

has recently noted that the green revolution may be turning red.

Although some of the policy issues and implications have changed since 1965, *Subsistence Agriculture and Economic Development* must still be regarded as one of the two or three outstanding volumes for understanding peasant societies. Its strong micro focus and its interdisciplinary character provide an excellent starting point for further work on individual countries and on specific policy techniques. In addition, the editor's perceptive concluding chapter, "The issues and a research agenda," helps to chart a plan of work that is useful and relevant for all those concerned with the social and economic development of poor countries.

WALTER P. FALCON
*Development Advisory Service,
Harvard University,
Cambridge, Massachusetts*

Herpetology

The Life of Reptiles. ANGUS BELLAIRS. Universe, New York, 1970. 2 vols. xx, 590 pp., illus. \$25. Universe Natural History Series.

One thing should be said clearly: there is nothing as good as these two slim volumes elsewhere in print nor is there soon likely to be. Nevertheless, it is necessary to make three complaints: (i) the books are overpriced; (ii) they are in several respects defective or out of date; (iii) they all but ignore some topics that are today an especially thriving part of the study of "the life of reptiles."

It is a pity that these complaints must be made. There is a very considerable wealth of information in these volumes and there is nowhere else to turn for simple summaries of so many topics. The competing *Biology of the Reptilia* edited by Carl Gans is a multi-volume series of erudite reviews by specialists of specialized topics. It will be some years before the series is completed and even then it will not replace Bellairs. The handsomely illustrated volumes by Mertens (now unfortunately out of print) and by Schmidt and Inger aim below the level of Bellairs, as the Gans volumes aim above it.

However, Bellairs, while filling a need, fills it not quite so well as he might. Thus, although his book is pleasantly written and what is said, especially about morphology and physiology, is often well said, there is much

that would be as lucid in half the words, and there are paragraphs and pages and occasional illustrations that could happily have been omitted. It would be possible to consider the "chatty" untechnical style a legitimate device to reach a wider audience did not the price assure a reverse effect and aggrieve those who look for higher content of information on each expensive page.

Again, for all that Bellairs in his preface endeavors to disarm his readers by hoping "that I shall be forgiven for numerous sins of superficiality and omission that I have certainly perpetrated," he does provide "addenda" to the second volume which purport to add more recent (1968, 1969) references or further data. These additions, however, are as casual in their coverage and as surprising in what they leave out as much of the text. One feels that Bellairs has relied too heavily on books and articles that he personally has received and very little on even the better-known journals. Two examples will serve. That sex chromosomes occur in lizards was reported in 1966 in two almost simultaneous articles in *American Naturalist* and in *Science*. Bellairs is as unaware of these as of further reports since then. A very important review by Fred White on blood circulation in reptiles in 1968 in the *American Zoologist* was perhaps too late for inclusion, but a first paper on crocodilian circulation by White appeared in the *Anatomical Record* in 1956. Bellairs does not mention it.

A major defect for a book entitled *The Life of Reptiles* is the lack of any serious consideration of ecology. A few references receive bare citation in the very first chapter ("The growth of knowledge," a chapter itself too much an insufficiently selective list of books), but there is no mention of Milstead's 1967 symposium volume *Lizard Ecology*. In the body of the text only those aspects of ecology are mentioned that have a strongly physiological flavor (thermoregulation or water balance, for example), and there is nothing at all of those aspects (competition, colonization, niche) that have begun to have important theoretical implications.

Though ethology is mentioned, it too is scant and mentioned primarily under reproductive physiology. Zoogeography as "geographic distribution" is given a page and a half. The fossil history of reptiles is given most of a chapter, but even so the account is rather lacking in substance.

The study of reptiles is currently a very active area in which much impressive work is being done. To be acquainted with all is surely too much to ask of any one man, but it is possible to know some of the men who work in the many subareas and to consult them. Bellairs has clearly not done enough of this. However, the greatest defect of Bellairs's volumes is that they give no hint of the liveliness of the field or of the fact that, as with better-advertised areas, there is intense pressure to keep up with the pace of discovery. In consequence he who buys these books may be misled into believing that he has in hand a summary of current knowledge and a way of entrance into ongoing research. As an antidote he had best procure the *Herpetological Review* published by the Society for the Study of Amphibians and Reptiles and confront there the list of "Current Herpetological Titles."

Were Bellairs one volume and half the price it would be possible to be kinder. As matters stand, it is necessary to recommend the English edition at 70 shillings the volume as far more acceptable value for price paid.

ERNEST WILLIAMS
*Museum of Comparative Zoology,
Harvard University,
Cambridge, Massachusetts*

Biological Substances

Chemistry of Sphingolipids. DAVID SHAPIRO. Hermann, Paris, 1969. 122 pp. Paper, 30 F. Chemistry of Natural Products (Original Series), vol. 9; *Actualités Scientifiques et Industrielles*, No. 1338.

This book is a most welcome publication for those working in the field of lipids and in related fields such as membrane biochemistry, which is quickly becoming one of the major fronts of modern biochemistry.

The book is concisely and clearly written with abundant illustrations showing structural formulas. References, many of them from the author's own laboratory, are up to date, and notably few typographical or other mistakes can be found.

The basic approach of this book is that of organic chemistry, understandably, because of the author's interests. Almost every chapter begins with a short histological background of the compounds under discussion. These not only place current information in a proper perspective, but are also an ex-

cellent way to supplement the main body of information and warn readers against many pitfalls earlier workers in the field fell into.

It is a worthy decision on the part of the author to devote as much as eight pages, of less than 100 total text pages, to sialic acids. These acids are the most important glycosyl residues of sphingoglycolipids, and much progress has been made in the study of them since the publication of Gottschalk's classic book (*The Chemistry and Biology of Sialic Acids and Related Substances*, Cambridge University Press, 1960).

The last chapter of Shapiro's book deals with synthetic procedures, concerning which enough details are given so that presumably syntheses can be carried out without further reference. Many new, previously unpublished improvements have been incorporated. It will be interesting to see how useful these accounts of synthetic procedures will be for biological scientists who are not familiar with organic synthesis in general. It would have been ideal if isolation and purification procedures for natural sphingolipids had also been given here. Practicing biologists and biochemists would perhaps like to see chromatographic data and analytical procedures included.

As the author states in the preface, there is a strong need for "a closer co-operation between chemical and medical research," and this book will undoubtedly serve to fill the gap between the two fields.

Y. C. LEE

*Department of Biology,
Johns Hopkins University,
Baltimore, Maryland*

Spectrum Analysis: A History

Nineteenth-Century Spectroscopy. Development of the Understanding of Spectra, 1802-1897. WILLIAM MCGUCKEN. Johns Hopkins Press, Baltimore, 1970. xiv, 242 pp., illus. \$11.

Spectroscopy has played so prominent a role in the development of modern physics that it is surprising that so few historians of science have paid serious attention to it. William McGucken's addition to the sparse literature on the history of this field should prove valuable and informative, not only for the professional historian of science but also for chemists and physicists interested in the roots of their

subject. The scientists might find particularly intriguing the different conceptions and purposes chemists and physicists have had for the terms "atom" and "molecule," which kept these two fields at odds through much of the last century.

McGucken presents some significant original material, including his coverage of the predecessors of Bunsen and Kirchhoff, his short portion on band spectra, and his elaboration of the kinetic theory and its place in early spectral theory with its dominant analogy to acoustics. Also, his development of the contributions of Plücker, Hittorf, Wüllner, and Salet in establishing the existence of multiple spectra for a single chemical substance, contrary to the previous fundamental principle of spectrum analysis, demonstrates the complexities and types of controversies, both experimental and theoretical, which haunted spectroscopy for decades. The difficulties arising for spectral theory from the work of Kundt and Warburg on specific heats based on the kinetic theory of gases provide another example of such controversy.

McGucken contrasts the dominance of the vortex atom model in Britain during the last decades of the century with the endurance on the Continent of more "traditional" atomic-molecular models for spectra, demonstrating the vibrant national competition in this area. Likewise, the search for spectral series formulas, culminating with Balmer, Rydberg, Kayser, and Runge, is handled briefly but adequately.

The establishment of the electron, the first subatomic particle of modern physics, by J. J. Thomson in 1897 was a watershed in the history of physics. G. E. Owen and I have maintained that Zeeman's discovery of the effect of magnetism on spectral lines had a direct influence upon Thomson's proposal several months later of a subatomic "corpuscle." McGucken now joins the support for this view, offering not only additional evidence but a further interpretation of how this may have come about. His conjectures strike me as highly plausible and completely in accord with the evidence at hand.

In addition to augmenting our knowledge of the history of spectroscopy, this fine volume is a substantial addition to the growing literature on the history of the atomic theory. McGucken observes correctly that spectroscopists predominantly were atomists. They opposed the anti-atomistic trends of the 19th century. The prolonged weak theoretic-

cal state of spectroscopy through much of that century was a source of embarrassment for atomistic theorists, but then the successful spectral theory of the early 20th century reinforced faith in a modified atomic hypothesis.

McGucken strictly limits himself to developments occurring during the 19th century. This limitation has a number of unfortunate consequences. For one, it terminates his story just at the point where the study of spectra was, owing to the new electron atomic models, becoming exciting and profitable for modern physics. For another, it distorts the role of J. Norman Lockyer and his dissociation theory of the elementary chemical atoms. McGucken makes a fine presentation of Lockyer's earlier conceptions, which were almost universally rejected when Lockyer's allegedly coincident "basic lines" in various elementary spectra proved spurious. However, Lockyer's later "enhanced lines," which played a significant role in the first successful resolution of the spectral puzzle in the early 20th century through the work of Niels Bohr and Lockyer's younger assistant Alfred Fowler, are completely neglected. But then these are far from fatal defects. At least two of the secondary sources listed in McGucken's bibliography cover this later period for those who are interested.

C. L. MAIER

*Montieth College,
Wayne State University,
Detroit, Michigan*

Groundwater Hydrology

Flow through Porous Media. ROGER J. M. DE WIEST, Ed. Academic Press, New York, 1969. xiv, 530 pp., illus. \$22.50.

This volume is an outgrowth of an Institute in Hydrology for College Teachers sponsored by the National Science Foundation and held at Princeton University in 1965. The editor has included updated, and in some cases expanded, versions of those lectures dealing with flow of subsurface fluids.

De Wiest commences with a discussion of the fundamental principles of groundwater flow, presenting major governing theories without delving into either well mechanics or specific examples of flow analysis. Davis follows with a thorough review of porosity and permeability of natural media. Inclusion of this material is laudable, for the analytical material of the volume can