tion is sequentially transformed. However, where anatomical information is lacking he is reduced to making vague generalizations. For example, in the section on instincts and interneuron growth he writes: "The only explanation of innate behavior is that interneurons grow and mature their connections in particular patterns which are derived from hereditary material" (p. 315). In another context he writes: "Basically, the properties of interneurons are an inescapable a priori of behavior. Perhaps the whole mind-body relation depends upon them . . . What any man or animal perceives or does, and all human conceptions, are restricted by the limitation of interneurons" (p. 372). In this context the properties of interneurons are equated with the properties of brain, and Horridge adds little but his justifiable admiration to our understanding of the complexities of central nervous system functioning.

The other problem with this book is its scope. In order to cover so many topics in a short monograph Horridge is forced to summarize rapidly large bodies of research. The reader is often not told how certain data were obtained, and most factual statements are not documented by references to the literature. As a result this book provides a rather personal account of Horridge's interesting and provocative view of the nervous system and will be of most value to those who enjoy following his train of thought. Other readers may benefit less, for the book is likely to prove difficult for the beginning student and impressionistic for the specialist.

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Mathematics

A History of Mathematics. CARL B. BOYER. Wiley, New York, 1968. xviii + 717 pp., illus. $10.95.

At last there is a history of mathematics that can be recommended without reservation. Making full and critical use of recent scholarship, Boyer has avoided major errors of fact or interpretation. And unlike several currently popular handbooks, the work is neither too concise nor too elementary.

The guiding principle of Boyer's book is that continuity in the development of mathematical ideas is the rule rather than the exception. Important ideas of modern mathematics, such as infinity, coordinate geometry, and the striving toward generality and rigor, are discussed in their ancient and medieval settings. The author makes judicious assessments of the influence and importance of individuals and schools, and illustrates his generalizations with well-chosen examples. Especially praiseworthy are the chapters on medieval European mathematics and early-17th-century mathematics, areas which Boyer's own research has illuminated.

Mathematicians will be most interested in the last quarter of the book, which gives a fine account of mathematics since 1789. Of particular excellence are the chapters on "The rise of abstract algebra" and "The arithmetization of analysis." Also worthy of notice are the discussion of the nature of modern mathematics that begins the last chapter, "Aspects of the twentieth century," and the treatment of Hilbert's Problems which helps organize that chapter. A high level of mathematical sophistication is reached, and the author has chosen to treat selected topics in depth rather than to try to cover everything superficially.

Teachers of the history of mathematics could not want a better textbook. Most of the book can be read by anyone who knows elementary calculus. Expositions of more advanced mathematical results are done with clarity and skill, often enabling one who has not studied a particular result to appreciate its place in the development of mathematics. Each chapter is followed by a number of instructive problems in the style of the time under study, as well as by a set of questions on the contents of the chapter.

Historians will find the work a splendid place to begin research; the bibliographical footnotes and the chapter bibliographies include most of the important secondary sources. Boyer pays attention to the role of translations and national styles in mathematics, and to social and economic conditions. The relations between mathematics and philosophy and between mathematics and physics are touched on at times, but the work does not claim to treat them with any degree of completeness.

The weaknesses of the work are really the weaknesses of the existing secondary literature, especially apparent for the 19th and 20th centuries. In particular, a full-length history of algebra is needed, as are overall evaluations, based on a careful study of original works, of a number of important men and topics in the modern period. The treatment of 20th-century mathematics is extremely brief, though the author does give many bibliographical suggestions. Finally, it would have been helpful had the chapter bibliographies been annotated, and had the annotations in the general bibliography been longer and more critical. But these are minor flaws. Boyer has produced a work which should be welcome to mathematicians, teachers, and historians alike.

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Rural Pollution

Agriculture and the Quality of Our Environment. A symposium presented at the 1966 meeting of the American Association for the Advancement of Science, Washington, D.C. NYLE C. BRADY, Ed. AAAS, Washington, D.C., 1967. xvi + 460 pp., illus. $13.50; members' cash orders, $11.50. AAAS Publication 85.

Improvement of environmental quality is of great concern today, as is evidenced by the prominence of the subject in the local, state, and national political arenas and by the trend for many college courses to be organized around the "environment." One undeniably important factor in that environment, though often taken for granted, is agriculture. The present book brings together for the first time in one volume a summary of our knowledge of the effects of a polluted environment on agriculture and, conversely, of the contribution of agriculture to environmental quality.

The 30 symposium papers are presented in three sections dealing with the three portions of the environment, air, water, and soil, and a fourth section devoted to disposal of wastes in rural areas.

The first section discusses the effects of various gaseous and particulate air pollutants, including radionuclides, on plants and animals. The effects of air pollution on agriculture are aggravated by the increasing invasion of rural areas by industry and urban communities. One interesting aspect of the problem relates to forests: whereas we readily recognize the threat to agronomic crops, recognition of the threat to trees,

recreational use, and watershed management in our forests is relatively new, and yet the threat is very real. With our best figures, estimates of losses to agriculture are rather vague. More precise criteria are needed by which to reconcile benefits and costs of control measures. Emphasis is given to the need for air quality standards which will protect plants not only from obvious injury but also from the insidious, but perhaps more important, effects that result in growth suppression. Similar guidelines are required to assure that important animal products are not wasted during periods of emergency radioactivity. It is suggested that standards for some materials are too conservative and result in unnecessary waste.

Agriculture as a source of pollution is the principal theme in the section on water quality. Pesticides, fertilizers, salts, sediments, and processing wastes are the main pollutants discussed. It is of special interest that facts about the movement and the fate of pesticides in the environment relieve fears that were expressed a few years ago; also, there is little evidence that fertilizer nutrients are contaminating water supplies. However, the need to minimize the movement of these materials from the areas where they are applied is clear. An interesting approach to water renovation is suggested wherein waste waters are flooded over suitable forest or agronomic lands so that the soil and its associated flora act as a living filter. It is mentioned that the long-term effects of this treatment on chemical and physical attributes of the soil cannot yet be evaluated; the statement could well be modified to include the effect on soil-borne plant diseases.

Soil pollution from radionuclides, nitrate fertilizers, pesticides, and heavy metals is the subject of the third section. Evidence is presented for buildup of these materials in the soil, and their probable effects on plants and subsequent entry into the food chain are discussed. Pesticides probably will be used for some time to come, and there is an evident need for a careful evaluation of their use, relative persistence, and eventual fate as weighed against the benefits to be gained in crop protection; benefits may be worth some risk. Data on the role of soil flora in detoxifying contaminants show that this means does not offer a panacea. The "biological incinerator" has its limitations.

That agriculture has created one of its most pressing environmental problems in its own backyard is convincingly revealed in the section on disposal of human and animal wastes in rural areas. The daily voided wastes of poultry, cattle, and swine are ten times those of the human population in the United States. What was once a problem for the individual livestock producer is now a national problem requiring for adequate solution the best in research competence and support. There is general agreement that ultimate disposal of animal wastes, as well as domestic waste water, must be on the land and not in surface waters. Discussion of alternative methods for treating the highly variable wastes so that they are harmless to the land without adding to water and air pollution illustrates the complex nature of the problem.

The book should appeal to readers who are not conversant with all aspects of our environment and who are interested in obtaining a good overview of this one. There is ample information to meet that objective; not too detailed, but neither diluted to the point of being ineffective. Rather complete bibliographies and excellent author and subject indexes conclude the book.

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Game in an English Forest

The Roe Deer of Cranborne Chase. An Ecological Survey. RICHARD PRIOR. With an Appendix on the Diseases of Roe by A. McDiarmid. Oxford University Press, New York, 1968. xvi + 222 pp., illus. $7.

Roe deer (*Capreolus capreolus*) are the common small deer of Europe, occupying forests and woodlots in agricultural areas. They differ in interesting ways from most other deer species. For example, the male defends his territory, the female exhibits delayed implantation, and the breeding season occurs in midsummer rather than in autumn. Traditionally, these animals are hunted according to seasons and harvest rates set by landowners, who also select the hunters. No government game departments assume responsibility for the management of these animals; nor is there an annual hunting season when the woods are filled with red-clad hunters who pay for the support of state game departments, as in the United States. Because of this lack of any organized responsibility for wild animals, support for research and management of Europe's wild game has lagged far behind that of North America. Prior's book reflects this lag.

The book reminds one, in its outline and methods, of Fraser Darling's *A Herd of Red Deer*, published 31 years ago, which probably served as a model for Prior. Darling's book became a classic in animal behavior, but our knowledge and understanding of game animals have increased manyfold since then. In conducting his work Prior did not take advantage of this progress. Obviously no animals were marked to determine the movement patterns, social behavior, or other characteristics discussed in the book.

The author has filled the book with empirical statements about roe deer, unfortunately not well substantiated by his own data or thorough references. He barely comments on his methods of study, and in the chapter on techniques he is more concerned with descriptions of clothing, binoculars, and rifles than with procedures used in gathering data. This probably reflects the attitude held by many that the deerstalker and the gamekeeper are completely qualified authorities. From the strict viewpoint of a biologist, the book leaves much to be desired because of the omission of substantiated data.

Despite the technical deficiencies, the book does have much to offer anyone interested in deer. It is the best thing available in English and contains a wealth of information, however weak some of it may be. The work is based upon years of observation made by the author in a large English forest. Many of Prior's observations are new, and he presents various insights into deer biology with a description of the history of roe deer in England and of how man's activities have affected these animals—all of which should be of considerable interest to American readers. Some of the vocabulary challenges the reader's imagination; such words as "ride-sides," "hurdle," "fraying," and "hummel" cannot be found in the ordinary desk dictionary. The appendix contains a summary by A. McDiarmid of the parasites and diseases of roe deer.

For these reasons and because of the other interesting elements outlined above, the reviewer recommends Prior's book to anyone concerned with deer biology, especially behavior. It will serve as a useful reference.

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