physical and climatic features of Madagascar and then describe the population biology, habitat preference, and ethology (especially social behaviors) of members of the two endemic subfamilies of tenrecs, the rice tenrecs, Oryzorictinae, and the hedgehog tenrecs, Tenrecinae. Conceptualization of evolutionary trends in morphology and behavior in the context of the varying ecological niches of these primitive mammals completes the main body of this work. There follows a useful series of appendixes setting out in detail experimental procedures and equipment. Behavioral information is variously presented. General descriptions of social behaviors are supported by sample protocols. A more quantitative presentation would have been appreciated by this reader. Acoustic communication is characterized by tabulations of the physical properties and the social contexts in which sounds are emitted. A thorough discussion of the phenomenon of stridulation in *Hemicentetes* is provided and includes results of a series of elegant experiments.

Evolutionary trends in behavior among the tenrecs are established by a careful comparison of both the ecology and the ethology of the species studied. This approach serves to emphasize changes in behavior that reflect differing ecological preferences. Many aspects of tenrec behavior are quite conservative; for example, comfort and marking movements, nest construction, mother-neonate responses, and acoustic signals. On the other hand, agonistic behaviors have undergone extensive changes that appear to be related to modifications in feeding patterns and to the development of a spinescent body covering. The latter, together with the ability to roll up into a quill-studded ball, is best developed in the specialized genera of the hedgehog tenrecs.

The book has been quite well produced with a minimum of typographical errors. The line drawings are informative although some have been reduced too much. A minor source of annoyance is the frequent shift from metric to English units of measure. In sum, I think the authors have provided us with a well-conceived example of how behavioral evolution can be reconstructed. In addition to devotees of mammalian ethology, students of population biology and evolution should find this monograph of value.

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