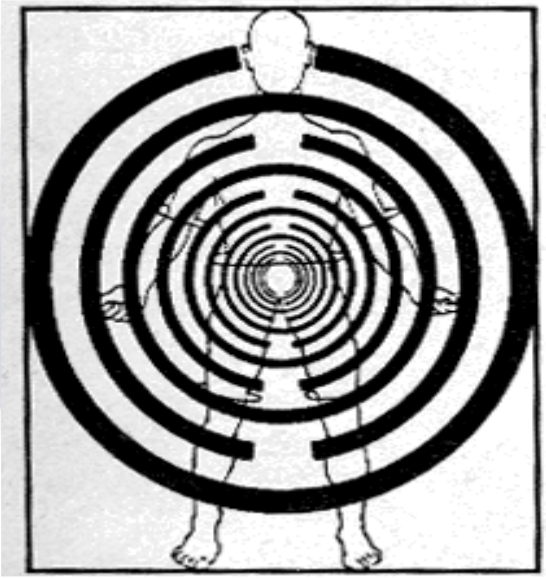
Lakhovsky's
Multiple Wave Oscillator



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Bioelectromagnetic Healing, its History and a Rationale for its Use

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Abstract

Bioelectromagnetics (BEMs) is the study of the effect of electromagnetic fields on biological systems [1]. Though electromagnetic fields have sometimes been associated with potential for harm to the body, there are many BEM instruments and devices re-emerging in the 21st century, based on high voltage Tesla coils, that apparently bring beneficial health improvements to human organisms. The Tesla coil class of therapy devices constitute pulsed electromagnetic fields (PEMF) that deliver broadband, wide spectrum, nonthermal photons and electrons deep into biological tissue. Electromedicine or electromagnetic healing are the terms applied to such developments in the ELF, RF, IR, visible or UV band. With short term, non-contacting exposures of several minutes at a time, such high voltage Tesla PEMF devices may represent the ideal, noninvasive therapy of the future, accompanied by a surprising lack of harmful side effects. A biophysical rationale for the benefits of BEM healing a wide variety of illnesses including cancer, proposes a correlation between a bioelectromagnetically restored transmembrane potential, and the electron transport across cell membranes by electroporation, with normal cell metabolism and immune system enhancement. The century-long historical record of these devices is also traced, revealing questionable behavior from the medical and public health institutions toward such remarkable innovations. This report also reviews the highlights of several BEM inventions but does not attempt to present an exhaustive nor comprehensive review of bioelectromagnetic healing devices.

History of Bioelectromagnetic Healing

Historically, as far back as 1890, the American Electro-Therapeutic Association conducted annual conferences on the therapeutic use of electricity and electrical devices by physicians on ailing patients. Some involved current flow through the patient, while others were electrically powered devices. At first, only direct current (DC) devices were utilized in the medical doctor's office for relieving pain and vibrating female patients who were routinely diagnosed with "hysteria."

Nikola Tesla

In 1895, the Niagara Falls Power Company opened for the first time and within a year, sent alternating current (AC) to Buffalo, NY, twenty-five miles away, thanks to Nikola Tesla AC generators. Cities throughout the world followed suit and made commercial AC power available to the general public, even miles from the power generating station. As a result, Tesla's high voltage coil devices, which were powered by AC, started to become widely known and applied.

In 1898, Tesla published a paper that he read at the eighth annual meeting of the American Electro-Therapeutic Association in Buffalo, NY entitled, "High Frequency Oscillators for Electro-Therapeutic and Other Purposes."[2] He states that "One of the early observed and remarkable features of the high frequency currents, and one which was chiefly of interest to the physician, was their apparent harmlessness which made it possible to pass relatively great amounts of electrical energy through the body of a person without causing pain or serious discomfort." Coils up to three feet in diameter were used for magnetically treating the body without contact, though ten to a hundred thousand volts were present "between the first and last turn." Preferably, Tesla describes using spheres of brass covered with two inches of insulating wax for contacting the patient, while unpleasant shocks were prevented. Tesla concludes correctly that bodily "tissues are condensers" in the 1898 paper, which is the basic component (dielectric) for an equivalent circuit only recently developed for the human body.[3] In fact, the relative permittivity for tissue at any frequency from ELF (10 Hz-100 Hz) through RF (10 kHz–100 MHz) exceeds most commercially available dielectrics on the market.[4] This unique property of the human body indicates an inherent adaptation and perhaps innate compatibility toward the presence of high voltage electric fields, probably due to the high transmembrane potential already present in cellular tissue. Tesla also indicates that the after-effect from his coil treatment "was certainly beneficial" but that an hour exposure was too strong to be used frequently. This has been found to be still true today with the Tesla coil therapy devices. On September 6, 1932, at a seminar presented by the American Congress of Physical Therapy, held in New York, Dr. Gustave Kolischer announced: "Tesla's high-frequency electrical currents are bringing about highly beneficial results in dealing with cancer, surpassing anything that could be accomplished with ordinary surgery."

Alexander Gurvich

In 1922, the Russian doctor and histologist Alexander (Gurwitsch) Gurvich (1874-1954) and his wife discovered that living cells separated by quartz glass were able to communicate vital-cell information. Numerous experiments suggested that this information was transmitted by invisible light waves in a UV frequency spectrum passed by quartz and stopped by window glass. Dr. Gurvich coined the phrase "mitogenic" "mitotic" wave since it was observed during enzymatic reactions and mitosis. "Gurvich determined that muscle tissue, cornea, blood and

nerves are all transmitters of this special energy."[5] His work is the first documented evidence of "biophotons," coherent light emitted by animal and plant cells, and became the basis for the design of later bioelectromagnetic therapy devices. It was not until the early 1960's that Leningrad State University succeeded in capturing the mitogenic rays with sensitive photomultipliers.[6]

Georges Lakhovsky

In 1925, Georges Lakhovsky published a paper with the explicit title of "Curing Cancer with Ultra Radio Frequencies" in Radio News.[7] His expressed philosophy was that "the amplitude of cell oscillations must reach a certain value, in order that the organism be strong enough to repulse the destructive vibrations from certain microbes." He goes on to say, "The remedy in my opinion, is not to kill the microbes in contact with the healthy cells but to reinforce the oscillations of the cell either directly by reinforcing the radio activity of the blood or in producing on the cells a direct action by means of the proper rays." Lakhovsky's Radio-Cellulo-Oscillator (RCO) produced low frequency ELF all the way through gigahertz radiowaves with lots of "extremely short harmonics."[8] He favored such a wide bandwidth device so that, "The cells with very weak vibrations, when placed in the field of multiple vibrations, finds its own frequency and starts again to oscillate normally through the phenomenon of resonance." As a result, Lakhovsky's RCO is now more often called MWO (multiple wave oscillator) for these reasons. The MWO uses a Tesla coil and special antenna with concentric rings that induce multiple sparks between them. Details can be found in his US patent #1,962,565 and the compact, portable, screw-in-lightbulb-style-vacuum-tube upgrades seen in his US patent #2,351,055. Lakhovsky's article and patents can be found on line at: http://www.rexresearch.com/lakhov/lakhusps.htm. His book, The Secret of Life was first published in English in 1939. In 1949, a review of Lakhovsky's work was published as Waves That Heal by Mark Clement. Besides this technical information, the life of Lakhovsky is a study in suppression and summarized below in a paper by Chris Bird:

The first man I will mention today is the Russian-born Frenchman, Georges Lakhovsky. I learned only yesterday that Lakhovsky seems to have been an associate, or knew, Nikola Tesla. I had not known that and from the point of view of the history of energy medicine, it's a very interesting thing. At any rate, Georges Lakhovsky began to experiment with what he called a "multiwave oscillator." (In the Library of Congress there are some ten books written by Lakhovsky, all in French.)

This multiwave oscillator (MWO) put out a very broad spectrum of electromagnetic frequencies. The theory, as propounded by Lakhovsky, was that each cell in the body of an organism-be it a plant, an animal, or a human being-is in itself a little radio receiver and works on its own special little frequency. Each cell, in addition to being tissue, in addition to being biology, is also electricity. On that theory, he held that pathology was a not matter of biological concern or intervention, but one of electrical concern and intervention. He theorized that from the bath of electrical frequencies put out by the multiwave oscillator, each cell individually could and would select that frequency which it most needed to restore its equilibrium.

So he began to experiment not with animals or human beings, but with geraniums. These were geraniums which had cancers-plants get cancers too. And, lo and behold, the geraniums were cured of their cancers; which simply began to fall off since they are external in the case of geraniums. The geraniums would just shed the diseased tissues when exposed to the MWO. Lakhovsky then went on to do work on animals and human beings and his work was picked up by doctors in six or seven countries, among them Italy, Sweden and Brazil. Finally, because he was on the "wanted" list of the Nazis, he was smuggled out of France and came to New York

during the war, where he worked with a urologist. The record of his treatment of degenerative disease, with what amounts to an early "energy-medicine" device, was remarkable. But the work had to be done in secret because orthodox medicine did not favor this device, and its power, associated with that of the FDA and the AMA and other "control organizations," kept the MWO underground.

The Lakhovsky device is a very effective one. I'm not going to say that it's 100% effective because I don't think any device is, but it is way up there. Georges Lakhovsky died in 1944 or 1945.[9]

Royal Raymond Rife

In 1934, the University of Southern California appointed a Special Medical Research Committee to study 16 terminal cancer patients from Pasadena County Hospital that would be treated with mitogenic impulse-wave technology, developed by Royal Raymond Rife. After four months the Medical Research Committee reported that all 16 of the formerly-terminal patients appeared cured.

Rife's high voltage gas tube device was designed, with the aid of his unique microscope, by experimentally witnessing the effects on microbes and bacteria, finding what he believed were the particular frequencies that resonated with their destruction. "In 1938, Rife made his most public announcement. In a two-part article written by Newall Jones of the San Diego Evening Tribune (May 6 & 11), Rife said, 'We do not wish at this time to claim that we have "cured" cancer, or any other disease, for that matter. But we can say that these waves, or this ray, as the frequencies might be called, have been shown to possess the power of devitalizing disease organisms, of "killing" them, when tuned to an exact wave length, or frequency, for each organism. This applies to the organisms both in their free state and, with certain exceptions, when they are in living tissues.'"[10]

"He had the backing in his day - this was in the 1930's - of such eminent people as Kendall, a professor of pathology at Northwestern University and Millbank Johnson, M.D., who was on his board, along with many other medical men, when he began to treat people with this new 'ray emitter.'… There were articles written on the Rife technique… in the Journal for the Medical Society of California and other medical journals. Suddenly, Rife came under the glassy eye of Morris Fishbein of the AMA and things began to happen very quickly. Rife was put on trial for having invented a 'phony' medical cure. The trial lasted a long time."[11]

In 1953, Rife published his cancer report in book form, History of the Development of a Successful Treatment for Cancer and Other Virus, Bacteria and Fungi.[12] A turning point occurred in 1958, when the State of California Public Health Department conducted a hearing which ordered the testing of Rife's Frequency Instrument. The Palo Alto Detection Lab, the Kalbfeld Lab, the UCLA Medical Lab, and the San Diego Testing Lab all participated in the evaluation procedure. "All reported that it was safe to use. Nevertheless, the AMA Board, under Dr. Malcolm Merrill, the Director of Public Health, declared it unsafe and banned it from the market."[13]

In 1961, after a trial with an AMA doctor as the foreman of the jury, John F. Crane, the new owner of the Rife Virus Microscope Institute, spent three years in jail, ostensibly for using the Frequency Instrument on people, though no specific criminal intent had been proven. In 1965, he attempted to obtain approval from the California Board of Public Health for use of the Frequency Instrument. "On November 17, 1965, the Department of Public Health replied that Crane had not shown that the device was safe or 'effective in use.'"[14]

From 1968 to 1983, Dr. Livingston-Wheeler treated approximately 10,000 patients with the Rife Frequency Instrument, at her University of Southern California clinic, with an 80% success rate.[15] In 1972, Dr. Livingston-Wheeler published Cancer: A New Breakthrough in which she "condemned the National Cancer Institute for its misuse of money [$500 million in 13 years], the corrupt handling of public health responsibilities, and its use of people [100,000 cancer patients] as guinea pigs for a 'surgery-radiation-chemotherapy' program dictated by special interests."[16] Her last book on The Conquest of Cancer was published in 1984 in which she celebrates the European acceptance of the Rife discoveries but complains about the situation in the U.S.

All these distinguished scientist, back in 1958, had been carrying on significant research in the biological and immunological treatment of cancer for years. It is still only now that the United States orthodoxy is beginning to catch up. Because of the suppressive actions of the American Cancer Society, the American Medical Association, and the Food and Drug Administration, our people have not had the advantage of the European research.

This work has been ignored because certain powerful individuals backed by large monetary grants can become the dictators of research and suppress all work that does not promote their interests or that may present a threat to their prestige.[17]

Rife died in 1971, mostly of a broken heart.

Antoine Priore

Antoine Priore's electromagnetic therapy machine was perfected during the 1960's and early 70's as a team of leading French scientists demonstrated "conclusive, total remissions of terminal tumors and infectious diseases in hundreds of laboratory animals…funded by the French Government. The approach employed very complicated mixing of multiple EM signals in a rotating plasma, and modulating the mixed output upon a very strong rippling magnetic field to which the body of the test animal was exposed. Complete remission of the treated diseases was obtained. In addition, the animals' immune systems were also restored to normal…In the mid-70's Priore's work was suppressed, because of hostility of the oncology community, change of the French Government, loss of further funding, and complete inability of the physicists and biological scientists to even hypothesize a mechanism for the curative results."[18] This last reason reminds one of the thesis by Thomas Kuhn, who argues that a radical phenomenon in science will be repeatedly treated as an anomaly until a new theory can explain it.[19]

Chris Bird gives us an interesting insight into his life:

I will tell you about one more person—still another self-taught genius, Antoine Priore, who began working in 1944-45, right after the war, to develop an electromagnetic device which cured cancer. He got the backing of some very interesting and courageous people, including the world-famous immunologist Dr. Raymond Pautrizel, of the University of Bordeaux II, who did all the animal work.

When Dr. Pautrizel arrived on the scene, because the emotional atmosphere surrounding the cancer cure was so great, he decided to take the research in another direction and began to use the machine to treat what he knew best, which was sleeping sickness in animals. Sleeping sickness was of primary concern to Dr. Pautrizel because it is a widespread affliction in tropical countries and, perhaps because he was born and raised in Guadeloupe in the Carribbean, he had become very interested in tropical medicine. When he injected rabbits with the pathogen

trypansome, which causes sleeping sickness, the trypanosome would multiply until there were billions of them circulating in the bloodstream and the rabbits would uniformly all die within 72 hours. But, when exposed to the radiation of the Priore device, these same rabbits would live. Yet their blood was still teeming with the trypanosomes, which could be extracted from the radiated rabbits and injected into other control rabbits, which would then die.

This implies that the machine was doing something electromagnetically to the immune system of the rabbits such that they were able to fight off a lethal disease which would normally kill them in 72 hours!

Had it not been for the courage of Dr. Robert Courrier, who at that time was Perpetual Secretary of the Academy of Sciences of France, in the face of great criticism, the scientific data on 20 years of that work might never have been published. Time after time, over 20 years or more, Dr. Courrier personally introduced the papers for publication in the Comptes Rendues (Proceedings) of the French Academy of Sciences. There are 28 such papers. Even this could not prevent Dr. Pautrizel from nearly being fired from his post at the University of Bordeaux II, where he finally treated human patients successfully with the Priore device.

When he wrote a paper and sent it this time to the Academy of Medicine, it was refused without explanation. Pautrizel then wrote a long letter, since made public, to the governing offices of the French Academy of Medicine to find out why the paper had been refused and which people on the jury refused it, so that he could consult with them in order to better inform them of the facts. For 3 1/2 years he received no reply.

So then he decided to step outside of normal scientific channels and offered his story to a journalist who wrote an extraordinary book called The Dossier Priore, A Second Affaire Pasteur? Because the book has not been translated from French, and may not be (because it was written for a French audience and should really be rewritten in English) it is not accessible to English readers. But I have written a 50-page paper which is a synopsis of it.

We have discussed the cases of four intrepid researchers. Of these, three had no formal academic training—Priore, Naessens and Rife—and yet they went on to develop the most extraordinary medical tools in energy medicine that I think exist. Two of them were put to trial! One was nearly fired from his position. All this is moving and largely unknown medical history and all of it affords real opportunities for further exciting research.[20]

Robert Becker

A pioneering medical doctor in the 1960's, Dr. Becker is most famous for his book, The Body Electric, which gives an autobiographical account of his life's experiences with bioelectromagnetics.[21] Not only did he establish that the Chinese meridians of the body are skin pathways of decreased electrical resistance but he discovered a host of other bioelectric effects within the body as well, such as electrostimulating limb-regeneration in mammals. He also worked on electrically stimulating bone growth with Dr. Andrew Bassett, who along with Dr. Arthur Pilla, developed a very effective PEMF generator to stimulate bone fracture healing, now approved by the FDA with an 80% success rate. Similar PEMF signals recently have been used effectively to prevent osteoporosis even in patients with an ovariectomy.[22]

Abraham Liboff

A modern-day physicist and inventor, Dr. Abraham Liboff is the discoverer of electric-field and geomagnetic ion cyclotron resonance, which more reliably explains the resonant interaction of

static magnetic fields with endogenous AC electric fields in biological systems.[23][24] A physicist with Oakland University, he has introduced significant physics principles into the field of bioelectromagnetics. His "Method and Apparatus for the Treatment of Cancer" (US Patent #5,211,622) tunes an alternating magnetic field, superimposed on a static magnetic field, to maintain a combined effect that has the proper cyclotron resonance frequency so that the neoplastic tissue containing a preselected ion can be treated to bring about a decrease in the proliferation rate of the cancer cells. It also can be combined with a chemotherapeutic agent for a synergistic effect. However, it is noted in the patent disclosure that "up to 100 days of treatment will provide beneficial results."

Stimulated Biophoton Emission

In 1976, Bernard Ruth rediscovered evidence of a very weak but permanent photon emission from living tissue, while doing research for his doctoral dissertation.[25] The findings of his research team led by Fritz Albert Popp, subsequently proved experimentally that biophotons exhibit multimode coherent properties akin to laser light and not merely spontaneous chemiluminescence which is chaotic.[26] One example is the unusually high transparency of tissue to biophoton light. It is an interesting phenomenon, which coincides with "light piping" in plant tissues, by which nature apparently ensures that several centimeters of cellular cytoplasm hardly attenuate the amplitude of biophoton intensity. Experimental data of the extinction coefficient of wet sea sand and soya cells at 550 nm from a Guilford spectrophotometer, compared to biophotons emitted by cucumber seedlings passing through the same sand and soya, reveal the lowest value (a constant 0.2/mm value for E/d) for the biophotons passing through 5 cm of soya cell cultures.[27] A well-developed biophysical hypothesis suggests that biogenic, long-distance intercellular communication implies information transmission.[28]

The total number of biophotons emitted by normal cells, when exposed to white light, decreases, not exponentially but with a hyperbolic relaxation of photon intensity after exposure, extending up to an hour. "Under ergodic conditions, hyperbolic decay is a sufficient condition for coherent rescattering."[29]

The emission of biophoton light by cancerous cells when exposed to white light, versus the slow decline in emission levels by healthy cells upon irradiation by white light, demonstrates a remarkable difference (see Figure 1). The HTC cell curve, representing malignant liver cells shows an exponential increase in activity with a linear cell density increase. The weakly malignant cells (H35 cells) show a slight increase, while the normal (Hepatoczytes) display a linear decrease with increasing cell density as they store the light energy. One proposed cellular communication hypothesis might correlate the experimental rate of biophoton emission vs. density with stimulating mitosis or proliferation. Normally a cellular colony would reduce such multiplication upon receiving evidence of overcrowding. Instead, cancer cells not only have no such limits, as is well-known, but the evidence suggests a tendency, as seen in Figure 1, for positive feedback, if such a correlation exists. Growth regulation through biophoton emission normally follows a nonlinear (proportional to the square of the number of cells) inhibition, confirmed by experiment, which shows a capacity for coherent superposition of biophoton modes.[30] It is quite possible that the Rife style of Tesla devices stimulate healthful biophotons.

Description of High Voltage Tesla PEMF Devices

While there are numerous other classes of BEM devices, as seen with the Priore machine, the Liboff device, and even pain fighters,[31] this investigation centers on the High Voltage Tesla

(HVT) class of BEM therapy PEMF devices. The standard Tesla coil, with a spark gap between the capacitor and high voltage transformer, sets the standard for this class of high voltage BEM devices which are of particular interest. Up until now, the lack of biophysical knowledge surrounding their operation has impeded, in this author's opinion, their widespread acceptance into the medical profession. They are pulsed by virtue of an intermittent high voltage conduction component, by means of a relay, switch, or simply the spark gap, sometimes with square wave characteristics.

Examples of the HVT PEMF devices are the Tesla Coil, Lakhovsky MWO, the Rife Frequency Instrument, and recently, the Natural Energy Institute's Electronic Wind Faser (soliton@optonline.net), the Azure Therapy Device (US Patent #6,217,604), the Vibration Integration Biophotonic Energizing (VIBE) device (www.vibe-machine.com), the Tesla Photon Machine (www.altcancer.com), the Pappas Pulsed Magnetic Induction Device (MID) (US Patent #5,068,039 and #5,556,418), and the Light Beam Generator (www.LightBeamGenerator.com).

Stages and Modality of PEMF Effects

In determining the most likely biophysical reactions, this investigation begins with some bioelectromagnetic statistics. The resistivity, conductivity, dielectric constants, etc. of the human body are all known in the literature. There are many stages and possible modalities of EMF and PEMF interaction with the body. Starting from the exogenous field penetration, known interactions with cellular metabolism are examined.

Skin Depth of HVT PEMF

For example, it has been established that high frequency electromagnetic fields (EMFs) can penetrate several centimeters into tissue, bone, and muscle.[32] Immunological effects of in vivo RF exposure often results an improvement or stimulation when local hyperthermia is induced with continuous wave, gigahertz frequencies of approximately 100 watts per square meter intensity.[33] However, without local hyperthermia induced, the biophysics of the effects on the tissue is less obvious. At least, it can be reasonably that HVT PEMF's also penetrate deeply into the body. The various effects of the PEMF's inside the body are explored below.

Negative Ion Effects

It is well-known that negative ions and traces of ozone have a wide range of health benefits, including boosting the immune system and killing germs.[34] Since high voltage Tesla PEMF devices provide an abundance of negative ions and traces of ozone, the hypothetical neuroendocrine cell-initiated reflex arc may also apply to explain neurological benefits.[35]

Transmembrane Potential

Another important aspect of the biophysical effects from HVT PEMF's can be found in analyzing the transmembrane potential (TMP). For example, it is known that damaged or diseased cells present an abnormally low TMP about 80% lower than healthy cells.[36][37] This signifies a greatly reduced metabolism and, in particular, impairment of the sodium-potassium

(Na-K) pump activity and ATP production.

It is proposed that cell membranes may, in fact, rectify alternating currents since structured proteins behave like solid-state rectifiers.[38] It is reasonable therefore to conclude, based on these biophysical principles, that any endogenous HV EMF potential of sufficient strength will theoretically stimulate the TMP, normal cell metabolism, the Na-K pump, ATP production and healing. This has already found in the literature: "TMP is proportional to the activity of this pump and thus to the rate of healing."[39]

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"Increases in the membrane potential have also been found to increase the uptake of amino acids."[40] Healthy cells, according to Nobel prize winner Otto Warburg, have cell TMP voltages of 70 to 90 millivolts. Due to the constant stresses of modern life and a toxic environment, cell voltage tends to drop as we age or get sick. As the voltage drops, the cell is unable to maintain a healthy environment for itself. If the electrical charge of a cell drops to 50, a person may experience chronic fatigue. If the voltage drops to 15, the cell often can be cancerous. Dr. Warburg also found in 1925 that cancer cells function best in the absence of oxygen, in effect, living on fermentation rather than respiration.[41]

Multiple Interactions with EMF

To address some of the complex modalities of interaction with electromagnetic fields, Figure 2 offers a standard set of (1) electronic excitation to a higher energy level following the absorption of electromagnetic energy in the visible or UV spectrum, which is also capable of altering chemical bonds; (2) polarization which, if the dipoles are attached to a membrane, could alter membrane permeability; (3) forces on induced dipoles cause pearl-chain formation for fields above 10 kV/m; (4) heat effects are a "ubiquitous consequence of EMFs" but independent of the details of molecular activity; (5) other processes that have sensitivities as low as one billionth of a microwatt per square centimeter (10-9 μW/cm2). Such processes include quantum mechanical and classical processes of superconductivity, Hall effect, converse piezoelectric effect, cooperative dipole interactions, and plasma oscillations. The #5 processes are "theoretically capable of serving as the underlying physical mechanism for any known EMF-induced biological effect."[42]

High Voltage Effects

Research has shown that simple high voltage electrostatic fields can have many effects on the human body, most of which appear to be favorable. For example, HV fields in the range of 2400 kV/m (2.4 MV/m) were found to have a beneficial effect on mice as measured by their activity, rate of liver respiration, and ability to form antibodies. In contrast, mice which were deprived of any electrostatic fields by being enclosed in a Faraday cage showed opposite results.[43] (It is noted that the outdoor, ambient electrostatic field caused by the ionosphere to earth potential is approximately 100 V/m and rises during thunderstorms.) Not only does such research imply a correlation to immunological ability but it also implies another important aspect of BEMs: The endogenous electric field strength, within a few centimeters of bone or tissue, will usually be in the range of only 10 mV/m for an exogenous field of 1 MV/m at 10 Hz or less. (The earth-ionosphere Schumann cavity for example, resonates fundamentally around 10 Hz.) However, the endogenous voltage relationship is a decreasing logarithmic with frequency, so that an exogenous MHz range signal need only be 100 V/m to create the same 10 mV/m internally.[44] Higher frequency EMFs thus have correspondingly higher endogenous fields. As an application example, it has been found that a temporal peak electric field magnitude of approximately 150 mV/m averaged within the medial cartilage of the knee, when stimulated by a osteoarthritis

therapy, 0.12 mT coil with 260 microsecond pulses.[45]

Pulsed electric or magnetic fields are also found to be another recourse, if it is understood that higher endogenous field strengths are desirable. Another example is a 100 kV/m electric field which has been shown to improve the synthesis of macromolecules, such as DNA or collagen (which forms connective tissue). However, if the field is interrupted at least once per second (pulse rate of 1 Hz), DNA synthesis goes up 20% higher than the previous measurement and collagen synthesis by 100%. A dependence on the field strength is also found.[46]

It has been proposed that only one PEMF device operates close to the minimum electroporation gradient of 1 kV/cm (100 kV/m). That is the Pappas Pulsed MID which has reported success in relieving 89% of acute or chronic pelvic pain and explains that, "Electroporation is a universal, non-thermal, bioelectrochemical phenomenon relating to the rate of two-way transmigration of chemical ions through the cell membrane, defining the cell's metabolic rate and hence energy level."[47]

In perspective, it may be noted that HVT PEMFs such as the Azure device and those like it may not achieve the high endogenous fields for creating electroporation but most likely stimulate membrane permeation through HF effects noted below, confirming the abundance of healing anecdotal reports. Dr. Robert Adair notes that without utilizing pulsed signals, continuous (AC) RF devices need to exceed 10 mW/cm2 in order to exceed the ubiquitous endogenous noise in biological systems.[48]

Concerns about endogenous HV safety issues have also been addressed in the literature. Recent experiments confirm that a two-minute exposure to 100 kV/m peak electric field, and a pulse duration of 1 ns "does not have an immediate detrimental effect on the cardiovascular system…"[49] Also confirmed is that "nonthermal biohazards seem unlikely in the ultra-high frequency range" with the chief physical loss mechanism being ionic conduction and dielectric relaxation.[50]

High Frequency Effects

When studying high voltage, especially with Tesla coils, it is also important to examine the BEM high frequency effects that are also well-known. The average specific absorption rate (SAR) for a human body for example, is measured in watts/kilogram (W/kg) and has an increasing logarithmic dependence with frequency up until 1 gigahertz (1 GHz) where it levels out at about 10 W/kg. The power absorption density for muscle per incident milliwatts per cm2 also levels out around 1 GHz.[51] This is valuable information for analyzing HVT PEMF devices since they operate in a broadband of frequencies, often with two resonant peaks in the kilohertz or megahertz range but still generating measurable energy extending well into the GHz range.[52] EMFs in the GHz range (1.8 GHz) have been shown to increase the permeability to sucrose of the blood-brain barrier in vitro.[53]

Also, as noted previously, higher frequency EMFs have correspondingly higher endogenous fields. This has been dramatically confirmed with experiments on human eosinophils in vitro. When 3 – 5 pulses with electric field intensities of up to 5.3 MV/m and 60 ns (nanosecond) duration were applied to the human eosinophils, intracellular granules were modified without permanent disruption of the plasma membrane. In spite of the ultrashort electrical power levels applied to the cells, thermal effects could be neglected because of the ultrashort pulse duration. "The intracellular effects extends conventional electroporation to cellular substructures and opens the potential for new applications in apoptosis induction, gene delivery to the nucleus, or altered cell functions, depending on the electrical pulse conditions."[54] It is noted that pulses with nanosecond periods will correspond to frequencies in the gigahertz range by a simple inverse relationship.

Demodulation of amplitude modulated radio frequency (RF) energy has been proposed as a mechanism for the biological responses to these fields. An experiment is also proposed that tests whether the electric and magnetic structures of biological cells exhibit the nonlinear responses necessary for demodulation:

A high Q cavity and very low noise amplification can be used to detect ultraweak nonlinear responses that appear as a second harmonic of a RF field incident on the sample. Nonlinear fields scattered from metabolically active biological cells grown in monolayer or suspended in medium can be distinguished from nonlinearities of the apparatus. Estimates for the theoretical signal sensitivity and analysis of system noise indicate the possibility of detecting a microwave signal at 1.8 GHz (2nd harmonic of 900 MHz) as weak as one microwave photon per cell per second. The practical limit, set by degradation of the cavity Q, is extremely low compared to the much brighter thermal background, which has its peak in the infrared at a wavelength of about 17 m and radiates 1010 infrared photons per second per cell in the narrow frequency band within 0.5% of the peak. The system can be calibrated by introduction of known quantities of nonlinear material, e.g., a Schottky diode. For an input power of 160 W at 900 MHz incident on such biological material, the apparatus is estimated to produce a robust output signal of 0.10 mV at 1.8 GHz if detected with a spectrum analyzer and a 30-dB gain low noise amplifier. The experimental threshold for detection of nonlinear interaction phenomena is 1010 below the signal produced by a Schottky diode, giving an unprecedented sensitivity to the measurement of nonlinear energy conversion processes in living tissue.[55]

Electron Transport and Free Radicals

Quite possibly the most comprehensive and significant for general disease states including cancer, relates to the science of free radicals in the human body. Free radicals contain an odd number of electrons. An example is a methyl radical or a chlorine radical. It is known that homolytically cleaved covalent bonds break in such a way that each fragment retains one electron of the bond. Oxygen or chlorine are such examples. (Chlorine gas is readily available in small amounts within the home when anyone turns on a water faucet in a metropolitan area throughout the US, without using a charcoal filtration system.) Since molecular chlorine has a rather low bond-dissociation energy (58 kcal/mole) chlorine atom radicals may be produced by light of relatively long wavelength or heating to moderate temperatures. Once chlorine atom radicals are present in a small amount, a chain reaction commences. They can continuously react with another molecule to produce another free radical, going through 10,000 cycles before termination.[56] Antioxidants are the most common types of "terminators" for the chain reaction caused by free radicals, since they offer an extra free electron, which the radical seeks to complete an outer shell. Many types of free radicals exist within our bodies and have been connected with the aging process, most apparent externally by the appearance of skin wrinkling. Antioxidants, donors of free electrons, are used externally to reduce wrinkles on the skin and internally to slow the aging process and halt many disease processes. Coenzyme Q-10 can function, for example, as a co-enzyme over and over again as an electron transfer agent or antioxidant.

Looking to a simple analysis of the electron transport chain found in the Krebs cycle, it produces ATP through chemiosmotic phosphorylation.[57] It can be proposed that as the high energy electrons are transferred to ubiquinone (Q) and cytochrome c molecules, which are the electron carriers within the membrane, free radicals may interfere with the process before the electrons reach the mitochondron, thus decreasing energy metabolism. In fact, Dr. William Koch found that "polymerizing unsaturated free radicals of low molecular weight stimulated cancer development decidedly...The free radical formed thus at the other pole…continues the polymerization process that supplies the energy for uncontrolled mitosis."[58]

It is proposed hypothetically that HVT PEMF devices offer abundant free electrons to the human body, in addition to plentiful negative ions, since they possess a unique static field

modulated with a multimode pulsed electric field. Such a flood of free electrons, penetrating through permeable membranes throughout the tissues, muscles and perhaps the bones, not only halt the chain reactions in process, but also most likely force the fermentation production of ATP in the Krebs cycle back into a respiration cycle, in the presence of neoplastic, carcinogenic cells. Any cancer cells thus affected cannot tolerate the respiration cycle, as is well known, with its oxygen abundance and instead, immediately expire. The discharging of toxic residue then may become an important task, requiring only short HVT PEMF exposures and detoxifying interludes.

Light Effects

It has been found that light can offer a photodynamic effect on the body and entire books have been written about the specific therapeutic effects of various frequencies of visible light. Dr. John Ott conducted experiments showing that mice living under pink fluorescent light were more likely to develop cancer and reproductive problems.[59] Dr. William Douglass states, "Photonic medicine should soon be used for diagnosis as well as therapy."[60] Interestingly enough, regarding the HVT PEMF devices which also add Rife gas tubes to the antenna, (see Azure patent #32 in Figure 3) it has been shown that PEMF and photooxidation together yield "lethal effects on cancer cells."[61]

Conclusion

In conclusion, the PEMF devices that are known to utilize a Tesla coil, for the HF and HV PEMF, include the Azure patent assigned to Healing Machines, Inc., the VIBE Machine, the Tesla Photon Machine, the Light Beam Generator, the Lakhovsky multiwave oscillator (MWO), and Natural Healing Institute's Electronic Wind Faser. Several of these also add biophoton-stimulating high voltage gas tubes which appear to have an additional synergistic effect on the body.

For more information, this author also has an expanded version of this report as a 60-page book: Bioelectromagnetic Healing and a Rationale for Its Use, published by IRI.

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