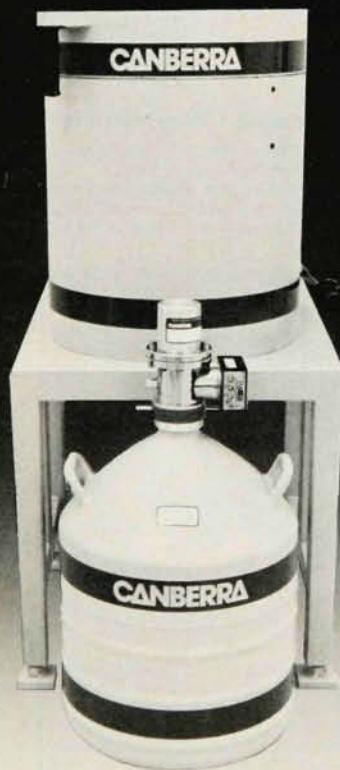


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applications, specifically solar cells.

The photovoltaic effect in molecular semiconductors was first detected a little before 1950. Since then a great deal of work has been done on molecular solar cells, mostly Schottky-type devices. Typically the conversion efficiency has been less than $10^{-2}\%$. The discovery in the late 1970s of a conversion efficiency for white light of about 1% for a merocyanine solar cell stimulated interest in this field. Despite all the work, as the authors detail, there still is little understanding of the physics and chemistry going on at the junctions, of the huge effects of exposure to air or even of how the current is carried.

In the effort to make the book useful to chemists as well as to physicists—both groups must be involved in the effort to tailor molecular materials to particular applications—the authors provide an introductory chapter on some of the requisite solid-state physics. The chapter includes discussions of electrical conduction, in terms both of band motion and of hopping and trapping processes. A second introductory chapter covers the various effects of light on molecular semiconductors, including a discussion of energy-migration mechanisms and the photogeneration of charge carriers. This chapter includes also the theory of p-n and Schottky junctions.

Acknowledging the impossibility of describing all the molecular semiconductors on which work has been done, the authors wisely devote one major section of the book to the detailed description of a group of "typical" molecular crystals, the metallophthalocyanines, and another major section to a "typical" polymer, polyacetylene. In each case they cover chemistry and physics in detail. They begin with the presentation of synthesis methods, describe the resulting structure and morphology, consider stability and effects of impurities, and go on to discuss light absorption, dark conduction, the photovoltaic effect and solar cells. In the case of polyacetylene they include also a discussion of band structure, soliton theory and the semiconductor-metal transition.

In the attempt to write for both physicists and chemists the authors have, as they admit, sacrificed rigor in the hope of providing a more intuitive understanding for the chemist. An example of this is their discussion of conductivity in the first chapter, where they ascribe scattering of band electrons in a metal to the cations. This unfortunate view is ultimately corrected on page 108, where they discuss phonons in more detail, distinguishing among acoustic, optical and internal modes and their effects on conductivity. But overall, although much of the

description of the basic processes is sketchy, the correct flavor is conveyed and the authors do give a large number of references—a useful feature of the book. It is unfortunate, however, that the cutoff date on the references is mid-1982; the discussion of polyacetylene, for example, suffers thereby.

Simon and André conclude that the ideal molecular semiconductor, as they have defined it, does not yet exist. As far as solar cells are concerned, the 1% efficiency of the merocyanine Schottky-barrier device is far inferior to the efficiency reported for single-crystal silicon solar cells (about 20%). However, in view of the possibility of covering large areas, and doing so cheaply, with a molecular material, it is clear that economics would tip the scale in favor of the molecular material at efficiencies well below 20%. This book should be quite useful for people engaged in the quest for the ideal molecular semiconductor, whether it results in a practical molecular solar cell or in material useful for other applications. Whatever the practical outcome, molecular crystals and polymers will be a source of interesting new physics and chemistry for many years to come.

ESTHER CONWELL
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Medical Physics, Volume III: Synapse, Neuron, Brain

Arthur C. Damask and Charles E. Swenberg

337 pp. Academic, New York, 1984. \$69.00

This book is the third and final volume of a series. The first volume, published in 1978, is subtitled *Physiological Physics, External Probes*. Volume II was published in 1981 and is subtitled *External Senses*.

The stated purpose of the series is threefold:

- ▶ to assemble a body of knowledge concerning the use of physics in medicine, as well as in physiology and biology
- ▶ to treat all topics at a common level, one that assumes that the reader has had one year each of physics and calculus
- ▶ to address those scientists and engineers who know very little of physiological processes.

Biochemical aspects are omitted except when they are related to a physical measurement. The books use primarily cgs units because the original papers referenced in the book are in those units. The authors "feel it will be easier to use as a reference book." However, the short (five-page) index is not very helpful. For example, neither "cortex" nor "event-related potential" is in the index.

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The physics of the body will still be largely an unknown territory when the mysteries of high-energy physics have been solved and their solutions have become common knowledge. The greatest mysteries will be in neurophysics. The volume reviewed here is aimed at this difficult area. As a result it is more descriptive than analytical. I would not recommend it as a text for a physics course. Other texts covering the same general area are *Neurophysics*, by Alwyn C. Scott (Wiley-Interscience, New York, 1977); *Electric Fields of the Brain: Neurophysics of EEG*, by Paul L. Nunez (Oxford U.P., New York, 1981); and *Studies of Mind and Brain*, by Stephen Grossberg (Kluwer, Hingham, Mass., 1982).

The typical medical physicist in the United States is immersed in the various applications of physics to radiology. Only Chapter 6, on new techniques for studying the brain, deals with topics in this conventional area. It describes the techniques of positron-emission tomography and nuclear magnetic-resonance imaging in detail. The modern technique of measuring magnetic signals from the brain, magnetoencephalography, is not even mentioned. Another chapter discusses noise theory in considerable detail but does not relate it to neurophysiological measurements of the brain.

A number of statements in the book are inaccurate or open to question. For example, the authors state that the human brain is convoluted because the skull failed to evolve to a size large enough to contain a smooth brain. The authors give no support for this statement and fail to consider that the convoluted brain may have advantages over a smooth brain. The authors state that an electroencephalogram can be recorded from a single electrode. Because an EEG always records a potential difference between two points on the skull, the reader has to assume that the reference electrode is ignored. The authors' statement that "brain surgery is now used only when the cause of the epilepsy, such as a tumor, must be removed for other reasons" is wrong. Neurosurgery for the treatment of epilepsy that does not respond to other therapy is now accepted practice.

Most of the chapters have about 50 references, but they are not always up to date. In the discussion of the diagnosis of optic neuritis using visual evoked potentials, only one dated reference, from 1972, is given. On the other hand, basic references to old work are sometimes omitted. In the fourth chapter, on chemical and electrical properties of synapses, there is no mention of the Hodgkin-Huxley model of the membrane potential!

The book appears not to have been reviewed by a neurophysiologist. For

example, the statement that there are six domains or lobes in the brain confuses the cortical with the brain-stem structures. The book also indicates that dendrites are passive and do not conduct action potentials, contrary to experimental evidence.

The text does not live up to its purposes, but it still could be a useful reference in a physics or medical library. The reader is cautioned not to believe everything he reads in it, however.

It is a rare department of neurology or neurophysiology that has a physicist on its faculty. Perhaps this book will encourage physicists to enter this important field. Unfortunately, there are probably few jobs waiting for such people.

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new books

Acoustics

Recent Advances in Aeroacoustics. Proc. Int. Symp., Stanford, Cal., August 1983. A. Krothapalli, C. A. Smith, eds. 511 pp. Springer-Verlag, New York, 1986. \$59.00

Astronomy, Cosmology and Space Physics

Astronomy and Astrophysics. M. S. Roberts, ed. 383 pp. AAAS, Washington, D. C., 1985. \$29.50 hardcover; \$17.95 paper. *Articles reprinted from Science*

Atoms of Silence: An Exploration of Cosmic Evolution. H. Reeves. 244 pp. MIT Press, Cambridge, Mass., 1985. \$8.95 paper. *Lay readers*

Build Your Own Telescope. R. Berry. 276 pp. Scribner's, New York, 1985. \$24.95

Cool Stars with Excesses of Heavy Elements. *Astrophysics and Space Science Library 114.* Proc. Colloq. Strasbourg, July 1984. M. Jaschek, P. C. Keenan, eds. 398 pp. Reidel, Boston, 1985. \$54.00

Galaxies, Quasars and Cosmology. *Advanced Series in Astrophysics and Cosmology 2.* Proc. Equatorial Sch., Bogota, February 1984. L. Z. Fang, R. Ruffini, eds. 221 pp. World Scientific, Singapore (US dist. Taylor and Francis, Philadelphia), 1985. \$26.00

Gravitational Physics of Stellar and Galactic Systems. W. C. Saslaw. 491 pp. Cambridge U.P., New York, 1985. \$90.00. *Monograph*

Infinite Vistas: New Tools for Astronomy. J. Cornell, J. Carr, eds. 302 pp. Scribner's, New York, 1985. \$18.95. *Compendium*

Radiotelescopes. Second edition. W. N. Christiansen, J. A. Hogbom. 265 pp. Cambridge U.P., New York, 1985. \$59.50. *Text*

Relativistic Astrophysics and Cosmology, Vol. 1. Proc. Sir Arthur Eddington