the effects of drugs thereon. The electrophysiologic presentations are particularly rewarding. These describe the effects of neurohormones and of various types of psychotropic drugs on electrical activities in various parts of the brain and attempt to relate these activities to normal and abnormal behavior.

The pharmacological papers accent the complexity of the pattern of effects elicited by psychotropic drugs. What makes these papers of particular value are attempts to relate pharmacological effects of the drugs to their effects on brain electrical activity and on behavior.

The clinical and psychiatric papers indicate the difficulty of determining the merit of drugs in the treatment of mental illness. Yet they leave the impression that certain of the "tranquilizing" agents are of definite aid in treating the symptoms, though not the basic defects, of mental illness.

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The Bacteriology of Tuberculosis. Egons Darzins. University of Minnesota Press, Minneapolis, 1958. xi + 488 pp. Illus. $10.

The effective treatment of tuberculosis with antimicrobial agents has led to the popular belief that this disease has been conquered. While great strides have been made in decreasing mortality (but probably not morbidity), many unsolved bacteriological problems still remain, and new ones have arisen. The purpose of this book is threefold: (i) to list in historical perspective the advances made toward the understanding of the tubercle bacillus; (ii) to present areas where further knowledge is needed; and (iii) to describe the newer experimental methods for the study of tubercle bacilli.

Basic theories and methods of general microbiology and specific problems pertaining to mycobacteria are described. Tubercle bacilli are discussed under the general headings of "Morphology and cytology," "Sources of energy and growth," "Isolation and identification," "Types and pathogenicity," and "Experimenting." In not all instances, however, are concepts and factual data accurately analyzed and presented. For example, the discussion of L forms of bacteria, on page 71, is misleading, and the tabulation of albumin as a nitrogen source for the metabolism of tubercle bacilli, on page 241, is incorrect. Nevertheless, an extensive subject index and a very comprehensive bibliography provide excellent access to the available literature.

A large section devoted to experimentation with the tubercle bacillus will be of value to the bacteriologist unfamiliar with the special techniques and precautions required in the laboratory.

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The Principles of Semantics. Stephen Ullmann. Philosophical Library, New York, ed. 2, 1957. 346 pp. $10.

This book is essentially a reprinting of the first edition with a supplement on recent developments in semantics and an expanded bibliography. For Ullmann, semantics is the scientific study of meaning, and meaning is the relation between name and sense, or, as some might prefer to put it, between sign and *designatum.*

Ullmann has described a variety of approaches to questions of change in meaning, semantic laws, homonymy and so on, and in the added chapter he correctly indicates that the most important new problem is that of whether a structural semantics is possible. A meaningful answer must be based on some explicit definitions of the terms *semantics* and *structure.*

A related and, in a sense, logically prior question is whether any semantic notions are essential, or indeed relevant to the syntactics—that is, the purely formal aspects of grammar, consisting of signs and of rules for their combination. If the two are not separable (and this seems to be Ullmann's view), then there is little point in discussing a structural semantics as distinct from a structural syntactics. If they are separable, then whether or not a structural semantics is possible obviously depends on what is meant by structure.

Structural is equated by some with *scientific.* If, as Ullmann suggests, semantics is the scientific study of meaning, then a structural semantics is possible by definition. However, there are some who are not convinced that meaning can be approached scientifically at all. Ullmann asserts that such a discipline exists but nowhere demonstrates that the meaning of a form is anything but an intuitive notion.

One not uncommon use of *structural* is as a synonym for *syntactical.* That is, the rules for the combination of signs are the structure of a language. In accordance with such a usage, structural semantics would seem to be a contradiction in terms.

Some students of language make a dichotomy between the structural elements (by which they mean inflectional endings like the plural *s* and the past tense *ed*) and the *lexical* elements, like *book, run,* and so on. From this point of view a structural semantics would presumably be the study of the meanings of these elements; such a study is not only possible but traditional in many schools of linguistics.

Ullmann quotes some linguists who use *structure* to mean symmetry or patterning and therefore make statements about certain systems or parts of systems being more highly structured than others. This would reduce the problem to the rather trivial question of how much symmetry one can discover (or impose) on the meanings of forms.

Other linguists have mistakenly used *structural* as equivalent to descriptive (as opposed to historical) studies. This is unfortunate, since surely one of the contributions of modern linguistics is to indicate how changes in language may be more clearly understood through a comprehension of the relationships of units to one another at any given time.

Now, if structure is used to express the notion that abstract units are defined in terms of hierarchical relationships to one another, as well as the fact that these relationships recur, then the conscious investigation and systematic description of these features in the area of semantics will be a discipline of increasing interest and importance.

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Toeplitz Forms and Their Applications. Ulf Grenander and Gabor Szego. University of California Press, Berkeley, 1958. vii + 245 pp. $6.

The study of spectral properties of matrices

$$[(C_{i,j})] = [(C_{i-j})],\ C_p = \overline{C}_{-p},\ 1 \leq i, j \leq n,$$

in the limit $n \to \infty$ has received considerable attention in the mathematical literature since the early days of this century.

More recently, analogous studies of integral equations of the form

$$\int_0^T K(x-y)\psi(y)\,dy = \lambda\psi(x),$$

$K(x) = \overline{K}(-x)$, in the limit $T \to \infty$, were also undertaken.

The present volume is an excellent and virtually complete summary of the work done on these and related problems up to 1955.

Toeplitz matrices and translation kernels occur in a wide variety of branches of pure and applied mathematics, ranging from the theory of analytic functions to crystal statistics and the theory of random noise. To present such wealth of material in the limited space of 240 small pages is a feat in itself. To do it

with such skill and elegance should earn the authors the gratitude of all those who might wish to gain acquaintance with this fascinating field.

The book is divided into two parts. The first part (eight chapters), gives the general theory, while the second (three chapters) is devoted to applications.

The latter includes applications to the theory of analytic functions (chapter 9) (centering mainly around the work of Carathéodory, and others, on analytic functions with positive real parts), to the Kolmogoroff-Wiener prediction theory, and to a class of problems related to random walk.

The general theory, which is attributable largely to the senior author, is presented in a unified and self-contained manner.

The chapters on applications complement the general theory, and the book emerges as a harmonious unit.

References and bibliographical notes are collected at the end, and the reader's attention is not distracted by footnotes.

Of course, this is a technical book on a technical subject. But discounting this, and even my own strong prejudices in favor of the subject, I recommend the book as an outstanding example of the power and beauty of analysis.

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Morphological Integration. Everett C. Olson and Robert L. Miller. University of Chicago Press, Chicago, 1958. xv + 317 pp. Illus. $10.

Direct observations of organisms are generally confined to single characters, characters often selected on a basis no more significant than that of expediency. Yet always in systematics and evolution, and often in other biological studies, the integrated whole of the organism is the proper object of concern. That difficulty has been widely recognized, and many biologists have coped with it in numerous different ways and with varying success. Olson and Miller have developed, far beyond anyone else, an approach that involves studying not the characters as such but a relationship among them. Specifically, they analyze, compare, and synthesize figures based on the covariance of multiple dimensions — almost exclusively linear measurements of hard parts of animals.

The dimensions (or measures) used are still defined by expediency, but the failings of expediency are largely neutralized by taking as large a number of different dimensions as is at all practicable. Olson and Miller then calculate correlation coefficients for all pairs of dimensions, taken two by two. In suitable instances partial coefficients are also calculated. The dimensions are then grouped by various and highly elaborated techniques into what the authors call ρ and ρF (that is, correlation and correlation-functional) groups. They have also devised an index reflecting the mean level of correlation among all the variants measured. They thus obtain data for studying the distribution of covariance within animals and among related or phylogenetically successive animals. Intensity and distribution of covariance are, by their special definition, the "morphological integration" of their title.

During the years of preparation of this volume, the authors encountered much misunderstanding and considerable criticism from their colleagues. This volume is especially welcome because it should finally clear away all the misunderstanding about just what they are trying to do, and why. They have also successfully countered most, but perhaps not quite all, of the criticisms. Their work depends heavily—indeed, fundamentally—on evaluation of differences between sample values of statistics, but the confidence levels and significances of these differences are established poorly or not at all. That seems to be the principal remaining methodological weakness.

The amount of work involved is downright appalling. In just one of their experiments, not the most elaborate, the study of a few teeth in a small sample ($N = 18$) of a night monkey involved taking 1494 measurements to 0.01 mm and then calculating 3403 separate correlation coefficients, plus an untold number of partial coefficients, and then performing hundreds, or probably thousands, of grouping operations. The reader is certainly grateful for the more than herculean tasks performed by the authors and their assistants. Yet he can hardly avoid asking, "Was it worth it?" If only the concrete results here published are considered, I must, with real regret, answer, "No." The authors have anticipated the possibility of that reaction. They may (how understandably!) somewhat overvalue the specific outcome, but they have a broader and satisfactory answer of their own. They have demonstrated that their methods do produce information not otherwise available and potentially, at least, pertinent to a considerable range of biological problems.

No systematist or evolutionist can safely ignore this difficult, laborious, brilliantly original, and potentially fruitful monograph.

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Nouveau Traité de Chimie Minérale. vol. III (group 1*a*), *Rubidium, Cesium, Francium*; (group 1*b*), *Généralités, Cuivre, Argent, Or*. Paul Pascal, Ed. Masson, Paris, 1957. xii + 838 pp. Illus. Cloth, F. 6900; paper, F. 6000.

A review of the two previously published volumes, I and X, in this 19-volume treatise on inorganic chemistry appeared in *Science* of 1 Mar. 1957 [**125**, 401 (1957)].

Volume III is devoted to the elements rubidium, cesium, francium, copper, silver, and gold. About 100 pages are given over to rubidium and cesium; 10 to francium; 265 to copper; 220 to silver; and 175 to gold. This volume maintains the high standard set for the series. Inorganic chemists will look forward with interest to the appearance of succeeding volumes.

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Soil–Plant Relationships. C. A. Black. Wiley, New York; Chapman & Hall, London, 1957. vii + 332 pp. Illus. $7.

This book covers the subject matter of a course taught by the author at Iowa State College. The continuing process of adjustment and revision of the material for teaching purposes is reflected in the orderly and concise manner in which the subject matter of the book is presented.

To me, the outstanding characteristic of the book is its accuracy and objectivity. These features will come as no surprise to those soil scientists who are familar with publications of the author's research.

A further noteworthy feature of the book is the intensity of the literature search that has obviously preceded preparation of the manuscript. The author has left few stones unturned in his search for appropriate examples bearing upon the various points discussed. Particular attention has been given to older work. The literature coverage alone is enough to justify the book to many research workers in agriculture.

The book contains chapters on soil composition, soil water, soil aeration, exchangeable bases, soil acidity, soil salinity and alkalinity, nitrogen, phosphorus, and potassium. Some readers will criticize this book not for what it is, but for what it is not. The lack of treatment of the trace elements in a book of this title will be disappointing to research workers in this field. Others may wish for a discussion of ion-exchange equations, or for a special treatment of the process of ion accumulation by roots.