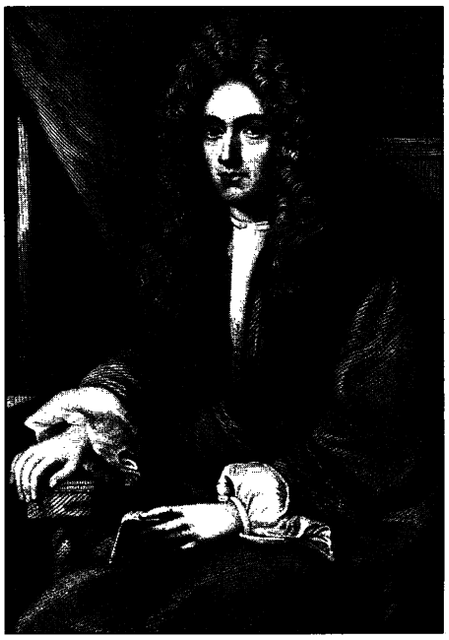

Robert Boyle, skeptical chemist. [Mary Evans Picture Library/Photo Researchers, Inc.]

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

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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.