ly helpful to the nonspecialist. The topics in part 1 include stochastic processes, independence and dependence, and three main results—martingale convergence theorem, stationarity theorem, and infinite decomposability theorem. Queries, including a number of unsolved problems, challenge the reader. Part 2 discusses stochastic structures, index spaces, abstract sample spaces, extensions (of sample spaces), and probability spaces. There are queries in this part as well.

The final article, "Random integrals of differential equations" by J. Kampé de Fériet, is in two parts, together with a short introduction. The first part includes statistical mechanics of holonomic systems, stochastic differential equations, transition probability and diffusion equations, and semigroups and infinitely divisible laws. The second has sections on statistical theory of turbulence, Burgers model, abstract Cauchy problem, and spatial homogeneity. This part appealed to me and served to emphasize what the author pointed out in the introduction—that, although the mathematical theory had its motivation in physics, the problems are becoming more and more abstract every day.

On simply reading the articles, I find that I cannot completely agree that the series was an outstanding success, although I am unable, of course, to judge how successful the actual lectures were. Many of the authors seem to have an exaggerated idea of how much a nonspecialist knows (or should know), and I certainly found out how little I know about some areas of mathematics. The authors fulfilled the purpose of the series in delineating a substantial research area and describing it broadly and comprehensively, but this sometimes led to a wealth of detail almost impossible to assimilate. I think a better approach would have been to select one particular problem in an area which illustrated the many ideas needed to tackle it. (This is what some of the authors did.)

In spite of this (perhaps unjustified) criticism, I must congratulate the cosponsors on the publication of the lectures. I feel sure that, at some later date when my inferiority complex is less acute, I shall find it a pleasure to return to many of the topics discussed in this series.

R. D. JAMES
*Department of Mathematics, University of British Columbia*

## Space Science and Technology

**Space Radio Science. Progress in Radio Science Series.** vol. 8. Fourteenth General Assembly of URSI (Tokyo, Japan), September 1963. Ken-Ichi Maeda and Samuel Silver, Eds. Elsevier, New York, 1965. viii + 235 pp. Illus. $13.50.

This is the eighth and final volume of a series containing the scientific presentations at the Fourteenth General Assembly of the International Scientific Radio Union held in September 1963 at Tokyo, Japan. This volume contains five papers presented at the session on space radio research and five papers on satellite communications systems presented before Commission VII (Radio Electronics). The advertising on the dust jacket states somewhat extravagantly that this volume includes discussion of all major aspects of space science and technology, whereas in fact the coverage is very incomplete and variable in the detail that is included.

Two major contributions constitute well over half the book. The first, by R. E. Bourdeau, J. H. Chapman, and K. Maeda, is on ionospheric research by means of rockets and satellites. This includes a concise description of the ionosphere and instruments for making ionospheric measurements in satellites and rockets. Although necessarily brief, it covers a broad span of subject matter and has many references. The second major contribution, by H. F. Weaver and S. Silver, is on the subject of planetary research in the millimeter and infrared regions of the spectrum. This paper, which also has many references, reviews the capabilities for planetary investigations by infrared and microwave observations. It also summarizes the results of measurements on the moon, Venus, and Jupiter.

The remaining contributions include a very brief introductory statement by S. Silver, a survey of the tests with the first active communications satellites (primarily Telstar) by E. F. O'Neil, and a brief discussion of data processing and its relation to communications from deep-space experiments by S. W. Golomb. There is a review of satellite communication devices by J. R. Pierce, which also includes the problems of components in active satellites. L. Jaffe presents a brief commentary on, or sequel to, Pierce's paper. There is only an abstract of H. A. Rosen's contribution on altitude, orbit, and antenna control for spinning satellites. J. C. Simon presents a brief, 3-page discussion, in French, on switched antenna arrays in satellites as a substitute for mechanical stabilization of directive antennas. Finally, W. E. Morrow, Jr., discusses long-range communications by orbiting dipole belts, including the West Ford experiment.

This volume will be of interest to a very small audience. Taken together with the seven other volumes of the series, it provides, at a rather high price, an account of the scientific presentations at the assembly.

F. S. JOHNSON
*Earth and Planetary Sciences Laboratory, Southwest Center for Advanced Studies, Dallas, Texas*

## Descriptive Plant Ecology

**Forest and Savanna.** An introduction to tropical plant ecology. Brian Hopkins. Heinemann, London, 1965. xii + 100 pp. Illus. 18s.

Part of the problem in writing an ecology textbook is that the examples chosen cannot be equally relevant in all parts of the world. A highly regional work will have such a limited potential sale that publishers will not handle it; they demand a wider market. The present volume, which partially satisfies the needs of undergraduate students in tropical Africa, gives the impression of having been written for Nigeria, with subsequent substitution of "West Africa" wherever possible. For example, some first-class work and an excellent bibliography (which is truly West African) are not called to the attention of students by the omission of reference to certain chapters (on vegetation, pedology, geology, and related topics) in *Agriculture and Land Use in Ghana* (1962), edited by J. B. Wills, which was also produced with the student in mind.

Plant ecology is presented in Hopkins' book in an uncomplicated manner. Semantic arguments that so bedevil adult ecologists are not allowed to complicate the presentation to academic adolescents—so the chapter entitled "The scope of ecology" is only two pages in length. The West African environment is described in terms of its

main physical features, and the modern concept of the soil and vegetation catena is introduced and illustrated.

The chapter entitled "Forest" includes neat descriptions of structure and physiognomy (including Raunkiaer's lifeforms), climatic peculiarities, and floristic composition. A similar treatment is given to savannas in another chapter. The two make up the vast bulk of West African vegetation.

Human effects on the forest, universal and dramatic as they are in West Africa, merit description in another chapter, "The relationship between forest and savanna." Finally, appendices give, in simplified form, descriptions of modern techniques of vegetation analysis and suggestions for student projects.

Through this pioneering little book, West African students will be introduced to the descriptive side of the study of vegetation. They will still need an introduction to the physiological, genetical, and evolutionary aspects of tropical ecology. But this is a start.

H. G. BAKER

*Botany Department,*
*University of California, Berkeley*

## Medical Technology

**Manual for the Identification of Medical Bacteria.** S. T. Cowan and K. J. Steel. Cambridge University Press, New York, 1965. x + 217 pp. $9.50.

The heart of this manual consists of 21 tables of cultural characteristics that have practical use in identifying various species of 43 bacterial genera. The species included are those whose strains are most likely to be found in association with tissues, secretions, and habitats of man or animals. Bacterial or closely allied groups of importance to medical bacteriologists that are *not* included are *Mycoplasma*, spirochetes, bedsoniae, and rickettsiae.

In compiling the tables, the authors tried to do minimal injury to existing classifications and to avoid creating any new names. They found large gaps in published works, and their own data are, in many instances, the only source of information. The features used in the tables can be determined in nonspecialized (routine) laboratories with a minimum of reagents, apparatus, and highly trained personnel. Omitted are methods of identification that require the use of fluorescence or electron microscopy as well as methods of serotyping (except for streptococci) and bacteriophage typing.

In addition to the tables, the manual contains useful appendices on the preparation of culture media, reagents, and stains; methods of performing the tests; and micromethods; approximately 600 references are provided. Classification, nomenclature, identification, and unsolved problems in bacterial taxonomy are discussed. Although methods of isolating cultures from natural sources are not described, the authors stress the importance of obtaining pure cultures before attempts at identification are made. They observe that the main source of impure cultures is the use of media containing substances that inhibit, but do not kill, unwanted contaminants.

The tests contained in the tables are mainly of a physiological nature; little emphasis is placed on colonial morphology because this will vary with the medium employed and is seldom sufficiently characteristic to be diagnostic. I quote with pleasure: "Thus the reader will not find in this *Manual* diagrams of the different shapes, edges, surfaces, and elevation of colonies . . . the elimination of these relics of 19th century bacteriology makes unnecessary a glossary of descriptive terms that now have but limited use."

In summary, this manual should serve its intended purpose: to assist technologists in medical, veterinary, and public health laboratories as well as students in diagnostic bacteriology who have isolated a bacterial culture and who wish to identify it at the species level.

EUGENE D. WEINBERG

*Indiana University,*
*Bloomington, Indiana*

## Linear Discrete Systems

**Discrete-Time Systems: An Introduction to the Theory.** Herbert Freeman. Wiley, New York, 1965. xiv + 241 pp. Illus. $10

At a time when most engineering textbooks on linear systems have a drab tendency to uniformity of content and when so many writers compete in saying the same old thing in what seems to them to be a better way, this is a refreshing little book. It should be pointed out that this is a book on *linear* discrete systems—that is, on systems best described by linear difference equations—rather than one predominantly devoted to sampled-data systems and z-transform analysis. The book is well conceived and well written, and the material covered is well chosen. It would make an excellent textbook for a one-semester introductory course on linear discrete systems. One could possibly level two criticisms at this book—(i) that it is occasionally imprecise in its mathematics and (ii) that it is somewhat superficial. However, neither of these defects substantially impairs its usefulness as an elementary textbook.

Let us now take a short look at the contents. In the first chapter the reader is introduced to the concepts of state, linearity, operators, system equivalence, controllability, and observability. I venture the opinion that this is not only the first but also the worst chapter in the book. It is too imprecise and too inaccurate to be of much value. However, once past this hurdle, the author settles down in the second chapter to a clear exposition of elementary aspects of scalar and vector difference equations, weighting sequences, formulation of state equations, and so on. The next chapter is on transformation calculus and presents elementary z-transform theory. Then the author goes on to a very interesting chapter on sampling of continuous functions, in which he gives a very clear exposition of the Shannon sampling theorem and a few extensions. Chapter 5 is devoted to interpolation and extrapolation, and the author discusses, in a very elementary way, polynomial interpolation, Newton-Gregory extrapolation, and zero-order, first-order, and second-order extrapolation. This part of the chapter is particularly interesting because of the way it dovetails with the next two chapters on sampled-data systems in which zero-order, first-order, and second-order holds are discussed. The chapters on the sampled-data systems contain standard elementary material, with the exception of the introduction of Liapunov functions in the section on stability analysis, which treats both input-output as well as Liapunov stability. The author completes the book with a short chapter on discrete stochastic processes in which he concentrates on discrete-state systems.

E. POLAK

*Department of Electrical Engineering,*
*University of California, Berkeley*