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Psychomagnetobiology

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1. Introduction

The magnetobiology is known in the scientific world as being the link between magnetic fields and the behavior of particular animal species (some migratory birds, dolphins, and ants)that navigate through the magnetic currents that are generated by the Earth, and have a special sense of orientation, which has been associated with genetic memory. This arises from an increased concentration of iron in the head, or from the presence of a chemical that is activated by the presence of magnetic fields, including those generated by human construction, allowing the assumption that such magnetic fields are observable by some birds (Hevers, 2010; Mouritsen, 2005; Wiltschko, 2007; Gegear, 2010; Oliveira, 2010).

In these species, the relationship between the animal and the strength of the magnetic field allows them to remember their previous travels, and this has a wide application, because the assumptions regarding changes in these magnetic fields suggest that magnetic fields can be linked to changes in migration flows (Lohmann, 2007), reproduction, or to the extinction of a species. This relationship between animals and the properties of the Earth is studied as a part of magnetobiology (Valentinuzzi, 2004; Temurvants & Shekhotkin, 2000).

On the other hand, psychobiology, or biological psychology, studies the physiological mechanisms and evolutionary relationship between the development of the body and brain with emotion, thought, and behavior. This has been amply demonstrated in studies of psychopathology and health psychology (Sánchez-Martín, 2011). For cases such as schizophrenia (Ritsner, 2006) or depression (Gartside, 2003), it was found that some hormones and neurotransmitters that can induce some personality traits (or variations of these neural substrates that may cause mood disorders) also influence those biological emotional states of being and pleasure (Zak & Fakhar, 2006) that are associated with an increase in particular neurotransmitters that also regulate or relieve stress (Heinrichs, 2003).

There are also known specific psychoneuroimmunological responses and reactions triggering autoimmune diseases, such as those caused by severe stress or a high-intensity emotional state. For example, some patients who are notified of a terminal illness have emotions that may trigger symptoms associated with these effects, which may activate the genes of some diseases such as lupus (Schattner, 2010), heart attacks, or cancer (Stürmer, 2006).

This chapter discusses the existence of a relationship between magnetism and the physiological responses of health and disease associated with emotional states, which is not a new concept, as many traditional medicines have assumed this relationship exists, in civilizations from different geographic locations, such as China (Rosch, 2009; Gulmen, 2004), Egypt, and many Mexican cultures (Bocanegra-García, 2009). Today it is known as magnetotherapy (Zyss, 2008).

This idea is strengthened by the somatic marker proposal, which poses that as there is a biological anticipatory response to the decisions we make, and that it is reinforced by stimuli from external perception, the consciousness and emotional states that can guide accompanying positive actions. For example, in the migratory birds discussed above, a strengthening of the biological response to the magnetic field intensity is expected, as the migration of the species depends on a successful response (Martínez-Selva, 2006).

We proposed to test the hypothesis of relationships among the body, mind, and consciousness as a way of showing what the above cultures, doctors, and healers have supposed for millennia: that a relationship between consciousness, mind, emotion, and the body exists, i.e., there is a two-way communication that can transform the emotions, perception, and biology from magnetic and electromagnetic fields that can influence biology.

An example of how changing a body's electromagnetic currents can alter the emotional state can be found in the electrical stimulator, which has proven effective for people with depression (Baeken & De Raedt, 2011), auditory hallucinations (Freitas, 2011), and chronic pain, and is a promising treatment in this area.

Another example is biological neurofeedback (Dias & van Deusen, 2011) which can change depressed or obese health patterns under transcranial magnetic stimulation or deep transcranial magnetic stimulation (Rosenberg, 2011).

This hypothesis raises the question concerning which current technology we have to measure magnetic fields in human beings and what the future options might be.

Knowing technological developments that can measure magnetic fields can help in biomedicine, as they could be used in early diagnostic techniques based on the measurement of magnetic changes that can anticipate changes in the biology, immunology and endocrinology of the body. Among the current applications available for this purpose, we note the Gas Discharge Visualization (Korotkov, 2010), Magnetic Scanner (Pacheco, 2010), and SQUIDS27 (Bryant, 2011) techniques.

Psychomagnetobiology is a new area of interdisciplinary research that includes psychology, medicine, biological engineering, and physics, and the following provides an overview of how one can use magnetism and electricity in diagnosis and treatment in both medicine and psychology(see figure 1).

2. Technologies that use electricity and magnetism for diagnosis and therapy

2.1 Microcurrent stimulation and cranial electrotherapy

Cranial Electrotherapy Stimulation (CES) is an experimental psychiatric treatment that applies a small, pulsed electric current through a patient's head (Smith, 2008). It has been shown to have beneficial effects forsome conditions, such as anxiety, depression, insomnia, and stress (Klawansky, 1995).

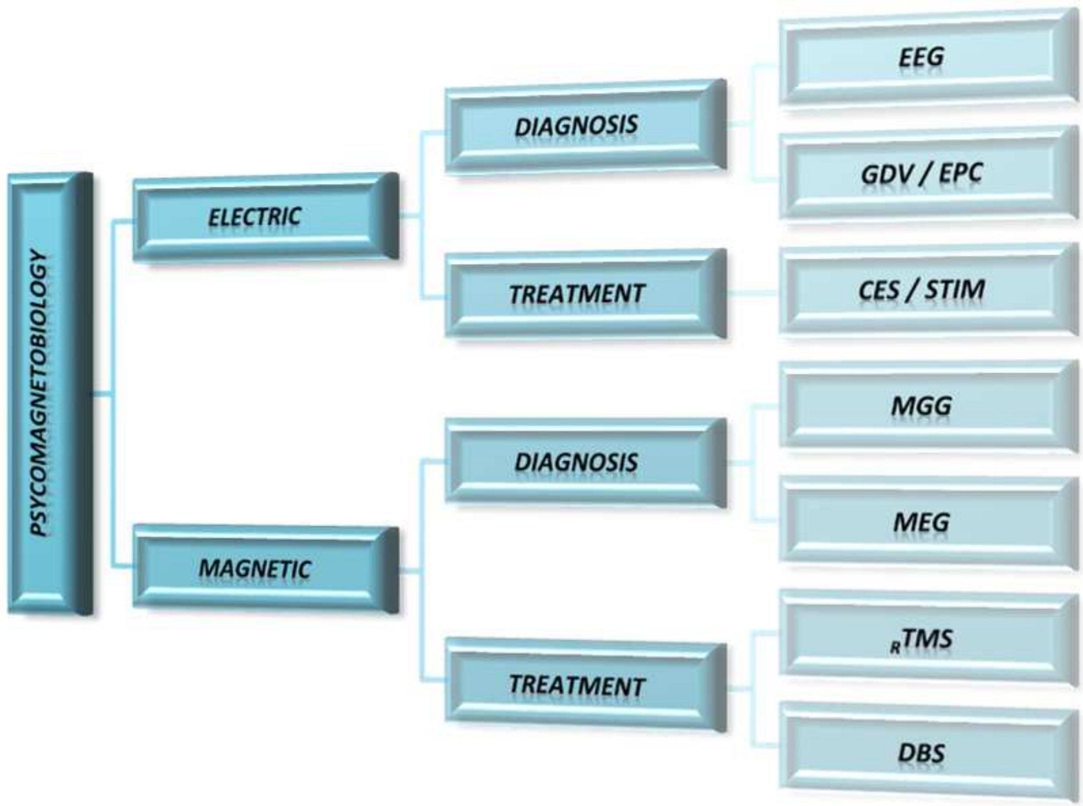


Fig. 1. Psychomagnetobiology

2.1.1 Early treatments

Electricity has been used in medicine since the ancient Greeks, who used eels for conditions such as rheumatism, gout, and pain. Unfortunately, because of a lack of legal controls, many charlatans took advantage of this situation, and captured the market. This led the Carnegie Foundation to carry out studies, and in 1910,it rejected electrotherapy as an acceptable medical method. The impact of this study has influenced physicians to this day (Fariña, 2010).

In the 1960s, Leduc and Rouxeau in France, initiated studies on the use of electricity in medicine using very low currents in the brain to induce sleep, and thus, introduced the term "electro-sleep". Note that sleep is induced after 4 to 5 hours using CES, and it is still unknown if it can induce rapid and consistent sleep (Fariña, 2010).

Electricity received another boost in its application to the brain when, in 1965,Melzack in Canada and Wall in Britain discovered a relationship between pain and the central nervous system, and tested the role of electricity in controlling pain (Melzack& Wall, 1965).

In 1967, when electrical stimulation was used to determine who really needed surgery to relieve pain, it was found that patients improved and responded therapeutically to a procedure that involved a distraction. This procedure was Transcutaneal Electrical Neuro Stimulation (TENS), a precursor of Microcurrent Electrical Therapy (MET). This method is different from MET, because TENS initially reduces pain by producing an alternative pain, and, therefore, is known as a "counter-irritant" (Debock, 2000). As the body adapts, the current is increased, even reaching levels not recommended as tolerable, or not required to stop the use of therapy. Using this method, the results are short term and recurrences are common. On the other hand, MET does not reach intolerable levels and the results are usually long lasting and positive (Fariña, 2010).

There are currently many research studies into CES in humans (Gunther & Phillips, 2010) and so far, 29 experimental animal studies have shown mostly positive results, with several using double-blind and placebo studies. No lasting adverse effects have been reported (Fariña, 2010).

CES has been approved by the US Food and Drug Administration (FDA) for use since 1979, and was reevaluated in 1986. Examples where the utility of CES/MET has been investigated are (Schmitt et al., 1986): discrete brain damage (reduction in pain and anxiety and increase in IQ); substance withdrawal syndrome (decrease in anxiety and increase in IQ), paraplegia and quadriplegia (decreased spasticity); cerebral paralysis (decrease in primitive reflexes); prisoners (reduced aggression); hypnotherapy (increases the speed and depth of the induction and reduces resistance to hypnotism); anesthesia (increases the effect of anesthesia by 37% and reduces postoperative pain); fibromyalgia (reduces pain and improves the quality of life) (Kirsch, 2006); and headaches (reduces many types of headache, such as migraine, tension, and headaches resistant to treatment where the patient has fibromyalgia and cancer) (Cork et al., 2004).

2.1.2 Mechanism of action

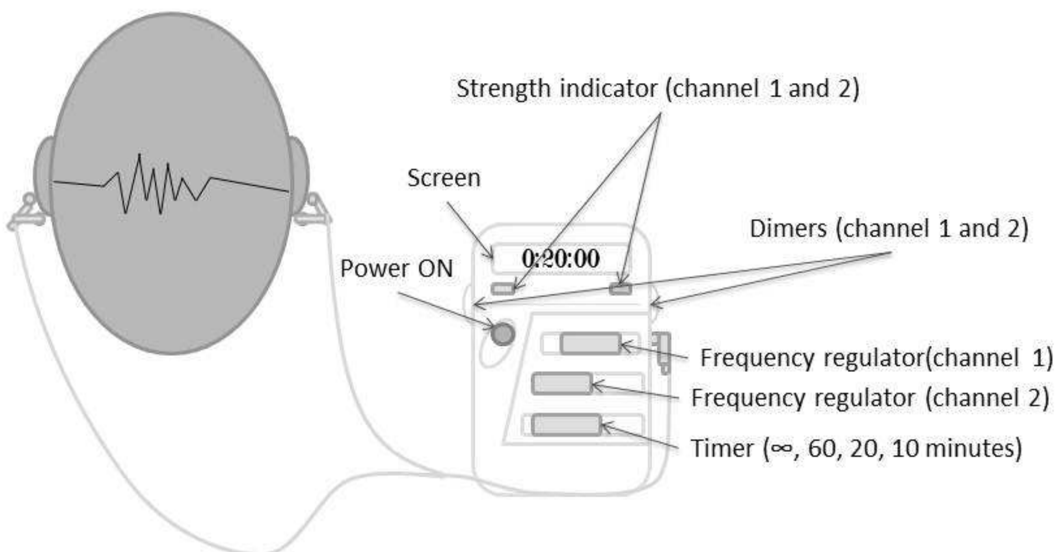
Studies have shown that, despite very low currents in the microampere range, 42% to 46% of the current passes through the cranial bone and enters the brain, focusing on the limbic system. It has been shown that this leads to an increase in the neurotransmitters dopamine, serotonin, and norepinephrine in the brain. The waveform used is as important as the current intensity, placement of electrodes, and exposure time (Kirsch, 2006).

2.1.3 Waveform

What really goes through the brain are unique waves that move the electrons and influence their frequency. The term used for this group of frequencies is "harmonic resonance", and using the above technology, it has been determined that the EEG changes to a more coherent resonance form, as observed in non-stressful conditions. This is comparable with results observed in deep meditation (Kirsch, 2006).

2.1.4 Microcurrent effects

Normalization of the electrical impulses reinforces the activity of the heart and blood circulation, andmicrovascular vessels are promoted; thus, cells are activated. The immune system's capacity increases, the rate of recovery doubles, healing ofwounds is promoted, and the sterilization effect suppresses bacterial growth. This technique is good for the treatment of patients with diseases associated with the feet, such as chronic pain, and reduces muscle fatigue (Kulkarni& Smith, 2000).(see figure)



Stim diagram. The kit contains two channels, both with separate indicators and regulators. Dimmers are responsible for leveling the strength of the shock, while another regulator level the frequency. A timer is responsible for limiting the discharge time, shown on the screen. The voltage is transmitted to the patient who experiences the shock with the chosen parameters.

2.2 Gas discharge visualization and electrophotonic camera

Gas Discharge Visualization (GDV) is a technique based on the collection of signals from the body after electrical stimulation. The method is fully noninvasive, as it does not alter the physical and mental integrity of the patient.(see figure)

The functional basis of the GDV technique is the "crown effect" that occurs after passing a voltage through a conductor susceptible to discharge with the surrounding environment, creating a colorful halo around a material, based on the conducting components and the amount of volatile compounds in the environment. Using GDV, the medium is maintained at a constant voltage by a dielectric plate, and in the case of the body, the conductor is the crown of the system.

The variation of the intensity and wavelength of each signal generated can be measured according to the processes occurring within the body, and mainly the physiological state of the patient.

While it is not known exactly how this method amplifies the body's natural electromagnetic field, or how the patient's information is collected, the "entropy" is already established as a diagnostic method in the fields of medicine and psychology, with outstanding results.

GDV cameras are certified in Russia as medical instrumentation, and are freely used in hospitals and medical centers, while Europe is working on certification, and the United States is still developing the necessary research.

2.2.1 History

In 1939, Kirlian observed the formation of a halo of light after an electric shock on an X-ray machine. Researchers discovered that the phenomenon that bears his name (the Kirlian effect) was also observed in more than 30 patients, and his invention was supported in the USSR, where it was classified as “secret”. In 1996, the Russian physicist Konstantin Korotkov at the University of St. Petersburg improved the Kirlian camera by adding a PC to allow processing and quantification of the data signals from the halo of light generated.

From the research of Mandel in Germany, Korotkov developed a methodology for medical diagnosis using fingers that generated a signal that could be used to diagnose the entire body’s physiology.

The images obtained are known as beograms, GDVgrams or bioelectrograms.

2.2.2 Operation

The object to be scanned (e.g., a finger or plant) is placed on the surface of a glass cover that has an electroconductive layer underneath that generates luminescence by passing a discharge from the object to the conductive material. A CCD camera captures the halo of light around the object, and the signal is sent to a PC for processing and analysis (Korotkov & Popechitelev, 2002).

The computer-controlled parameters of the equipment are: pulse width (5.0ms), frequency (11.0 to 3.0kHz), amplitude voltage (1000.0 to 4000.0V), peak pulse power consumption (80watts), pulse current (1 mA), stability (0.1%), and the resolution of the CCDcamera (800 ×600pixels).

2.2.3 Applications

This technique has been used to monitor and diagnose disease. In the case of asthma, it can detect the developmentof the disease even before symptoms occur, allowing for early treatment. It can also monitor body functions during treatment and rehabilitation, providing a direct observation of drug efficacy and side effects (Alexandrova et al., 2003).

In cancer studies, statistical analysis shows differences in the beograms between healthy people and those with breast or lung cancer (Gagua et al., 2005), and during follow-up to radiation therapy, beograms show the effect on the physiological state of patients, depending on the entropic energy, which is correlated to the functional state of the organ (Gedevanishvili et al., 2004).

A study of subjects at risk of foot amputation from diabetes shows that an increase in the functional reserve of energy is a favorable sign for the recovery of the patient, a constant factor in chronic diseases (Olalde et al., 2004).

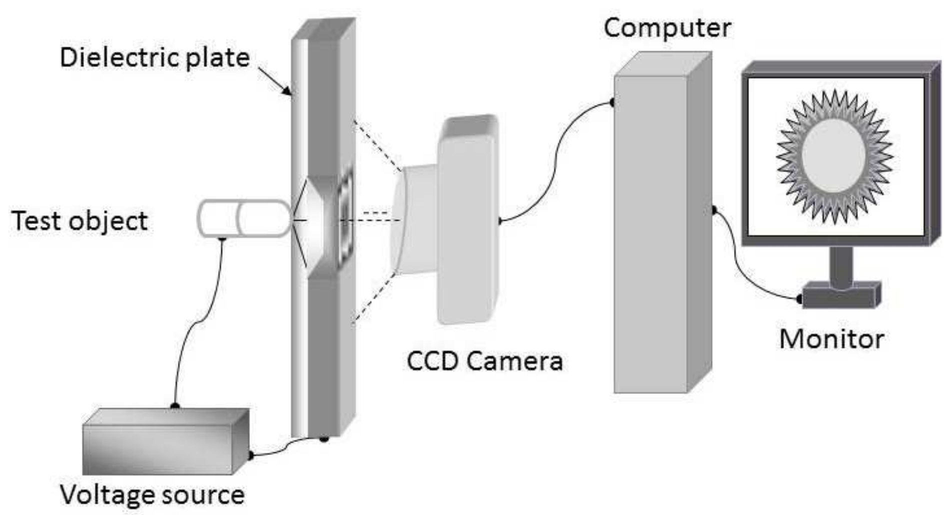
After operation, GDV can also detect and monitor the status of preoperative anxiety in patients, correlating low functional energy reserves with the Spielberger–Khaninscale (Polushin et al., 2004).

In cellular metabolism, GDV studies are correlated with metabolic processes and humoral regulatory processes at the level of the reflex nervous system. The photoelectric emission increases with the parameters of stress tolerance and decreases with a low energy index (Bundzenetal., 2003).

In the examination of blood using GDV, specifically for the electrophoretic mobility of erythrocytes, it has been used to characterize the membrane surface charge, an important factor in a wide variety of diseases that are mainly genetic in nature (Gertsenhtein & Panin, 2008).

Within psychology, there is a significant relationship between GDV beograms and the state of anxiety ,and to a lesser extent, a relationship to neuroticism. There was also a strong relationship observed with the degree of openness and empathy of a patient towards healthy subjects and athletes (Dobson & O'Keeffe, 2007; Polushinetal., 2003; Polushinetal., 2004).

Low levels of entropy in a beogram are correlated with acute stress (O'Keeffe, 2006). The GDV method can detect the influence of odorants in humans, which could be used to record the influence of environment on the psycho-emotional state (Priyatkinetal., 2006). GDV methodology can evaluate the overall improvement of an emotional state and eliminate nervous excitement during short-term rehabilitation (Sergeev & Pisareva, 2004).



EPC Diagram. The "testing object" is placed on the "dielectric plate." Under the influence of a "voltage source", the object generates a luminous halo, which is captured by the "CCD camera" and sent to a "computer" for processing the signal.

2.3 Transcranial magnetic stimulation

Transcranial Magnetic Stimulation (TMS) is a noninvasive method that can depolarize or hyperpolarize neurons in the brain. TMS uses electromagnetic induction to induce weak electric currents in either specific or general parts of the brain.

It has been described as selective depolarization of the neurons in the neocortex or cerebral cortex, located between 1.5 and 2 cm below the cranial bone using magnetic pulses with specific intensity, either single or repetitive. This latter method is known as repetitive Transcranial Magnetic Stimulation or rTMS (Rothetal., 1994).

It is one of the latest tools in neuroscience that have been incorporated in both studies and research as therapeutic methods for the treatment of various diseases and neuropsychiatric disorders, among which are: depression, anxiety, attention deficit, hyperactivity, autism, tinnitus or unusual noise in the ear(s), post traumatic stress, phantom pain in people who have suffered limb amputation or central nervous system injuries, migraine headaches, decreased libido, some cases of schizophrenia and epilepsy, sleep disorders, obsessive–compulsive disorder, and bipolar disorder (Fitzgerald et al., 2006).

It is known to have neuro protective effects that help, at least temporarily, people affected by degenerative neurological diseases, such as multiple sclerosis, Parkinson's disease, and Alzheimer's disease, and impacts very favorably in the modulation of brain plasticity, which refers to the brain's ability to renew or reconnect neural circuits, and thus, acquire new skills and abilities and preserve memory (McDonald et al., 2011).

TMS uses a magnetic field oriented orthogonally to the plane of the coil. The magnetic field passes unimpeded through the skin and cranium, inducing a current in opposite directions in the brain to activate nearby nerve cells in the same way as currents applied directly to the cortical surface (Cacioppo et al., 2007).

The course of the field is difficult to predict, because the brain has an irregular shape and magnetic field lines are not distributed uniformly throughout the tissues or brain surface. Usually, the pulse only penetrates no more than 5 cm into the brain (Riehl, 2008). Depolarization from electromagnetic induction was originally discovered by Faraday (NIMH, 2009).

2.3.1 Clinical applications

From a therapeutic perspective, there are already a large number of studies that have shown that there are two sides to transcranial magnetic stimulation. Both TMS and rTMS have the great virtues of being harmless, but not innocuous, i.e., they are effective and can be classified as being safe. However, various measures need to be taken to ensure this (Rossini & Rossi, 2007). These techniques have been tested as a tool for treating depression and auditory hallucinations (Pascual-Leone et al., 2002) and for increasing attention (Fregni & Pascual-Leone, 2007).

2.3.2 Risks

The main contraindications for treatment are pregnant women, children under 6 years, patients with pacemakers, electrodes, or drug infusion pumps (Rossi, 2009), or patients with metallic implants in the head (Roth et al., 1992).

On the other hand, some patients subjected to cortical stimulation experience some side effects after application, which can be regarded as being minor and transient, including headaches, which can be mitigated by common analgesics (Wasserman, 1998). There have also been reports concerning patients with epilepsy or who take epileptogenic antidepressants who are unable to reach convulsive crises during treatment with transcranial magnetic stimulation (Duckworth, 2008). We have observed that at magnetic field intensities above 1Tesla and frequencies above 60 Hz can cause convulsions (Zelaya et al. 2010), and, therefore, we have suggested setting international standards for medical use.

2.4 Deep brain stimulation

Deep Brain Stimulation (DBS) was first developed as a treatment for Parkinson's disease, to reduce tremors, stiffness, difficulty in walking, and uncontrollable movements. In DBS, a pair of electrodes are implanted in the brain and controlled by a generator that is implanted in the chest. The stimulation is continuous at a frequency and level to suit the patient (Perlmutter & Mink, 2006). It has only recently been studied as a treatment for depression or OCD (obsessive–compulsive disorder).

It is currently available on an experimental basis. So far, very little research has been conducted on testing DBS for the treatment of depression (Mohr, 2011), but a few studies have been conducted showing that this treatment may be promising. In a trial using patients with severe depression that were treatment resistant, we observed that four of the six patients showed a marked improvement in their symptoms immediately after the procedure (Maybergetal., 2005). In another study on 10 patients with this disorder, we found that the improvement was consistent among the majority of patients 3 years after surgery (Greenbergetal., 2006).

2.4.1 How does it work?

DBS requires brain surgery. The head is shaved and then a screw is fixed to a frame that prevents the head from moving during surgery. Scans are taken of the head and brain using magnetic resonance. The surgeon uses these images as a guide during surgery. The patient is awake during the procedure to provide feedback to the surgeon. During this procedure,the patient feels no pain because the head is numbed using a local anesthetic.

Once ready for surgery, two well sare drilled in the head. From there, the surgeon inserts a thin tube into the brain to place the electrodes on either side of a specific part of the brain. In the case of depression, brain target area 25 is considered. This area has been found to be related to depression, hyperactivity, and mood disorders (Maybergetal., 2005). In the case of OCD, the electrodes are placed in a different part of the brain that is believed to be associated with the disorder.

After the electrodes have been implanted and the patient has provided feedback on the placement of the electrodes, the patient is placed under general anesthesia. The electrodes are connected to wires that run inside the body from the head to the chest, which are connected to two battery-powered generators. From here, electrical impulses are continuously delivered through the wires to the electrodes in the brain. Although it is unclear exactly how the device reduces depression or OCD, scientists believe that the pulses help to "restore" the area of the brain that is not working properly to function normally again (Perlmutter & Mink, 2006).

2.4.2 What are the side effects?

DBS has risks that are associated with any brain surgery. For example, the procedure can lead tobleeding in the brain or stroke, infection, disorientation or confusion, unwanted changes in mood, movement disorders, dizziness, and difficulty sleeping.

Because the procedure is still experimental, there may be other side effects that have not been identified. The long-term benefits are also unknown.

3. Diagnostic techniques for magnetism

3.1 Magnetogastrography

The use of sensors to measure magnetic activity generated by the body has been known since 1950 (Wenger et al., 1961; Wengeretal., 1957), although it has been "known" since ancient times for healing applications and diagnosis. It was in the 1970s that biomagnetic techniques began to expand their application and to become more common, with publications on ferromagnetic contamination in the lungs and other organs, as well as the detection and analysis of magnetic fields produced by bioelectric currents in human beings (Cohen, 1973; Cohen, 1969; Cohen et al., 1970; Benmair, et al., 1977; Frei et al., 1970).

Mechano-Magnetogastrography (M-MGG) is a biomagnetic technique used to determine the gastrointestinal activity of the stomach by determining the frequency of peristaltic contractions and gastric emptying half-time (Córdova et al., 2004; Córdova-Fraga et al., 2005).

Biomagnetic applications in the gastrointestinal system have resulted in the study of the transit time in different phases of the menstrual cycle in women or spatiotemporal assessment of the colon motility (Córdova-Fraga et al., 2005).

MGG is a technique that has advantages over current diagnostic techniques because it is noninvasive, lacks ionizing radiation, does not interfere with a patient's privacy, and provides reproducible results (De la Roca et al., 2007).

The reproducibility of measurements was analyzed in a study that measured the same patient over a period of several weeks evaluating the gastric emptying half-time, which showed a reproducibility coefficient above 85%. The remaining variation can be attributed to changes in motility of the same patients, depending on social and environmental conditions such as diet and health (De la Roca et al., 2007).

Several studies (De la Roca et al., 2007; Benmair & Dreyfus, 1977) have evaluated gastric emptying using magnetic tracers and the results have been presented in terms of half-time of emptying and peristaltic contractions in healthy male volunteers employing magnetic tracers in a yogurt vehicle test meal (Carneiro, 1977; Forsman, 2000), with similar results.

Gastric emptying has been evaluated in patients with functional dyspepsia, and a solid food test has been developed to compare results against benchmarks that primarily use the above type of food.

The esophageal transit time has also been evaluated. Techniques and instrumentation for biomagnetic studies permit the noninvasive functional evaluation of the gastrointestinal tract (Daghastanlietal., 1998; Córdova-Fraga et al., 2008).

We believe that the use of fluxgate sensors using magnetic markers can be used as a complement to manometric studies and are equivalent to centigraphy for clinical use.

Various studies have been performed using different test assemblies, and designs that we consider most relevant showing common patterns are presented below.

3.1.1 Magnetic stimulator

A magnetic stimulator has been used in experiments involving susceptometry (Carneiro et al., 2000) and magnetogastrography (Córdova et al., 2004). The magnetogastrograph (De la

Roca et al., 2007) was built by the Medical Physics Laboratory at the University of Guanajuato in Mexico.

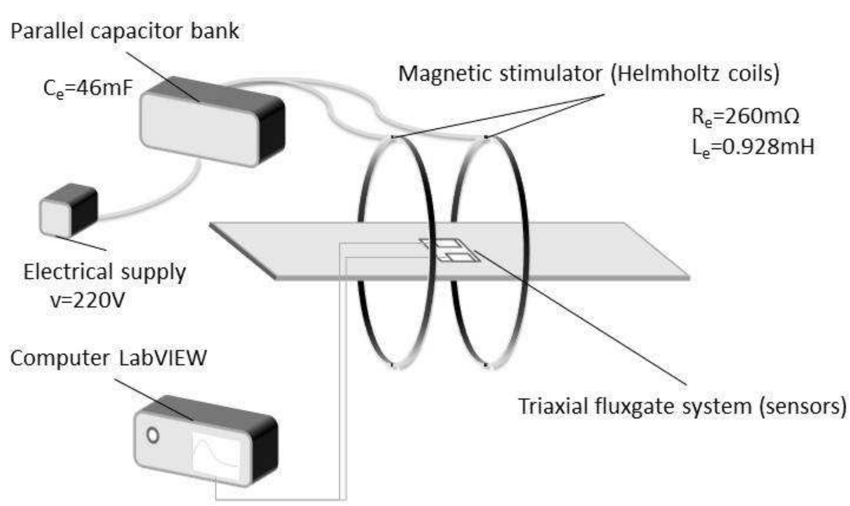
The magnetic stimulator is composed of two identical coils, assembled as a Helmholtz coil array. This setting means that the coils are placed parallel to each other and share the same axis of symmetry, with the separation distance being equal to the radius of the coils.

The coils contain 60 turns composed of magnet gauge 4 copper wire (average radius =6 mm). The wire was wrapped around two aluminum supports that contain five layers of 12 turns of wire. The magnitude of the pulse field produced by this arrangement is of the order of a few millitesla.

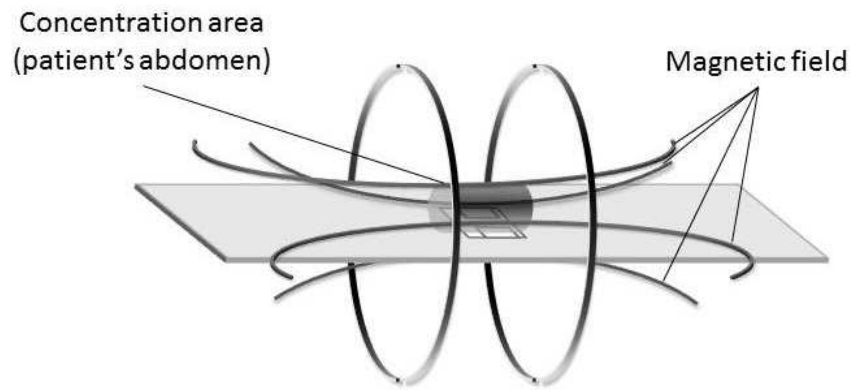
This arrangement of coils connected in parallel has a resistance of 260 milliohms and an inductance of 0.928mH. The magnetic pulse is generated by a bank of six capacitors connected in parallel with an equivalent capacitance of 46mF. The capacitor bank is connected to the mains voltage (220V), and this voltage is rectified before reaching the capacitor bank. Once the capacitors are charged, the discharge produces a magnetic pulse of 32mT for a period of 17μs.

For field measurements, we used the above system with a Model 53 triaxial fluxgate (Physics Applet Systems),which is a solid state device used to measure the direction and magnitude of direct current magnetic fields, or variations thereof, with a frequency less than 100Hz and a magnetic field of 18mT. This device has an output in three axes that can transmit data from the measurements performed through a serial port at a frequency of 250 samples per second with a noise level of 3nT. This system is automated and operated from a PC via the LabVIEW software package both for stimulation and data acquisition.

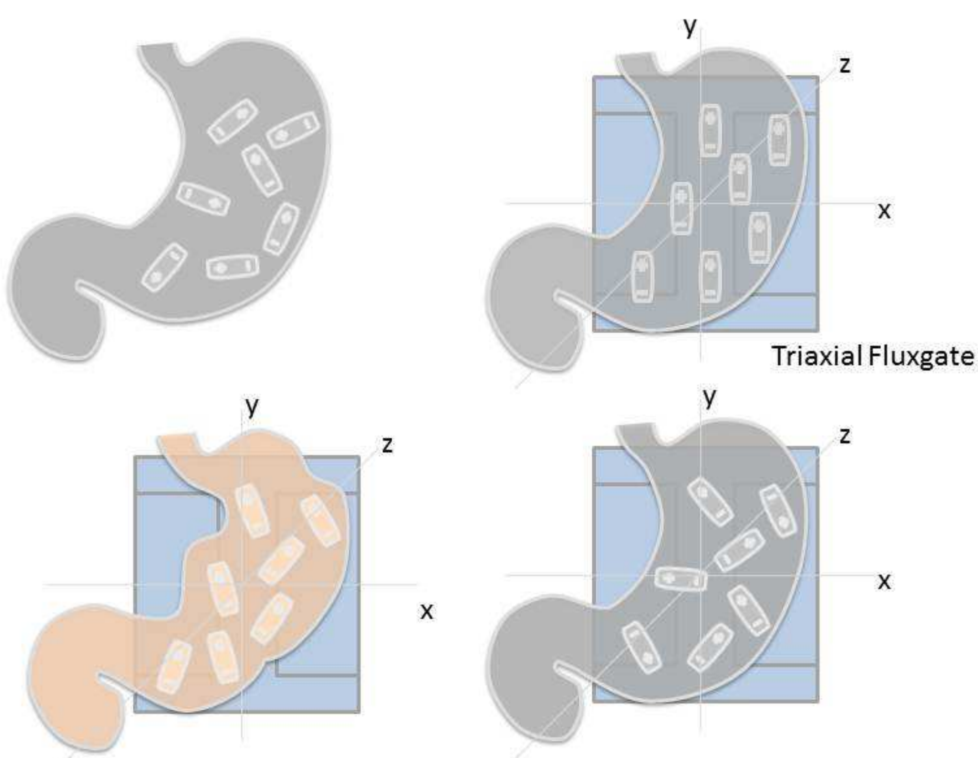
(see figures)



Magnet-gastrographer diagram. Helmholtz coils are responsible for generating the magnetic field, and receive the voltage from a bank of six capacitors in parallel. A triaxial fluxgate system detects the alignment of the magnetic markers, and information is recorded on a computer.



The stimulator generates a magnetic field is concentrated in the abdomen



1. Stomach after eating markers, 2. Markers aligned by the magnetic field, located in triaxial plane, 3. Markers for gastric movement, 4. Misaligned markers after gastric movement.

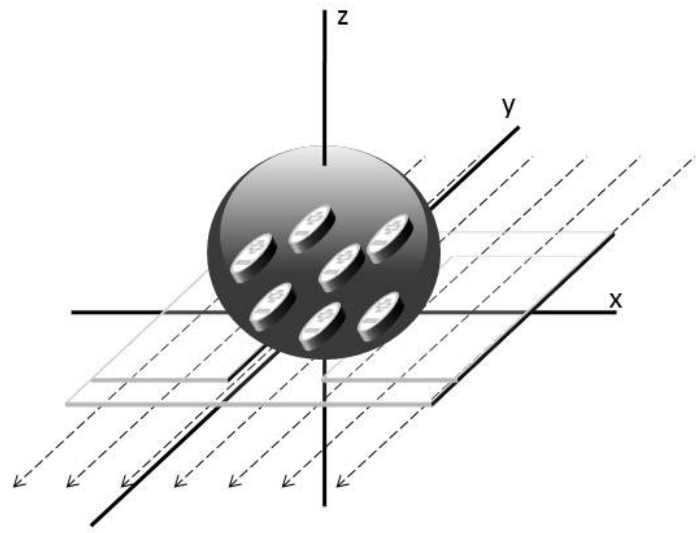


Diagram of the orientation of the markers on the triaxial sensor.

3.1.2 Magnetic contrast

Volunteers were asked to fast the previous evening and not to take any medication that would affect the gastric emptying time. The patients were asked to ingest a harmless dye and were placed in a prone position. Ten minutes after ingestion, the measurements began and were conducted every 10 minutes for a period of 1–2 hours.

In the case of semisolid food, the patients were given 250g of yogurt mixed with 4g of magnetite (Fe_3O_4). In the case of solid food in healthy volunteers (controls), this comprised a scrambled egg, a piece of bread and 250ml of peach juice. The bread contained 4g of magnetite for the MMGG and was made from milk, flour, eggs, and butter where the bread was in the form of a "hot cake"with a mass of approx. 30g (Reynaga, 2008).

3.2 Magnetic scanner

We have developed a device that is capable of creating a map of the magnetic fields obtained using magnetically marked phantoms, produced in the laboratory. This is a mobile automatic two-way device, developed to detect changes in magnetic flux, and is composed of on an array of magneto resistive sensors designed to detect magnetic fields of 100mT to 10nT (Pacheco, 2010).

4. Conclusions

Psychomagnetobiology is an interdisciplinary field that will help scientists propose strategies for the diagnosis and treatment of biological and psychological diseases, knowing that there is technology for electric or magnetic stimulation that has proven experimentally to be effective for the treatment of depression, anxiety, and in some cases, even hallucinations and addictions. It shows promise in this challenging landscape.

Both biological engineering and developments in technology are needed to implement new products in the service of human beings, but more research is required in joint efforts in psychology, medicine, and medical physics. Commitment is needed to continue working on this to help create the links needed to reach people in need.

We are currently developing new equipment and applications for research into missing areas, and the development of portable, magnetic and low-frequency equipment and software for the treatment of depression in Latin America.

Technology advances more each time to provide tools for the diagnosis and treatment of physical and mental illnesses, we have developed with several collaborators, technology to measure gastric emptying time, peristaltic contractions andtransit time in the gastrointestinal system (De la Roca-Chiapas JM et al, 2011), the influence of emotions on the symptoms of Dyspepsia (De la Roca-Chiapas et al, 2010), we have developed technology to measure magnetic fields on surfaces (Pacheco et al, 2008) , and we tried to measure tumor sizes (De la Roca-Chiapas, 2009) and now we are developing technology in electrical and magnetic microstimulation as tools that serve to treatment in people with anxiety, stress and depression.

There needs to be increasingly greater openness in science, allowing us to learn more about the man, and serve it better, this means leaving the arrogance to believe that science is "truth" and need to learn interrelated studies to do with people who think differently and in turn need projects to enter these sciences with integrators projects.

5. Future directions

Areas in which I think will developing the technology and where future research can focus are displayed in spaces that need to be covered in Figure 1. It's needed a portable and powerful magnetic technology for the treatment of depression. Lack the technological development of a scanner capable of measuring magnetic fields in the human body, and perhaps they are needed armored cameras, but I think the SQUID application for this is part of the answer, but today only deals to equip magnetoencephalography with the EEG, providing information on what brain areas are running the electric field lines. Similarly we believe that knowing how it behaves electric and magnetic fields in the human body can be used for the treatment and diagnosis.

I think in the future we will learn more about how magnetic fields of the human body and the planet affect us in the biological and psychological. We have technology that measures the order of femtoteslas, human magnetic fields, allowing us to understand how there is this mind-body-health interaction.

As for the GDV/EPC, in the future we will find a basic application that achieves characterize the behavior of fluids and tissues in humans, and their interaction with the environment.

In this sense, it is working at the University of Guanajuato to create models that seek to both basic research and the development of patents and technology with human sense.

I conclude by recalling that understanding the human being as an integral whole is an essential part of this work, since linking the mind, body and health consciousness, it is a model that seeks to achieve interdisciplinary in the service of man, speaking of the psycomagnetobiology, search of integrating different areas of expertise: medicine, psychology, physics and engineering. And this effort is retrieved from the traditional medicine of many cultures, including Mexico, China and Egypt, without being new, and that by proposing a new term is intended to entrench in a modern language, an expression that is natural multidimensional human.

As time passes, more and more will be heard: engineering biological and engineering psychological; science and technology for physical and mental health.

6. Acknowledgments

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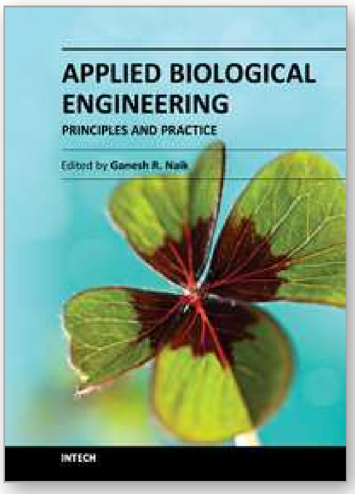

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Biological engineering is a field of engineering in which the emphasis is on life and life-sustaining systems. Biological engineering is an emerging discipline that encompasses engineering theory and practice connected to and derived from the science of biology. The most important trend in biological engineering is the dynamic range of scales at which biotechnology is now able to integrate with biological processes. An explosion in micro/nanoscale technology is allowing the manufacture of nanoparticles for drug delivery into cells, miniaturized implantable microsensors for medical diagnostics, and micro-engineered robots for on-board tissue repairs. This book aims to provide an updated overview of the recent developments in biological engineering from diverse aspects and various applications in clinical and experimental research.