

What is healing energy?

Part 3:

silent pulses

The two papers in this issue by Dr James Oschman continue his indepth review of 'healing energy' as it relates to health care in general and bodywork in particular. When *JBMT* commissioned this series the hope was that out of it, based on research which Dr Oschman has undertaken over the years, practitioners, therapists and educators would find intellectually acceptable explanations for what has been described clinically and anecdotally for many years. While a good deal remains to be understood it is now possible to suggest with some confidence that the evidence presented in this series to date offers verification for much that has previously been dismissed as unproven.

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Abstract This article explores the roles of rhythmic processes in the dynamics of healing. It begins with a close look at the oscillating magnetic fields emitted by practitioners of therapeutic touch and related methods. Medical researchers are using similar fields to 'jump start' healing in a variety of soft and hard tissues. What is different about the fields emitted from the hands of energy therapists is that they appear to 'scan' or 'sweep' through a range of frequencies. As a result, we propose an hypothesis that is also a definition: 'Healing energy', whether produced by a medical device or projected from the human body, is energy of a particular frequency or set of frequencies that stimulates the repair of one or more tissues. The cascade of activities initiated by such signals may provide essential information to cells and tissues, and open channels for the flow of information that coordinates repair processes. This is also significant for prevention and for restoring normal function after trauma. When considering the roles of rhythmic interactions, the concept of *entrainment* is important. For example, brainwaves are entrained by the thalamus. Research on the thalamus shows periods of inactivity, when the brainwaves are said to 'free run'. During these periods, the brainwaves may be entrained by external sources, such as the biological rhythms of a therapist or geomagnetic oscillations. Entrainment is a highly controversial topic, although the likely mechanisms are well understood. They involve the pineal gland and magnetite-bearing tissues, which serve as magnetoreceptors. Part B explores rhythmic entrainment as a therapeutic tool, and its recent application in resolving severe trauma and abuse. A theory of consciousness called microgenesis can account for many of the phenomena described.

Introduction

At all levels, nature is a composite of rhythms. The vast cycles of the

heavens represent an extreme of virtually unimaginable scale, with times measured in light-years. At the other limit are the minute oscillations

of atoms and subatomic particles, vibrating trillions of times per second. Life is immersed in this spectrum, and contributes its own unique set of rhythms. One long cycle is that between birth and death. Superimposed upon that rhythm are many cycles of replacement of the atoms comprising the body (Schoenheimer 1942). Some tissues, such as bone and fascia, are completely replaced some 10–15 times during a lifetime, while others, such as skin and intestine, are replaced 10 000 times during the same period. Certain enzymes last only a few seconds before they are renewed (Ratner 1979). Each organ has its own set of activity rhythms, such as the ovary, with its monthly cycle. Shorter yet are the rhythms of the cranial/sacral pulse, the breath, the heartbeat and the brainwaves, which average about one tenth of a second in duration. Even shorter are the vibrations of molecules, which spin, wiggle and shake millions of times each second. These rhythms will be discussed in the next article in this series.

Our intellectual history shows a continuing fascination with the ways life is tied to the rhythms of nature, including the earliest astrological speculations, which far antedate the modern science of astronomy. Recent scientific explorations have replaced many early superstitions with accurate and repeatable observations and measurements. This exploration has had a pulse of its own, as ideas of one generation give way to new truths, based on new data.

In terms of healing, important rhythms have been discovered by medical researchers who are employing magnetic pulses for 'jump starting' the repair of a wide spectrum of tissues and for treating diseases. While a variety of signals are being tested, medical interest has especially focused on pulsing magnetic fields of low energy and extremely low frequency (ELF). (The ELF range is

arbitrarily defined as frequencies below 100 Hz, Miller 1986.) Similar frequencies emanate from the hands of practitioners of therapeutic touch and related methods. Moreover, the fields emitted by practitioners are not steady in frequency, but 'sweep' or 'scan' through the range of frequencies that medical researchers are finding effective in facilitating repair of various soft and hard tissues. This is a recent and profoundly exciting correlation. Let us take a closer look.

Frequency windows of specificity

The Table lists some of the frequencies being tested in medical research laboratories and the types of tissues they affect. These are sometimes called 'frequency windows of specificity'. References to the original reports are given in the review article by Sisken & Walker (1995). In addition, various frequencies are being tested for their effects on specific diseases. Some of these studies can be found in various United States Patents (e.g. Sandyk 1995, Liboff et al 1993).

Figure 1 shows a signal recorded by Dr John Zimmerman from the hand of a practitioner of therapeutic touch (Zimmerman 1985, 1990). The signal frequency was not steady, but varied from 0.3 to 30 Hz, with most of the activity in the range of 7–8 Hz. Figure 1 also shows the portions of the

'sweep' that correspond to some of the clinical results in the Table.

Defining 'healing energy'

There is an obvious correlation between biomagnetic emanations from the hands of therapists and the 'frequency windows of specificity' found by biomedical researchers. While such correlations are exciting, they do not prove anything. More investigation is needed. Research begins with testable hypotheses that can be verified or refuted. We therefore present an hypothesis that is also a *definition* of 'healing energy', whether it is produced by a medical device or projected from the human hand:

'Healing energy', whether produced by a medical device or projected from the human body, is energy of a particular frequency or set of frequencies that stimulates the repair of one or more tissues.

Other frequencies are involved

Medical experimentation is not confined to the ELF region of the energy spectrum. Popular devices such as the Diapulse machine emit 27 MHz (27 million pulses per second) and have been studied extensively. Clinical trials of the effects of the Diapulse on injuries have shown

Table Healing effects of specific frequencies (frequency windows of specificity)

Frequency	Effects
2 Hz	Nerve regeneration, neurite outgrowth from cultured ganglia
7 Hz	Bone growth
10 Hz	Ligament healing
15, 20 and 72 Hz	Decreased skin necrosis, stimulation of capillary formation and fibroblast proliferation
25 and 50 Hz	Synergistic effects with nerve growth factor

From Sisken & Walker 1995

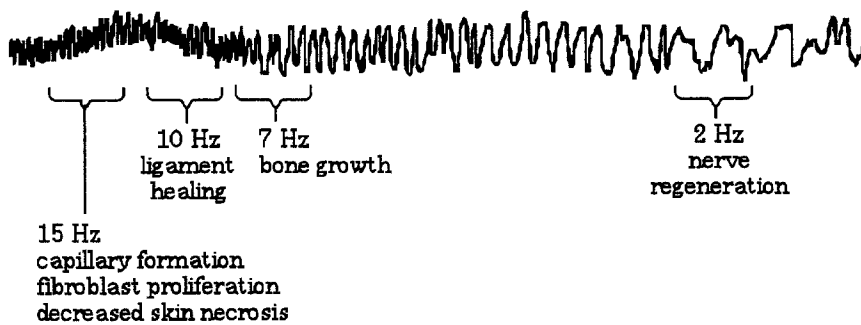


Fig. 1 Signal recorded by Dr John Zimmerman from the hand of a practitioner of therapeutic touch. The frequency was not steady, but varied from 0.3 to 30 Hz, with most of the activity in the range of 7–8 Hz. The 1-second wide brackets show portions of the ‘sweep’ that approximately correspond to some of the clinical results presented in Table 1.

reduced swelling, acceleration of wound healing, stimulation of nerve regeneration, reduced pain and faster functional recovery. References to this literature are given in the review by Sisken & Walker (1995).

The recording shown in Figure 1 shows only the ELF portion of the spectrum emitted from the hands of the therapeutic touch healer. Other frequencies and other forms of energy are undoubtedly present. These frequencies can be explained, in part, by the presence of the coherent Fröhlich oscillations mentioned in Part 1B of this series. For every frequency produced by the body, there are usually harmonics and subharmonics (i.e. signals that are exact multiples or fractions of the ‘fundamental’ frequency).

The possible involvement of infrared radiations was mentioned in Part 2B. There is evidence that infrared radiations from the hands of QiGong practitioners can increase cell growth, DNA and protein synthesis, and cell respiration. There is also evidence that living systems emit microwaves (Enander & Larson 1977) and light (Rattemeyer et al 1981, Popp et al 1992).

As an example, the heart produces a variety of types and frequencies of energy that propagate through the circulatory system to every cell in the body. The fastest signal is an electromagnetic pulse (recorded with

the electrocardiogram and the magnetocardiogram), followed by the heart sounds, a wave of pressure, and then a temperature change (infrared radiation). Russek & Schwartz (1996) refer to this as a *dynamical energy system*, and describe its potential for communicating information throughout the body.

Mechanisms

Medical researchers have stated that energy field therapies are effective because they project ‘information’ into tissues. This triggers a cascade of activities, from the cell membrane to the nucleus and on to the gene level, where specific changes take place (see Bassett 1995). The interpretation of these findings is that particular repair processes are triggered by the information contained in signals of specific frequencies.

While this is an interesting hypothesis, it leaves unanswered the question of why repair is not activated naturally. Why should it be necessary to trigger healing with an external signal? The following describes some additional considerations.

The living matrix is one medium through which the ‘cascade of activities’ takes place. Complete health corresponds to total interconnection through this matrix and its associated layers of water.

Suppose accumulated physical

and/or emotional trauma impairs continuity. The application of ‘healing energy’, whether from a medical device or from the hands of an energy therapist, would then open the network to the flow of energy and information. Once the whole network is functioning, natural biological communications could flow freely through the entire system, from the extracellular matrix, across the cell membrane, through the cytoskeleton, to the nucleus and on to the gene level, and in the opposite direction as well (Oschman 1993, Oschman & Oschman 1994). In other words, activation of specific processes goes hand in hand with opening of the channels for the flow of energy and information.

A leading medical researcher has confirmed what alternative practitioners observe frequently: application of therapeutic energy fields ‘can convert a stalled healing process into active repair, even in patients unhealed for as long as 40 years’ (Bassett 1995). The mechanism by which ‘active repair’ is initiated probably involves both activation of specific cellular activities *and* the opening of the channels or circuitry for the natural biological communications required for initiating and coordinating injury repair.

The free flow of messages through tissues is essential for prevention and for simply ‘feeling well’. An example of experimental evidence for preventive effects was given in Part 2B. Animals treated with magnetic fields *prior* to nerve injury experienced the same acceleration of nerve growth as animals treated *after* injury.

While the focus in this discussion is on the healing of wounds, energetic bodywork can be of profound significance to the organism even if no specific problem is present. A healthy individual will be both happier and less likely to have an injury or disease. If problems do arise, they will recover more rapidly. Likewise, athletic, artistic and intellectual performance is

enhanced when all of the body's communication channels are open and balanced. This point is well understood in many complementary practices, in which regular maintenance treatments or 'tune-ups' are given. These treatments are not for specific ailments, but serve to reduce the future incidence of medical problems, to enhance performance of all kinds of activities, and to generally facilitate an individual's progress in their personal evolution or achievement of their individual 'destiny'.

One mechanism of prevention comes from study of some of the effects of acupuncture: mild stimulation of tissues (as by insertion of an acupuncture needle, acupressure, Shiatsu, structural integration, massage, etc.) can *simulate* an injury without actually injuring the tissue. By simulating an injury, the mild stimulus activates the cascade of repair processes through the living matrix. Mild stimulation of key points on a healthy individual is a sort of 'test run' or 'tune-up' of the repair channels (Oschman & Oschman 1994).

Along with the healing of injuries and prevention is the role energy therapies can have in releasing or resolving long repressed 'somatic memories' associated with trauma and/or abuse. This will be examined in more detail in Part B.

If the ideas presented so far are valid, there are a number of obvious implications. First, on a practical level, manufacturers of medical devices might find it worthwhile to test the effects of stimulators that scan through a range of frequencies, rather than produce a single frequency. It would obviously be worthwhile to simply record the natural emissions from the hands of a therapist, and project the recorded signals into injured tissues.

Some research along this line has been done. A device has been developed that projects signals comparable to those produced by a

QiGong practitioner (Niu et al 1992, Walker 1994). Interestingly, this device produces an ELF acoustic signal. Literature on this device and on other effects of QiGong can be accessed through a database (QiGong Institute 1995).

Evolutionary biology leads to an additional interpretation. The evidence presented so far suggests that an ability of organisms to project and respond to 'healing energy', as defined above, has evolved as a natural design feature of living systems. Our ancestors lived in a world fraught with hazards, but had no hospitals or clinics to help them mend wounds of the flesh. A natural ability of individuals to facilitate injury repair in each other had obvious survival value in the earliest communities. Evolution by natural selection took care of the rest.

Biological rhythms and wound healing

The next mechanistic questions concern the sources of the oscillating fields emitted by the hands of various energy therapists, and the reason the signals scan or sweep through a range of frequencies. Research has led to detailed and rather remarkable answers to these questions. The focus is on biological rhythms and the ways they are regulated.

Injury repair involves a wide spectrum of biological rhythms associated with the replacement of various tissue elements. How can these processes be coordinated? The problem can be stated this way:

Wound healing is a remarkable and intricate process, involving the integrated and cooperative activities of a variety of systems. Each wound is different, and the body's response must be precisely appropriate if structure and function are to be fully restored. Dynamic interactions take place between local and systemic processes. A wide range of physiological activities are activated, and all must be down-regulated when repair is complete. Some repair processes persist for weeks or even longer after an injury.

Until recently, the medical approach has been almost exclusively molecular. Researchers have looked for, and found, a variety of chemicals that influence the repair of tissues. The clotting of blood involves a cascade of reactions involving many different substances. Fibroblast growth factors stimulate division of the cells that lay down collagen, a major structural protein used in healing wounds. Hence healing can be promoted by adding natural growth factors, or genes for those growth factors, directly to a site of injury (e.g. Vogt et al 1994).

It is easy to see how molecules can regulate the rates of cellular processes by activating or inactivating particular metabolic pathways. However, there is something missing from the picture. How can the ebbs and flows of regulatory substances provide a 'blueprint' for the elaborate architecture of cells and tissues and organs?

The 'blueprint'

Harold Saxon Burr was convinced that energy fields provide the 'blueprint' for living systems (Part 1A). Molecular biology can account for the manufacture of the parts, in appropriate quantities, but the forces exerted by living fields bring those parts together in meaningful ways to produce living structure and function.

The last entry in the Table supports Burr's hypothesis. Growth factors (molecules) stimulate the growth of nerves, but magnetic pulsations at 25 and 50 Hz *synergize* or enhance the effect. This point of view was expressed over a century ago by one of the fathers of modern physiology, Claude Bernard (1839): 'The genes create structures, but the genes do not control them; the vital force does not create structures, the vital force directs them.'

In the words of Strohman (1993), the genes are important but not on tap – just on tap! Genes are undoubtedly involved at every step of development,

and influence all physiological processes, but this does not mean that genes are entirely responsible for establishing order and function at every level.

Modern evidence comes from a wide range of studies on the effects of energy fields on development and regeneration (e.g. Libbin et al 1979, Borgens et al 1981, Jaffe 1981, 1982).

A simple hypothesis can account for the beneficial effects of 'healing energy' projected from the hands of one person into the body of another.

Hypothesis: a variety of electrical, electronic, magnetic and other energetic phenomena take place within healthy tissue as a consequence of the communications needed to coordinate cellular activities. The resulting energy fields are radiated from the hands of the healthy individual. Whether caused by physical or emotional trauma, 'the wound that does not heal' is a wound that is not receiving the natural regulatory signals needed to initiate and coordinate repair processes. When healthy tissue is brought close to such a wound, essential information is transferred via the energy field, communication channels open and the healing process is 'jump-started'.

Sources of ELF signals

The functioning of the heart, brain and some other organs result in oscillations in the ELF range of the electromagnetic spectrum. The principal brain wave frequencies are shown in Figure 2.

Over the last half century, Robert O. Becker and others have done important research on the role of brainwaves in healing. These studies have many implications for bodywork and movement therapies.

Modern neurophysiology focuses primarily on the activity of less than half of the cells in the brain (Becker 1990a, 1991). The 'neuron doctrine' holds that all functions of the nervous system are the result of activities of the neurons. Integration of brain function is therefore regarded as arising from the massive interconnectivity of the neurons. This view is incomplete because it ignores

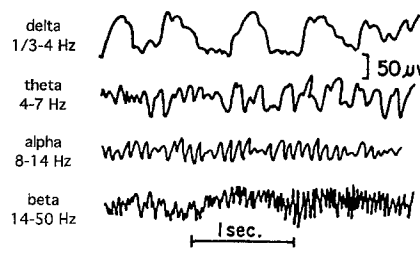


Fig. 2 Brainwaves. Dominant brainwave frequencies recorded with the electroencephalograph, with electrodes on the scalp. The frequency of brainwaves is constantly changing. Delta activity occurs during deep sleep and in certain brain disorders. Theta activity occurs during various stages of sleep in normal adults and during emotional stresses, including disappointment and frustration. Alpha brainwaves have been associated with a normal and alert state of mind. Beta waves are normally seen over the frontal portions of the brain during intense mental activity. Beta waves of higher frequencies, up to 50 Hz, are associated with intense activation of the nervous system or tension. The diagram is modified from AC Guyton's *Textbook of Medical Biology*, 8th edn, WB Saunders, Philadelphia, PA, Fig. 59-1, p. 662, with permission from the publisher.

an evolutionarily more ancient informational system residing in the perineural connective tissue cells that constitute more than half of the cells in the brain. Perineural cells encase every nerve fibre, down to their finest terminations throughout the body.

The perineural system is a direct current communication system reaching to every innervated tissue. The perineural system establishes a 'current of injury' that controls injury repair. Historically, the injury potential was discovered *before* resting and action potentials of nerves (Davson 1970).

The current of injury is generated at the site of a wound, and continues until repair is complete. One function of the current is to alert the rest of the body to the location and extent of an injury. The current also attracts the mobile skin cells, white blood cells and fibroblasts that close and heal the wound. Finally, the injury current changes as the tissue heals, and therefore feeds back information on

the progress of repair to surrounding tissues. Becker's research demonstrated that the current of injury is not an ionic current, but a semiconductor current that is sensitive to magnetic fields (the Hall effect). Semiconduction takes place in the perineural connective tissue and surrounding parts of the living matrix.

Other tissues in the body are ensheathed in continuous layers of connective tissue. The vascular system is surrounded with perivascular connective tissue; the lymphatic system with perilymphatic connective tissue; the muscular system with myofascia; the bones with the periosteum. Conceptually, the living matrix encompasses all of these connective tissue systems, including the cellular and nuclear scaffolds within them.

It has been suggested that the current of injury is not confined to the skin, but is a general property of layers of cells, called epithelia (Oschman 1993). If this is so, a current of injury will arise in any tissue, epidermal, vascular, muscular, nervous or bone, that is injured. Which systems are activated will depend on the depth and severity of the injury. This perspective is leading to a detailed explanation of how the body coordinates its responses to injuries of all kinds.

Oscillations of the brain's direct current field, the brainwaves, are not confined to the brain. Instead, they propagate through the circulatory system, which is a good conductor, and along the peripheral nerves, following the perineural system, which reaches into every part of the body that is innervated. Similarly, oscillations of the heart's electrical activity are not confined to the heart muscle, but are propagated through the vascular system, perivascular connective tissue and living matrix to all parts of the body.

The measurable brain waves arise because of the rhythmic and synchronized spread of direct current through large populations of neurons

in the brain. The field is relatively strong and partly coherent because it flows through massive numbers of parallel neurons in the vertically oriented pyramidal portion of the somatosensory cortex (see Kandel & Schwartz 1981).

Becker's research shows that brainwaves regulate the overall operation of the nervous system, including the state of consciousness. There is a neurophysiological basis for this concept. The brainwaves cause the local fields around individual neurons to vary rhythmically. The local field, in turn, determines the sensitivity of the neurons to stimulation. When the local field is such that the neuron is ready to send a signal (called the threshold for depolarization), a small stimulus will cause the nerve to fire. When the local field is far from the firing level (far from threshold), a much larger stimulus will be needed for the nerve to be excited. Hence there is a rhythm in the excitability of nerve cells throughout the body. Sophisticated research using microelectrodes has confirmed that the probability of a nerve firing in the brain changes rhythmically in relation to the electroencephalogram (Verzeano 1970, Fox 1979). The significance of these phenomena to consciousness will be discussed shortly.

Entrainment

When considering the timing of any biological rhythm, the concept of *entrainment* is important. Physicists use this term to describe a situation in which two rhythms that have nearly the same frequency become coupled to each other, so that both have the same rhythm. Technically, entrainment means the 'mutual phase-locking of two (or more) oscillators'. For example, a number of pendulum clocks mounted on the same wall will eventually entrain, so that all of the pendulums swing in precise synchrony. For this to happen, the

pendulums must have about the same period, which is determined by their length. What couples the pendulums are vibrations (elastic or sound waves) conducted through the structure of the wall.

The brain's pacemaker

Brainwaves are not constant in frequency, but vary from moment to moment. The 'pacemaker' or 'rhythm section' is located deep in the brain, specifically in the thalamus. The system is known as the thalamic rhythm generator or pacemaker (Andersen & Andersson 1968). Careful research is determining the cellular basis of the rhythms (Destexhe et al 1993, Wallenstein 1994). Calcium ions slowly leak into single thalamocortical neurons, which oscillate for 1.5–28 seconds, triggering and entraining the brain waves, which spread upward throughout the brain. Eventually the thalamic oscillations cease because of the excess calcium built up in the thalamocortical neurons. During this 'silent phase', lasting from 5 to 25 seconds, the brain waves are said to 'free-run'. It is during this phase that the brainwaves are susceptible to entrainment by external fields, as will be discussed below. Eventually the thalamic oscillations begin again, after the cells have restored their calcium levels to the point where they are able to oscillate again.

The electroencephalographic waves spread not only throughout the brain, but throughout the nervous system (via the perineural system) and into every part of the organism. In this way, the brainwaves regulate the overall sensitivity and activity of the entire nervous system (Becker 1990a, 1990b).

Entrainment of biological rhythms – more controversy

This article is heading toward a discussion of the possibility that

external signals, including signals projected from the hands of an energy therapist, can entrain brainwaves during the thalamic 'silent' or 'free-run' period. The reader should be aware that the entrainment of biological rhythms is a subject as controversial among biologists as the vitalism versus mechanism issue discussed in Part 1 of this series. The controversy is about whether biological rhythms are predominantly timed by 'internal clocks' or by 'external clocks'. While there are good arguments on either side of this issue, the current consensus among scientists is that biological clocks are mostly set by internal pacemakers, such as the thalamus, and that organisms are, for the most part, independent of natural energy cycles, such as those discussed below. However, the history of science has repeatedly demonstrated that scientific consensus has a rhythm of their own, as ideas of one generation give way to new truths, based on new data.

Most scientists and non-scientists alike take a firm position on one side or the other of this question. For many, it is obvious that life is part of a larger fabric, and that rhythms of the sun, moon, planets and other celestial bodies must affect us (e.g. see Leonard 1978). For others it is equally obvious that any such effects, if they do exist, are minimal. For many scientists, there is strong bias against any concept that might be taken as support for astrology, a field that is widely frowned upon. There are good reasons to suspect that a person's point of view on this subject is based less on logical analysis and more on their individual emotional and personality structure. This perspective will be addressed in the second part of this article, when energetic aspects of personality structure are examined.

Geomagnetic and geoelectric fields

Evidence will be presented that the

'free-run' periods, when the brainwaves are not paced by the thalamus, allow the brain's field to be entrained by external electric and magnetic rhythms, either natural or man-made. What is the source of natural electric and magnetic rhythms?

The magnetic field of the earth, called the geomagnetic field, causes the compass needle to point toward the North Pole. However, if you look carefully at a compass needle, with a microscope, you will see that the needle is rarely still – it dances back and forth in a variety of rhythms. Some of these rhythms are diurnal (24 hour), some are much slower, and others are quite fast, in the ELF range. The latter are called geomagnetic micropulsations. They are caused by a unique geophysical mechanism known as the Schumann resonance.

In the 1950s, a German atmospheric physicist, W.O. Schumann, suggested that the space between the surface of the earth and the ionosphere should act as a resonant cavity, somewhat like the chamber in a musical instrument (Schumann 1952). Pressing the keys on a wind instrument changes the size of the cavity and therefore changes the frequency of the standing waves within that cavity.

In a musical instrument, tones are generated when the musician blows over an orifice or reed. Energy for the Schumann resonance is provided by lightning. While you may be experiencing calm weather where you are now, there are, on average, about 200 lightning strikes taking place each second, scattered about the planet. To use the physics terminology, lightning pumps energy into the earth-ionosphere cavity, and causes it to vibrate or resonate at frequencies in the ELF range.

In the 1960s, Schumann's theory was confirmed (Galejs 1972, Balsler & Wagner 1960). Lightning creates electromagnetic standing waves that travel around the globe. As electromagnetic waves, the Schumann resonance can be detected either as electric or magnetic micropulsations.

The waves are reflected from the ionosphere, back to the earth, back to the ionosphere, etc. (Fig. 3). This 'skip' phenomenon has been widely studied, because it is the basis for long distance radio communication. Radio signals of certain frequencies can travel great distances because they are reflected by the ionosphere.

The average frequency of the Schumann resonance is about 7–10 Hz. But when the ionosphere gets higher, the cavity gets larger and the resonant frequency drops. Rhythms of terrestrial and extraterrestrial origin alter the height and other properties of the ionosphere, and thereby alter the Schumann frequency in the range of 1–40 Hz. There are times when solar activity leads to 'magnetic storms' that disrupt the ionosphere, and Schumann resonances cease. Some of the factors influencing the Schumann frequency are given in the legend for Figure 3.

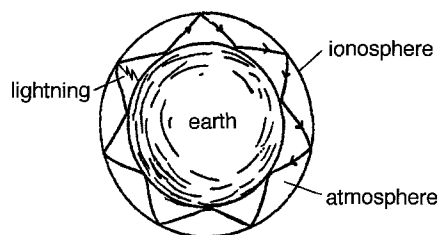


Fig. 3 The Schumann resonance is a unique electromagnetic phenomenon created by the sum of the lightning activity around the world. Electromagnetic pulses from lightning travel around the earth, bouncing back and forth between the ionosphere and the earth's surface. At any given point on the earth, the Schumann resonance shows up as electric and magnetic micropulsations in the range of 1–40 Hz. The frequency and strength of the signals depend on the distribution of global thunderstorm activity, local meteorological conditions and the conductivity of the earth's surface at the point of observation. Bursts of Schumann pulses are easier to detect in fair weather, and occur more often during the day than at night. These terrestrial factors are, in turn, influenced by more distant extraterrestrial factors, such as solar and lunar position, sun spots, planetary positions, etc. For details, see Pressman 1970, Dubrov 1978. The diagram is modified from Bentov (1976).

To summarize, the Schumann resonance is created by terrestrial activities, and is modified or modulated by extraterrestrial activities. In radio terminology, the signals are frequency modulated (FM).

Evidence for entrainment by external fields

The Schumann oscillations propagate for long distances and readily penetrate through the walls of buildings and into the human body. Schumann frequencies have considerable overlap with biomagnetic fields such as those produced by the heart and brain, but the Schumann resonance is thousands of times stronger. The similarity of a train of Schumann signals and an α -brainwave are shown in Figure 4.

A number of biologists have concluded that the frequency overlap of Schumann resonances and biological fields is not accidental, but is the culmination of a close interplay between geomagnetic and biomagnetic fields over evolutionary time (e.g. Dierenfeld 1983). Hence researchers have examined interactions between external fields and biological rhythms.

Organisms are capable of sensing the intensity, polarity, and direction of the geomagnetic field (Gould 1984). There is evidence that geomagnetic rhythms serve as a time cue in the organization of physiological rhythms (e.g. Wever 1968, Gauguelin 1974, Cremer-Bartels et al 1984), although this continues to be controversial. A variety of behavioural disturbances in the human population are statistically



Fig. 4 A Schumann signal and an α -brainwave. The illustration is modified from Figure 15 in Konig (1974).

related to disturbances in the earth's electromagnetic field or to man-made interferences:

- Howard et al (1965) documented a relationship between increased geomagnetic activity and the rate of admission of patients to 35 psychiatric facilities.
- Venkatraman (1976) and Rajaram & Mitra (1981) reported an association between changes in the geomagnetic field due to magnetic storms and frequency of seizures in epileptic patients.
- Becker (1963) and Friedman et al (1963, 1965) also studied the relationships between psychiatric ward admissions and behaviour and geophysical parameters.
- Perry et al (1981) correlated suicide locations in the West Midlands, England, with high magnetic field strengths due to 50 Hz power lines.

Many studies have demonstrated the probable entrainment of brain waves by external rhythms of natural and artificial origin:

- Reiter (1953) measured reaction time, an important factor in traffic safety. Upon entering a cubicle at a traffic exhibition, visitors were asked to press a key. When a light came on, they were to release pressure on the key. Their reaction time, i.e. the time between 'light on' and 'key release', was recorded for many thousands of visitors over a 2-month period. At the same time, the ELF micropulsations (Schumann resonances) were monitored. The micropulsations slow when a thunderstorm is approaching, and Reiter found that the subjects were slower to respond during such periods. When the micropulsations speeded up, into the range of alpha brainwave activity, reaction times were faster.
- After the traffic exhibition, Reiter took his test cubicle to the University of Munich and lined the top and bottom with wire mesh connected to an electrical

generator. He introduced artificial low-level, low frequency signals similar to those of the earth's field. Under these controlled conditions, the effects of the fields on reaction time were comparable to those obtained during the exhibition. Moreover, subjects in the laboratory experiments repeatedly complained about headaches, tightness in the chest, and sweating of the palms after several minutes of exposure to 3 cycle/second fields. When the headaches faded away, there was often a feeling of fatigue. These symptoms resemble the so-called 'weather sensitivity' complaints that some people have before the arrival of a thunderstorm.

- Hamer (1965, 1969) pulsed subjects with low intensity artificial electric fields from metal plates on each side of their heads. Fields of 8–10 Hz speeded up reaction time, while slower oscillations of 2–3 Hz slowed down reaction times significantly. Similar results were reported by Friedman et al in 1967.
- In 1977, Beatty reported studies on the practical significance of brainwave entrainment for people such as air traffic controllers, who need to maintain an alert state for long periods. Subjects monitored a simulated radar screen, watching for certain targets to appear. In agreement with the findings of Reiter and Hamer, slower brainwaves were correlated with slower reaction times and poorer performance in the task.
- Wever and colleagues at the Max-Planck Institute in Germany observed hundreds of subjects, over many years, who lived in two underground rooms that were shielded from external rhythms of light, temperature, sound, pressure, etc. One room also had an electromagnetic shield around it, consisting of a mesh of steel rods and plates, that reduced the influence of geomagnetic rhythms

by 99%. The rhythms of body temperature, sleep-waking, urinary excretion and other physiological activities were monitored. All subjects developed longer and irregular or desynchronized or chaotic physiological rhythms. Those in the magnetically shielded room developed significantly longer and more irregular physiological rhythms. In some experiments, artificial electric and magnetic rhythms were pulsed into the shielding. Only one field had any effect: a very weak 10 Hz electric field. This field dramatically restored normal patterns to the biorhythm measurements.

Each of these studies concluded that biological rhythms can be entrained with natural and artificial ELF electric fields. Entrainment of brainwaves can set the overall speed of responsiveness of the nervous system to stimulation. This is called 'reaction time', and is an easily measured parameter of consciousness. The results support Becker's contention that the pulsing DC electrical system (brainwaves) set the tone of the entire nervous system.

These studies do not mean that when a thunderstorm approaches, everyone will get drowsy, react slowly and accidents will happen. Instead, they suggest that there is a statistically greater chance of slower reactions and more frequent accidents under these conditions. Geomagnetic pulsations do not affect everyone the same way. However, there is evidence that geomagnetic pulsations strongly entrain brain waves during meditation and other practices, in which one 'quiets the mind' to allow the 'free-run' to be dominated by geophysical rhythms.

Mechanism of entrainment

The internal pathways involved in the body's responses to external magnetic

rhythms are shown in Figure 5. The pineal gland is the primary magnetoreceptor. Between 20 and 30% of pineal cells are magnetically sensitive. Exposure of animals to magnetic fields of various intensities alters the secretion of melatonin, the electrical properties of pineal cells, and their microscopic structure (reviewed by Sandyk 1995). In addition, various animal tissues contain particles of organic magnetite. Two separate research groups have now recorded magnetically influenced impulses in single neurons connecting magnetite-bearing tissues with the brain (reviewed by Kobayashi & Kirschvink 1995).

The question of whether living systems are sensitive to the earth's magnetic field has been bitterly controversial for more than a century. There are now a number of plausible and well-documented mechanisms for such interactions, and abundant evidence that they take place. Moreover, Becker's research has shown how geomagnetic entrainment of the brainwaves can affect the entire nervous system at a very high level of control, i.e. the perineural DC system that extends throughout the body and has roles in regulating injury repair.

In terms of an energetic paradigm for bodywork and movement therapies, there is no need for us to hypothesize that geomagnetic fields, modified by terrestrial and extraterrestrial events, entrain brainwaves. Scientists from around the world have already done so, and continue to build solid supporting evidence.

Part B of this article explores how these concepts may apply in the therapeutic setting.

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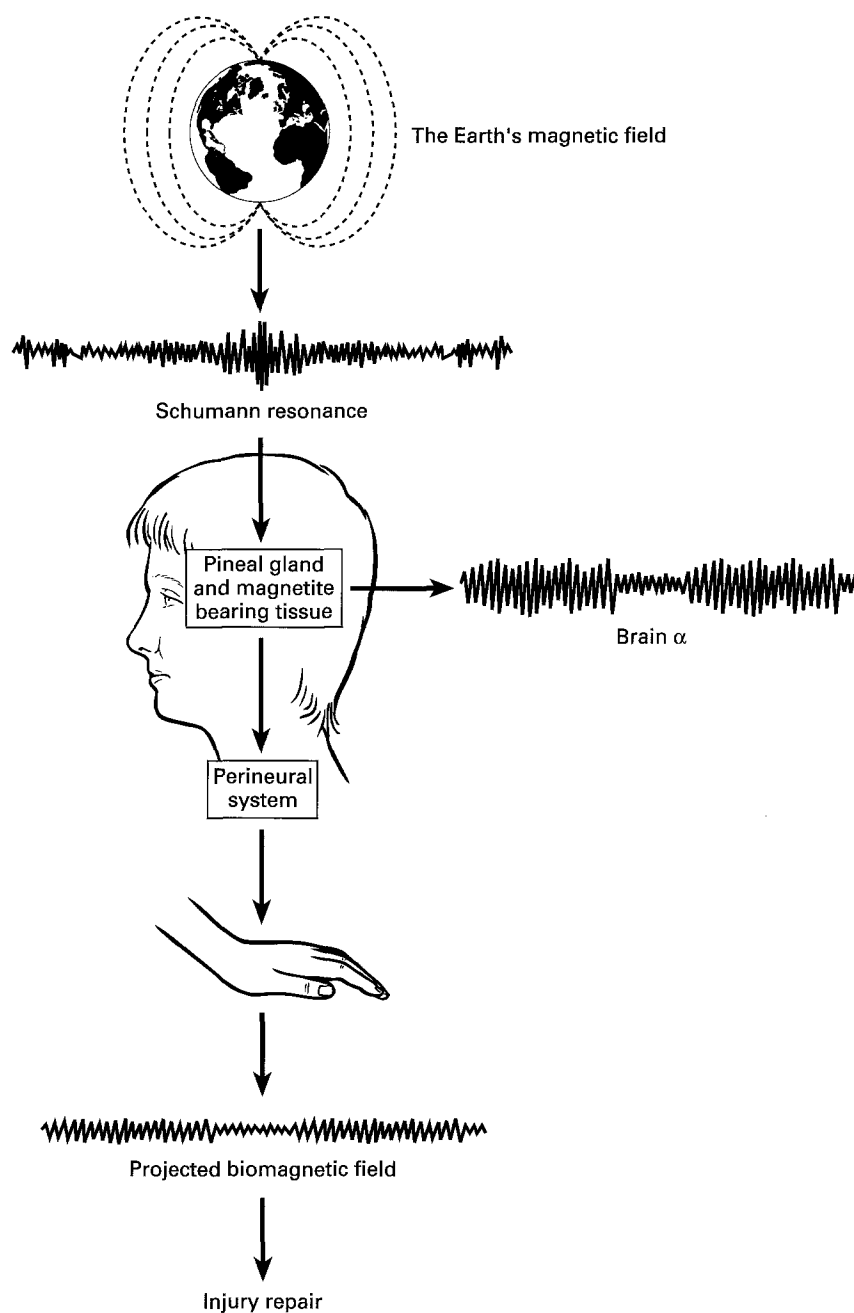


Fig. 5 A summary of the pathways involved in magnetoreception, the regulation of brain waves and therapeutic emissions from the hands of therapists. Micropulsations of the geomagnetic field, caused by the Schumann resonance, are detected by the pineal and magnetite-bearing tissues associated with the brain. During the 'free-run' period, when the brainwaves are not being entrained by the thalamus, the Schumann resonance can take over as the pacemaker, particularly if the individual is in a relaxed or meditative state (Schumann signals are thousands of times stronger than brainwaves). The brainwaves regulate the overall tone of the nervous system and the state of consciousness. The electrical currents of the brainwaves are conducted throughout the body by the perineural and vascular systems. The biomagnetic field projected from the hands can be much stronger than the brainwaves (Seto et al 1992) indicating that an amplification of at least 1000 times takes place somewhere in the body. Alternatively, the body may simply act as an effective antenna or channel for the Schumann micropulsations. The projected fields scan or sweep through the frequencies medical researchers are finding useful for 'jump-starting' injury repair in a variety of tissues (see Table). Portions of this illustration are redrawn from Becker (1990b).

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ENERGY REVIEW PART 3B

Therapeutic entrainment

Evidence has been presented that strong biomagnetic fields are projected from the hands of practitioners of therapeutic touch, QiGong, and other methods. In Part 2A it was suggested that repeated practice of various hands-on bodywork techniques might increase the size of brain areas devoted to movement and sensitivity of the fingers involved. This, in turn, could enhance the biomagnetic output from those areas of the brain, as it does in those who practice with a stringed instrument. Increases in the strength of the brainwaves would lead to a corresponding increase in the output from the fingers, as the brainwaves are conducted to the fingers via the perineural and circulatory systems.

Hence the arrangement shown in Figure 1 is ideally suited for coupling or entraining the biomagnetic rhythms of therapist and patient. If the therapist relaxes into the state of consciousness typical of meditators, practitioners of therapeutic touch and QiGong, and

other methods, it is likely that their brainwaves will, from time to time, become entrained with the micro-pulsations of the earth's field. If the patient is relaxed, both individuals may become entrained with the earth's field.

There is remarkable documentation for this concept. In 1969, Robert C. Beck began a decade of research on the brain wave activity of 'healers' from a wide variety of subcultures around the world (Beck 1986). Beck recorded their electrical brainwaves with an electroencephalograph (EEG). All the 'healers' produced similar brainwave patterns when they were in their 'altered state' and performing a 'healing'. It did not matter what the healers' beliefs and customs were, all registered brainwave activity averaging about 7.8–8 cycles/second while they were in their healing state. Beck studied exceptional individuals who were famous or who had developed reputations as healers, psychics, shamans or dowsers. He studied a charismatic Christian faith

healer, seers, ESP 'readers', an authentic Hawaiian kahuna, practitioners of wicca, Santeria, radesthesia and radionics. Most of these so-called 'sensitives' entered an altered state of consciousness and produced nearly identical EEG signatures, which lasted from one to several seconds.

The obvious question is how these individuals, unknown to each other and located thousands of miles apart, developed the same brainwave frequency during their 'healings'. Beck noted that '... the subjects were practising opposing disciplines, and came from totally disparate teachings, and held opposing viewpoints, and would barely acknowledge the existence or authenticity of practitioners outside their belief systems ...' Beck performed additional studies on some of his subjects and found that during the 'healing moments' their brainwaves became phase and frequency synchronized with the earth's