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The Physics / Biology Interface: Implications for Clinical Medicine

There is a basic assumption underlying biomedical science in western industrialized societies that profoundly influences the practice of clinical medicine. The tenet of this assumption -- that all causality can be found in matter -- is so axiomatic that it is never discussed. Yet it affects not only the variables included in investigations of disease pathways, but also the options available for treatment. In concrete terms, the belief is that the body is composed of matter, disease is caused by some form of matter (genes, bacteria, viruses, etc.), and that the best treatment options must, therefore, also be based on applying matter (e.g., pharmaceuticals) or removing matter (organ or tumor resection). Not only is western medicine based on a materialist frame of reference, it is reductionist, and becoming increasingly more so with the current focus on genetics. The human genome project reflects the materialist belief that the structure of DNA and the different alleles and single nucleotide polymorphisms that are part of the genome, are the source of the body's physical characteristics, predisposition for disease, psychological attributes and psychiatric illnesses. According to this theory, if we succeed in identifying and labeling the structure of the genome, we will have the knowledge we need to understand not only how, but why human beings function the way they do, and we will have most of the information we need to treat human disease. This basic assumption is internally inconsistent because it contradicts the very data on which it claims to be based. The most common causes of mortality, namely cardiovascular diseases

and cancer, are complex, meaning that they have multiple causes, including genes, lifestyle and environmental factors. This is why establishing the presence or absence of an oncogene does not provide sufficient information for predicting whether an individual will contract cancer.

Furthermore, the subsystems and organs of the body are also complex. This means that the aggregate organ or system exhibits emergent properties, or characteristics that are not present in any form in its constituent parts. Learning everything there is to know about an individual muscle or a blood cell does not provide enough information for conceptualizing the properties of the blood transport system, even though both muscle and blood cells are integral parts of this system. Furthermore, just as the component cells of an organ influence its function, the emergent properties of the composite system or organ influence the function of the component cells. Causality goes in both directions, not just from singular to complex, but also from composite organ or system to the single unit. It is not possible to understand how an organ or tissue works by describing the function of its individual components. A molecule or receptor isolated from the host organism will behave in one way when exposed to a stimulus *in vitro*, but in a completely different way when reintroduced into the host organism where it is no longer isolated from the surrounding humoral environment. Herein lies the first problem for westernized clinical medicine. Its treatments are based on the incorrect assumption that complex diseases can be understood by reducing them to their smallest constituent parts. Despite the obvious inconsistencies in the reductionist model and the lack of data supporting its usefulness in the treatment of disease, billions of dollars continue to be spent on the human genome project, in the belief that it provides the ultimate answer to human disease.

However, reductionism is only one of several problems with the current medical model. A second problem stems from basing theories of disease causality on the outmoded belief that physiological functioning can be understood by investigating matter. This is a problem because experimental data from physics long ago rejected materialism as a basis for understanding the nature of reality. The assumption of biomedical scientists and clinicians is that because disease manifests on a physical plane, its cause can be found there, and a material treatment is the only logical option. Emphasis is placed on the chemical and cellular components of different organs and systems in the body and how their structure influences function (e.g., how a hormone locks onto a receptor, how an antigen responds to an antibody, etc.), while ignoring the underlying essence of matter, which is the ener-

getic forces of atomic structure and the electric characteristics that create chemical bonds. Even the shape of molecules stems from their attractive and repulsive forces. Since all electrons have the same charge, they repel each other, and the number of electrons in the outer shell of an atom determines not only its chemical bonding properties, but also its shape. The electrons configure themselves so that they are as far from each other as possible. If there are only two pairs, they are on opposite sides of the nucleus and are linearly aligned with it. If there are four, the angle that puts them farthest apart is 109.5° and the pairs are on different planes, forming a tetrahedron. If a pair of electrons belongs to only one nucleus, their electron cloud has one shape, but if a pair of electrons in a bond shares two nuclei, such as in a covalent bond, their electron cloud is shaped differently because it moves within the fields of both nuclei. Thus, the electron configuration of atoms and the shape of molecules are both determined by the repelling forces of electrons. Molecular structure is primarily determined by energetic forces, not matter.

Similar principles apply to physiological functioning in the body. The materialist assumption is that the function of, and communication between the body's different systems is determined by the chemical composition of the hormones, neurochemicals, enzymes, nutrients, etc. In explaining the causality of disease, it focuses on the physical characteristics of the chemical subcomponents of these substances and of any invading bacteria or viruses. The resulting model is partially true but gives a very skewed and incomplete picture of how the body functions, again, because it ignores the fundamental role of bioelectric fields. Although it is probably common knowledge that nerve impulses throughout the body propagate as a result of electrical energy; other forms of biological oscillations seem to be less well known by medical scientists. This is rather astonishing since oscillations in biological systems are practically ubiquitous (2). They include neural oscillators, the cardiac pacemaker, and oscillations in secretory cells in the anterior pituitary, adrenal gland and pancreatic beta cells. No cardiologist could function without the use of EKGs to measure heart rhythms, and neurosurgeons performing operations on epileptics are dependent on EEGs to measure brain frequencies. MRIs, which measure the magnetic fields emanating from the head, are an invaluable tool in the diagnosis of tumors. However, although energy aspects of biological systems such as these oscillators and piezoelectricity in living tissues, provide accurate information for diagnosing the presence of systemic disease, they are ignored as possible mechanistic pathways and have been relegated by biomedical scientists to the status of epiphenomena having no intrinsic function.

Despite the ignorance and lack of interest in the medical community concerning bioelectric fields, it has been proposed by biologists that biological oscillations play an important role in biochemical regulation (3). An example that illustrates this is the oscillations that occur in cell membranes, which can arise when negative and positive components in a particular section of the dipolar layer vibrate against each other (4). Just as engineers long ago discovered that digitalizing information allowed a more accurate signal transfer by protecting the signal from the “noise” of surrounding systems; so too, can the encoding of information at a cellular level, allow resistance to distortion from ambient cellular processes. Physiologically, the input signal can be in the form of a hormone attaching to the receptor on a secretory cell, light to a photoreceptor, or mechanical pressure to a stretch receptor. The intensity of the signal determines the frequency to which it will be encoded (analogue to digital conversion). The signal then travels through the cell to the response site, where the frequency determines the intensity of response (digital to analogue conversion) (4). Bioelectric fields have also been observed to play pivotal roles in embryonic development and regrowth of severed limbs in certain species (5-13). In sum, the medical community seems to be ignorant of abundant documentation of an important mechanistic role for bioelectric fields in biological functioning.

However, the inadequacy of materialism as a theoretical model for the understanding of human physiological and psychological functioning is even more substantive. The more basic problem with materialism is that it involves a fundamental misunderstanding about the ultimate nature of reality. Not only is the materialist view of reality inaccurate, if we take Heisenberg at his word, energy, not matter, is actually primary: “We can say that all particles are made of the same fundamental substance, which can be designated energy or matter; or we can put things as follows: the basic substance “energy” becomes “matter” by assuming the form of an elementary particle (14).” Another quantum physicist, Hans Peter Durr, expresses this relationship similarly (15): “Einstein’s special theory of relativity, however, ...enforced another important change by revealing mass as a special form of concentrated energy. As a consequence there is no principal difference between matter and force field anymore particles, in fact matter as such, disappear as possible building blocks of matter and are replaced by a number of basic fields spread out in space....” Thus, as seen from the perspective of modern physics, namely the tenets of quantum theory and the experimental data supporting it, it has been conclusively established that reality cannot be reduced to little building blocks of matter. This divergence in the way physics and biomedical science

view the nature of reality has profound implications for the scientific questions posed by medical scientists and the variables they choose to investigate. The latter part of Heisenberg's statement, namely, that energy becomes matter by assuming the form of an elementary particle, is the basis for the hypotheses proposed in the remainder of this paper.

The premise of this paper, based on the physics of quantum theory, is that the physical manifestations of disease such as a cancer tumor are not caused by matter, but originate as blockages in energy meridians. The physical manifestations and clinical symptoms that we observe, such as chemical and immune changes or the appearance of tumors, occur farther "downstream" in the causal pathway. Their origin lies in changes in an underlying, dynamic, energy field. It is further hypothesized, that ignorance on the part of medical scientists concerning the principles of modern physics and its interface with biology, is a primary reason for the consistently poor track record of traditional methods in the treatment of malignant neoplasms.

Scientific Process in the Formation of Hypotheses

Since the hypotheses in this paper challenge the assumptions of mainstream biomedical research, a good place to begin a discussion of this theory is with a review of scientific process. This process begins with *observation*, and is followed by *reflection*. When we observe phenomena that don't seem to make sense, we try to comprehend them by examining the principles and laws that we do understand to see if any part of this new phenomenon fits these theories. Through reflection, we arrive at *hypotheses* that might explain what we have observed. These hypotheses serve as the basis for subsequent experiments to test our theories. The resulting *experimentation* either leads to the *substantiation or rejection* of our hypotheses. If rejected, we *reformulate* them based on the results of the first experiment. Reformulated theories are again subjected to experimental verification until our understanding of the issue is complete.

Observations

We can begin with an examination of data that are typically ignored by allopathic medicine because their successes contradict the unspoken belief systems and assumptions on which traditional medical treatments are based. Acupuncture will serve as a focus for this discussion because it provides a plethora of available data

and its clinical practice in the U.S. is steadily increasing. A cursory literature search reveals hundreds of references on acupuncture, most of which investigate clinical outcomes. An overview of the data indicates that acupuncture can be efficacious in the treatment of a broad range of conditions, including neurological problems (e.g., stroke rehabilitation (16), anesthesia (17); infectious disease (e.g., chronic urinary tract infection (18); cystitis (19); angina pectoris (20); and immunomodulation in patients with malignant neoplasms (21-23). According to the 1997 Consensus Development Conference on Acupuncture held at the National Institutes of Health, (21) findings from basic research have begun to elucidate mechanisms of action, including the release of opioids and other peptides in the central nervous system and the periphery, as well as changes in neuroendocrine function. Examples of physiological systems that have been reported to be affected include ACTH, oxytocin, vasopressin, norepinephrine, follicle stimulating hormone, prolactin, and 17-hydroxycorticosteroids, immune and cardiovascular functions (24-26). At first glance, this seems to indicate that the pathways of efficacy are consistent with those we use in allopathic medicine and that continuing this line of research will eventually lead to a more complete understanding of acupuncture mechanisms.

Reflection

However, if we continue the scientific process described above and follow our observations with reflection, we are forced to admit that the data do not support this conclusion. To begin with, needles are not inserted into nerves. If they were, it would be incredibly painful and acupuncture is, for the most part, painless. Second, the needle locations do not have any logical association with the CNS peptides and changes in neuroendocrine function that are proposed as mechanisms of healing. The neuroendocrine data cited above would fit more logically as part of the changes occurring farther downstream in the causal pathway. A clinical case history will be used to illustrate this point. A 13-year-old girl who had a 5-8 mm palpable mass in her right breast and had been bleeding from the nipple for two months. When this was discovered by her mother, she was taken to a doctor, who referred her to a surgeon. The surgeon diagnosed intraductal papilloma, probably benign. He recommended that the area be watched and re-examined every three months due to a familial history of breast cancer. If the mass did not enlarge, excision could be postponed to avoid deforming the breast before it reached maturity. The surgeon made it clear that the mass would have to be surgically removed. The

mother then took the child to an acupuncturist, who, after lengthy discussion with the 13 year old, determined that she had a blockage in one of the energy meridians that originated in the big toe and extended into the chest. He hypothesized that it began after she had sustained a severe injury to her big toe several years earlier in a horse riding accident, and that it was exacerbated when she became consistently dehydrated in the sports she was currently pursuing. The acupuncturist did not insert needles, but instructed the mother to massage two acupuncture points on the front of the child's shins every night before bedtime. The mother, somewhat skeptical, did as she was instructed. Within two weeks, the lump and blood-like discharge had disappeared and the girl has had no recurrence in the intervening seven years. How could the massage of two points on the child's legs possibly influence what happened in the breast? Or how could injury to a toe, cause a breast lump in the first place? According to traditional medicine, it couldn't, and we would be forced to conclude that the surgeon's diagnosis had been incorrect. Certainly, there are many reasons for breast cysts: infections, malignancy, etc. Maybe it would have gone away by itself. Furthermore, these acupuncture points are not consistent with any known plausible therapeutic mechanism.

In cases such as this, where observed clinical phenomena do not seem to make sense, cognitive dissonance arises. Either the diagnosis was wrong or the theory that we are using to judge the reliability of the observations is flawed. Traditional medical scientists have opted for the former alternative without a great deal of reflection. Based on only one case history, this would be a logical conclusion – the diagnosis was simply incorrect. However, the clinical literature on acupuncture is now quite extensive and with some minor exceptions regarding pain, the needle locations still do not make anatomical sense with respect to the neurophysiological changes that are purported as mechanisms.

Let us therefore suspend premature judgment and continue the scientific process by reflecting on what we know. The theory of traditional acupuncture states that clinical changes are achieved by manipulating the energy flow in meridians throughout the body. However, the concept of energy flow in the body (other than heat and metabolic energy) is not consistent with western concepts. Despite this, as mentioned earlier, electromagnetic fields are the primary basis for the diagnosis of a number of common ailments. What an EEG or an ECG measures is an existing electromagnetic field on the surface of the body, the rhythm, time pattern and/or morphology of which changes when the body becomes diseased. Despite

the paramount importance of these electromagnetic systems in diagnosing illness, the medical community regards them as epiphenomena.

Furthermore, electrostatic forces of attraction between oppositely charged groups stabilize many amino acids in living organisms.

They occur in and crystallize from aqueous solutions as dipolar ions (28), i.e., molecules incorporating both positive and negative charges. Atoms on dipolar molecules oscillate, creating electromagnetic waves that can be amplified by water (whose molecules also have a dipole moment). Dipoles have some similarity to magnets except that the strength of their attraction is not constant, but determined by the size of their charges and their angle of separation on the molecule (29).

Many of the molecules in the body are dipoles – water molecules, protein molecules, etc. Theoretically the structure of dipoles would allow them to align with other dipoles in “strings.” Is it possible that the acupuncture meridians are strings of dipoles held together by their electric charges, somewhat similar to the principle of a ferromagnetic? In that case, the structure of these meridians might be partially determined by the geometry of the body. If such meridians exist, the insertion of acupuncture needles might function to modulate their orientation by changing the vibration of atoms in nearby molecules, resulting in the propagation of an electromagnetic wave along the meridian. Since the chemical properties of atoms and molecules are determined by their electron configurations, which in turn determine the types of bonds they form with other molecules, a perturbation at a particular point in a meridian might be associated with a specific range of chemical changes (e.g., neuroendocrine, immune) resulting from changes in the physical properties of the molecules and membrane potentials affected. Since traditional acupuncture theory postulates that these meridians interact, needle insertion at one point may initiate a chain reaction that stimulates other meridians and other chemical changes. From this perspective, physical changes in energy systems would precede chemical changes of the type that have been reported in clinical acupuncture studies.

The concept of longitudinal electric modes based on the dipolar properties of cell membranes was introduced by Frohlich in 1968 (3). According to his theory, components with electric dipole oscillations interact through nonlinear long-range Coulomb forces and thus establish a branch or branches of longitudinal electric modes in frequency ranges of 10^{11} - 10^{12} sec⁻¹. If the rate of energy supply to the relevant components is sufficiently large, it gets channeled into a single mode, which

then presents a strongly excited coherent longitudinal electric vibration whose wavelength depends on details of the geometrical arrangement of the components. According to Frohlich, a certain fraction of the supplied energy is not thermalized but stored in a single mode that exhibits long-range phase correlations. Del Guidice et al. (30), have also pointed out what Heisenberg and other quantum theorists established, namely, that the two features of a quantum field: its quanta, e.g., the particles that constitute it; and the phase, which determines how the different simultaneous trajectories of the quantum object must be superimposed, cannot be simultaneously known. If we focus on counting the particles or determining where specific particles are located, we lose all information on the phase. Yet, as Del Guidice points out, the “particle representation” of matter is the mainstream approach for exploring condensed and biological matter. Focusing on particles and their location (e.g., describing the sequence of alleles on the genome) is precisely what biomedical science does, to the exclusion of examining the phase. This is the equivalent of describing light as only consisting of particles and completely ignoring its wave structure.

Theoretical Implications

What, if any, are the implications of this interpretation of physical phenomena for the study of medicine? The implication is that the molecules we are studying emerge from quantum wave dynamics and that underlying mathematical relatedness is essential to understanding them. This is directly contrary to what we usually assume, namely, that atoms or molecules are primary and their relatedness to each other is secondary. In searching for a particular allele on the genome, we are forgetting that the electrons of the adjacent alleles are combined in clouds of potential electrons and that the electrons of one allele are exactly the same as the electrons of another. Are we missing some important information by separating them and ignoring the interacting wave dynamics? If we ignore the energy aspects of matter, and thus the laws that apply to the inherent wave forms, we may have a great deal of difficulty understanding some of the material phenomena that we observe. Or we may simply “not see” some very important phenomena at all. For example, could it be, that homeopathic remedies retain the waveforms or imprints of the original chemical molecules that can no longer be detected?

What relevance do these facts have for the understanding of acupuncture, and what are the implications for clinical medicine? Data indicate that bioelectrical systems are an integral part of human physiology and that they have important

biological functions. Ninety percent of skin points of particularly high conductivity coincide with traditional acupuncture points (31). Together, these data indicate that bioelectrical phenomena are a common, and in fact, integral part of physiological functioning in the human body. Furthermore, electromagnetic phenomena outside the body can influence physiological functioning within it, as documented by the changes in cellular levels of cyclic AMP and enhanced DNA synthesis in skeletal cultures exposed to pulsed electric stimulation of both low (13 V/cm) and high (54 V/cm) field strength (32); and the diminishing effect of drug actions in cells that are exposed to electromagnetic fields (33). Thus, there are three basic facts that are currently being ignored in clinical medicine.

- 1) Ubiquitous bioelectrical phenomena in the human body (treated as epiphenomena)
- 2) Documented effects obtained from acupuncture locations that are not consistent with a mechanistic role for the neurophysiological and neuroendocrine systems that are purported to explain them.
- 3) The fact that the laws of physics determine chemical properties and experimental physics has demonstrated that matter and energy are the same fundamental substance.

Hypotheses

We are now ready for the third step in the process of scientific investigation, namely, hypothesis formation. We have discussed our observations and reflections. What then are the hypotheses?

Hypothesis 1: Biologically ubiquitous electromagnetic systems have potential for use in the treatment and prevention of multiple human diseases. Abuse of these systems (e.g., through radiation) can result in disease.

Hypothesis 2: The mechanism of acupuncture is fundamentally different from any currently known treatment in western medicine. Its demonstrated neurophysiological and biochemical efficacy is achieved not through manipulation of matter but through the manipulation of energy. The mechanism of energy meridians may involve dipole "strings."

Hypothesis 3: There are two primary approaches to the treatment and prevention of disease:

Approach 1: Apply matter to “fight” matter (e.g., pharmacology, surgical resection or amputation, the “war on cancer”). This method is characterized by the targeting of a specific organ, receptor, etc., which is denoted as primary. Additional, non-desirable effects on other organs, receptors and systems are termed “side effects.”

Approach 2: Regard the primary cause of matter as its underlying energy structure (in the human body, the meridian system). Restore the body’s innate ability to heal itself by removing blockages and restoring balance in this system (through methods such as acupuncture, Jin Shin Jyutsu, Qi Gong). The primary characteristic of this method is that it targets the whole body and local areas of concern change automatically as balance is restored.

Clinical Implications

A recent review of therapy-related malignancies following treatment of germ cell cancer (34), states that, “therapy-related malignancies probably represent the most severe long-term complication for patients cured of their primary malignancy, leading to death in those patients originally cured of their primary neoplasm.” Although that review discusses both chemotherapy and radiation related secondary malignancies, it estimates radiation-induced cancer to be extremely high, namely 3 to 7 times higher than in the general population. If the hypothesis presented in the present paper is correct, there arises the possibility that another explanatory mechanism in addition to the destruction of cellular DNA is the cause of those neoplasms, namely, damage to the underlying energy meridians due to cellular ionization (35). Radiation initiated ionization creates charged particles from either uncharged particles or dipoles. Given the long-range correlations previously mentioned, the uncontrolled cascade of chemical and bioelectric changes resulting from radiation would be devastating to the system as a whole.

Is it possible that a primary tumor could arise from the blockage of an energy meridian, as was stated by the acupuncturist who treated the 13 year old girl? If so, the underlying chemistry (e.g., estrogen receptor sensitivity, etc.) would be a result rather than a cause of the cancer. Treating the chemistry is one approach, albeit

farther downstream and more susceptible to “side effects” than treating the original energy block, which would be approaching the problem at its source. Obviously, these theories are speculative. However, the accumulating documentation of acupuncture efficacy for a wide range of human illnesses, together with the long-range coherences in biological systems previously described, warrants serious research into underlying mechanisms. Many billions of dollars have been spent on cancer research, with only moderate success. Although systemic involvement in the form of compromised immune function is required for tumor cells to proliferate, the focus of research strategies in oncology is still local, i.e. the primary neoplasm. Most types of chemotherapy (other than those targeting angiogenesis) still employ the basic mechanism of trying to kill the tumor and metastases while containing the “side-effects” to avoid killing the patient. They are “dose limiting,” which means that the goal is to destroy the tumor before killing the patient. If it were to be demonstrated that acupuncture mechanisms function in ways similar to those described in this paper, the possibility of a non-toxic, less invasive method of cancer treatment would be well worth investigating.

Variables not in the Experiment don't appear in the Results

Having worked through the first three steps of the scientific process (observation, reflection, formation of hypotheses) in the analysis of acupuncture mechanisms, it should now be evident that the accuracy of scientific data depends entirely upon the nature of the questions that spawn the hypotheses. Variables that are excluded from the original hypotheses will not be included in the experiments and will not appear in the results. As stated previously, concentration on the particles renders the wave aspects undetectable. Just as the blind man feeling the tusks of an elephant thinks the whole elephant is hard, smooth, curved and skinny, so too, can medical science be misled by incomplete data. It is the thesis of this paper that the current frame of reference in biomedical science is not wrong, but incomplete. We have left physics out of the equation. In so doing, we have been able to increase our knowledge about many important details of molecular and biochemical processes but have missed important aspects of the system as a whole. The implications for clinical medicine are profound. To paraphrase Daniel Boorstin (36), what is standing in the way of further scientific discovery, is not our ignorance, but the illusion of knowledge.

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