

considered significant, viable and provocative in the field of epilepsy". With the diversity of topics and authors, no unifying concept could be anticipated, but at the present state of our understanding, this is probably a strength rather than a weakness. Inevitably, the treatment of the various subjects is uneven and perhaps the most serious criticism is that some of the authors did not, in fact, collate and synthesize modern knowledge in their areas, as charged. There is some drum-beating for favorite theories, even if these are not widely supported and the volume is, in consequence, somewhat lacking in that flavor of controversy which can be so stimulating and revealing. At the symposium itself there was some opportunity for free discussion and a number of significant disagreements among the assembled experts were aired, but these discussions have not been included in the monograph.

A number of the chapters are, indeed, detailed collations of available data with extensive and useful bibliographies, *e.g.*, Curtis cites 244 references, Tower, 220. Although the presentation of new data was not a primary objective, some of the contributors, particularly the discussants, do add new information of significance.

What emerges is a series of pictures, sometimes kaleidoscopic, which are a good representation of the state of the art, dynamic and vital and holding much promise. Not the least of the virtues of the monograph is the attempt on the part of many of the workers to define important areas in which our knowledge is seriously lacking, and the final chapter by Walker, called "A prospectus", looks to the future, outlining many significant problems for further investigation.

The volume is well prepared and edited and the organizers and editors are to be congratulated for their careful planning and the extraordinary effort that must have been required to produce such early publication. Study of this monograph should be a rewarding experience for anyone interested in the behavior of the brain.

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The human visual evoked response. — N. W. Perry and D. G. Childers. (C. C. Thomas, Springfield, Ill., 1969, 187 p., \$14.00).

This book does not fit readily into one of the usual pigeon-holes. It is oriented around an account of the authors' personal experiences with the technique of evoked response averaging as applied to human work with the visual system, but it incorporates a considerable amount of descriptive and pictorial material taken from the relevant literature as well. The items selected for inclusion reflect the authors' backgrounds in psychology and electrical engineering.

What the authors have assembled may not reassure the quizzical clinician that the visual evoked response technique can be applied profitably to the elucidation of patient

problems. Perhaps this is not its main intent, although a quick survey of the material covered—physiological significance of the visual evoked response, stimulation variables, subject variables, procedures and instrumentation for data acquisition, and analysis techniques—naturally leads to hope for a satisfying answer. Rather, the general approach underscores correctly the inherent complexity, not only of the physiological event itself, but also of the strategies required to bring it to the fore, to ascertain its true features and to endow it with substantive meaning. Recognition of the intricacies involved is expressed in concern about the pros and cons of various methodological maneuvers, a type of presentation, along with incomplete coverage in a number of instances, that might cause disagreement with the authors' assertion that the book is a "how-to" manual, even "in part". Nonetheless, it will be of service to the individual who is developing a response averaging facility by assisting him in pinpointing areas of particular procedural impact.

Treatment of the variability of the averaged VER in relation to response sample size, across time in a given subject and among different subjects is straightforward and effective. The point that intra-individual latencies are more stable than amplitudes across time is well taken. Especially instructive are the intra-individual data illustrating the degree of similarity between two VERs taken at different times under identical experimental conditions. For the first five successive 100 msec segments of the VER, the correlation coefficients obtained were 0.76, 0.92, 0.97, 0.72, and 0.68. Note is made of the usefulness of high frequency filters to reduce variability.

Factors that might be expected to influence the intensity and nature of the activity in the primary optic pathway are discussed in a general way: those relating to the physical characteristics of the stimulus being radiant energy and brightness, pattern, size, color, duration, frequency and surround intensity; those relating to the physiological characteristics of the visual system, including interactive functions of the eyes, retinal location, retinal adaptation, visual acuity, pupil size and eye dominance. Considerable insight can be gained as to the relative importance of each variable. Only a few brief comments can be made. The measure that the authors habitually use as the index of a physiological effect is over-all amplitude of the VER as derived by a "vertical" occipito-parietal bipolar linkage. However, recognition is given to the occurrence of instances in which one component of the VER undergoes modification without reflection in the over-all measurement. Also, material is included to illustrate the limitations of the data acquired by such an approach from lack of spatial information and inter-individual variability of electrode locations in respect to field configurations. The insensitivity of the bipolar technique to *parallel* changes at the two electrode sites is not stressed. The statement in the text, "in general, the binocular response will be very similar to either monocular response" does not seem to be borne out by the illustration to which the reader is referred, the binocular responses in the two examples appearing to be somewhat larger than those of either monocular response alone. In the section on eye dominance, the information to the effect that the response may be larger over the

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dominant hemisphere, apparently based on a small number of personal observations, is gratuitous and contrary to the general experience. A further assertion that "larger amplitude VERs could be defined as a dominance measure" seems to lack any rational basis and would, if accepted, lead to great strain on time-honored concepts of hemispheric dominance.

Subject variables discussed include age, sex, habituation, affect, intelligence and cognitive functioning but, surprisingly, not level of consciousness. The comments on the difficulties that attend attempts to relate VER measures to intelligence and cognitive processes are exceedingly sensible and are commended to all those who have been concerned about the matter. The sections on electrode location and spatio-temporal characteristics convey little useful information.

The possibility of contributions to the VER from evoked myogenic activity, the electroretinogram and the electrocardiogram is considered briefly. Although the reviewer would agree with the general position of the authors that these do not constitute serious obstacles to the use of the averaging technique for the detection of cortical potentials, blanket discounting of their significance is a questionable practice. In the case of myogenic activity, reasonable care must be given to experimental design, as the authors state. A further point seems to have been overlooked—that of individual differences, the same procedure producing quite different myogenic responses in different subjects with respect to size and location. Dispensing entirely with myogenic control recordings results in unnecessary ambiguities in the data. The basis of the thought that an increase in the inter-electrode distance over the midsagittal line increases the likelihood of myogenic components in the VER, introduced in this context, is not clear, nor is the significance of the statement that "a myogenic component will rarely be detectable... even if the subject consciously flexes facial and neck muscles in responses to the light" since it is early reflex activity that is of concern.

In the second half of the book, various procedures relative to data acquisition and processing are examined. Practical advice is given on such subjects as stimulus sources, electrodes and their application, magnetic tape recording, filtering, elimination of sources of noise and operation of the signal averager. The process of signal averaging is discussed in some detail. Some of the analytical techniques commented upon are measurement of amplitude and latency, standard statistical analyses (calculation of correlation coefficients and analysis of variance), principal components analysis, auto-correlation and cross-correlation, frequency spectrum analysis, synchronous component analysis and zero crossing analysis. The authors conclude that the utility of each procedure is dependent upon the question being asked; no one procedure is an "optimum analysis aid".

A number of sources of confusion are encountered in the illustrations. In the legend to Fig. I-1, the equating of noise with "EEG" would seem to be a considerable oversimplification since EEG is defined elsewhere in terms of activity of the brain. All artifacts, technical and physiological, well described in the EEG literature, must be kept in mind. The control sample shown actually contains a ma-

ior component at 60 c/sec. The voltage calibration line indicated to be 25 μ V in Fig. I-2B gives an over-all response amplitude of some 50 μ V for the VER recorded from inion to ear. Such a value is several times the usual magnitude, making the illustration rather unsuitable as a teaching example. The voltage calibration line in Fig. I-2A seems reasonable. Fig. I-3, a comparison of VERs obtained by various investigators, has no time calibration, no indication of polarity and no information in respect to electrode arrangement. The authors' method of measuring the luminance of their stimulus source is not outlined, making it uncertain whether the photometric values cited are for peak intensity or perhaps some type of average intensity. The values seem small considering the known characteristics of the xenon-type flash lamp being employed.

The usual superscript system of references within the text is not followed. Instead, works relevant to a particular topic are listed by numbers at the end of the book, each number referring to a bibliographic entry from a compilation totaling 646 titles.

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Mechanism of synaptic transmission. Progress in brain research, Vol. 31. — K. Akert and P. G. Waser (Editors). (Elsevier, Amsterdam, 1969, 360 p., \$25.00).

This is a beautifully illustrated book, printed on good paper and the latest in an illustrious series. My first reaction on seeing it, however, was negative. The title covers a vast subject. How could 50 scientists, gathered together in a Swiss Benedictine Abbey in September 1968, cope with it in two days without a miracle, for which, of course, they were strategically sited. A quick look at the Contents seemed to confirm this opinion. Comments came to mind like — the mixture as before, the locals and the visiting firemen (12 out of 50), a discrete mixture of reviews and research presentations, with a sprinkling of the new and exciting. On more careful reading, however, I must admit the book has merit as a source of valuable reviews of some aspects of synaptic transmission. What it lacks is editing of this material so that the articles fall into clearly defined categories that can be found rapidly by interested readers.

Synaptic transmission can be classified in many ways. A basic distinction is between chemical and electrical systems, each with a characteristic morphology and physiology. The chemical systems can be divided by location (into peripheral and central), by transmitter (e.g., cholinergic and adrenergic) and by function (excitatory and inhibitory). The book does contain material covering almost all of the subdivisions of synaptic transmission here proposed, and it seems to me that the best service I can do for the potential reader is to indicate how the book is structured and the nature of the material in each subdivision.

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