

ENERGY MEDICINE AND THE UNIFYING CONCEPT OF INFORMATION

Beverly Rubik, PhD

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Beverly Rubik is the director of the Center for Frontier Sciences at Temple University, Philadelphia, Pa. [Current location: Center for Frontier Medicine in Biofield Science, Institute for Frontier Science, Oakland, CA, in consortium with University of Arizona, Tucson]

1. ABSTRACT

Alternative medicine remains alternative because it poses serious challenges to the mainstream biomedical paradigm of mechanical reductionism and because it requires a new framework. This paper explores some of the hypotheses and challenges of energy medicine including healer interventions, electromagnetic therapies, and homeopathy. Together with new findings from the bioelectromagnetic field, they spell out the rudiments of a new paradigm for biology and medicine based on information. Information embraces the complex network of relations in the matter and energy transactions of living systems. It offers a unified view of energy medicine modalities as well as a fresh perspective for biology and medicine and new questions for further research.

2. INTRODUCTION

Certain types of alternative medicine that involve subtle or very low intensity nonmaterial stimuli are popularly known as energy medicine. Examples are healer interventions, homeopathy, electromagnetic (EM) therapies, and possibly acupuncture. Although clinical and fundamental research on these modalities exists, they remain outside the mainstream because they challenge the dominant biomedical paradigm by defying conventional scientific explanation. For example, healer interventions have been associated with positive effects on sick organisms and have been documented in more than 155 controlled laboratory and clinical studies.¹ Homeopathy is considered incomprehensible and anomalous by the scientific community because its mode of action is unknown, despite more than 100 clinical trials that were reviewed and evaluated for methodology characteristics and outcome.² This review showed that 81 of these trials yielded positive results significantly better than results produced by placebo, although some of the studies had methodological problems.

This lack of acceptance is not surprising, because the history of science and medicine shows that the accumulation of anomalous data in itself is not enough to shift the scientific or medical paradigm toward accepting something new. The crucial step toward recognition and acceptance by the biomedical community is conceptual work toward explanatory scientific theories and a paradigm that would accommodate them. This conceptual work is perhaps the greatest challenge to those researching subtle energies and energy medicine.

Although various explanations are offered for energy medicine in terms of a vital force or life energy, there is no agreed upon scientific understanding or precise meaning of these ideas in Western scientific

concepts. This paper examines a few Western scientific hypotheses or concepts — unified by the explanatory concept of information — that underlie energy medicine. It is proposed as a first step toward a new paradigm for energy medicine.

3. PROPOSED SCIENTIFIC HYPOTHESES OF ENERGY MEDICINE

Various hypotheses have been proposed to explain the modus operandi of the energy medicine modalities. Some pertaining to healer interventions, homeopathy, and electromagnetic therapies are discussed here.

3.1. Healer Interventions

Two proposed mechanisms for healer interventions are summarized below.

1. *Consciousness is causal*; i.e., the healer's intent to heal may interact with the physical realm. More specifically, the conscious intention of the healer through prayer or other means may physically improve the health and well-being of the patient.³ According to conventional physical theory, acceptance of this hypothesis would require extending Bell's theorem of nonlocality in quantum physics and the principle of causality to consciousness. A number of experiments on the effects of conscious intention, some relevant to healing, have demonstrated physical effects, offering precedence for extending Bell's theorem and the principle of causality.⁴⁻⁶

2. *Subtle energies may be exchanged or otherwise involved*, for instance, a condition of physical resonance between the energy fields of healer and patient, which may mediate the beneficial effects.⁷ The central nervous system emits electromagnetic fields up to about 30 Hz, measured by electroencephalogram (EEG), although these are extremely low intensity fields. Some other type of energy even more subtle than electromagnetism but not yet identified by science also may be involved in healing.

The first mechanism is possible despite any distance that may exist between healer and patient because nonlocal effects do not diminish over distance. However, the second mechanism is possible only for local interactions (short-range distances), because energy fields -- at least electromagnetic fields -- dissipate over long distances. On the other hand, if new forms of energy that do not decay rapidly over distance are invoked, the exchange of subtle energies would be a possible mechanism for long-distance healing. Also, both mechanisms may be involved for local and nonlocal healing interventions. It is not unusual for living systems to have multiple mechanisms that work together and potentiate each other.

3.2. Electromagnetic Therapies

Previously it was thought that nonionizing electromagnetic radiation produced no biological effect except tissue heating at high field intensity. However, discoveries in the emerging science of bioelectromagnetics have demonstrated a variety of biological effects from the application of ultraweak, nonionizing electromagnetic fields. As with homeopathy and healer interventions, there is no agreed upon mechanism for the effects of ultraweak electromagnetic fields. Although molecular mechanisms have been inadequate to explain the biological effects,⁸ some evidence suggests that the cell membrane is one locus where applied electromagnetic fields act on the cell. It is possible that electromagnetic forces on the membrane could modify ligand-receptor interactions such as the binding

of hormones and calcium, which in turn would alter the internal state of the cell.⁹

Bioelectromagnetic research shows that certain types of ultraweak nonionizing electromagnetic fields can indeed stimulate the healing response.¹⁰ Such fields are used in bioelectromagnetic therapeutic devices such as bone stimulators for nonunion fractures. Other therapies in use or under development using low-level electromagnetic stimulation include transcutaneous electrical nerve stimulation for chronic pain control and transcranial electro stimulation for insomnia and mood disorders. Many other devices in various stages of development would promote soft tissue healing and regeneration or stimulate the immune response.¹⁰

3.3. Emerging Science of Bioelectromagnetics

A new view in which the energy patterns of life take on central importance is emerging from contemporary biophysics. The diagnostic procedures of EEG and electrocardiography (ECG), for instance, are based on the detection of endogenous electromagnetic fields that arise in the central nervous system and heart muscle, respectively. Researchers are exploring the possibility that weak electromagnetic fields associated with tissues other than the heart or central nervous system might also carry information of diagnostic value. Another focus is on the dynamics of subtle fields both internal to an organism and interactive with its environment.

The presence of biological effects from extremely low intensity, extremely low frequency fields is especially challenging to conventional science, because the energy content is less than the physical thermal noise limit (i.e., less than the energy of random molecular motion) at physiological temperature.⁸ For this case, the biological effects of such weak electromagnetic fields are explained by the carrier wave's informational content, encoded in the waveform and temporal sequence of the waves (see note). Specific changes in the field configuration and exposure pattern of ultraweak, extremely low frequency electromagnetic fields can produce highly specific biological responses.¹⁰ Some wave forms have highly specific effects on tissues, as do drugs.

The informational content of externally applied fields has been postulated to elicit an effect by mimicking natural bioinformation carried by endogenous bioelectromagnetic fields within living systems.¹¹ Electrical activity at the level of tissues and organs is known to exhibit macroscopic patterns such as those of the EEG and ECG that contain medically useful information. Such natural bioelectromagnetic fields arise from naturally occurring component oscillators in the organism such as biochemical or electrical pacemakers. Indeed, in terms of chaos theory, life has been conceptualized as a nonlinear, dynamic, open system in which natural oscillators abound. The frequencies of biological oscillations including the heart rate, respiratory rate, brain waves, and menses vary. A natural oscillator may entrain to the externally applied oscillations of a coherent electromagnetic field, such as that from an electromagnetic-generating therapeutic device or a healer, if it has the same natural frequency. Resonance occurs when the natural oscillators in the organism become synchronized with the oscillations of an externally applied field.¹² Induced synchronization constitutes a flow of information from the external field to the organism.

An important link was made by Froehlich, who introduced the idea that life may be capable of coherent excitation.¹³ The living state displays features of coherent macroscopic quantum energy states analogous to those of a tunable laser. Cells and organisms display their own rhythms of activity that are partly internally regulated, but they also respond to external energy phenomena. Just as a tunable laser

responds to particular external frequencies imposed upon it, a cell, group of cells, organism, or group of organisms is capable of coherent excitation and resonance with external frequencies from the environment.¹² For example, the brain is composed of neurons, many of which are oscillators that produce electrical signals with a particular periodicity. Regions within the brain (bundles of neurons) function as coherent units, but not with a precisely defined boundary. The circadian oscillator, a network of cells in the hypothalamus that regulates daily biological rhythms, is an example.

The concepts of Froehlich and his colleagues suggest that living systems regulate themselves by means of an internal coherent field extending throughout the organism, an endogenous field that encodes bioinformation. Disease or a precursor condition disposing the organism to disease may occur at an energetic level when the endogenous biofield is disturbed or the oscillators are otherwise disrupted. The ideas of Froehlich et al suggest that there are certain resonant frequencies which, when applied externally, produce beneficial effects serving to 'tune' the organism back to a state of health and homeostasis, and other frequencies that may thwart health by disrupting the regulation of bioinformation.

3.4. Biophoton Emission and Its Potential Applications

Besides nonionizing extremely low frequency fields in the invisible region of the electromagnetic spectrum, there is some experimental evidence for life as a "biolaser" involving ionizing electromagnetic fields. Very low intensity visible and ultraviolet light is in fact emitted by most organisms. This work goes back to the discoveries of Gurvitsch¹⁴ who, in the 1920s, studied the influence of self-stimulation on the growth of onion rootlets. Gurvitsch found that radiation emanating from the actively growing rootlets stimulated root cell division and deduced from its absorption properties that it was ultraviolet light. Since the 1960s, when sensitive photomultiplier tubes became available, Popp¹⁵ and others have demonstrated ultraweak light emission, frequently called "biophotons," from a variety of organisms including humans. The evidence from a large number of experiments performed in Europe and Russia, taken collectively, suggests that biophotons are coherent. If the light emission is coherent, it implies, moreover, that at least some of the components (biomolecules) of the organism are dynamically in phase.

Modern, although indirect, evidence also exists that biophoton emission from organisms carries bioinformation. For example, Kaznacheev¹⁶ and other Eastern Europeans¹⁷ have reported on the alleged transfer of "pathological information" by means of such light. What is known as the "cytotoxic effect" involves two cell cultures separated by at least a few centimeters and by a quartz or glass window. Under certain conditions, a poisoned, dying culture apparently communicates a long-range electromagnetic signal that initiates pathological changes and even death in the second culture. More recent work in Germany has shown a related effect. A culture of the algae *Gonyaulax*, if chemically stressed, emits a burst of photons; if a normal culture of *Gonyaulax* is optically exposed to the disturbed light-emitting culture, it also emits an instantaneous burst of light, suggesting optical communication between the two cultures.¹⁸

Biophoton emission has been used experimentally in cancer diagnostics and therapeutics.¹⁹ Experimental results show differences in the light emitted from cancerous tissue compared with light from normal tissue,²⁰ which may relate to differences in the long-range interactions between cells in a population. The degree of this difference in light emission may be used to diagnose the degree of tissue abnormality from an energetic viewpoint. Following such analysis, homeopathic remedies (added in

vitro to the tumor tissue) that are found to shift the biophoton emission toward normality are then recommended as the remedies of choice for the patient.

Experimental data clearly show the presence of a ubiquitous, ultraweak biological light. Although evidence is accumulating that would support the notion of a coherent, organizing field that conveys bioinformation, further research is needed to substantiate this concept.

3.5. Bioelectromagnetic Information

Additional evidence from other biological and medical areas supports the idea that bioregulation intimately involves electromagnetic fields. Small changes in geomagnetic fields to which organisms are sensitive may drive life's rhythms including the circadian and the seasonal.²¹ A natural electrical current associated with wounds changes as healing progresses. A particular profile of bioelectrical patterns in healing generates scar tissue, and a different profile in animals regenerates limbs.¹¹ Increasing epidemiologic evidence shows that chronic human exposure to low levels of power line frequencies (50 or 60 Hz) is associated with a higher risk for cancer, especially during childhood.^{22,23} There is evidence also that acupuncture points possess higher electrical conductivity than surrounding tissue, even though they are not usually anatomically distinct.²⁴

Conventional science maintains that biological information is stored and transferred via biomolecular structures such as DNA. The concept of an endogenous, coherent, regulatory biofield that senses and responds to low-level environmental fields goes beyond the dominant paradigm of molecular reductionism. Such a field is a collective property of the organism and cannot be reduced to a sequence of biomolecular events. The concept of electromagnetic bioinformation is the subject of considerable scholarly activity,^{13,15,20} but a comprehensive theory has not been elaborated.

3.6. Homeopathy

Several mechanisms have been proposed for the action of homeopathic remedies on organisms,²⁵ although the nature of the homeopathic signal and its information remain unknown.²⁶ Moreover, the fact that the potency of homeopathic preparations increases upon increasing dilution, even beyond the Avogadro limit, when theoretically no molecules would be left from the original solute, challenges a cornerstone of modern science: molecular theory and the dose-response relationship in conventional medicine. On the other hand, it may indicate that something else is occurring that does not involve the usual concept of molecules. One common theme among the modern hypotheses of homeopathic action is that the solvent (usually water) stores energy or information from the solute (the bioactive agent) that may be electromagnetic in nature and that does not diminish upon dilution. This energy or information is conveyed to the body upon ingestion or injection of the remedy, which often has rapid effects.

Molecular theory falls short in attempts to explain how homeopathy works in terms of infinitesimal dilutions of a solute. However, an analysis of the nature of the solvent, usually a polar substance, might be more fruitful. The homeopathic signal could involve a coherent excitation in the polar solvent carrier (e.g., water, sugar, ethanol) that is produced during the succussion process. One may speculate that the homeopathic remedy stores electromagnetic frequencies that are released in the organism, where they drive various oscillators at those same frequencies; that is, they produce resonance. Thus, the homeopathic remedy may transfer information, not energy. In relation to a hypothesis for homeopathy, a novel theory of condensed matter (liquids and solids) has been proposed

by Del Giudice²⁷ and Preparata²⁸ in which a new concept of coherence in matter is critical to its structure and properties.

Based on quantum electrodynamics, conventional molecular theory is shown to work well for gases, but it falls short in explaining the phenomena of liquids and solids. A system of molecules kept together by purely static forces becomes dynamically unstable beyond a certain density threshold. Therefore, the system enters a lower energy configuration in which molecules oscillate in tune with a self-produced coherent electromagnetic field. The theory predicts the appearance of coherence domains in solids and liquids such as water at physiologic temperatures.²⁹ Because the living cell and its structural components are of the same order of size as the calculated coherence domains in water, it is expected that electrodynamic coherence may be relevant to the living state in terms of enhanced stability and novel energy and information transactions. Such novel transactions, if they exist, may be relevant to the action of homeopathic remedies.

4. THE UNIFYING CONCEPT OF INFORMATION

Taken collectively, the observations and hypotheses from bioelectromagnetics and energy medicine suggest a unifying concept of information as a fundamental feature in bioregulation that goes beyond the conventional molecular notion of information. Healer interventions may involve information associated with conscious intention that mediates a beneficial effect, or information from the subtle biofields may be exchanged between healer and patient. Homeopathy may involve a new form of information storage in matter released into the organism, where it acts at a bioregulatory level. Electromagnetic therapies may involve bioinformation that interacts with endogenous electromagnetic biofields or at the level of membrane receptors in the organism.

This concept of information may not appear to be new, because it is widely accepted that DNA stores genetic information and that other biomolecules transfer signals within the cell. Consider, for example, the terms "molecular recognition," "receptors," "DNA code," "transcription," and "translation," which are already accepted in conventional biology. Indeed, life may be defined as a system that both stores and processes the information necessary for its own survival and reproduction; the cell can be seen as an information processing machine. Despite the fact that this concept is considered mainstream and consistent with the dominant medical paradigm, it actually poses serious challenges to it. Polanyi wrote, "All objects conveying information are irreducible to the terms of physics and chemistry."³⁰ He pointed out that, even for machines, higher operational principles and boundary conditions that govern their design and function cannot be deduced from a description of their hardware, no matter how accurate and detailed this description may be.

For science and medicine to embrace life's full capacity and full human potential, we need to go beyond mechanical concepts that were developed for machines. Clearly, one important difference between mechanical and living things is their number of critical internal interconnections and their degree of interrelation with their environment. Machines and their parts have relatively few of these and essentially exist independently of other things and the environment. On the other hand, living things have an immense network of internal and external interconnections, depending on habits and dispositions they have inherited or acquired.³¹ The continuous exchange of information in living systems to maintain their integrity is awesome. Furthermore, new relationships emerge at the higher levels of order in life, elevating the communication network to new "wholes." For example, a living organism is much more than a collection of organs or tissues; it manifests a distinct wholeness,

possessing a drive to exist, sustain itself, reproduce, constitute itself purposefully in response to its environment, and relate to other organisms and its ecological community. A web of relationships at many levels of order sustains the human being. A wealth of information exchange, or "conversation," between and within the elements of these levels of order in life is involved in sustaining or recovering health.

5. CONCLUSIONS: TOWARD AN INFORMATIONAL PARADIGM FOR BIOLOGY AND MEDICINE

An informational paradigm is proposed here as a new basis for the life sciences and medicine, although only its rudiments are described in this paper. This paradigm may reframe our thinking about subtle energies and energy medicine and indeed, all of biology and medicine, allowing us to pose new questions and gain new insights. The rationale for this proposal follows.

1. The concept of information is already used successfully to explain various phenomena in the fields of molecular biology, computer science, thermodynamics, and more recently, quantum physics. To build a bridge from alternative to mainstream medicine, it is useful to consider and incorporate emerging paradigms from other scientific disciplines.
2. Living systems are fundamentally different from nonliving systems, in that they involve more levels of organization and more complex, dynamic interactions of their components and with their environment. The notion of information flow among these various levels, in which the more complex are irreducible to simpler levels, is a novel way to conceptualize the living state that avoids reducing it to conventional physics. Thus, higher levels of organization may involve additional principles that do not violate the laws of physics and chemistry, but are not determined by and cannot be reduced to them. Examples of these higher principles are evolutionary design, consciousness, and the mind-body connection. As indicated earlier, the lowest levels of living organization (e.g., biomolecules) have already been described in mechanical molecular codes that convey information. Therefore, information is a unifying concept that spans the many levels of organization of living systems. Furthermore, information may also flow among the levels of order in living systems.
3. An enhanced concept of information serves to unify our thinking about local and nonlocal interactions in research on healer interventions. Briefly, local healing may be mediated by informational patterns of ultraweak, extremely low frequency electromagnetic fields emanating from the body of the healer that are associated with altered states of consciousness such as healing states. In distant healing the effects of prayer or conscious intention may be explained on the basis of subtle, highly specific information that is distributed nonlocally and has effects only on whom it is intended.
4. The concept of information serves to unify our thinking about energy medicine -- healer interactions, homeopathy, electromagnetic medical applications, and possibly acupuncture -- and move us beyond thinking about them in terms of mere energy transactions. Although both information and energy transactions involve at least two parties, the concept of information goes beyond that of energy because it involves features of purposeful design, communication, communion, and meaning, often on the part of both parties. Information is usually carried by energy or matter, but it transcends the conventional physical concepts of both.

5. Information must be defined operationally at each level of order in living systems, and different working definitions are likely at each level. New ways of codification and utilization of qualitative or "soft" information are needed.³² With the incorporation of information at various levels of order, there is the recognition and the acceptance that an extended science that encompasses higher levels of order such as the transpersonal domain will not be mechanical or quantitative, but will appropriately achieve a position somewhere between ignorance and precise knowledge. Such a science has already been advocated in human communication theory to accommodate features such as relevance, context, interpretation, and meaning.³³ Concepts of information in biology, especially in a science of the human being, should reflect these features to address life in its fullest capacity.

6. In considering a primary role for information in a new science of life and especially of the human being, we take a step forward in considering explicitly the role of human participation as a part of science. This is true even for physics, as according to one interpretation of quantum theory, the observer participates in the quantum system by collapsing the wave function in the act of measurement. What we call data is more than a pile of numbers; it is information. Scientific facts do not stand alone; they are theory-laden and context-dependent. Information depends on the experimental context, the experimenter's viewpoint, and the scientific paradigm. Science always involves our individual, social, political, and cultural participation in the observation and measurement process. This concept is especially important in research on alternative medicine.

6. DISCUSSION

Science is driven by new questions, and the power of a new conceptual framework is, in part, to generate them. For example, some questions raised in an informational paradigm for the healer-patient or healer-laboratory system interaction are the following:

- What are all the informational carriers (e.g., energy and matter, such as physical touch, biofield, words exchanged, prayers, ritual objects) in the healer-patient interaction?
- What do the electromagnetic biofields of the healer and patient, as well as their states of consciousness and subjective experiences, tell us?
- What is the nature of the information exchanged in the healer-patient interaction? If an investigator (third party) is involved, what is that person's role in the information exchange?
- Is ultraphysical information exchanged that may or may not have energy or material carriers, for example, conscious intention and conscious and unconscious beliefs? What is the meaning of the interaction to each person involved in the study?
- At what levels of order (e.g., molecular, cellular, organ, organismic, cultural, conscious, spirit) does the healer-patient communication occur?

Questions raised by the informational paradigm apply to other areas of energy medicine:

- For homeopathy, the question is reframed from: What is the physical signal in an infinitesimal dilution? to: What is the information carrier in a succussed, polar solvent? What is the nature of the information conveyed in the homeopathic treatment of a particular patient? and At what

level(s) of order (in living systems) does the communication occur?

- For extremely low level nonionizing electromagnetic field bioeffects, the question moves from: How can an electromagnetic signal that has less power intensity than physically thermal noise fluctuations have effects on the organism? to: How can the applied electromagnetic field, considered as a small, coherent excitation, convey information to an organism? Also, What is the nature of the information conveyed? and At what level(s) of order in the living system does the communication occur?
- For biology some general questions are: How can we reframe what we already know about the organism (e.g., anatomy, physiology, biochemistry) in terms of levels of communication, meaning, purposeful design, and information? A theory of living systems in terms of information is needed that would encompass their structure, physiology, evolution, network of interrelationships and interdependencies, consciousness, and other higher functions of life based on communication and community. Can we raise specific, scientifically testable questions about life processes in terms of information exchange? Reconceptualizing research problems along the lines of information flows may provide new insights into energy medicine modalities and beyond.

Information is about relationship and exists only in relationship. Is it possible that information about the highest quality relationship, love, may supersede information originating from the mechanical levels of organization and promote healing despite physical odds against it? Is this effect occurring in certain healer interactions with patients or in certain medical practitioner-patient relationships? This hypothesis could be tested experimentally.

The concept of information being invoked here at the higher levels of order of human potential is similar to what Bohm called "active information."³⁴ This term refers to information that is potentially active everywhere, but becomes active only where meaning is drawn. Consider a ship automatically piloted by radar waves that travel everywhere through space. The waves are sensed only by the ship. This causes the ship to respond to the signal with a certain type of movement. Similarly, the conscious intention of a healer to heal may be manifested everywhere but is active only on the patient for whom the message is intended. The idea of active information implies that matter has a mind-like quality. It also implies that information may be causal.

Finally, it must be acknowledged that the concept of information is also a limited one. No scientific concept can ever represent the richness of nature or the complexity of its full creative potential. Thus, the concept of information proposed here is only another facet of the diamond, recognizing that other facets, equally valid, offer different perspectives. The most that a new model, metaphor, or concept in science can give us is the gift of new questions, because discoveries are driven by posing new questions of nature, who then responds to us in a new language.

Note: Consider the following analogy. A person at a party in which many people are conversing in small groups is able to select and listen to a conversation nearby, despite the fact that the volume of this conversation may be much lower than the ambient background noise made up of all the chatter in the room. The volume, or sound energy intensity, of the voices is virtually irrelevant; it is the informational content of the conversation that is meaningful to the person, who is able to "tune in" specifically to low-level input.

7. References

1. Benor D. (1993) *Healing Research: Holistic Energy Medicine and Spiritual Healing*. Munich, Germany: Helix Verlag
2. Kleijnen J, Knipschild P, ter Riet G. (1991) Clinical trials of homeopathy. *Br Med J*; 302: 316-323
3. Achterberg J, Dossey L, Gordon JS. (In press) Report of the panel on mind/body interventions. In: Swyers J, et al (11-member editorial board). *Expanding Medical Horizons: Report to the NIH on the Status of Alternative Medicine*. Washington, DC: National Institutes of Health, Office of Alternative Medicine
4. Rubik B. (1992) Volitional effects (of healers) on a bacterial system. In: Rubik B, ed. *The Interrelationship Between Mind and Matter*. Philadelphia, Pa: Center for Frontier Sciences at Temple University: 169 -190
5. Schmidt H. (1992) Progress and problems in psychokinesis research. In: Rubik B, ed. *The Interrelationship Between Mind and Matter*. Philadelphia, Pa: Center for Frontier Sciences at Temple University: 39 - 56
6. Dunne BJ, Jahn RG. (1992) Consciousness, randomness, and information. In: Rubik B, ed. *The Interrelationship Between Mind and Matter*. Philadelphia, Pa: Center for Frontier Sciences at Temple University: 57-82
7. Rubik B, Pavek R, Greene E, Laurence D, Ward R. (In press) Manual healing. In: Swyers J, et al (11-member editorial board). *Expanding Medical Horizons: Report to the NIH on the Status of Alternative Medicine*. Washington, DC: US Government Printing Office
8. Rubik B. (1991) BEMS Symposium Explores Mechanisms for ELF Electromagnetic Bioeffects. *Frontier Perspectives*; 2 (2): 1-24
9. Tenforde TS, Kaune WT. (1987) Interaction of extremely low frequency electric and magnetic fields with humans. *Health Physics*; 53: 585-606
10. Rubik B, Walleczek J, Liboff A, Hazelwood C, Becker RO. (In press) In: Swyers J, et al (11-member editorial board). *Expanding Medical Horizons: Report to NIH on the Status of Alternative Medicine*. Washington, DC: US Government Printing Office
11. Becker RO. (1982) Electrical controls of regeneration. *J Bioelectricity*; 1: 239
12. Rubik B. (1989) Music at the heart of life: toward a resonant model of health and healing. In: Heinze RI, ed. *Proceedings of the 6th International Conference on Shamanism and Alternate Modes of Healing*. Berkeley, Calif: Independent Scholars of Asia: 16-21
13. Froehlich H, ed. (1988) *Biological Coherence and Response to External Stimuli*. New York, NY: Springer-Verlag
14. Gurvitsch AG. (1922) Uber den Begriff des embryonalen Feldes. *Archiv Entwicklungsmechanik*; 51: 383 -415.
15. Popp FA, Warnke U, Koenig HL, Peschka W. (1989) *Electromagnetic Bio-Information*. Baltimore, Md: Urban and Schwarzenberg
16. Kaznacheev VP, Shurin SP, et al. (1976) Distant intercellular interactions in a system of two tissue cultures. *Psychoenergetic Syst.*; 1: 141-142
17. Kirkin AF. (1981) Non-chemical distant interactions between cells in culture. *Biofizika.*; 16: 839-845
18. Ober H, Popp FA, Rubik B. (1992) Unpublished results
19. Popp FA. (1992) Personal communication
20. Popp FA, Li KH, Gu Q, eds. (1992) *Recent Advances in Biophoton Research*. Singapore: World Scientific
21. Tomassen GJM, de Graaff W, Knoop AA, Hengeveld R, eds. (1990) *Geo-Cosmic Relation: The*

Earth and Its Macro-environment. Pudoc, Netherlands: Wageningen Press

22. Wertheimer N, Leeper E. (1979) Electrical wiring configuration and childhood cancer. *Am J Epidemiol.*; 109: 273-284
23. Savitz DA. (1988) Childhood cancer and electromagnetic field exposure. *Am J Epidemiol.*; 128: 21-38.
24. Becker RO. (1976) Acupuncture points show increased DC electrical conductivity. *Am J Chin Med.*; 4: 69.
25. Resch G, Gutmann V. (1987) *Scientific Foundations of Homeopathy*. Bergam Starnberger See, Germany: Barthel & Barthel
26. Endler PC, Schulte J, eds. (1994) *Ultra-High Dilution: Physiology and Physics*. Boston, Mass: Kluwer Academic
27. Del Giudice E, Preparata G. (1991) Superradiance: Towards an understanding of the ground states of QED in condensed matter. In: Clark TD, Prance H, Prance RJ, Spiller TP, eds. *Macroscopic Quantum Phenomena*. Singapore: World Scientific: 167
28. Preparata G. Coherence in QCD and QED. (1992) In: Bressani T, Minetti B, Zenoni A, eds. *Problems and Ideas of Modern Physics*. Singapore: World Scientific: 3
29. Del Giudice E, Preparata G, Vitiello G. (1988) Water as a free electric dipole laser. *Phys Rev Letters.*; 61: 1085-1088
30. Polanyi M. (1967) Life transcending physics and chemistry. *Chem Eng News.*; 45: 54-65
31. Birch C. The postmodern challenge to biology. (1988) In: Griffin DR, ed. *The Reenchantment of Science: Postmodern Proposals*. Albany, NY: State University of New York Press; 69-78
32. Josephson BD, Rubik BA. (1992) The challenge of consciousness research. *Frontier Perspectives.*; 3 (1): 15-19
33. Ritchie LD. (1991) *Information*. Newbury Park, Calif: Sage: 8-18
34. Bohm D. (1980) *Wholeness and the Implicate Order*. Boston, Mass: Routledge and Kegan Paul