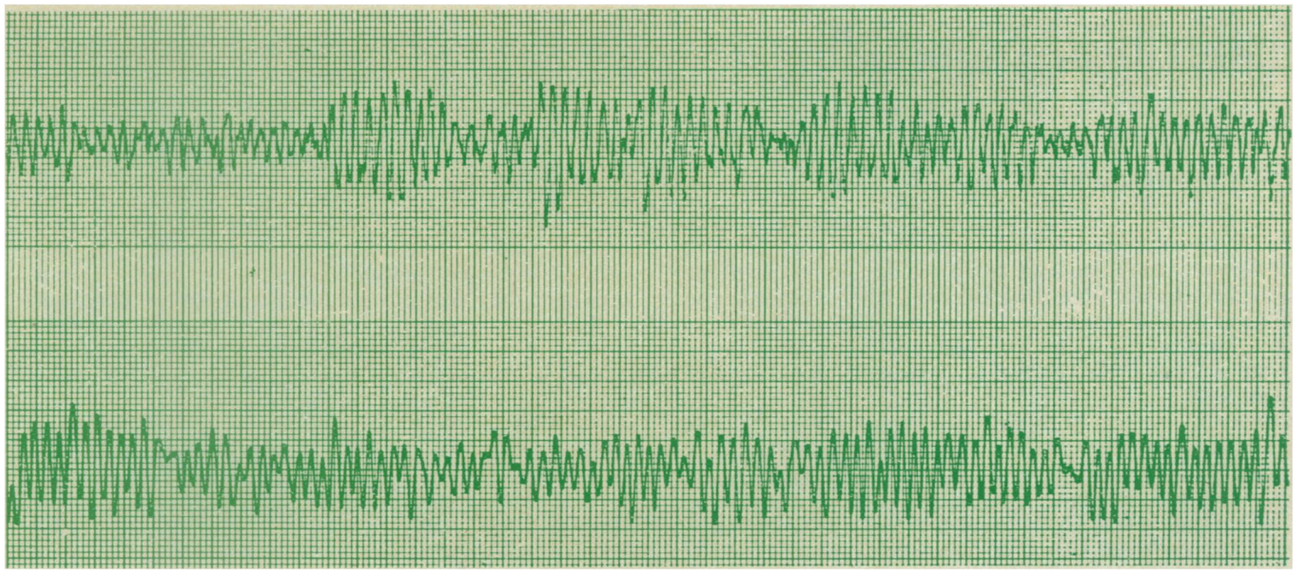

Listen to your head

Researchers record and evaluate brain waves while commercial promoters cash in prematurely on a technology that needs more basic research

by Robert J. Trotter

Listening to the music of the hemispheres was a favorite pastime for members of the American Psychological Association in September at their annual meeting. Of all the booths in a 45,000-square-foot exhibition hall, some of the most popular were those displaying and demonstrating brain-wave biofeedback machines or alpha pacers.

With these machines a person can see his own brain's electrical wave patterns traced on an electroencephalograph ribbon or hear corresponding tones on a set of earphones. This feedback follows and records for the subject any changes in his brain's electrical activity.

The 10 billion cells of the brain are constantly producing an electrical current (using about as much power as a flashlight) that fluctuates at various frequencies. By closing and opening the eyes or by alternately relaxing and concentrating, the frequencies are varied. In most cases by watching the variations, a person can learn to consciously control the brain's wave patterns.

Four of these wave patterns have been identified and named according to the number of cycles per second (hertz) and the amplitude of the wave. In the normally unconscious state the brain produces delta (0 to 4 hertz) and theta (4 to 8) waves. In the normally conscious state alpha (8 to 13) and beta (13 to 26) waves are produced.

The alpha wave, however, is the one scientists and laymen are most interested in. It was first detected in 1928 by Hans Berger, a German physicist.

Stanford Med Center

Morrell: Serious questions of ethics.

And it has since been hypothesized to be related to such things as creativity, pleasure, relaxation, hypnosis and meditation. But it was not until recently that researchers began experimenting with alpha training. Believing that alpha waves are associated with various beneficial states of consciousness, researchers attempted to reproduce the states by teaching their subjects to increase alpha-wave production. Scientists knew, for instance, that yogis in India could regulate a large number of so-called involuntary physiological processes such as heart rate or pain. This unusual degree of control was obtained through long practice of specific mental, emotional and physical disciplines. In addition, the work of Neal Miller at Rockefeller University (SN: 3/14/70, p. 274) confirmed the possibility of autonomic nervous system control and the use of biofeedback in learning this control. The electronics explosion added to the possibility with the development of sensitive transducers, high-gain amplifiers and sophisticated computer techniques that can be applied to psychophysiological research. Subjects who can hear and see brain waves can use

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Fehmi: The beginning of a new field.

this feedback in learning to produce only alpha waves.

Joseph Kamiya of the Langley Porter Neuropsychiatric Institute in San Francisco was a pioneer in this field. He began in 1958 by comparing EEG's made during sleeping and waking states. He became fascinated by the alpha rhythms that came and went in the waking EEG's. "I wondered if, through laboratory experiments with this easily traced rhythm, a subject could be taught awareness of an internal state." Using operant conditioning, Kamiya showed that "just as rats can be taught to press a bar, so people can be taught conscious control of their brain activity in a relatively short time."

At the Menninger Foundation in Topeka, Kan., Alyce and Elmer Green are also working on various aspects of alpha control through feedback. The goal of their research involves voluntary control of the central nervous system so that those states of awareness associated with the conscious control of alpha and theta rhythms in the brain can be studied. In their training, subjects are encouraged to practice at home with "low-cost portable alpha detectors."

This home training is one aspect of alpha rhythm research that is causing a controversy. Portable alpha pacers have become a fad. Manufacturers of them are making extravagant claims: quit smoking, cure insomnia, increase salesmanship, have more happiness, creativity, memory, health and friends. They also claim that alpha training can help a person lose weight, enhance meditation, reach nirvana, achieve super relaxation, open the door to the Promised Land and gain mental powers.

Many persons, searching for tranquillity and spirituality, see the alpha method as a safe and legal replacement for mind-altering drugs; but the exact possibilities of alpha training have not been fully explored or tested. And in the hands of an amateur, the machine may do nothing more than record amplifier noises or scalp twitches.

Lenore Morrell, an EEG researcher at the Stanford University School of Medicine, goes even further. She thinks that alpha control has reached the proportions of a fad. "The premature commercial exploitation of biofeedback technology raises serious questions of ethics. The presumed benefits remain to be substantiated by serious research; some persons in need of medical attention may be led into relying upon methods which must still be regarded as experimental."

Her experience with EEG has led her to doubt that there is any simple correlation between the presence or absence of alpha activity and a particular conscious state. For example, the simple act of glancing upward is followed by an increase in alpha activity in many persons. Quite opposite effects on alpha abundance have been noted depending on whether the person observed has been keeping his eyes open or closed. Alpha waves, she finds, often increase during a passive drifting along the stream of consciousness; but alpha also increases during the sharply focused concentration required for problem solving. And alpha activity varies with the location of the recording electrode. More basic research, she concludes, is needed before the advocacy of alpha control can be supported by scientific knowledge.

Some of the basic research aimed at answering the many remaining questions in the existing literature was presented at the APA meeting. E. C. Brown, T. J. Erwin and R. T. Putney of Georgia State University in Atlanta question the relationships between increased alpha density, meditation and biofeedback. They designed procedures using a control group with no feedback. All groups were tested under similar circumstances because the experimental environment (usually dark, quiet and isolated) may be responsible for increased alpha. Preliminary results indicate that "all subjects increased in alpha density during the experiment." But the original hypothesis that alpha is increased by feedback was not completely confirmed. "Biofeedback had some effect," they say but "meditation also had some effect." And it was not shown that increased production of alpha facilitates meditation.

Other researchers, however, feel that the alpha phenomenon has been proved and that the biofeedback principle has important implications for mental medicine. Kamiya agrees that better quality control is needed for commercially sold machines. But he feels that through in-

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Budzynski: Applying EEG biofeedback procedures to psychosomatic disorders.

Menninger

The Greens, working on a voluntary control project, attach electrodes.

tensive investigation, "the discontinuity between the subjective and the objective aspects of psychology and psychiatry might dissolve, and we would have a unified science. Someday it might be possible to examine a patient's physiological state and diagnose his neurosis just as the physician now detects tuberculosis by examining an X-ray."

Lester G. Fehmi of the State University of New York in Stony Brook has been working for four years on EEG feedback and associated states of awareness. He finds that the ability to control feedback is quite wide. And only a few subjects failed to establish control of alpha production with extensive training. Those who did gain control described their subjective experiences in relation to the feedback signal in terms common to each other: an increase in smooth-flowing energy, a release of tension and a spreading of attentional focus.

Although alpha has been generally associated with relaxed wakefulness, Fehmi says little is known about its relation to behavior and experience. But, he says, "this is just the beginning of a relatively new scientific field. With continued effort and with refinement of our techniques, we may, in not too many years, be able to state with some certainty which nervous circuits in the brain deviate from their optimal and normal activity patterns to bring about behavioral disturbances."

Thomas H. Budzynski, at the University of Colorado Medical Center, has been applying EEG biofeedback procedures to anxiety problems and psychosomatic disorders. Stutterers and claustrophobics can be taught to relax without the use of tranquilizers. "Biofeedback may yet realize its greatest potential in the applied areas of psychotherapy, behavior therapy, psychosomatic disorders, education and attitude and value change," Budzynski says.

With these goals in mind, the Greens are working on a more controlled and exact training procedure at the Menninger Foundation that combines physiological and psychological research with feedback techniques. They feel that if a successful training procedure develops out of this work it will be significant. "Psychiatrists," they say, "will be able to develop in many patients a deep reverie in a short period of time through the use of feedback techniques for a deep relaxation, and if they use EEG feedback during interviews with selected cases, as we have done with each experimental subject, an increased amount of normally unconscious material should be recoverable."

They also suggest that the pain of education will be lessened if these procedures are used in attention control. And there is a possibility that recall can be facilitated and mental blocks during examinations can be avoided. In the field of social science, the Greens conclude, "it goes without saying that the person with voluntary control of his own behavior (or who at least could curb the excesses of his responses) would not only not be a problem, but would make it easier for others to attain a stable, and yet creative life." □