Article

The Bioelectronic Basis for "Healing Energies": Charge and Field Effects as a Basis for Complementary Medical Techniques

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ABSTRACT

As of the time of this review over 150 studies of "healing energies" have been reported in which the energy parameters were specified and controlled. More than half demonstrate statistical significance, $p < 0.05$. Some researchers have measured electromagnetic (EM) signals emanating from the hands of healers which are within the same frequency range as human brain waves. There are some indications that a correlation exists between atmospheric oscillations, brain waves, and biological EM emissions. Understanding the nature of this correlation may enable us to characterize and further utilize various types of "healing energies". The paradigm for the application of these energies may develop into a basis for a variety of existing complementary medical practices. Integral portions of biological systems have been shown to be semiconducting, ferromagnetic and piezoelectric. The biosemiconductor, together with the drift of charges, ions, and radicals, may be considered as a form of "bioplasma". Bioplasma may be subject to magnetohydrodynamic (MHD) control. The EM fields emitted by trained healers may be considered as coherent, resonant biomagnetic emissions by which a less coherent EM field of the patient is "tuned" to the specific frequency and phase, and through which homeostasis can be "aligned" to induce "healing".

Key Words: bioelectric, biomagnetic, bioplasma, healing energy, charge effect, field effect, complementary, medical technique.

1. A Working Definition of Healing Energy

The question of whether treatments involving various types of "healing energies" are effective for numerous illnesses has long been a subject of debate. In a recent review by Benor, a substantial number of research studies demonstrating statistically significant results demonstrated that "healing" may bring about changes in a variety of situations involving water, enzymes, plants, animals and humans [1].

A working definition of "healing energy" is that it is an emanation of energy from the body and mind of the healer which goes beyond normal physiological processes to influence homeostasis in another living system. In all probability, this energy forms part of the biological EM field of

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Note: This work was completed in 1994, posted as a white paper in March, 2006 at bioelektronika.com and published in Journal of Nonlocality & Remote Mental Interactions, Vol. 4, Issue 1, April 2006.

the healer. What is the mechanism by which the biological EM field of a healer induces "healing?" Oschman reports on energy emissions from the hands of healers as well as brain wave activity specific to healers.[2] During these "healing moments" the brain waves of the healers became phase and frequency synchronized with the electric field of the earth. This observation closely echoes that of Bentov, who studied similar mechanisms in meditators.[3] Bentov found that there were actually several other interlocking resonating systems in the body activated by this steady 7 to 8 Hz activity during meditation. As the upper part of the body has a resonant frequency of about 7 Hz under normal conditions, Bentov notes that additional resonance effects resulting from this "phase interlock phenomenon" are not unlikely.

Studies indicate that low frequency fields, at the frequency and signal strength of the Schumann resonance (an atmospheric condition), can synchronize brain waves under a variety of experimental conditions and have predictable effects on behavior.[4] Oschman suggests that the "healing energies" emitted by healers involve conditioning of the brain waves and other body rhythms with the slow electrical and magnetic rhythms of the earths atmosphere.[5] This view was expressed earlier by Bentov in connection with a study of the kundalini energies exhibited by practitioners of yoga.[6]

This correlation between inner and outer rhythms seems likely. It is well known that there is also a relationship between the plasma fields of the earth and those of the sun. Bentov pointed out that charged particles produced by the sun residing in the Van Allen belts oscillate back and forth along the magnetic lines of the earth between the north and south poles. Much of this vibration is in the frequency range 1 to 40 Hz, well within physiological frequencies. These oscillations are coupled with the changes in the earth's magnetic field. The spectrum of the earth-ionosphere cavity resonance, the Schumann resonance, covers the 1 Hz to 30 Hz region with an average value of about 7.8 Hz. This coincides with the brains alpha rhythm typically about 8 Hz. Also, numerous reports have demonstrated the extremely low frequency electromagnetic fields, or radiofrequency field amplitude modulated at ELF, can alter the efflux of calcium ions from CNS-derived samples. Three research groups have shown that a range of frequencies between 6 and 20 Hz was effective; while frequencies below and above that range were ineffective.[7]

Not only brain waves, but other systems also are affected by the Schumann resonance. As quoted in Smith, Ludwig (1987) has measured and compared a large number of the ELF rhythms in human subjects with resonant frequencies in homeopathic remedies using a spectrum analyzer. Bentov reported that Schumann calculated the earth-ionosphere cavity resonance frequencies at 10.6, 18.3, and 25.9 Hz, and he reported more recent values calculated by Toomey and Polk at 7.8, 14.1, 20.3, 26.4, and 32.5 Hz.[8] Ludwig found a number of frequencies have been found to be common to all the subjects and to relate to the specific physiological functions. For example, the frequency 0.1 Hz relates to the circulatory system, 7.8 Hz relates to the hippocampus, 10 Hz to the circadian rhythms, 33 Hz to the lymphatic system, etc.[9]

It is reasonable to assume that the interactions between the ionosphere and the solar wind which yields geomagnetic field variations can also be expected to cause a wide range of other electromagnetic disturbances, or contribute to variations in the ground level cosmic ray flux and other generalized atmospheric effects. When man-made components are introduced on top of

this, the results are apt to be unpredictable. Human brain activity, as well as that of animals, may be modified by extremely low levels of amplitude modulated electromagnetic fields.

Statistical studies have revealed potential dangers to living systems. The EPA, for example, has issued official warning for certain leukemic conditions in infants associated with living in proximity to power lines.[10] If there is a relationship between various type of EM waves in living systems and the external environment, whether by controlled application (such as healing) or by inadvertent exposure (such as accidental exposure to some manmade EMF), these interactions may be very important to human health. A task for future research will be to identify the physical variables responsible for the variations in phenomena. These external waves are somehow transformed and processed by some mechanism through organisms. The question for science is "What are the mechanisms in the living fabric by which such charge and field can affect biological systems beneficially or detrimentally?"

2. The Need for a Bioelectromagnetic Model for Healing Energies

The current biochemical paradigm for healing cannot adequately address conditions involving the effects of EM fields on living organisms. Such effects are best described in the languages of physics and electronics. It is advantageous to supplement the current biochemical model of healing with a bioelectronic one in order to explain "healing energies." To think of living systems as basically bioelectronic in nature is not a new idea, but until this last decade, biophysics has not addressed the therapeutic models beyond a sophisticated statement of electrophysiology. A biophysical model based on electronic concepts, with due consideration for the biochemical connection, may therefore provide the best modality in which to address these issues.

Biological systems have been shown to be piezoelectric, semiconductive, and ferromagnetic in nature.[11] It is reasonable to postulate the existence of some intermediate layer between the internal and external environment in living systems, which somehow processes and transmits signals. It is as if the system and its environment were intimately related, possibly through charge and field effects and induced internal processes which control system sensitivities as they receive surrounding electromagnetic signals.

The need for creating a new area of science to explain this has been most clearly recognized in countries outside of the U.S. In particular, since the 1960s, Poland has participated heavily in its development, beginning with the theoretical works of scientists W. Sedlak and S. Manczarski, and in the later theoretical and experimental works of many others.[12] The work of the Italians has also been very important, especially in the area of medical applications.[13]

A living system is capable of resonance and oscillation. What components of this system are involved in this process? Two possible contributors may be:

(1) The role of water and counterions in the connective tissue cytoskeletal system; and,

(2) The existence of bioplasma (see below); subject to magneto-hydrodynamic (MHD) control.

Great progress in cell biology, partly due to electron microscopy, has enabled us to visualize how the smallest parts of an organism are tied together in a structural and functional continuum. At the base, there is the cytoskeletal system of the cell. This system is attached at the inner wall of the cell membrane to glycoproteins, which extend through to the cell surface. The glycoproteins attach, in turn, to elements of the extracellular ground substance matrix. The ground substance matrix exists within the intervals of the connective tissue fibers. These contiguous elements form the building blocks for larger structures, including larger groups of connective tissues. One can visualize tendons, for example, building from this cellular level to tropocollagens, microfibrils, subfibrils, fibrils, fascicle, tendon, etc. In fact, on examination of any anatomy text, the presence of fascia, a form of connective tissue, is almost universal throughout the body. It surrounds muscles, bones, organs, and nerve fibers. Soft tissues, in particular those containing a great deal of collagen, elastin, or actin, are considered bioviscoelastic solids, with some very interesting elastic properties. Also, many of these proteins are semiconducting. The entire organism should be considered as one structure with respect to its capacity for wave and oscillatory phenomena, although it is obviously not homogenous.

Biomembranes composed of proteins maintain a high electrical field potential. In addition, they can also generate photons as chemiluminescence. Photons that are generated in layers of proteins can activate chemical processes. Taken together with the drift of charges, ions, radicals etc. this photon emission forms the basis for "bioplasma", a central idea in a bioelectronic model of living systems. (Photons here include those in the UV visible spectrum as well as in the infrared, microwave frequency domain). Bioplasma may be under MHD control.

"Healing energies" may involve manipulation by the healer, consciously or unconsciously, of the bioelectronic subsystems of the living organism. The success of a healing may have a great deal to do with the organisms ability to oscillate and resonate with the EM emissions generated by the healer. How living systems interact with EM fields is not exactly known, although many theories have been proposed. The concept of communication channels within each living system may be one answer.

Through a long evolutionary process, living systems have managed to develop in (or possibly because of) an environment permeated with EM frequencies. Using the language of electronic systems analysis, C. W. Smith points out that to facilitate evolution, Nature would have been able to make use of high coherence, narrow spectral bandwidth channels for parallel data processing channels in living systems without risk of interference from the frequencies present in sunlight. Living systems may be able to optimize the degree of coherence they use for any given biocommunication channel choosing between: one broad-band high carrier frequency; a high data rate serial communication channel; or, the corresponding number of narrow band, low data rate communication channels capable of parallel data processing. Each of these are coherent enough to overcome the ambient noise but together they have the same overall capacity.[14]

According to Smith, diurnal circadian rhythms can be synchronized using ELF fields. The involvement of highly coherent frequencies throughout the life-span of a living system carries

with it the risk of sensitivity to and disruption by coherent EM fields in the environment. Similarly, there is a risk of chemical disruption of the genetic information by antagonistic chemicals in the environment that can specifically cause various types of mutations. Electrical and chemical signals are closely correlated manifestations of living systems. The fundamental correlations between chemical structure, electronic properties and coherent oscillations have been well-established by atomic spectroscopy and molecular quantum physics, and have been applied in chemical analysis.[15]

3. Biological Mechanisms Supporting Charge and Field Effects

3.1 Existing Mechanisms

There are quite a number of known mechanisms which support the notion that charge and field effects are the basis of "healing energy." Oscillation and bioresonance, the role of cell membranes, the role of the connective tissue and associated water molecules, and photon/phonon emission are but a few components of the bioelectronic model which can be examined.

3.1.1 Oscillation and Bioresonance

There may be a biophysical basis for oscillation and bioresonance. The electrodynamics of the connective tissue cytoskeleton matrix and the related hydrogen bonds in surrounding water, as well as the electro-mechanical physical properties of the proteins themselves (the exact nature of which must be determined by future research), may result in whole-body collective oscillations. These, in turn, may be derived from the energy of higher frequency Fröhlich oscillations.

Such oscillations may directly involve hydrogen bonds. Bistolfi reports that the frequency of the oscillating phenomenon related to biological hydrogen bonds appears to remain limited to the infrared frequency band, from near infrared (10-6 wavelength, l014 Hz) to far infrared almost to in the microwave region (10-4 wavelength, 1011 Hz). He maintains that one can consider DNA and protein hydrogen bonds as centers of EM radiation emission in the range going from the millimeter waves to the far infrared.[16]

Low frequency harmonic pulsations may be the result of the interaction of the Schumann resonances with such signals, the resulting waves in turn generating a stronger oscillation within the connective tissues of the body. The result of this activity may be measurable as a "biofield", and may represent a form of biomagnetic emission consisting of relatively stable, coherent, measurable vibrations. "Healing energy" may be a type of this sort of EM emission.

3.1.2 The Role of Cell Membranes

Fröhlich discussed why cell membranes may play an important part in macromolecular oscillation. Biomembranes maintain fields on the order of 105 V/cm, a field in which ordinary materials would break down electrically unless special care were taken. Molecules subjected to

such fields will, in general, exhibit non-linear reactions such as change of structure.[17] Extraordinary dielectric properties arise from the high electric fields maintained in membranes. When taken in conjunction with the biomembranes sensitivity to very low weak electric fields, these properties play an important role in resonance interactions between molecules. Models have been developed of the interactions of two molecules, one of them in the membrane, the other outside it. The electronic charge, the proton mass, and the width of the membrane allow for a definition of a frequency in the 1011 Hz region, which is on the order of the frequency of membrane vibrations (millimeter wave region).

Fröhlich suggested that some of the large molecules within a cell resonate with the membranes electrical oscillations. Hence the cell as a whole, and a tissue composed of a number of such cells, could have a stable resonant frequency which would be a collective property of the whole assembly. Long range phase-correlated vibrations between the components of such an assembly could constitute a type of communication system regulating certain cellular behaviors, such as cell division.

3.1.3 The Role of the Connective Tissue System

Traditionally, the living cell is pictured as a membranous bag containing liquid water with proteins and small cations in free solution. Microscopically it does not resemble a bag of fluid, but should be regarded as an organized semi-solid (a biorheological structure) consisting of a matrix of water with embedded macromolecules complexed with sodium and potassium ions. This view of the cell was explained in detail by Hazlewood and later verified through experimental research.[18] The cell may be considered to resemble somewhat of a solid, so that cellular ion transport phenomena may be analyzed by the methods of solid state, or perhaps, liquid crystal physics.[19]

Biologically, the cell cannot be accepted without the vital environment in which it exists. Pischinger explores this weakness in Virchows classically accepted cell theory.[20] The 50 billion cells in the human organism exist in a working system. They are not merely cellular functioning units, which can be repaired when defects are present. Acute events cannot be isolated from intermeshed biological associations. Cells have a reciprocal relationship to their environment.

The ground substance surrounding a cell forms a basic matrix in multicellular organisms, called the extracellular matrix. This matrix has a significant effect on a cells ability to express its genetic constituency and maintain a healthy quality. The interactive nature of the extracellular matrix with the connective and supporting tissues and blood is extremely important. Nerves and vessels do not come into direct contact with the functioning cells at any point in the body; the connective tissue via the extracellular matrix is really the mediating member. It transports nerve and nutrition flow and reciprocal effects from the nerves pass through it everywhere. The condition of this medium (such as its degree of hydration and toxicity) may have a bearing on the ability of the whole structure to oscillate.

The components of the connective tissue matrix extend throughout the body.[21] The mechanism that may link it with the brain electrical activity, as measured with the EEG and the emissions from the body, is the perineural direct current regulatory system as described by R. 0. Becker.[22] Becker maintains that contrary to prevailing neuron doctrine, the glial substrate and other perineural structures of the central nervous system, through their sensitivity to extremely low levels of electric currents and magnetic fields, may directly control brain functions. The neuronal brain is not only supported by, but modulated by, the glial brain. Electromagnetism and its effects on the "integration of brain function" in consciousness are also considered in this model. Becker suggests that DC and low-frequency extraneuronal electric currents generated in, or transmitted by, the glial components of the brain may be a basis for perceptual awareness. This system may provide a link between the bioelectronic and biochemical models. The brain, in turn, regulates the biochemical activity in the body in accordance with bioelectronic signals. This process may work in both directions, involving in particular the endocrine system. Bioenergetic continuity of the connective tissue system is still in the modeling stages. Cells and intracellular elements are capable of vibrating in a dynamic manner with complex harmonics which can be analyzed using Fourier analysis.[23]

Pienta and Coffey discuss mechanisms by which information can be transferred along this matrix. Cellular events occur within spatial and temporal harmonics and have potential regulatory importance. Vibrational information can be transferred through the cell. The connective tissue system, they maintain, may act as a coupled harmonic oscillator, operating as a signal transducing system from the cell periphery to the nucleus and ultimately to the DNA. The transfer of information can occur through the direct transfer of vibrational energy through harmonic wave motions. Wave propagation along a tensor can pass information through the amplitude, frequency, and phase of the wave propagating along it. The amount of information that a tensor system can pass is equal to the width of the frequency of the waves of information and the total time they are available for interpretation.

The connective tissue system matrix is a quasi-crystalline structure consisting of semiconductive piezoelectric proteins and associated biochemical metabolic pathways. Evolution may have determined the course of embryogenesis (i.e., the development of the nervous system, circulatory system, etc.) and outlined this course within the connective tissues of the body along predetermined lines of force caused by exposure to electric and/or magnetic fields. The field lines act as a blueprint and are determined by long-term evolutionary exposure of this matrix to EM radiation in the environment.[24] Specific molecular channels could exist within the structure of the matrix to conduct bioelectromagnetic signals.

Such a bioelectronic communications network would function similar to a waveguide or fiber optic cable to transmit and receive information along specific channels within the body. Since this network is composed of ordinary molecules that have become organized in particular ways at a microscopic level, it would not necessarily be anatomically distinguishable from normal connective tissue, at least using the devices we have available at this time. The acupuncture meridians may make up such a network. It is interesting to note that in the process of needling, each needle must be inserted at a specific point, at a certain angle, to a measured depth in the tissue to effect optimum results. The "eye" of the acupuncture point, on the surface of the skin, is

a point of low electrical resistance. Invariably, on proper insertion, the needle rests in a fascial plane or along a tendon, e.g., in connective tissue.

The body is composed of bioviscoelastic fluids and solids. The thermodynamics of elastic deformation of these components have been addressed by Fung.[25] In studies of inorganic materials, certain electromagneto-rheological devices (principally braking systems) have unique gel-to-sol-to-gel reactions when acted on by external force; perhaps an analogous situation exists in the living protein matrix comprising the connective tissue matrix when affected by biological EM emissions in healing.

3.1.4 The Role of Water Molecules

An excellent treatment of the structure and function of long chain protein molecules and of the surrounding water is given by Bistolfi[26] who reports on the relationship between the filament structures of the cytoplasm and water. Some information pertinent to the bioelectromc model is that each cell has a very thin layer of ordered water extending over at least 3 nanometers from the billions of square nanometers of solid state surfaces. This water can be coupled to the coherent dynamics of the protein solid state, enabling the protein filaments to carry signals.[27] Since the connective tissue system is functionally continuous, large scale information pathways may use such filaments as signal transmitters. It is easy to conceive of such an aqueous proteinaceous environment as a type of forward-biased p-n semiconductor, transmitting signals in a regulated fashion to surrounding cells, influencing the metabolic pathways.

3.1.5 Photon/Phonon Emission

In the bioelectronic model photon energy, as well as chemical energy, plays an important role. There is a certain biological structural morphology that is a result of the interaction between photons, electrons, and phonons in the protein substrate of a semiconductor. Chemical reactions can be broken up into a multitude of enzymatically catalyzed processes. For example, amino acids, proteins and nucleic acids, porphyrins such as chlorophyll and carotenoids are semiconductive. A quantum of light entering a semiconductive protein structure results in photoexcitation causing charge transfer or excitation "hopping", and sometimes, emission of photons, as in photoluminescence in plants.

The charge activated in a structural protein creates opportunities for photon emission through several methods: fluorescence, electron acceleration in an electrical field, temporary emergence of paramagentic centers and emission as a result of spin relaxation. Photons generated by various methods in biological systems are closely linked with chemical processes, which can either stimulate or attenuate photon production. Photons are reinforced by as yet undefined mechanisms, increase their number through stimulated emission, and are assisted by processes which maintain a constant reserve of "fresh" electrons of metabolic origin, or having a highly populated excited state of another molecule (excitation or energy donor) energetically close to the lowest electronically excited state. Biological systems, according to Sedlak, may work on the principles of a quantum photon amplifier with biolasing effects.[28] Contemporary work by Popp, et al., outlines the nature of biophotonic coherence in biosystems, and particularly

examines coherent radiations emanating from DNA, and examines interactions between photons and phonons.[29]

3.2 Proposed Mechanisms

Proposed mechanisms for the transfer of charge and field effects involve some old ideas applied in a new way: decelerating systems, wave physics, MHD control of bioplasma, the formation of helical structures, redox reactions, and spin waves.

3.2.1 Decelerating Systems

Electromagnetic waves can be guided and simultaneously slowed down by appropriate semiconducting and dielectric structures. The nature of the interaction of electrons with the electrical component of the electromagnetic wave is very important, especially in electric fields having a high frequency wave. Structures which slow EM waves are known as "decelerating systems." Subcellular structures, such as mitochondria, Golgis apparatus, biological membranes, chloroplasts, and molecular structures such as DNA and RNA, as well as alpha-helix proteins and accompanying beta-sheets, may act as decelerating systems in the body. An electromagnetic wave moving in a dielectric medium reacts with electrons at the point of contact of a semiconductor and a dielectric. The decelerated wave is linked with a beam of electrons "modelled" by the configuration of a thin-layered conductor. This forms the p-n semiconductor junction in between layers of proteins.

3.2.2 Wave Physics in Biological Systems

Wave motion, in order to be effectively distributed throughout the body, must also be "directed". A surface level electron concentration appears at various levels of plant and animal organization, forming a directing "layer". Surface potentials exist not only in microorganisms but also in individual cells of tissue systems. Seldak referred to this phenomenon as "electrostasis", parallel to "homeostasis".[30] The electrostasis "layer" between a living system and its environment results from semiconductor properties of living tissues and the surface layer in the EM field.

Gurwitch observed a similar phenomenon in dividing cells.[31] Presman ascribes the generation of EM waves to nucleic acids, such as RNA and DNA.[32] In the bioelectronic model, these types of radiation are referred to under the generic heading of "biological fields". The electrostasis layer plays the role of a spherical waveguide reflecting the biological field back into the living system. The losses of the organism through radiation are minimized. Simultaneously this layer is set into rhythmical vibrations by the biological emitted field. It protects the organism from harmful EM radiation, and permits beneficial radiation to enter the organism.

The human body is able, due to electrostasis, to separate each component of this radiation according to the body’s anatomic makeup and need, and absorb the bands in the spectrum specific to that wavelength or frequency. In the practice of physical therapy and electrotherapy, various bands of energy are artificially applied to patients. The use of the cold laser is among the

newer modalities. Research has indicated that the 6,328 angstrom helium-neon cold laser may stimulate intracellular structures and functions.[33]

Healing energy may induce piezoelectric or pyroelectric effects which modulate this surface layer. Under the influence of variable mechanical forces (pressure, tension, torsion), piezoelectric material generates charges resulting in a difference of electric potential. Pyroelectric substances do the same, but in a stable field of action of mechanical forces of the hydrostatic type. Temperature changes cause more molecules to be in higher vibrational energy states resulting in crossing over to a different electronic energy state. For some bioluminescent molecules this may result in biological pyroelectric phenomena.

The organism may be considered as an oscillator emitting a biological field with a large band spectrum. The nature of the biological oscillator is explained by the physics of dielectrics -- they behave like crystal semiconductors modified to the specific nature of the biological system in question. Further, the properties of semiconductors decide the drift of charges, ions, radicals and crystalochemical groups. The semiconductor manifests its properties in the presence of external electromagnetic fields or temperature. The electrostasis layer is a special one - it makes the semiconductor able to receive EM information from its environment.[34]

3.2.3 Bioplasma

Some insight into bioplasma may be gained by analogies with plasma physics. Plasma is sensitive to magnetic and electric fields, to wave acoustics, operational mechanics, and to gravitational fields and temperature, depending on its chemical composition. Its exceptional selectivity and responsiveness, through alteration of its own state, make plasma the ideal carrier system of information within living organisms.

This sort of plasma is basically diamagnetic; there are however, many factors which may locally produce paramagnetism. In the evolution of biological systems, several things were probably important: a) the growth of the number of electrical components forming the plasma; b) and the accumulation of paramagnetics and the formation of temporary paramagnetic centers in diamagnetic organic compounds.

Bioplasma can be thought of as an "averaged-out" state of all the energetic factors resulting from metabolism. In a semiconductive proteinaceous aqueous environment, ions, drift of charges, etc. contribute to the overall "bioplasma." In the process of evolution, the number of electrical and magnetic components which contributed to the formation of this form of plasma increased with the evolution of the organism. Bioplasma is not plasma in the strict physics sense of the word, yet displays some physical properties.

A good example of an accumulation of paramagnetics is the pyrolysis reaction which yields condensed pyridine rings. This has been studied experimentally in polyacrylonitrile.[35] The reaction of pyridine latticization is enhanced by the presence of Fe, Cu and Cr atoms or by irradiation. The products of pyrolysis are paramagnetic, containing approximately 1019 unpaired electrons per gram of substance, even though the polymer is diamagnetic before pyrolysis.

Nature presumably makes use of the same properties of heterocyclic rings in forming complexes involving Fe in the case of heme, cyto-chromium or catalase, Cu in the case of hemocyanine, Mg in chlorophyll, and Co in cobalamine. Derivatives of pyridine have found extensive application in the organization of vital processes.[36] Annular complexes with charge transfer, formed from aromatic amines and quinones with quadruple substitution, molecular oxygen, photexcited molecules in metastable triplet states, some organo-transition metal chelates, are other examples of paramagnetics. Research on charge-transfer paramagnetism has barely begun, we are still referring to semiconducting polymers.

Experimental attempts to prove the reality of bioplasma have been underway in Russia since 1968. Magnetic fluctuation and the concomitant emission of weak radiation are only different pictures of the same plasma discontinuity. Paramagnetic centers are quantum-mechanically "mobile," and vary according to the general magnetic state of the system and radiation. The term "plasmon", popular in solid state physics (an analog of excited states such as exciton or polaron) may be adequate for describing the biological oscillation in terms of plasma.

3.2.4 The Formation of Helical Structures

A separate issue is the formation of helical waves. Presumably, the helical structures of DNA and RNA are the product of a long molecular evolution. If bioplasma exists, it is quite possible that a "pinch" phenomena occured which caused a helical geometry to manifest - in the same way that "pinch" affects superheated gases magnetohydrodynamically. In addition, nucleic acids and their protein complexes are systems of strongly coupled spins.[37] Anisotropic biological structures form a kind of guideway for plasmic processes. In some situations, such as in nucleic acids, they may direct electronic processes towards cyclotron motion -- along helical trajectories. Helical waves in plasma produce a strong axial magnetic field. The DNA helix may be the result of the action of this field on a paramagnetic medium of variable magnetic susceptibility.

3.2.5 Redox Reactions

If one accepts the idea of the temporary increase of paramagnetic centers in a diamagnetic medium, what may exist in a biological system is a magnetic analogy with an electronic state which can be described by an oxidative-reductive (redox) potential or magnetic "donor - acceptor" state. Plasma repels magnetic field lines or is itself repelled by them, or "freezes" field lines within itself. In such a description, diamagnetic to paramagnetic transitions can be expressed as "magnetic redox reactions". Sedlak describes such reactions as "dia-par" (dia to paramagnetic transitions). The analogy with redox processes may be further substantiated by the existence of charge transport between paramagnetic centers and diamagnetic molecules. Equally important is the subsistence of a level of diamagnetism (i.e. spin = 0 state) as a general background for "dia-par" processes. Most likely, the enzymatic decay of organic compounds serves a similar purpose in that the decay products are always diamagnetic.

3.2.6 Spin Waves

As a result there would be both plasma pulsations between paramagnetic and diamagnetic components, and spin pulsations within organic diamagnetics and paramagnetics (otherwise known as spin waves). In this spatial aspect, the plasma pulses occur between two dia-par systems, exciting spin waves within them. These two waves display a relative phase shift. This may be how the generation and decay of plasma takes place within a biological system rendering it subject to periodic states of magnetic compression.

4. Toward a Magnetohydrodynamic (MHD) Model

4.1 MHD Biological Control

As we have discussed, living systems may be comprised of semiconducting proteinaceous oscillators. The biological semiconducting oscillator may emit a type of physical plasma. MHD phenomena are built on the existence of plasma. There may be some sort of MHD process at work in living systems.

Magnetohydrodynamic biological control was anticipated in 1967.[38] It is implied by the description of semiconductors in terms of plasma, by microplasmic features of hydrogen bonds, and the existence of bioplasma (the averaged-out description of electronic processes in a living organism). Control over the correct and sequential development of paramagnetic centers in a living system is presumably based on magnetic transmission over a plasma carrier. [39]

Sedlak proposed that semiconducting organic matter constitutes a diamagnetic "solvent" for paramagnetic components. These may thus form a paramagnetic "colloid" within a diamagnetic medium. Such a "colloidal" state is an essential condition for the propagation of an MHD wave. The activated particles must form an actual or colloidal solution, while preserving their paramagnetic properties. The medium consists of diamagnetic water, as well as saccharides, lipids and proteins.

A bioplasma implies the coexistence of phenomena like electrodynamics, electronics, and hydrodynamics, even in the absence of a fluid medium. One of the manifestations of this unification is given by the magnetohydrodynamic wave, that is, the wave propagation of magnetic field fluctuations in plasma, accompanied by real transport of magnetic energy. The recently discovered presence of very small amounts of ferromagnetic crystalline substances in the brain and meninges of humans lends some support to this notion.[40] It seems that a biological system, especially a ferromagnetic one, may possesses its own magnetic information, be highly sensitive to external field variations, and be responsive to spin variations in its organic structure.

MHD control of bioplasma provides an explanation for many effects. Above all, it points to two aspects of one and the same fact: life is, in its nature, electric -- however, its control takes place

magnetically. The suitable arrangement of ferromagnetic atoms and the existence of temporary paramagnetic centers create a particular situation within the plasma, which undergoes abrupt changes in its properties under the action of a magnetic field, even a very weak one [41].

The distribution of diamagnetics and paramagnetics, bioluminescence, semiconductivity of protein, and the plasma features of metabolic processes leads to conclusions concerning the control of vital functions. Plasma may be biologically maintained in a constantly agitated state of generation and decay through magnetohydrodynamic control. This state is correlated with other antagonistic situations, such as anabolism-catabolism, redox reactions, and dia-paramagnetism. It is moreover related to physiological currents and weakly luminescent effects. What is formed is a complex signaling system for MHD involving electric, magnetic, optical and acoustic effects.[42]

This signaling system must operate not only on the level of single macromolecules like DNA, but also on one of groups of molecules, biological complexes such as cells, tissues, organs and the organism, and above all on the level of the metabolism, as an ensemble of chemical processes. Reducing the matter to basics: in a plasma medium with the features of a conducting liquid, control is effected by magnetic mechanisms. Here hydrodynamics combines with electrodynamics, yielding magnetohydrodynamic vibrations. The common factor of the entire system is bioplasma, which seems therefore to be a carrier and receptor of those controls. Bioplasma is probably species specific.[43]

On top of this general wave-like background a more detailed communication takes place, involving weak bioluminescent radiation and all sorts of effects collectively termed the "biological field". On the same plasma substrate various other types of vibrations, other than MHD, may also develop -- such as optical, electric, gravitational, or mechanical. The plasma and the wave-like interactions within produce an inherent integrity of the system. The plasma is a source of all types of waves, which feed back on the plasma and display mutual correlation.[44]

The motion of a conducting or semiconducting fluid material across magnetic lines of force induces some current. The magnetic fields associated with these currents modify the magnetic field which creates them. In other words, the fluid flow alters the electromagnetic state of the system. The electric current flow across a magnetic field is associated with the Lorentz force, which influences fluid flow. It is this intimate interdependence of hydrodynamics and electrodynamics which really defines and characterizes magnetohydrodynamics. Since charge and field effects within biological systems are "small" in contrast with the surrounding environment, ideas such as superconductivity and MHD may very well be useable concepts -- and be definable.

4.2 Application of Biological MHD to Healing

MHD has been successfully applied to large scale phenomena, such as sunspots, the general solar field, stellar magnetic fields, the geomagnetic field, and the direct conversion of energy. There is a great deal of difficulty, however, in demonstrating it in the laboratory. However, initial steps have been made in applying it to living systems.

For example, the concept of a "flow meter" has already been used to measure the flow of blood. (When a conducting fluid passes down an insulating pipe across which a steady magnetic field is applied, a potential gradient is created and can be measured by probes imbedded in the walls of the pipe). Semi-hydraulic systems are present in the circulatory system and in the cranio-sacral system.[45] Perhaps a similar device could be developed to measure the flow of cerebrospinal fluid, and micromeasurements made during the expansion or contraction of the dural tube.

In magnetohydrodynamics there is a dimensionless number, symbolized by N, known as a magnetic force parameter. It contains terms of magnetic permeability, magnetic field strength, electrical conductivity, a characteristic length, mass density and fluid velocity. In parallel, the living tissue matrix has: magnetic permeability, magnetic field strength, electrical conductivity, and mass density. There is a fluid velocity inherent in the tissue which, although not yet exactly defined, apparently can be affected by both pressure and magnetic field strength. The system possesses properties of piezoelectricity, ferroelectricity, ferromagnetism, and semiconduction. All the elements are present to begin to define a simple model of the magnetic force parameter for the connective tissue cytoplasm matrix. Elements of the fascia, especially the extracellular matrix, and in particular, the dural meninges, may be a type of "magnetofluid", a ferrofluid, whose flow properties become viscoplastic when modulated by a magnetic field and may be subject to laws of magnetohydrodynamic stability.

It is interesting to note that ferromagnetic fluids are colloidal suspensions of single domain magnetic grains in a liquid vector, which have the fluidity of a homogenous liquid and magnetic susceptibility. The magnetic particles are so small in ferrofluids that the colloid magnetizes but still remains fluid. Kirschvinks work seems to indicate there is biogenic magnetite in the brain, pia, and dura, on the order of what is needed for a ferrofluid.[46] Ferrofluids develop a volume force on the application of a magnetic field. If these collodial suspensions, in particular collagens, should also have liquid crystal properties (such as those exhibited by lyotropic nematic liquid crystals), we may be looking at ferronematic crystals in these tissues which can orient with very small magnetic fields, and which can generate magnetohydrodynamic forces while being subject to them. In a sense, perhaps the human being is contained in his own "magnetic bottle", within the greater plasma sheet of the magnetosphere.

Perhaps, in the process of using healing energies, what effectively occurs is a form of "tuning" between healer and client. In MHD terms (to borrow from electrodynamic interaction in three dimensions) this process may be likened to the coalescence of two closed toroids of magnetic flux, with the biofields of the healer and the client merging at the center. These toroidal forms are rhythmically pulsing and may be modulated by the Schumann resonance. In "healing" the toroidal fields synchronize, with the weaker being strengthened. Loops of flux are created by this motion, sever from their parent loops, and reconnect with themselves to form new flux loops, which gradually normalize and may disappear through ohmic losses depending on the homeostatis conditions of the client.[47] This "diffusion" of energy throughout the clients system strengthens and feeds the homeostatic mechanisms (bioplasma), causing vibration and cellular oscillation, which in turn ultimately affects the physical condition of the client.

5. Conclusion

Collectively, from all of the works referred, one may state that there is a mechanism based on charge and field effects behind healing phenomena, one which is in its formative stages in terms of scientific definition. Some alternative healing practices, which have been around through the ages, and which we now class as complementary medicine, may be in part expressions of this mechanism. The basis for any healing may lie in the expression of restoring normal states of health bioelectronically, which in turn influences and is influenced by the biochemistry of living systems. Using tools of nonlinear thermodynamics, quantum electrodynamics, cybernetic models and open energy systems the image of our traditional "Homo Biochemicus" is being complemented slowly and lately further modified into the new image of "Homo Electronicus".

Acknowledgements: The author wishes to thank William S. Yamanashi, Ph.D., University of Oklahoma, Oklahoma City, OK; Neil Mohon, Ph.D., The Upledger Institute, Palm Beach Gardens, FL; Carleton Hazlewood, Ph.D., Baylor College of Medicine, Houston, TX; Josef Zon, Ph.D., Catholic University, Lublin, Poland; Dr. Franco Bistolfi, Genova, Italy; and James L. Oshman, Ph.D., Dover, N.H. for their kind assistance in reading, reviewing and/or editing this manuscript. Special thanks to M.J. Allen, Ph.D., Virginia Commonwealth University, Richmond, VA., for encouragement. The funding for this review paper was provided by Neuro Magnetic Systems, San Antonio, TX.

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