and then hewing the ethnography and the theory out of the rock of one's psyche, let him first read the corpus of Malinowski's work and then come to these journals. And if he wants to clinch the point with negative instances, let him do the same for Morgan or for Boas. Malinowski's diaries are the private notes of a man who is alternately enthralled and tortured by himself and his experiences. They form one of the most poignant records available of the personal horrors of what is today glibly called "culture shock." Malinowski did not share with Boas or the Anglo-Saxons the tradition of never admitting to himself that he felt lousy, that he suffered from vast personal insecurities, that he was randy from time to time, that he had dreams with meanings, and—most touching of all—that when he was most lonely in this strange and beautiful and distasteful work, he missed his mother. I dare any of my own generation to be so frank—or so revealingly to the point.

In the hyperbolic suffering of Malinowski and the stoic unsuffering of Boas, cultural and social anthropology became a social science instead of a field of curiosa. All anthropology before that time properly belongs to the realm of history—the social history out of which anthropology grew. There is a great deal in what came before these two monumental figures that foreshadows their concerns and ours—but so is there in Aristotle. I would, in fact, place the development of modern anthropology as stemming from the teaching and university work of Boas, the fieldwork and the protestations of learning to interact with "natives" of Malinowski, and the 1930 debates between Linton and Radcliffe-Brown (neither of them considered today to have been good fieldworkers) about society and culture: that is, with the development of the department at Columbia University, with the fieldwork in the Trobriand Islands, and with the development of role theory.

There seems little doubt that the late 20th century will be remembered in history for formulation of social science, just as the first part of the century will be remembered for maturation of natural science. These books, with some others of the past few years, provide a fascinating account of the "prehistory" of that formulation.

PAUL BOHANNAN
Department of Anthropology,
Northwestern University,
Evanston, Illinois

Visual Systems

The Functional Organization of the Compound Eye. Proceedings of an international symposium held in Stockholm, October 1965. C. G. BERNHARD, Ed. Pergamon Press, New York, 1966. 605 pp., illus. $19.50.

Unlike what happens with many other international symposiums, the proceedings of this one were published within a year and contain more than a rewrite of work already in print elsewhere. In fact, this is the first major book devoted exclusively to the compound eye since Exner's classic of 1891.

As might be expected, a good proportion of the volume is concerned with the work of Hartline and his collaborators and students on *Limulus*. One continues to be amazed at the clarity with which we now see the details of the physiological mechanisms of this eye as a result of their work.

Reading this book we become aware of the many reasons for studying compound eyes—apart from the fact that, by many orders of magnitude, more animals alive today possess compound eyes than simple eyes. For example, one may find a different method of stimulus analysis, one not exhibited by vertebrate eyes. Such is the demonstration by Waterman that the eyes of *Daphnia* possess the capacity to detect the polarization of light. Again, the discussion on the resolving power of compound eyes continues its fascinating course, and new, subtle points concerning image formation are being raised.

Lest the majority of students of the visual apparatus, who work with the vertebrate visual system, be tempted to overlook a book on the compound eye, let them reflect on the facts that the single-unit studies on *Limulus* led to similar studies on vertebrates by Hartline, Barlow, Kuffler, and Hubel and Wiesel; that the parametric feedback model of the *Limulus* eccentric cell by Fuortes and Hodgkin led to Rushton's theory of human visual adaptation; and that Ratliff and Hartline's work on inhibition has had a phenomenal excitatory effect on neurophysiology in general. Similar precursors of important vertebrate studies are surely contained among the 36 contributions in this book. To try to pick them would be an interesting game: this reviewer would point to the type of work reported by Reichardt's and Horridge's groups.

The book is beautifully produced. It lacks an index and is perhaps the poorer for not conveying to the reader the added insight and perspective brought to light at "live" symposiums by the discussion. Its careful perusal is a rewarding experience, highly recommended by this reviewer.

GERALD WESTHEIMER
Neurosensory Laboratory,
University of California, Berkeley

Radioactive Tracer

Tritium and Its Compounds. E. ANTHONY EVANS. Van Nostrand, Princeton, N.J., 1966. 455 pp., illus. $15.

In the past decade, growth in the use of tritium and compounds labeled with tritium has been phenomenal. But future use of the isotope will be even more spectacular, because modern instrumentation for liquid scintillation counting of beta radiation has solved the analytical problem that restricted early progress, and has made many applications of tritium practicable. The unique properties of the isotope, its low cost, the ease of preparing labeled compounds, and the simplicity of the analytical methods make work with this isotope particularly attractive. The book was written "primarily to guide and to encourage the research worker to examine the many opportunities which tritium offers as a radioactive tracer."

The book is exceptionally easy to read. Historical material and descriptions of unique applications of the isotope, interspersed with discussions of the peculiar properties of tritium-labeled compounds, hold the reader's interest and fill him with the desire to take advantage of the manifold opportunities of using tritium in his own research.

The fascinating text treats in depth the use of tritium in biological and chemical research, the preparation of tritium-labeled compounds, methods of analysis, and unique problems encountered in the use of the isotope. Readers are referred to the original papers for experimental details; but the author's evaluation of past work is extremely valuable, because he provides first-hand information obtained in the course of his work at the Radiochemical Centre at Amersham.

This is a stimulating book. Descriptions of past triumphs in research made possible by the use of tritium

fire the reader's imagination; critical discussions of methods and techniques not only provide drama and entertainment, but give the reader an accurate view of the wonders of this powerful research tool. The specialist will find the book provocative and informative. From study of this text, all students of chemistry and biology should obtain a clear and vivid understanding of the uses of tritium as a research tool.

HORACE S. ISBELL
Institute for Materials Research, National Bureau of Standards, Washington, D. C.

Mathematics in Practice

Stochastic Processes. M. GIRAULT. Springer-Verlag, New York, 1966. 138 pp., illus. $7.

Modern mathematical theories not only awe applied scientists by their abstruseness but frustrate them as well by not offering much help for their practical problems. The situation has been well put by a theoretical physicist as follows: Mathematical problems arising from applied sciences are like brush fires which demand simple and quick action, but mathematicians are more interested in building spic-and-span fire stations which are too remote for those little fires. If one looks at the various current books on "stochastic processes," one is amazed at the great discrepancy among them, although some have almost identical titles.

On the one hand, there are those austere volumes of which the perusal is well-nigh impossible without years of intensive study in pure mathematics; on the other hand, there are recipe-book or handbook types just as full of equations and formulas but at a level supposedly (and advertisedly) accessible to readers with only "calculus background." The need to bridge the gap is obvious; bridging it is difficult indeed. Yet one could also easily imagine contemporaries of Newton and Leibniz shaking their heads over those fluxions and exclaiming over the absurdity of teaching that kind of stuff (namely the "calculus" just mentioned) to physicists and engineers!

The present effort by Girault to teach stochastic processes to "practical workers [in] Physics, Chemistry, Biology, Medicine, Population, Economics, Organisation, Operational Research etc." is one in a growing literature and should be viewed in this perspective. It presents a number of relatively simple "models" such as Poisson, additive, Markov, second order, and Laplace (alias Gaussian) processes, illustrates them with figures and numbers, and summarizes some of the relevant theory. Even such abstruse matter as infinitely divisible distributions receives some attention; but in contrast there is no discussion of certain familiar types of integro-differential equations encountered in applications. The explanation of the confusion of notation on page 32—"the sign $+$ in $(X + Y)$ denotes a convolution of two probability laws but in $(a + b)$ it denotes a sum of two numbers"—is outmoded and merely adds to the confusion. Even a practical worker nowadays must be taught that the sum of two random variables is just like the sum of two numerical functions and therefore, *in sum*, just like the sum of two numbers. But the probability law of a random variable (not necessarily a sum as in this instance) is not the same as the random variable itself. Without this truly fundamental understanding much in the rest of the book, such as the meaning of an "additive" process, must be incomprehensible or, worse, misapprehended.

KAI LAI CHUNG
Department of Mathematics, Stanford University, Stanford, California

Freshwater Life

A Treatise on Limnology. Vol. 2, Introduction to Lake Biology and the Limnoplankton. G. EVELYN HUTCHINSON. Wiley, New York, 1967. 1127 pp., illus. $39.

This is the second volume of a monumental three-volume monograph. Although it contains only nine chapters, these are nicely subdivided, and each has a concise and adequate summary. The first chapter, "The nature of the fresh-water biota," accounts for about one-quarter of the text. Perhaps the most unusual feature of this chapter is the inclusion of short comments about a host of rare, atypical, and fortuitous inhabitants of fresh waters from all parts of the world. Few aquatic biologists are familiar with *Aldrovandra* (a floating sundew), *Calpasoma* (a Swiss freshwater hydroid), *Limnostylochus* (freshwater polyclad in Borneo), *Planolineus* (Javanese freshwater nemertine), *Aetheria* (an oyster-like mollusk from African rapid streams), and *Potamocypoda pugil* (a Malaysian freshwater crab), for example. The list of freshwater polychaetes is surprisingly long. Only 18 pages are devoted to vertebrates. There is an excellent discussion of the many facets of the physiology of adaptation to fresh waters, but the reader is judiciously left to draw his own conclusions about genetic mechanisms and precise ecological migratory pathways involved in the colonization of lakes and streams by marine and terrestrial ancestors.

A short chapter on "The structure and terminology of lacustrine biological communities" clarifies ecological concepts that are used in the subsequent portions of this volume (and presumably will be in volume 3). The mathematically minded limnologist will be pleased with the chapter on "The hydromechanics of the plankton." This is a remarkable treatment of sinking rates of phyto- and zooplankton in relation to turbulence, size, density, dispersion, and nutrient uptake, especially from the standpoint of ramifications of Stokes's law. "The nature and distribution of the phytoplankton" is a taxonomic consideration based chiefly on ecological nutrient requirements. "Phytoplankton associations" contains an intriguing mathematical consideration of "conditions for multispecific equilibrium." There is a new "provisional" classification of 13 different phytoplankton communities of the euphotic zone, including such associations as oligotrophic desmid plankton, oligotrophic chlorococcal plankton, eutrophic diatom plankton, and myxophycean plankton. Undoubtedly Hutchinson's simple classification will spark a good deal of controversy among phytoplankton specialists. In view of his extensive and complicated classification of lake types in volume 1 of this monograph, I am disappointed and surprised with his oversimplified concept of phytoplankton communities.

"The seasonal succession of the phytoplankton" is a thorough discussion of the frustrating problems of algal population irregularities with respect to physical, chemical, and biological agencies. The literature on antibiosis and biochemical growth stimulators is brought together in a complete and critical fashion. It is notable, however, that "grazing" effects by zooplankton are given only passing attention. I trust volume 3 will elabo-