facilitating the movement of food from surplus-producing nations to the hungry peoples all over the world. Time is demonstrating that the application of science and technology by the underdeveloped nations to increase the production of food and of things they can exchange for food—and not a world food bank administered by an international agency—will be the mechanism by which science and technology can improve human nutrition and raise levels of living.

All royalties on Hambidge's book will go to support the work of FAO.

NOBLE CLARK
University of Wisconsin

Chemical Engineering Cost Estimation. Robert S. Aries and Robert D. Newton. McGraw-Hill, New York, 1955. xiii + 263 pp. $6.

This is a well-organized effort comprising 10 chapters on cost estimation. It includes an analysis of various cost items entering directly into the manufacture of a product as well as a good deal of pertinent discussion of the economics involved in a chemical enterprise. For the practical engineer, who is daily faced with a need to justify engineering recommendations on a dollars-and-cents basis, the book fills a real need. The authors have drawn extensively from the contributions of Harding Bliss, C. H. Chilton, Roger Williams, Jr., and others.

The chief criticisms to be leveled against the book are (i) failure to use a cost index system or (at least) to recognize its value, (ii) failure to indicate in the cost-of-equipment graphs that the curves are either averages or medians of a considerable spread of data, and (iii) overemphasis on equipment costs at the expense of discussion of items such as transportation, installation, and maintenance costs. The book as it stands is far from being comprehensive. But although it is *dated* and *imperfect* with respect to the matters just indicated there is no denying its immediate usefulness.

J. M. DALLAVALLE
School of Chemical Engineering, Georgia Institute of Technology

Inorganic Reactions and Structure. Edwin S. Gould. Holt, New York, 1955. viii + 470 pp. Illus. $6.50.

This book was written to serve as a textbook for chemistry students at the senior or first-year graduate-student level. It is to be used with those courses in inorganic chemistry that have developed in recognition of the renaissance of inorganic chemistry and the general lack of knowledge of the subject shown by so many chemistry graduates in the past 20 years. The author states that the book will serve the students who have had courses in both qualitative and quantitative analysis, but it is my opinion that some introduction to physical chemistry is also necessary.

The book is made up of alternating chapters of theoretical and descriptive inorganic chemistry. No attempt is made to cover the chemistry of all the elements, but the common elements of each group are adequately treated, and generalizations are made wherever possible. The theoretical treatment is exhaustive in that all the current rationalizations to "explain" structure and reactions in inorganic chemistry are covered and numerous specific applications are cited. The development of the theories is limited, however, and a good set of lectures will have to accompany the book if the students are to have a real understanding of these theories.

This book will provide an excellent orientation and a review of modern inorganic chemistry for the practicing chemist whose academic training ended before such terms as *bond angles, bond length, bond strength, bond order, sigma, pi,* and *delta bonds, Lewis acids*, and so forth, became standard terms in the chemistry courses. Further works will have to be consulted for complete comprehension of all aspects of this new approach, however. There are few references to the original literature, but there are numerous references to treatises and books on special phases of inorganic chemistry.

I was particularly impressed by the exercises at the end of each chapter. They are thought-provoking, stimulating, and an excellent test of one's ability to apply what has been learned. The information within the chapter is not always adequate to supply the answers to the exercises. For example, the text carries that all-too-common phrase "It may be shown that . . ." but without actually showing that "it" is so. One of the exercises at the end of a chapter states "Show that . . . is so." I believe that this is a good exercise. A number of exercises involve oxidation-reduction potentials at other than the standard conditions. Although the standard oxidation-reduction potentials are given in an appendix, the Nernst equation does not appear in the text. It must be presumed that the student will recall the equation from his course in quantitative analysis.

The only serious omission is a chapter on oxidation-reduction. Even though the topic is referred to repeatedly throughout the book and is covered in piecemeal fashion, it is of sufficient importance to justify a separate chapter.

Typographic and factual errors are few. The implication that pentavalent vanadium is readily reduced to the trivalent state by SO_2 in acid solution is erroneous, since the reduction proceeds only to tetravalent vanadium.

Inorganic Reactions and Structure is a worth-while addition to the growing list of modern inorganic books and will be valuable both as a textbook and as a guidebook to bridge the gap between the "old" and the "new" inorganic chemistry. It should serve as a stimulus to many chemistry departments to offer a course wherein such a textbook will be appropriate, because too few such courses are being offered at the present time.

CHARLES R. NAESER
U.S. Geological Survey

A Study of the Brain. A companion text to the stereoscopic atlas of neuroanatomy. Hyman S. Rubinstein. Grune and Stratton, New York, 1953. xiii + 209 pp. Illus. + plates. $9.50.

Designed to be used in conjunction with the author's *Stereoscopic Atlas of Neuroanatomy,* yet complete in itself, this textbook is intended to provide students with a functional approach to the organization of the central nervous system by guiding them through a dissection of the human brain. The first chapter provides directions on how to proceed with the dissection; interspersed at appropriate points in its text are suggestions with regard to the portions of subsequent chapters that should be studied in conjunction with a particular stage in dissection or before proceeding farther with it. The subsequent chapters, which represent the material usually covered in textbooks of neuroanatomy, are in turn generously populated with references to the "Atlas of transverse sections" and an appendix that follow the text; the latter includes the key drawings of the aforementioned *Stereoscopic Atlas.*

As an approach to the study of neuroanatomy, the plan on which the textbook is organized has merit; for there is no better way to obtain a three-dimensional view of the organization of the brain than by dissection. Unfortunately, the manner and form in which the ancillary material is treated—the text and illustrations—lack the merit of the plan. For example, the value of the "Atlas of transverse sections" is considerably lessened by the fact that too many structures are identified in many of the illustrations; as a consequence, the labels are too small and too crowded to be easily read, and the direction lines are difficult to follow. Many times the identifying line ends in a region in which the structure mentioned may reside but its presence or the limits of its distribution in the case of a

fiber tract cannot be recognized, nor are they indicated. This criticism applies with even greater force to the treatment of most of the line drawings that are included in the appendix. Finally, the usefulness of the text and the bibliography is materially limited because neither was brought up to date; for example, references to Fulton's *Physiology of the Nervous System* are to the 1938 edition, and those to Howell's *Textbook of Physiology* are to the 1922 or eighth edition. No reference is made in the chapter on the hypothalamus to the work of Wislocki or to the work of Harris and Green on the hypophyseal circulation; and none is made to the problems of temperature regulation, obesity, and energy exchange, which are focal points of so much recent work on this region. These omissions and others of similar character seriously limit the usefulness of this book.

DONALD H. BARRON
Yale University

The Origin of Vertebrates. N. J. Berrill. Oxford Univ. Press, Oxford, 1955. viii + 257 pp. Illus. $4.

From about 1875 through the 1920's, the origin of the vertebrates was one of the active subjects of evolutionary biology. Then discussion died down from lack of fuel. All the available evidence seemed to be in, and all together was insufficient to warrant much more than a verdict of "not proved." Hardly any new evidence is at hand today, and yet there is room for a reconsideration of probabilities with more perspective than was available when discussion was at its height. As Berrill emphasizes, any hypothesis of vertebrate origin is still speculative, but his exercise in speculative logic, tied to a wealth of detailed observation of indirectly pertinent facts, is well worth while.

Perhaps the most generally accepted (or, at least, repeated) hypothesis has been that of Garstang which was published in final form in 1928 and which stemmed from Willey's views of 1894. According to that view, the ancestral hemichordates and the echinoderms had a common origin. Tunicates arose from ancestral hemichordates and then the vertebrates arose by neoteny from the tadpole larvae of tunicates. The first two-thirds of that hypothesis, emphasized by many students almost to the exclusion of the last third, are now flatly rejected by Berrill. He does not believe that the hemichordates (a name he considers incorrect) are especially related either to the echinoderms or to the true nonvertebrate chordates (tunicates and lancelets). He does agree that in some vaguer sense the grouping of echinoderms, "hemichordates," nonvertebrate chordates, and vertebrates is probably natural, but this casual statement is mysterious because any actual evidence for it seems later to be confuted.

Concerning the vertebrates, Berrill agrees in essence, although not in detail, with the last part of Garstang's hypothesis. The tunicates arose as a group of sessile food-strainers. Tadpole larvae later evolved among the tunicates as an adaptation enabling the animals to settle on a suitable substrate. Neoteny in some of those larvae gave rise to animals free-living and -swimming throughout life. Such neotenous ex-larvae then evolved on the one hand into the degenerate lancelets and on the other into the first true vertebrates (Agnatha). A shift from marine to freshwater environments was supposedly a crucial factor.

Such a brief statement of the thesis does scant justice to an argument that is detailed, eloquent, and imaginative. The author's own characterization of his book as "in a sense . . . science fiction" is justified to the extent that this work, although it is technical enough and honestly linked with factual data, is a rare sort of scientific entertainment. Berrill's last sentence is, "Proof may be for ever unobtainable, and it may not matter, for here is such stuff as dreams are made on." *Perhaps* this is the last word on the chordate ancestry of the vertebrates. As for the ancestry of the chordates, all is left in darkness without even the dream of 60 years ago.

G. G. SIMPSON
American Museum of Natural History

The Quantitative Analysis of Drugs. D. C. Garratt. Philosophical Library, New York, ed. 2, 1955. xv + 670 pp. $17.50.

This volume is a carefully prepared compendium of selected methods for the chemical analysis of drugs. Details are adequate for conducting an analysis, and appropriate literature citations are included. Throughout it is evident that the selections have been based on the author's wide experience with procedures of this type. Regrettably, this work suffers from a high proportion of older methods, and some important current methods are omitted. There is no mention, for instance, of the fluorometric determination of epinephrine or of the spectrophotometric methods for barbiturate analysis. The necessity for brevity has prevented any elaboration on the chemical reactions involved in these procedures, and the presentation is usually in the nature of empirical directions.

Many of the drugs are strictly identified with the past generation and have little significance under present conditions of medical practice. This is indicated in a ten-page supplement, which in large part is a list of the drugs described in this volume that have been deleted from the 1954 *British Pharmaceutical Codex*. The British drug nomenclature, particularly in the case of newer drugs, may prove confusing to some in this country, since no synonyms, therapeutic applications, or structural formulas are given.

R. P. WALTON
Department of Pharmacology, Medical College of South Carolina

Vascular Plants of Illinois. G. Neville Jones, George D. Fuller *et al.* Univ. of Illinois Press and Illinois State Museum, Springfield (Museum Scientific Ser. vol. 6), 1955. xii + 593 pp. Illus. $10.

"Those who may be unfamiliar with botany" write the authors of this book, "often take for granted that the floras of the world are more or less completely known and have been fully and accurately accounted for in existing botanical literature . . . the study of plant populations, particularly from floristic, ecological, and phytogeographical standpoints, [still] presents many fascinating opportunities for scientific investigation in almost any part of the world, and by no means least interesting is the flora of the great Mississippi Valley of North America, part of which includes the richly endowed state of Illinois." The authors clearly recognize that "No report on a flora is, of course, ever complete. Even now, the plants of Illinois are imperfectly known."

This handsome volume, except for its double-column format and different style of printing, is at once reminiscent of Deam's *Flora of Indiana*. It is difficult to think of a better model. The use of small state-county dot maps to show distribution, the inclusion of a full-page vegetation map, a brief description of the flora and vegetation, an account of the principal collectors, and a full bibliography are a few of the laudable similarities between the two. Jones and Fuller depart from their model principally in omitting all keys and a glossary, in emphasizing full synonymy and recording all published references to Illinois plants, and in stressing orders while abjuring varieties and forms. I agree with the use of the standard Englerian sequence of families and orders. Since the authors recognize its artificiality, however, it may be questioned whether there is any value in trying to "modify" it into conformity with assumed phylogeny.

Deam's *Flora of Indiana* very clearly stems from its author's 40 years of field work in his state and has a distinctly per-