information of practical value in the understanding of normal and abnormal function of the human brain from the electrical changes that can be recorded from the surface of the scalp.

The variety of wave-form and pattern of the electroencephalogram must be presented graphically. Words alone are inadequate. In the atlas are hundreds of samples of records, thoughtfully and systematically selected, the digest of six years of experience with thousands of cases. Each record is accompanied by a brief but informative note on the case-history of the subject. Study and comparison are greatly facilitated by the fact that all the records were taken by the same (ink-writer) technique, under similar conditions, at the same speed of tape and usually at approximately the same amplification. All have been skilfully traced by hand and reproduced without reduction in size. The reader is not confused by immaterial and distracting technical differences and can concentrate his attention on the essential wave-forms and patterns. In a clear and simple text that occupies part of each left-hand page, the technique and the principles of electroencephalography are presented. The unity of presentation is further preserved by the omission of the Grass-Gibbs spectrum analysis. The authors are to be complimented on their restraint at this point, for valuable and interesting as the frequency-analysis is it would have been confusing to include it in this volume.

Particularly valuable is the long series of records from normal children. Instability, slow waves and irregularity that would be quite abnormal in an adult are perfectly normal in children, and although these differences were first pointed out by Berger and later elaborated by Smith and by Lindsley there has nowhere been so complete a graphic presentation, side by side with records from normal adults.

The variety of records obtained in the convulsive states is equally valuable, including the presentation of questionably normal and even abnormal records from individuals who are and always have been normal as far as convulsions or epileptic conditions are concerned. The principles of localization of gross intracranial lesions are lucidly presented in considerable detail.

The atlas, in spite of its large size, twelve by fifteen inches, too large for any ordinary bookcase, is a "must" for every laboratory or clinic of electrophysiology and for every one who would be really informed on the subject. It is limited to human electroencephalograms, it is true; animal experimentation is represented only in the bibliography. But the bibliography of over six hundred titles is an achievement in its own right and will be of great use to students of the subject.

The text is admirable for its directness and clarity. Readers should appreciate that many of the statements are to be understood as first approximations or as general principles subject to secondary qualifications which are for the present omitted. Some may disagree, for example, with a sharp separation of epileptic patterns into three categories, the petit-mal, the grand-mal and the psychomotor. But the authors point out that the separation is schematic and that a patient may show now one and now another type or mixtures of any two or all three patterns. Perhaps the main fault of the book is its very clarity and simplicity of presentation. It makes electroencephalography look too easy and too much like a finished subject. The atlas should be regarded as a foundation and a starting-point—not as a final goal that has been achieved.

HALLOWELL DAVIS

DEPARTMENT OF PHYSIOLOGY,
HARVARD MEDICAL SCHOOL

## PSYCHOLOGY

*General Psychology.* By RAYMOND B. CATTELL. 624 pp. Cambridge, Mass.: Sci-Art Publishers. $3.50. 1941.

THE atmosphere of spirited discussion permeating this book should make it stimulating and provocative to students possessing the necessary command of basic factual material and terminology. While rather careless of details the author takes pains to present both sides of controversial questions, and his own conclusions appear to be fair and judicious. The present achievements of psychology he regards with a decidedly critical eye, but he is enthusiastic regarding the potentialities of this science. Even at present it has very considerable practical value. The applications to psychotherapy, education and industry are presented briefly but at sufficient length to carry some sense of their importance.

In his treatment of cognitive processes the author follows Spearman quite largely, while in the chapters on motivation he develops the ideas of McDougall and Freud with some attention also to Alfred Adler. This general topic with its ramifications is presented with relative fulness, occupying one third of the text. All motives and all behavior, the author believes, "spring from the need of satisfying a few pervasive and biologically indispensable drives." These "ergs," as he prefers to call them, control learning and acquired modifications to a great extent by making it naturally easier for the individual to learn some things than others. Much light on human motives and their conflicts and frustrations has been derived from the study of neurotic patients. Clinical experience affords pragmatic sanction to some at least of the

theories of psychoanalysis, but leaves to the experimental psychologist the duty of putting these theories to a laboratory test, so far as may be possible; and some such experimental work is being done. "All in all, the theories of the pioneers in clinical work give us broader horizons and indicate the probable shape of the things to be investigated; but they can not provide us with a scientific foundation until other more statistical and experimental methods have confirmed them."

R. S. WOODWORTH

COLUMBIA UNIVERSITY

# SPECIAL ARTICLES

## CHIMPANZEE HANDEDNESS

FEW reports have appeared on preferential hand usage in anthropoid apes; such data as have been presented have derived from scattered, largely non-experimental observations of a few animals. The present inquiry, utilizing 30 chimpanzees as subjects, is an attempt to determine if they use one or the other hand preferentially, how pronounced hand preference is in individual chimpanzees, and how right- and left-handedness is distributed in these animals.

Four test situations, demanding fairly precise, skilful manipulations and designed to preclude the subjects' procuring incentive in any way other than with one hand, were set up. All subjects were tested in their outdoor living cages; each was isolated while being tested. Manipulation (procuring pieces of fruit) was performed by the subjects through the 2-inch square apertures of their wire-netting cage-walls (diagonals of apertures were horizontal and vertical). Test situations were: (*A*) One end of each of 10 parallel strings, each 6 inches long, spaced at 3-inch intervals, was attached 1 inch from the edge of a board 30 inches square; with the strings stretched out on the board and perpendicular to edge of attachment, pieces of fruit were attached to the free ends of the strings; the edge of the board was placed against the cage-wall; hand used by subject in pulling- or raking-in each piece of fruit was tabulated; in this (and in the other situations) the board was quickly withdrawn if subject attempted to procure incentive in any way other than with one hand (such as with lips, feet or both hands); (*B*) 10 small pieces of fruit, spaced at 3-inch intervals and 1 inch from edge of board, were presented; (*C*) small pieces of fruit were placed individually under a small metal box which was hinged at end away from subject; subject procured incentive by reaching through a rectangular hole (1½ inches wide, 2 inches high) in a piece of ¼-inch plywood and upsetting metal box; hand so used was scored "preferred"; and (*D*) pieces of fruit were presented individually on a board 1 inch from cage-netting. Situation *A* was presented until subject had procured 100 pieces of fruit, then Situation *B* until subject had procured 100 pieces of fruit, and so on in the sequence *A-B-C-D-D-C-B-A*. Thus, for each subject, hand used was tabulated for 800 manipulations. Subjects were given 100 trials in a single session in one day, were not tested on immediately succeeding days.

Of the 30 chimpanzees tested, there were 22 adult females, 4 adult males (Bokar, Frank, Jack, Pan), 2 adolescent females (Beta, Gamma), 1 five-year-old female (Dina), and 1 three-year-old male (Fin).

Fig. 1, a bar diagram, shows the distribution of *right* hand use among the subjects for the combined trials of all situations (*i.e.*, the number of times in 800 trials each subject used right hand).

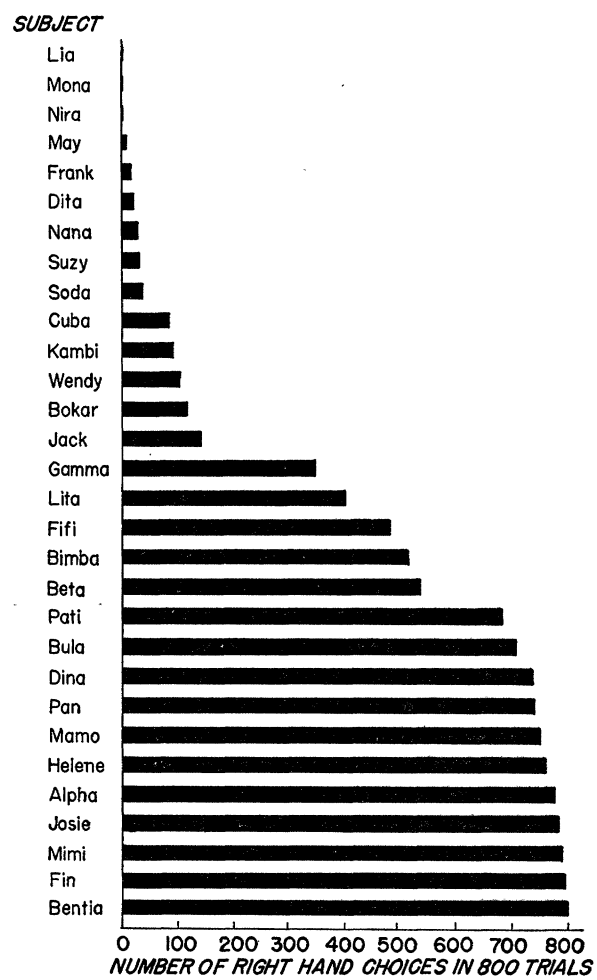


FIG. 1