

acoustics of sound production and wave propagation, through the physiology of the ear, to the psychology of the perception of musical form. At the perception end of its purview, the world of musical acoustics must diffuse into its image-world of musical esthetics, the two together forming the musical experience.

The part of musical acoustics concerned with perception has a poor experimental basis at this time. The acoustical literature refers only occasionally, for example, to the Jamesian theory of the perception of the psychological present or its alternatives, or to the ability of a listener to discriminate between major and minor triads, both of which subdivide the fifth into a major and minor third.

On somewhat surer grounds are the subareas of physical acoustics, namely the study of vibration and sound, of overtones and scales, of auditoriums and instruments. It is to these fields that Backus restricts his attention. In his view, the acoustical foundations of music are the phenomena that occur before the music strikes the ear. In most of the subareas, the focus is on the Western musical experience: the scales are Western scales and the instruments are, in the main, the instruments of the Western symphony orchestra. The tunings of Javanese patets and the complexities of Indian ragas, the construction and tone of the *anklong* and *hichiriki* are outside the scope of this book.

The book covers essentially the same topics as have been covered in earlier books on "acoustics of music," similarly restricted. It is directed to non-specialists and should serve the non-technical reader well, whether he be composer, performer, or listener. The prose style is easygoing and the presentation is eminently transparent.

After a presentation of the theory of wave motion, the book discusses all too briefly the structure of the ear. The discussion of intensity and loudness is excellent. The section on tone quality, scales, tuning, and other such topics is classical but most readable, and will be of interest to the nonspecialist.

The second half of the book is concerned with the nature of Western musical instruments, the area of the author's own research. It is a clear and absorbing presentation of a large amount of often little-known information concerning the properties of these instruments in the mode in which they

produce sustained sound. The problems of attack and decay of instrumental sounds are not discussed significantly, although instrumental quality depends heavily on these properties. However, the discussion of the properties of sustained tones of Western instruments is fascinating and readable and will be of value to both the musical amateur and the professional.

L. KNOPOFF

*Institute of Ethnomusicology
and Department of Physics,
University of California, Los Angeles*

Nuclear Reactions

The Theory of Neutron Resonance Reactions. J. E. LYNN. Clarendon (Oxford University Press), New York, 1968. xiv + 504 pp., illus. \$16. International Series of Monographs on Physics.

Resonance phenomena are observed in all branches of physics. Study of them has proven especially fruitful in nuclear physics, and the theory of low energy neutron resonances as presented by Lynn is a reasonably complete and self-consistent subject. This book meets well its goal of unifying the treatment for experimentalists working in the field.

The time-honored and tested *R*-matrix formalism developed by Wigner and his students is emphasized from the outset. A highly condensed outline of the essential features of this framework is presented first, and then follows an even briefer summary of the Humblet and Rosenfeld *S*-matrix theory. We are indebted to Lynn for a very clear discussion of the relationship between these two quite different formalistic approaches to reaction theory. However, one must still labor through the earlier excellent review article on *R*-matrix theory by Lane and Thomas before one obtains sufficient skill for application to real problems. The original papers must be consulted on *S*-matrix theory.

A detailed treatment of the spacing and distribution of neutron resonances is contained in this book. This is the heart of the subject, and Lynn rightly devotes his considerable knowledge and talents to providing what is the most complete exposition available in a single volume. Large quantities of experimental data are correlated in a fashion that reinforces the physical concepts.

Low energy neutron reactions proceed primarily through the elastic scattering, radiative capture, and fission channels. Each of these is covered rather completely in a highly sophisticated and up-to-date manner. Again, the material is not suitable as a textbook but functions best as a handbook for research. The sections on elastic scattering and capture are particularly good illustrations of the high density of information that can be assembled by a true expert.

Although neutron fission is a very specialized topic, it certainly is relevant to neutron resonance phenomena. The discussion in this book, limited by space restrictions, is unusually good. Many of the threads of present-day nuclear theory are woven together in a manner which gives a better understanding of this complex problem.

HARVEY B. WILLARD

*Department of Physics, Case Western
Reserve University, Cleveland, Ohio*

Water and Aqueous Solutions

Hydrogen-Bonded Solvent Systems. Proceedings of a symposium, Newcastle upon Tyne, England, Jan. 1968. A. K. COVINGTON and P. JONES, Eds. Taylor and Francis, London, 1968. xvi + 356 pp., illus. \$14.50.

This volume comprises the papers presented at a symposium held to mark the retirement of Lord Wynne-Jones of Abergele as professor of physical chemistry at the University of Newcastle upon Tyne ("a sort of funeral ceremony," Wynne-Jones lightly remarks). The papers are grouped loosely around themes representing the research interests pursued by Wynne-Jones throughout his career, and by and large they fall within the scope of the title chosen for the collection as a whole.

The first 100 pages are taken up by five review papers, and these are followed by 18 shorter papers dealing with current work of their authors. Appropriately, the first and outstanding review is Walrafen's description of his investigations of the structure of water by Raman spectroscopy. Vibrational spectroscopy has long been considered crucial in deciding the fundamental and deceptively simple question of whether water is a homogeneous medium or a mixture of hydrogen-bonded molecular clusters in various states of aggregation. Walrafen's demonstration

that Raman spectra measured meticulously over a range of temperatures exhibit an isosbestic point and that the hydrogen bond energy evaluated from the temperature dependence of the absorption intensities is in agreement with independent estimates and measurements offers the most compelling recent support for the mixture model.

An important role in the increasing popularity of the view that water is a mixture has also been played by statistical calculations based on molecular models. In their article, Levine and Perram go some way toward redressing any imbalance by criticizing the partition function used by Némethy and Scheraga in their well-known calculations, and by questioning the sufficiency of Frank and Wen's concept of "cooperative hydrogen bonding" as the sole basis for the formation of compact hydrogen-bonded clusters. They suggest that a continuum model, such as Pople's, provides no less adequate grounds for interpreting the properties of water than do the mixture models.

Other papers deal largely with aqueous solutions and solvent mixtures. Bates reviews solvent effects on acid dissociation constants, and Hyne provides a useful introduction to recent measurements of activation parameters for solvolysis reactions in aqueous alcoholic solvents. Franks presents a general account of the effects of added solutes on the properties of water, and Symons and Blandamer offer as a case history the results of a combined application of a variety of spectroscopic and relaxation techniques to the investigation of mixtures of water with tertiary butyl alcohol. But, despite the wealth of evidence that different classes of solute enhance or diminish water "structure," the structural changes involved continue to resist precise definition, even in operational terms. Franks summarizes simple molecular interpretations of interactions between water and hydrophilic solutes, and Glew argues in favor of a clathrate model for hydrophobic structure-making, but the evidence tantalizingly lacks definitiveness.

Not surprisingly, this volume is something of a patchwork, and topics range from the thermodynamics of micelle formation to kinetic studies in H_2O - D_2O mixtures and hydrogen bonding in aqueous colloidal systems. It is in no sense an elementary introduction to its subject, and the breadth of its coverage makes it unlikely that its contents will be of uniform interest to a wide num-

ber of readers. Many, however, will wish to dip into articles here and there, and for those who desire seriously to come to grips with this important field it should prove an excellent source book, well illustrating the range of techniques and viewpoints adopted by chemists in the study of hydrogen bonding in water and its solutions.

The book is most handsomely produced and the inclusion of brief discussion sections adds freshness to its presentation.

R. A. MORE O'FERRALL

*Department of Chemistry,
Rice University, Houston, Texas*

Books Received

Advanced Heat Transfer. Lectures from a short course, Urbana, Ill., 1967. B. T. Chao, Ed. Published in cooperation with Engineering Publications Office, College of Engineering, by University of Illinois Press, Urbana, 1969. x + 462 pp., illus. \$12.50.

Aging Life Processes. Seymour Bakerman, Ed. Thomas, Springfield, Ill., 1969. xiv + 190 pp., illus. \$9.75. American Lecture Series, No. 729.

Algebra Simplified. Kaj L. Nielsen and Charlotte M. Gemmel. Barnes and Noble, New York, 1969. vi + 186 pp., illus. Paper, \$2.50. Keynotes 722.

Altered States of Consciousness. A Book of Readings. Charles T. Tart, Ed. Wiley, New York, 1969. x + 582 pp. \$9.95.

Analecta Medico-Historica. No. 4, Un Grand Médecin et Biologiste, Casimir-Joseph Davaine (1812-1882). Jean Théodorides. Pergamon, New York, 1968. 238 pp., illus. Paper, \$13.

Animal Life of Europe. The Naturalist's Reference Book. Jakob Graf. Translated from the German edition (Munich, 1961) by Pamela and Maurice Michael. Warne, New York, 1968. 596 pp., illus. + 16 plates. \$15.

Annuaire Climatologique pour 1967. Institut Royal Météorologique de Belgique, Uccle-Bruxelles, 1968. 206 pp., illus. Paper.

Biologie Générale. J. Trémolières. Vol. 1, Bases Physico-chimiques de la Biologie (ed. 2); xiv + 538 pp., illus.; paper, 39 F. Vol. 3, Physiologie du Milieu Intérieur et des Organes; xii + 360 pp., illus.; paper, 29 F. Vol. 4, Physiologie de la Nutrition et du Comportement Animal; xx + 512 pp., illus.; paper, 44 F. Dunod, Paris, 1969.

Block Copolymers. A symposium, Pasadena, Calif., 1967. J. Moacanin, G. Holden, and N. W. Tschoegl, Eds. Interscience (Wiley), New York, 1969. vi + 210 pp., illus. Paper, \$9. *Journal of Polymer Science*, Part C, Polymer Symposia, No. 26.

British Avonian (Carboniferous) Conodont Faunas, and Their Value in Local and Intercontinental Correlation. Frank Harold Trevor Rhodes, Ronald Leyshoun Austin, and Edric Charles Druce. British

Museum (Natural History), London, 1969. 316 pp., illus. + plates. Paper, £11. Bulletin of the British Museum (Natural History): Geology, Supplement 5.

Cactus-Feeding Insects and Mites. John Mann. Smithsonian Institution Press, Washington, D.C., 1969 (available from the Superintendent of Documents, Washington, D.C.). xii + 160 pp. + plates. Paper, \$1.25. U.S. National Museum Bulletin 256.

Calculus with Analytic Geometry. William K. Smith. Macmillan, New York; Collier-Macmillan, London, 1969. xvi + 912 pp., illus. \$12.95.

Carcinogenicity Testing. A Report of the Panel on Carcinogenicity of the Cancer Research Commission of the UICC. I. Berenblum, Ed. International Union Against Cancer, Geneva, 1969. viii + 58 pp. Paper, \$2.

Cetothere Skeletons from the Miocene Choptank Formation of Maryland and Virginia. Remington Kellogg. Smithsonian Institution Press, Washington, D.C., 1969 (available from Superintendent of Documents, Washington, D.C.). viii + 40 pp., illus. + 25 plates. Paper, \$1.50. U.S. National Museum Bulletin No. 294.

Chemical Zoology. Marcel Florkin and Bradley T. Scheer, Eds. Vol. 3, Echinodermata, Nematoda, and Acanthocephala. Academic Press, New York, 1969. xxii + 690 pp., illus. \$34.

Chemistry. A Brief Introduction. Mark M. Jones, John T. Netterville, David O. Johnston, and James L. Wood. Saunders, Philadelphia, 1969. xii + 356 pp., illus. \$9.50.

Chemistry. A Quantitative Approach. R. Nelson Smith. Ronald Press, New York, 1969. xvi + 640 pp., illus. \$10.50.

Child Development and Personality. Paul Henry Mussen, John Janeway Conger, and Jerome Kagan. Harper and Row, New York, ed. 3, 1969. xvi + 800 pp., illus. \$9.95. **Instructor's Manual.** Marshall M. Haith. iv + 72 pp. Paper.

Chromatographic and Electrophoretic Techniques. Ivor Smith, Ed. Vol. 1, Chromatography. Interscience (Wiley), New York, ed. 3, 1969. xx + 1084 pp., illus. \$24.

Clinical Psychology and Personality. The Selected Papers of George Kelly. Brendan Maher, Ed. Wiley, New York, 1969. x + 374 pp. \$8.95.

College Physical Science. Vaden W. Miles, G. Ray Sherwood, and Willard H. Parsons. Harper and Row, New York, ed. 2, 1969. xii + 532 pp., illus. \$9.95.

Common Edible Mushrooms. Clyde M. Christensen. University of Minnesota Press, Minneapolis, 1969. x + 126 pp., illus. + 4 plates. Cloth, \$4.50; paper, \$2.45. Reprint of the 1943 edition.

Computer Graphics. Techniques and Applications. An international symposium, Uxbridge, England, 1968. R. D. Parslow, R. W. Prowse, and R. Elliot Green, Eds. Plenum, New York, 1969. xvi + 250 pp., illus. \$16.

Cycles génitaux saisonniers de mammifères sauvages. Entretiens de Chizé, 1967. R. Canivenc, Ed. Masson, Paris, 1968. viii + 168 pp., illus. Paper, 46 F.

Data Extraction and Processing of Optical Images in the Medical and Biological Sciences. A conference, New York, 1967.

(Continued on page 834)