# Alpha Rhythms: Back to Baselines

Alpha is a paradox. Since its existence was first reported in 1928 by German physician Hans Berger, the alpha rhythm in human brain EEG's has been a sort of inexplicable phenomenon. It obviously exists, but researchers are not quite sure what it means. Now, after several years of close examination with some of the best technology available, the alpha rhythm may be even more of a mystery. Instead of answers, new questions are being raised. Can the 8 to 13 cycles per second alpha waves be controlled or learned, as has been thought? Are they related to a beneficial state of consciousness? A growing body of evidence suggests not.

Some of these questions have come up as a result of research being done at the Unit for Experimental Psychiatry of the Pennsylvania Hospital and the University of Pennsylvania. Last week in Boston at the meeting of the American Association for the Advancement of Science this work was reviewed in a paper by Martin T. Orne and Stuart K. Wilson. Their work dealt specifically with attempts to teach people to control alpha waves through biofeedback.

In the 1960s, biofeedback became a research and a media fad as a result of studies suggesting that many of the body's involuntary functions could eventually come under voluntary control if the proper monitoring and feedback systems were available. It had been noted that subjects who could see their heartbeat or blood pressure continuously displayed (feedback) could, with training, learn to control those functions. While some progress was made along these lines, one of the most promising areas of biofeedback research had to do with brain waves, and especially the alpha rhythm. When the presence or absence of alpha waves was visually displayed, subjects appeared to rapidly gain control over them.

The consequences or value of learning to control alpha output was never fully explained, but many claims were made. Alpha has been linked with such things as creativity, pleasure and relaxation as well as with hypnotic and meditative states. The manufacturers of portable alpha feedback equipment made even more extravagant claims—quit smoking, lose weight, improve memory, gain friends, enhance health, achieve tranquility. Not all of these claims were taken seriously, but alpha control did appear to have clinical applications, especially in the control of anxiety and arousal. Since alpha activity was thought to predominate in relaxed individuals sitting in a dark room with their eyes closed, it seemed reasonable to assume that an increase in alpha would lead to a decrease in anxiety or arousal.

Now, not only this but the original claim that people can even learn to control alpha waves has been challenged by Orne and his co-workers.

In their first experiment, subjects were given visual feedback to signal the presence of alpha waves. A green light came on for alpha, and a red light for no alpha. Most subjects were able to produce a threefold to fourfold increase in alpha activity with feedback training. They also demonstrated an apparent ability to block or cut out alpha activity at will. These results were similar to those reported by other researchers, and it was thought that the subjects were actually learning to control their brain waves. Subsequent experiments, however, forced a reevaluation of this conclusion.

When subjects were told "keep the red light on" or inhibit alpha, their alpha density dropped to close to zero. But, says Orne, "speaking of the subjects having learned to block alpha would appear to be inappropriate since they were able to do this from the very first trial without any practice." Of even greater interest were the "green light" trials during which subjects attempted to increase alpha output. The amount of increase, while dramatic when compared with baseline readings taken when the subjects had their eyes open in the presence of light, did not bring the subjects even close to the amount of alpha produced during the rest periods when the room was totally dark and when the feedback light was turned off. "It is evident from these data," say the researchers, "that in total darkness subjects began with a spontaneously high level of alpha density. This was immediately depressed by the visual feedback stimulus." If the feedback light itself was inhibiting alpha, then what appeared to be learning to control brain waves may have been nothing more than learning not to attend to the visual stimulus that was blocking alpha production.

Because the light seemed to be affecting alpha production, the researchers replaced it with an auditory feedback signal and tested subjects in a dark room. No learning or increase in alpha was noted under these conditions. Another group of subjects was then tested in dim light with auditory feedback. The results were similar to those of the original study. Even the dim, ambient light seemed to depress alpha in the same way the visual feedback signals had. This supports the researchers' hypothesis "that apparent augmentation of alpha density occurred only when it had previously been depressed and seemed to involve the individual's gradually learning to ignore the stimulus that had been responsible for alpha suppression in the first place."

These data, along with the previously reported findings of Orne and David A. Paskewitz that alpha training may not be useful in the control of anxiety (SN: 11/9/74, p. 294), represent a real setback for alpha research. But if alpha control cannot be learned, and if alpha training does not have an effect on anxiety, how is it possible that some success has been reported in the use of alpha training to counteract anxiety? There are two possible answers. Either nonspecific effects (such as sitting in a darkened room listening to a pleasant tone go on and off) or a placebo effect could be responsible. In either case, the reported effects are probably not the result of alpha training, and it may be that a complete reconceptualization of what alpha feedback is all about is needed. Until that happens, alpha remains a paradox. □

# J-psi particles called charmless

Since the discovery in November 1974 of the very heavy, peculiarly acting particles called psi or J, theoretical physicists who have considered their nature have mostly seen them as evidence for the existence of a quantum number or property of elementary particles called charm. Charm is a property introduced into theory to account for some anomalies in the radioactive decay behavior of already known particles. A confirmation of its existence would open a new chapter in particle physics because its introduction makes radical changes in the theory of how particles are structured.

Unfortunately, one of the experimental groups that discovered the original member of the J-psi family, the Massachusetts Institute of Technology—Brookhaven National Laboratory collaboration led by Ulrich J. Becker and Samuel C. C. Ting of MIT, now issues a pessimistic caution against concluding that charm is at work in the J-psi particles. They point out that there is very little hard experimental evidence in favor of charm and some of the most recent results of their experiment actually seem to contradict the charm hypothesis.

The MIT-Brookhaven group produced the first of the new particles, which they call J, by striking energetic protons against proton targets. Simultaneously, a group including physicists from the