

# Analysis

## The Physics of 'Alternative Medicine' Bioenergetic Fields

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Much of alternative medicine is grounded on vitalism, the notion that living organisms possess some unique quality, an *élan vital*, that gives them that special quality we call life. Belief in the existence of a living force is ancient and remains widespread to this day. Called *prana* by the Hindus, *qi* or *chi* by the Chinese, *ki* by the Japanese, and 95 other names in 95 other cultures, [1] this substance is said to constitute the source of life that is associated with soul, spirit, and mind. Wheeler reviewed the history of vitalism in the West and defined it as "all the various doctrines which, from the time of Aristotle, have described things as actuated by some power or principle additional to mechanics and chemistry." [2] Modern theories of vitalism include those of Driesch [3] and Bergson. [4]

In ancient times, the vital force was widely identified with breath, which the Hebrews called *ruach*, the Greeks *psyche*, or *pneuma* (the breath of the gods), and the Romans *spiritus*. As breath was gradually acknowledged to be a material substance, words like "psychic" and "spirit" evolved to refer to the assumed nonmaterial and perhaps supernatural medium by which organisms gain the qualities of life and consciousness. The idea that matter alone can do the job has never proved popular.

Chi or qi remains the primary concept in traditional Chinese medicine, still widely practiced in China and experiencing an upsurge of interest in the West. Chi is said to be a living force that flows rhythmically through "meridians" in the body. The methods of acupuncture and acupressure are used to stimulate the flow at special acupoints along these meridians, although their location has never been consistently specified. The chi force is not limited to the body, but is believed to flow throughout the environment. [5] When building a house, many believers rely on a feng shui master to decide on an orientation that is well-aligned with this flow.

As modern science developed in the West and the nature of matter was gradually uncovered, a few scientists sought scientific evidence for the nature of the living force. After Newton had published his laws of mechanics, optics, and gravity, he spent many years looking for the source of life in alchemic experiments. His search was not

irrational, given the knowledge of the day. Newtonian physics provided no basis for the complexity that is necessary for any purely material theory of life or mind. This would eventually require quantum physics. Furthermore, Newtonian gravity had an occult quality about it, with its invisible action at a distance. Gravity seemed to be transmitted across space with no intervening matter evident. Perhaps the forces of life and thought had similar immaterial properties. Still, Newton and others who followed the same trail never managed to uncover a signal for a special substance of spirit or life.

In the eighteenth century, Anton Mesmer imagined that magnetism was the universal living force and treated patients for a wide variety of ills with magnets, a therapy still being promoted today. He believed that a force called "animal magnetism" resided in the human body and could be directed into other bodies. Indeed, patients would exhibit violent reactions when Mesmer directed his energy toward them by pointing his finger, until the flow of "nervous current" would rebalance the patient's energies. [6] Today, "mesmerism" has become associated with hypnosis and disconnected from animal magnetism or other notions of a living force, but Mesmer's ideas have survived in various modern "holistic" theories that contradict science.

In the late nineteenth century, prominent scientists, including William Crookes and Oliver Lodge, sought scientific evidence for what they called the "psychic force" that they believed was responsible for the mysterious powers of the mind being exhibited by the mediums and spiritualist hucksters of the day. They thought it might be connected with the electromagnetic "aether waves" that had just been discovered and were being put to amazing use. If wireless telegraphy was possible, why not wireless telepathy? This was a reasonable question at the time. However, while wireless telegraphy thrived, wireless telepathy made no progress in a century of uncorroborated "parapsychology" experiments that followed. [7]

Conventional medicine follows conventional biology, conventional chemistry, and conventional physics in treating the material body—a complex, nonlinear system assembled from the same atoms and molecules that constitute nonliving objects such as computers and automobiles. Medical doctors are in some sense glorified mechanics, who repair broken parts in the human machine. Indeed, any stay in the hospital reinforces this image, as one is hooked to devices that measure blood pressure, temperature, oxygen saturation, and many other physical parameters. You are almost always treated with drugs designed to alter the body's chemistry. You usually get better,

every time but once. But unless you are a physicist, you tend to view the experience rather negatively.

No surprise, then, that alternative practitioners find many eager listeners when they announce that they go beyond materialism and mechanism and treat the really important part of the human system—the vital substance of life itself. People's religious sensibilities and images of self-worth are greatly mollified when they are told that they are far more than an assemblage of atoms—that they possess a living field that is linked to both God and cosmos. Furthermore, the desperately ill will quite naturally seek out hope wherever they can find it. So a ready market exists for therapists who claim they can succeed where medical science fails.

## **Unified Biofield Theory**

The hypothetical vital force is often referred to these days as the bioenergetic field. Touch therapists, acupuncturists, chiropractors, and many other alternative practitioners tell us that they can effect cures for many ills by "manipulating" this field, thereby bringing the body's "live energies" into balance.

The use of "bioenergetic" in this context is somewhat ambiguous. This term is applied in biochemistry to refer to the readily measurable exchanges of energy within organisms, and between organisms and the environment, which occur by normal physical and chemical processes. This is not, however, what the new vitalists have in mind. They imagine the bioenergetic field as a holistic living force that goes beyond reductionist physics and chemistry.

By "holistic" here, I am not referring to trivial homilies such as the need to treat the patient as a whole and recognize that many factors, such as the psychological, emotional, and social, contribute to well-being along with the physical body. While this is often the example used by those who claim to practice holistic medicine, they imply that something much more is at work in their treatments. Treating the whole person does not contradict any reductionist principles. Neither does the fact that the parts of a physical system interact with one another. Reductionism is not about a universe of isolated objects. The holism that goes beyond reductionism implies a universe of objects that interact simultaneously and so strongly that none can ever be treated separately. This concept enters into the discussion of bioenergetic fields, where that field is imagined as some cosmic aether that pervades the universe and acts instantaneously, faster than the speed of light, over all of space.

Therapeutic touch and other forms of "holistic healing" are now widely practiced within the nursing community. [8] These seem to be based on a theoretical system called "The Science of Unitary Human Beings," proposed by Rogers. [9] According to Rogers, "energy fields are postulated to constitute the fundamental unit of the living and nonliving." The field is "a unifying concept and energy signifies the dynamic nature of the field. Energy fields are infinite and paradimensional; they are in continuous motion." [10]

The exact nature of the bioenergetic field is not specified, even as a speculative hypothesis, in Rogers or the other literature on holistic healing. On the one hand, the biofield seems to be identified with the classical electromagnetic field; on the other it is confused with quantum fields or wave functions. For example, Stefanatos writes: "The principles of energy medicine originate in quantum physics. Bioenergetic medicine is the study of human and animal bodies as dynamic electromagnetic fields existing in an electromagnetic environment." [11]

I must at least mention the highly celebrated recent publication in a major medical journal of the tests of therapeutic touch performed by the schoolgirl Emily Rosa. [12] In this simple experiment, TT practitioners were unable to detect Emily's "energy field." It seems that not only is this field so transparent that no one can see it, the theory behind it is so transparent that even a child can see through it.

## **Auras and Discharges**

Perhaps the most specific model for the bioenergetic field is some special form of electromagnetism. Advocates claim that measurable electromagnetic waves are emitted by humans. In the *Journal of Advanced Nursing*, Patterson relates "spiritual healing" to the belief that "we are all part of the natural harmonious energy of the universe." Within this universal energy field is a human energy field "that is intimately involved with human life, often called the 'aura.' " [13]

Some self-described psychics claim that they can "see" a human aura. The claim has not been substantiated. [14]

Indeed, humans have auras that can be photographed with infrared-sensitive film. However, this can be trivially identified as "black body" electromagnetic radiation. Everyday objects that reflect very little light will appear black. These bodies emit invisible infrared light that is the statistical result of the random thermal movements of

all the charged particles in the body. The wavelength spectrum has a characteristic smooth shape completely specified by the body's absolute temperature. As that temperature rises, the spectrum moves into the visible. The sun, for example, radiates largely as a "black body" of temperature 6,000 K, with a broad peak at the center of the visible spectrum in the yellow. At their much lower body temperatures, humans radiate mostly in the infrared region of the spectrum that is invisible to the naked eye but easily seen with infrared detection equipment.

The inability of the wave theory of light to explain the black body spectrum led, in 1900, to Planck's conjecture that light comes in bundles of energy called "quanta," thus triggering the quantum revolution. These quanta are now recognized as material photons. It is somewhat ironic that holists find such comfort in quantum mechanics, which replaced etherial waves with material particles.

Surely black body radiation is not a candidate for the bioenergetic field, for then even the cosmic microwave background, 2.7K radiation left over from the big bang, would be "alive." Black body radiation lacks any of the complexity we associate with life. It is as featureless as it can be and still be consistent with the laws of physics. Any fanciful shapes seen in photographed auras emanating from humans can be attributed to optical and photographic effects, uncorrelated with any property of the body that one might identify as "live" rather than "dead," and the tendency for people to see patterns where none exist.

Stefanatos [15] tells us that the "electromagnetic fields (EMF) emanating from bacteria, viruses, and toxic substances affect the cells of the body and weaken its constitution." So the vital force is identified quite explicitly with electromagnetic fields and is said to be the cause of disease. But somehow the life energies of the body are balanced by bioenergetic therapies. "No antibiotic or drug, no matter how powerful, will save an animal if the vital force of healing is suppressed or lacking." [16] So health or sickness is determined by who wins the battle between good and bad electromagnetic waves in the body.

Now it would seem that all these effects of electromagnetic fields in living things would be easily detectable, given the great precision with which electromagnetic phenomena can be measured in the laboratory. Physicists have measured the magnetic dipole moment of the electron (a measure of the strength of the electron's magnetic field) to one part in ten billion, and calculated it with the same accuracy. They surely should be able to detect any electromagnetic effects in the body powerful enough to

move atoms around or do whatever happens in causing or curing disease. But neither physics nor any other science has seen anything that demands we go beyond established physical theories. No elementary particle or field has been found that is uniquely biological. None is even hinted at in our most powerful detectors.

Besides the infrared black body radiation already mentioned, electromagnetic waves at other frequencies are detected from the brain and other organs. As mentioned, these are often claimed as "evidence" for the bioenergetic field. In medicine, they provide powerful diagnostic information. But these electromagnetic waves show no special characteristics that differentiate them from the electromagnetic waves produced by moving charges in any electronic system. Indeed, they can be simulated with a computer. No marker has been found that uniquely labels the waves from organisms "live" rather than "dead."

Kirlian photography is often cited as evidence for the existence of fields unique to living things. For example, Patterson [17] claims that the "seven or more layers within an aura, each with its own colour," have been recorded using Kirlian photography.

Semyon Davidovich Kirlian was an Armenian electrician who discovered in 1937 that photographs of live objects placed in a pulsed high electromagnetic will show remarkable surrounding "aura." In the typical Kirlian experiment, an object, such as a freshly-cut leaf, is placed on a piece of photographic film that is electrically isolated from a flat aluminum electrode with a piece of dielectric material. A pulsed high voltage is then applied between another electrode placed in contact with the object and the aluminum electrode. The film is then developed.

The resulting photographs indicate dynamic, changing patterns, with multicolored sparks, twinkles, and flares. [18] Dead objects do not have such lively patterns! In the case of a leaf, the pattern is seen to gradually go away as the leaf dies, emitting cries of agony during its death throes. Ostrander and Schroeder described what Kirlian and his wife observed: "As they watched, the leaf seemed to be dying before their very eyes, and the death was reflected in the picture of the energy impulses." The Kirlians reported that "We appeared to be seeing the very life activity of the leaf itself." [19]

As has been amply demonstrated, the Kirlian aura is nothing but corona discharge, reported as far back as 1777 and completely understood in physical terms. Controlled experiments have demonstrated that claimed effects, such as the cries of agony of a

dying leaf, are dependent on the amount of moisture present. As the leaf dies, it dries out, lowering its electrical conductivity. The same effect can be seen with a long dead but initially wet piece of wood. [20]

Once again, like the infrared aura, we have a well-known electromagnetic phenomenon being paraded in front of innocent lay people, unfamiliar with basic physics, as "evidence" for a living force. It is nothing of the sort. Proponents of alternative medicine would have far fewer critics among conventional scientists if they did not resort to this kind of dishonesty and foolishness. [21]

## Quantum Healing

"Quantum" is the magic incantation that appears in virtually everything written on alternative medicine. It seems to be uttered in order to make all the inconsistencies, incoherences, and incompatibilities of the proposed scheme disappear in a puff of smoke. Since quantum mechanics is weird, anything weird must be quantum mechanics.

Quantum mechanics is claimed as support for mind-over-matter solutions to health problems. The way the observer is entangled with the object being observed in quantum mechanics is taken to infer that human consciousness actually controls reality. As a consequence, we can all think ourselves into health and, indeed, immortality-if we only buy this book. As I showed in a previous issue of this journal, "quantum healing" is based on a particularly misleading interpretation of quantum mechanics. [22] Other interpretations exist that do not require any mystical ingredients. [23]

"Einstein" is a name found frequently in the literature on bioenergetic fields. Stefanatos says: "Based on Einstein's theories of quantum physics, these energetic concepts are being integrated into medicine for a comprehensive approach to disease diagnosis, prevention, and treatment." [24]

Einstein's theories of quantum physics? What theories are these? While Einstein contributed mightily to the development of quantum mechanics, especially with his photon theory, modern quantum mechanics is the progeny of a large group of early century physicists: Planck, Bohr, de Broglie, Heisenberg, Schrodinger, Pauli, Born, Jordan, and Dirac. Each made contributions to quantum mechanics at least as important as Einstein's. Einstein's immortality rests securely enough on his two theories of relativity.

Referring to well-known authorities such as Fritjof Capra and Ken Wilber, Stefanatos tells how "Einstein's quantum model replaced the Newtonian mechanistic model of humankind and the universe." [25] Thus holistic healing is associated with the rejection of classical, Newtonian physics. Yet holistic healing retains many ideas from eighteenth- and nineteenth-century physics. Its proponents are unaware that these ideas, especially superluminal holism, have been rejected by modern physics as well.

Never mind that Einstein was not the inventor of quantum mechanics and objected strongly to its anti-Newtonian character, saying famously, "God does not play dice." Never mind that electromagnetic fields were around well before quantum physics and it was Einstein himself who proposed that they are composed of reductionist particles. And never mind that Einstein did away with the aether, the medium that nineteenth-century physicists thought was doing the waving in an electromagnetic wave, and a few others thought might also be doing the waving for "psychic waves." The bioenergetic field described in holistic literature seems to be confused with the aether. Or perhaps no confusion is implied. They each share at least one common feature—nonexistence.

As the nineteenth century drew to a close, experiments by Michelson and Morley had failed to find evidence for the aether. This laid the foundation for Einstein's theory of relativity and his photon theory of light, both published in 1905. Electromagnetic radiation is now understood to be a fully material phenomenon. Photons have both inertial and gravitational mass (even though they have zero rest mass) and exhibit all the characteristics of material bodies. Electromagnetism is as material as breath, and an equally incredible candidate for the vital field.

Much as we might wish otherwise, the fact remains that no unique living force has ever been conclusively demonstrated to exist in scientific experiments. Of course, evidence for a life force might someday be found, but this is not what is claimed in the literature that promotes much of alternative medicine. There you will see the strong assertion that current scientific evidence exists for some entity beyond conventional matter, and that this claim is supported by modern physical theory—especially quantum mechanics. Furthermore, the evidence is not to be found in the data from our most powerful telescopes or particle accelerators, probing beyond existing frontiers. Rather, it resides in vague, imprecise, anecdotal claims of the alleged curative powers of traditional folk remedies and other nostrums. These claims simply do not follow from reasonable application of scientific criteria.



The bioenergetic field plays no role in the theory or practice of biology or scientific medicine. Vitalism and bioenergetic fields remain hypotheses not required by the data, to be rejected by Occam's razor until the data demand otherwise.

## The Significance Level of Medical Studies

In my field of particle physics, reputable journals such as *Physical Review Letters* will not publish any claim of a new phenomenon, such as evidence for the top quark or the mass of the neutrino, unless the data have a "significance level" of 10 to the power of -4, or less. This means that if the same experiment were repeated 10,000 times, the reported effect would have been produced artifactually, as a statistical fluctuation or systematic error, no more than once on average.

In medicine, and related fields such as psychology and pharmacology, and in the social sciences as well, the significance level for publication in the best journals is typically 5%. That is, the experiment need only be repeated 20 times, on average, to have the reported effect not be real but to result from an artifact of the experiment. This means that every twentieth paper you read could be a fluke, although many, of course, exceed the significance threshold and so the fraction of reliable results is probably, thankfully, much greater.

This very loose criterion in the human sciences is justified by the very reasonable argument that any new result should be put to use as soon as possible in case it may save lives. Indeed, medical researchers are placed under pressures, unheard of in the rest of science, to make their results available well before they can be confirmed by criteria and procedures that are quite conventional in other disciplines. Also, in many cases this is perhaps the best that can be done, given the greater complexity of the human body or human social systems compared to the typical systems studied in physics. Still, it might do well for the human disciplines to tighten up a bit. They will avoid much confusion and very likely make better progress, as fewer researchers waste time and money following blind alleys that are suggested by research already "published in peer-reviewed journals."

We might ask: What criterion should be applied to those studies that claim to show that some therapy works when that therapy violates well-established scientific principles, such as the laws of physics? For example, should we publish an experiment that indicates that therapeutic touch works where the significance level is 5%? I argue that we should not. Given the difficulty of accurately estimating errors in any human ex-

periment, any such claims are far more likely to be wrong than 1 in 20. One in one are more likely to be wrong.

I am not advocating censorship-just tighter standards to apply for any extraordinary claim, in physics and medicine. When the significance level for bioenergetic fields reaches 0.01 percent, that is, one in 10,000 chances for an artifact, then publish away and watch physicists scramble for an alternative to their conventional theories of matter.

If bioenergetic fields exist, then some 200 years of physics, chemistry, and biology has to be reevaluated. I would insist that any experiment claiming their existence be forced to obey the same criteria that particle physicists and other forefront researchers must obey, a significance level of 1 part in 10,000 rather than 1 part in 20. It is one thing to publish a low significance result that does not violate known principles; it is another to publish one that forces science to undergo a paradigm shift and redirect the limited resources of research to areas that are extremely unlikely to produce any payoff.

Much of alternative medicine is based on claims that violate well-established scientific principles. Those that require the existence of a bioenergetic field, whether therapeutic touch or acupuncture, should be asked to meet the same criteria as anyone else who claims a phenomenon, the existence of which goes beyond established science. They have an enormous burden of proof, and it is time that society laid it on their thin shoulders.