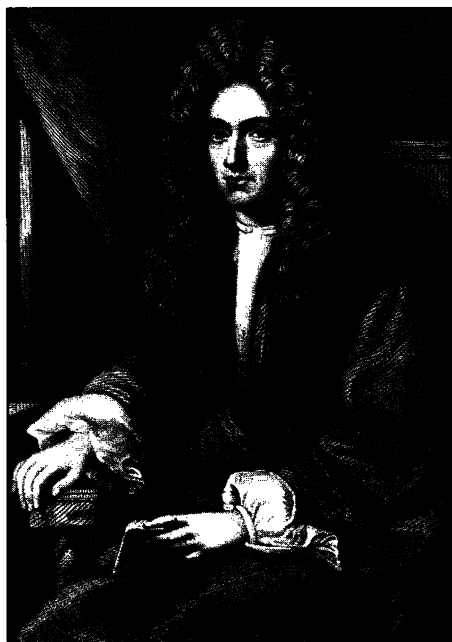




Robert Boyle, skeptical chemist. [Mary Evans Picture Library/Photo Researchers, Inc.]

views of Lawes and Gilbert. Above all, Fruton repeats his well-known view that the development of biochemistry owed more to techniques than to ideas. That the role of craftsmanship has been undervalued is now being recognized by historians of science. Both biochemistry and organic chemistry offer ample evidence for its historical importance.

As for historians of science themselves, Fruton's observations will be greeted with a mixture of puzzlement, annoyance, and delight. I confess my response to be in the last category. Deprecating some early criticisms of Partington's monumental *History of Chemistry* for its overwhelmingly factual content, Fruton berates the critics for inconsistency (they do the same thing themselves), for "opportunistic pandering" to a wider audience, and for simply not knowing enough science. His prescription for good history of biochemistry will not please everyone:

A detailed knowledge of the present state of these areas of scientific inquiry is, in my view, indispensable for the understanding of the past, and the counsel to historians of science that the less they know about the present, the better their perception of the past, is therefore misguided.

Fruton's latest book is a shining demonstration of that thesis and should be read by scientists and historians of science alike.

Colin A. Russell

Department of History of Science and
Technology,

The Open University,
Milton Keynes MK7 6AA, United Kingdom

Grains in Space

Dust in the Galactic Environment. D. C. B. WHITTET. Institute of Physics, Philadelphia, 1992 (distributor, American Institute of Physics, New York), xii, 295 pp., illus. \$95; paper, \$39. Graduate Series in Astronomy.

Interstellar dust, composed of submicron particles between the stars, has a huge influence on the properties of interstellar matter and on the galaxies themselves. By radiating efficiently in the far infrared, it provides a means by which dense molecular clouds can rid themselves of gravitational energy and collapse further, eventually forming stars. Dust is the site of molecule formation within the clouds, certainly of H_2 and possibly of others that are observed (contrary to theoretical expectations) by radio astronomers. Warmed by starlight, it is the source of a substantial fraction of the total energy radiated by the Galaxy per second.

Much is known about the properties of dust, such as the wavelength-dependence of its extinction (scattering plus absorption) and polarization, and some of the implications thereof. This book clearly describes the relevant observations and theories. In addition, there are several mysteries, based upon apparently conflicting (and certainly puzzling) data, with appeal to physicists, chemists, and astronomers. For instance, the only spectral feature in the ultraviolet extinction law (down to about 100 nm) is a very strong resonance at 217.5 nm. It is almost, but not quite, at a fixed wavelength among various lines of sight but has a highly variable width. This feature is so strong that the abundant element carbon is almost surely responsible for it, but there is no agreement about the form of the carbon. There are aromatic rings present (judging from infrared emission bands), but individual molecular species have strong ultraviolet absorptions that are not seen.

Another major mystery is the origin of the optical "diffuse interstellar bands," over 100 spectral features spanning a wide range of widths and strengths. The first were discovered in 1922 and recognized in 1934 as interstellar. The bands are still completely unidentified, even as to whether they arise from impurities within the solid dust grains or from molecules in the gas phase (there are good reasons against either hypothesis). Their properties present a fascinating puzzle.

The book discusses well the origin and evolution of grains, both of which are subjects of considerable controversy. Grains of at least two distinct chemical compositions (depending upon whether carbon or oxygen

has the larger number density when condensation occurs) are injected into the interstellar medium from a variety of stellar sources. Chemical modification of grains within the interstellar medium is very interesting because the chemical and physical state of grain surfaces (highly processed by radiation, cosmic rays, and interstellar shock waves and sometimes possessing mantles of various ices) is quite conjectural. There is a major discrepancy in our understanding of grain destruction: according to reasonable theoretical estimates, grains within the interstellar medium should be returned to the gas phase rather quickly because of the severe buffeting they receive from the occasional violently expanding supernova shell. Observations, however, show that almost all of certain elements is contained in the grains. Whittet takes the best approach, which is to trust observations of molecular species in clouds, meteoritic abundances, and spectra whenever possible.

The book is aimed at an advanced-undergraduate or beginning-graduate level. It presents several points of view on various subjects and discusses the strengths and weaknesses of each, instead of dwelling upon the theories currently favored by a majority of workers in the field. There is a very complete list of references to the original literature. The necessary astronomical background is given in the first chapter.

I recommend this book to workers in a variety of fields involving the interactions of solids and gases under conditions that are not encountered in our laboratories. The author presents the relevant observations, with theories as useful frameworks for interpretation. He is not at all shy about pointing out gaps in our knowledge and weaknesses in our interpretation, and the reader learns much in the process.

John S. Mathis

Department of Astronomy,
University of Wisconsin,
Madison, WI 53706

ET and Company

Organic Superconductors (Including Fullerenes). Synthesis, Structure, Properties, and Theory. JACK M. WILLIAMS, JOHN R. FERRARO, ROBERT J. THORN, K. DOUGLAS CARLSON, URS GEISER, HAU H. WANG, ARAVINDA M. KINI, and MYUNG-HWAN WHANGBO. Prentice-Hall, Englewood Cliffs, NJ, 1992. xvi, 400 pp., illus. \$66. Inorganic and Organometallic Chemistry Series.

This work attempts to cover what is described by the series editor, Russell N.

Grimes, as "the burgeoning area of organic superconducting materials." These remarkable substances become superconducting at temperatures ranging from below 1 K to as high as 45 K. The major focus of the book is on the series of charge transfer salts, largely related to bis(ethylenedithio)tetrathiofulvalene, colloquially known as ET, within which the highest superconducting transition temperature is below 13 K. The fullerenes, which have much higher transition temperatures, are included in the title but are a late addition to the book, confined to a brief appendix.

In contrast to the implication of the series editor's comment, the total number of known organic superconductors is in fact rather small, there currently being fewer than 40, of which more than half contain ET as the donor and most of the remainder have donors that are closely related to ET. For the reader interested in this special class of compounds, the synthesis, structure, and properties of all these materials are given in exhaustive detail. The synthetic and experimental methods for the preparation of the compounds and crystals are well described, and stereo views of and crystallographic data for most of the compounds are included. More than 120 of the 400 pages are devoted to references; many of the physical properties of prototypical compounds are tabulated; and previously published experimental measurements of the electron spin resonance, vibrational, and optical spectra of these compounds are presented. In all, the book is a valuable compendium of the organic superconductors known at the time of publication.

The authors state clearly that the book focuses on the chemical aspects of the organic superconductors, and this is abundantly evident in the text. Indeed, they trace the origin of organic metals to 1911 to the work of McCoy and Moore, who studied amalgams of substituted ammonium ions. This early work focused on the chemical similarities between such organic moieties and the elemental alkali metals; and though such physical properties as crystallinity, metallic luster, and electrical conductivity were discussed, no conductivity measurements were reported. In a strange twist, the authors then go on to credit the discovery of the first organic superconductor in 1981 as the realization of "the most speculative suggestions of McCoy and Moore." I believe this is historically incorrect. I could find no such speculation in the McCoy and Moore paper and, indeed, this paper even predates Onnes's discovery of superconductivity.

Granted the omission of the physics of the materials, the perspective of the book is narrower still. In the preface, for example, it is stated that "only superconductive or-

ganic materials that can be synthesized in the laboratory are discussed." Surely this is an overstatement. I believe the authors really mean that only those materials that have been synthesized and found to be superconducting are discussed. For these, they do provide a comprehensive overview. But they do not go beyond these compounds. They draw little insight from what has been learned. No lead is given as to what other classes of organic compounds might become superconducting, or what other areas of organic chemistry might be of potential interest to the field. As a result the book fails to capture the excitement that has characterized the field for several decades.

I believe it was Akamatu, one of the pioneers of organic semiconductors, who stressed that the term "organic" as applied to conductive compounds means more than simply that the compounds are composed of carbon. It reflects the ability of such molecules to be organized into a unified, organic whole. This is all the more important for organic superconductors where the macromolecular structure plays so important a role. We see little of this here, except in the last chapter. In this chapter an effort is made to give a theoretical treatment of the superconductivity from a chemical perspective and relate it to structure. This is refreshing, but it is a far cry from a theoretical treatment of the entire phenomenon that might be assumed from the book's title. Such a treatment would involve some of the most advanced concepts of condensed-matter physics, and this is not to be found in this book.

In summary, *Organic Superconductors* is a useful compendium of chemical and physical properties of the currently known organic superconductors written by a group of experts intimately involved in their study. It is of limited scope and narrow in its view but gives one a snapshot of the present status of this field.

W. A. Little

Department of Physics,
Stanford University,
Stanford, CA 94305

Books Received

Acoustic Systems in Biology. Neville H. Fletcher. Oxford University Press, New York, 1992. xiv, 333 pp., illus. \$65.

Acousto-Optic Devices. Principles, Design, and Applications. Jieping Xu and Robert Stroud. Wiley, New York, 1992. xviii, 652 pp., illus. \$69.95. Wiley Series in Pure and Applied Optics.

Acquired Immune Deficiency Syndrome. Biological, Medical, Social, and Legal Issues. Gerald J. Stine. Prentice-Hall, Englewood Cliffs, NJ, 1993. xxxii, 462 pp., illus. \$30.

Baikal. Sacred Sea of Siberia. Peter Matthiessen. Sierra Club, San Francisco, 1992. xvi, 91 pp., illus. \$25.

Basic Guide to Pesticides. Their Characteristics and Hazards. Shirley A. Briggs and the staff of the Rachel Carson Council. Hemisphere (Taylor and Francis), Bristol, PA, 1992. xviii, 285 pp., illus. \$39.50. Sierra Club, San Francisco, 1992. xvi, 91 pp., illus. \$25.

Calculus Using Mathematica. K. D. Stroyan. Preliminary ed. Academic Press, San Diego, CA, 1992. vi, 120 pp. + diskettes, illus. Spiral bound, \$24.95. Macintosh version.

Cannibalism. Ecology and Evolution among Diverse Taxa. Mark A. Elgar and Bernard J. Crespi, Eds. Oxford University Press, New York, 1992. viii, 361 pp., illus. \$75.

Data Communications Principles. Richard D. Gitlin, Jeremiah F. Hayes, and Stephen B. Weinstein. Plenum, New York, 1992. xx, 733 pp., illus. \$95. Applications of Communications Theory.

Data Fusion in Robotics and Machine Intelligence. Mongi A. Abidi and Rafael C. Gonzalez, Eds. Academic Press, San Diego, CA, 1992. xii, 546 pp., illus. \$59.95.

Encyclopedia of Marine Sciences. J. G. Baretta-Bekker, E. K. Duursma, and B. R. Kuipers, Eds. Springer-Verlag, New York, 1992. viii, 311 pp., illus. \$39.

The Energy-Environment Connection. Jack M. Hollander, Ed. Island Press, Washington, DC, 1992. xxix, 414 pp., illus. \$48; paper, \$25.

Food Engineering in a Computer Climate. Institution of Chemical Engineers, Rugby, U.K., and Hemisphere (Taylor and Francis), Bristol, PA, 1992. xiv, 532 pp., illus. \$150. From a symposium, Cambridge, U.K., March 1992.

Food Poisoning. Anthony T. Tu, Ed. Dekker, New York, 1992. xxvi, 624 pp., illus. \$185. Handbook of Natural Toxins, vol. 7.

Green Globe Yearbook 1992. An Independent Publication on Environment and Development from the Fridtjof Nansen Institute, Norway. Helge Ole Bergesen, Magnar Norderhaug, and Georg Parmann, Eds. Oxford University Press, New York, 1992. 303 pp., illus. \$45.

A Guide to Task Analysis. B. Kirwan and L. K. Ainsworth, Eds. Taylor and Francis, Philadelphia, 1992. xiv, 417 pp., illus. Paper, \$39.

The Hacker Crackdown. Law and Disorder on the Electronic Frontier. Bruce Sterling. Bantam, New York, 1992. xvi, 329 pp. \$22.50.

Handbook of Clinical Dietetics. American Dietetic Association. 2nd ed. Yale University Press, New Haven, CT, 1992. xii, 588 pp., illus. Paper, \$60.

International Approaches to Chemicals Control. A Historical Overview. Rune Lönngren. National Chemicals Inspectorate, Solna, Sweden, 1992. xii, 512 pp. \$80.

International Directory of Primatology. Wisconsin Regional Primate Research Center, Madison, WI, 1992. Unpaginated. Illus. Spiral bound, \$10.

Kingfishers. Bee-Eaters and Rollers. A Handbook. C. Hilary Fry and Kathie Fry. Princeton University Press, Princeton, NJ, 1992. xiv, 324 pp., illus. \$49.50.

Lectures on Kac-Moody Algebras. M. J. Bergvelt and A. P. E. ten Kroode. Centrum voor Wiskunde en Informatica, Amsterdam, 1992. viii, 97 pp. Paper, Dfl. 30. CWI Syllabus 30. Proceedings Seminar 1986-87.

Life Before Birth. The Moral and Legal Status of Embryos and Fetuses. Bonnie Steinbock. Oxford University Press, New York, 1992. x, 256 pp. \$29.95.

Life in Amber. George O. Poinar, Jr. Stanford University Press, Stanford, CA, 1992. xvi, 350 pp., illus., + plates. \$55.

Life, Death, and In Between. Tales of Clinical Neurology. Harold L. Klawans. Paragon House, New York, 1992. x, 270 pp. \$21.95.

Marine Pollution. R. B. Clark. 3rd ed. Oxford University Press, New York, 1992. xii, 172 pp., illus. \$75; paper, \$35.

Materials Modelling. From Theory to Technology. C. A. English *et al.*, Eds. Institute of Physics, Philadelphia, 1992 (distributor, American Institute of Physics, New York). xii, 225 pp., illus. \$96. From a symposium,