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 undergraduate 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-