Do I need magnetic therapy?

**Question:** What do Shaquille O'Neal, Igor Olshansky, Albertus Maximus and NASA have in common?

**Our world is surrounded by magnetic fields:** some are generated by the earth’s magnetism, while others are generated by solar storms and changes in the weather. Magnetic fields are also created by everyday electrical devices such as motors, TV’s, fluorescent lights, office equipment, house wiring and also the power lines, which supply our high demands for electricity.

**The topic of magnets, magnetism and healing** abound in the media like never before. Athletes in many fields claim tremendous recovery from injuries with the help of magnets. Igor Olshansky is the first Russian-born pro football player recognized by his peers as one of the strongest players in the league. He is an expert on "Getting back in the Game Faster!" He uses pulsed magnetic therapy to stay fit and heal faster from injuries. [http://pulsedenergytech.com/igor.html](http://pulsedenergytech.com/igor.html) The Dallas Cowboys professional football team is now using the PER this season. The Miami Dophins have used pulsed magnetic therapy for some time. We proudly welcome another professional football team to the Pulsed Energy family. NBA superstar Shaquille O'Neal has become the first professional athlete to own his own PER mini. If you follow sports headlines, you can read that Shaq is having his best season in years!

Famous horses have used pulsed magnetic therapy and have shown extraordinary performance; names like Kafwain, Ten Most Wanted, Indian Express, Senior Swinger, and Elloluv. [http://pulsedenergytech.com/horse-gallery.html](http://pulsedenergytech.com/horse-gallery.html) Breeders Cup Millionaire - Pulsed Energy offers congratulations to Vladimir and Tyler Cerin. They are the first horse trainers to have a horse win a Grade 1 Stakes Race. **Albertus Maximus won the million dollar purse** at the Breeders Cup Classic in Los Angeles, CA. The Cerins used the machine on Albertus for two weeks prior to the race. [http://sports.espn.go.com/sports/horse/breederscup08/news/story?id=3663387](http://sports.espn.go.com/sports/horse/breederscup08/news/story?id=3663387) Even NASA has studied and shown that pulsed magnetic fields can prevent bone loss and muscle atrophy in astronauts. [http://research.jsc.nasa.gov/PDF/SliSci12.pdf](http://research.jsc.nasa.gov/PDF/SliSci12.pdf)

**Do magnets really heal all kinds of ailments?**

**Yes & No. Some magnets can do wonders, many do not.** According to Dr. Joseph Mercola magnets and energy medicine are clearly the medicine of the future. He has observed that our minds can be helped, and treated to be able to fight depression with the help of magnets. [http://v.mercola.com/blogs/public_blog/treating-depression---with-magnets-71511.aspx](http://v.mercola.com/blogs/public_blog/treating-depression---with-magnets-71511.aspx)

According to Dr. Robert Becker, **magnetic deficiency is clearly misunderstood** in our healthcare system, “in many cases, the body simply does not supply and maintain enough negative magnetic energy at the injury to facilitate healing. The human body does have limitations—based on its own energy capacity and how much negative magnetic energy it can generate.”

**Answer:** Each used pulsed magnetic therapy; the first 3 used a pulsed energy replenisher from [www.pulsedenergytech.com](http://www.pulsedenergytech.com), NASA made their own with taxpayers monies.
As a consumer considering magnet therapy you can choose from a wide range of natural approaches for your healthcare. You might take supplements, see acupuncturists, chiropractors, massage therapists or physical therapists; or perhaps you may consult a homeopath or herbalist about health problems that you are trying to solve. Your regular doctor may be less informed about alternative or holistic care, than you are. Few mainstream physicians know very much about the newly developed field of Energy Medicine. But for those physicians that have seen the palace of possibilities offered in energy medicine—the opportunities for healing are a fountain of life!

**WHAT IS ENERGY MEDICINE?**

"For most of this century", says William Tiller, Ph.D., of Stanford University, "**science and medicine** have seen health as being **dependent** upon the balance of **body chemistry and the functioning of physical structures**. However, attempts to treat illnesses and imbalances chemically often lead to **unwanted side effects** or the body becoming insensitive to the chemicals." This fact has led many physicians and health professionals to **look beyond conventional drug-based therapies to the field of energy medicine**. Many of the most sophisticated diagnostic systems used today in conventional medicine, such as the EKG (electrocardiogram), EEG (electroencephalogram), EMG (electromyelogram), MEG (magnetoencephalogram), and MRI (magnetic resonance imaging), employ the principles of energy medicine. Energy medicine refers to therapies that use an energy field - electrical, magnetic, sonic, acoustic, microwave, infrared - to screen for or treat health conditions by detecting imbalances in the body's energy fields and then correcting them.

"**The doctor of the future will give no medicine, rather interest their patients in the care of the human frame through lifestyle and diet, and in the cause and prevention of disease.**" -- Thomas Edison.

All living organisms both generate and respond to electromagnetic fields. Specific bio-electronic signals appear naturally in human and animal tissues in response to injury and stress.

**EVERYTHING RESPONDS TO A MAGNETIC FIELD.**

All elements respond to a magnetic field in one of three ways:

1) **The element will be drawn** toward the magnet or magnetic field; these kinds of substances are known as **ferromagnetic**. We are familiar with a bunch of paperclips clinging to a paperweight magnet.

2) **The element will be repelled** by the magnet or magnetic field, and is called **diamagnetic** substances. People and frogs are diamagnetic. Living things such as animals and plants have a lot of carbon and water, which are diamagnetic. An interesting experiment showing this is at
http://www.sci.kun.nl/hfml/froglev.html where a frog is levitated at the top of a very strong electromagnet. A diamagnetic substance is one whose atoms have no permanent magnetic dipole moment.

3) **The element will line up** in the magnetic field and are said to be **paramagnetic**. When a paramagnetic material is placed near a magnet, it will be attracted to the region of greater magnetic field, like a ferromagnetic material. The difference is that the attraction is weak. Oxygen, Sodium, and Uranium and aluminum are examples of paramagnetic materials. Some materials, however, have stronger paramagnetic qualities that overcome their natural diamagnetic qualities. These paramagnetic materials, such as iron and nickel, have unpaired electrons.

**HOW IS A PERMANENT MAGNET AND ELECTROMAGNET DIFFERENT?**

Simply put, a permanent magnet emits a magnetic field, while an electromagnetic device gives off an electric and magnetic field says John Zimmerman, Ph.D., one of the leading authorities in America on the subject of magnets. He is president of the Bio-Electro-Magnetics Institute, an independent, nonprofit, research organization dedicated to furthering our understanding of bioelectromagnetism. Dr. Zimmerman elaborates: "Magnetism and electromagnetism are different sides of the same coin. However, unlike a coin, electromagnetism has three sides rather than two. They are the electric field, the magnetic field, and the electromagnetic radiation. Electromagnetic radiation is another way of saying—light or as science calls it, photons streaming out into space. Electromagnetic radiation is all part of a group of phenomena known as the electromagnetic spectrum.

A **pulsed magnetic field (PEMF)** is produced by an electromagnet at a specific rate (or speed). There are many different devices available in the market place—low end do it yourself models priced at a few hundred dollars up to ones costing thousands of dollars. Generally speaking the slower the pulse rate the deeper the effect. There is so much variation in different brands that NASA built their own machine that had complete variability to do research into what works best. The PER-2000 is not as far out as the unit built by NASA, but it seems to be head and shoulders above the competition. The PER-2000 is only advertised as a pulsed energy replenisher to recharge your battery—but the testimonials tell a much bigger story. [http://pulsedenergytech.com/research.html](http://pulsedenergytech.com/research.html)
Electromagnetic Pollution


All over the countryside one may see high-voltage transmission poles standing like metal skeletons strung with high-tension wires. These and other products of modern power and communications industries, such as radio, television, and radar, all operate in the electromagnetic spectrum. All produce electromagnetic waves into our environment which we cannot hear, see, feel, or otherwise detect with our senses without instrumental intervention.

Until recently, scientists believed that electromagnetic radiation had no effect on life. No obvious diseases had been identified as having been caused by such energy. Expert opinion held that there was little or no connection in nature between biological tissue and electromagnetic radiation, other than gross heating effects from high doses. And so industry has gone ahead expanding its use of the electromagnetic spectrum with the assurance that no danger exists. We now live submerged in a sea of unperceived electromagnetic radiation that manufacturers insist is totally safe—and all is not well.

Only PART OF OUR ELECTROMAGNETIC ENVIRONMENT OCCURS NATURALLY most of it is artificially produced. Naturally occurring long-wavelength electromagnetic radiation in the Earth’s atmosphere primarily results from geophysical processes and from lightning. Extraterrestrial sources, such as radiation from the sun, account for the short wavelengths. At any given time there are 1,000 to 2,000 thunderstorms on the earth and at least 100 lightnings occurring over the earth. Thunderstorms provide electricity to our atmosphere and energize our body’s acupuncture circuits—such is the spark of life.

Human activities within the last hundred years have profoundly changed the natural electromagnetic background waves, which have prevailed since the beginning of time. Power and communication systems have drastically altered the frequencies and the strength of the nonionizing electromagnetic radiation (NIEMR) in the environment.

From the standpoint of what is healthy for us we can be overwhelmed by information as well as by electromagnetic radiation itself. How can we know what is useful and effective in the battle of treatment and defense from electromagnetic pollution? One way is to search PubMed for articles.

PubMed, a service of the National Library of Medicine, provides access to over 12 million MEDLINE citations back to the mid-1960’s and additional life science journals. PubMed includes links to many sites providing full text articles and other related resources. Listed below is the medical site for all kinds of published articles on any topic. On the topic of Magnetic Fields—11,632 entries are listed, magnet therapy—40 entries, Magnet—2909 entries and the word Magnetic some—229,758 entries are found. Thus the topic of magnets is gaining increased exposure in the professional literature. (30) From PubMed we find that magnet therapy is used for a wide variety of conditions—before spinal disc surgery, as adjunctive therapy with chemotherapy in the treatment of children with malignant tumors (lymphosarcoma), many cases of multiple sclerosis and improvement of cognitive behavior in children with Tourette’s syndrome. Magnet therapy has also been effective with reduction of pelvic pain in
women. And of course the most common form that magnets are used in medicine is in the form of diagnostic imaging, which we know as MRI (Magnetic resonance imaging). So far we can assume that our bodies do indeed respond to magnetic fields—some fields can cause harm from long-term exposure and other kinds of magnetic fields can produce healing for suffering mankind.

**MAGNETIC THERAPY PENETRATES THE WHOLE BODY**

Magnetic therapy is a method that penetrates the whole human body and is capable of treating any organ or tissue without the need for chemicals and their unwanted side effects. Magnets have been used to successfully treat many conditions including arthritis, cancer, circulatory problems, fractures, headaches, inflammation, infections, and not the least—pain. The proper kind of magnetic therapy can even counter the effects of electromagnetic pollution (EMF).


<table>
<thead>
<tr>
<th>Acid pH</th>
<th>Injuries as well as degenerative diseases form local or regional shift in tissue pH; from alkalinity toward acidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxia</td>
<td>An oxygen deficit, molecular oxygen is necessary for energy production and oxygen cannot remain available in an acid medium.</td>
</tr>
<tr>
<td>Free Radicals</td>
<td>Free radicals are destructive to our bodies and form in any degenerative, infectious or inflammatory process. Found in abundance in pollution and “junk food”.</td>
</tr>
<tr>
<td>Reduced Ionized Calcium</td>
<td>Calcium is necessary for bone, muscle and nerve function. Calcium becomes insoluble in acid tissues. Overused muscles make lactic acid. (Body cannot use this form)</td>
</tr>
<tr>
<td>Impaired Cellular Function</td>
<td>Acid conditions produce edema (tissue swelling) and permits cell mutation, which prevents DNA cell repair. (31)</td>
</tr>
</tbody>
</table>

**What can magnetic fields do?** They can reverse the above effects in our bodies and prepare the cellular neighborhood to become healthy and whole once again.

You can treat nearly any condition with magnets (the exceptions are hemorrhage, cancer, pregnancy and medical implants such as pacemakers); it will either respond or it will not. However it is important to understand if no improvement is felt within a short period of time, then discontinue the magnetic exposure. If you continue, stress to the meridian system will be produced. *Over time if magnetic therapy is used with inappropriate polarity or only superficial penetration, the meridians will become*
imbalanced and may inhibit immune function. Magnetic therapy works for about 80% of common ailments. Healing takes time, no matter what treatment method is used.

**Effects of Pulsed Electromagnetic Fields PEMFs on Stress**

Tue, 24 Dec 2002 14:45:37 -0600 William Pawluk, MD, MSc

The very presence of life means that stress is also present. The recognition of and the reaction to stressors are fundamental to physical and emotional existence. Our reactions to stressors are either healthy or unhealthy. Unhealthy reactions to stress create physical and psychological damage, if either too large to withstand or too frequent to recover from. A healthy response to stress is perspiring when the body temperature increases. This response becomes harmful, when the body is not able to perspire or if the stress continues too long and bodily fluids are depleted. Stressors may also be psychological or mental. Again, the reaction may be helpful or harmful. For most of us, the use of the term "stress" refers most often to the negative psychological or physiological responses to life's stimuli.

The primary need for a stress response is called the “fight or flight” response. Typically, this response allowed us to engage a threat, such as an attacking animal. In modern civilization, the most common daily stressors are psychological events, such as, an angry client on the telephone or the tension of driving in heavy traffic. Even these seemingly minor occurrences produce a low-level "fight or flight" reaction in the body. The cumulative or chronic occurrence of these stressors does not allow adequate recovery and results in health problems.

Stress accelerates wear and tear; chronic stress accelerates aging and the cause of heart disease, atherosclerosis, diabetes, arthritis, fatigue, immune problems, adjustment disorders and anxiety and depression.

Some of the physiologic reactions to stress are: muscle tension, rapid heartbeat, sweaty palms, diarrhea or constipation, increased gastric acid, high blood pressure, increased blood sugar, increased fat, dry mouth, increased insulin, as well as hormone and immune system changes.

The physical problems that can result from stress are: insomnia, nervous irritability, headaches, Atherosclerosis, hypertension, irritable bowel, gastritis, arrhythmias, panic attacks, anxiety, depression, fatigue, substance abuse, immune deficiencies, asthma, skin problems, allergies, muscle spasms, neuralgias, vision changes, hyperventilation, dehydration, sudden cardiac death, vasospasm, increased cholesterol, increased platelets, decreased oxygen, appetite problems, accelerated auto immune problems increased actually, miscarriages decreased libido, impotence, menstrual changes, disturbed memory, among others.

Clearly not all of these problems happen to everybody under stress. They happen to varying degrees depending on genetics, environmental experiences and the level and duration of the stress. Most of us
throughout our lifetimes will develop at least some of the above problems. There are many approaches to preventing and managing stress reactions. Once a stress reaction is initiated it is difficult to turn off immediately. The reaction is immediate but the recovery takes hours to days. Since the effects of stress are cumulative, a daily routine of reducing the physiologic response becomes necessary to ward off long-term damage. One approach to reducing the physiologic response to the effects of daily stress is whole body pulsed magnetic field (PEMF) therapy.

Humans are very sensitive to magnetic fields (MFs). Functional physiologic variations were observed during solar magnetic storms in healthy humans, patients with cardio-vascular diseases and cosmonauts in SOYUZ spacecraft and the MIR space station (Rapaport). They showed nonspecific adaptive stress reactions, accompanied by variations in stress-hormone production. Magnetic storms in both ill and healthy individuals increased cortisone secretion and activation of the sympathoadrenal system (SAS) and suppressed production of melatonin.

Much experimental evidence has been gathered to suggest that biological systems are highly sensitive to weak generated PEMFs and PEMFs have a wide range of biologic effects in almost all biologic systems. We will cover the results of a number of these effects. Since experiments are difficult to do in humans, much work has been done in animals. PEMF exposures of rats inhibited the activation of the sympathetic-adrenal system (SAS) as well as prevented a decrease in nonspecific resistance (Temur’lants). They found a decreased concentration in plasma of catecholamines, chemical messengers associated with increased sympathetic arousal. Normalization of the SAS state occurred due to the modulation of hypothalamic functional activity and increased urine excretion of epinephrine. Even weak PEMFs are able to inhibit the development of a stress reaction. There is a possibility that long term use of weak PEMFs may be able to remodel tissues that tend to be hyper-reactive to chronic or acute stress. Hyper-reactivity of the stress response is often based on stress experiences in infancy and, if recurring, throughout life. Remodeling of tissues and organs has been found with treatment of other pathologic states such as asthma, hypertension and cardiac failure.

Even environmental stressors, such as heat or sunlight, have an effect on cellular homeostasis (Gutzeit). There are interactions between thermal stressors and electromagnetic fields (EMFs) as inducers of intracellular heat stress proteins (hsp), which are protective proteins in the cell. PEMFs can be used preventively prior to heat, toxicity or injury to prevent cellular harm and thus produce cellular stress resistance and reduce cellular stress responses. A number of studies have shown that the presence of hsp in a cell mediates this effect, an effect that is usually denoted "thermo tolerance" or "stress tolerance." The stress response proteins are induced by numerous stimuli in addition to heat, for example, heavy metals and oxidative stress. During severe metabolic stress, the stress proteins preserve cell viability (Litovitz).
This phenomenon could be exploited as a beneficial presurgical cardiovascular treatment. This has been borne out in studies that have shown that cardiotoxic effects, such as occur during cardiac surgery, may be prevented by preconditioning with PEMFs. Stimulating the cardiac cell with PEMFs may provide for it protection from injury, including cardiac surgery or heart attack. Similarly, heat pre-treatment can result in significantly improved heart salvage following coronary artery bypass grafting (Litovitz).

Other potentially therapeutic applications include protection against viral infections, autoimmune diseases, inflammatory diseases, and the support of the stress response in the elderly, in an attempt to counteract the normal loss of the stress response during aging. Originally, the therapeutic effects of electromagnetic fields in a wide range of frequencies were considered a result of activation of metabolic processes in the immediate tissues exposed. Subsequently, it was found to be more advantageous to expose endocrine glands and control centers of the central nervous system since EMFs there triggered natural control processes of homeostasis (Zubkova). Lower dosing of the thyroid area produced a similar response vs. the local area, e.g., the heart in ischemia. These adaptive changes promoted elimination of hemodynamic and hypoxic disorders in the myocardium, and restored levels of production of mineralo- and glucocorticoids by the adrenals. In rabbits with experimental hepatitis microwave PEMFs to the thyroid was more effective in restoring liver function than to the liver itself. Local exposure of adrenals in patients with rheumatoid arthritis activated production of glucocorticoids and returned to normal functional activity of lymphocytes. This work confirmed that an adaptation to short-term (or weak) stressor factors increases the resistivity of the organism to severe stressors, including low temperatures, physical load, ischemic heart necrosis, ionizing radiation, etc.

Stress causes a very quick and significant decrease in leukocyte and absolute lymphocyte numbers in the peripheral blood of up to 10-20%. The level of cortisone in the blood increases two to three-fold. PEMFs modulate host resistance (Ilsaeva) through enhancing some immune functions. The percentage of neutrophils (including immature neutrophils) increases gradually with exposure and neutrophil metabolism and superoxide production are significantly higher with PEMF. The blood level of cortisone is lowered.

In some animal species, such as rabbits, emotional stress increases lethality. PEMFs increased resistance of the rabbits to stress: lethality in animals exposed to stress plus PEMF was 1.9 times lower than lethality in rabbits exposed to stress alone (Gorbunova).

Stress activation of the SAS in rats is seen by changes in (nor)adrenaline in the hypothalamus, adrenal glands, plasma and urine. Daily 3-hr exposure to PEMFs decreased activation of the SAS shown by a decrease in plasma and urine catecholamines (Temur'iants). The excitability of the nervous system
decreased and corrected the emotional reactions that accompany stress. Pain inhibition (i.e. analgesia) is a biological function consistently found to be affected by exposure to magnetic fields in various species of animals, including: land snails, laboratory mice, deer mice, pigeons, as well as humans (Prato).

Application of PEMFs to acupuncture points has been found to produce anti-stress benefits (Lukianova). Therefore, PEMFs act similarly to electroacupuncture (EA). The stress responses induced by painful tooth pulp stimulation in rats was reduced by electroacupuncture (EA) (Han), evidenced by decreased nor/epinephrine, dopamine, ACTH, and corticosterone. No elevation in either diastolic or systolic blood pressure was seen following EA. Millimeter wave (MMW) exposure of an acupuncture point affects heart rate and heart rate variability and lability of central nervous system (CNS) processes (Lukianova). Measurements were performed in healthy examinees before and after a physical exercise. Almost all the examinees had increased lability of central nervous system (CNS). The effect on the heart rate depended on the predominance of sympathetic or parasympathetic control mechanisms in a particular subject. With parasympathetic predominance, exercise increased both the heart rate and its variability. With predominance of sympathetic tone, individual reactions to exercise varied greatly. MMW exposure facilitated recovery of the heart rhythm after exercise in parasympathetic toned individuals, not consistently in sympathetic predominance.

**Chronic stress causes depression.** Amitryptiline also seems to have a similar effect in blunting or negating the stress response (Nemeroff). Stress induces neuronal atrophy and death in the brain, especially in the hippocampus. Alterations in the expression of neurotrophic factors are implicated in stress-induced hippocampal degeneration (Yun). EA stimulation significantly restored neurotrophic factors.

One group studied for many years the effects of an PEMFs 1-500 G and also a constant magnetic field (CMF) at up to 2500 G intensity (Garkavi). With a CMF, the pattern of a training reaction, or very low-level response, was found. PEMF exposure of the head at frequencies greater than 50 Hz produced a low-level adaptation reaction, whereas a lower frequency PEMF stimulates the development of a higher reaction level. Exposure of the peripheral parts of a body by PEMF up to 1000 Hz at a low intensity 100-200 G or less could provoke the development of a high reaction level. In studies of weak PEMF (100 G), these magnetic fields were antitumorigenic, protective (in relation to toxic agents and X-ray radiation), and produced rejuvenation effects in the organism, especially in cases where there was a high reaction level.
Millimeter waves (mmW) have been found to attenuate stress reactions in experimental animals (Lebedva). They were also found to prevent a stress response in healthy 20 to 24 yr old humans applied to the outer surface of the hand. Stress was evaluated by heart rate variability and electroencephalogram (EEG) changes. The heart rate variability reflects the balance of sympathetic and parasympathetic stimulation of the heart. Stress normally increases the heart rate. MmW’s prevented or attenuated these changes. Stress-induced EEG changes were suppression of the alpha rhythm, enhancement of the theta rhythm, and a decrease in the coherence of bioelectric activity in different brain structures. EEG changes with mmW treatment were the opposite of those, which occurred in control experiments. MmW treatment may help to increase resistance and to ameliorate stress.

In another study of mmW exposure (EMR (Temuri)ants) resistance to stress was tested. All stressed animals had precipitous decreases of non-specific resistance, activation of lipid peroxidation and brain thiol-disulfide exchange. Normal control animals exposed to EMR showed a 10-15% increase in neutrophil metabolism and increased thalamic and hypothalamic thiol exchange. None of the changes seen in the stressed control animals were seen in those, which were stressed and exposed to EMR.

Stress in rats can lead to breakdown of elastin and collagen fibers in serum, heart muscle, cerebral cortex and liver (Varakina). Low- and high-frequency PEMFs in rats modulated elastase-inhibitory activity in all tissues with exposures to frontomastoid area of the head or paravertebrally, alone or in combination with laser, infrared exposure or static magnetic field (SMF). High laser strength and the combination of laser with SMF decreased the stress reaction. The use of the combination of infrared laser + SMF + PEMF had a stress-limiting effect and enhanced elastase-inhibitory activity. The increase in elastase-inhibitory activity by PEMFs is because of its antioxidant abilities.

According to present views, ascorbic acid (AA) plays a key part in the antioxidant system and, therefore, is mainly responsible for the coordination of neuroendocrine and immune mechanisms of stress adaptation (Zotochkina). High frequency fields for 1 hr daily over a period of up to 90 days caused AA and serotonin (S) to significantly decrease after 3 days by16% and 28%, resp., increase nearly 2-fold by the 30th day of exposure and by the 90th day, AA concentration recovered to the initial (pre-exposure) value, while S content still remained significantly increased.

Low-level 50-Hz PEMF exposure on host immunologic defense and on splenic colony formation was tested in a mouse model (Korneva). After 1 or 4 days the magnetic field caused a protective effect.

PEMF effects were evaluated in athletes engaged in different sports, with different qualifications, and in different periods of training and competitions (Gigineishvili). Decimeter wave therapy (DMW) exposures (460 MHz) of adrenal, thyroid gland, or collar areas have been found to have a favorable
effect on the immune status and production of hormones, specifically, T-lymphocytes, testosterone and growth hormone, and a decrease in circulating B-lymphocytes and cortisol. DMW exposures of the thyroid gland decreased the initially elevated levels of thyroid hormones, cortisol, and somatotropin. These effects were interpreted as favorable and helpful in maintaining a high resistance to diseases and a high working capacity.

Heart rate variability (HRV) results from a complex interplay of neural and hormonal control mechanisms. Changes in HRV have been associated with increased risk of severe arrhythmia and sudden cardiac death in patients with recent myocardial infarction. Human volunteers had their heart rate variability tested with PEMF exposures (Sait 1998). The slowing of heart rate associated with field exposure has been confirmed. Sinusoidal continuous waveform seemed to be more effective at producing this effect than intermittent or square-wave current waveforms. There was significant greater inter-subject variability than within subject. Some individuals may be more sensitive to or alternately more consistent in producing these field-induced changes in HR and HRV than others. This effect appears to be a modulation of the threshold properties of the cardiac pacemaker, the Sino-Atrial Node, giving rise to greater beat-to-beat variability.

In another series of double-blind studies it was also found that PEMFs altered the normal variability inherent in human cardiac rhythm (Sastre). Intermittent exposure is more effective than continuous exposure. Static magnetic fields (SMFs) act on rabbit sinocarotid baroreceptors by reducing blood pressure (Gmitrov 1995). The effects were attributed to changes in cell membrane calcium ion (Ca++) transport since they were abolished by treatment with verapamil, a potent Ca++ channel blocker. A more pronounced effect occurs with stronger fields. Heart rate was significantly decreased during the after-effect period. Changes were indicative of peripheral vasodilation and increased baroreceptor activity causing the baroreceptor to reset the sympathetic tone. In humans, SMFs over the right and left carotid sinuses, respectively, at the baroreceptors, increased heart rate variability somewhat vs. shams and controls (Gmitrov 1996). The effects were of minimal clinical significance in the subjects tested but could be significant in individuals with cardiovascular disease with decreased HRV.

High strength stimulation level fields act somewhat differently than low-level PEMFs. Slow repetitive transcranial magnetic stimulation fields (rams) also affect human heart rate variability (HRV) (Yoshida). HF HRV in the supine position is thought to reflect parasympathetic nervous system activity, while LF HRV while standing is thought to be mediated by the sympathetic nervous system, based on its decrease following administration of a beta-adrenergic blocker such as propranolol. LF power band of HRV was significantly increased relative to baseline when measured immediately after rTMS. No significant long-term effect of either active or sham stimulation on LF power was seen when measured 5 days after the end of the experiment. The transient increase in LF power induced by active stimulation but not sham stimulation suggests that rTMS may transiently activate the sympathetic nervous system.
Application of the PEMF signal resulted in the several apparently related long-lasting localized effects being observed in certain tissues: an increase in blood volume, an increase in oxygen partial pressure (PO2), persistent increases in pH (reduced acidity), increase in respiration amplitude, decrease in heart rate and changes in blood pressure (Warnke). The magnitude of these effects in the human subjects showed significant inter-individual variability. The effects were observed to be modulated by changes in the level of blood acidity, as indicated by measurements of lactic acid and pyruvic acid concentration, carbon dioxide partial pressure (pCO2), and hydrogen ion (H+) concentration. This meant that the PEMF effects would be increased during periods of high muscle activity, after drinking alcohol, while sleeping, or after inhaling CO2. Conditions that promoted alkalosis such as hyperventilation and eating large meals could be expected to reduce the magnitude of the effects.

Extremely low-frequency (ELF) pulsed magnetic fields (PMFs) affect blood vessels. Head and thorax exposure to ELF PMFs induced dilation of the larger blood vessels in these areas and increased oxygen partial pressure (Warnke). PMFs having a variety of pulse shapes, amplitudes, and repetition rates that were applied to the neck of human volunteers showed that these stimuli could alter the respiration cycle, heart rate, blood pressure, and vessel perfusion. Although these effects showed wide variability and poor reproducibility, they were, nonetheless, attributed to a decrease in central nervous system (CNS) activity and a local increase in sympathetic activity.

Strong SMFs induced a vagotonic state (Nakagawa).