mination from a Lissajous figure. The table of symbols furnished shows only minor variations from nomenclature common in this country. The index appears to be complete. It should be noted that all units are in the cgs system.

The author has achieved his objective in a workman-like manner, considering the space used, 296 pages. The discussions are clear, the numerous diagrams are well executed, and the mathematics used is well within the grasp of anyone who has had a college course in calculus.

For the engineer or plant executive who wishes to gain familiarity with the general field of vibrations, this is an excellent first book. For the serious worker in the field or for the prospective teacher of a college-level course in vibrations, the treatment would have to be amplified by material from other sources, since much of the treatment is descriptive rather than analytic. In general, it is a review of many aspects of the field rather than a textbook on the subject.

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Condensed Pyridazine and Pyrazine Rings. Cinnolines, Phthalazines, and Quinoxalines. J. C. E. Simpson. Interscience, New York–London, 1953. xvi + 394 pp. Illus. $12.50.

The advancement of science is highly dependent on the accurate classification of scientific data. Accordingly, much appreciation should be felt for the accomplishments of those who labor at the often unrewarding task of gathering and classifying chemical knowledge.

This book is the fifth volume published in a series of monographs devoted to the field of heterocylic chemistry. It is indeed lamentable that the capable author of this work passed away before publication time. Simpson died on 7 Feb. 1952, at a time when his manuscript was being set in type.

Dealing with the chemistry of condensed pyridazine and pyrazine rings, the subject matter of the book is divided into three distinct parts: cinnolines, phthalazines (both formed by fusion of pyridazine and aromatic rings), and quinoxalines (formed by the fusion of pyrazine and aromatic rings). As stated by the author

> . . . this book has been written with the objective of ensuring continuity with, and expansion from, Meyer-Jacobson's *Lehrbuch der organischen Chemie,* Volume II, 3, and in order to avoid the creation of possible gaps the literature has been fully covered from 1917 up to the end of 1948. Adequate reference is also made to the 1949 literature, and in many instances details of compounds there described have been included in the tables.

In all, 9, 14, and 16 chapters are devoted to cinnolines, phthalazines, and quinoxalines, respectively. Where adequate information is to be found in the literature, the subject matter of each chapter is organized in sections devoted to methods of preparation, properties, and reactions. Much of the material is presented in convenient tables listing for each compound: preparation, melting point, general remarks of chemical and physical character, and references to the original literature. Appendixes give data on the ultraviolet absorption spectra, basic strengths, and antibacterial-parasiticidal activities of various compounds.

The text is well prepared and the binding is excellent. As a reference, the book should be welcomed by all who are interested in the complex and difficult field of heterocyclic organic chemistry.

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Annual Review of Nuclear Science, vol. 3. James G. Beckerley *et al.,* Eds. Annual Reviews, Stanford, Calif., 1953. 412 pp. Illus. $7.

Probably no one, certainly not the undersigned, can claim honestly and critically to review this book. The subjects of three full-page charts will make the reason clear: one shows the cross section for photoproduction of pi mesons from protons, over the whole energy range, including the quasi resonance at around 300 Mev; one, the time-scale for events in radiation chemistry, from the molecular transit of a fast primary electron to the reaction time of free radicals in water; and the third, the frequency of production of specific abnormalities in the development of mice, as a function of the amount and timing of the x-ray dose to the embryo. Nuclear science is broadly seen by the editors!

The editors and publishers deserve high praise for the production of such a volume of expert essays, with a good index and a set of more than 2000 references, in a time of only some 7 months between the latest citations and general availability of the book—moreover, one in serviceable letterpress typography.

One can group the 15 articles into three or four broad categories. Two authoritative articles, surprisingly up to date in such a volatile field, deal with "fundamental particle physics." Three Columbia experts present a succinct résumé of theory and experiment in the area of pion-nucleon interaction, and Leprince-Ringuet summarizes the situation of the "strange particles" of cosmic rays, as of late last summer (including the new nomenclature). Both of these pieces, particularly the first, can be highly recommended to students.

Three pieces concern themselves with nuclear physics of the more or less "classical" kind. Corson and Hanson review the interactions of photons and electrons, especially at energies from 10 or 20 Mev up. Hughes recounts the subtle and powerful technique of neutron optics and presents a useful up to date summary of coherent amplitudes for just about 100 nuclear targets. Wattenberg tells how neutron measurements have been made absolute, to a precision of about 4 percent.

There are articles on techniques of measurement in two distinct fields: one on the use of photographic emulsions in studying ionizing particles, and one on techniques of element separation in radiochemistry. The former, by Goldschmidt-Clermont, seems to carry much quantitative detail.

The last large category, about 40 percent of the book, deals with the relationships of nuclei and their radiations with more complex systems, from molecules to the bodies of men. One article (by Yankwich) discusses the effects of stable isotopes on the rate and equilibria of chemical reactions, emphasizing carbon and hydrogen. Two deal with radiation chemistry proper; one of these, by Magee, forms an excellent introduction to the general mechanisms involved, while the other, by Willard, is more specifically experimental and summarizes hot-atom chemistry at a more detailed level. Marinelli has a gem of a short piece on dosimetry, pinned to the present physical unit of dose, the erg/gram. Four pieces are devoted to radiobiology, and include a detailed résumé of results concerning the effects of various radiations on the cellular level, on the embryos of vertebrates from fish to man, on specific vertebrate tissues, including the generation of tumors, and last, an unforgettable piece by Hempelmann and Hoffman called rather ironically "Practical aspects of radiation injury."

In this last, the authors dryly and aseptically detail mainly the acute effects of radiation on mankind. Here one can read of the cataracts and the leukemia that followed the Japanese wartime epidemic of fatal radiation injury and of the poor microcephalic children exposed to the bombs *in utero*. The severe hand burns from some 10,000 roentgens to the skin from fission-fragment beta decays, received by five men in tests in Eniwetok, are described. Late effects are discussed, although not much is said about long-time low-level exposure. Workers with radiation ought to read this chapter, to understand the need for precautions. Indeed, since most of the data have been found by study of the victims of deliberate or accidental chain reactions, the chapter is worth study by every technically trained city-dweller, nuclear physicist or not. The table of doses to reactor victims will repay imaginative reading. Perhaps it will help translate the 75 disintegrations per second per milligram counted in sodium from the blood serum of case 3 if a few words remind the reader that this disintegration of the living blood is two orders of magnitude faster than that of the hottest sodium samples made with the usual laboratory radium source. It may help make clear the wider meaning of nuclear science in our times if I go on to say what the authors leave out: that the warm dark red radioactive sample, drawn from the veins of a man who was outwardly robust yet already swiftly dying, was that of my friend and colleague, the gentle, skillful physicist, Louis Slotin. He remains so far the last man on earth to have died from acute radiation injury.

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New Books

Radiation Biology. vol. I, *High Energy Radiation,* pts. I and II. Alexander Hollaender, Ed. McGraw-Hill, New York–London, 1954. ix + 1265 pp. Illus. $17.50.

College Textbook of Physics. Arthur L. Kimball. Rev. by Alan T. Waterman. Holt, New York, ed. 6, 1954. xii + 942 pp. Illus. $7.95.

The Compleat Strategyst. Being a primer on the theory of games of strategy. J. D. Williams. McGraw-Hill, New York–London, 1954. xiii + 234 pp. Illus. $4.75.

Geography of North America. George J. Miller, Almon E. Parkins, and Bert Hudgins. Wiley, New York and Chapman & Hall, London, ed. 3, 1954. xi + 664 pp. Illus. $7.50.

New Biology, No. 16. M. L. Johnson, Michael Abercrombie, and G. E. Fogg, Eds. Penguin Books, Baltimore, 1954. 135 pp. Illus. + plates. Paper, $0.50.

Wave Motion and Vibration Theory. Proc. of Symposium in Applied Mathematics of the American Mathematical Society. vol. V. Albert E. Heins, Ed. McGraw-Hill, New York–London, 1954. v + 169 pp. Illus. $7.

Aerodynamics. Selected topics in the light of their historical development. Theodore von Karman. Cornell Univ. Press, Ithaca, N.Y., 1954. ix + 203 pp. Illus. $4.75.

Physics of Experimental Method. H. J. J. Braddick. Wiley, New York, 1954. xx + 404 pp. Illus. $7.

Representative Chordates. A manual of comparative anatomy. Charles K. Weichert. McGraw-Hill, New York–London, 1954. vii + 204 pp. Illus. $3.50.

Ethics. P. H. Nowell-Smith. Penguin Books, Baltimore, 1954. 324 pp. Paper, $0.85.

Vegetable Tanning Materials. F. N. Howes. Chronica Botanica, Waltham, Mass.; Butterworths, London, 1953. xi + 325 pp. Illus. $5.50.

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Economic Geography. Clarence Fielden Jones and Gordon Gerald Darkenwald. Macmillan, New York, rev. ed., 1954. xxv + 612 pp. Illus. $6.75.

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Introduction to Psychiatry. O. Spurgeon English and Stuart M. Finch. Norton, New York, 1954. viii + 621 pp. $7.

Dictionary of European History. William S. Roeder, Ed. Philosophical Library, New York, 1954. viii + 316 pp. $6.

Endemic Goiter. The adaptation of man to iodine deficiency. John B. Stanbury *et al.* Harvard Univ. Press, Cambridge, 1954. xii + 209 pp. Illus. $4.

Dreams and Nightmares. J. A. Hadfield. Penguin Books, Baltimore, 1954. xi + 244 pp. Paper, $0.65.

Molecular Theory of Gases and Liquids. Joseph O. Hirschfelder, Charles F. Curtiss, and R. Byron Bird. Wiley, New York; Chapman & Hall, London, 1954. xxvi + 1219 pp. Illus. $20.

The Judgment of History. Marie Collins Swabey. Philosophical Library, New York, 1954. x + 257 pp. $3.75.

Industrial Stoichiometry. Chemical calculations of manufacturing processes. Warren K. Lewis, Arthur H. Radasch, and H. Clay Lewis. McGraw-Hill, New York–London, ed. 2, 1954. xi + 429 pp. Illus. $7.50.

George Davidson: Pioneer West Coast Scientist. Oscar Lewis. Univ. of California Press, Berkeley; Cambridge Univ. Press, London, 1954. viii + 146 pp. + plates. $3.50.