presumed to be sparser offshore than inshore for marine birds (p. 247, although terns are apparently an exception—p. 263), and above the forest canopy than within it for swifts (p. 195), but little attention is paid to the fact that for each of the areas in which food is supposedly less abundant birds also have to travel much farther for it.

The coevolution of such factors as food availability, number and growth rate of the young, predation, and others that affect the survival rates of parents and young in my view receives inadequate treatment, yet is the essence of the problem. Perhaps only a really cohesive and simultaneous handling of variables, preceded by some a priori structuring and grouping on which individual subrelations can be hung, will avoid the rather confusing mass of cross-relations through which *Ecological Adaptations* takes us. The book pushes its approach as far as it can go, but in fact little further insight into its difficult subject has been gained since Cole's 1954 paper (*3*). Perhaps the problems will prove more amenable in the hands of the "strategists," by whom several tentative starts have been made (*4*).

A concluding word should mention the delightful drawings by Robert Gillmor, which do much to make progress through the book more enjoyable.

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References

1. R. K. Selander, *Amer. Naturalist* **99**, 129 (1965).
2. K. Crowell. *Proc. Natl. Acad. Sci. U.S.* **67**, 240–43 (1961).
3. L. C. Cole, *Quart. Rev. Biol.* **29**, No. 2, 103–37 (1954).
4. See, for example, G. L. Murphy, *Amer. Naturalist* **102**, 391 (1968).

Physiological Optics

Light, Colour and Vision. YVES LE GRAND. Second English edition, translated from the French by R. W. G. Hunt, J. W. T. Walsh, and F. R. W. Hunt. Chapman and Hall, London, 1968 (U.S. distributor, Barnes and Noble, New York). xiv + 566 pp., illus. $11.25.

Optique Physiologique was originally published as three volumes in 1946, 1948, and 1956. Volume 1, *La Dioptrique de l'Oeil et Sa Correction*, has twice been revised, but has not yet been translated into English (it should be). Volume 3 has recently been translated as *Form and Space Vision* by Millodot and Heath (Indiana University Press, 1968). The first English edition of the second volume, considerably updated, appeared as *Light, Colour and Vision* in 1957. Superbly translated by a distinguished trio of British specialists, it achieved rapid acclaim and has become one of the most widely cited modern sources of fundamental information about vision. The appearance of this second English edition will be greeted with particular interest by those who have made extensive use of the first.

Robert Cunningham and Sons have once again done the printing: binding, paper, type, plates, and format are so similar that the new edition might easily be mistaken for the old. And a careful examination reveals many more similarities. The same 20 chapters are again distributed within two major groupings. Section A, containing the first 15, includes "Experimental Facts," while "Theories of Vision" are presented in section B. All of an original 210 subheadings are retained in section A, where only five new ones ("absorption in the lens," "standard daylights," "the colorimetry of large fields," "colour contrast," "the problem of flash blindness") are listed.

But there are also many changes. An examination of the bibliography reveals that an extensive amount of new literature has been cited. The first edition contained a numbered list of 190 specially selected books and fully referenced journal articles of "wide scope." To this list 81 new items have been added. The original 13½ pages of additional journal references, cited without titles, have been expanded to 21 pages.

Although the updating of section A is a patchwork affair, it reveals that physicist Le Grand has been keeping a sophisticated eye on recent developments. Most readers are likely to find many references that they have overlooked during the productive decade that elapsed between editions.

With the help of two of the original translators, section B has been extensively revised. More than 20 new subsections have been written, and six of the old ones have been deleted. These changes reflect contributions to visual theory resulting from new advances in electrophysiology, psychophysics, retinal densitometry, microspectrophotometry, and photochemistry. To the physiologist, these sections will again seem superficial; Le Grand admits that this material is "less familiar to me" than what is covered in section A.

Few changes have been made in the extensive tables and formulas which comprise valuable features of the book. All original figures except one have been retained: only five new ones have been added. Regrettably, ten pages of exercises and their solutions (this was originally a textbook) have been eliminated, probably to keep the volume—now ten percent thicker—within bounds. The index is again excellent.

Le Grand's opinions are sprinkled throughout the book, particularly in section B. The reader will probably wish to quarrel with some of them. But they make for lively reading and are not too rigidly held. As Le Grand puts it: "even if this Section B contains a little science-fiction, it is of great importance for men of science to try to understand the human machine." Those who study this book will be rewarded by an enhanced understanding of the physics of human vision.

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Gamete Fusion

Ultrastructure of Fertilization. C. R. AUSTIN. Holt, Rinehart and Winston, New York, 1968. x + 198 pp., illus. $5.95.

Electron microscopy has been brought to bear on fertilization only in the past decade. Not all stages known histologically have yet been seen at the higher magnifications. The author of *Ultrastructure of Fertilization* briefly mentions what has not been studied and why, then summarizes what has been. The acrosome reaction, the cortical granule response, and relations between gamete cell membranes have been studied in most detail, in sequential stages, and in various species. Sperm penetration through egg investments is sufficiently understood to permit a very systematic presentation with subsections on sperm structure, egg investments, and sperm penetration for each of nine invertebrate groups and mammals (chiefly rabbit). Conjugating protozoa as well as gametes have been considered with respect to nuclear migration, nuclear union, and especially those cell membrane interactions that lead to cell fusion. In such matters of how cell membranes merge and where and what they come from and disappear to, research is moving beyond high-magnification comparative anatomy through

quantitation and toward conjointly mechanical and chemical understanding. However, that perspective is conveyed somewhat remotely, two chapters later, in the discussion that essentially concludes the book. The final chapter is actually an appendix of methods and materials. It is comprised of abstracts arranged alphabetically by author, and references to them in the preceding chapters are conveniently distinguished by enclosure in brackets rather than parentheses. There are 13 pages of references through 1967, an author index, and a subject index. The numerous line drawings and electron micrographs are well chosen and well labeled to illustrate discussed points. Most are reproduced better than passably in spite of the economies of coarse halftone screen and paper, but about half a dozen evidence poor control of contrast and exposure. That lapse may be discounted as merely esthetic, and the book is recommended for specialists in the field of fertilization, biologists in related disciplines, and advanced biology students.

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Tropical Crop

Yams. An Account of the Nature, Origins, Cultivation and Utilisation of the Useful Members of the Dioscoreaceae. D. G. COURSEY. Humanities Press, New York, 1968. xiv + 230 pp., illus. $9.50. Tropical Agriculture Series.

This work, the eleventh in the Tropical Agriculture Series, is the third dealing with a major tropical staple. A preferred crop and often the basis of a prestige economy, yams are also a major institution in themselves in the few areas of the intertropical world where they are known to be indigenous. From time to time different writers have analyzed one or more of the many aspects of the "yam culture." The author of this study brings together a vast amount of material in what is the first attempt at anything like a comprehensive overview of the edible yams of the tropical world.

This book is divided into ten chapters which could be conveniently grouped according to three major themes: yams in space and in time, their agricultural and institutional environments, and the technical aspects.

The first two chapters take the reader on a journey "into space and history," introducing him to the crop, the places where yams developed as a "cultivated crop," and the major centers of production and consumption. By a careful examination of the major species and their distribution pattern (such as the tendency to local concentration), Coursey isolates four distinct centers of origin for edible yams, including a West African area.

The agricultural and institutional aspects of yam production are covered in chapters 4, 5, 6, 8, and 9. The conventional topics, including the agronomy of the crop, pest and disease problems, the economics of yam production and consumption, and the social and cultural role of yams in the West African area, are treated. A reference to the "yam traditions" of Asia might have enhanced the comparative value of the West African data. There are gaps and some unevenness of treatment in this section, but these do not detract greatly from the value of this pioneer effort.

Further work is needed on the economics of yam production. This reviewer finds no convincing evidence in this study which leads to the conclusion that yam farming "belongs primarily to subsistence rather than to commercial agriculture" (pp. 3, 68). The labor-intensiveness of commercial yam production notwithstanding, high seed requirement remains one of the problems. One or two statements in this section can be misleading to the ignorant and annoying to the informed: First, despite the ritual ambivalence which the Igbo manifest toward them, *Ajokuji* and *Mmaji* do not constitute a "group of tabu persons (*Osu*)" (p. 201) and must not be confused with *Osu,* a caste group. Second, the number 400 is not "synonymous with infinity" (p. 201) but is a maximal counting unit, and the qualification for the first rank in an Igbo yam title is not 400 yams but 400 yam stakes—a stake carrying from 40 to 120 yams (see plate 28).

Technical questions regarding yams, ranging from taxonomy, storage, and processing to toxic and pharmacologically active ingredients, are discussed in chapters 3, 8, and 10. Despite the technical treatment demanded by these subjects, the writing in the book is exceptionally literate, and it can appeal to a wide range of readers: professionals, students, agricultural administrators, and laymen.

The book is well documented, a reference list following each chapter. There are 16 figures and 28 plates, including closeups of yam barns. Coursey does not claim to have said the last word on yams. He has written a book which no serious student of yams can afford to ignore.

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Paleobotany

Les Plantes Fossiles dans Leurs Rapports avec les Végétaux Vivants. Eléments de Paléobotanique et de Morphologie Comparée. LOUIS EMBERGER. Second edition. Masson, Paris, 1968. 758 pp., illus. 198 F.

This volume, a very substantial and handsome and expensive elaboration of the previous edition (the plan and spirit are said to be the same) with new material added, is a strange blend of old and new. Americans may be inclined to view the cryptogam and phanerogam classification of plants as a now outmoded relict of a pre-evolutionary era, but, with the intercalation of an intermediate group, called the Prephanerogams, these taxa still form the basis for organization of higher plants in Emberger's new edition. Perhaps this organization reflects an ultra-causal rather than a conventional philosophy and a theoretical rather than a practical approach to the subject. Theoretical aspects are discussed at considerable length, but Emberger generally leaves the issues unresolved. Unfortunately, it is frequently difficult to relate statements in the text with the original works on which they are based. Written in French, the book must be judged as a reference volume for Americans.

The book may be regarded as a compendium of how paleobotany appears in review to a neobotanist who has attempted a comprehensive summary of literature. A tremendous number of groups of fossil plants are mentioned, and many good new illustrations are included. Few, if any, taxa are critically discussed in detail. Points others regard as having importance are given little emphasis, and features that seem too indefinite to be of value commonly are given exaggerated importance (as in Prephanerogams). Quite a few neobotanical matters are dis-