Electromagnetic models

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Various western researchers in the past have suggested in a general way that a field of electromagnetic (EM) radiation somehow guides the growth of the cellular organism. Harold S. Burr of Yale studied and measured electrical fields; which he called “L fields”, or “life fields” around living things. Elmer Lund, of the University of Texas, showed that he could control regeneration of hydra heads by passing a weak electric current thru the body. Orthopedist Robert O. Becker attempted to stimulate or speed up regeneration in humans and animals. He also demonstrated a "current of injury" in which salamanders with amputated limbs develop a charge at the site of the stump, whose voltage climbs until the new limb appears.

These and other discoveries have led to medical technological healing devises, using artificially generated pulsed EM fields, and the applications continue to grow. [1] This is a big hint that EM energy is very important in maintaining and healing living tissue.

A Note on Photons

Although wave-particle (photons-EM field) duality is a characteristic of the entire EM spectrum, the energy of photons below the frequency of visible light is so low that many refer to this as a region of waves rather than particles. Many of the physical characteristics of photons, such as size and shape, are illusive and debated in the scientific community. [2] The most widely accepted facts are that photons have no mass and their energy increases with frequency.

A short history of Biophotonics

In the 1920s, Alexander Gurwitch, Professor of Histology,[3] asked why organs had a definite shape. He argued that chemical reactions are isotropic (the same in all directions) which means that chemistry can’t determine shape. In his signature experiment, two onion roots were arranged at right angles to one another with the horizontal root (Inductor) pointed towards the vertical stem (Detector), with a space between the two for either normal window glass or quartz glass plate. Gurwitch recorded the rate of cell division (mitosis) on the detector. With window glass, no cell division occurred, whereas with quartz glass, cell division increased significantly. Gurwitch was aware that normal window glass blocks UV rays and quartz glass plate is transparent for UV light of about 260 nm. He concluded that 260 nm UV emissions from the Inductor were stimulating increased cell division in the Detector, and that this “mitogenetic radiation” might regulate cell growth and differentiation.

In the 1940s, L. Colli (Italy), T.I. Quickenden (Australia), Humio Inaba (Japan) and Alberto Boveris (USA) began experimenting with a newly devised photomultiplier (light detector) which accurately counted single photon emissions. They dropped the term "mitogenetic radiation," preferring "dark luminescence", "low level luminescence", "ultraweak bioluminescence", or "ultraweak chemiluminescence". These researchers proposed that photons emitted from living tissue were the result of oxidation and free radical reactions, and were therefore unimportant.[4]

Since enzymes and anti-oxidants normally mop up reactive oxygen and free radicals before they can damage cells, healthy cells tend to release very few photons, making them hard to detect, even in a pitch-black lab.

In the 1980s, manufacturers such as Hamamatsu, a Japanese company specializing in photomultipliers, developed new highly sensitive instruments designed to record weak light signals. Keen to exploit this opportunity, and to seed a new bio-optics industry, the Japanese government funded a five-year, multibillion-yen research program into biophotons in 1986. [5] Dozens of researchers across Japan found these emissions coming out of everything from plant seeds to fruit flies. It was discovered that injured or stressed or diseased cells release far more photons than their healthy counterparts.

Researchers are trying to develop ways to convert patterns of photon emissions into images of the body that resemble X-rays or CAT scans. However, cells are sensitive to many factors that alter the rate at which photons are emitted. This causes problems with reproducibility of results, even for relatively simple systems. [6] Apparently direct diagnosis of disease from biophotons will remain difficult without some technical or medical breakthrough. [7]

Still, the difficulties of reproducibility does not rule out the possibility that information transfer is taking place.

The Biophotonic model

In the 1970s, Fritz-Albert Popp discovered a much wider spectrum of photon emissions than had previously been recorded and coined the term “Biophoton’. [8] The energy released in assumed conventional processes, such as oxidation, and the reorganization of hydrogen bonds and Van der Waals complexes, is too low to excite electronic energy levels corresponding to the observed spectral range of ultra weak photon emissions (UPE), noted in various sources from 200 to 900 nm. [9]

In the 1980s, Popp found that two cells separated by an opaque barrier release biophotons in uncoordinated patterns. Remove the barrier and the cells soon begin releasing photons in synchrony. The cells, Popp concluded, were communicating by light. [10]

Popp found that carcinogenic substances absorb UV light (at 380 nanometers), and re-emit it with a changed frequency. He found that photo repair works most efficiently at 380 nm, the same wavelength the carcinogens would react to and scramble. He deduced that carcinogens must inhibit photo-repair, and if so, there must be some light in the body responsible for photo-repair. A prestigious journal on cancer agreed to publish these results. He was invited to speak to the world's leading cancer researchers. Popp's science was unassailable, except for one detail: it assumed that a weak light of 380 nm was being produced in the body, which most scientists refused to believe.

Popp also discovered the photons in the living systems he had examined were more coherent than anything he had ever seen. In quantum physics, coherence means that subatomic particles are linked by bands of common electromagnetic fields, so they can 'communicate'. As they get into phase, they begin acting like one giant wave.

From experiment, he showed that one of the most essential sources of biophoton emission was DNA; that the more DNA unwound, the higher the intensity of light, and also that DNA was capable of sending out a large range of frequencies.

Modern conventional biology is still at a loss to adequately explain the process by which cell differentiation, migration, and integration occur with such speed and accuracy to form living organisms. [11] Popp believes that weak biophoton emissions are sufficient to orchestrate body processes, [12] and is the answer to the question of morphogenesis; that is the question of how living forms take shape. Note that this is what Gurwitch originally argued for his mitogenetic radiation. Mitogenetic radiation is now considered ultraweak photon emissions.

Results of other researchers have supported biophotonic theory, and in fact an *International Institute of Biophysics* (IIB) was founded, with about forty scientific groups worldwide focusing on biophotonic studies [13]. Although perhaps deserving of it, Popp is not yet on the list of Nobel prize winners, [14] as is often claimed on the internet.

Although US participation in this effort is relatively small, in the early 1990s, Guenter Albrecht-Buehler, a biophysicist at Northwestern University Medical School in Chicago, demonstrated that cells can detect and respond to light from one another. Albrecht-Buehler believes cell's centrioles function as light detectors. He also believes the reason for this detection and response is that cells are talking to one another. [15]

Some theorists suggest that the notion of a common cellular language puts biophotons at the center not only of biological communication, but also of consciousness. Scott Hagan, a theoretical physicist at the British Columbia Institute of Technology in Burnaby, Canada, points out that we cannot think unless cells in the brain function simultaneously, as parts of a whole. In quantum physics, coherent states can act as a whole. Could the coherent biophotonic emissions from living tissue also act as a whole?

Hagan and Stuart Hameroff, associate director of the Center for Consciousness Studies at the University of Arizona, suggest that quantum coherence in the protein subunits of microtubules may give rise to consciousness . And, says Hameroff, biophotons could somehow control this process. [16]

Members of the IIB certainly concur that quantum theory needs to be evoked to allow for the emergence of consciousness, although the specific function of biophotons is not made clear. [17]

Biological Coherence model

Originally, Biological Coherence referred specifically to the work of Herbert Fröhlich, professor of Solid State Physics at the University of Salford in the 1970's, He was among the first researchers to suggest that waves or vibration allow proteins to cooperate with one another and carry out instructions from DNA. [18]

Observing that millivolt electrical potentials maintained across cell membranes ~10 nm thick give rise to huge fields ~10^7 volts/m, Fröhlich proposed that membrane molecules must be highly electrically polarized and thus could interact to produce coherent surface acoustic vibrational modes in the 10-100 GHz (microwave) frequency range. [19]

According to Stuart Hameroff and Roger Penrose, Fröhlich termed these modes acousto-conformational transitions, or coherent (pumped) phonons, and noted such coherent states are termed Bose-Einstein condensates in quantum physics. [20]

Fröhlich proposed that metabolic energy is not being lost as heat but is stored in these vibrations, now known as Fröhlich Oscillations. [21] This storage of energy is analogous to the non-dissipative storage of magnetic energy in inductors in electric circuits.

He showed that once energy reaches a certain level, molecules begin to vibrate in unison, until they reach a high level of coherence, when they may take on certain properties of quantum mechanics.[22]

Semiconductor model

Discovery of the Hall effect [23] in the perineural system confirmed Albert Saint-Gyorgyi's suggestion that semiconduction is occurring in the human body. [24] Saint-Gyorgyi was not the only one thinking about biological tissue as a solid sate semiconductor. In the 1970s, Freeman W. Cope produced pivotal work linking physics and biology, and developed a solid-state theory of

biological processes. He deduced that the activity in the cell is not just electrochemical, and looked at the cell function as if the organelles were three-dimensional semiconductors. [25]

In semiconductors, a phonon is a special type of vibrational motion, in which the elements of a crystalline lattice uniformly oscillate at the same frequency. [26] Only certain vibrational modes are possible, and each is characterized by its mechanical energy. Only a few modes are active at low energies, which are acoustic modes. As mode energy increases, at a certain point many modes become active. These are optical modes. An electron can give energy to a lattice, in which case it excites an available phonon mode. An electron can also acquire energy from a lattice, in which case a vibrational phonon mode dissipates. It is easy to think of these vibrational modes, or phonons, as particles. Then you can talk about phonon, as well as photon emission and absorption by an electron. These are important energy exchange mechanisms in semiconductors. [27]

Acoustic mode phonons are low frequency, and correspond to sound waves in the lattice. Optical mode phonons always have some minimum frequency of vibration, even when their wavelength is long. They are called *optical* because in ionic crystals (like sodium chloride) they are excited very easily by infrared radiation. [28]

James Oschman, author of *Energy Medicine: the scientific basis* [29], subscribes to the Piezoelectric / crystal / Semiconductor Model. He refutes the "bag model" (of biological processes), in which molecular reactants in the enzymatic pathways move, meet, and react randomly. He maintains the cell is filled with filaments, tubules, fibers, and trabeculae, collectively called the cytoplasmic matrix or cytoskeleton. Many of the enzymes once thought to be floating in the "soup" are actually attached to structures within the cell nucleus. This provides an assembly line arrangement along which reaction sequences and frequencies can proceed rapidly. Furthermore, it serves as an integrated piezoelectric solid state system, thereby coordinating activities such as repair and defense as well as movement of nutrients, hormones, and toxins.

Oschman, suggests that therapies based on homeopathy, herbs, aromatherapy, sound, heat, light, and crystals are effective because they provide the frequencies needed for healing. Peter Lindemann also found that "the (Eeman) relaxation circuit must be able to carry detailed vibrational information" [30]

The (sort of) Convergence of Models

The Biological Coherence, Semiconduction, and Biophotonics models, developed by a number of different western scientists[31], appears to be converging with the physical basis of the Chinese model.

This integrated model maintains that all parts of the living matrix create vibrations that propagate within an organism and radiate into the environment at different frequencies, including visible light. Each molecule, cell, tissue, and organ has a resonant frequency that coordinates its activities. Living matter is highly sensitive to the information conveyed by these signals, which may integrate processes such as growth, defense, injury repair, and the function of the organism as a whole. [32]

This convergence is indicated in a number of publications. The stated goal of the International Institute of Biophysics (IIB) paper *Anatomic Characterization of Acupuncture System and Ultra-weak Photon Emission.* [33] is to link traditional Chinese acupuncture with Western bioregulatory concepts. The paper notes that a western concept of a bioregulatory system based in the connective tissue of the human body began to be developed in the 19th century, in parallel with the cell pathology model dominating medicine today [34]. The association of acupoints and

meridians with connective tissue has already been noted in the PSN paper validation of hef.doc. The IIB paper outlines a more refined perspective on biological tissue.

It is widely recognized that major constituents of living organisms are not so much solid state semiconductors as they may be liquid crystal, including DNA cytoskeltal and muscle proteins, and collagens [35] Liquid crystals are states or phases of matter between solid crystals and liquids, and are called mesophases. A liquid crystal has orientational order and some translational order, but is flexible.

Water is structured in biological tissue, meaning that it has the ability to form three-dimensional mutually bonded networks of molecules. The collagenous liquid crystal mesophases in connective tissue combined with the associated structured water constitutes a semi-conducting highly responsive network that extends through out the organism. This network is directly linked to the intracellular matrices of individual cells, forming an excitable electric continuum for rapid intercommunication throughout the organism. [36]

This excitable electric continuum and the acupuncture system have a common anatomical basis. Both support rapid semiconduction of protons, which is much faster than conduction of electric signals by nerves. This “ground substance” may form a much better intercommunication system than the nerves.

Evidence supporting the hypothesis of liquid crystal tissue comes from nuclear MRI studies of living human muscles, as well as the successful imaging of live organisms using an interference color technique that amplifies weak birefringence typical of biological liquid crystal. [37]

Based on research, it has been concluded that collagen structures conduct and modify photon pulses coming from biological sources.

Popp et al’s biophoton physical model for inter and extra cellular communication postulates that the photon is trapped and emitted by cellular physical resonance devise, presumably DNA, resulting in a high degree of coherence. The resulting long range EM waves and fields can be seen as a basis of self organization.

Bonghan Kim, a surgeon, claimed to have discovered anatomically distinctive corpuscle like tissues at the acupoints, and threadlike ducts at the meridians of human skin. He traced the ducts, now called Bonghan ducts, and found they formed a circulatory network throughout the body.

The alleged Bonghan corpuscle and duct system is gaining more credibility with independent research findings, providing an anatomical basis for the acupoint and meridian system. Bonghan ducts appear to supply the channels in the connective tissue with DNA granules inside, connecting acupoints in the skin to internal organs. As the narrow channels form a network of tubes with light sources, they can become an optical (fiber optic) channel which can produce a coherent photon state. [38] This is a scientific interpretation of acupuncture therapy. [39] This interpretation is supported by the fact that biophoton emissions have been recorded from acupuncture points during electro acupuncture. [40]

The book *Bioelectrodynamics and Biocommunication,* a collection of technical articles edited by Mae-Wan Ho, Fritz-Albert Popp and Ulrich Warnke, draws many of the same conclusions as the IIB paper, and also confirms that in the 1990s a technique was developed to image live organisms by interference colors by detection of “dynamically ordered, coherent liquid-crystalline mesophases of the macromolecules making up living tissues…” [41]

This book also notes that biocommunication denotes the process of signal generation, transmission and transduction covering the entire electromagnetic spectrum and in both the 'phonon' and 'photon' modes. [42]

In an article titled *Nonlinear bio-photonic crystal effects revealed with multimodal nonlinear microscopy,*[43] a Chinese team reports*: "*Highly optically active nonlinear bio-photonic crystalline and semicrystalline structures in living cells were studied by a novel multimodal nonlinear microscopy. Numerous biological structures, including stacked membranes and aligned protein structures are highly organized on a nanoscale and have been found to exhibit strong optical activities through second-harmonic generation (SHG) interactions, behaving similarly to man-made nonlinear photonic crystals." Photonic crystals are periodic optical nanostructures that are designed to affect the motion of photons in a similar way that periodicity of a semiconductor crystal affects the motion of electrons/(protons?). Various forms of photonic crystals have been studied scientifically for the last 100 years. [44]

Interestingly, the Mae-Wan Ho/ Popp book was published in 1994. An entry in *The Journal of the Korean Physical Society,* dated 2002, states: "Another possible application (of biophoton emission counts) is to evaluate the function of acupuncture meridians because there are suggestive reports on the correlation between biophoton emission rates and the condition of the meridians. [45] The IIB paper was published sometime after 2007, [46] while the latest mainstream MRI studies are only now (2010) speculating that fascial connective tissue might be the anatomic basis for the acupuncture meridian system, as noted above.

Obviously there is a significant delay between the time key research is done and the time by which it has been disseminated into the general scientific community. Much additional research undoubtedly will be done before this model is even generally acknowledged.

Of course there is still a lot of debate on what exactly biophotons are doing. Ken Muldrew, a biophysicist at the University of Calgary in Alberta, Canada still believes, as do many others, that "What biophotons communicate is the fact that certain oxidative reactions are going on." [47]

MIT Review recently published a news article which discusses the hypothesis that microtubules can act as wave guides, channeling light from one part of a cell to another. Regardless of skepticism, the article notes, biophotons, bioelectrodynamics and biocommunication have become an established area of scientific inquiry. [48]

The Work of Jacques Benveniste

Jacques Benveniste's entry into controversy began at INSERM [49], where he and his researchers found evidence of the "memory of water", whereby water diluted to the point where the original molecules of a substance can no longer be present exhibit the characteristics of the original substance. [50]

His meticulous studies are widely regarded as making a valid case for homeopathy, [51] If water were able to imprint and store information [52] from molecules, this would have an impact on our understanding of molecules and how they "talk" to one another in the body. The conventional theory of how molecules communicate in the body requires direct contact, a process which is too slow and too dependent on chance. According to Benveniste's theory, which has been supported by experiment, molecules rely on electromagnetic signaling at low frequencies (less than 20 khz), corresponding to frequencies in the audio range.

Beneviniste experimented with a devise that was essentially a standard audio amplifier connected to another coil to create an "audio frequency oscillator". Yolene Thomas notes that she worked with Beneviniste between 1992 and 1996 to show that they could transfer molecular signals indirectly to water or directly to cells with this amplifier, giving rise to "digital biology". [53]

McTaggart notes that these signals could be recorded and played back using a PC. [54]

Reputable research supporting Benveniste's results slowly began to surface in other areas. In 1992, the Federation of American Societies for Experimental Biology (FASEB) held a symposium, organized by the international Society for Bioelectricity, examining the interactions of electromagnetic fields with biological systems.

Numerous other scientists have replicated high dilution experiments, and several have endorsed and successfully repeated experiments using digitized information for molecular communication.

Independent scientific work in this area continues to surface, with the expected mainstream skepticism. A 2011 article in *Wired* magazine, entitled *Bacteria on the Radio: DNA Could Act as Antenna notes "*Theoretical physicists have proposed an explanation for how bacteria might transmit electromagnetic signals: Chromosomes could act like antennae, with electrons traveling gene circuits to produce species-specific wavelengths." "…according to Northeastern University physicist Allan Widom, calculations based on the properties of DNA and electrons square with what's been measured." The original report of bacterial radio transmissions was made by French virologist Luc Montagnier, who in 2009 described how inductor coils wrapped around flasks of bacteria-enriched water and hooked to an amplifier detected signals in the low frequency one KHz range. Montagnier, whose work linking HIV and AIDS had earned him a Nobel Prize, also described signals causing loose pieces of DNA to assemble into bacterialike structures. [55]

Interestingly, Glen Rein postulated the antenna function of DNA back in 1996, based in part on the reality of the "Phantom DNA Effect". [56]

The most unassailable tests of homeopathy were performed in Glasgow by Dr. David Reilly. Despite the scientific design of his tests, although *The Lancet* agreed to publish the results, the journal simply refused to accept them. [57]

Wave Genetics

According to Petar Gariaev, distinct types of acoustic and electromagnetic fields from DNA [note: which he says themselves are holograms and solitons, or are associated with holograms and solitons, it is not clear from the original text] are the simplest examples of DNA coding. These fields are generated by the so called "non-coding", or "junk" DNA, estimated to compose 98% of all DNA. Mathematical modeling was used to develop a laser beam tunable to specific frequencies. A series of experiments demonstrated the ability of the laser beam frequencies to promote regeneration of a damaged pancreas in rats. Gariaev calls this technology "Wave Genetics." [58]

However, in the West, it has apparently been known for decades that many noncoding sequences are functional. These include genes for functional RNA molecules (see above) and sequences such as origins of replication, centromeres, and telomeres. Some sequences may have no biological function for the organism, such as endogenous retroviruses. However, many types of noncoding DNA sequences do have important biological functions, including the transcriptional and translational regulation of protein-coding sequences, origins of DNA replication, centromeres, telomeres, scaffold attachment regions (SARs), genes for functional RNAs, and many others. Other noncoding sequences have likely, but as-yet undetermined, functions. (This is inferred from high levels of sequence similarity seen in different species.) [59]

How does this relate to Gariaev's position?

Gariaev et al also showed that there is a fundamental similarity between fractal sequence structures of DNA and human speech. In 1990 Jeffrey Delrow discovered that the four “letters” of the genetic alphabet (Adenine, Guanine, Cytosine and Thymine) in DNA form fractal structures. The theory of fractal representation of natural human and genetical languages, developed by Gariaev and M U Maslov, holds that by use of human language structure, the quasi-speech of DNA can be “edited’ by a voice modulated laser beam [60].

It seems that Benveniste’s theory of molecular communication would fit into the expanded biological coherence model, but the difference in frequency between Fröhlich’s model, in the 10-100 GHz (microwave) frequency range, and Benveniste’s, below 20 kHz,(audio/radio) will need to be explored.

Low Frequency Biological EM Phenomenon

Although the electromagnetic models appear to be converging, it is not quite clear how all the model threads connect.

Benveniste formed a company to provide EM signaling to biological components via audio frequencies; Digi Bio, and since then digital biology has become an established field. [61]

Although some references suggest biophotons effect the entire EM spectrum, none appear to really address the issue of how photons in the range of visible light, from 4 ^{14} Hz (400000000000000 Hz) to 7.5 x 10 ^{14} Hz (75000000000000000Hz),[62] induce electromagnetic signaling in molecules at frequencies less than 20 kHz (20000Hz), the frequency of audio and radio signals. We know from Fourier analysis that high and low frequency components affect one another, but this cannot be the whole story.

Popp does not seem to include frequency in his description of the phenomena of biological development. His actual statements on how biophotons may effect molecules appear to be somewhat more complex than just “exciting” molecules. From the text *Integrative Biophysics: Biophotonics*[63] Popp notes that with higher orders of quantum coherence, one expects biological structures to be based on cavity resonators and wave guides. Miotic activity can be described in terms of superpositions of cavity resonator waves, which also represent coherent states of the biophoton field…. The living cell may have developed to the degree of coherence of the biophoton field where Bose-condensation [pure coherence] and thermal dissipation balance one another. This explains delayed luminescence.… Biophotons originate from a coherent field which keeps its coherence thru some type of coupling between radiation and matter. The electromagnetic field pattern is the driving force for the movement and interaction of molecules, while matter constitutes the boundary conditions of the field.

Perhaps the answer also has to do with phonons, discussed above under **Semiconductor model**. In 2007, Dr. Mae-Wan Ho wrote:

“[Veljko] Veljkovic and [Irena] Cosic essentially asked a fundamental question in biology: what is it that enabled the tens of thousands of different kinds of molecules in the organism to recognize their specific targets…”

They proposed that molecular interactions are electrical in nature, and take place over macroscopic distances. Cosic later introduced the idea that molecules recognize their particular targets and vice versa by electromagnetic resonance.

“In other words, the molecules send out specific frequencies of electromagnetic waves which not only enable them to 'see' and 'hear' each other, as both photon (light) and phonon(sound) modes exist for electromagnetic waves, but also to influence each other at a distance…” [64]

Interestingly, although these ideas strongly resemble those of Jacques Benveniste, his name appears nowhere in Ho’s TheRealBioinformaticsRevolution paper.

According to Elizabeth B. Bauer, photon-phonon coupling creates the sub atomic blueprint for healthy cells through photon chemistry. Sound and light are closely connected in their action on the energy states of our DNA, and the shifting energy states of the photon and phonon are responsible for health or disease.

Photon-phonon coupling then, would appear to address the issue of the relationship between low frequency audio and high frequency photons. Interestingly, there exists such a phenomena, as discussed in the inorganic physics literature. *The Institute of Condensed Matter Physics* reports that localized mechanical modes (phonons) exist that couple to the light field “via radiation pressure”. [65] The *Optics Info Base* reports *Photon and phonon coupling by electrostrictive forces in photonic crystal fiber.*[66] Since, as established above, biophotonic crystal effects have been observed in human tissue, such coupling in biological systems appears entirely plausible.

Raman spectroscopy can be used to study low frequency modes. Laser light interacts with molecular vibrations, phonons or other excitations in the system, resulting in the energy of the laser photons being shifted up or down. This shift in photon energy gives information about these modes. [67]

At a more conventional level, researchers are studying the resulting energy transfer and biological effects on molecules using the signature frequency at which those molecules absorb light. [68]

Low frequency signals appear to be very important in healing. In Dr. John Zimmerman's 1980s studies of therapeutic touch, the SQUID[69], an extremely sensitive magnetometer, measured large biomagnetic fields emanating from the hands of therapists when they relaxed into their meditative or healing states. The fields pulsed at swept frequencies from 0.3 Hz to 30 Hz, and primarily between 7-8 Hz. (7-8 Hz is in the range of the fundamental Schumann Resonance)…In the experiment, no biomagnetic pulses were observed from non-practitioners. This field is also noticed coming from practitioners of Qi Gong, Yoga, Zen, and the martial arts. Furthermore, the biomagnetic pulses are in the same frequency ranges that are used in pulsed electromagnetic field (PEMF) therapy to jump-start the healing of bone fractures, a medical procedure that also applies magnetic fields to induce current flow in nearby tissues. [70]

We can conclude that, although a number of questions remain, the biological coherence, semiconductor, biophotonic and Chinese models are convergent toward a single credible model. Although western energy medicine is not formally established as in Chinese medicine, evidence supporting the efficacy of human healers has been provided by SQUID experiments.

A Connection Between Biophotons and Homeopathy; Between Popp and Benveniste?
Fritz Popp believes biophotons orchestrate body processes, and his work on biophoton emission seems often to be sited as an explanation for homeopathy, without actually explaining the details of how the two might be related. [71]

Jacques Benveniste and his work are also often associated in popular literature with Popp and biophotonics. This is especially true in Lynn McTaggart’s book *The Field,* which may be the source for many of the popular associations.

The precise character of the association of Popp and biophotons on the one hand and Benveniste and homeopathy on the other is not clear.

In terms of technical collaboration, I can find no evidence that Popp and Benveniste ever spoke to one another. Although both Popp and Benveniste did much of their work prior to the mid 1990's, I could find neither studies, nor collections of studies, to which both Popp and Benveniste have contributed to. On the other hand, Popp and Dr. Mae-Wan Ho have collaborated frequently.

In McTaggart's book, the concept of "signature frequency" appears to be important in determining the details of exactly how biophotons might orchestrate low frequency body processes. The central issue seems to be ambiguity in use of the term "frequency" and definition of "signature frequencies".

McTaggart states that Popp found that molecules in cells would respond to certain frequencies and that a range of vibrations from the photons would cause a variety of frequencies in other molecules of the body. She also states that "the biophoton vibrations Popp had observed in the body caused molecules to vibrate and create their own signature frequency, which acted as its driving force and also its means of communication. " [72]

McTaggart further states that Benveniste learned how vibrations of Popp's biophotons could cause new molecules to vibrate and create their own signature frequency, even in the absence of physical molecules. " If photons in the body excite molecules along the entire spectrum of electromagnetic frequencies, it is logical that they would have their own signature frequencies." [73]

"Signature frequency" is a well known concept in conventional physics. Atoms and molecules have signature frequencies of vibration in the range of visible light which are detected by absorption spectroscopic analysis. [74]

In conventional physics, the frequency range of visible light ranges from 4^{14} to 7.5×10^{14} Hz, [75] and photons do not cause molecules to vibrate; the atom or molecule absorbs the frequency of visible light which matches its own natural resonant frequency. [76]

Multidimensional Model

The Multidimensional model holds that a human being consists of multiple layers, or dimensions, that coexist simultaneously. There seems to be general agreement about four main dimensions: the physical-etheric, emotional, mental, and spiritual. Versions of the multidimensional model have been discussed over the years at annual conferences of the International Society for the Study of Subtle Energies and Energy Medicine (ISSSEEM),

An interesting version of the multidimensional model has been advanced by William Tiller, professor emeritus at Stanford University and former chair of the Materials Science department.

The basis of the multidimensional model appears to derive from the Vedas, which are the oldest written tradition in India, dating to 2,000 - 600 B.C. [77] In the resulting Yogic science, the chakras, which represent energy centers of different dimensional levels, have been primarily the object of meditation. However, it has been pointed out that through modern physiology we can see that the seven chakras of traditional Yogic practice correspond exactly to the seven main nerve ganglia, or glands, which emanate from the spinal column. [78]

Marmas on the other hand, defined as prana (subtle energy) points, have been a primary topic of Yogic and Ayurvedic medicine. The marmas are said to connect to the nadis (subtle nerves) and chakras of the subtle body and mind, and bridge the physical and subtle bodies in Yoga science. They correspond to acupuncture points in Chinese medicine, and are the subject of Ayurvedic acupuncture, which has also been called marmapuncture. [79]

The multidimensional model has not been scientifically well substantiated, primarily because the chakra system, with the possible exception of the marmas, is acknowledged to be non-physical. Research suggesting scientific verification of the Chakras comes from Dr. Hiroshi Motoyama in the 1950s [80] , and Dr. Valerie Hunt in the 1970s. Both used instruments that measured physical electrical fields which are thought of as secondary fields caused by the non-material chakras.

Dr. Motoyama detected electrostatic fields at the traditional chakra locations. His results are said to have been repeated by Itzhak Bentov, author of *Stalking the Wild Pendulum*. [81]

A standard EMG can only measure up to 1 kHz; the higher frequencies are assumed to be noise and filtered out. Dr. Hunt found that a specially wired Electro Myo Graph (EMG) machine detected very high frequency signals; much higher than normally found in muscular activity, apparently at the traditional chakra locations. These signals appear to exhibit chaos, and have been interpreted as having a very high information content. [82] Dr. Hunt also correlated the EMG readings with the color descriptions of the chakras given by energy healer Rosalyn Bruyere [83]

The Hunt studies recorded 'Chakra' EMG frequencies of up to 16 kHz, but also measured EEG frequencies up to 200 kHz in meditators, as high as their equipment would go. [84]

In 2008, the Indian *Journal of Physiology and Pharmacology* [85] published a short paper by RE Mendanha, a physiologist, regarding the issue of high frequency EMG signals in humans. He references the work of Motoyama and Hunt, and notes that the standard procedure of filtering out higher frequencies because they are assumed to be noise may be filtering out coherent information of the human biofield.

Mendanha has developed a low cost way to study such signals, by combining standard EMG limb electrodes with a laptop computer, sound card, and windows application software. Using this system he is able to record frequencies of up to 96 kHz, enabling FFT analysis up to 48 kHz. Ambient voltage was also recorded.

With the electrode attached to the subjects left wrist, Mendanha found hundreds of well formed minor potential peaks, all the way up to 42 kHz. He found that the relative peak at 40 kHz was profoundly effected by the switching on of a compact florescent bulb. He also found that following meditation, a distinct peak occurs at about 40 kHz.. (Figure D below). Interestingly, he found that the ambient data also showed this distinct peak at 40 kHz. He concludes high frequency oscillometry opens a new field of research.

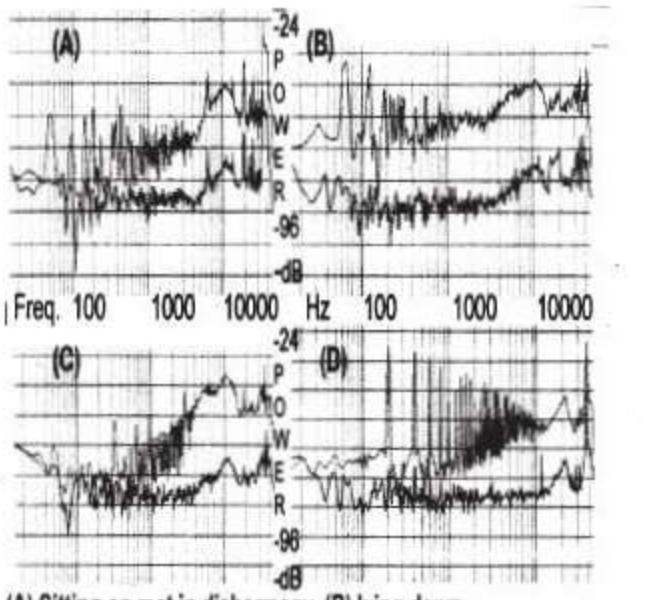

Fig. 2: Progress of meditation with the main switched off.

From: RE Mendanha: http://www.ijpp.com/vol52_4/398-402.pdf

The book *Holistic Nursing; a Handbook for Practice*, by Barbara Montgomery Dossey, Lynn Keegan notes: “Curtis, Zeh, Miller, and Rich measured chakra functioning and found that people with more psychological symptoms had more poorly functioning chakras.” [86] However, Curtis, Zeh, Miller, and Rich did not use electrostatic fields or electromyography over the alleged chakras, but rather an Inneractive Aura Video System 5.1, [87] which is discussed below. The Aura Video System obtains its data from electrodermal activity of the hands.[88] Electrodermal activity is associated with the physical meridian energy flow of Chinese medicine, not with the Ayervedic non-physical chakras.

A further problem, it seems, is that the original researchers placed sensors only at alleged chakra locations. I could find no references to researchers who placed these types of sensors at intermediate locations along the spine. An HEF may be inferred, but it has not yet been verified by instrumentation that there are discrete energy centers along the spine.

Little scientific evidence for the anatomical existence of the marmas can be found on the internet.

The issue of measuring voltages from human beings to obtain information on the human energy field is discussed further in the PSN paper *Voltages From the Human Body.*

Tiller notes that in the theoretical physics literature on the Big Bang theory, one finds that our normal state is called the U(1) electromagnetic gauge symmetry state, and there is a higher gauge symmetry state, SU(2), which has a higher thermodynamic free energy per unit volume than U(1), and in which electric and magnetic monopoles naturally coexist. The SU(2) state is associated with a time period closer to the Big Bang.

Tiller thought that if humans had an organ or body system present from birth that was at a higher gauge symmetry, it would enliven the body; it would direct chemical, electrical, and optical flows; cause the heart to pump and neural synapses to operate. He found that bringing the south pole of a DC magnet near an acupoint associated with a particular muscle group strengthened that muscle group, and that bringing the north pole of that magnet near the same acupoint weakened that muscle group. He argues that because the DC magnet is effecting the acupoints, it must be accessing magnetic monopoles, and concludes the acupuncture meridian and chakra system both operate at a higher gauge symmetry than U(1) (normal reality); perhaps SU(2) This further suggests that human bioelectromagnetism is different than normal Maxwellian electromagnetism. [89]

Tiller's multidimensional model was used by Richard Gerber, a practicing physician trained in internal medicine and devoted to researching vibrational healing. Gerber became a definitive authority on energy medicine with the publication of his seminal contribution *Vibrational Medicine.* [90]

The credibility of the SQUID, electrostatic field detection, and EMG results suggesting an HEF could be expanded considerably if more tests, by more people, were done and reported, on paar with the research done with MRI and acupuncture. Dr. Hunt apparently will soon market her version of an HEF monitor, [91] but before you buy one, check out Mendanha's do it yourself approach.

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[1] Electromagnetic fields are now being used in many conditions such as osseous, ligamental, cartilaginous, or nervous reparation, diabetes, and myocardial or cerebral ischemia. (1996) http://www.ncbi.nlm.nih.gov/pubmed/8951540

Double-Blind study of Pulsing Magnetic Field Effects on Multiple Sclerosis:1997 http://www.liebertonline.com/doi/abs/10.1089/acm.1997.3.21 1997

Electromagnetic Fields for Bone Healing: 2002: http://ijl.sagepub.com/content/1/3/152.abstract 2002

Strong Magnetic Fields Aid Severe Depression:2005: http://www.medicalnewstoday.com/articles/27318.php 2005 (Transcranial Magnetic Stimulation).

[2] Science forums discuss the physical properties of photons: http://www.scienceforums.net/topic/27337-does-a-photon-have-physical-volume-or-geometrical-size/ http://www.physicspost.com/physicsforums/topic.asp-ARCHIVE=&TOPIC_ID=2536.htm

Scientific paper: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TVN-470N734-XW&_user=10&_coverDate=01%2F24%2F1972&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1621382554&_rerunOrigin=google&_acct=C0

00050221&_version=1&_urlVersion=0&_userid=10&md5=9416e4665c139278ce009a7249426c0d&searchtype=a

Abstract

We attempt to clarify the question of the effective size of a photon on the basis of a physical picture which has been found useful in understanding the “shadowing” effects in nuclear photoprocesses and the diffractive features in both high energy nucleonic photoprocesses and large $\omega \equiv 2M\nu/Q^2$ nucleonic electroproductions. The result is in contradictions with the result of Cheng and Wu's model calculation and with the formal estimate of important space-time regions, in the law ω region. Origins of this disagreement are analyzed.

Physics letters B Volume 38 1972 Issue 2 p. 100-104
Published by Elsevier Science

A good summary:
http://www.oxygraphics.co.uk/photons.htm

[3] from 1918-1924 at Taurida University (Now Crimean University) in Crimea

[4] http://www.anatomyfacts.com/research/photonc.htm

[5] Humio Inaba, an engineer at the Research Institute of Electrical Communication at Tohoku University headed the project.

[6] "The problem is reproducibility of results, even for relatively simple systems like cell cultures," says Barbara Chwirot, head of the Laboratory of Molecular Biology of Cancer at Nicolas Copernicus University in Torun, Poland. Light emission may depend on free radicals, but it is also affected by enzyme activity and the supply of protective antioxidants such as vitamin E or carotenoids.

[7] http://www.tohtech.ac.jp/~elecs/ca/kobayashilab_hp/NewScientist.html

[8] http://www.anatomyfacts.com/research/photonc.htm

[9] http://www.lifewave.com/pdf/AcuArticles/acuart-Anatomic-characterization.pdf
http://www.ratical.org/co-globalize/MaeWanHo/prague.pdf p. 14

[10] http://www.tohtech.ac.jp/~elecs/ca/kobayashilab_hp/NewScientist.html

[11] See The Field, p 45 f.

[12] *The Field,* Lynne Mc Taggart p. 39 f.

[13] http://www.lifescientists.de/

[14] http://nobelprize.org/nobel_prizes/lists/all/

[15] http://www.tohtech.ac.jp/~elecs/ca/kobayashilab_hp/NewScientist.html

[16] http://www.tohtech.ac.jp/~elecs/ca/kobayashilab_hp/NewScientist.html

[17] Molecular biology fails to account for consciousness. In order to account for consciousness, the framework of molecular biology needs to be quantum theory. The inclusion of a quantum framework can be done in a way that retains the successes of molecular biology. From Integrative Biophysics: Biophotonics: F.A. Popp et al Springer 2003, p. 442 f.

[18] http://en.wikipedia.org/wiki/Herbert_Fr%C3%B6hlich

[19] http://www.howstuffworks.com/framed.htm?parent=human-body-make-electricity.htm&url=http://www.nanomedicine.com/NMI/4.7.1.htm

[20] http://www.quantumconsciousness.org/penrose-hameroff/orchOR.html

[21] http://elizabethbauerconsults.com/motion.html

[22] http://en.wikipedia.org/wiki/Herbert_Fr%C3%B6hlich also see *The Intention Experiment* Lynne Mc Taggart p. 49 f
The following reference states the biological system could also take on the specific quantum property of non-locality: http://nonlocal.com/hbar/frohlich.html

[23] The Hall effect is the development of a transverse electric field(Hall voltage) in a solid material when it carries an electric current and is placed in a magnetic field that is perpendicular to the current. http://www.britannica.com/EBchecked/topic/252688/Hall-effect. The Hall effect is a rich source of information about the conduction properties of semiconductors. http://Socrates.berkeley.edu/~phylabs/adv/ReprintsPDF/SHE%20Reprints/10-**Hall**%20**Effect**.PDF

[24] http://www.thefreelibrary.com/Energy+Medicine%3A+The+Scientific+Basis-a0163336257

[25] http://www.nutrienergetics.com/tech-quantum-biology.html

[26] http://en.wikipedia.org/wiki/Phonon

[27] http://dspace.mit.edu/bitstream/handle/1721.1/46331/6-720JFall-2002/NR/rdonlyres/Electrical-Engineering-and-Computer-Science/6-720JIntegrated-Microelectronic-DevicesFall2002/583B7E11-AA3D-408F-91E9-7527E94F1983/0/lecture1.pdf

[28]http://www.ece.rochester.edu/courses/ECE423/ECE223_423_MSC426%20Workshop06/term%20papers%2006/Mathew_06.pdf

[29] Published Spring 2000 by Harcourt Brace/Churchill Livingstone, Edinburgh. See a review: **http://www.thefreelibrary.com/Energy+Medicine%3A+The+Scientific+Basis-a0163336257**

[30] Leslie Patten *Biocircuits: Amazing New Tools For Energy Health* p. 159

[31] http://www.biolabor.hu/story-es.php Shows images of many of the western scientists who helped develop these models.

[32] http://www.thefreelibrary.com/Energy+Medicine%3A+The+Scientific+Basis-a0163336257

[33] http://www.lifewave.com/pdf/AcuArticles/acuart-Anatomic-characterization.pdf

"In 1767, Bordieu postulated the existence of an organ that provides nutrition to all tissues and facilitates their
collaboration. He believed that the essentials of diseased processes reside in this most extensive organ of the
body [13]. In 1845, Reichert recognized the vital importance of the connective tissues of the body. He emphasized that there is no direct contact between (vegetative) nerve endings, capillaries and parenchymous
cells. The interstitial tissue both separates and simultaneously functions to facilitate nerve action and nutrition
trafficking [14]. In 1869, Von Rindfleisch elaborated on the cellular humoral neural components [15]. Buttersack
demonstrated that the system has its own structure and physiology [16]. The physical chemistry of the system
was investigated by Schadé [17]. The collagen fibers presenting as a loosely knit network are, during expansion,
able to absorb large amounts of acid. Subsequently, it has been documented that homeostasis of the acid/alkaline
level resides largely in the interstitial tissue [17]. The qualities and functions of the system were summarized by
Standenath: "It is an intermediary for metabolite and fluid flow between the capillary system and parenchymous
cells; it governs metabolism by regulating levels of H_2O, ions, and nutrition; it has storage capacities; it regulates
tonus; it has (immune) defense functions [18]. In 1949, Eppinger compiled data about the behaviour of the system during illness. Under normal conditions, the system of pores and crevices that delineates the organs is
hardly visible. Only after "swelling", due to some pathology, can it be easily discerned [19]. Other data suggested that all loose connective tissues "amalgamate" throughout the body and extracellular fluid flows at a
slow rate [20]. The concept has matured as a result of extracellular matrix research.
The goal of this article is to present a conceptual model linking traditional Eastern acupuncture theory and Western bioregulatory concepts. This objective will be approached with biophysical, molecular cell biological,
and biophotonic perspectives." p. 2-3

Notes: iib_acup_upe.htm

[34] Acuart article, p. 2-3
[35] Acuart article, p. 21.

[36] Acuart article, p. 23.

[37] The authors now have a technique that optimizes the detection of small birefringences, enabling them to obtain high resolution and high contrast coloured images of entire, living, moving organisms. The technique depends on visualizing dynamically coherent liquid crystalline mesophases in the tissues. It involves viewing the organism between crossed polars with an asymmetrically placed compensatory

full wave-plate-about 7.5° from either polarizer when brilliant colours are generated in all living tissues and organisms, whereas, little or no colour is generated when the wave-plate is at its usual position of 45° between the crossed polars. Another innovation in the authors' technique is that they can differentially illuminate various internal organs and tissues by adjusting the level of the condenser

http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=369777

[38] So far, the organ surface Bonghan Corpuscles (acupoint) in rats has been found to be relatively transparent.

[39] http://www.lifewave.com/pdf/AcuArticles/acuart-Anatomic-characterization.pdf

[40] Imaging of biophoton emission from electrostimulated skin acupuncture point jg4: Effect of light enhancers 2008
http://nopr.niscair.res.in/bitstream/123456789/4469/1/IJEB%2046(5)%20340-344.pdf

[41] *Bioelectrodynamics and Biocommunication* edited by Mae-Wan HO, Fritz-Albert Popp and Ulrich Warnke World Scientific Pubishing 1994. ($349) p 431 f (referencing Chapter 8 of the book)
Google books
http://books.google.com/books?id=uxAfnxKMdPcC&pg=PA432&lpg=PA432&dq=SQUID+magnetometer+biophotons&source=bl&ots=6fni_oglSW&sig=RRKnWsVk3WJm_7mPCF91LaBnbog&hl=en&ei=8bTHTIeKEoX6swOXsbSnDQ&sa=X&oi=book_result&ct=result&resnum=4&ved=0CB4Q6AEwAw#v=onepage&q=SQUID%20magnetometer%20biophotons&f=false p. 432

chapter and author breakdown:
http://www.worldscibooks.com/lifesci/2267.html

see also: Imaging liquid crystalline mesophases in living organisms

"The authors now have a technique that optimizes the detection of small birefringences, enabling them to obtain high resolution and high contrast coloured images of entire, living, moving organisms. The technique depends on visualizing dynamically coherent liquid crystalline mesophases in the tissues. It involves viewing the organism between crossed polars with an asymmetrically placed compensatory full wave-plate-about 7.5° from either polarizer when brilliant colours are generated in all living tissues and organisms, whereas, little or no colour is generated when the wave-plate is at its usual position of 45° between the crossed polars. Another innovation in the authors' technique is that they can differentially illuminate various internal organs and tissues by adjusting the level of the condenser."
http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=369777 1994

[42] *Bioelectrodynamics and Biocommunication* edited by Mae-Wan HO, Fritz-Albert Popp and Ulrich Warnke World Scientific Pubishing 1994. ($349)
"…Bioelectrodynamical processes are the means whereby both communication and the effects of communication are achieved. It becomes arbitrary to separate the signaling process and call it 'information', for the signaling, the reception and the transduction form an indivisible unit which gives content to the so-called information…"

[43] The Journal of Microscopy,
http://onlinelibrary.wiley.com/doi/10.1046/j.1365-2818.2002.01081.x/full

[44] http://en.wikipedia.org/wiki/Photonic_crystal; tutorial on photonic crystals http://ab-initio.mit.edu/photons/tutorial/

[45] Biophoton Emission from the Hands Journal of the Korean Physical Society Vol 41 no. 2, August 2002, p 275-278
http://www.energetic-medicine.net/research/biphotonemissionfromthehands.pdf

[46] The article has no publication date, but references articles up to 2007, based on endnote dates

[47] http://www.tohtech.ac.jp/~elecs/ca/kobayashilab_hp/NewScientist.html

[48] Even MIT has now acknowledged "What's for sure is that biophotonics is one of the fastest moving and exciting fields in science today." http://trsub.com/blog/arxiv/26151 12/17/2010

[49] Institut National de la Santé et de la Recherche Médicale. French Institute of Health and Medical Research.

[50] The Field p. 62

[51] While Benveniste was director at INSERM, he found that if solutions of antibodies were diluted repeatedly until they no longer contained a single molecule of the antibody, they still produced a response from immune cells. These effects were replicated by five different labs in four countries: France, Israel, Italy, and Canada. Although strongly contested, the results were published in a 1988 edition of Nature magazine.

These researchers concluded that: "specific information must have been transmitted during the dilution/shaking process. Water could act as a template for the molecule, for example, by an infinite hydrogen-bonded network, or electric and magnetic fields.. the precise nature of this phenomenon remains unexplained." *The Field* pp 39-71

[52] Authoritative sources concur the "memory of water" is real:
http://www.physorg.com/news105191502.html

[53] Yolene Thomas The history of the memory of water *Homeopathy* 2007 96:151-157

http://www.scribd.com/doc/47787580/The-History-of-the-Memory-of-Water-Thomas-Homeo-2007

[54] Over thousands of trials, Benvenista's team recorded the activity of the molecule on the pc, and replayed it to a biological system sensitive to that substance. In every instance, the biological system had been fooled into thinking it was interacting with the substance itself. Other studies showed that if these signals were erased these signals and stop activity in the cells would sstop. .. The inescapable conclusion: As Fritz Albert Popp theorized, molecules speak to each other in frequencies. *The Field* pp 39-71

[55] http://www.wired.com/2011/04/bacterial-radio/

[56] http://www.item-bioenergy.com/infocenter/ConsciousIntentiononDNA.pdf

[57] *The Field* pp 39-71

[58] http://eng.wavegenetic.ru/index.php?option=com_content&task=view&id=2&Itemid=1

human_energy_field\russian dna\dna wave biocomputer.doc

weak criticism:

http://skeptophilia.blogspot.com/2013/10/peter-gariaev-wave-genetics-and-problem.html

[59] http://en.wikipedia.org/wiki/Noncoding_DNA

[60] http://eng.wavegenetic.ru/index.php?option=com_content&task=view&id=2&Itemid=1

[61] Yolene Thomas The history of the memory of water *Homeopathy* 2007 96:151-157

http://www.scribd.com/doc/47787580/The-History-of-the-Memory-of-Water-Thomas-Homeo-2007

02/02/07 http://www.i-sis.org.uk/TheRealBioinformaticsRevolution.php

See also the PSN paper *Water.*

[62] Ho says: typically 200-900 nm http://www.ratical.org/co-globalize/MaeWanHo/prague.pdf

For conversions from various Hz/m levels, see http://www.unitconversion.org/frequency-wavelength/hertz-conversion.html

[63] *Integrative Biophysics: Biophotonics:* F.A. Popp et al Springer, 2003 p. 396-397

[64] 02/02/07 http://www.i-sis.org.uk/TheRealBioinformaticsRevolution.php

[65] http://actu.epfl.ch/news/photon-phonon-coupling-2/

[66] http://www.opticsinfobase.org/abstract.cfm?uri=IPRSN-2012-JTu5A.36

[67] http://en.wikipedia.org/wiki/Raman_spectroscopy

[68] http://www.eurekalert.org/pub_releases/2007-11/uoc--ntc111907.php

[69] SQUID: Superconducting Quantum Interference Device

[70] http://www.thefreelibrary.com/Energy+Medicine%3A+The+Scientific+Basis-a0163336257

[71] For example; http://www.wddty.com/shedding-light-on-biophotons.html

[72] The Field, p 60

[73] The Field, p. 67

[74]According to Wikipedia, http://en.wikipedia.org/wiki/Absorption_spectroscopy, absorption spectroscopy refers to techniques that measure the absorption of electromagnetic radiation of a material as a function of frequency or wavelength. The material absorbs energy in the form of photons. The intensity of the absorption varies as a function of frequency, and this variation is the absorption spectrum**.** Wikipedia also states that absorption spectroscopy is performed across the electromagnetic spectrum. However, this statement cannot be literally true because photons for frequencies below the visible portion of the electromagnetic spectrum have very little energy.
See http://dearplanetaryastronomermike.blogspot.com/2009/02/light-particle-wave.html
See also http://www.bmg-frenchmedical.com/references/Spectral-properties.pdf

[75] http://hyperphysics.phy-astr.gsu.edu/hbase/ems3.html

[76] http://www.physicsclassroom.com/class/light/u12l2c.cfm

[77] They were written largely by the Indo-European invaders of India, known as the Aryans.

[78] *http://www.yoga.com/ydc/enlighten/enlighten_document.asp?ID=341&section=9&cat=0*

[79] http://www.amazon.com/Ayurveda-Marma-Therapy-Energy-Healing/dp/0940985594#reader_0940985594
Dr. Frank Ros is author of The Lost Secrets of Ayurvedic Acpuncture: Marmapuncture

[80] https://www.cihs.edu/cihs/Dr_Motoyama_bio.htm

[81] Vibrational Healing Through the Chakras: With Light, Color, Sound, Crystals…
By Joy Gardner-Gordon
4.5 stars out of 5

http://books.google.com/books?id=Sg_erJTJ-_8C&pg=PA27&lpg=PA27&dq=Chakras+electrostatic&source=bl&ots=Wufr5ZER48&sig=0MKyYvryhEpLnvrRjfOHvumNlFw&hl=en&ei=pHe3TIffGoKusAOi14S3CQ&sa=X&oi=book_result&ct=result&resnum=1&ved=0CAYQ6AEwAA#v=onepage&q=Chakras%20electrostatic&f=false

[82] More on the chaos of human physiology at:
http://www.hummingbird-one.co.uk/humanbeing/artery1.html

EMG signals do have strange attractors:
Multifractal characterization of electromyogram signals
http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=808048

[83] http://www.somatics.de/HuntStudy.html
Pg 24-27: Science of the Chakras

In her book *Infinite mind*, Valerie Hunt reports using an electromyogram to record signals from a subject's upper and lower arm, back, and head. As the subject began to dance, the signals from the upper and lower arm and back stopped, but the signal from the head became intense. Dr. Hunt concluded she had recorded electromagnetic radiation from the subject's crown chakra. 40. Dr Hunt later had a NASA engineer, who had developed highly sensitive telemetry systems, build a system to record very weak signals. Surface sensors picked up the body's electrical signals by an FM radio frequency carrier via a miniature battery operated radio transmitter and amplifier attached to the subject by a belt. The transmitted signal was then picked up by a radio receiver and recorded. This system allowed Dr. Hunt "to record regular high frequency oscillations coming

from the chakras that had never been previously recorded or reported in the scientific literature. … conventional recordings are taken by inserting needle sensors or probes into a nerve or muscle, which gives a reading only for a very local area. Dr Hunt attached the electrodes to the surface of the skin where there was a larger signal. She amplified and filtered the baseline data to remove the brain and muscle signals, including the heart. She discovered a void of electrical activity between about 250 and 500 cycles per second (hertz), and then discovered continuous activity from 500 to 20,000 cps (the highest capacity of the instrument at the time. 41. An energy healer treated a patient. The EMG signals at the chakra locations up the patients spine and out of the top of his head during healing agreed with the flow of energy reported by a medical intuitive. That intuitive was the quite well known Rosalyn Bruyere. 42

Dr. Hiroshi Motoyama of Japan had no way to measure the alleged energy of the chakras, he hoped to measure secondary energy, such as electrostatic fields. He found that the level of energy found at chakra locations of advanced meditators was significantly greater than that found at the corresponding location of control subjects. (Those with no meditative or psychic experience) He also monitored the energy advanced meditators claimed to be able to project through their chakras. He documented significant electrical field disturbances emanating from the activated chakras. These results were repeated by Itzhak Bentov, author of *Stalking the Wild Pendulum*. 43

Gordon p. 26 on.

p. 40 Hunt, Infinite Mind 11, 19, 21

p. 41 ibid 18, 19, 21, 27

p. 42 ibid 14-16

[84] Hunt, Infinite Mind, data exhibit

[85] *A method for computerized recording and analysis of high frequency biopotentials*. Mendanha RE
Indian Journal of Physiology and Pharmacology 2008 52(4): 398-402
http://www.ijpp.com/vol52_4/398-402.pdf

also posted at NIH:
www.ncbi.nlm.nih.gov/pubmed/19585757

[86]
http://books.google.com/books?id=EeLoxW5RoYgC&pg=PA656&lpg=PA656&dq=Chakras+EMG&source=bl&ots=pPRWewFKQl&sig=ZvVhub1uqhtX73KuAvoxKGTK1kI&hl=en&ei=EwS4TNzwBIHGsAPf1tGWDw&sa=X&oi=book_result&ct=result&resnum=2&ved=0CBYQ6AEwAQ#v=onepage&q&f=false Pg 656, references Fn 16

[87] Curtis, R.C., Zeh,D., Miller, M. & Rich, S.C. (2006) Examining the validity of a computerized chakra measuring instrument. A pilot study. Subtle Energies & Energy Medicine, 15, 209-223.

Examining the Validity of a Computerized Chakra Measuring Instrument: A Pilot Study. Russ Curtis, Ph.D.; Doug Zeh, M.S. & Michelle Miller, M.S

Context: The chakra system, a complex network of energy vortexes that receive and process energy within the body, has been espoused for centuries in Asian and other cultures to play a fundamental role in the health of individuals. Many illnesses are thought to originate as blocked energy within the chakra system, and are often thought to be caused by unresolved psychological trauma. Recently, instruments have been created to measure chakra functioning, but no studies to date have attempted to determine their validity in accordance with chakra theory. Objective: To determine discriminant validity of the Inneractive Aura Video System 5.1 (IAV system) by examining the relationship between self reported psychological symptoms and chakra levels. Method: Sixty-four university students, 42 Americans and 22 Jamaicans, volunteered to complete the Symptom Checklist 90-R (SCL-90-R) and the IAV system measuring chakra level functioning. Results: The expected overall negative relationship between chakra levels and psychological symptoms was confirmed. Pearson product moment correlation analysis revealed significant negative correlations between chakra levels and psychological symptoms. More significant correlations were found among females than males, and American females had more significant and robust correlations than did Jamaican females. Implications for future chakra research are discussed.

KEYWORDS: Chakra

Ms doc:

http://www.dr4mind.net/board/bbs/include/DOWNLOAD.php3?table=Quantum_Medicine&l=121&inc=local&f=filelink

html:

http://webcache.googleusercontent.com/search?q=cache:0DTkx2KXZlYJ:www.dr4mind.net/board/bbs/include/DOWNLOAD.php3%3Ftable%3DQuantum_Medicine%26l%3D121%26inc%3Dlocal%26f%3Dfilelink+Examining+the+validity+of+a+computerized+chakra+measuring+instrument&cd=5&hl=en&ct=clnk&gl=us

[88] Quoting from the website: “The Aura Video Station uses the ‘hand’ biosensor to measure the biofeedback data- the Electro-Dermal Activity and Electrical Conductivity of the skin of the hand and its temperature in real time. This …data is analized,processed, and coorelated… http://www.aura.net/flash_e/index.shtml?gclid=CKuWr4rZzKQCFSNsgwodw2mNzQ

[89] http://www.quantrek.org/Technical%20Literature/**Tiller**_Vision_in_Action_Article_a.pdf p. 9-15

[90] *Energy Medicine and the Multidimensional Model* by Debra Greene
“Meridians and smaller capillaries called nadis have been validated by a number of modern scientific methods, including magnetic resonance imaging(MRI). Chakras have been experimentally verified with electrostatic measurements as well as electromyography (EMG).” http://www.noetic.org/noetic/issue-three-october/energy-medicine-and-the-multidimensional-model/

[91] Dr. Hunt has developed the Bioenergy Fields Monitor™, a high frequency low amplitude system with sensitive low noise optic lead cables. Testing and protocol development are scheduled for Fall 2009 with commercial production following in 2010."
http://valerievhunt.com/ValerieVHunt.com/Valerie_Hunt_Research.html