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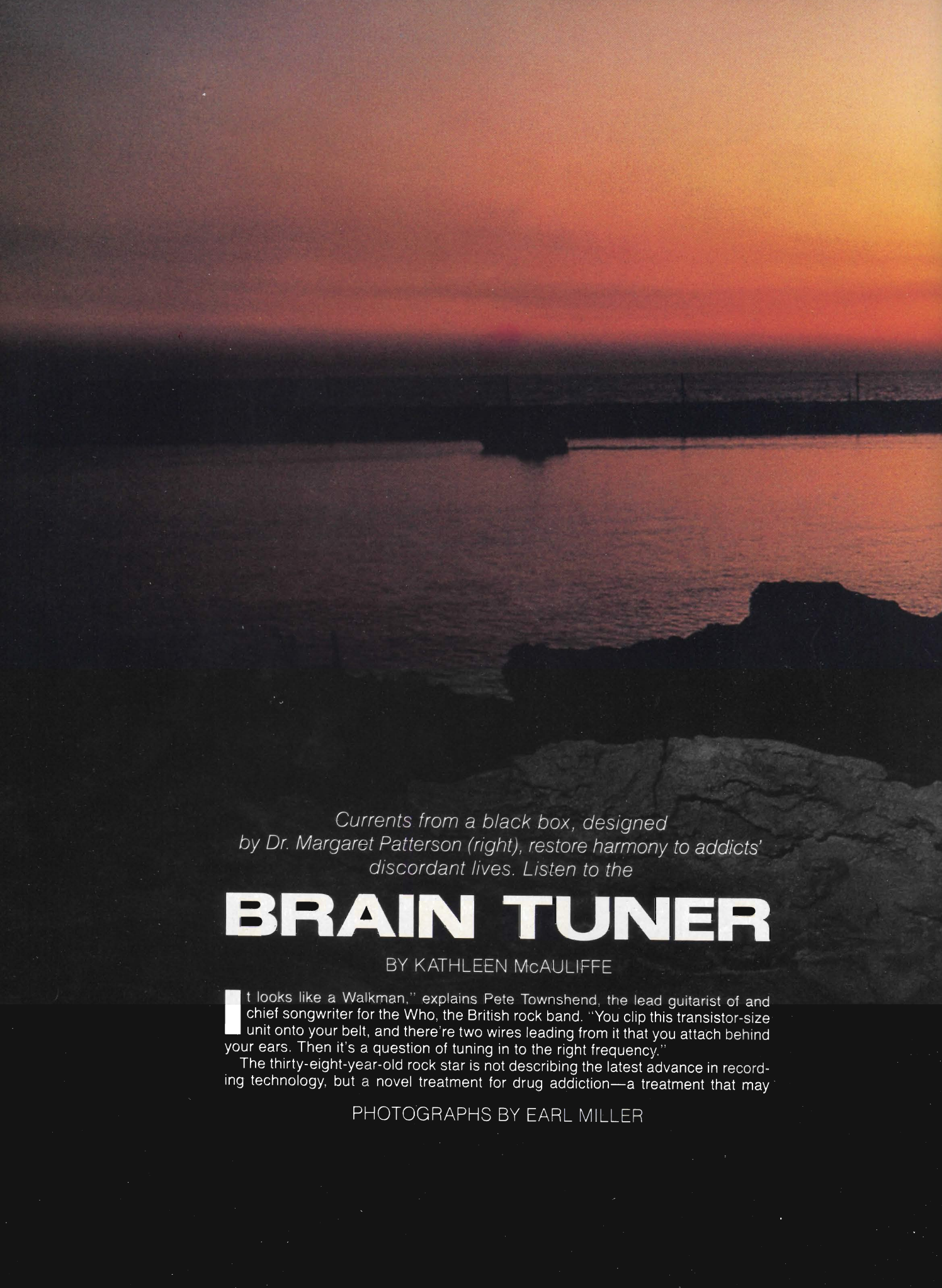
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*Currents from a black box, designed  
by Dr. Margaret Patterson (right), restore harmony to addicts'  
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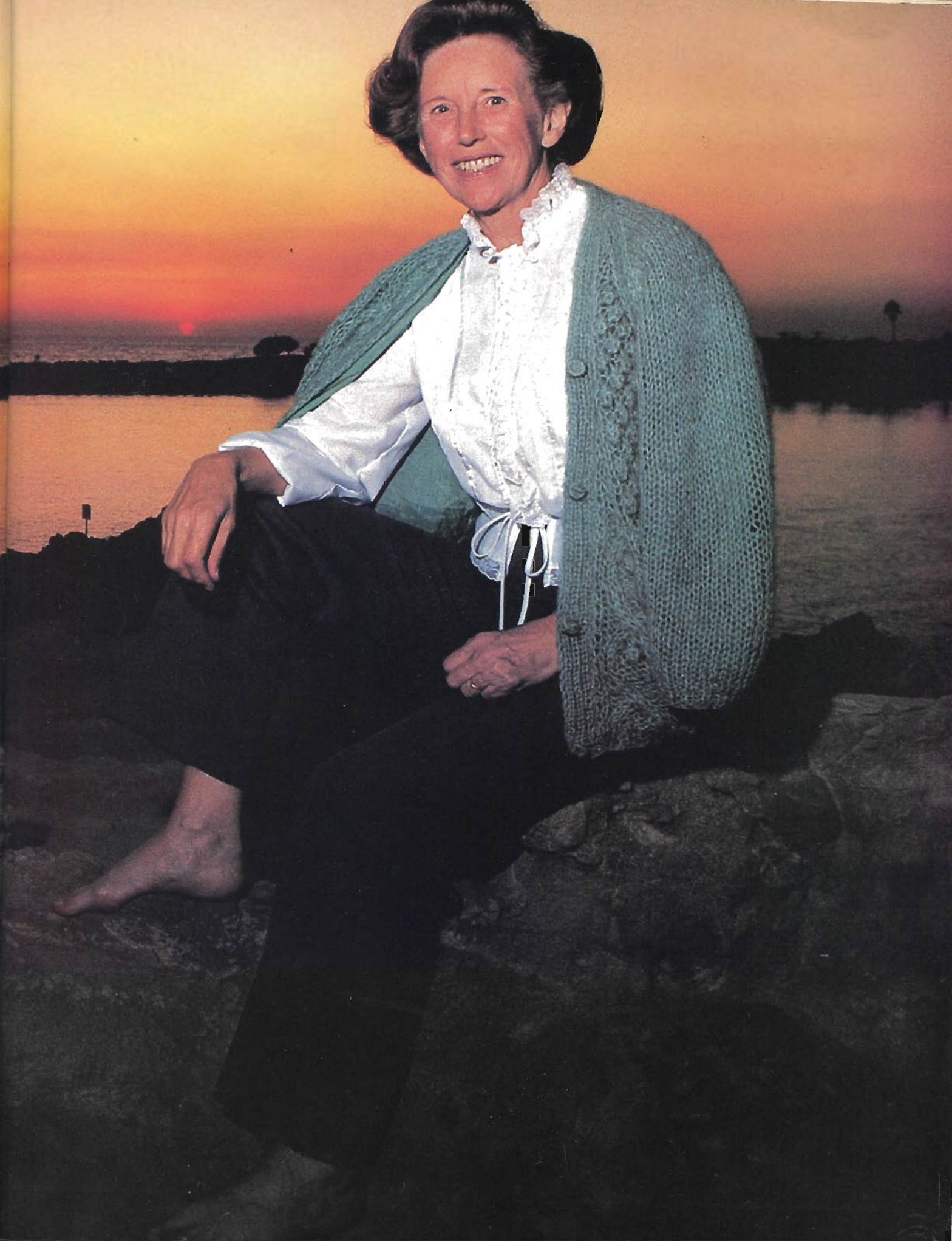
# BRAIN TUNER

BY KATHLEEN McAULIFFE

It looks like a Walkman," explains Pete Townshend, the lead guitarist of and chief songwriter for the Who, the British rock band. "You clip this transistor-size unit onto your belt, and there're two wires leading from it that you attach behind your ears. Then it's a question of tuning in to the right frequency."

The thirty-eight-year-old rock star is not describing the latest advance in recording technology, but a novel treatment for drug addiction—a treatment that may

PHOTOGRAPHS BY EARL MILLER



Patients feel only  
a slight tingling, yet this mild therapy  
subdues violent reactions.

work by striking a melodic chord in the brain. The Walkman look-alike transmits a tiny electrical signal that appears to harmonize with natural brain rhythms and, in the process, reduce craving and anxiety. Or at least it worked for Townshend. The little black box, he says, saved him from a nearly suicidal two-year alcoholic binge that eventually drove him to heavy tranquilizers and virtually any other drug he could get his hands on. "The treatment works not only for boozers," Townshend emphasizes. "It's helped people give up cigarettes, heroin, barbiturates, speed, cocaine, marijuana—you name it. There is a different frequency that works best for each kind of addiction."

Dr. Margaret Patterson (above), a Scottish surgeon currently residing in southern California, is the owner and inventor of this magical device. Her black box (innards of an early model are pictured on the page opposite) sounds suspiciously like quackery. Just twiddle a few knobs and—presto—you can be cured of every imaginable vice. But the magic is real to people in the rock 'n' roll industry, who call her a miracle worker. Apparently Townshend is not the only celebrity who has benefited from her unusual remedy. She is credited with having reformed more than a dozen top recording stars, including ex-heroin addicts Eric Clapton and the seemingly indestructible Keith Richards, of the Rolling Stones, whose reckless abuse of drugs became as legendary as his music. (For Townshend's personal account of combating drug addiction with Patterson's black box, see page 48.)

Happily, Patterson does not fit the image of either a charlatan or a cult figure. She is in her fifties, slender of frame, with a kindly face that radiates compassion. Her pale blue eyes are set off by a magnificent mane of auburn hair, which is swept up into a graceful, oversized bun. "I hesitate to use the word *cure*," she says in a soft, lilting burr. "I prefer to call it a method of rapid detoxification. The electricity quickly cleanses the addict's system of drugs, restoring the body to normal within ten days. Most patients report that their craving also subsides in the process."

Patterson's electrical stimulator is currently pending clinical approval by the Food and Drug Administration (FDA) in the United States, where she has lived since 1981. Over the last decade in Britain, however, almost 300 addicts have received NeuroElectric Therapy (NET), the technical name for her treatment. Patterson claims that all but four left drug-free at the end of the detoxification process—a remarkable 98 percent success rate. "NET should not be confused with ECT—electroconvulsive therapy for mental



patients," she cautions. "NET is far milder, involving currents at least twenty times weaker. Patients feel only a slight tingling sensation behind their ears where the electrodes are taped on." Yet this "mild" therapy, she insists, will subdue the violent physiological reactions that can make "going cold turkey" intolerable for even the most strong-willed person. Though normally soft-spoken, Patterson asserts unequivocally, "I can take anyone off a drug of abuse, no matter how severe his or her addiction, with only minimal discomfort."

Of course, not all those who complete the detoxification program remain abstinent. Patter-

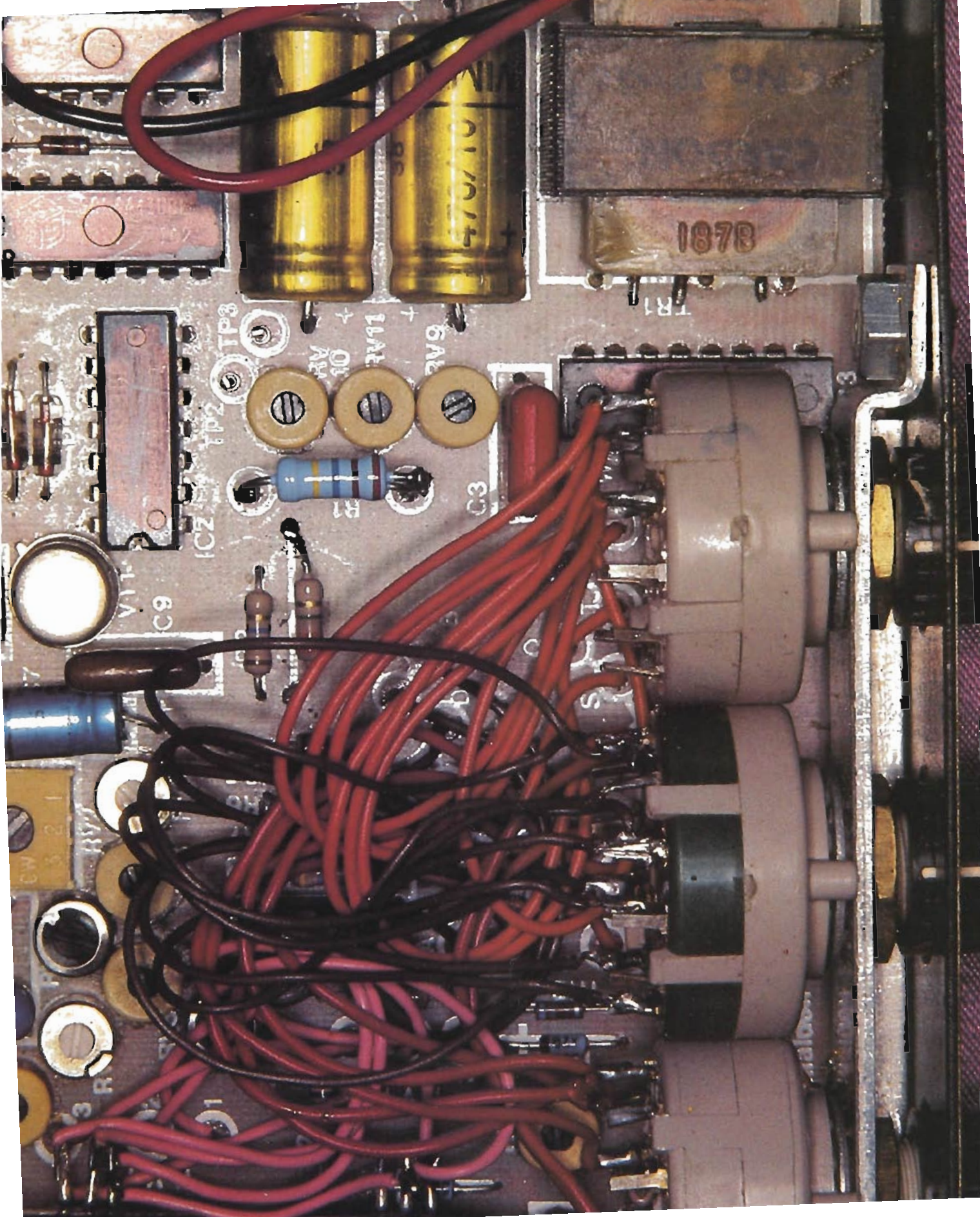
son emphasizes that NET is most effective when backed up by counseling, remedial training, and a supportive home environment. For many individuals, however, the treatment does appear to have long-lasting effects. If we are to believe the recidivism figures she cites, they are many times lower than the national average for every class of addictive drug.

A glance at Patterson's credentials provides reassurance that she is both serious and highly capable. At twenty-one, she was the youngest woman to qualify as a doctor at Scotland's Aberdeen University. Only four years later she obtained her Fellowship at the Royal College of Surgeons, at Edinburgh University—an elite circle that few surgeons penetrate before their thirties. And just before her fortieth birthday she was presented one of her native land's highest honors by the Queen—an M.B.E., or Member of the Order of the British Empire—for her outstanding medical work in India.

Colleagues and patients describe the tiny Scottish surgeon as warm, confident, and virtually unflappable. "You can't con her," says one patient who had spent years cheating and lying to get bigger drug prescriptions. "And if you try to put one over on her, she won't turn her back on you like other doctors."

"She's the sort of mother you always dreamed of having," says a female addict. Still another views her as a saintly figure "with the selfless devotion of someone like Mother Theresa."

Patterson's close rapport with her patients has made some professionals question whether her dazzling record in drug rehabilitation is really attributable to the powers of electricity. "It's her personality" is the chief disclaimer psychiatrists have attached to her work. "She doesn't control for psychological factors such as people's expectations," says Dr. Richard B. Resnick, an associate professor at New York Medical College, who is recognized as an innovator in the treatment of heroin addiction. "For






## PETE TOWNSHEND ON THE BLACK BOX

Who guitarist Pete Townshend traces his downward slide toward drugged oblivion to the troubled spring of 1980. Long months of touring had brought him to the brink of a marital rift. Gross financial mismanagement had left him \$1 million in debt to English banks. And all the while he brooded incessantly about the future of the *Who*. "I started drinking about a bottle and a half of cognac a day," Townshend recalls. "And to cut through the drunken stupor I was in, I got into this deadly alcohol-cocaine oscillation. Eventually I became such a physical wreck that I went to this doctor, who prescribed me sleeping pills and an anti-depressant called Ativan. These Ativans made me feel great, and soon I was taking eight to ten tablets a day, plus three sleeping pills every night. By Christmas, though, the Ativan stopped working, and so I turned to heroin. A month later it dawned on me that I was actually dying, that my macho, 'I-can-do-anything' mentality would kill me. It was then I contacted Meg [Margaret Patterson]."

"Even though I'd seen startling successes with her technique, I didn't know whether it would work for me. But by the second day I knew I was on the home straight. And on the third day I felt feelings of sexual desire returning, feelings of just wanting to go out for a walk. It was incredible! There was a sense of inner joy as I started to gain independence from drugs. A natural energy flow slowly returned to my body. I could feel the old me coming back, and the first emotion I felt was arrogance. I thought, 'This will be easy. A few more days on this machine, and then I'll shoot up to L.A. and go dancing.' That was my frame of mind. But the fourth day I got depressed. Initially I had been given low electrical frequencies for heroin, but when I became depressed, I was given some high frequencies for my cocaine addiction. And at this high setting, I would sometimes have psychedelic experiences. The colors in the room would suddenly start to go woow. Then I had another setback, followed by a day when I felt superhuman. It was just like being on heroin. But the next day I again felt like death warmed over. Some withdrawal symptoms even returned.

"Gradually, though, your mood levels off so that by the tenth day you feel fairly normal. In retrospect, I realize that the treatment is an education in itself. NET reeducates the brain to produce its own drugs, and in the process you learn something about your human potential. You come to realize that somewhere within you is the power to deal with crises, tensions, and frustrations. So the treatment reaffirms one's faith in the self-healing process.

"Of course it seems incredibly crude to shoot a thousand-cycle pulse through the brain—and *voilà!* Yet that's the beauty of it. There's something almost mystical about recovering by such a ridiculously simple technique. Somehow a simple little gadget has made me feel whole. And if I'm ever raped by a crazed pusher and become hooked all over again, I won't hesitate to call Meg and have my addiction handled in this straightforward, completely technical way." 

example, what happens if you fasten electrodes to patients' heads but don't turn on the electricity? You just talk to them and feed them chicken soup. Will they do better, the same, or worse than the group that got current?"

Such skepticism is less common in England, where Patterson's clinical practice was based until recently. There, a number of doctors have already begun to obtain the same beneficial effects with her electrical stimulator model.

Dr. Margaret Cameron, a psychiatrist with the National Health Service, in Somerset, England, reports that NET gives "very, very good results—better than any other treatment I've encountered." Since May 1981 Dr. Cameron has treated 40 alcoholics, 2 methadone addicts, 4 heroin addicts, and a few individuals with mixed addictions involving cocaine and barbiturates. In follow-up interviews conducted six months to a year later, 60 percent of the alcoholics were still off alcoholic beverages and none of the other patients had relapsed. A private practitioner based in New Jersey, Dr. Joseph Winston, shares Cameron's enthusiasm for NET: "As a benign, effective technique for withdrawing people from drugs, it is virtually unmatched."

If NET has met with resistance, it is because its mode of action strains the explanatory powers of modern science. Until recently orthodox medicine refused to recognize that infinitesimal electrical currents may influence the behavior or function of living organisms. Currents less than 100 millivolts—or below the threshold for triggering a nerve impulse—were assumed to have no effect on biological processes. This dogmatic view had to be reassessed when accounts of such unsettling phenomena began appearing with increasing frequency in technical journals over the last decade. NET is, in fact, only one branch of a young, controversial discipline that is still struggling to achieve respectability—the science of electrical medicine.

In the early Seventies scientists began introducing very small currents via electrodes to different parts of the body—with dramatic results. A rat amputee was induced to regrow a forelimb down to the midjoint, according to one exciting—though sometimes contested—report. In human applications, the FDA has approved the use of such currents for stitching together stubborn bone fractures. Recent experimental trials also indicate that trickling flows of electricity promote the healing of chronic bedsores, burns, and even peripheral-nerve injuries. The external currents, it is theorized, stimulate rapid healing by augmenting the body's internal currents.

"By contrast, weak currents applied to the brain affect different physiological processes," says Dr. Robert O. Becker, a pioneer of electrical medicine who recently retired from Veterans Administration Hospital, in Syracuse, New York. "But I believe Dr. Patterson is producing profound alterations of the central nervous system.

# BRAIN TUNER

CONTINUED FROM PAGE 48

The psychological set that makes a person become an addict seems to disappear."

Researchers are now starting to elucidate NET's scientific rationale, winning over new converts from the more conservative ranks of the medical profession. In the process, Patterson's black box is helping to unlock the mysterious inner workings of that other black box: the human brain. The stimulus goes in and the response comes out, but seldom are we afforded a glimpse of what happens in between. By probing NET's effects on experimental animals, investigators are shedding light on the underlying mechanisms that control everything from addictive behavior to our most basic drives and emotions. As Dr. Becker surmised, the stimulator does indeed cause "profound alterations of the central nervous system." Underlying consciousness is an intricate orchestral arrangement of trillions of brain cells, firing in concert. Like different instruments in a symphony, subpopulations of neurons are now believed to produce frequencies within a specific range. Frequency, so to speak, is the music of the hemispheres.

Like penicillin and X rays, NET was born of scientific serendipity. It began with an accidental discovery in the fall of 1972. At that time Patterson was head of surgery at Hong Kong's Tung Wah Hospital, a large charity institution with a poor clientele. A neurosurgeon colleague, Dr. H. L. Wen, had just returned from the People's Republic of China, where he had learned the technique of electroacupuncture. Primarily interested in its usefulness in the suppression of pain, he began testing it on patients with a variety of ills. Dr. Wen, however, did not know that almost 15 percent of his patients were addicted to heroin or opium of extremely high purity. At that time the drugs were easily affordable at a daily cost of less than a pack of cigarettes.

"One day," Patterson says, "an addict approached Dr. Wen, announcing that the electroacupuncture had stopped his withdrawal symptoms. 'I felt as if I'd just had a shot of heroin,' he said. Wen initially thought nothing of it, but a few hours later a second addict reported a similar experience, equating the electroacupuncture with a certain dosage of opium."

Further inquiries revealed that a few alcoholics and cigarette smokers in Wen's experimental group had also been freed from their craving. To the eye, however, the electroacupuncture produced the most dramatic response in the narcotics addicts deprived of their drugs. The characteristic runny nose, stomach cramps, aching joints, and feeling of anxiety usually disappeared after 10 to 15 minutes of stimulation by needles inserted inside the hollow of the external ear, at the acupuncturist's lung point. At first these good effects lasted only a few hours. But with repeated treatments,

patients remained symptom-free for periods of longer duration.

The results of Wen's first study with 40 opiate addicts were published in the *Asian Journal of Medicine* the following spring. Of this group, 39 were drug-free by the time they left the hospital, roughly two weeks after starting treatment. When Patterson returned to England in July 1973, however, she found that addicts there were far less enthusiastic about the procedure. The Chinese loved acupuncture: the British hated it. "As bizarre as it may sound," Patterson explains, "Westerners—even those who mainlined drugs—often had an aversion to the needles."

There was another reason not to use needles. Patterson had suspected from the outset that acupuncture was essentially an electrical phenomenon. Even the traditional explanation hinted that this might be so. The ancient practice revolves around the notion that all living things possess vital energy, called *chi*, which circulates through

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*From the moment  
the electrodes were put  
on my head,  
my craving immediately  
diminished. When  
I had passed the three-day  
mark, I felt  
no craving at all.*

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the body by way of a network of channels, or "meridians." Sickness was seen to be the result of disharmony, manifested by an obstruction in the flow of *chi*, which the needling was thought to remedy.

Was *chi* the ancients' concept for what modern man now recognizes as the internal currents that course through the body? Could it be that the Chinese, more than 2,500 years before the discovery of electricity, had intuitively sought to alter this life force in an attempt to alleviate pain and to cure disease? Perhaps, Patterson reasoned, the twirling of needles generates a tiny electrical voltage. Viewed in this light the more recent practice of electroacupuncture was simply a more intense form of the original twirling technique. If so, the electrical signal would be of crucial significance in the treatment of addictions.

Years of clinical trial and error eventually confirmed her hunch. First Patterson replaced needles with surface electrodes. Then she went on to compare direct current with alternating current, while varying the voltage, shape, and other aspects of the electrical signal. Next she altered the electrode placement, finding a position just

behind the ear over the mastoid bone to be more effective than the lung point. But, of all the variables explored, electrical frequency quickly emerged as the single most important element for success. Those addicted to narcotics and sedatives preferred frequencies within the 75-hertz to 300-hertz range, barbiturate addicts responded to lower frequencies, and still other addicts, especially those dependent on cocaine or amphetamines, benefited most from frequencies as high as 2,000 hertz. "Musicians," she fondly recalls, "really helped to strengthen my guesswork during those early days. They invariably found the correct therapeutic setting right away. It was as if their brains were more attuned to frequency."

A further refinement of the therapy was prompted by still another fortuitous discovery: A heavy abuser fell asleep with the electrical stimulator on and awoke 30 hours later, well-rested and eager to take Patterson's children ice skating. From that moment onward, Patterson advocated continuous current application in the initial phases of treatment. She began the search for more comfortable electrodes that could be worn during sleep and for smaller electrical stimulators that could be clipped onto belts, permitting mobility during the day.

By 1976 Patterson had transformed electroacupuncture into an exciting new experimental treatment mode that she christened NeuroElectric Therapy. In her first clinical study, which was reported that year in the U.N. *Bulletin on Narcotics*, opiate addicts given NET as in-patients were all found to be drug-free an average of ten months after completing treatment. In contrast, opiate addicts who received NET only during the day as out-patients did not fare as well: 47 percent were drug-free at the time of the follow-up.

Because this preliminary investigation was limited to 23 patients, her results could not be extrapolated to a larger cross section of addicts. To provide better information about the long-term effects of NET, and also to assess its value in the treatment of other kinds of addictions, Patterson was recently awarded a research grant by the British Medical Association.

Last fall, at a Washington, D.C., symposium sponsored by the American Holistic Medical Association, Patterson presented the findings from this follow-up evaluation, which tracked the progress of patients treated between 1973 and 1980. Data were obtained from confidential questionnaires and, when possible, from personal interviews. Fifty percent responded to the survey, and these respondents included 66 drug addicts (mostly mainline heroin or methadone users and mixed-addiction cases), 9 cigarette smokers, and 18 alcoholics. At the time of the follow-up, total abstinence was said to be achieved by 80 percent of the drug addicts, 44 percent of the cigarette smokers, and 78 percent of the alcoholics who stated abstinence to be their goal. An additional

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7 alcoholics whose goal on admission was controlled drinking all reported success. (As Patterson herself cautions, however these figures probably represent too favorable an outcome since patients who relapsed, especially alcoholics, may have been less likely to reply to the survey.) Of those who were successfully weaned from their dependence, 68 percent said they never or only rarely experienced craving, 15 percent said they occasionally felt craving, and another 17 percent said they frequently felt craving.

Interestingly, none of the drug addicts at the time of reporting had substituted alcohol for their earlier addiction—a finding that contrasts sharply with the figures cited in other studies. In one national survey, for example, 60 percent of addicts who had given up narcotics became heavy drinkers or alcoholics. Equally noteworthy was the extremely low dropout rate of all addicts enrolled in the program. Only 1.6 percent did not complete detoxification.

All things considered, the success of Patterson's patients is probably most remarkable from the standpoint of the brief duration of the therapy, which, including counseling, rarely extends beyond 30 days. According to a large study of drug abusers admitted to a variety of government-sponsored programs, addicts treated less than three months did not fare any better than those in a no-treatment comparison group.

So NET seems to achieve in a few weeks what few, if any, orthodox treatments can accomplish after months or years.

Not everyone, however, is convinced by the report's conclusions. A look at the history of drug reform in the United States shows that their cynicism is not ill-founded. Consider the government's efforts to curb narcotics use. The first U.S. Public Health Service hospital for heroin addicts opened in Lexington, Kentucky, where 18,000 patients were admitted between 1935 and 1952. All except some 7 percent of the alumni promptly relapsed after dismissal from the institution—a dreary record that other institutions scarcely improved upon in subsequent decades.

By the 1960s heroin addiction had spread like cancer through inner-city ghettos. To control the expanding epidemic, health professionals turned to methadone, a synthetic opiate that is legally prescribed. Today thousands of clinics throughout the nation dispense methadone to certified addicts, and those maintained in these programs show higher rates of employment and fewer criminal offenses than before they began treatment. But methadone, alas, is even more addictive than heroin. As one medical authority points out, "The tragedy of methadone is that we cannot get people off methadone."

For narcotics addicts who aspire to a drug-free existence, society offers two main

alternatives: the highly structured and insulated environments of such residential homes as Daytop Village, Phoenix House, and Odyssey House or out-patient clinics, which provide daily counseling services. As many as 30 to 40 percent of the people who enroll in these community-based programs remain abstinent a year after leaving treatment. But to enter most of these programs, one must first detoxify in a hospital. And here's the hitch: 64 percent don't make it past the acute withdrawal phase to qualify for further treatment.

"It is still not understood why simple detoxification is so ineffective, but the facts are clear and inescapable," says Dr. Avram Goldstein, professor of pharmacology at Stanford University. "As I see it, the reason for the dismal failure is that the newly detoxified addict, still driven by discomfort, physiologic imbalance, and intense craving, cannot focus attention on the necessary first steps toward rehabilitation, but soon succumbs and starts using heroin."

Jean Cocteau, the French writer, who resumed smoking opium after medicine had "purged" him of the habit, put it another way: "Now that I am cured, I feel empty, poor, heartbroken, and ill."

In sharp contrast, NET patients are said to emerge from treatment feeling healthy, energetic, even cheerful. Dr. Joseph Winston, the American physician who collaborated with Patterson in the treatment of



Keith Richards recalls that the musician "came to us terribly ill. He was literally green. But he slept eighteen hours the first day and ten days later he was playing tennis and the group said he had not looked so good in years."

If Patterson's findings seem at total variance with the bulk of the clinical literature, the firsthand accounts of NET patients may help explain why.

Stuart Harris started shooting heroin as a sixteen-year-old cadet in the Royal Navy. By the time he underwent NET in the spring of 1981, he had been addicted to heroin 15 years, and for 11 of those years he had also injected methadone intravenously. "I had the sweats very badly," he says of his experience on NET. "You're emitting all this bad grunge from your body, and you feel like you're speeding [on amphetamines]. But there's no withdrawal at all! That much I'll say for it. I mean when they told me about it, I just took it with a pinch of salt—another treatment they've lobbed off on the poor junkies. But believe me, if I was getting any pain as I used to have with withdrawal, I wouldn't have stayed there, cause I was a voluntary patient. When I discharged myself from hospital, I didn't go searching out for drugs as I would normally have done in the past, say after methadone reduction or narcosis (that's when they sedate you up to your eyeballs on sleeping pills). After completing all the other methods, I felt so uptight all the time. The first thing I wanted to do was have a massive great fix. But after NET, all you really want to do is sleep. Everything is so easygoing. I can't say that it [heroin] doesn't drift into my mind. Like the other day, I fancied a fix. But it passed over in a few minutes. Before, if I'd felt the slightest urge for a fix, off I'd go to London. Something has changed. You feel calmer. You can accept the ups and downs."

A man in his thirties, who requested anonymity, had injected heroin for eight years, combining this dosage with prescribed methadone during the last five years of the period. He received NET in 1974. "The treatment was rough," he says. "I felt as if I had a mild case of the flu, combined with short periods of feeling spaced out—even a bit euphoric. My anxiety and craving subsided right from the beginning, but a few weeks later my craving for heroin went back up again. I wanted to go out and score. And as a matter of fact, I did. But it was different. It wasn't satisfying. It didn't make me feel that great. I know this treatment changed my head, because I never thought about heroin again after that. You see, I had gotten off heroin for as much as a month, even two months, at a stretch. But the whole of that time I would be thinking of heroin and nothing else."

A twenty-eight-year-old man, who also requested anonymity, combined a high level of alcohol and marijuana consumption with a cocaine habit of two to six grams each week for more than seven years. (The cocaine alone usually cost him more than

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\$1,000 a month.) He agreed to speak to *Omni* immediately after completing NET treatment in the summer of 1982 "Until this therapy," he says, "I couldn't go three days without feeling an enormous craving for drugs. Cocaine and, to a lesser degree, alcohol would always be on my mind. But from the moment the electrodes were put on my head, my craving immediately diminished. When I had passed the three-day mark, I felt no craving at all, and I still don't. Drugs never enter my mind. Now that I remember what it's like to feel good—to be clearheaded after all these years—I'm certain that I won't go back on drugs."

Rachel Waite, a heavy smoker for five years, was treated for her cigarette addiction in June 1981. "For the first three days on NET," she recalls, "I still had the urge to smoke, and I probably would have lit up had a cigarette been handy. However, by the end of the treatment I definitely did not want one. When I took an experimental puff, it was a different sensation altogether. It tasted foul, and there was no hit whatsoever. It was as if I was drawing on hot air."

Surprisingly, many patients who go on to build drug-free lives do not receive any formal counseling beyond that provided during the brief detoxification program. Yet NET, by itself, cannot remove the root causes of addiction, nor can it replace years of maladaptation with healthy skills for coping with life's stresses and disappoint-

ments. Why then do so many patients experience such a metamorphosis?

The treatment, Patterson believes, simply sets the stage for further growth. "Because they feel so good," she says, "they are better able to face the sort of problems that drove them to addiction in the first place. You see, most people who come off drugs without NET enter a phase of prolonged dysphoria: They suffer from fearful depression and pessimism. They can't eat. They can't sleep. They have no energy. This can last for six months in the case of heroin and even longer in cases of methadone and barbiturate addiction. But NET restores physiological normality within ten days, which enormously reduces the amount of time needed for readjustment."

If anything, Patterson thinks that euphoria—not dysphoria—is to blame when rehabilitation fails. The newly detoxified addict is optimistic to the point of being overconfident. "In their elated state," Patterson says, "they think it will be easy to stay off drugs and then end up stumbling because they don't make enough of an attempt to change their ways."

As if obeying Newtonian mechanics, the black box appears to counter one mood shift with an equal swing in the opposite direction, until the emotional pendulum finally comes to rest. Is the black box, in reality, an electronic substitute for a chemical high? How can a physical treatment

cause such a swing toward euphoria?

As fate would have it, a scientist who had taught Patterson years earlier, Dr. Hans Kosterlitz, would once again serve as her mentor by illuminating the mainspring of euphoria in the brain. While working with Dr. John Hughes at the University of Aberdeen in 1975, Dr. Kosterlitz identified an endorphin, a natural brain chemical, with a molecular structure very similar to the opiates. For this outstanding discovery, the investigators later received the prestigious Lasker Award—revered as America's equivalent of the Nobel Prize in medicine. Almost overnight their finding triggered an explosion in the understanding of the biochemical basis of behavior, opening a new vista on the controlling factors behind addiction. Opium, heroin, morphine, and other related drugs owe their potency to what Avram Goldstein calls "one of nature's most bizarre coincidences"—their uncanny resemblance to the endorphins.

Over the succeeding years researchers uncovered evidence of myriad other brain hormones that mimic psychoactive drugs, from Valium and angel dust to hallucinogens. Almost every mind-altering substance, it is now assumed, has an analogue in the brain. And the precise mixture of neurojuices in this biochemical cocktail can mean the difference between tripping, speeding, crashing, or seeing the world through sober eyes.

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These insights immediately suggested how the addict becomes trapped in a nightmarish cycle of dependency. In the initial phases of narcotic use, for example, the individual is assumed to have normal levels of endorphins in the brain. Injecting heroin causes a sudden and drastic elevation of opiates, which is subjectively interpreted as ecstasy. If through repeated use, the brain is regularly flooded with opiates, it redresses the imbalance by cutting back on the production of its internal supply. Hence, the well-known condition of tolerance develops. The addict 'steps up' his dosage, and the brain further compensates by calling a massive shutdown of production. Eventually, according to theory, the addict is shooting up solely for the purpose of feeling normal. Should the drug supply be cut off at this stage, the opiate shortage cannot be instantly remedied. Drought ensues, unleashing withdrawal symptoms.

If an exogenous drug depletes the brain of its natural counterpart, it seemed logical that NET might quite literally juice up the system, rapidly replenishing the scarce neurochemical. Might certain frequencies of current catalyze the release of different brain hormones? Patterson wondered.

To find out, she conducted animal experiments in collaboration with biochemist Dr. Ilor Capel at the Marie Curie Cancer Memorial Foundation Research Department in Surrey, England. Simply by monitoring the blood of NET-treated rats, the investigators discovered low-frequency currents can indeed cause as much as a threefold elevation of endorphin levels.

In another experiment, the researchers examined NET's effects on rats rendered unconscious by massive doses of barbiturates. Once asleep, all the animals had electrodes clipped on to their ears, but only half the group actually received electrical current. The result? At one particular frequency—ten hertz—the experimental group rapidly regained consciousness, sleeping on average 40 percent less than the rats that received no electricity.

Why is the detoxification process hastened? One clue surfaced when the rats' brain tissue was analyzed. It was learned that the ten-hertz signal speeds up the production and turnover rate of serotonin (a neurotransmitter that acts as a stimulant to the central nervous system).

Similar experiments have now been repeated on rats made unconscious by injecting them with alcohol or ketamine (a cousin of angel dust). In almost every instance, the frequencies that reduced sleeping time had earlier been proved therapeutic in the detoxification of human addicts. "Virtually every single parameter of current that I had stumbled upon during my clinical work was corroborated by the rat studies," Patterson declares, with barely concealed excitement.

How a weak electrical current can open the floodgates of the mind is still a matter of conjecture, but the implications are ob-

vious. Like a citizen's-band transmitter that infiltrates television frequencies, the black box must broadcast through brain frequency channels. And just as a TV receiver can pick up CB transmissions from a passing truck, the brain undoubtedly responds to the foreign-generated signal as if it originated from within its own communication network.

"As far as we can tell," says Dr. Capel, a rugged Welshman with a melodic voice, "each brain center generates impulses at a specific frequency based on the predominant neurotransmitters it secretes. In other words, the brain's internal communication system—its language, if you like—is based on frequency."

Unfortunately, neuroscientists are not yet fluent in this new tongue. NET is still a very blunt tool, Capel acknowledges. Presumably, when we send in waves of electrical energy at say ten hertz, certain cells in the lower brain stem will respond because they normally fire within that frequency range. As a result, particular mood-altering chemicals associated with that region will be released. That's what we hope is happening. In reality, however, much of the signal may be lost before it actually reaches the target cells. We just don't know. But if we can fine-tune the signal, I am confident our results will steadily improve.

At her small, two-bedroom home in Corona del Mar, Patterson has begun testing a new, improved model of the stimulator. Her goal—and the major impetus behind her decision to come to the United States—is to obtain funding for the establishment of a center where human and animal research can proceed in tandem. Until FDA clearance is given, however, she cannot begin treating addicts on a routine basis.

Will NET open a new route to salvation for the millions of Americans who each year flock to Alcoholics Anonymous, Smoke Enders, and methadone maintenance clinics? Clearly, the final verdict is contingent upon replication of controlled studies. But if a feeble electrical current can truly curb the mind's excesses—from uncontrollable lusts to extremes of mood—its impact is sure to be far-reaching.

"Addicts may represent only a tiny fraction of the people who will eventually be helped by NET," Capel predicts. "In all likelihood, it will find an enormous range of uses, especially in the area of pain control." In one preliminary trial, terminal patients suffering from chronic pain found NET just as effective as their daily dose of morphine. "By stimulating the brain's own painkillers, we didn't have to administer drugs," Capel marvels.

Early data also indicate that NET may prove highly promising in the treatment of mental disorders. The frequencies that induce euphoria and reduce tension, according to Dr. Cameron of Britain's National Health Service, "seem to work wonders for patients suffering from severe depression and acute anxiety." Though it is far too soon to draw any conclusions

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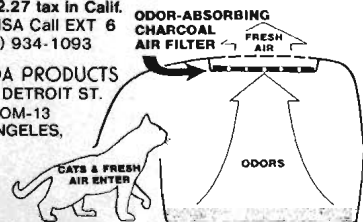
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she notes that "a few of the half-dozen chronic depressives we've treated have found themselves jobs after years of unemployment."

As for Patterson, she hopes eventually to broaden her practice to include behavioral addictions, from overeating and compulsive gambling to video-game fanaticism. Absurdity aside, these wider applications follow a certain logic. "Her ideas make perfect sense if one accepts the idea that behavioral addictions have a chemical basis," says Dr. William Regelson, at the Medical College of Virginia. "It is very likely, for example, that all activities vital to survival—from sex to physical exercise—are physiologically addictive. It is now thought that the phenomenon called jogger's high is actually endorphin-mediated. In all probability, eating also releases some kind of pleasurable molecule. After all, why do we crave food? Low blood-sugar levels don't explain why. The truth is that we feel abnormal when we haven't eaten in a while. Some chemical in our brain has become depleted. We become restless and agitated, and, after extreme deprivation, we suffer withdrawal symptoms commonly known as hunger pangs. The only way to relieve our discomfort is to get more food. It's a fix—plain and simple."

If basic drives are addictive, then drugs are an ingenious means of shortcutting the elaborate scheme nature devised to ensure that we maintain health and reproduce ourselves. Merely by popping a pill, we can top off our neurochemical reservoirs with no sweat expended. Instant orgasm without any foreplay. A cheap thrill.

But can't the same be said of NET? "Is it not, after all, an electronic fix?" asks Regelson, who fears the black box may become addictive in its own right. Patterson has kept her eyes open to any signs that her patients are becoming physically dependent on the equipment. But she rules out the possibility that there will ever be a black market in black boxes, because individual models can cost upward of \$1,000—a hefty sum to cough up for purely recreational use. Besides, she has not encountered a single instance of electronic addiction in her ten years of practice. The explanation, she believes, "is that drugs—for the very reason that they are foreign—upset the brain's chemistry. NET, on the other hand, simply coaxes the brain to restore its own chemical balance. The body heals itself."

The intuitive feelings of her patients support this view. As reformed heroin addict Stuart Harris says, "At first I thought it would be fun to wire up the human race, so we could all go whizzing about. But after the initial buzz, you feel, well, normal. Frankly, all NET does is help you face reality."

Patterson concurs: "All we can do is give people a chance. We can get them off whatever drug they're hooked to, but it's up to them to fill the void. They've got to find a constructive substitute for the drugs that have dominated their lives." ☐

# MONSTERS

CONTINUED FROM PAGE 113

Bartholomai, the museum's director, doesn't believe the skin comes from the long-lost tiger. Instead, he's convinced it was torn from the back of a giant pussycat. "Domestic cats may have escaped to the rain forest decades ago," he speculates. "Then, through the process of natural selection, they may have grown frightfully large to survive in the new terrain."

## GIANT OCTOPUS

The Queensland cat may seem big, but it pales before what could be the world's hugest invertebrate—a six-ton octopus said to lurk off the Florida coast.

The beast came to light on November 30, 1896, when two boys cycling along the beach in St. Augustine, Florida, discovered a huge carcass buried in the sand. News of the find soon reached medical doctor and naturalist DeWitt Webb, who rushed to the scene, expecting a whale. But after careful examination he reached the astonishing conclusion that the beast was a giant octopus, the first ever glimpsed by a scientist.

With the help of a Yale professor named A. E. Verrill, an expert on the giant squid, Webb did further studies on the creature. Verrill himself eventually published accounts in local newspapers and a few scientific journals. The reaction of their peers? Outrage. Webb had found a mass of blubber, they charged—nothing more.

The story would have ended there but for a chance find in 1957 by Forrest Wood, newly appointed curator at Marineland of Florida. Wood was going through some of his predecessor's papers when he discovered a yellowed newspaper clip describing the beast—a six-ton octopus stretching 150 feet tentacle tip to tentacle tip.

Amazed, he began an intensive investigation, finally discovering a jar filled with samples of the 60-year-old carcass stowed away at the Smithsonian Institution. Then he recruited the help of his friend and fellow marine biologist Joseph Gennaro, Jr. of the University of Florida.

Gennaro persuaded the Smithsonian to let him take a few pieces of flesh back to Florida, and soon he was hard at work. Doing a microscopic analysis of the tissue, he found that it resembled neither whale blubber nor squid tissue. Instead, the cells formed a broad pattern of dark and light stripes seen only in the octopus. He and Wood published their account in *Natural History* magazine in 1971, only to receive a nasty letter from the Smithsonian. How dare they suggest the tissue was anything but whale blubber, the institution demanded, requesting that Gennaro return the borrowed sample at once.

Gennaro ignored the request, and just recently he conducted yet another study suggesting that the tissue was in fact something totally unique.

Working from his current lab at New York University, Gennaro cut a snippet of tissue from the Smithsonian sample. Then he removed tissue from a whale, a 60-year-old giant squid preserved in formaldehyde, an ordinary squid, and an ordinary octopus, too. Carefully labeling each sample with a number, he sent the batch off to Mackal at the University of Chicago.

Without knowing the real identity of the samples, Mackal conducted a biochemical analysis of each. They were all more or less similar, he found, except for one containing huge quantities of the supportive substance known as collagen. That sample, of course, turned out to be from the behemoth beached at St. Augustine.

As far as Gennaro is concerned, these results combine with Webb's detailed descriptions to indicate that the monster was indeed a giant octopus. Without any internal skeleton, he explains, an octopus grown large would need huge amounts of collagen to give it support. Whales, with strong internal skeletons, and squid, which use a substance called elastin for support, would have no such requirement, even if they did weigh five or six tons.

If any kin of the giant octopus still roam the sea, Gennaro says, they would count among the ocean's greatest beasts. "If it's anything like the octopus we know," he adds, "it lays hundreds, even thousands, of eggs at a time. There could be more than just a few of them, but they'd be harder to find than lake monsters. The ocean is a pretty big loch."

Monsters are a part of our heritage. The first sailors believed that if they didn't fall off the edge of the earth, a man-eating sea serpent would devour them alive. Reports of leviathans and mermaids continue to this day. Most of these, when examined, turn out to be mistaken identifications of known animals. Yet every once in a while a rumor turns out to be something extraordinary: a previously unknown animal. As in the case of the pygmy hippopotamus. For years natives in Africa talked about these miniature hippos, and no one believed them—until one was finally captured.

Yale University biologist Alvin Novick doubts that cryptozoologists will uncover anything significant. "There are far more important challenges to biologists, and far more important uses for large expenditures of time, money, and talent," he says, "than seeking marine apes in the Aleutians, sea serpents in Maryland, or zeuglodon in Vermont. Belief in these creatures is nothing more than a reflection of anxiety in the modern world of science, and an obvious extension of current interest in the paranormal."

To Richard Greenwell, though, the future of cryptozoology is bright: "From a statistical perspective alone," he contends, "some of these animals just have to be real. The field won't all crumble on one claim; we may be wrong about Bigfoot, and right about Loch Ness." ☐