Books

A Contemporary Theory

Theory of Hearing. By Ernest Glen Wever. 484 pp. John Wiley and Sons, Inc., New York, 1949. $6.00.

In this day of preoccupation with information theory and with the role of the sense organs in the impedance-match of machine to man (or should we say man to machine?) a book with the title *Theory of Hearing* is assured of an eager public. Those who are familiar with Professor Wever's work know that he and his teammates have been among the most prolific contributors to the field of audition for the last two decades, i.e., ever since the discovery of the Wever-Bray phenomenon.

The present book extends, amplifies, summarizes, and crystallizes these researches by attempting to present them in the unifying framework of the volley theory. The book is subdivided into three main parts. After a guided tour through the history of the so-called *Classical Theories,* there follows a section on *Modern Developments,* which deals mainly with the audioelectric response of the cochlea and which culminates in an exposition of the volley principle of nerve action. The third and by far the largest part of the book is given over to the *Volley Theory.* The basic evidence in its favor is cited and its ability to account for certain facts of auditory experience is tested (here the critical reader might want to argue with the author for not assigning their due share to data that have become available during the last decade, in particular data on the mechanical properties of the ear and experiments making use of stimuli other than pure tones). The author feels that his theory, which on occasion he calls the volley-resonance theory in order to accent its dual character, represents the logical compromise between the two main explanatory principles for auditory phenomena. He is convinced that he has impartially called upon the resonance and frequency principles since "it is only in their harmonious combination that we come to a full realization of our explanatory purpose". Wever admits freely however that "there may still be a degree of uncertainty as to the particular spheres of operation of these principles . . ." So there is room for disagreement and some of Wever's colleagues will probably feel disinclined to subscribe to his particular formulation of the two principles and to the roles he assigns to them in his explanatory scheme.

But this is neither the place to discuss the details of Wever's presentation of his case nor the place to argue the merits of his particular form of a dual theory. In his introduction Wever warns us that his treatment is not exhaustive: evidence is selected, marshaled, and weighed in terms of relevance to theory. For the research worker in hearing, the main value of the book lies then in its coherent presentation of the work of the Wever group and in the systematic exposition of an admittedly controversial theoretical viewpoint. The nonspecialized reader will find in this book a highly readable account of *a* contemporary theory of hearing by a man whose stature in the field is universally recognized.

To this reviewer the book touches, however, upon an issue of more general interest in this model-conscious age. In his introduction Professor Wever states that he has "given little attention to mechanical models of the cochlea" and "little credence to mathematical formulations of theories". He feels that at present both types of models are quite as likely to confuse as to inform. This is a serious accusation that can hardly be shrugged off by physicists, applied mathematicians, and engineers whose interest in the ear transcends mere curiosity. Some of them might be inclined to retort that Professor Wever's treatment of mathematical and physical concepts is not always successful. But this leaves the central issue still wide open.

Too many writers of college physics texts (or of introductory texts in physiology and psychology for that matter) are satisfied with waving a harplike basilar membrane into their students' faces as a definitive explanation of the phenomena of hearing. We should therefore not blame Professor Wever for repeatedly slaying this bare-fact saddle-riding ghost of a resonance theory.

Many workers have contributed to progress in hearing in different ways. Psychologists and physiologists have had to learn how to handle physical instruments and concepts, and sometimes have even had to acquire competence in new mathematical techniques. The physical scientists have had to realize that no off-hand invocation of general laws or principles would yield valuable results without a first-hand understanding of the experimental realities of biological structures, or of behaving organisms. Neither group of scientific workers wants to mislead or confuse the other, and both groups are making use of formal—mathematical, physical or verbal—models or principles of some sort. We know that it is possible to transform a physiological model into a logically equivalent mathematical model. This, however, does by no means abolish preferences for certain types of models, preferences that will be determined by the Zeitgeist and one's own training. Everyone is by now agreed that problems in borderline areas can be successfully attacked from the vantage point of different disciplines. The usefulness of a model, and in particular of a radically new one, is easily enough measured in terms of its ability to account for a broad spectrum of experimental material. Out of the richness of his own experience Wever has come forth with what to him are the most valid generalizations on the sense of hearing. By sharing his knowledge with others, Wever is bound to act as a catalyst in the making of new models.

Walter A. Rosenblith
Harvard University

Biological Effect of Cosmic Rays

Cosmic Radiation and Its Biological Effects. By Victor F. Hess and Jakob Eugster. Second edition, revised and augmented. 173 pp. Fordham University, the Declan X. McMullen Company, Inc., Distributors, New York, 1949. $4.00.

This volume was originally published in German in 1940 under the title *Die Weltraumstrahlung und ihre biologische Wirkung,* Orell Fussli Verlag (Zurich-Leipzig). The book has now been partially rewritten and translated into English. It is an interesting document dedicated to the collaboration of the physicists and biologists.

The first part of the book was written by Hess and is a lucid and up-to-date (1948) presentation of the physics of cosmic radiation. There is an interesting chapter on the history of cosmic rays followed by essays on methods of measurement, the distribution of cosmic ray intensity in the atmosphere and below the earth's surface, and the interaction of cosmic rays with matter and the origin of cosmic rays.

The treatise is intended to serve as an introduction in the field of cosmic rays for those who have not had intensive background in physics and mathematics.

The second part of the book was written by Jakob Eugster. It contains a detailed description of experiments carried out by the author chiefly in the mountains of Austria and Switzerland. The aim is to assay the possible biological effects of cosmic radiation. These experiments were begun in the year 1931. Their description purports to show that cosmic radiation, particularly cosmic ray showers, has a demonstrable deleterious effect on a wide range of organisms including bacteria, plants, drosophila flies, mice, and cancer tumors. Because of the very low intensity of cosmic ray radiation, the experiments were difficult to perform. The observations had to be extended for a long period of time and were hard to interpret. One should admire and encourage the apparent unceasing efforts of the Swiss workers to attempt such experiments. Yet in spite of the meticulous and detailed effort on the part of the author to describe experimental details, one obtains a hesitancy and a certain amount of disappointment in reading this part of the book, chiefly for two reasons. First, extrapolating from practically all of the observations available on biological effects of artificial sources of radiation, the biological effect of cosmic rays at sea level should be almost negligibly small. Secondly, it has been pointed out by Delbruck, Timofeeff-Ressovsky, and others that the intensity of cosmic rays is so small that even theoretically the biological effects of cosmic rays are negligible in importance compared to the biological effects of other environmental agents to which organisms are exposed (e.g. temperature fluctuations, light, etc.).

In view of the above reasons, if cosmic rays have a significantly large biological effect one would expect such an effect to be due to a new, but as yet not well known, component of cosmic rays, or to a type of biological response to radiation that has not previously been proven. This explains the possible importance of experiments of this type. The authors claim to have observed some significant biological effects. In view of the great variability of biological material and of their sensitivity to minute environmental changes, the reader should accept and interpret such results with reserve and caution.

Cornelius A. Tobias
University of California

Briefly Noted

Particle and Quantum Detectors. By R. R. Wilson, D. R. Corson, and C. P. Baker. National Research Council, Washington 25, D. C. 1950.

Number 7 in the NRC Nuclear Science Series, this report contains sections on ionization, proportional, Geiger, and scintillation counters, and electron multipliers. Pulse shape, pulse time, electronic amplification, and similar characteristics and techniques are discussed for each type of detector. It is available without charge to active workers in the nuclear science field, and is one of a series being compiled by the Committee on Nuclear Science of the NRC's Division of Mathematical and Physical Sciences. It is planned to publish the complete work later as a handbook of nuclear instruments and techniques.

Prevention of Deterioration Abstracts. National Research Council, Washington 25, D. C. Yearly subscription, $50.00.

Approximately 2000 loose-leaf pages of abstracts of prevention of deterioration papers are published annually in monthly issues under the headings biological agents, electrical and electronic equipment, fungicides and other toxic compounds, lacquers, paints, and varnishes, leather, lubricants, metals, miscellaneous, optical instruments and photographic equipment, packaging and storage, plastics, resins, rubbers, and waves, textiles and cordage, and wood and paper. The subscription rate includes yearly subject and author indexes compiled from July through June, two sturdy binders, and index tabs. An advance list, a monthly bibliography of all reports received in this field, is available for $10.00 a year.

Subject Index to Volume 12 of Bibliography of Technical Reports. Office of Technical Services, Department of Commerce, Washington 25, D. C., 1950. $1.00.

Copies of the recently available Index to *Volume 12*, which gives the location of reports on any subject carried by the Bibliography in the period July–December 1949, are obtainable from the Office of Technical Services. Checks should be made payable to the Treasurer of the United States.

Thermistors as Tools in Research and Development. PB 100 655. 32 pp. $2.25 in microfilm, $5.00 in photostat.
Practical Limits of Speed Speech. PB 110 071. 24 pp. $2.00 in microfilm, $3.75 in photostat.
New Design of Metal to Ceramic Seals Compared with Former Designs. PB 100 731. 24 pp. $2.00 in microfilm, $3.75 in photostat.

The above three publications have been released to the public by the Air Force through the Office of Technical Services, U. S. Department of Commerce, and can be purchased from the Library of Congress Photoduplication Service, Washington 25, D. C. Checks or money orders should be payable to the Librarian of Congress.

A Functional Description of the EDVAC. 400 pp. Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., 1950. $9.00.

EDVAC, the electronic digital computer developed by the University of Pennsylvania for the Army Ordnance Department, is the subject of a report made available to the public by the Office of Technical Services of the Department of Commerce. General principles covered in the report include descriptions of the dispatcher, EDVAC control, computer, memory, reader-recorder, timer, power supply, and switchgear. It appears in two volumes plus an Errata Section. Orders should be addressed to the Moore School of Electrical Engineering, the University of Pennsylvania, Philadelphia 4, Pa., and *not* to O.T.S.

Liquid Metals Handbook. Editor-in-Chief, R. N. Lyon. 194 pp. Sponsored by Atomic Energy Commission, Office of Naval Research, and Navy Bureau of Ships. U. S. Government Printing Office, Washington, D. C., 1950. $1.25.

This book is a compilation of information on metals having sufficiently low melting points to become liquid within a few hundred degrees of room temperature. Although the *Handbook* will be of interest chiefly to reactor designers, the AEC has expressed the hope that its publication will encourage the use of liquid metals in other industrial applications and thereby increase the number of personnel trained to work in this relatively new field of technology.