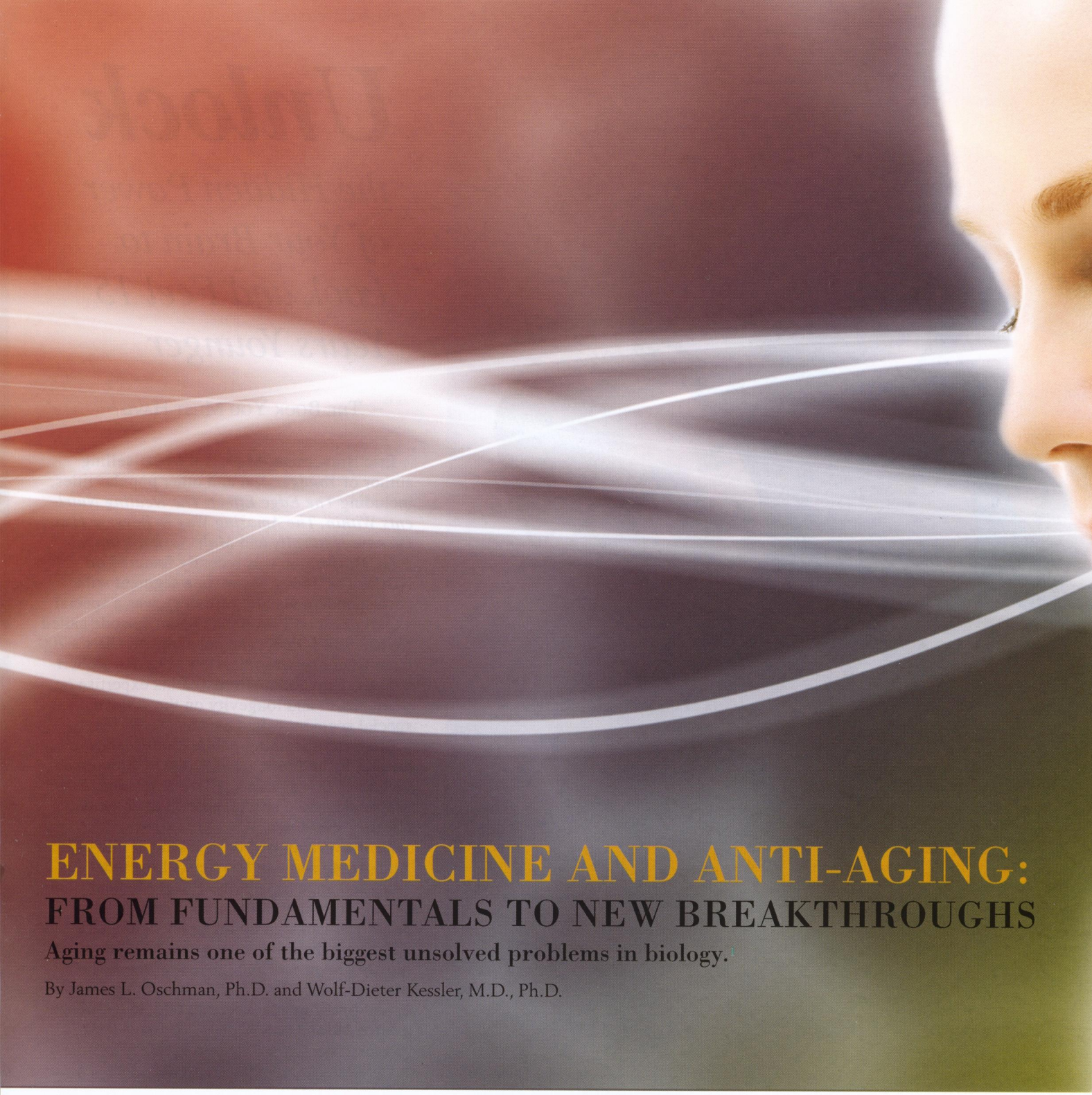


ENERGY MEDICINE AND ANTI-AGING:
FROM FUNDAMENTALS TO NEW BREAKTHROUGHS

Aging remains one of the biggest unsolved problems in biology.[1]

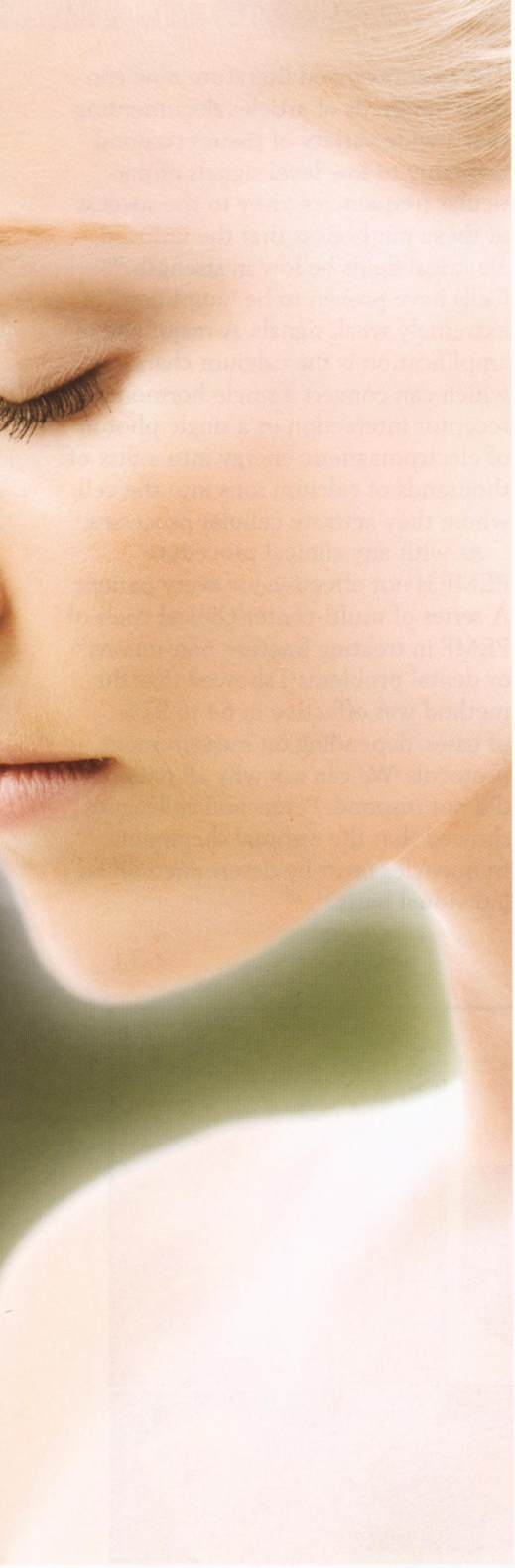
By James L. Oschman, Ph.D. and Wolf-Dieter Kessler, M.D., Ph.D.

INTRODUCTION

After much skepticism, energy medicine and the science behind it are emerging as rich and fascinating topics with major implications for anti-aging medicine. Those who follow this emerging field are being introduced to new vistas about how the human body works in health and disease, and anti-aging specialists are acquiring valuable new tools. This article will summarize the fundamentals of energetics and some of the significant breakthroughs. The fundamentals demystify energetics, answer the logical questions raised by skeptics and provide appropriate answers to patient questions. The breakthroughs are revealing how energetic methods are having a dramatic impact on health and longevity, and helping us solve one of the biggest unsolved problems in biology referenced above. We begin by discussing theories of aging to lay a foundation for new concepts based on discoveries in the fields of cell biology and biophysics.

THE FREE RADICAL AND OXIDATIVE STRESS MODELS OF AGING

Much of the theoretical and clinical discussion in anti-aging medicine centers on free radicals and oxidative stress.



In 1956, Denham Harman proposed a free radical theory of aging: cumulative damage from oxygen free radicals is a fundamental cause of aging.[2] This has become the most extensively tested of all theories of aging.[1] The most recent development is the recognition that free radicals and oxidative stress appear to contribute to the pathogenesis of many chronic diseases, including virtually all of the diseases of aging.

Because free radicals are molecules with one or more unpaired electrons, they have charge and magnetic properties that make them highly reactive as well as attractive to both antioxidant molecules and to mobile electrons - free radicals are electrophiles (literally *electron-lovers*). The energetic properties of free radicals have brought energy medicine to the forefront in the study of aging, oxidative stress and chronic disease. An enormous amount of research has been conducted on the metabolic production and breakdown of free radicals. However, to understand the reactive attributes of free radicals and to appreciate the energy medicine perspective one must go beyond biochemistry and molecular biology. Dietary and metabolic anti-oxidants act by donating one or more electrons to neutralize free radicals, but electrons by themselves are much smaller and more mobile and can act directly.[3] Rapid movements of anti-oxidant electrons into sites of inflammation or free radical damage provides us with a logical and testable hypothesis to explain the successes of various energy medicine techniques. Devices or hands-on therapies[4], [5] that introduce or induce microcurrents into tissues, alone or when combined with appropriate nutritional supplementation, can produce profound therapeutic and anti-aging effects.

OXIDATIVE STRESS IN AGING

The term *oxidative stress* represents the balance between the production of reactive oxygen species (ROS) and their derivatives, and their reduction by oxidative defense systems. Miwa et al[1] point out that the oxidative stress theory fits with many of the other hypotheses that have been developed to explain aging. For example, the *somatic mutation theory* states that oxidative damage to DNA leads to the accumulation of harmful mutations. The *error catastrophe theory* involves damage to ribosomes, and the *cross-linking theory* is based on the observation that with age, proteins, DNA and other molecules develop inappropriate attachments to one another that decrease their mobility or elasticity.

After reviewing the extensive research on the oxidative stress theory of aging, Miwa et al[1] concluded that it would be premature to suggest that oxidative stress is the major *determinant* of life span. The more conservative statement is that oxidative stress contributes to senescence or limits lifespan. This theory is supported by research on some model systems but not in others. The major issue is that increases in antioxidant activities through dietary supplementation or genetic manipulation have not consistently increased life span. At this stage in the evolution of Harmon's original theory it can be stated that the oxidative stress theory of aging is a valuable framework for further research. After looking at some of the basic physics of energy medicine, we will use this framework to explore recent discoveries that point to an entirely new model of oxidative stress and aging.

ENERGY MEDICINE AND LONGEVITY - THE FUNDAMENTALS

There is vast and detailed literature on oxygen chemistry and on the biochemistry of reactive oxygen species that forms the basis for most research on oxidative stress. What can basic physics, cell biology and biophysics add to the picture? The answer is that energy medicine involves a number of physical methods that influence biochemical and physiological processes. By "physical methods" we are referring to the therapeutic use of different forms of energy, such as magnetism, electricity, light, sound and heat. Such methods differ from pharmaceutical approaches that affect cell functions through the use of chemical agents that interfere with or augment specific cellular signalling or metabolic pathways. Energetic methods can also influence cellular signalling and metabolic pathways, but the influences are directly on the electronic or related physical properties of molecules. For example, electric and magnetic fields affect the movements of free radicals, other charged molecules, ions and electrons within and around cells. Moreover, there are indications that physical signals, as opposed to or in cooperation with chemical messengers, are the basis for some of the communication pathways in living systems. The current of injury that regulates wound repair is one important example.[6]

Understanding the roles of electricity and magnetism in therapeutics depends on two firmly established 19th century

laws of electromagnetism: Ampère's Law states that the flow of electric currents, as in a wire or coil, must produce magnetic fields in the surrounding space; and Faraday's Law of Induction states that oscillating magnetic fields such as those produced by a coil will give rise to oscillating electric currents in nearby conductors, including living tissues.

ENERGY MEDICINE AND LONGEVITY - SOME APPLICATIONS

Therapeutic application of these two laws of physics is illustrated by the use of pulsing electromagnetic fields (PEMF). The method was introduced in the 1980's for the treatment of non-union of fracture.[7] PEMF (Figure 1)

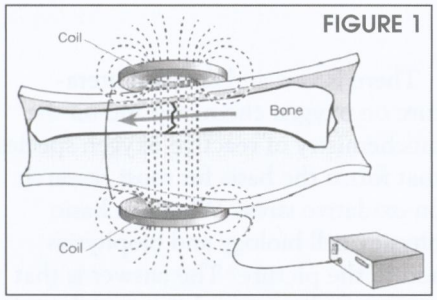


FIGURE 1

involves the use of electromagnets placed on either side of a fracture site. When currents are passed through the coils, magnetic fields are set up in the surrounding space (Ampère's Law). Living tissue is virtually transparent to magnetic fields. When these fields pass through the bone, currents are induced to flow through the fracture site in a direction perpendicular to the direction of the magnetic field lines (Faraday's Law of Induction).

This early work on bone led to the discovery that PEMF's of the appropriate frequency stimulate healing in a variety of other tissues, including ligament, skin, capillaries and nerves.[8] Further research revealed that PEMF's induce a cascade of reactions within tissues, traversing the cell surface and nuclear envelope to influence the genetic material.[5] Subsequently researchers have developed a variety of therapeutic approaches involving either the direct introduction of electricity into tissues (microcurrent therapy) or the induction of current flows by PEMF's.

The peer-reviewed literature now contains hundreds of articles documenting that a wide variety of tissues respond favorably to low level signals of particular frequencies.[9] Key to the success of these methods is that the induced electrical fields be low in strength.[10] Cells have proven to be "amplifiers" of extremely weak signals. A major site of amplification is the calcium channel, which can convert a single hormone-receptor interaction or a single photon of electromagnetic energy into a flux of thousands of calcium ions into the cell, where they activate cellular processes.[11]

As with any clinical procedure, PEMF is not effective for every patient. A series of multi-center clinical trials of PEMF in treating fracture non-unions[12] or dental problems[13] showed that the method was effective in 64 to 97% of cases, depending on measurement protocols. We can ask why all patients did not respond. Peters and colleagues showed that the optimal therapeutic frequencies must be determined on an individual basis.[14, 15]

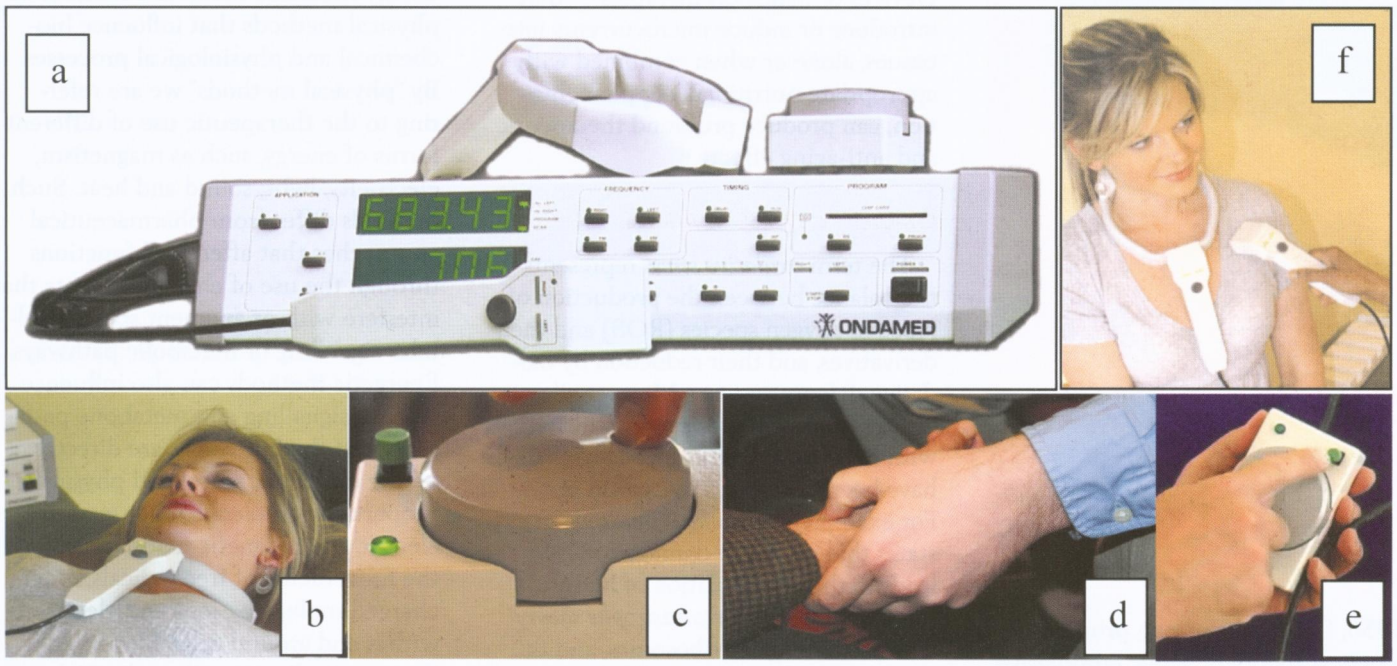


FIGURE 2

PATIENT-SPECIFIC PROCEDURES

This raises another question: can we determine the optimal frequency for the individual patient? The technology shown in Figure 2a answers this question. The procedure begins with placing a magnetic applicator around the patient's neck to introduce microcurrents into their body (Figure 2b). The operator then scans through a range of PEMF frequencies from 0.5 to 32,000 Hz by turning the wheel on the regulator (Figure 2c). When a physiologically significant frequency is induced into the body via the applicator, there is a subtle but palpable change in the radial artery pulse (Figure 2d). This is the vascular autonomic signal or VAS. When a response is detected, the operator depresses a button on the regulator (Figure 2e) and the device

stores the frequency in its memory. When the full range of frequencies has been scanned, the device is shifted to a second phase. The operator scans the body with a hand held applicator (Figure 2f) that sequentially emits the same frequencies the body responded to in the first phase. For each frequency, the appropriate anatomical position of the applicator and the optimal distance from the body are determined, again guided by the radial artery pulse.

To understand the mechanisms involved, we need to look at mechanisms of charge transfer in living systems. In the past, charge transfer has been attributed to the migrations of charged electrolytes that are abundant in the various body fluids. A new line of investigation points toward another charge carrier: the electron.

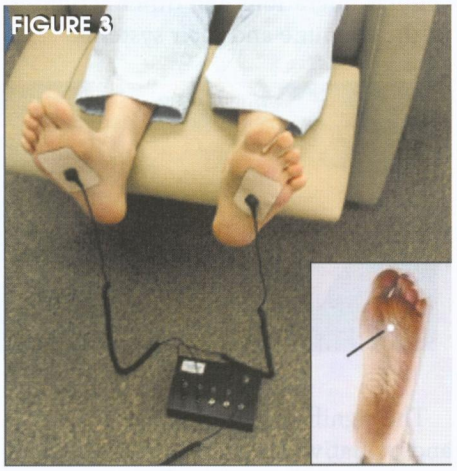
ELECTRONS AS CHARGE CARRIERS AND ANTIOXIDANTS

A number of investigators have remarked on the similarities between modern microelectronic circuits and living tissues. Several biophysicists have suggested that the quantum-mechanical electron tunneling that explains conduction in amorphous solids may take place in biomolecules such as proteins.[16] The consequence is rapid vectoral electron transport along structural biopolymer pathways or electron hopping between molecules. Until recently it has been difficult to verify these ideas experimentally, but this situation has changed. The new discoveries have direct application in understanding the basis for technologies such as those shown in Figures 1 and 2.

Significant information on charge movement in living systems has now emerged from a surprising source: study of the effects of connecting the human body to the earth, as by walking barefoot. The surface of the earth is a vast and continuously renewed source of electrons.[17] Skin contact with the earth allows electrons to enter the body. The modern use of shoes with insulating soles made of plastic or rubber prevents this. Recent research is showing that the resulting loss of contact with the earth has health consequences.

An experimental setup (Figure 3) allows researchers to study a variety of physiological parameters before and after grounding the body. While an earth connection can be established anywhere on the skin surface, a particularly important low resistance connection is on the ball of the foot. This point is known in the acupuncture literature as Kidney 1 (See, Figure 3).

FIGURE 3



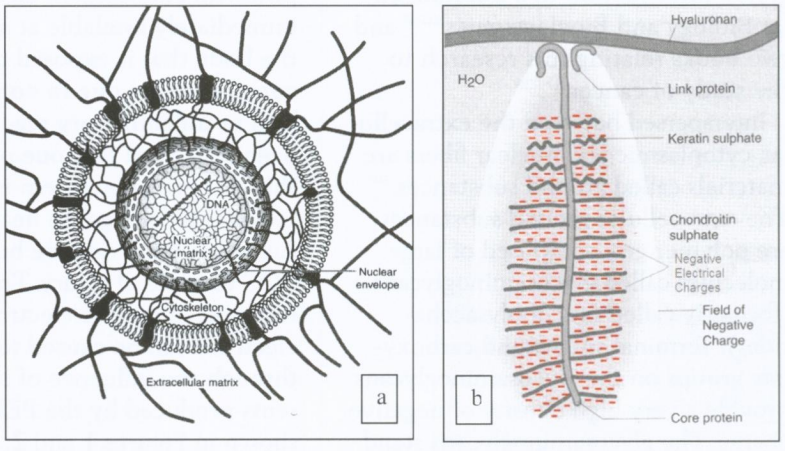
Electron transfer from the earth to a person is accompanied by rapid reduction in inflammation that can take place in virtually any part of the body.3, [18] The results support the concept of the acupuncture meridian system as a low resistance pathway for the flow of electrons throughout the body. Many physiological processes change immediately or soon after connecting the body to the earth. Muscle tensions are normalized, brain wave patterns shift from sympathetic arousal toward a more parasympathetic state (relaxation)[19] and prolonged contact with the earth (as by sleeping on a conductive pad or sheet that is electrically connected to the earth) normalizes cortisol rhythms and improves sleep.[20] All of the studies done to date indicate that grounding the body leads to significant reductions in inflammation and decreased oxidative stress. Similar results are obtained with the system shown in Figure 2: relaxation and reduction in pain and inflammation. We can ask if there is a common denominator to the results produced by these and related energetic modalities.

A STRUCTURAL/ELECTRONIC MODEL OF LONGEVITY AND OXIDATIVE STRESS REDUCTION

The two lines of basic research and clinical experience described above, the antioxidant effects of both PEMF and grounding to the earth, point toward a new concept of aging and oxidative stress. The concept is based on structural systems within the human body and the suggestion that these systems are electronic circuits with the capacity to store and deliver antioxidant electrons to any part of the body that is threatened by free radical damage.

Previous articles published in *Anti-Aging Therapeutics* and in other journals have documented the existence of a continuous physical matrix in living systems.[21-23] Cells contain a pervasive framework known as the cytoskeleton.

FIGURE 4



Portions of this framework connect to cell surface glycoproteins that span the membrane from the cell interior to the exterior.[24] These *integrins* are widespread, and have vital roles in many living processes.[25] Integrins communicate energy and information between the cell and its environment and *vice versa*: the extracellular matrix is "hard-wired" to the cytoskeleton and nuclear matrix.[26]

The links are both mechanical and energetic.

Hence we have a new structural and functional image of the cell and its environment (Figure 4a) that includes the well characterized extracellular matrix elements, primarily collagen and ground substances (described next), and equally thoroughly studied intracellular scaffolds called microtubules, intermediate filaments, and microfilaments, and the nuclear matrix composed of histones and DNA. Termed the *living matrix*, this all-pervasive system has extensions into every cell and nucleus, and is therefore the largest organ-system in the body - it is the material that forms all living structures.

The living matrix provides a pathway connecting the entire body, including the nervous system and all sensory receptors, with the genome in every cell.

The connective tissue is composed primarily of collagen, the most abundant protein in nature. Collagen and many other proteins are semiconductors, and are therefore capable of providing a body-wide conduit for anti-oxidant electrons. The idea that proteins are semiconductors originated with Albert Szent-Györgyi[27,28] and has been further developed and confirmed by many others.[29-33] See also Szent-Györgyi's trilogy, Bioenergetics, Introduction to a Submolecular Biology and Bioelectronics[34-36] and two books relating this research to the study of cancer.[37, 38]

Interspersed between the extracellular, cytoplasmic and nuclear fibers are materials called ground substances.[39] The extracellular ground substances are polymer gels composed of large molecules called glycosaminoglycans (formerly called mucopolysaccharides). Terminal sulfate and carboxylate groups on the glycosaminoglycans provide a very high density of negative charge. The glycosaminoglycans stand out straight from the proteoglycan backbones, and adjacent chains repel each other to form an arrangement like the bristles of a brush (Figure 4b). The result is a strong field or "domain" of negative charge.[40-43] The ground substances form a body-wide storage reservoir for electrons, and the living matrix is a semiconductive network reaching into all parts of the body.[44]

The systems shown in Figure 1 and 2 introduce PEMF into the body. We suggest that one effect of these magnetic fields is to cause electrons to move from the ground substance to sites of inflammation. A second effect is to saturate the electron transport chains in mitochondria, thereby increasing the levels of ATP available for cellular migrations and other activities of the immune and reair systems.

The significance to the free radical and oxidative stress model of aging may be as follows. The all-pervasive living matrix provides a substrate for the transfer of anti-oxidant electrons to any place they may be needed, even inside cells and nuclei, assuming one's ground substance reservoirs are saturated with electrons. The harmful effects of free radical damage to DNA, mitochondria and ribosomes have been mentioned above. Because of the systemic nature of the living matrix, powerful anti-oxidant electrons are immediately available at any point in the body that is exposed to oxidative stress, whether due to normal metabolism or inflammatory reactions. It has been suggested that one purpose of this all-pervasive system is to prevent "collateral damage" to healthy tissue when the oxidative burst delivers ROS to a site of injury. The matrix is a reservoir of mobile electrons and these electrons can be caused to move about through the influence of induced currents produced by the PEMF devices shown in Figures 1 and 2. Contact with the earth, as was present during millions of years of evolution prior to the development of plastics, will restore electrons in the reservoirs. Once one disconnects from the earth, the reservoirs will be gradually depleted by free radicals produced by metabolism, and oxidative damage will accumulate. Many people are electron deficient because they rarely make skin contact with the earth. A working hypothesis is that a consequence of electron deficiency is a greater vulnerability to oxidative stress and the accumulation of oxidative damage with its age-related consequences. For those who find it inconvenient to make regular barefoot contact with the earth, methods are being developed to establish the equivalent of barefoot contact with the earth as much as possible throughout the day and night (Figure 5).

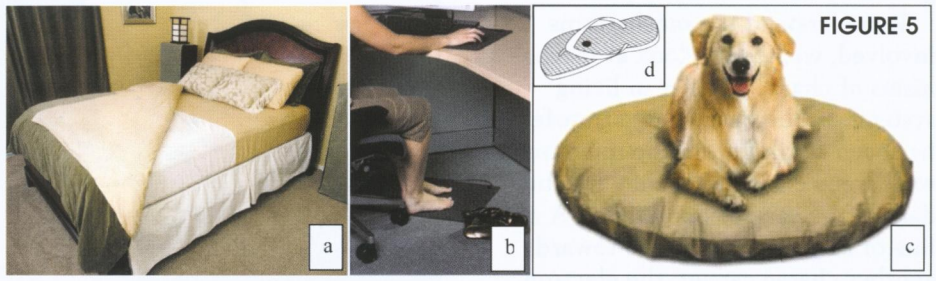


FIGURE 5

A NEW PERSPECTIVE ON INFLAMMATION

Acute injury does not necessarily lead to inflammation if the injury site is quickly treated with the appropriate methods that favor electron transfer into the repair field. Both the device shown in Figure 2 and grounding (Figures 3 and 5) have proven extremely effective in treating acute injuries. When these energy medicine tools are used soon after an injury, the classic signs of inflammation - swelling, redness, heat, pain and loss of range of motion - are greatly diminished or absent.

CONCLUSIONS

The human body possesses efficient metabolic networks that protect against oxidative stress. We are beginning to discern that these networks, so thoroughly studied from the biochemical perspective, exist alongside a pervasive structural system that is capable of rapidly delivering antioxidant electrons to every nook and cranny of the body. If this hypothesis is validated, future studies of oxidative stress will have to consider the degree of grounding of any system under investigation. Some of the previously reported inconsistencies from biochemical and genetic studies may be explainable on the basis of a significant but previously

uncontrolled variable: the electrical relationship of the experimental subjects to the ground plane of the earth.

Semiconduction can be far more rapid than metabolic and dietary antioxidant processes that are rate-limited by diffusion. For example, a topic of further research concerns the so-called inflammatory barrier or barricade surrounding sites of chronic inflammation.[45] It will be of interest to determine the relative permeability of the inflammatory barricade to antioxidant molecules compared to electrons.

A structural/electronic model of longevity and oxidative stress reduction may help us answer some of the outstanding questions about the relationship between oxidative stress and chronic disease and the nature of the aging process. It is a reasonable hypothesis, for example, that if the charge reservoirs in the ground substance are fully saturated, and if the living matrix is properly maintained by locating and neutralizing free radicals in pockets of chronic inflammation (as with the device shown in Figure 2), oxidative damage and its cumulative and aging effects will be reduced. Use of the system shown in Figure 2, dietary antioxidants and grounding provide potent tools to enhance one's "health-span". ◆

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