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# The Energy Body and Its Functions

## Immunosurveillance, Longevity, and Regeneration

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There are three interrelated levels of a macromolecular energy-information relay system in the human body, each generated by a specific type of semiconductant tissue and each with a specific function. The surface layer of the energy body, generated by fluid connective tissue and known as the ordinary channel system or meridian system in traditional Chinese medicine (TCM), functions in the service of immunosurveillance through detection of distress signals and transmitting energy-information regarding immunoresponse. The middle layer of the energy body, generated by semiconductant hard and spongy bone tissue, known as the extraordinary channel system in TCM, functions in the service of longevity and regeneration, as described in Bodhidharma's classic, *Bone Marrow Washing*. The bone marrow energy-information system has direct relevance to modern stem-cell research on the role of stem cells in regeneration of injured tissue. The deepest layer of the energy body generated by semiconductant nervous system tissue notably the vagus nerve and spinal column, functions in the service of awakening consciousness and in immortality. This system is described in the Tibetan Inner Fire meditations as well as in the Taoist shen breathing practices. There is very little scientific understanding of the central channel system.

**Key words:** energy medicine; immune system; stem cells; bone marrow; piezo electricity; regeneration

### The Immune System

The primary purpose of the immune system is protection. Externally, the immune system protects the body from invasion by pathogenic viruses, mycoplasmas, bacteria, and protozoa that have the ability to interfere with normal physiological processes and thereby cause disease. Internally, the immune system protects the molecular integrity of the body, by identifying and eliminating indigenous cells whose genetic signature has been transformed by spontaneous mutation, toxic exposure, or viral infection. There are two broad specialized divisions of the immune system, roughly corresponding to handling external and internal threats to bodily functioning or bodily integrity.<sup>1</sup>

The B-cell system derives its name because these lymphocytes are produced primarily in the bone marrow. B cells are specialized to handle pathogenic microorganisms. These cells produce and secrete large protein molecules, known as immunoglobulins, or antibodies. The B-cell system is also known as the humoral system of immunity because it secretes free-floating antibodies. These immunoglobulins allow for virtually infinite reconfigurations of their ionic bonds. According to the lock-and-key analogy when antibodies encounter potential antigens of an invading microorganism a high-speed search is initiated entailing very many reconfigurations of these molecules until a "fit" is found that interferes with the physiological processes of the microorganism, thereby rendering it incapable of causing disease. The flexible ionic bonding of immunoglobulins makes them potentially infinitely programmable, so that conceivably the B-cell

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system could handle most pathogenic organisms encountered in a life time.

A unique property of the B-cell system is that it possesses memory capacity. After encountering a new disease-producing microorganism and going through a high speed search process of millions of reconfigurations of an antibody until the right 'fit' is found, it would be remarkably inefficient to have to repeat the same process in the future, if the same pathogenic microorganism were encountered again. B cells possess a molecular memory of the effective antibodies for each disease-producing antigen encountered. Vaccination is based on this molecular memory system. A vaccination is simply the use of an attenuated form of an antigen (one that won't produce the full disease) in a way that initiates the high-speed search of molecular reconfigurations until an efficacious antibody is discovered for that antigen. Then, when a live, fully pathogenic form of the microorganism is encountered in the future, activation of the molecular memory makes it unnecessary to go through the high speed search once again, and the correct antibody is produced much faster.

The T-cell system derives its name because these cells are produced primarily in the thymus. T cells function to protect the molecular integrity of the body. They do not produce or secrete antibodies. Therefore, the T-cell system is also known as the cellular immunity system. Every indigenous cell type in the human body has a unique identity as defined by the genetic material within the cell. That unique identity is also marked on the cell surface. Each unique cell type in the body has a characteristic pattern or organization of receptor sites on the cell surface. Certain specialized T cells have the capacity to read the pattern of receptor sites for any given cell-type and compare it against a memory for the normal receptor pattern for that cell type. If a cell has been damaged by spontaneous mutation, viral infection, or toxic exposure, the organization of the receptors on the cell surface will be correspondingly altered, and therefore will be detected by the T cells and marked for

eventual destruction by another group of specialized T cells, the cytotoxic T cells. Cytotoxic T cells utilize enzymes like lysozyme to bore holes in the cell wall of the mutated cell, which then explodes through osmotic pressure. The specialized capacity of T cells to detect surface alterations in mutated cells and to eliminate them has been called a "system of molecular touch" (personal communication, Melnechuk, 1986).

More recent discoveries have shown that the T-cell system is enormously complex, with many types of subspecialized cells. Monoclonal antibody testing is used to identify T-cell subtypes based on their unique pattern of receptor marks (called "cluster determination"). T4 cells, now called CD4 cells, for example, have two functions. Inducer cells stimulate the immune system once a new external or internal threat has been detected. Inducers initiate acceleration in the rate of cell division of stem cells and also determine the type of immune cell needed to be produced for the type of threat in question. This process of up-regulating immune response in the face of threat is called immunostimulation. The overall efficiency of the immune system's response to threat can be measured with standardized laboratory assays, such as mitogen response. Helper T cells coordinate the respective action of B cells, T cells, and other cells in fighting a threat. The appreciation of the central role of helper cells in coordinating immune efficiency was the unfortunate by-product of the AIDs epidemic. HIV specifically destroys T-helper cells. HIV-infected individuals do not die of AIDS but rather die of opportunistic infections once the loss of helper cells reaches a critical level, so that there is little coordination of otherwise intact and healthy immune cells types in fighting opportunistic infections.

CD8 suppressor cells function to down-regulate immune response after successfully fighting a threat. Certain specialized types of T-suppressor cells decelerate the rate of cell division of immune cells and attenuate inflammatory response. Other specialized types of

CD8, the cytotoxic cells, function to eliminate mutated cells that have been so marked. CD8 suppressor cells play a central role in autoimmune diseases, which are characterized by misrecognition of a normal indigenous cell population as if it were an antigen, and also by an unmitigated inflammatory response toward that cell population.<sup>2</sup>

Natural killer (NK) cells, or CD56 cells, are an unusual cell type in that they function as the first line of defense against *both* external and internal threats. These cells possess high mobility, high toxicity, but poor recognition capacity. Because their recognition threshold is set low, CD56 cells destroy normal cells along with anything else that appears as a threat. However, from the perspective of immunosurveillance, there is an advantage to quickly destroying any kind of threat before it has a chance to become disease-producing even at the expense of some normal cells that can easily re-grow.<sup>3</sup>

A third major branch of the immune system is the monocyte-macrophage system. These are extremely large, slow-moving cells. They serve as manufacturing plants for many of the molecular products of the immune system. They also serve to engulf pathogenic cells and cell debris like giant amoebas, in the aftermath of the response of NK, B cells, antibodies, and T cells to a given threat.

Varela<sup>4</sup> has pointed out the parallel between the central nervous system (CNS) and the immune system. First, both systems possess a unique biological signature or fingerprint. Every individual brain is unique from all other brains. Likewise, the immune system marks its indigenous cell population with a unique signature, which is why transplanted organs are rejected by a healthy immune system. Second, this paper will show that both the CNS and the immune system share another common feature, namely a *dual signaling system*.

The CNS's dual signaling is well documented. The CNS utilizes both an energy-information signaling system and a biochemical signaling system. Information-relay is prop-

agated in the form of electromagnetic impulses along the axon through ionic depolarization (the sodium pump). Once the impulse reaches the synapse the message is then transported across the synapse by a biochemical information relay system, namely the neurotransmitter system. Overall, transmission of information in the nervous system entails toggling back and forth between energy information transmission and biochemical information relay.

When it comes to the immune system, a case could be made that it similarly operates with a dual signaling system as does the CNS. The immune system's biochemical information-relay system is a hot topic in modern immunology research. Neuropeptides are to the immune system what neurotransmitters are to the CNS. Table 1 illustrates the types of important neurohormones identified in the past few decades. Note that the macrophages produce interleukin-1, which in turn activate the CD4 cells. Note also that the CD4 cells produce interleukin-2, which in turn activate the macrophages. A biochemical picture of the immune system is emerging wherein the complex specialized functions of various immune cell-types consist of a highly interrelated network of biochemical interactions, all regulated by a group of common reciprocally inhibiting or reciprocally activating neuropeptides.

While neuropeptide signaling in the immune system is indeed a hot current topic in modern Western immunological research, a significant problem remains in that modern immunology, for the most part, fails to acknowledge the possible central role that an energy-information relay system plays in immune functioning. By way of contrast, Eastern indigenous healing systems, such as traditional Chinese medicine and Tibetan medicine, primarily describe an energy signaling system, but not a biochemical signaling system. If we are to engage in a genuine dialogue between modern Western science and Eastern healing systems, we must begin this dialogue with the acknowledgment that, at least theoretically, a dual signaling system exists. On a theoretical level at least, the remarkable

**TABLE 1.** The biochemical signaling system

Cell system	Activator	Inhibitor	Product
B cells	Neuropeptides	Corticosteroids	Globulins
CD4 cells	Interleukin-1	Glucocorticoids	Interleukin-2
		Endorphins	
CD8 cells	Histamines	?	?
Macrophages	Interleukin-2	Catecholamines	Interleukin-1
Migration	Neuropeptides	Corticosteroids	
Immuno-stimulation	Thymosin	?	

parallel between the CNS and the immune system would predict an energy-information signaling system in the immune system as well as in the CNS. On the level of scientific evidence, I will suggest that a considerable body of scientific evidence exists for an energy-information system in the body that is both a property of the immune system, and also of other physiological systems as well. The remainder of this paper will address this evidence from the emerging science of energy medicine.

## Energy Medicine

New areas of science first evolve as “invisible colleges,” i.e., networks of scientists who correspond informally around shared ideas. Eventually, as the fundamental questions are refined along with the methods to investigate them, a body of evidence emerges. The newly emerging field is typically heralded by a seminal conference, wherein the basic domain of inquiry is articulated along with the central scientific questions to be addressed.<sup>5,6</sup> The newly emerging field of energy medicine started as far back as the 1940s, but began its visible career with a seminal conference, “Energy Fields in Medicine,” sponsored by the Fetzer Foundation in Kalamazoo, Michigan in 1989. The Fetzer mission statement for the conference stated that the purpose of the conference was to “open the door to research into bio-field medicine which investigates the energetic mechanisms of the total organism.”<sup>7</sup> Energy medicine is best defined as:

Energy Medicine is the application of science to the understanding of energy exchange and information-relay within the human body towards the prevention and treatment of disease. Energy Medicine represents the integration of Eastern healing traditions (Traditional Chinese Medicine, Tibetan energy yoga, and Indian energy yoga) with modern Western scientific research on human bioenergy and psychoneuroimmunology.

Since that conference, a professional society for the study of energy systems was formed, *The International Society for the Study of Subtle Energies & Energy Medicine*, along with several important textbooks, such as Rosch and Markov’s *Bio-electromagnetic Medicine*<sup>8</sup> and Oschman’s *Energy Medicine: The Scientific Basis*.<sup>9</sup>

The fundamental idea of energy medicine is that certain tissue systems in the human body function as semiconductors that have the ability to relay energy-information to other sites in the body. In physics it is well-understood that certain substances in the physical universe conduct electromagnetic flow better than other substances. Conductance is typically measured by ease of flow, or conversely by the degree of impedance or resistance to the flow of current. For example, copper is much more highly conductant than rubber, which is why copper is used to conduct electromagnetic flow while rubber is used to insulate the wire. Crystals are highly conductant, or semiconductant, which is why they have revolutionized technology from computers to cell phones.

About a half a century ago some Western scientists began to view the tissue systems in the human body from the perspective of

electromagnetic conductance. The Nobel laureate Albert Syent-Gyogyi,<sup>10,11</sup> for example, hypothesized that many tissues in the body are likely to possess some degree of semiconductance because of their proteinase or liquid crystalline structure. If such proteins are organized into a crystalline structure electrons can flow through them over long distances between “common energy levels” in a way that they can transmit information within certain energy ranges:

If a great number of atoms be arranged with regularity in close proximity, as for example, in a crystal lattice, the terms of the single valency electrons may fuse into common bands. The electrons in this band cease to belong to one or two atoms only, and belong to the whole system. . . a great number of molecules may join to form such energy continua, along which energy, *viz.* excited electrons, may travel a certain distance. . . the single catalysts are connected with different, distinct energy levels and that electrons do not travel directly from one substance to the other but travel within the corresponding energy band.<sup>10</sup>

Much later Ingbar<sup>12</sup> argued that nuclear, cellular, and tissue structure within the body are all organized as a “complex interweaving meshwork,” i.e., as “tensegrity systems,” and Oschman<sup>9</sup> has shown that such structures strongly support semiconductance.

Syent-Gyogyi saw human connective tissue as an example of highly conductant tissue because of its molecular properties. Shortly thereafter, a hot area of research was the conductance of live bone tissue, which generated numerous journal articles and several textbooks on what became known as Piezo electrical theory.<sup>13</sup> Nordenstrom<sup>14</sup> pioneered the view that blood plasma and interstitial fluid constitute a “new circulatory system” that was also highly conductant. He called this the “vascular-interstitial system.”<sup>15</sup> Of course, since the early days of the sodium pump model, Western scientists had no problem believing that the tissues of the CNS readily conducted electromagnetic impulses. What was emerging by the 1960s was a view, at least in certain circles, that at least three major tissue systems had the property of

reasonably good semiconductance—the nervous system, the skeletal system, and the connective tissue system. While the conductance of the nervous system is well-known and generally accepted by most scientists, the conductance of the skeletal and connective systems is less well-known in the West. It is exactly the energy-information relay properties of these latter two systems that are at the heart of the Eastern healing systems.

### **Piezo Electrical and Streaming Electrical Theory: Conductance of the Skeletal Tissue System and Bone Regeneration**

Mechanical stress or strain applied to crystal structures such as a quartz crystals causes the crystalline structure to break down, the result of which is the generation or transduction of an electromagnetic current as the electrons are released from the crystalline structure. This mechano-electrical phenomenon is known as the piezo electrical effect (“pressure electricity”).<sup>9,16</sup> In the 1960s Bassett and his associates first noted that human bone tissue possessed a crystalline structure, and therefore according to prediction, should have piezo electrical properties. He found that bending bone tissue produced significant changes in electromagnetic currents, with the compressed side of the bone having a negative charge and the positive side of bone having a positive charge. Subsequent researchers have found that any dynamic stress of bone tissue, such as running, jumping, or dancing results in endogenous EM current generation within the bone tissue. The emerging view was that human bone tissue was semiconductant and produced the same classic piezo electrical effects as well documented for physical crystalline systems.<sup>17–20</sup>

Subsequent research demonstrated that two types of endogenous currents are generated within human bone tissue: (1) mechanical stress generates piezoelectrical currents, and (2) the flow of ions in blood vessels and extracellular

fluids generates electrokinetic or streaming currents within the soft bone tissue.<sup>9,20</sup> These latter streaming currents are especially strong and directly affect bone marrow cells.<sup>21</sup>

Becker<sup>20</sup> discovered that the molecular composition of human bone tissue and its conductance implications are far more complex than Bassett originally had appreciated. In fact bone tissue is remarkably similar to a diode. The bone's proteinase collagen behaves like an N-type (piezo electric) semiconductor and the bone's apatite (mineral crystal) behaves like a P-type semiconductor, the combination of which forms a PN junction or diode. Mechanical stress of bone tissue produces a biphasic current which switches polarity when alternating stressing and unstressing of the bone tissue. The "coherent signal" that is generated "did more than merely indicate that stress had occurred. Its strength told the cells how strong the stress was, and its polarity told them what direction it came from. Osteogenic cells where the potential was negative would be stimulated to grow more bone."<sup>20</sup>

The more interesting finding from investigating conductance in human bone tissue was that the flow of electromagnetic currents stimulated bone growth. This phenomenon was known as Wolf's law. A century ago Wolf discovered that bones react to stress or strain by growing new bone tissue at the compression site, thereby strengthening the bone tissue by growing new tissue according to demand. Bassett and Becker and their associates conducted a series of experiments to test Wolf's law. They hypothesized that stress-induced EM currents were responsible for osteogenesis of the bone cells. They applied exogenous EM currents of varying amperage to both animal and human tissue both *in vitro* and *in vivo*. For example, Bassett et al.<sup>18</sup> implanted an electrical device in the femora of dogs and varied the amperage. They found that 10 amp and 100 amp, but not 1 amp currents, as compared to a no current control implant, produced "massive production of new bone" reaching a peak in about two weeks. They concluded that the EM current

stimulated "osteogenic activity," probably because the current caused "an increase in the mitotic rate" of the bone cells. According to their model, mechanical stress or strain of a bone at the apatite-collagen juncture produces an endogenous EM current, which in turn causes osteogenesis, and the formation of new bone tissue at the site of the stress. This is "true regeneration" of the bone tissue.<sup>20</sup>

Bassett, Becker, and others have applied piezo electrical theory to healing bone fracture. Piezo electrical theory predicts that stressful fracture of bone tissue produces EM currents, which then stimulate bone regeneration to knit the fracture. Numerous studies have shown that the exogenous application of direct EM currents or pulsed currents significantly increases healing time as compared to control with no EM current applied at least in certain subjects.<sup>19,20</sup> Unfortunately, while a considerable body of evidence was generated by piezo electrical research on bone tissue over several decades, the application of electromagnetic fields to bone healing never quite made it into main stream medicine, despite a number of promising findings from randomized double-blind clinical trials both on non-union and delayed union fractures.<sup>22-25</sup>

A number of other researchers have applied direct current or pulsed magnetic field currents in the regeneration of injured nerves and/or restoring functionality.<sup>26-32</sup> In fact, exogenously supplied electromagnetic fields have been used in the regeneration of a variety of soft tissue wounds, e.g., nerve, skin, muscle, and tendon injury.<sup>31,33,34</sup> In some instances the positive effects of the exogenous currents were comparable to the effects of biochemical growth factors.<sup>28</sup>

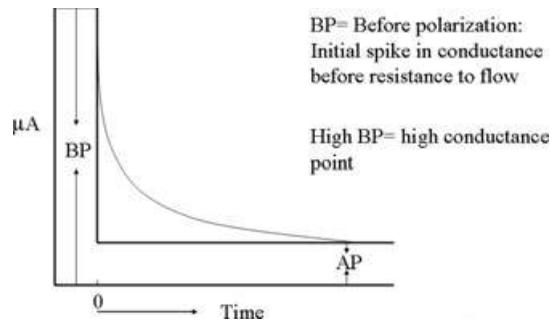
Some researchers have emphasized that the connective tissue and tendon tissue are also semiconductant and have streaming electrical properties as does human bone tissue.<sup>9,35</sup> Therefore, complex repetitive dynamic movement like dance or Tai Chi, as compared to simple bending, is likely to have far greater conductance and regenerative effects on the

composite of bone, tendon, and connective tissue. These complex repetitive movements involving bones and tendons may be the key to remarkable physical strength as the meditation master Bodhidharma discovered in the 6th century in a series of exercise he called *Tendon Transforming Nei Kung*. More will be said about this later in this paper.<sup>36</sup>

Even more interesting is the hypothesis that Becker came to eventually. He found that the effects of exogenously applied currents to the outside surface of bone tissue were for the most part transient, but that comparable currents applied to the inside of the bone, directly to the bone marrow, produced far greater regenerative effects. Therefore, he ultimately concluded that the main regenerative effect was not caused by piezo electrical stimulation, but rather by “continuously stimulating the bone marrow.” His conclusion offered scientific support to a method discovered by the meditation master Bodhidharma in the 6th century called *Bone Marrow Washing*.<sup>36</sup> More will be said about this later.

### Electrodermal Mapping: The Conductance of the Fluid Connective Tissue System

Prior to the 1950s the technology of skin conductance was unrefined. Rather large electrodes were used to measure galvanic skin conductance. With the advances in technology by the 1950s it now became possible to use much smaller electrodes for electrodermal mapping of the skin.<sup>37</sup> Nakatani<sup>38,39</sup> first pioneered microelectrode mapping of skin conductance. Nakatani found that systematically applying a series of 12v Volt pulses of DC current to each of a number of small points on the skin resulted in significant conductance differences across points. Whereas most points on the surface of the skin were low conductant, from time to time Nakatani discovered “good conductivity” points. In other words, certain points on the surface of the skin were highly



**FIGURE 1.** Measuring conductance of EM current at a skin point. (Adapted from Tiller.<sup>37</sup>)

conductant. Shortly thereafter, similar findings were reported in China.<sup>40,41</sup>

These studies were painstakingly replicated by Tiller<sup>42</sup> two decades later at Stanford University and also by others.<sup>43–46</sup> Tiller, for example, applied a 10  $\mu$ amp DC current @ 1–3v Volts for 1 msec. The exogenous current was applied as a needle point to a specific location on the skin surface and the flow of this current at the site was assessed. Figure 1 illustrates the fate of the EM current over time at the site. After an initial spike or high amplitude flow of EM current (called “before polarization BP”) the current quickly encounters increasing resistance to its flow over time, gradually reaching a floor effect (called “after-polarization AP”). Tiller and others have “mapped” the skin surface of the body electrodermally using this procedure. Like Nakatani, they found that there were a number of sites on the skin that were highly conductant. Acupuncture points had significantly higher conductance values than nearby control points.<sup>45</sup> In other words, the BP values of these skin points were significantly higher than the BP values of most other skin points. The results showed that there was an array or pattern of high conductance points distributed over the skin of the human body. However, with respect to the histological composition of the skin no differences could be found between the high and low conductance sites. McCarroll & Rowley,<sup>43</sup> however, did not fully replicate observed differences between acupuncture and control points unless the stratum corneum of

the skin surface was damaged, thereby demonstrating that the high conductance points may be at a deeper layer than the skin surface.

Building upon this earlier work Motoyama in Japan<sup>47-49</sup> replicated Tiller's work. He found that the location of the significantly higher BP points corresponded almost exactly to the traditional map of acupuncture points in traditional Chinese medicine. Acupuncture points are points of high conductance, or semi-conductance, within the skin, wherein EM energy-information relay occurs. Therefore, the acupuncture/meridian system in traditional Chinese medicine is not a primitive misunderstanding of the circulatory or lymphatic system, as was once thought, but rather a very precise mapping of energy-information relay channels within the human body that were discovered over four thousand years before electricity was discovered in the West.<sup>50</sup> Meridians are high conductance or flow lines of EM current between acupuncture sites.

Some evidence exists regarding the rate of propagation along classical meridians<sup>51,52</sup> The rate of energy propagation varies widely but is usually within the range of 1–20 cm/sec. Rate of propagation also increases with acupuncture treatment.<sup>52</sup>

Furthermore, Motoyama<sup>49</sup> carefully measured the BP values of all the acupuncture points across many subjects (Ss) in order to establish quantified normative data. He hypothesized that disease is the result of BP values in excess of expected norms. Consistent with this hypothesis Motoyama found that degenerative diseases are typically associated with BP values significantly lower than the normative range (<50), and that inflammatory diseases are typically associated with BP values significantly higher than the normative range (>82–100). Motoyama then developed a software system, the AMI system to rapidly assess the BP values of all acupuncture points in the body, determine which points are outside of the normal range, and identify a protocol of acupuncture points to treat in order to bring all BP values back within the normal range. The AMI system functions

much like laboratory assessment in Western primary care medicine, in that quantified laboratory results are used to identify values outside of the normative range.

Motoyama also attempted to identify which tissue system in the body was responsible for generating high conductance along the meridian lines. He compared the results of electrodermal mapping on the skin surface to the same mapping conducted after the surface epidermal layer of the skin had been stripped off. There was only a modest drop in conductance. He concluded that the deeper layers of the skin were responsible for the high conductance, notably the connective tissue. Further work showed that fluid connective tissue is largely responsible for generating high conductance across the meridian system.<sup>53</sup> These findings supported Syent-Giorgi's much earlier hypothesis that connective tissue was semiconductant, only the hypothesis was now given considerably more precision: the molecular properties of the fluid connective tissue generate a semiconductant energy-information relay system along the lines of fluid connective tissue in the body. These high conductance flow lines are referred to as the ordinary channel system or meridian system in traditional Chinese medicine. Oschman<sup>9</sup> says, "The meridians are simply the main channels or transmission lines in the continuous molecular fabric of the body." (p. 70).

### **Endogenous Energy Fields within the Body**

Further support of an energy-information signaling system in the human body was provided by Nobel laureate Frolich<sup>54</sup> in his notion of cooperative molecular systems. Frolich discovered that certain macromolecular systems in the body, e.g., enzyme systems, naturally generate field effects and coherent oscillations:

Collective chemical oscillations in which globular proteins and the surrounding ions and structured water behave as an entity and oscillate

between a strongly electrical polar excited state and a weakly polar ground state. A slow chemical oscillation is connected with a corresponding electrical vibration.

Frohlich's work shows that cooperative macromolecular systems naturally generate vibratory field effects of numerous frequencies. Coherent vibrations occurring at a specific site can relay energy-information to other cooperative macromolecular systems at other sites within the body. Similarly, Pienta and Coffey<sup>55</sup> added that such coherent vibrations across the body create complex harmonics, the function of which is to transmit "vibrational information. . . throughout the organism. . . through a tensegrity-matrix."

Different systems within the body communicate with each other through high-speed energy-information relay. Of note here is that structured water plays a central role in the energy-information relay. Oschman<sup>9</sup> has observed that many tissue and cellular systems use crystalline arrays within which structured water plays a central role in generating field effects that form a type of electromagnetic circuitry system connecting all parts of the body. He further noted, as had Syent-Gyogyi<sup>11</sup> years earlier, that "The connective tissue fabric is a semiconducting communicative network that can carry the bioelectronic signals between every part of the body and every other part." Again, the fluid aspect of connective tissue gives it its unique crystalline properties that allows for semiconductance. Becker<sup>56</sup> and Oschman<sup>9</sup> have likened the information-relay properties of the connective tissue system to a second nervous system.

### **The Effects of Exogenous Energy Fields on Cellular Systems**

Some research has addressed which frequency ranges are most conducive to energy information-relay within the body. This research mainly consists of the application of exogenous electrical and/or magnetic cur-

rents of varying frequencies to cells cultivated in a tissue culture system in order to determine which frequency ranges have the strongest effects on cellular processes. For example, exogenous extremely low frequency (ELF) currents have been found to: induce cellular transcription,<sup>57-59</sup> activate or deactivate certain enzyme systems,<sup>60-62</sup> induce or inhibit immuno-stimulation,<sup>63-67</sup> stimulate the signaling pathway for T and B cells,<sup>68</sup> increase utilization of neuropeptides like interleukin (IL)-2 and IL-2 receptor expression,<sup>69</sup> alter cell surface receptor migration and distribution,<sup>70</sup> and stimulate or deactivate cytotoxic T cells<sup>71</sup> and inflammatory T4 cells.<sup>61</sup> No effects were found on histamine release by inflammatory mast cells.<sup>72</sup> While the results across studies are not always consistent, one finding is clear: lymphocytes tend to respond primarily within select frequency ranges or "windows,"<sup>73</sup> especially within the ELF range,<sup>9,74</sup> but also in the extremely high frequency (EHF) or Giga Hertz range<sup>73,75-80</sup> (cf. Sisken and Walker<sup>81</sup> for a review of frequency ranges).

### **The Structure of the Macromolecular Energy Body: An Integration of Western Energy Medicine and Traditional Eastern Healing Systems**

We can divide the energy information signaling system in the body into two broad categories—a macromolecular system, and a micromolecular system. Oschman<sup>9</sup> describes both systems in some detail. The macromolecular system includes broad lines of EM circuitry across the body, such as that generated by the fluid connective tissue system. The micromolecular system includes EM circuitry designed for communication within and to surrounding cells.<sup>9,55</sup> This paper will limit the discussion to certain macromolecular energy information systems that are of central relevance to the themes of this conference,

namely health-maintenance, longevity, and regeneration.

According to the model proposed here, there are at least three important layers to the macromolecular energy information signaling system, and each layer of the body's overall energy signaling system is generated by a unique type of semiconductant tissue:

- (1) The *outer layer* of the energy signaling system is generated by fluid connective tissue. This corresponds to the meridian or ordinary channel system in traditional Chinese medicine. The primary function of this signaling system is to serve as a rapid response signaling system for the immune system. Given the research on the application of exogenous currents to lymphocytes, it appears as if the lymphocytes are set to respond to endogenous energy information signals only of certain frequencies. These fast-acting signals communicate to the lymphocytes the nature of the threat and also where and how to respond. In other words, a fast-acting energy information relay system from the outer layer of the energy body primarily functions in the service of immuno-surveillance.
- (2) A *middle layer* of the energy signaling system is generated by bone tissue, particularly because of its outer crystalline composition combined with the inner structured fluid of the bone marrow. This system corresponds to the extraordinary channel system in traditional Chinese medicine. The primary functions of this signaling system are regeneration and longevity, according to ancient esoteric texts, such as Bodhidharma's classic, *Bone Marrow Washing Nei Kung*.<sup>36</sup>
- (3) A *central channel layer* of the energy signaling system is generated by the spinal column and the vagus nerve. The central channel runs roughly equidistant between the spinal column and the vagus nerve. This system corresponds to the central channel system in the Tibetan Buddhist *bsre*

*'pho* or energy meditation practices, to the Indian *kundalini* yoga system, and to the Taoist *shen* system. The primary function of this system is awakening the mind to its real nature, or altering consciousness in an enduring and positive way.

- (4) *An energy storage or battery system.* Storing EM energy in batteries depends on the physical properties of the system. In a car battery, for example, storage best occurs by constructing the battery to have layers of substances alternating between high and low conductant substances. Lead is low conductant while the acid is high conductant. Cells of alternating low and high conductant material functions as a capacitor. Likewise, certain tissue structures in the human body are composed of alternating high and low conductance tissue so as to function like a capacitor.<sup>14</sup> Jwing-Ming,<sup>36</sup> for example, an electrical engineer as well as a Chi Kung master, has argued that the structure of the human gut is like a large battery. The smooth muscle tissue comprising the intestines is low conductant, while the massive amount of connective tissue linking all of the loops of the intestine together is high conductant tissue. Packaged together in a small space, the combination of gut and connective tissue functions like a large battery. Yang further argues that the tissues of the upper gut and the dura area of the brain are also constructed in such a way as to function like batteries. These three areas are referred to as the "triple heater" in traditional Chinese medicine.

The microcircuit energy centers in the Taoist yoga system<sup>82</sup> and the similar chakra system in Indian kundalini constitute the distribution of smaller size "batteries" through the energy body, while the acupuncture points are essentially even smaller "batteries."<sup>37</sup>

Overall, what emerges from this integration of the findings from modern Western energy medicine with those of traditional Eastern

**TABLE 2.** The macromolecular energy signaling system

Location	Semiconductant tissue	Traditional Eastern description	Function
Outer	Fluid connective tissue	Meridian or ordinary channel system	Immuno-regulation
Middle	Bone tissue	Extraordinary channel system	Longevity and regeneration
Central	Nervous tissue (spinal cord and vagus nerve)	Central channel system	Awakening consciousness; Immortality
Energy storage system	Gut/brain interspersed with connective tissue	Triple heater	Energy information storage

energy healing systems is a map of a sophisticated, multilayered macromolecular energy signaling system. Table 2 illustrates this map.

### Immuno-regulation and the Ordinary Energy Channel System

So far we have argued that the fluid connective tissue system serves as an energy information relay system. Meaningful information about biological processes is transmitted at high speeds along the meridian system to other areas of the body. Specifically, the lymphocytes are pre-wired to respond to EM signals of certain frequency ranges, and in that sense the meridian system plays a central role in the transmission of information relevant to immunosurveillance. How then does the immune system recognize a potential threat, and initiate an energy-information signal of this threat?

The available evidence suggests the following hypotheses: (1) The immune system in particular, and each individual human body as a whole, has a unique signature or identity, and that this unique signature, in part, is preserved as an *energy signature* or *fingerprint*. (2) Any threat to the body—either an external threat by an invading pathogen or an internal threat by a mistake in cell division resulting in an abnormal cell formation that can potentially develop into a tumor or cancer—is first recognized as a *disturbance in the unique energy signature* of the body.<sup>83</sup> Using a *Star Wars* analogy neurohor-

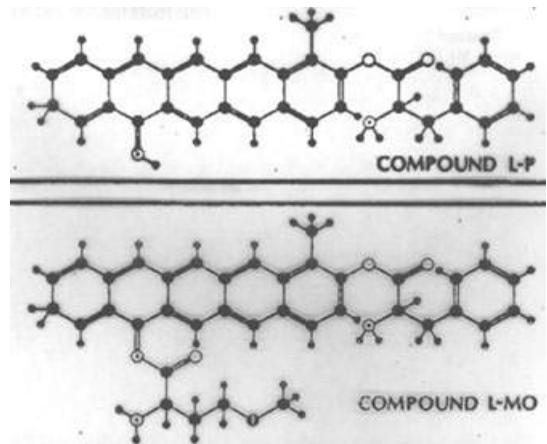
mones, like Jedi knights, are able quickly to recognize a *disturbance in the force* way before the battle begins. Burr believed that faults in the [energy] field could reveal latent illnesses<sup>20,83</sup> (3) The immune system, like the CNS, contains a dual signaling system—a faster-acting energy-information signaling system and a slower-acting biochemical signaling system. There is a distinct evolutionary advantage to having a high-speed signaling system that can quickly detect any disturbance in the energy signature before a problem develops. These signaling systems send information to the immune cells about the disturbance. However, these hypotheses do not answer the question of how the immune system recognizes a disturbance in its energy signature.

Joe Navach's research on inherent resonance theory<sup>84,85</sup> directly adds the missing evidence. Navach began his research studying flatworms, platyhelminthes. He found that if a stimulant like adrenaline were added to an ampule containing the worm, the activity level of the worm was greatly increased. An assay system was developed to measure the change in activity level in the worm following the introduction of the stimulant into the medium. Far more interesting was the fact that the activity level of the worm also significantly increased if the adrenaline was added to another ampule in the nearby vicinity not containing the worm. Navach tried to understand how the worm "sensed" the presence of the stimulant in a nearby ampule, when the worm had no direct contact with the stimulant. He reasoned

that the worm must have an energy-sensing system that allowed it to detect the presence of the adrenaline in the vicinity. To test this hypothesis Navach conducted an experiment in which he shielded the adrenaline ampule with either a high conductant (copper), low conductant (lead) shield, or no shield. There was a 30–100% decrease in the expected activity response of the worms across trials when lead was used as a shield, and a 50% increase in expected activity when copper was used as a shield as compared to the no shield control condition. These data suggest that the worms possess a system for sensing changes in the energy field, even when not in direct contact with the stimulant itself.

Subsequent research showed that flat worms have high concentrations of a particular class of neurohormones called pentenes in their tissue. The benzene ring is a unique structure in biochemistry. In order to solve the problem of missing two electrons the benzene ring orbits its electrons across all six carbon atoms. Kekule discovered this unique structure of the benzene ring in the form of a dream of a snake biting its own tail. By spinning the electrons across all six atoms, a strong field effect is created. A pentene is a molecule that contains five or more benzene rings, and often a number of side-chains. These molecules generate remarkably strong field effects. Figure 2 illustrates typical pentene-based neurohormones; note the unusual structure based on a number of benzene rings strung together.

According to Navach pentenes easily become activated in response to changes in the local energy environment. Neurohormones are capable of detecting even subtle changes in the surrounding energy field, and transmitting energy information about these changes in the form of energy information relay. In other words, pentene-based neurohormones within the tissue of the flatworm are capable of detecting the presence of the adrenaline in a nearby test tube in the form of a disturbance in the energy field. Inherent resonance means that the neurohormones become activated and gen-



**FIGURE 2.** Pentene molecular structure. (Used with permission from Navach.<sup>84</sup>)

erate an EM energy-information relay in response to the detected field disturbance.

Navach argues that detection of threats to the human immune system functions similarly. Any threat to the immune system is first registered as a disturbance in the field by pentene-based neurohormones distributed throughout the body. Navach and Ackerman have further demonstrated that pentene-based neurohormones are heavily concentrated in gut tissue, connective tissue, and in the brain, and also at acupuncture points. Neurohormone clusters are likened to a radar detection system, designed to detect disturbances in the energy signature, and in response, they are induced to resonate, and then send out a high-speed distress signal in the form of energy information relay, presumably along the meridian energy information relay system generated by the fluid connective tissue system.<sup>86</sup>

A yet to be answered question is how this energy information signaling system interacts with the biochemical information signaling system in the immune system. The work of Jean-Claude Darras<sup>87</sup> has offered some evidence to explain this. Darras injected a radioactive isotope, thallium, either into the exact site of a target acupuncture point or a placebo spot in the nearby vicinity known not to be an acupuncture point (control condition). Darras then took

a scintograph every 4 minutes. After a delay of about 4 minutes, the scintograph showed a bidirectional migration of a trace of the radioisotope when the acupuncture point was needled with the radioisotope, but no migration when the control site was needled. He found that no migration occurred if needling occurred 2 mm outside of the acupuncture point. He then replicated the findings using a different isotope. In other words, molecular migration occurred regardless of the isotope used, provided that the acupuncture point had been stimulated through needling.

In another set of studies Darras found that stimulation of two successive acupuncture points along a known meridian line resulted after a brief delay in a bidirectional flow between these points, along the meridian line, whereas no such migration occurred in the control condition. The speed of migration of the isotope was around 6 cm/min. Inserting the needle directly into a vein or a lymph vessel rather than an acupuncture point resulted in a rapid disappearance of a detectable radioactive signal on the scintograph. These findings effectively rule out the hypothesis that migration occurs primarily in the circulatory or lymphatic systems and strongly suggests that migration mainly occurs along the meridians. Darras concluded that “a neural compound must play a major part” in this migration and that migration occurs probably “at the connective tissue level.” Stimulation of acupuncture points on one side of the body resulted in detectable migratory flow also at the corresponding acupuncture point site on the other side of the body, even though that acupuncture point had not been needled. Stimulation of a target acupuncture point with a laser beam increased the rate of diffusion of the isotope, but only at certain frequency ranges (optimal frequency 24 Hz).

Because migration didn't begin for a number of minutes Darras reasoned that migration was too slow to be electromagnetic flow, and probably represents biochemical transport. The best hypothesis is that the detected migration represents migration of neuropeptides along the fluid

connective tissue or meridian lines in response to stimulation of the acupuncture point.

To summarize these findings, the emerging East/West view of the immune system is as follows: The human body has a unique energy signature or blueprint in the form of an electrodynamic field of life or “L-field.”<sup>83</sup> The immune system carries a memory of this unique energy signature, a memory of a unique EM field or life pattern. Whenever the body is faced with an external threat like an invading pathogen or an internal threat like a mistake in cell division, this threat is first detected as a disturbance in the unique energy signature. Pentene-based neurohormones distributed at strategic sites throughout the body detect this disturbance in the energy field through inherent resonance, and in response generate an energy information signal regarding the site location and nature of this disturbance.<sup>84,85</sup> This high-speed energy information signal is propagated along the connective-tissue-based meridian system. Along the way, specific biochemical neuropeptides are activated.<sup>87</sup> These neuropeptides then migrate, also along the meridian channels, but at a much slower rate. Along the way they enter the lymph and circulatory systems where they link on to specific receptor sites on the surface of the lymphocytes. The information conveyed by these peptides communicate to the inducer T cells to initiate immuno-stimulation, and along the way the peptides interact with certain existing lymphocytes communicating the location and nature of the threat. Following that, through a process of chemotaxis, these lymphocytes begin a process of migration specifically to the location of the threat, and thereafter begin to fight the threat in whatever specialized way the cell uses. The CD56 or natural killer cells, because of their high mobility, are likely to arrive at the location of the threat first. The B cells arrive and initiate a high-speed search for the right configuration of an immunoglobulin when there is an external threat like a bacteria, and the T cells arrive to detect and mark mistaken cells for destruction in the case of an internal threat. Finally, the slowly arriving

**TABLE 3.** Summarizes the levels of immune response and the interactions at each level

Level of immune system	Treatment strategy
Energy information relay	Traditional Chinese medicine, e.g., acupuncture and Chi Kung
Energy/biochemical interface	Homeopathy; Aromatherapy
Biochemical information relay	Neuropeptide treatment, e.g., interferon, interleukin-1, interleukin-2, corticosteroids
Biochemical/lymphocyte interface	Peptides that target lymphocyte receptors, e.g., peptide-T
Lymphocyte proliferation, migration and response	Stem cell treatment
	Herbal and drug treatments that affect immune cell response

macrophages and monocytes clean up the debris and down-regulation of the immune response begins.

This integrated view of the immune system has important implications for treatment. The Western approach to treatment emphasizes treating the disease *per se* irrespective of immuno-status, but sometimes includes attempts to enhance immune functioning after disease onset. Intensive current research on neuropeptides reveals the assumption that treatment can occur at the level of the biochemical signaling system. For example, injection of signaling molecules like interferon, (IL)-1, and (IL)-2 have been used as strategies to arrest cancer, however ineffective they have been. Along a similar line, Pert (personal communication, 1989) proposed that administration of peptide-T might compete at the specific receptor site where HIV links onto the monocyte, thereby arresting HIV infection of monocytes. The Eastern approach to treatment is very different. Traditional healing systems target disturbances and imbalances in the energy system and treat these before a disease actually develops. From the Eastern perspective treatment is a failure if a disease has already developed; treatment is designed to prevent the development of disease by intervening at the level of the energy system.

Some treatments address the interface between the energy information and biochemical information signaling systems. For example, homeopathy is based on using minute quantities of a substance, quantities too small

to have a direct chemical effect. Homeopathic substances may operate directly to stimulate energy-information signaling, not a direct biochemical response, within the immune system.<sup>88</sup> Smith<sup>89</sup> and Oschman<sup>9</sup> have argued that water molecules store “molecular signatures,” and that the introduction of minute amounts of a substance induce inherent resonance and therefore the flow of energy-information across the system. Likewise, aromatherapy may have similar effects. It is notable that aromatherapy utilizes small quantities of pleasant smelling essences, all of which are aromatic benzene-based compounds, that possess the property of inherent resonance.<sup>90</sup> How different treatment strategies target different levels of immune response is summarized in Table 3.

### **Regeneration, Longevity, and the Extraordinary Energy Channel System**

Piezo electrical theory posits that stressing the skeletal system initiates an energy information relay system. Meaningful information about biological processes is transmitted at high speeds by channels generated by bone tissue to other areas of the body. The mapping of the flow lines generated by bone tissue was first described in China in the 5th century.

The extraordinary channel system remains virtually unknown in the West, and also is not commonly known in many circles of traditional

Chinese medicine. Chan Buddhism was first introduced in China during the Han dynasty in 58 A.D. Taoist meditation developed around the same time. In 527 A.D. the emperor of China invited the great Indian master to teach Buddhism. Bodhidharma (called Da Mo in China) discovered that many of the Chinese practitioners were physically unfit and sickly, and so did not have the stamina to sustain the deep concentration required to perfect meditation practice. Therefore, Bodhidharma went into a solitary meditation retreat for nine years, wherein he focused his meditation on the problem of bodily strength, wellness, and longevity. He emerged from his retreat having written two works, *Yi Gin Ching* (*Tendon Transforming Nei Kung*) and *Shui Soei Ching* (*Bone Marrow Washing Nei Kung*). He developed the Tendon system from meditation on animals like horses. He discovered that horses are able to move massive weight with relatively small leg muscles because the strength of the tendons, not the striate muscles, gives them great force. From this he created a set of movement meditations that result in remarkable physical strength based on developing the energy or “Chi” within the tendons.<sup>36</sup>

The second work, *Bone Marrow / Brain Washing Nei Kung*,<sup>36</sup> has remarkable relevance to the central theme of our conference, namely regeneration and longevity. Through his meditations on the body Bodhidharma discovered that physical stimulation of the bones, followed by certain meditations that directly stimulate the flow of Chi energy within the bone marrow, when practiced for a minimum of 100 days, lead to a remarkable increase in longevity. His text contains two sets of practices. Jwing-Ming<sup>36</sup> describes these practices:

The first is leading sufficient Chi to the bone marrow to keep it clean, healthy, and functioning properly, the second is leading the abundant Chi to the brain to nourish it.

As the passage implies the skilled practitioner must first open an easy flow of energy in the extraordinary channels, and through repeated

practice learn to store this energy in the battery system until it is “abundant.”

Bodhidharma maps out eight extraordinary channels, which are not at all part of the 12 ordinary meridian channels common to traditional Chinese medicine. Learning to activate the energy within these extraordinary channels and then to use meditation to circulate the flow energy in the two main extraordinary channels is known as spinning the small heavenly cycle. Subsequently learning to meditate so as to circulate the energy in all eight extraordinary channels at once is called spinning the large heavenly cycle.

Bodhidharma discovered that there was a direct relationship between the status of bone marrow and longevity. He believed that aging begins when the Chi energy within the bone marrow diminishes or becomes deficient, and therefore, strengthening the Chi within the bone marrow arrests the aging process. Some of the modern masters of *Bone Marrow Nei Kung*, who have taught in the West, have added that bone marrow tissue fills with fat deposits as we get older.<sup>36,91</sup>

The effects of free fatty acid deposits on vascular tissue are well documented in Western medicine. In arteriosclerosis free fatty acid deposits progressively fill the inner wall of blood vessels leading eventually to coronary and stroke risk. Anti-cholesterol medications and certain mind-body methods like exercise and healthy nutrition have been shown to reverse the fatty acid deposits in vascular tissue. It is curious that Western medicine has yet to apply this fat deposit model to other tissue systems in the body, and therefore has not considered that a similar process might occur within the bone marrow. Fifteen hundred years ago Bodhidharma, and now his contemporary interpreters,<sup>36,91</sup> have advocated that the key to aging is the aging of the bone marrow, and that aging of the bone marrow occurs through a process very similar to that already well understood in Western medicine to occur in vascular tissue. If true, the implications for treatment are profound: (1) reversing the fat-based aging of the

bone marrow revitalizes bone marrow; (2) since the bone marrow contains red and white blood cells, including the all-important stem cells, revitalization of these cell populations may have a direct effect on both longevity and regeneration; and (3) certain mind-body techniques, like those described in *Bone Marrow Washing*, directly contribute to longevity and regeneration. Chia and Chia<sup>91</sup> state that purpose of the techniques is “eliminating the accumulated fat which restricts the production of blood.”

There are essentially three types of practices described by Bodhidharma to “wash” the bone marrow. These methods are described in some detail in *Bone Marrow Nei Kung*.<sup>91</sup> The first methods entail either Chi massage, or frequently hitting the surface of the muscle tissue over a bone until a vibration occurs. This activates the Chi energy within the bone marrow. These practices take about 30 days. Second, the practitioner conducts the small heavenly cycle meditation, and eventually masters the large heavenly cycle meditation. This creates an even flow of Chi energy throughout all channels of the extraordinary channel system. Finally, through doing bone breathing, the practitioner learns to visualize systematically the flow of energy directly through the soft marrow in the center of each bone until generating an automatic flow of Chi energy throughout the bone marrow of all bones in the skeletal system at once. “Compression” of the energy during bone breathing is said “to burn the fat out of the marrow.”<sup>91</sup> Building up the strength of this Chi energy through repeated practice is said to increase the abundance of the Chi within the bone marrow, reverse the aging of the bone marrow tissue per se, and presumably to revitalize the red and white blood cells and the stem cells to release their full potential for regeneration and longevity. According to Chia and Chia stimulating energy flow directly within the bone marrow makes the blood “lighter and easier to move,” or in the terms of Western science, increases the enumeration of circulating stem cells available for cell regeneration.

## **The Importance of Bone Marrow in Modern Stem Cell Science and the Emerging Scientific View of Regeneration**

The contemporary view emerging in Western science is that the bone marrow cell populations play a central role in cell repair and regeneration. The bone marrow contains two main cell populations, called progenitor cells, responsible for regeneration. Hematopoietic stem cells (HSCs) are a type of stem cell responsible for replenishing most red and white blood cell populations. Mesenchymal stem cells (MSCs) or marrow stroma cells are largely responsible for replenishing endothelial, bone, cartilage, and fat cells. There is an additional class of multipotent adult progenitor cells (MAPCs) that potentially can replenish any adult cell type at least under certain conditions. In a given organ, for example, the liver, hepatic cells generally replenish themselves through the normal process of cellular transcription. In other words, the hepatic cells divide and make additional copies of themselves. However, under certain conditions, most notably in the face of injury to the liver tissue, localized stem cells nested within the liver tissue and/or circulating migratory stem cells are recruited to replenish liver cells through a process of “plasticity.”<sup>92</sup> Plasticity means that stems cells are capable of changing their “phenotypic fingerprint” depending on the demands of the local tissue environment.<sup>93</sup> In other words, protean stem cells transform themselves into specific types of specialized cells according to need. In this conference, for example, we learned how radioactively tagged engrafted stem cells later appeared as normal hepatic cells in animals (this conference, Krause, 2006).

One of the primary strategies to study the behavior of stem cells is to inject or transplant them into a specific tissue environment *in vivo*. According to Bianco et al.<sup>93</sup> stem cell transplantation is the “gold standard” of stem cell research (see Grove et al.<sup>92</sup> for a review of the main research findings from stem cell

transplantation). The main finding across many studies is that transplanted stem cells transform into the specific cell type demanded by the local tissue environment. For example, Kopen et al. injected marrow stromal cells into the brain tissue of neonatal mice. After several weeks these stem cells had migrated throughout the brain tissue. Many had transformed into glial cells or astrocytes and some had differentiated into neurons.<sup>94</sup> Grove et al. conclude that stem cells “give rise to mature functional cells of many tissues” (p. 497), such as skeletal, cardiac, epithelial, gastrointestinal, pulmonary, pancreatic, and CNS tissue. Active replenishment of cell types according to need by transformation of a stem cell into a particular cell type, instead of through cell division of that cell type, constitutes true regeneration.

The second main strategy regarding stem cell research has been to study stem cell behavior specifically with respect to experimentally injured tissue. Here the results are most interesting and quite consistent across different types of tissue injury. Pereira et al.<sup>95</sup> injected bone marrow-derived mesenchymal stem cells with a collagen I marker into radiation damaged mice. The stem cells replicated, migrated to various tissue sites, differentiated, and after several months were found as mature bone, cartilage, and lung cells. Peterson et al.<sup>96</sup> also studied the fate of transplanted bone marrow-derived stem cells into the liver of laboratory rats after the liver tissue had been lethally damaged with irradiation. They found that some of the bone marrow-derived stem cells eventually appeared as different types of liver cells, such as hepatocytes, biliary cells, and oval cells, when normal hepatocyte proliferation is blocked. Ferrari et al.<sup>97</sup> found that bone marrow-derived stem cells played a critical role in myogenesis in patients with muscular dystrophy, and that circulating stem cells migrated to the site of the degenerated muscle tissue, where they became transmuted into normal muscle tissue cells. However, not all stem cell regeneration is positive. Asahara et al.,<sup>98</sup> for example, found that circulating endothelial progenitor

cells were recruited to support neovascularization of developing cancer tissue.

The fate of introduced stem cells into animals with experimentally-induced stroke injury has been studied in some detail. In one study bone marrow progenitor cells from male rats were transplanted into the tail vein of female rats. Four weeks later ischemia was experimentally induced by occluding a cerebral artery on one side of the brain. Following the stroke injury, the fate of the transplanted stem cells was studied. While these stem cells had migrated throughout all areas of the brain, a significantly greater number of stem cells (55% more) migrated to the ischemic side of the brain, and most of these cells had transformed into glial cells and astrocytes.<sup>99</sup> The authors conclude that the evidence suggests “preferential homing of marrow-derived progenitors to the site of the injury” (p. 1289). Similarly, Hess et al.,<sup>100</sup> investigated the behavior of radioactively tagged circulating progenitor cells following stroke injury. They discovered that these bone marrow-derived stem cells played a central role in vasculogenesis, and that some of these stem cells not only eventually appeared as mature endothelial cells, and but also as mature neurons in the damaged tissue area. A series of studies from another laboratory replicated the Eglitis et al. findings in that stem cells migrated and transformed in the brain tissue.<sup>99</sup> However, functional improvement following the stroke depended on how the stem cells were introduced. Intravenously injected stem cells proved to be the best method, in that stem cells are able to readily pass the brain-blood barrier. When stem cells are directly injected into the brain microenvironment, the injection itself may cause damage and mask potential functional changes.<sup>102</sup> Because the evidence strongly showed that the intravenously injected stem cells “migrate preferentially to the ischemic cortex” (p. 1010), Chen et al. hypothesize that preferential migration is likely to occur based on a distress signal from the injured tissue. They state, “These cells appear to be recruited by long-range, possibly inflammatory,

signals originating from the degenerating tissue” (p. 1010).

An important question emerging from the experimental injury research is: how do the stem cells know how to preferentially migrate to the injured tissue? The answer in this presentation is that migrating stem cells follow *both* an energy-information signal and biochemical signal. Azizi et al.<sup>103</sup> found that bone marrow stromal cells injected into the brains of albino rats not only migrate and have a “high potential to proliferate in the host microenvironment” (p. 3912), but also had the capacity to “home into damaged tissue” (p. 1367). Absent in the Azizi et al. study and in most contemporary stem cell research is any discussion of the nature of the energy information signal that causes the stem cells to migrate and also causes them to make a bee-line for the injured tissue.

With the exception of the Chen et al. research,<sup>101</sup> which alludes to the possibility of an energy distress signal emitted from damaged tissue, and mediated by an inflammatory process, the great majority of the current Western scientific research on the “homing” of stem cells has focused on biochemical signaling, in the form of “homing receptors” or “adhesion molecules.” Adhesion molecules, like selectins and integrins, are very specific receptor markers on the cell surface which mediate adhesion of the given stem cell to a specific kind of cell.<sup>104</sup> These findings suggest that stem cells migrate to very specific “niches” along “different adhesive pathways,” each pathway being mediated by very specific adhesion molecules.<sup>105</sup>

The energy medicine model described earlier in this paper to explain how the immune system responds to internal or external threat is also applicable to explain stem cell homing to tissue injury. The main hypothesis in this presentation is that tissue injury results in a disturbance in the unique energy signature or “blueprint” for the body. Neurohormones are distributed strategically throughout the tissue structure of the body. Neurohormones in the microenvironment of the injured tissue directly register the disturbance of the body’s normal

energy signature through inherent resonance, and transmit a high speed energy-information distress signal propagated along predictable connective tissue/meridian lines. This energy-information signal is transmuted into biochemical information. The stem cells then preferentially home to the site of the injury. The energy distress signal also initiates expression of adhesion molecules, which in turn link specific receptor sites of the homing stem cells and injured tissue cells. The distress information transmitted to the stem cell informs the stem cell specifically how to change its “phenotypic fingerprint” so as to transform itself into the specific type of cell needed to repair the injury.

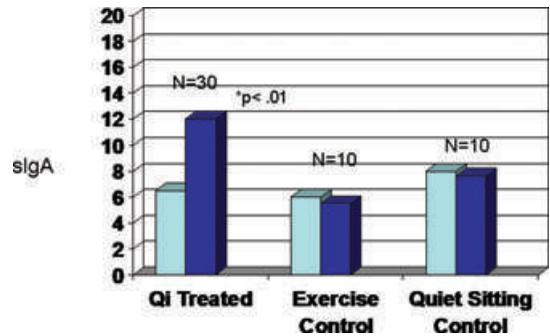
There is at least some contemporary scientific support for the energy information relay model for stem cell regeneration. These studies, however, are limited to experimental investigation of exogenously supplied EM currents. For example, Yonemori et al.<sup>106</sup> demonstrated that pulsed electromagnetic stimulation of the bone marrow in animals *in vivo* resulted in a significant increase in proliferative activity of osteoblasts. ELF currents have been shown to stimulate osteogenesis both *in vitro*<sup>107–110</sup> and *in vivo*<sup>111,112</sup> Matsunaga et al.<sup>113</sup> found that such ELF electrical stimulation of histologically tagged bone marrow tissue *in vivo* initiated the differentiation of mesenchymal cells into osteoblasts. Landry et al.<sup>111</sup> found that ELF stimulation clearly caused differentiation of stem cells into osteoblasts, but did not result in any proliferation of the cells. In osteoblasts grown in tissue culture ELF treatment stimulated collagen type I mRNA expression and the synthesis of specific proteins used in building the extracellular matrix. The magnitude of the ELF effects on the differentiation of osteoblasts and the development of an extracellular matrix were comparable to the effects of several well-known growth factors.<sup>108</sup> Several studies have demonstrated that exogenous ELF currents induce stem cells to regenerate as part of the cardigenesis process.<sup>114–116</sup>

There are a few studies on the application of exogenous EHF currents. Soboleva and

Ignasheva<sup>117</sup> studied the effect of EHF currents on cryogenically preserved and transplanted bone marrow in mice. Nonthermal EHF doses stimulated hemopoietic cells and increased survival rate in transplant donors. Pletnev<sup>118</sup> found that giga hertz irradiation in mammary cancer patients on chemotherapy offset the otherwise expected negative effects of the chemotherapy on red and white blood cells. Exogenous energy currents stimulated the proliferative activity of the red and white blood cells in the bone marrow. These studies demonstrate the EHF currents applied to bone marrow cells directly stimulate the proliferation of bone marrow cell populations, provided that the EHF are not within a frequency range that damages the tissue.

Across these studies it appears that exogenous ELF, and possibly EHF currents play a central role in signaling osteogenesis, thereby raising the question that naturally occurring endogenous distress currents after injury may also activate homing to and differentiation of stem cells at the site of an injury. The studies with both exogenous ELF and EHF currents on the stimulation of bone marrow cells support the observation made fifteen hundred years ago by Bodhidharma, namely that direct manipulation of the bone marrow is associated with regeneration. Contemporary Western stem cell research could very well benefit from the knowledge about energy information relay in indigenous Tibetan and traditional Chinese medicine because this “inner science” knowledge may provide important evidence about the endogenous signaling system that stem cells use to home to and then regenerate in injured tissues. Virtually nothing is known in modern science about the endogenous energetic information signaling system used by stem cells. Very little is yet known about the complex biochemical information signaling utilized by stem cells.

Unfortunately, to my knowledge, there has been no Western scientific research on bone marrow washing or any other mind-body methods designed specifically to gain mastery over



**FIGURE 3.** Effects of spinning the small heavenly cycle meditation on immunoglobulin activity (sIgA). Gray bars, pre-test; black bars, post-test. (Used with permission from Feng and Yan.<sup>120</sup>)

the extraordinary energy channel system originally mapped by Bodhidharma. From the extensive work done on reversing fat depositing within vascular tissue,<sup>119</sup> Western medicine certainly has evolved the technology and set of procedures that could be readily applied to studying techniques to reverse fat depositing in the bone marrow and thereby restoring the health of bone marrow tissue. My hope is that this presentation in this conference will stimulate such research.

At least one study in China, however, has addressed the effects of spinning the small heavenly cycle meditation on immune functioning. Feng Li Da and Yan Xuanzuo<sup>120</sup> had 30 experimental subjects practice the small heavenly cycle for ten 40 minute sessions. Ss in one control group sat quietly for ten sessions, and Ss in another control group did exercise for 30 minutes over ten sessions. The dependent measure was salivary immunoglobulin A (sIgA). The sIgA level was found in other studies to be a reasonably valid indicator of overall immunocompetence (McClelland, personal communication, 1987). As Figure 3 shows only Ss in the experimental group showed a significant pre/post increase in sIgA. According to *Bone Marrow Washing* circulating the small heavenly cycle increases the flow of Chi energy in both the 12 ordinary channels as well as in the two primary extraordinary channels. Therefore, it is not surprising that stimulation of the ordinary

channel system through this meditation had a direct effect on the immune system because the ordinary channel system is directly associated with immune functioning. Unfortunately, the Feng Li Da and Yan Xuanzuo study failed to include any dependent measure of the effects of the meditation on the bone marrow. The findings do however suggest that such mind-body practices directly stimulate the energy systems in the body, and can produce significant and measurable effects on physiological systems. To my knowledge no modern scientific study has yet addressed the effects of spinning the small heavenly cycle on cell populations or fat depositing within the bone marrow, and certainly no scientific studies have been conducted on the more powerful bone breathing methods.

Overall, Bodhidharma's *Bone Marrow Washing*<sup>36</sup> is a remarkable achievement in that through intensive meditation on the body, Bodhidharma discovered fifteen hundred years ago what contemporary Western stem cell scientists are just beginning to rediscover, namely that the health status of stem cells is *the* key to longevity and regeneration, and that mind-body methods can directly alter the signaling system used by stem cells in the service of promoting longevity in general and regeneration of damaged tissue in particular.

### **Awakened Consciousness and the Central Energy Channel System**

Knowledge of the central channel system is most developed within the Indo-Tibetan Buddhist tantras as compared to other Eastern traditional healing systems. Therefore, in order to foster meaningful dialogue between the Tibetan doctors and lamas speaking at this conference and Western medical scientists some knowledge of central channel system is warranted. Unfortunately, from the perspective of scientific evidence there are virtually no studies on the central channel system, except for a single case study. In that study a Western subject proficient in the energy tantras was able

to block both the visible weal and flare, but also cellular infiltration at the site, in repeated measures a passive transfer skin test to *Varicella zoster*. The subject claimed to block the migration of the immune cells by blocking energy currents,<sup>121</sup> in other words by blocking the energy information signal for the presence of the antigen.

Traditionally, the central channel system is said to run vertically roughly between the spinal cord and a vagus nerve, and may constitute a flow channel generated by the semi-conductance of these nerve tissues. According to the classical description there are also two other parallel channels that run along side the central channel. For the normal adult, the flow of energy in these side channels is said to be impure, and the central channel remains largely inactive. The practitioner first learns to perceive clearly the flow of energy in these side and tributary channels. This type of practice is called "vajra body practice" or "subtle body practice." Through a series of strenuous physiological manipulations of the breath combined with deep concentration ("vase breathing") the practitioner of tantric energy yoga learns to redirect the flow of energy from the two primary side channels and many tributary channels into the central channel. Having done so, the meditator now engages in "inner fire" meditation. The act of redirecting the flow of energy into the central channel is sometimes called "igniting" the inner fire. Next, the goal is progressively to direct the energy up the central channel, and in the process to achieve a level of mastery so the energy flows in a stable way, under the control of the meditator. This type of skill is sometimes called "causing the fire to blaze." The two-stage process of igniting and causing the fire to blaze is sometimes referred to as "mixing and moving" practices. The Tibetan compound, *brse 'pho* contains the terms, "to mix" (*brse ba*) and "to move or transform" (*'pho ba*) because the exercises entail first directing and mixing the energies from other channels of the body into the central channel, and then moving up the central channel

in a carefully controlled manner until a fundamental transformation of consciousness occurs. This transformation of consciousness is sometimes called “very subtle body practice.” The quantum of awareness represented by the very subtle body is said not to be packaged either in the physical body or in personal consciousness. It is also said to survive physical death of the body.<sup>122,123</sup> These are the kinds of extraordinary meditation practices that the speaker, Geshe NgawangTsondu alluded to earlier in this conference when he described the possibility of achieving the “deathless body” through full mastery of the very subtle energy and subtle body practices. The primary goal of tantric energy yoga is to aid the awakening of consciousness to its natural condition. Direct manipulation of energy in the central channel system is said to rapidly remove negative bodily and mental states that otherwise serve to obscure realization of the mind’s real nature, namely realization of the simultaneous, non-dual bliss/wisdom mind.<sup>123</sup> Skillful mastery over central channel flow is also said to increase the likelihood of establishing just the right conditions to awaken the mind.

However, another outcome of Tibetan central channel meditation that is generally not talked about is at least some allusion to the fact that advanced mastery of the *bsre pho* practices leads to “immortality,” i.e., survival of a quantum of awareness beyond physical death. This extraordinary claim is not limited to Tibetan *bsre pho* practices. For example, the second section of Bodhidharma’s *Bone Marrow Washing* text is on *Brain Washing*.<sup>36</sup> These meditations were designed to open the upper energy centers of the inner brain region through special breathing exercises called *shen* (“spirit”) breathing, which when fully mastered enables a quantum of awareness to “gradually separate from your physical body”<sup>36</sup> (p. 251). As Bodhidharma says, these practices help the master to “disembody and become immortal” (p. 252). Similarly, in Taoist inner element meditation, mastery of *shen* breathing is said to allow the master “to ascend heaven in broad daylight as

an immortal.”<sup>82</sup> (p. 396). Of course, as Western scientists we have little way of knowing exactly what the masters of these great Eastern meditation traditions are all referring to when they speak of true immortality. Certainly, these masters speak of something far more extraordinary than anti-aging and tissue regeneration per se.

As Western scientists, in our sincere efforts to enter the uncharted area of bringing longevity and regeneration into the domain of legitimate and respectable scientific inquiry, we may wish to divest ourselves of developing hypotheses and research designs on the topic of immortality. Yet, if we are to show respect to our Tibetan friends participating in this conference, we can’t fully avoid, for example, Geshe Ngawang-Tsondu’s description of the “very subtle body” or “deathless body,” whatever that may mean to us. While contemporary Western science, for the most part, probably isn’t ready at all to tackle the issue of immortality, there are at least some scientists who have found a starting point for dialogue, for example, Tiller’s work<sup>124</sup> on the relationship between subtle energy, intention, and consciousness, and Schwartz’s work on quantum theory and survival of the individual energy-information system beyond physical death.<sup>125</sup>

## Summary

I’ve included this paper in the conference for several reasons. First, I believe that Western research on the immune system has over-emphasized the biochemical signaling system and under-emphasized the energy information signaling system, which is so much the focus of traditional Eastern healing systems like traditional Chinese medicine and Tibetan medicine. Modern Western energy medicine is just rediscovering an energy signaling system first described nearly four thousand years ago and mapped out in detail about five hundred years ago. Second, I believe that this overview of the three layers of the macromolecular energy signaling system provides a conceptual foundation

to understand exactly where the central channel system of Tibetan meditation and medicine does and does not fit into the question of longevity, so that we might engage in a more focused dialogue with our Tibetan friends. Finally, I believe that the extraordinary channel system and especially the *Bone Marrow Washing* practices “cut right to the bone” of the central questions of this conference, namely regeneration and longevity. *Bone Marrow Washing* offers a set of practices promising to reverse the aging of the bone marrow, to revitalize the red and white blood cell population and especially the all-important stem cell population, so the full potential of these regenerative cells is available to the organism for growth and/or healing from tissue injury. I hope that this brief overview will stimulate well designed scientific inquiry on the body’s regeneration and longevity resources.

### Conflicts of Interest

The author declares no conflicts of interest.

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