

## **Wired for miracles?**

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### ***What is Biofeedback?***

When Mary Obringer and her husband adopted a five-month-old South Korean baby in May of 1987, she knew immediately that something was wrong. "He developed slowly," Obringer says of the infant, whom they named Max. "He had speech disabilities, motor skill problems, social problems. He was hyperactive and had trouble concentrating." As a toddler, Max couldn't be in a large group of people without getting violent -- hitting, kicking, and screaming. By the time he started kindergarten, in Jackson, Wyoming, "It was clear right away he wasn't going to be able to stay." Even after doctors diagnosed the boy with attention deficit disorder (ADD) and put him on the drug Ritalin, Max's condition still required that he be in a special-education classroom. The family's frustration level was reaching a peaking point. And then they met psychologist Michael Enright.

Enright, a member of the oversight board of the American Psychological Association, told Obringer he knew of a treatment that might help her son. The treatment was EEG biofeedback -- a promising new approach that teaches patients to consciously recognize and control their own brain-wave patterns.

Obringer was more than willing to give it a try. Twice a week for the next six months, she brought Max to his thirty-minute treatments in Enright's small, darkened EEG room at the Jackson hospital. At the start of each session, Enright would dab globs of conducting paste on Max's scalp and attach two electrodes to amplify his brain waves, which were displayed on a computer screen. A second machine was set up to run a variation of the popular video game Pac-Man. Instead of using buttons or a joystick, however, Max would play this game with his brain waves alone. Whenever he generated certain patterns associated with alert concentration, the little yellow monster would gobble his way around a maze to reward him. And the more he played, the better his technique became: As the weeks went on, Max became something of a pro at generating those focused brain waves.

Today, Obringer believes that EEG feedback has worked wonders for her son. "We started seeing immediate results," she recalls. "Within a couple of weeks he could sit in a chair and not fidget." The violent outbursts stopped, too -- "no kicking, no hitting, no fighting," his mother says with relief. And though he still needs to take Ritalin, Max has begun to spend part of every day in a regular

classroom. "He's like every other kid," she concludes, gratefully.

Max is one of a growing number of people turning to EEG biofeedback -- a cutting-edge, if controversial, treatment used to relieve a host of health complaints, both mental and physical. Though some forms of EEG biofeedback have been around since the 1970s, today researchers and practitioners are directing the technique toward more than alleviating anxiety and stress. Problems as diverse as closed-head injury, alcoholism, and learning disabilities are being addressed by teaching people to consciously change the rhythms in their own brain. "The field is just exploding," says Joel Lubar, a professor of psychology at the University of Tennessee and incoming a president of the Association for Applied Psychophysiology and Biofeedback (APB), the professional association that represents the biofeedback field. Indeed, the Association has seen the number of EEG specialists in its membership grow from a handful a decade ago to a full 500 of its 2,300 members today. Among them are psychologists, nurses, physicians, and educational specialists variously affiliated with hospitals, clinics, university research centers, and doctors' offices. All of them practice a treatment that would seem the ultimate in self-healing: training the brain to fix its own disorders.

### ***Reprogramming The Brain***

By broad definition, the term biofeedback refers to the process in which subtle information on how a person's body and brain are operating is amplified and shown back to that person. Simple devices measuring muscle tension and body temperature, for example, help people learn to regulate their blood pressure, temperature, and other physical and mental processes not typically under their conscious control. Many forms of biofeedback are now well established as treatments for stress related conditions such as migraine headaches and chronic pain. Today these types of biofeedback are not only practiced at such bastions of main stream medicine as the Mayo Clinic, but are increasingly being paid for by insurance companies as well.

The branch of the field known as EEG biofeedback has remained more controversial. Indeed, only in the last few years has this approach attracted widespread research interest or clinical use. Its premise: that many conditions -- from learning disabilities to depression to panic attacks -- can be helped by teaching patients how to alter their brainwave patterns.

In a typical EEG biofeedback session, electrodes are placed on the scalp to pick up brain-wave activity ("No electricity goes into the brain," one practitioner told

us reassuringly.) The brain wave information is then fed into a computer which translates its patterns into a user-friendly display on the screen -- a game showing cars speeding along a highway, say, or small squares whose size and color can be changed. There's only one catch with these computer games: You can't use your hands. Instead, the object is to try to manipulate what happens on the screen by mind power alone.

While this kind of no-hands Nintendo may sound impossible, practitioners say that, through trial and error, users can actually be trained to increase and decrease their brain waves at will. "It's like learning to ride a bicycle: You learn by experimenting," says one. (EEG biofeedback therapy, used to induce brain waves associated with relaxation is a simpler process: Electrodes are attached to devices that emit audible tones when the person gets into a relaxed state.) Sessions typically last from forty-five minutes to an hour, and an entire treatment program can take from ten to sixty sessions, depending on the condition being addressed. Where other forms of biofeedback aim to teach people a skill they can call upon in specific situations -- for example, learning to relax deeply to head off an impending migraine headache -- EEG biofeedback may have a more enduring goal: to "retrain the brain" so it gets in the habit of producing healthy brainwave patterns on its own thereafter.

### ***Alpha Waves for Addiction***

To appreciate the different ways EEG biofeedback is being applied today, it helps to understand some brain-wave basics. The brain continuously produces combinations of four distinct frequencies, or speeds, of brain waves -- delta, theta, alpha, and beta -- and our state of consciousness depends on which of these waves is dominant. When we sleep, delta waves take over, with their slow-moving signals traveling at up to 4 cycles per second, or four hertz (Hz). Slightly faster are theta waves (4 to 8 Hz), associated with the twilight consciousness on the brink of sleep in which dreamlike mental images can surface. Above theta is alpha (8 to 12 Hz), the calm and mentally unfocused state typically connected with relaxation. In our normal waking state, when our eyes are open and focused on the world, beta waves are in charge. Within beta itself, scientists recognize a range-from low beta, a relaxed but alert state of 12 to 15 Hz, to the excited, anxious state of high beta, which can climb as high as 35 Hz.

Much of the early interest in EEG biofeedback focused on helping people learn to generate waves associated with deep relaxation: alpha and theta. Alpha-theta biofeedback was pioneered in the '70s by Elmer and Alyce Green of the

Menninger Clinic in Topeka, Kansas -- still a leading center for biofeedback research -- and Joe Kamiya, a researcher in San Francisco. The researchers found that if biofeedback users were alerted with an audible tone when they generated sufficient alpha waves, the subjects could, in just a session or two, get into a deeply relaxed state -- a state as deep as that reached by people who'd meditated for years. Today, alpha training is commonly practiced to reduce stress and anxiety and to help manage pain.

Recently, however, researchers have begun studying some surprising new applications for alpha-theta training. In one provocative, if small-scale, 1989 study, Eugene Peniston, a clinical psychologist then of Fort Lyon Veterans Affairs Medical Center in Fort Lyon, Colorado, gave ten chronic alcoholics thirty sessions of biofeedback training focused on boosting their alpha and theta waves. A second group was given conventional treatment, including participation in a twelve-step program and antidepressant medications. As part of what has since become known as the "Peniston protocol," alcoholics in the first group were coached in basic relaxation techniques, trained to boost their own alpha-theta waves, and led through visualization and imagery exercises (such as scenes in which they saw themselves refusing an offered drink). Counseling was also provided to help subjects work through any images and feelings that might surface. At the end of a month of treatment, the biofeedback trainees achieved an unprecedented 80 percent abstinence rate, compared to 20 percent in the conventional group. What's more, when the trainees were followed up five years after treatment's end, their recovery rate remained an impressive 70 percent, having declined by only 10 percent.

What's to account for the dramatic shift? Alcoholics before treatment have trouble reaching and staying in the alpha state, where "self soothing" neurotransmitters are produced, theorize researchers. Often they turn to alcohol as an artificial means of inducing this state of relaxation. But as biofeedback treatment progresses, and those self-soothing neurotransmitters begin to flow, the craving for a drink may be reduced.

Another possible reason for biofeedback's effectiveness is that it can help subjects stay in a theta, or hypnagogic, state for a sustained period of time. While people pass through theta on their way to sleep every night, they quickly move on to delta. "EEG helps people linger in theta," says Dale Walters, of Topeka, Kansas, who conducted biofeedback at the Menninger Clinic and is currently working to set up a six-week outpatient biofeedback program to treat addiction in Kansas City, Missouri. In a theta state, says Walters, childhood memories and buried

emotions bubble spontaneously to the surface. With the help of a psychologist, he says, such associations can often be worked through. "Those experiences lead to unblocking of intense emotions," says Walters.

Peniston's treatment is slowly beginning to make inroads into clinical settings. In Topeka, Kansas, the Life Sciences Institute of Mind-Body Health now offers an intensive outpatient program that includes seven weeks of two-and-a-half hour daily alpha-theta training sessions, coupled with intensive psychotherapy. According to Carol Snarr, a registered nurse and biofeedback therapist at the Institute, the program has so far treated not only alcoholics but also drug addicts, people with eating disorders, even smokers, some of whom have come across the country for treatment. "It is truly a way to integrate body, mind, emotion, and spirit," she says. Over the next few years, the Institute will be following patients' progress as part of a long-term follow-up study on Peniston's findings.

### ***Helping ADD Children Focus***

If this dreamy theta state is a boon to alcoholics, it's a bane to children who suffer from attention deficit disorder and attention deficit hyperactivity disorder (ADHD), according to Joel Lubar, a professor of psychology at the University of Tennessee. For more than two decades, Lubar has studied biofeedback's applications with ADD and ADHD children and adults, publishing his findings in such leading medical journals as the *Journal of Pediatrics* and *Pediatric Neurology*. Lubar has found that many children who suffer from ADD and ADHD have brain-wave patterns high in theta and low in beta -- the latter waves being associated with alert concentration. As a result of such brain-wave imbalance, these children can go through life prone to daydreaming and unable to focus their attention. Lubar says he has treated hundreds of children with these two disorders, using a treatment protocol typically aimed at boosting beta waves and decreasing those theta waves. "Once they can control their minds, their native intelligence comes out, and their self-worth increases," he says. Follow-up studies on these children, notes Lubar show significant increases in academic and behavior scores: Some can leap as much as two and a half years in grade level achievement and boast IQ increases of as much as 15 points. Thank in part to such work, treatment of ADD and ADHD is one of the most widely accepted applications for EEG biofeedback, says Francine Butler, executive director of the AAPB.

### ***Healing Head Injuries***

EEG biofeedback is also offering hope for a condition finding little help through

mainstream medicine: mild closed-head injury. These injuries result when the brain bangs against the inside of the skull, causing bruising and impairing the ability of the neurons to fire properly. Symptoms can range from the psychological (flaring tempers, mood swings, irritability) to cognitive (short-term memory loss and confusion) to physical (headaches, nausea, blurred vision).

Psychologist Steven Stockdale, director of the Neuro-Health Center in Colorado Springs, Colorado, is one of a small number of clinicians across the country currently using this modality to treat the head-injured. After giving his subjects a battery of neurological tests to determine which parts of the brain have been damaged, Stockdale hooks them up to an EEG biofeedback machine to help them work toward trying to normalize brain-wave activity in the damaged area. "It's a little like going to the gym for your brain," he says. Exactly why such treatment might work is still a matter of debate. "One of the theories is that EEG biofeedback may help bring about increases in 'dendritic growth' or new connections in that area," Stockdale says.

Even while the mechanism behind the treatment remains unclear, results have been promising. Recently Stockdale concluded a three-year-study (as yet not published) involving his patients' progress. According to Stockdale, these subjects started treatment two to four years after sustaining their injury -- past the period when any spontaneous recovery would be expected to have occurred. "About 80 percent of the people we work with learn to do the feedback," says Stockdale. "Of that 80 percent, there's a 75 to 90 percent reduction in symptoms. They clear up."

### ***Epilepsy and Beyond***

Those on the cutting edge of this twenty-first century treatment believe its potential applications may be unlimited. Currently, researchers are studying EEG biofeedback for conditions ranging from premenstrual syndrome to depression to post-traumatic stress disorder in Vietnam vets. At the Sepulveda Veterans Affairs Medical Center in California, Barry Sterman, a professor in the school of medicine at UCLA and a career scientist at the Sepulveda center, has had impressive results using the treatment with epileptics resistant to standard drug treatment. EEG biofeedback, he says, helps his subjects learn to control the excitability that triggers seizures along the brain's motor pathways. Published findings show a 60 percent seizure-reduction rate in a full 70 percent of Sterman's patients.

Siegfried Othmer -- who founded his Encino, California-based company, EEG

Spectrum, after his epileptic son was treated successfully with EEG biofeedback - brims with an almost evangelical fervor about the therapy's potential. "What's remarkable about this new technique is that we're not stuck with the brain we're born with," he enthuses. Othmer's four California-based clinics have treated some 2,000 patients -- not only sufferers of attention deficit disorder and anxiety, but also people with Tourette syndrome, bipolar disorder, premenstrual syndrome, even stutterers. What these disorders have in common, he argues, is that they all can benefit from stabilizing and normalizing brain patterns.

Take the case of Los Angeles writer Margaret Sachs, forty-seven, a patient at one of Othmer's clinics who underwent EEG biofeedback for mood swings associated with menopause. "I was waking up in the middle of the night totally drenched with sweat," she recalls. "I started waking up at three or four in the morning as if I were on speed." But after twenty sessions of EEG biofeedback, designed to teach her to stabilize her brain rhythm, her symptoms vanished. "I felt grounded in a way I never had before," says Sachs.

According to Othmer and other proponents, the promise of EEG biofeedback may not be limited to the sick. Othmer has worked with professional athletes to help them improve their ability to focus. Others bring the benefits home with them: Therapist Michael Enright from time to time pastes the electrodes on his own scalp. "If I had an article that was due and I had to have extended periods of mental activity without distraction, I'd do beta protocol," says Enright. "It's much better than a cup of coffee." And there's nothing that beats a bedtime alpha session, he says, to foster a good night's sleep.

This explosion of interest worries some in the field who believe that solid scientific proof of the effectiveness of EEG biofeedback has not yet kept pace with the promises of some of its practitioners. Indeed, while applications such as ADD and epilepsy do have a growing body of research to back them up, other applications must still be considered experimental. "One of the criticisms of this field is that there needs to be more scientific studies in peer-reviewed journals -- and I absolutely agree with that," says researcher and clinician Steven Stockdale, who notes that many such studies are in fact on the way.

Adds Peter Parks, a biofeedback therapist at the Menninger Clinic: "It is being used by reputable clinics, but it's still considered controversial. You'll find doctors who use it and doctors who are skeptical. In our clinical experience, EEG biofeedback seems to be helpful." Certainly, with so many factors unknown, potential subjects should be aware that they're signing up for a therapy that is still

unproven -- especially if they're anticipating extended treatment.

And in some cases, note experts, EEG biofeedback may actually be harmful. In its published guidelines, the Association For Applied Psychophysiology and Biofeedback warns that patients with a history of seizures should not be treated with EEG biofeedback unless they coordinate that treatment with their physician. People suffering from severe mental illnesses -- acute psychoses, major affective disorders, histories of dissociation experiences, or borderline personality disorders -- also should undertake treatment only in close conjunction with their doctors.

"If a person has a propensity toward mania and you do this training wrong, you can put them into mania," cautions Othmer. "Likewise with depression. In a clinical setting, people know this and redirect the training."

But even if EEG biofeedback must be considered a brave new world, for some it has offered relief where more-established medical practices could not. Ask Mary Obringer. "I can't tell you how important this is to our family," she says of her son Max's experience. "Our family was falling apart because of this. It has turned our lives around."

*Jim Robbins is a writer in Helena, Montana, whose work has appeared in The New York Times and Smithsonian. He is the author of A Symphony in the Brain: The Evolution of the New Brain Wave Biofeedback (2001, GroveAtlantic).*