

his ascribing of Spemann's "organisers" to Joseph Needham (page 64). In such an undertaking there are bound to be a few errors.

"To ignore the time dimension of any problem," says the author, "is to risk misunderstanding it. Particularly is this so if, as with regard to Pain, it involves neglect of the keenest and most brilliant thinkers the world has known." The history and thought on pain has been laid out before us, ably and well, in a book which all biologists and clinicians will find valuable as a means of increasing their understanding of this fascinating problem, perhaps justifying the author's hope that they will find there seeds worthy of germination.

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Vector Spaces and Matrices. Robert M. Thrall and Leonard Tornheim. Wiley, New York; Chapman & Hall, London, 1957. xii + 318 pp. \$6.75.

Starting with the text by Birkhoff and MacLane in 1942, we have seen a steady succession of books designed to replace the traditional "theory of equations" course with one that presents portions of modern algebra at a level suitable for undergraduates. Some authors have centered on the notions of group and ring; others have elected to develop the basic concepts of finite dimensional linear spaces. All are motivated by the need to place this material at an earlier stage in the training of mathematicians, physicists, engineers, and behavioral scientists.

The present book belongs in the second category. In the first seven chapters (195 pages), the reader will find a detailed treatment of finite dimensional vector spaces over a field, and their associated linear transformations. Matrices appear as representations of transformations, under a specific choice of basis. The relations of equivalence and similarity for matrices are given brief treatments, with the latter confined for the moment to the case of distinct eigenvalues. Bilinear and quadratic forms are introduced, and the usual classification theorems for symmetric matrices are obtained. Determinants appear in chapter 3, defined by induction on the order; later, in chapter 6, they are characterized in the usual way as special multilinear functions. Chapter 4 contains a treatment of the solution theory for systems of linear equations.

The remaining four chapters (112 pages) take up some topics not usually regarded as suitable for an undergrad-

uate course. There is an excellent treatment of the polynomial ring $F[x]$ over a field F and of the theory of simple algebraic extensions of F , presented as quotient rings of $F[x]$. This is used to discuss matrix algebras with entries in a ring and some of the simpler properties of vector spaces (modules) over a ring; for this discussion the ring of integers and $F[x]$ are chiefly used. Here also is to be found the general study of similarity for matrices with nondistinct eigenvalues, as well as many additional topics. Finally, the last chapter contains a terse account of some of the basic existence theorems for linear inequalities, with applications to linear programming and game theory.

The authors have produced a competent and comprehensive book; one who studies it with care, and masters the extensive collection of exercises, will emerge with an excellent command of the classical techniques of matrix theory and some appreciation of the more abstract approach. An instructor, however, might do well to examine several other books in this area before selecting this as the text for an undergraduate course. The pace is uneven; for example, in the space of several short paragraphs (page 61), one meets the concepts of group, ring, and algebra. Some key aspects of modern algebra, elementary in nature, are noticeable by their absence; in chapter 8, devoted to ring theory, the term *homomorphism* is used only in connection with a linear transformation (page 32), and no general connection is made later when ideals are introduced (page 205). Nevertheless, for a more advanced reader who already has some knowledge of the elements of algebra, the book will provide a detailed introduction to the classical matrix theory, out of which so much of the recent development in algebra has sprung.

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Phenazines. G. A. Swan and D. G. I. Felton. Interscience, New York, 1957. xix + 693 pp. \$22.50.

This volume deals with the chemistry of phenazine (9,10-diazaanthracene) and its derivatives (by G. A. Swan of Kings College) and with the condensed mono- and polybenzophenazines and their derivatives (by D. G. I. Felton of the British-American Tobacco Company, Ltd.). These are treated essentially in the order in which they appear in Patterson and Capell's *Ring Index*.

Several dyestuffs of considerable commercial importance, such as the safranines, indulines, nigrosines, aniline black, and indanthrones, fall into this series,

but the treatment is not one especially designed for a dye chemist but one adapted to the needs of any organic chemist interested in investigating these particular types. This is not a compilation of every such compound known, but it does make frequent use of tables to summarize many examples of a certain group. The text is documented with over 2000 references and has a section of addenda, including 145 references, which covers the literature through most of 1956.

This volume does an excellent job of reviewing this field thoroughly and expertly. The authors are to be congratulated on the service they have rendered. The formulas and tables are beautifully presented, and I have nothing but praise for the resulting product, which maintains the over-all high quality of the Weissberger series.

This is a very specialized book and a fairly high-priced one. Few will want it for their private use, but it should be a required addition to any technical library of organic chemistry.

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Advances in Electronics and Electron Physics. vol. IX. L. Marton, Ed. Academic Press, New York, 1957. x + 347 pp. Illus. \$9.

Volume IX of *Advances in Electronics and Electron Physics* represents a drastic, though temporary, change from the earlier volumes, being devoted entirely to geophysics. According to the editor: "In this volume, we have two aims: one is to help acquaint geophysicists and their allies with some of the modern methods at their disposal; and the other, to acquaint workers in electronics with the very interesting problems posed by geophysicists." After reading the volume, however, one is likely to conclude that the editorial aims and the contents are in only very partial agreement.

This is not meant to imply that the contents are not informative or interesting, for they are. But a geophysicist concerned with instrumentation, for example, will find it stressed in only two of the articles: "Electronics in oceanography" (J. B. Hersey) and "Contributions of electronics to seismology and geomagnetism" (B. S. Melton). On the other hand, a worker in electronics looking for interesting geophysical problems will find them primarily in the article "Aurora borealis" (C. T. Elvey) and in the article on oceanography already mentioned. Both of these, but especially the latter, will appeal to many readers.

The remaining articles are good re-

views that will appeal to the specialist rather than expositions for more general consumption. More or less in order of increasing specialization, they are: "Radio observation of meteors" (J. A. Davies), "Intensity variations in cosmic rays" (D. C. Rose), "Radio-wave propagation" (R. L. Smith and D. C. Rose), and "Negative ions" (L. M. Branscomb).

Now some concluding comments: A volume organized around a single theme can certainly play a most useful role. But, in my opinion, the results would be much more valuable for the regular subscribers to these volumes if the theme remained within the area normally covered. Cross-fertilization is an admirable goal, but it might be better for all concerned to leave this task to the several excellent publications that are exclusively devoted to it.

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An Introduction to Automatic Digital Computers. R. K. Livesley. Cambridge University Press, New York, 1957. viii + 53 pp. Illus. + plates. \$1.75.

This book provides a first, quick look at the digital computer, so that an engineer or scientist can make a rough appraisal of the value of using one in his work. The reader is expected to have no specialized knowledge of the field.

The emphasis is on the applications that can be made of an automatic digital computer and on what a person does in order to use it. The question of what is inside the machine is treated only to the extent necessary to provide enough background information to make the rest of the book intelligible to a scientifically inclined person.

In the first 13 pages the reader learns to program a simplified stored-program machine. This chapter can be merely read and it will seem plausible; but if the reader goes through the examples in detail and works the suggested exercises, he will learn what a stored program really is. It is well known that programming is learned best by doing rather than by reading. However, the more casual reader will find that he does not have to do the exercises in order to understand the rest of the book.

The next chapter treats input, output, and storage of numbers, so that one gets a rather good idea of how it is possible for a machine to do the things discussed elsewhere in the book. Then the subject of programming is considered in a qualitative, over-all way. Finally there is a discussion of what problems have been solved by machines, and of future prospects.

The principal shortcoming of the book

is that the author does not seem to realize how good our modern machines really are, how bright the prospects for the future seem, and how deep an understanding of programming has been gained. This can probably be explained by the fact that he has been associated with the rather small machine at Manchester University rather than with the hundreds of much more powerful machines now in operation in the United States. The book is based on a set of lectures that were designed to acquaint people with this machine and with the general subject.

For example, he says, "... machine-produced programs take longer to run and use more storage space than the equivalent human product. . . . It does not seem likely . . . that machines will ever be able to carry out the broader aspects of programme design." However, modern automatic programming techniques often produce a better program than even very good human programmers, unless the human beings spend an uneconomical amount of time on the project. We have already done what Livesley predicts will never happen.

Then he says, "... the speed of a computer is 100 to 500 times that of a human being equipped with a desk calculator." There are hundreds of installed machines with a speed of 10,000 to 50,000 times that of a human being with a desk calculator. In the engineering stage are machines that are 100 to 1000 times again as fast.

With the exception of the overly conservative appraisal of achievements and prospects, the book is excellent, and it deserves to be read.

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New Books

Naven. A survey of the problems suggested by a composite picture of the culture of a New Guinea tribe drawn from three points of view. Gregory Bateson. Stanford University Press, Stanford, Calif., ed. 2, 1958. 331 pp. \$6.

Russia, the Atom and the West. George F. Kennan. Harper, New York, 1958. 125 pp. \$2.50.

Psychotropic Drugs. S. Garattini and V. Ghetti, Eds. Elsevier, Amsterdam, 1957 (order from Van Nostrand, Princeton, N.J.). 620 pp. \$19.50.

An Introduction to the Theory of Random Signals and Noise. Wilbur B. Davenport, Jr., and William L. Root. McGraw-Hill, New York, 1958. 402 pp. \$10.

The Physical Chemistry of Electrolytic Solutions. Herbert S. Harned and Benton B. Owen. Reinhold, New York; Chapman & Hall, London, ed. 3, 1958. 836 pp. \$20.

A Guide to Archaeological Field Methods. Robert F. Heizer. National Press, Palo Alto, Calif., ed. 3, 1958. 171 pp. \$5.

Annual Review of Entomology. vol. 3. Edward A. Steinhaus and Ray F. Smith, Eds. Annual Reviews, Palo Alto, Calif., 1958. 526 pp. \$7.

General Geology Laboratory Workbook. Physical geology and historical geology. Geology Department Teaching Staff, University of Texas. Samuel P. Ellison, Jr., Ed. Harper, New York, 1958. 295 pp. \$3.75.

College Plane Geometry. Edwin M. Hemmerling. Wiley, New York; Chapman & Hall, London, 1958. 319 pp. \$4.95.

Alcohol and the Jews. A cultural study of drinking and sobriety. Charles R. Snyder. Yale Center of Alcohol Studies, New Haven, and Free Press, Glencoe, Ill., 1958. 226 pp. \$5.

A Primer for Coronary Patients. Robert J. Needles and Edith M. Stoney. Appleton-Century-Crofts, New York, 1958. 191 pp. \$3.75.

Types of Graphic Representation of the Periodic System of Chemical Elements. Edward G. Mazurs. The Author, La Grange, Ill., 1957. 158 pp.

Aids to Public Health. Llywelyn Roberts. Baillière, Tindall & Cox, London, ed. 8, 1957 (order from Williams & Wilkins, Baltimore). 343 pp. \$3.

The Threshold of Space. The Proceedings of the conference on chemical aeronomy. M. Zelikoff, Ed. Pergamon Press, New York and London, 1957. 353 pp. \$15.

Mechanical Resolution of Linguistic Problems. Andrew D. Booth, L. Brandwood, J. P. Cleave. Academic Press, New York; Butterworths, London, 1958. 313 pp. \$9.80.

The Development of Titrimetric Analysis till 1806. E. Rancke Madsen. Gads, Copenhagen, Denmark, 1958. 238 pp. Kr. 20.

Elements of Water Supply and Waste-Water Disposal. Gordon Maskew Fair and John Charles Geyer. Wiley, New York; Chapman & Hall, London, 1958. 622 pp. \$8.95.

Observation and Interpretation. A symposium of philosophers and physicists. Proceedings of the ninth symposium of the Colston Research Society held in the University of Bristol, 1-4 Apr. 1957. S. Körner, Ed. Academic Press, New York; Butterworths, London, 1957. 232 pp. \$8.

Toeplitz Forms and Their Applications. Ulf Grenander and Gabor Szegő. University of California Press, Berkeley, 1958. 252 pp. \$6.

Chemistry Problems in Jet Propulsion. S. S. Penner. Pergamon, New York and London, 1957. 408 pp. \$12.50.

Basic Feedback Control System Design. C. J. Savant, Jr. McGraw-Hill, New York, 1958. 434 pp. \$9.50.

National Symposium on Vacuum Technology Transactions, 1956. 10-12 Oct. Hotel Sheraton, Chicago, Ill. Edmond S. Perry and John N. Durant, Eds. Pergamon Press, New York and London. 234 pp. \$12.50.

Reaching Delinquents Through Reading. Melvin Roman. Thomas, Springfield, Ill., 1957. 140 pp. \$4.50.

Principles of Economic Policy. Kenneth E. Boulding. Prentice-Hall, Englewood Cliffs, N.J., 1958. 448 pp. \$7.95.