tion geophysics. Advanced texts treat such topics as the earth's gravitational field, satellite geodesy, and elastic wave propagation. To proceed from one to the other and to the journal literature normally requires a detour through mathematical physics.

Interpretation Theory in Applied Geophysics (McGraw-Hill, New York, 1965. 603 pp., $17.50), an excellent and important volume by two Canadian geophysicists, F. S. Grant and G. F. West, attempts to bridge the gap. Grant and West propose to supply the essential material from mathematical physics in a concise form, and to relate this material to the physical measurements obtained in geophysical exploration. One may question whether they have succeeded in materially reducing the mathematical demands on the readers, but they have compressed a tremendous amount of information into a volume of some 600 pages.

The subject matter of geophysical exploration is treated under three headings: seismology, gravity and magnetism, and electromagnetic conduction and induction. Each section is complete in itself and each receives equal space. This division of subject matter is a natural one because the mathematics can be developed from the Helmholtz, Laplace, and diffusion equations respectively. Each of the 18 chapters is preceded by a useful summary of its contents and its relationship to other chapters.

Within each section, the authors have attempted to provide an introductory chapter for perspective, one or more chapters to develop the underlying mathematics, and several chapters to show the use of these results in interpreting physical measurements in terms of geological structure. Relatively little attention is given to measurement techniques, instrumentation, field procedure, or corrections.

The section on seismology treats elastic wave propagation in uniform and nonuniform media, plane and spherical waves in layered media, surface wave dispersion, seismic ray theory, and many other topics. Tensors, contour integration, and other such mathematical tools are used where needed. Individual topics are treated competently, but the overall impression is one of too many scattered items treated too briefly. Despite such chapter titles as "Analysis of seismic records" and "Seismic interpretation," the would-be interpreter will find that much of the discussion is of a peripheral nature.

The second section develops potential theory for use in the interpretation of gravity and magnetic measurements. Detailed interpretation procedures, some presented here for the first time, are based on geological models such as sheets, cylinders, or blocks. Emphasis is given to identifying characteristic features of the anomalies as a basis for interpretation.

The section on electrical conduction and induction disposes of the former in a brief but fairly advanced discussion. A chapter somewhat misleadingly titled "Electromagnetic theory" precedes an excellent, thorough, and partly original discussion of induction effects in geological structures. Characteristic features of the anomaly curves are again emphasized as interpretational tools.

The book is directed to advanced students and professional exploration geophysicists. Certain portions will interest earthquake seismologists, geologists, hydrologists, geodesists, oceanographers, and radio engineers.

This volume will immediately take its place as a basic text and reference in solid-earth geophysics.

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Botany

K. R. Sporne's new pocket-sized book, **The Morphology of Gymnosperms** (Hutchinson, London; Hillary House, New York, 1965. 216 pp., $3), is the first comprehensive treatment of gymnosperm morphology since Chamberlain's *Gymnosperms: Structure and Evolution* (1934). In the meantime many important discoveries have been made, especially in paleobotany and embryogeny, and these have considerably altered some of our notions about evolution and relationships within the gymnosperm complex.

Ten of the 12 chapters treat the nine orders—Pteriodospermales, Bennettitales, Pentoxylales, Cycadales, Cordaitales, Coniferales, Taxales, Ginkgoales, and Gnetales—that the author recognizes. These are distributed among the three classes Cycadopsida, Coniferopsida, and Gnetopsida, but no divisional taxon is named. On page 18 Sporne explains that, because many regard the group as representing an evolutionary level rather than a formal taxon, he prefers to use the common noun "gymnosperms" rather than "Gymnospermae." This alludes, of course, to the naked seeds, which they all possess in common, and leaves open the possibility of polyphyletic origin. However, on page 196, he says that "the evidence which is available at the moment seems to favour the view that the gymnosperms are monophyletic."

Each chapter begins with a formalized diagnosis of the order that it treats. Families are listed under some of the orders, and in the case of several of the families the genera are named. For most of the taxa, whether order, family, or genus, pertinent facts are cited concerning habit, distribution, anatomy, reproductive morphology, embryogeny, and affinities. Chromosome numbers are given where known.

The book is well written in a readable and understandable style. It is illustrated only with drawings, taken mostly from other sources. Although small, the drawings are well made, suitably grouped, and clearly reproduced. An excellent bibliography of 230 entries is appended, and the index is complete. Factual and typographical errors are few. There are some passages, however, that may be a bit puzzling at first—for example, the statement that the genus *Libocedrus* has five species confined to New Zealand and New Caledonia (p. 145). Sporne does not explain that the incense cedar of Oregon and California was transferred to the genus *Calocedrus* many years ago. For the most part controversial matters are impartially dealt with, and arguments for both sides are usually given. Sometimes the author expresses his preference, sometimes he does not.

It is a good book to possess, and constitutes suitable reading for students at all levels.

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General Anthropology

For the past decade mathematicians and engineers have found their exclusive preserve—the computing center—more and more violated by strangers of dubious credentials from other sides of the campus. Social scientists and

even humanists now boldly assert their rights to time on the computer. The presence on the campus of a machine with the sorting, listing, and mathematical ability of more graduate assistants than one could ever dream of has served as an irresistible attraction to researchers in many disciplines. The achievement of critical mass has, typically, resulted in the organization of a conference to discuss the applicability of the computer to the subject area (the humanists, for example, have held about half a dozen).

The Use of Computers in Anthropology (Mouton, The Hague, Netherlands, 1965. 558 pp.), edited by Dell H. Hymes, is the result of a conference held at Burg Wartenstein, Austria, during June 1962, as the 18th in the program of summer symposia sponsored by the Wenner-Gren Foundation for Anthropological Research.

Issued as volume 2 of the series Studies in General Anthropology, this book is a collection of 18 papers dealing in general with (i) the structure of the computer and computer use (articles 1 to 6) and (ii) with special research areas (articles 7 to 18). The introduction by Dell Hymes is a thoughtful discussion of the likely impact of computers on anthropological research. Hymes sees the computer as a means of heightening the quality of work in anthropology by forcing "increased attention by anthropologists to two things: the logic and practice of quantitative and qualitative analysis, and the forms of cooperation and integration needed to make our stores of data systematic, comparable, accessible to each other and to theory."

The first of the six papers in Section 1, "An anthropologist's introduction to the computer," by Sydney M. Lamb and A. Kimball Romney, discusses the availability of computers and gives some examples of application to anthropology. The second part of the article is a clear and simple explanation of the structure and operation of the digital computer. J. C. Gardin, in "A typology of computer uses in anthropology," presents a classification of the different uses of computers in anthropology based on the kind of data and the nature of operation involved. Paul L. Garvin, in "Computer processing and cultural data: Problems of method," considers the preparation necessary for computer processing (a section which could be profitably read by those who are contemplating using a computer for the first time) and the processing of textual and nontextual data. "Computers and the storage and retrieval of anthropological information," by Robert Bruce Inverarity, is a broad-brush and elementary treatment of the problem of the proliferation of information and of possible aids towards its solution. In "Linguistic data processing," Sydney M. Lamb provides an excellent survey of the major processes used in computational linguistics—from the most elementary, for example, concordance making, to the most complex, for example, machine translation, knowledge retrieval, and the like. The chief values of Wilhelm Milke's brief "Statistical processing" are its inventory of available programs for routine statistical processing and its useful and extensive bibliography.

The first subsection of the second section, "Text-Oriented," contains four papers. Roy Wisbey, in "Computers and lexicography," describes how computers have been and are being used to provide lexicographical aids to the literary scholar and gives a brief account of his own work in preparing an index to the Middle High German *Wiener Genesis*. Pierre Guiraud, in "Diacritical and statistical models for languages in relation to the computer," argues that the essential task of the linguist is the construction of models and that the computer is the tool which will allow him to "check, rectify, and go beyond his hypotheses." "The computer as a tool in folklore research," by Thomas A. Sebeok, presents the methods used in a computer-aided analysis of approximately 1200 Cheremis folksong texts. Colette Piault's "A methodological investigation of content analysis using electronic computers for data processing" describes an experimental method of content analysis of questionnaires dealing with the relations between foreigners (French nationals) and natives (Ashanti), as well as the modes of integration of the former in Ghana.

"Classification and Grouping," the second subsection, begins with Harold E. Driver's "Survey of numerical classification in anthropology," a brilliant and well organized paper. This concise and excellent 34-page survey, which deals with classification in bioanthropology, archeology, linguistics, and ethnology, with its list of more than 200 references, is a model of what a survey should be. Obviously, Driver's contribution could serve well as an introduction to numerical classification in these four areas. R. M. Needham's "Computer methods for classification and grouping" describes clump theory, as developed at the Cambridge Language Research Unit for information retrieval, and its application to an experiment in ethnological grouping. Peter Ihm, in "Automatic classification in anthropology," reviews the principal methods of different workers in classification research and describes the point clustering method developed by Schnell and himself. "Reconstructing an economic network in the Ancient East with the aid of a computer," by J. C. Gardin, shows some of the problems encountered in an attempt to reconstruct an economic network of Assyro-Cappadocian commerce based on the records contained in hundreds of clay tablets dating from some 2000 years before the Christian era.

In the last subsection, "Experimental Papers," David G. Hay's "Simulation: An introduction for anthropologists" covers the nature, *desiderata*, and applications of the techniques of simulation. "The computer as a tool for theory development," by John T. Gullahorn and Jeanne E. Gullahorn, presents the state of social theory and the contribution of the computer to theory development and gives an account of a computer model, HOMUNCULUS, of social exchange. "Request-answer interaction in relation to man-computer interaction," by Robert Pagès, is intended to show how the computer intervenes in a natural and essential way as an element of man-machine interaction within a theoretical and methodological perspective in the *sciences humaines*. Most of Silvio Ceccato's "Suggestions for anthropology: The machine which observes and describes" is taken up with the development of a "Talking Automaton" at the Centro di Cibernetica e di Attività Linguistiche.

Appendix A lists the participants and the papers prepared for the conference. Appendix B presents a number of short accounts of some current uses of the computer in anthropology. The editor has provided a list of section headings at the beginning of each article and excellent summaries of six of the discussions.

This book will be of interest and value primarily to anthropologists, linguists, and others who wish to utilize the computer for research by helping them to understand the capabilities and

limitations of, and the demands made by, the computer. Both the individual and his discipline will benefit from such an understanding.

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Serological Research Methods

The practical and theoretical discipline of immunology and immunochemistry has developed at a bewildering rate, and all fields of biological and medical research are being influenced by the advances. As a result, many rigorous and sophisticated serological methods have been introduced in recent years, and several general guides to such methods, their applications and limitations, have hit the stands in the last five years. Of the four guides that come to mind the authors or editors have wisely recognized their limitations and have confined their efforts to tasks of less monumental scope than has J. B. Kwapinski, the author of this book.

Basically, **Methods of Serological Research** (Wiley, New York, 1966. 541 pp., $18.50) is a review of the literature. There are more than 2200 bibliographic references (less than 10 percent are more recent than 1960; nearly 20 percent are pre-1940) servicing about 400 pages of text and 350 "methods." There are several tables illustrating protocols, flow-sheets for bacterial fractionation, or summarizing the bibliography on a particular subject. There are no figures, however, even to illustrate visual methods such as hemagglutination, flocculation, and diffusion reactions in gels, or to demonstrate the plotting and analyzing of data derived from quantitative techniques.

The descriptions of procedures are sometimes adequate to follow as given but these satisfactory descriptions are rare and deal primarily with the author's own methods or with those that are obviously familiar to him. Understandably, these are concerned largely with methods in microbial serology toward which the book is heavily weighted. Other descriptions may be presented in principle only or with greatly telescoped and sometimes cryptic stepwise directions. Often a method, considered by many to be important in immunological research, is only mentioned. Some have escaped any treatment even when the general topic has been assigned one of the 17 chapters. An example is the barest allusion to equilibrium dialysis as "a useful method," giving a 1932 reference.

Omissions, however, are an author's prerogative; indeed, Kwapinski would have done well to omit a hundred or so other methods if that would have permitted him to treat in more detail some methods which are still in use or which have been fully developed more recently. Another serious risk in condensing methodology is that incomplete scraps of data out of the research context are often meaningless or, even worse, misleading. This context is frequently lacking even in those sections that are otherwise well presented. The bibliographic references intended to provide the context and guide to applications were apparently selected with more homage to chronological priority than to useful technical content. This, in turn, has introduced some serious omissions—and some glaring errors even in the author's text.

The amount of work that has gone into this book should not go unnoticed, however, and in spite of the foregoing it has its indisputable virtues. As a comprehensive guide to the early literature it excels; and it does provide an almost complete list of serological reactions.

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New Books

Biological and Medical Sciences

Ability Structure and Subgroups in Mental Retardation. Johs. Clausen. Spartan Books, Washington, D.C., 1966. 216 pp. Illus. $10.

Advances in Botanical Research. vol. 2. R. D. Preston, Ed. Academic Press, New York, 1965. 394 pp. Illus. $12. Six papers: "Some phyletic implications of flagellar structure in plants" by I. Manton; "Fundamental problems in numerical taxonomy" by W. T. Williams and M. B. Dale; "Ultrastructure of the wall in growing cells and its relation to the direction of the growth" by P. A. Roelofsen; "The protein component of primary cell walls" by Derek T. A. Lamport; "Embryology in relation to physiology and genetics" by P. Maheshwari and N. S. Rangaswamy; and "The soft rot fungi: Their mode of action and significance in the degradation of wood" by John Levy.

Advances in Carbohydrate Chemistry. vol. 20. Melville L. Wolfrom, Ed. Academic Press, New York, 1965. 565 pp. Illus. $18.50. Nine papers: "Chemical and physical studies of cyclitols containing four or five hydroxyl groups" by G. E. McCasland; "Unsaturated sugars" by R. J. Ferrier; "Chemistry of osazones" by Hassan El Khadem; "Sulfates of the simple sugars" by J. R. Turvey; "Cyclic acetals of the aldoses and aldosides" by A. N. de Belder; "Reactions of amino sugars with *beta*-dicarbonyl compounds" by F. García González and A. Gómez Sánchez; "Naturally occurring *C*-glycosyl compounds" by L. J. Haynes; "Phenol-carbohydrate derivatives in higher plants" by J. B. Pridham; and "Wood hemicelluloses: part II" by T. E. Timell.

Advances in Heterocyclic Chemistry. vol. 5. A. R. Katritzky, Ed. Academic Press, New York, 1965. 411 pp. Illus. $16. Six papers: "Electronic structure of heterocyclic sulfur compounds" by R. Zahradník; "Theoretical studies of physico-chemical properties and reactivity of azines" by R. Zahradník and J. Koutecky; "1,2,4-thiadiazoles" by Frederick Kurzer; "The aminochromes" by R. A. Heacock; "Aromatic quinolizines" by B. S. Thyagarajan; and "Advances in pyrrolizidine chemistry" by N. K. Kochetkov and A. M. Likhosherstov.

Advances in Marine Biology. vol. 3. Sir Frederick S. Russell, Ed. Academic Press, New York, 1965. 412 pp. Illus. $13.50. Four papers: "Learning by marine invertebrates" by M. J. Wells; "Effects of heated effluents upon marine and estuarine organisms" by E. Naylor; "Aspects of the biology of the seaweeds of economic importance" by A. D. Boney; and "Marine toxins and venomous and poisonous marine animals" by Findlay E. Russell.

Atlas of Developmental Anatomy of the Face. Bertram S. Kraus, Hironori Kitamura, and Ralph A. Latham. Harper and Row, New York, 1966. 392 pp. Illus. $20.

Basic Arthropodan Stock: With Special Reference to Insects. A. G. Sharov. Pergamon, New York, 1966. 283 pp. Illus. $12.50. International Series of Monographs in Pure and Applied Biology.

The Biochemistry of Animal Development. vol. 1, *Descriptive Biochemistry of Animal Development*. Rudolf Weber, Ed. Academic Press, New York, 1965. 662 pp. Illus. $23. Nine papers: "Chemical constitution and metabolic activities of animal eggs" by J. Williams; "Biochemical aspects of fertilization" by Alberto Monroy; "Morphogenetic significance of biochemical patterns in sea urchin embryos" by Tryggve Gustafson; "Morphogenetic significance of biochemical patterns in mosaic embryos" by J. R. Collier; "Biochemical patterns in early developmental stages of vertebrates" by E. M. Deuchar; "Enzyme development in relation to functional differentiation" by Florence Moog; "Development of nonenzymatic proteins in relation to functional differentiation" by J. B. Solomon; "Biochemical mechanism of information transfer" by Matthys Staehelin; "Informational molecules and embryonic development" by Philip Grant; and an introduction on "The history of chemical embryology" by J. Brachet.

Control of Macromolecular Synthesis: A Study of DNA, RNA, and Protein Synthesis in Bacteria. Ole Maaløe and Niels Ole Kjeldgaard. Benjamin, New York, 1966. 296 pp. Illus. $12.50. Microbial and Molecular Biology Series, edited by Bernard D. Davis.