

HEALTH AND STRESS

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STRESS, HEALTH AND AGING CONFERENCE

KEYWORDS: Cancer and regeneration, inflammation and immune system function, stress and aging, mindfulness based stress reduction, telomerase, SIR longevity genes, stress and autonomic nervous system function, transcendental meditation, *Bioelectromagnetic Medicine*, subtle energy communication

Two weeks ago, I participated in the **Longevity & Optimal Health Conference** sponsored by the Columbia Integrative Medicine Program and Tibet House U.S. that was designed to integrate Eastern and Western perspectives on these complex topics. For most Western physicians, Eastern medicine is a perplexing potpourri of practices such as acupuncture, numerous meditative techniques, herbal medications and various yoga and Tai Chi exercises. Their benefits are believed to result from influences on the orderly flow of equally enigmatic life force energies like *chi* through prescribed pathways (meridians) or promoting *prana* in chakra centers around the body. A major goal of the conference was to demonstrate how cutting edge technologic advances in sophisticated imaging procedures, stem cell, telomere, energy medicine and stress research have objectively verified the benefits of Eastern approaches. To accomplish their objectives, the organizers attracted leading scientists in these and other relevant areas as well as Buddhist scholars and authorities on Tibetan medicine that included some well-trained physicians who had already incorporated traditional Eastern techniques in treating patients, particularly those with stress-related complaints.

The program consisted of six panel sessions in a format that usually provided brief presentations by Western scientists whose findings were responded to by experienced Eastern medicine proponents to explain how such studies supported ancient teachings and practices. Following each session, there was a discussion by the panelists after which questions submitted from the audience of several hundred were answered as time permitted. A summary of the salient features of each of these panels follows:

Panel I: Foundations of Longevity Practices in the Indo-Tibetan Tradition

Indo-tibetan Buddhism claims that its meditative, yogic, and related practices can retard and even reverse aging, protect the body from deadly diseases and acute trauma, and dramatically enhance psychological and cognitive functioning. Tibetan anti-aging therapeutics and their mechanisms were discussed to lay the foundational cultural, religious, and philosophical framework for achieving optimal health within this tradition, and

ALSO INCLUDED IN THIS ISSUE

- **Introductory Essays By Drs. Erin Olivo And William C. Bushell**
- **Bioelectromagnetic Energies, *Chi*, *Prana*, Auras And Heart Rate Variability**

to set the stage for a more precise discussion of these practices as they relate to recent advances in the Western sciences.

Panel II: Longevity Advancements

The lifespan extension claims of the Indo-Tibetan tradition implicate a host of physiological processes, which have been traditionally viewed as exceptional in humans, including resistance to the damaging effects of normal metabolic activities. However, work in the biomedical sciences has recently begun to elucidate the potential biological bases of these claims. Leading researchers in the cellular biology of aging have demonstrated that strategies such as caloric restriction and extended between-meal fasting are effective in extending maximal lifespan by bringing about changes in the basic metabolic pathways that determine cellular energies. It seems plausible if not likely that similar metabolic effects are induced by the Indo-Tibetan ascetic diet as well as other traditional Tibetan medical practices.

Panel III: Regeneration

The longevity potential described by the Indo-Tibetan tradition necessitates the regeneration of damaged tissue in a fully functional manner. Such a postulation may not be so exceptional when considered alongside exciting experiments demonstrating the full regeneration of damaged heart tissue in the MRL/MpJ strain of mouse. Previous research has focused on the remarkable regenerative abilities observed in amphibians and other "lower" forms of life but this recent research suggests the presence of a genetically latent regenerative potential in mammals and possibly humans. Other scientists have come to recognize the regenerative capacities of human stem cells, especially those derived from bone marrow, based on their capability to differentiate into mature cells of organs as varied as the heart, liver, kidney, lungs, GI tract, skin, bone, muscle, cartilage, fat, endothelium, and brain. These new findings indicate the existence of alternate pathways of aging, which make possible the persistence of the organism in a "youthful" state that could indeed be activated by certain Indo-Tibetan meditative, dietary and yogic practices.

Panel IV: Protection

The Indo-Tibetan tradition maintains that proficiency in longevity practices can bring about extraordinary resistance to the harmful effects of disease and other forms of physical damage. A growing body of work in neuroendocrinology and psychoneuroimmunology is now establishing a physiological link between the stress-reducing effects associated with Indo-Tibetan yogic and meditative practices and the inhibition of disease processes central to the issue of human lifespan extension. Excessive stress reactivity has been implicated as a biological mechanism of neuronal damage and brain aging; recent work by Dr. Elizabeth Blackburn and colleagues on telomere and telomerase activity has established very direct links between the experience of psychosocial stress, basic markers of cellular aging, and cardiovascular disease risk. Developments in psychoneuroimmunology have elucidated the role played by the autonomic nervous system in immune regulation and demonstrated the deregulating effects of psychosocial stress. The action of the immune system has also been found to have considerable influence over the local signaling environment at the site of injury, as it coordinates the inflammatory response and subsequent wound healing. Yogic and meditative practices are known to induce autonomic modulation and, as current research suggests, may be capable of enhancing certain protective and regenerative aspects of immune function. Indeed, combined cognitive-behavioral stress reduction and aerobic-exercise training (which approximates aspects of Indo-Tibetan meditative and yogic practices) has been shown to prevent the negative effects of psychosocial stress upon immune system regulation and function.

Panel V: Optimization

The scientific research on Buddhist meditation has focused primarily on the ways in which mindfulness meditation is effective in reducing stress and improving health. Much less

attention has been devoted to research demonstrating the potential of certain types of meditation to not only protect and help regenerate the brain, but also to profoundly enhance psychological and cognitive functioning by significantly improving emotional regulation, memory, learning, and analytic abilities. The Indo-Tibetan tradition possesses a system of highly refined meditative and yogic practices, which it claims are capable of positively transforming practitioners and enhancing their cognitive, physiological, and psychological faculties. This session examined these practices in detail and discussed how such exceptional cognitive abilities that are exhibited by advanced virtuoso meditators can be accessed and cultivated by normal individuals.

Panel VI: Methodology

One of the aims of this conference was to mobilize a greater understanding and more creativity in appreciating the nature of biologic aging process by recognizing that potentially radically effective longevity-enhancing practices are encoded in the Indo-Tibetan tradition. In order to sustain this dialogue, it is essential to devote careful consideration to the methodological issues inherent in any conversation dealing with investigative practices that have emerged from divergent cultural contexts, especially those that bridge the traditionally expansive gap between Eastern and Western epistemologies. This session explored several of the most pertinent methodological issues and panelists presented upcoming research programs for discussion in these areas. Opportunities to learn and experience some of the modalities being discussed such as yoga and meditation were also made available throughout the course of the conference.

The highlight of this remarkable and ground breaking event was the last day, when panelists presented their key findings to His Holiness, the 14th Dalai Lama, who responded in his closing remarks, which included a statement of the directives for future research. The conference was conducted September 18-21 at the Menla Retreat, an idyllic setting in the Catskill Mountains. A schedule of the program and information about the sponsors and organizers of this conference and the Dalai Lama can be obtained by Googling Paul Rosch and Dalai Lama and more detailed information is available at www.columbiaintegrativemedicine.org/events.html. The conference proceedings will be published next year by The New York Academy of Sciences.

Introductory Essays By Drs. Erin Olivo and William C. Bushell

Some appreciation of the scientific rigor characteristic of this event may be gained by the following edited introduction to the Protection Panel by Erin Olivo, Director of the Columbia Integrative Medicine Program at the Columbia University Medical Center who chaired the meeting. (The more than 100 References are omitted due to space constraints.)

"We are extremely honored to have as a part of this Protection Panel several of the world's most eminent authorities in the fields of Neuroendocrinology as well as Psychoneuroimmunology (PNI). Our discussion during this panel session will center on the scientific study of the complex interactions among emotions, the central nervous system, and the immune and endocrine systems. Extensive research in these areas over the past decade has resulted in the development of a new paradigm of health, which has begun to elucidate the multidirectional and multidimensional nature of health and the stress response. This PNI paradigm is astoundingly congruous with the "holistic" view of health at the center of Tibetan medicine and indeed provides a body of evidence descriptive of the mind-body connection proposed by this twelve centuries old healing tradition which is a continuation of the 2500 year-old Indian Buddhist tradition. Indeed, Tibetan Medicine does not establish (as Western medicine historically has) a duality between the mind and the body, but instead, views mind and body as a single totality in which the somatic and the psychic interact with one another.¹

The Indo-Tibetan tradition claims that proficiency in the suggested longevity practices of meditation, diet, and physical exercise (yoga, prostrations), will result in profound anti-

aging, stress reducing and health enhancing effects. Western biomedical research has begun to demonstrate that the psychobiological states induced and cultivated by cognitive behavioral practices that are emblematic of those contained within the Indo-Tibetan tradition, (hypnosis, meditation, visualization, systematic relaxation), do have a profound impact on the body's protective and regulatory systems. Although further study is necessary, much of the early research illuminating the mechanisms responsible for the lifespan extending and health enhancing effects of these cognitive behavioral practices points to the importance of their anti-inflammatory, anti-stress, and antioxidant effects, as well as their impact in improving the production of endogenous substances that possess general longevity-enhancing and regenerative properties.

Impact on Immune Function and Inflammatory Process

Aging is characterized by the simultaneous heightening of baseline inflammation and reduced antimicrobial effectiveness, and many investigators now believe that such immunosenescence may be in large part responsible for the fundamental processes of aging itself.^{2,3} Inflammation has been linked to a broad spectrum of conditions associated with aging, including cardiovascular disease, type II diabetes, Alzheimer's disease, rheumatoid arthritis and various cancers.⁴ The groundbreaking work of Kevin Tracey in the area of immune function and inflammatory processes has set the stage for further research into how the cognitive behavioral practices of the Indo-Tibetan tradition may modulate dangerous inflammatory mechanisms, while at the same time up-regulate the body's innate antimicrobial capacities and reverse immunosenescence. At the heart of this action may well lie the interrelation elucidated by Dr. Tracey and others, between stress, the inflammatory response and specific tracts of the central nervous system (CNS). The observation that inflammatory challenges activate pituitary-dependent adrenal responses and alter neuronal signaling in the hypothalamus alerts us to the presence of a central nervous component of inflammatory regulation.⁵ The CNS receives both humoral and neural input from peripheral inflammatory loci, and in turn exerts immunomodulatory effects through parasympathetic efferent activity. Activation of the vagus nerve drives acetylcholine release in the liver, spleen, heart, and GI tract, which effectively inhibits the release of inflammatory cytokines from tissue macrophages. These linkages work together in a "neural pathway that reflexively monitors and adjusts the inflammatory response."

Documentation of this "cholinergic anti-inflammatory pathway" provides further proof of the connection between mind and body and offers guidance in the development of potential interventions that may target components of this pathway. For example, Dr. Tracey has suggested that biofeedback, hypnosis, meditation and acupuncture may all potentially be used to regulate autonomic function (through vagal activation) and thereby modulate cytokine release.⁵ Indeed, studies of meditation and meditation-like practices (self-hypnosis, systematic relaxation, guided imagery etc.) have demonstrated a range of anti-inflammatory effects. Reductions in levels of tumor necrosis factor (TNF),⁶ interleukin-2 (IL-2),⁷ and interferon (INF),^{7,8} as well as attenuations in inflammatory responses to a range of antigens, allergens and irritants, including lipopolysaccharide,⁹ histamine,¹⁰ capsaicin,¹¹ varicella zoster,¹² and ultraviolet B,¹³ all of which have been shown to result from the use of these cognitive behavioral practices. Interestingly, practices such as these may also have bearing on recent treatment models of neurodegeneration, which focus on the use of cholinesterase inhibitors to enhance acetylcholine-mediated neural transmission.¹⁴ Though the potential impact of Indo-Tibetan cognitive behavioral practices on age-related neurodegeneration is discussed in depth below, at this point it should be noted that this treatment strategy, as well as the association of anticholinergic drug treatment with cognitive decline in the elderly,¹⁵ suggest a role for practices which enhance parasympathetic tone in neuroprotection since acetylcholine is the principle parasympathetic neurotransmitter.

Resistance to Trauma and Infection

Cognitive behavioral techniques might not only exert ongoing, "chronic" anti-

inflammatory effects, but also acute anti-inflammatory responses to challenges or trauma from burns, surgery and other forms of injury.¹⁰⁻¹⁹ In fact, there is a small but significant body of research showing that, with training and proficiency, an impressive, even extraordinary level of resistance to stress, inflammation, and the associated tissue damage, is achievable for practitioners of these cognitive behavioral techniques.²⁰⁻²⁷ Enhanced secretion of endogenous melatonin (MT) and dehydroepiandrosterone (DHEA), as well as of acetylcholine, alpha-melanocyte stimulating hormone and growth hormone, appear to be significant components of a neuroendocrine response triggered by cognitive behavioral practices such as meditation.²⁸⁻³⁵

The anti-inflammatory and anti-shock properties of these substances have been established in a number of clinical and experimental trials.³⁶⁻⁴⁵ Interestingly, these substances – especially MT and DHEA – appear to exert either direct or indirect antimicrobial actions on a wide range of disease-causing pathogens, such as West Nile virus,⁴⁶ schistosomiasis,⁴⁷ and many others. In addition to their overt antimicrobial actions, these substances also appear capable of counteracting the inflammation-mediated pathological changes induced by these and other major infectious diseases, such as tuberculosis.⁴⁸ It is also interesting to note that the cholinergic anti-inflammatory pathway identified by Dr. Tracey and described above is in many ways isomorphic with the pathway that more generally mediates stress and relaxation. A number of studies have shown that animals and humans subjected to prolonged, heightened stress can be at considerably greater risk for developing disease when infected by viruses, bacteria, and other pathogens.⁴⁹⁻⁵¹ This highlights the interaction between the autonomic nervous system (and the associated stress response) and immune modulation, and suggests the possible role of anti-stress cognitive behavioral practices in conferring immunity to a host of harmful pathogens.

Psychological Impact – Stress and Aging

Central to the psychoneuroimmunology paradigm as well as the holistic view maintained within the Indo-Tibetan tradition, is the role of emotions, psyche and stress in both the development of disease and the aging process. Numerous studies have demonstrated that negative affect, depression, anxiety, and perceived stress are implicated in the development and exacerbation of diseases such as cancer, cardiovascular disease,⁵²⁻⁵⁴ metabolic syndrome, and multiple sclerosis⁵⁵ to name a few. In addition, several recent controlled studies have demonstrated that in some populations, depression can increase risk of death by as much as four times as compared with non-depressed controls.⁵⁶⁻⁶⁰ It is only recently that physiological mechanisms capable of explaining the link between negative affect and mortality have begun to be elucidated. The groundbreaking research of Drs. Elizabeth Blackburn and Elissa Epel has recently demonstrated an association between the experience of stress and both telomere length – a basic indicator of cellular aging – and telomerase activity – a measure of cellular capacity for ongoing replication.⁶¹⁻⁶³

Researchers have only recently begun to measure the impact meditation and related cognitive behavioral practices may have on psychological variables with a focus on symptoms such as subjective feelings of stress, depression, anxiety, panic attacks, and chronic pain. While this body of research is handicapped by small sample sizes and a relative paucity of controlled studies, overall, the preliminary evidence does support the usefulness of meditation in decreasing these symptoms. The majority of research in this area has been conducted using the mindfulness-based stress reduction paradigm (MBSR) developed by Kabat-Zinn.⁶⁴ For reviews of the MBSR literature, more extensive than is possible here, see Baer⁶⁵ and Bishop.⁶⁶

However, it is worth noting that investigations of the MBSR program have demonstrated its effectiveness in decreasing stress, anxiety, and depressive symptoms in the general population in the absence of clinically-defined mood disorder.⁶⁷⁻⁶⁹ Within clinical samples, MBSR training is capable of reducing total mood disturbance and stress symptoms (in a group of cancer patients),⁷⁰ and a combined program utilizing cognitive-behavioral therapy in conjunction with MBSR has been shown to reduce rates of relapse

among formerly depressed patients.⁷¹ There have been numerous uncontrolled studies of the impact of meditation on psychological symptoms. Kabat-Zinn⁷²⁻⁷⁴ reports findings from several studies of his MBSR program with chronic pain patients that indicate reductions on self-report measures of present-moment pain, negative body image, inhibition of activity by pain symptoms, mood disturbance, and psychological symptomology including depression and anxiety. In addition, in Kabat-Zinn's research studying the impact of MBSR programs on anxiety and panic disorder,^{75,76} clinically and statistically significant post-treatment reductions were found in both subjective and objective symptoms of anxiety and depression and these results were maintained at the three-year follow-up. A recent pilot study conducted at Stanford demonstrated that a program of meditation and yoga could significantly impact the perception of caregiver stress and the related symptoms of depression and anxiety.⁷⁷ It is worth noting that this is exactly the type of challenge – perceived caregiver stress – linked by Blackburn and Epel to telomere shortening.

Impact on Neuroendocrine Function

The research of Dr. Bruce McEwen and others has begun to elucidate the role played by glucocorticoids (GCs) in the deleterious effects of stress on health and aging.^{78,79} The "glucocorticoid cascade hypothesis" (established through investigation in rat models), suggests that basal levels of glucocorticoids and ACTH rise with age and that aging is associated with a loss of sensitivity in the adrenocortical axis to feedback inhibition, presumably due to "degenerative changes within the aging brain, specifically in the hippocampal region of the limbic system."⁷⁸ In addition, this model suggests that "cumulative exposure to basal concentrations of glucocorticoids lead to the degenerative loss of neurons and GC receptors in the senescent hippocampus, and that chronic stress, with its resultant increases in GC concentrations, accelerates this process."⁷⁸ The overall results of research in the area of the neuroendocrinologic impact of cognitive behavioral practices suggest that practices such as meditation induce a complex neuroendocrine response. Research demonstrates acute declines in several hormones implicated in the deleterious effects of the stress response in response to meditation and related practices, such as cortisol and thyroid stimulating hormone (TSH).⁸⁰⁻⁸³

Additionally, several longitudinal studies confirm that these effects are long lasting in subjects who regularly practice meditation. In addition to the reduction of the above mentioned harmful substances, endogenous neuroendocrine substances with proven anti-inflammatory, anti-stress and general longevity enhancing properties such as melatonin (MT), dehydroepiandrosterone (DHEA), and alpha-melanocyte stimulating hormone (alpha-MSH) have all been shown to be enhanced by cognitive behavioral practices, as mentioned above.⁸⁴⁻⁸⁸ In the context of this discussion, it is relevant to note that among the broad range of protective and regenerative effects they are found to have on the body, melatonin (MT) and dehydroepiandrosterone (DHEA) both appear to counteract the GC-mediated deleterious effects of stress.⁸⁹⁻⁹¹

Impact on Autonomic Function – Stress and ANS

Since Herbert Benson's description of the stress response, a substantial body of research has been devoted to elucidating the role of the autonomic nervous system in both health maintenance and disease processes. A primary set of findings of this research implicate increased sympathetic reactivity and decreased parasympathetic tone as contributing factors to the development of cardiovascular disease. There has been considerable research investigating the acute and long-term impact of meditation on autonomic activity. The overall results indicate decreased activation and include such findings as decreased spontaneous electrodermal response (EDR) and decreased heart rate (HR).⁹²⁻⁹⁵ A meta analysis of 31 studies comparing physiological differences between Transcendental Meditation (TM) and rest control groups indicated that those subjects who had been practicing TM for a long time exhibited significantly lower baseline levels of spontaneous skin resistance responses, respiration rate, heart rate and plasma lactate prior to meditation than comparison subjects did prior to rest.⁹⁶

Yet another group of studies investigated the impact of meditation on recovery from stressful stimulation. Several researchers have reported significantly faster habituation or return to baseline (as measured by GSR, EDR, and HR) after exposure to stressful stimuli in meditators as compared to controls.^{97,98} Hemodynamic variables such as systolic and diastolic blood pressure (SBP, DBP), cardiac output (CO) and total peripheral resistance (TPR) have also been a focus of study in regard to how they are impacted by the practice of meditation. Individuals practicing TM have been found to have lower resting SBP and DBP than matched controls.⁹⁹⁻¹⁰¹ Because blood pressure is the product of cardiac output and total peripheral resistance, changes in these variables have also been studied during meditation. (An investigation of circulation that utilized dye-dilution and radioactive clearance methods yielded results that demonstrated a small but significant increase in CO (15%) during TM. In perhaps the only controlled study investigating the impact of meditation on TPR, subjects in the TM group exhibited significantly decreased TPR and SBP compared with increases in the eyes-closed relaxation control group.¹⁰⁰

Conclusions

The Indo-Tibetan tradition maintains that proficiency in meditative and yogic practices can bring about extraordinary resistance to the effects of disease, stress and aging. The research discussed above demonstrates that there may be, in fact, a scientific basis for these claims. Further rigorous research is necessary in order to prove within the Western scientific paradigm what the Indo-Tibetans have known to be true for thousands of years. It is through this research that we will create a common language embraced by both traditions and thereby truly achieve the 'globalization of medicine.'"

An equally scholarly and well-referenced essay introducing the Longevity Panel was provided by Bill Bushell, a Visiting Scholar at Columbia University who is affiliated with the Anthropology Program at MIT and played a major role in recruiting me and other speakers for this conference. A former Fulbright Scholar and Post Doctoral Fellow at Harvard, his research has focused on the health enhancing effects of cognitive-behavioral practices such as meditation both cross-culturally and physiologically. Some of the evidence he presented showing that meditation has demonstrated effects that are consistent with a lengthening of both the mean life span and the "health span."

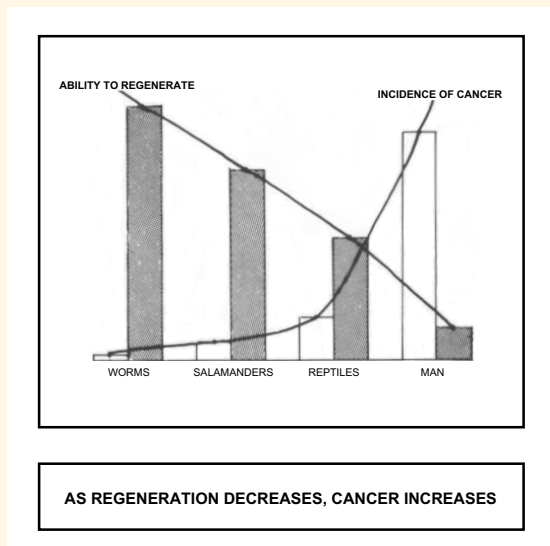
1. A large-scale epidemiologic study comparing hypertensive practitioners of Transcendental Meditation (TM) with matched hypertensive controls over two decades revealed a 23% decrease in all-cause mortality a 30% decrease in the rate of cardiovascular mortality and a 49% decrease in cancer-related mortality.
2. A study of components of the metabolic syndrome in patients with coronary heart disease, found that 4 months of practice led to significant improvements in fasting glucose levels, insulin levels, insulin sensitivity, systolic blood pressure, and heart rate variability. These results are obviously suggestive for retarding the aging process, particularly since blood pressure, glucose and insulin levels, and insulin sensitivity are generally regarded as biomarkers of aging. Other studies on TM that have attempted to evaluate practitioners against controls with respect to putative aging-related biomarkers, including blood pressure, lipid peroxide levels, and standardized sensory and cognitive measures have found meditation to be a successful anti-aging intervention based on these criteria.
3. The mechanisms by which meditation may retard aging and prolong survival and the health span that are currently under investigation include counteracting oxidative and other (e.g., nitrosative, psychosocial) forms of stress, and inflammation, and the general promotion of innate reparative and regenerative processes. Oxidative stress is considered to be a primary cause of aging and may be conceptualized as a result of oxygen radical formation during normal metabolic functioning and/or deficiencies in protective endogenous antioxidant, free radical scavenging capacities. Several studies on meditation have

demonstrated reduced indices of oxidative stress during meditation as measured by levels of lipid peroxides, malondialdehyde concentration and urinary vinyl mandelic levels. Such reduced levels of oxidative stress have been hypothesized to reflect a slower rate of aging and/or enhanced activity of antioxidant/free radical scavenging activities.

4. Of particular interest is evidence of profound reductions in metabolism demonstrated by long-term virtuoso practitioners of meditation and yoga in studies by scientists affiliated with the Scripps Institute, Stanford, Harvard, and Rockefeller Universities. These demonstrate that such individuals could lower their metabolic rate by as much as 40-64%, which is actually within the range of hibernating animals! The reduced metabolic rate associated with "quiescent states" such as hibernation, torpor, estivation, and diapause appears to be associated with a slowed rate of aging, according to a recent extensive review of the available data.
5. Caloric restriction, which also reduces the metabolic rate, has been shown to promote longevity. However, it is not generally appreciated that the classical Indo-Tibetan monastic or ascetic diet is similar or identical to standard calorie restricted diets. Its focus on nutrient-dense staples including beans, legumes, nuts, seeds, fruits, vegetable, milk, yoghurt, and other dairy products roughly reduces caloric intake 33 to 66 percent. This lowered metabolism-based longevity enhancement appears to be mediated by the "silent information regulator" or SIR family of genes, originally discovered to be key agents of life span extension by Leonard Guarente and colleagues at MIT, have largely been responsible for establishing the new field of fundamental longevity biology.
6. A number of studies of meditation and meditation-like practices (self-hypnosis; systematic stylized forms of relaxation; etc) have also demonstrated a range of anti-inflammatory effects and dampening of inflammation-like immune processes. Recent gerontological research has focused on elucidating the aging-accelerating effects of chronic inflammation and related immune processes. These studies show that meditation and similar practices may lead to reductions in levels of tumor necrosis factor-alpha, interleukin-2 (IL-2), interferon gamma (IFN-gamma) (as well as reduced inflammatory/immune responses to a wide range of antigens, allergens, and irritants). The other primary components of the regimen – physical exercise and special dietary programs – appear in general to possess anti-aging effects that are similar to those achieved by meditation.

Bioelectromagnetic Energies, *Chi*, *Prana*, Auras And Heart Rate Variability

My contribution to the Regeneration Panel focused on the crucial role of communication in the body as a determinant of health and the role of subtle energies in maintaining homeostasis whenever this "steady state" is threatened by stress. In doing so, I relied heavily on chapters in *Bioelectromagnetic Medicine*, a book published in 2004 that I co-edited with Marko Markov. I began by explaining that my interest in this subject was kindled when Hans Selye asked me to contribute to a 1976 conference on Stress and Cancer sponsored by his International Institute of Stress and the Sloan-Kettering Cancer Center. My presentation proposed that cancer might represent another of his "Diseases of Adaptation" due to faulty responses to stress. This was supported by animal studies and evidence that loss of an important emotional relationship was a frequent antecedent in certain human malignancies. The gold standard for assessing stress at the time was the Holmes–Rahe scale and the leading stressors, (loss of a spouse, loved one and divorce) were all associated with increased risk of cancer. I also noted that as one descends the phylogenetic scale, the incidence of cancer progressively decreases and disappears. Concomitant with this is a corresponding increase in the capability of the organism to regenerate body parts when they are lost or severed, as noted on the following page.



A starfish or salamander can regenerate a lost appendage and other body parts and this likely involves something more than a simple local reaction. The leap from a physical to an emotional loss as a stimulus for cancer growth should not be troublesome. With man's highly developed cerebral cortex, loss of an important emotional relationship may be perceived as being as significant or even a greater stress than physical loss. Perhaps some cancers might represent a vestigial remnant of primitive and very purposeful, regenerative responses to loss that has gone awry, and which now results in new growth or neoplasia that is harmful, rather than restorative.

In his Foreword to the published proceedings of the conference, Selye wrote, "Perhaps as Paul Rosch of New York has suggested, cancer might even be an attempt by the human organism to regenerate tissues and organs and even limbs, as lower animals are able to do spontaneously. Going further, one might say that **'the ultimate health of the organism, like that of society, appears to depend on how well or appropriately its constituent units communicate with one another.'**" This was a quote from my chapter that I expanded on in the recent Longevity and Optimal Health Conference. I also cited studies showing that when metastatic cancer involving the body and tail of the salamander is induced by carcinogens or transplantation of a malignancy, if the tail is severed, it will be completely regenerated. **During this process, the other metastases will disappear, resulting in a cured and perfectly normal animal.** In 1934, two years before his first publication on stress, Selye showed that during the first five days of life, the rat could regenerate an amputated leg indistinguishable from the severed limb. It has also been verified that loss of a fingertip below the nail in children under the age of two requires no treatment since it will grow back perfectly, nail and all. Thus higher forms of life retain this regenerative capacity due to communicative capabilities that are still intact when they are very young.

But how does communication take place in the body? The major pathways are:

Nervous System - Central nervous system (brain and spinal cord) and autonomic (sympathetic and parasympathetic) system have hard-wired connections that communicate at nerve synapses.

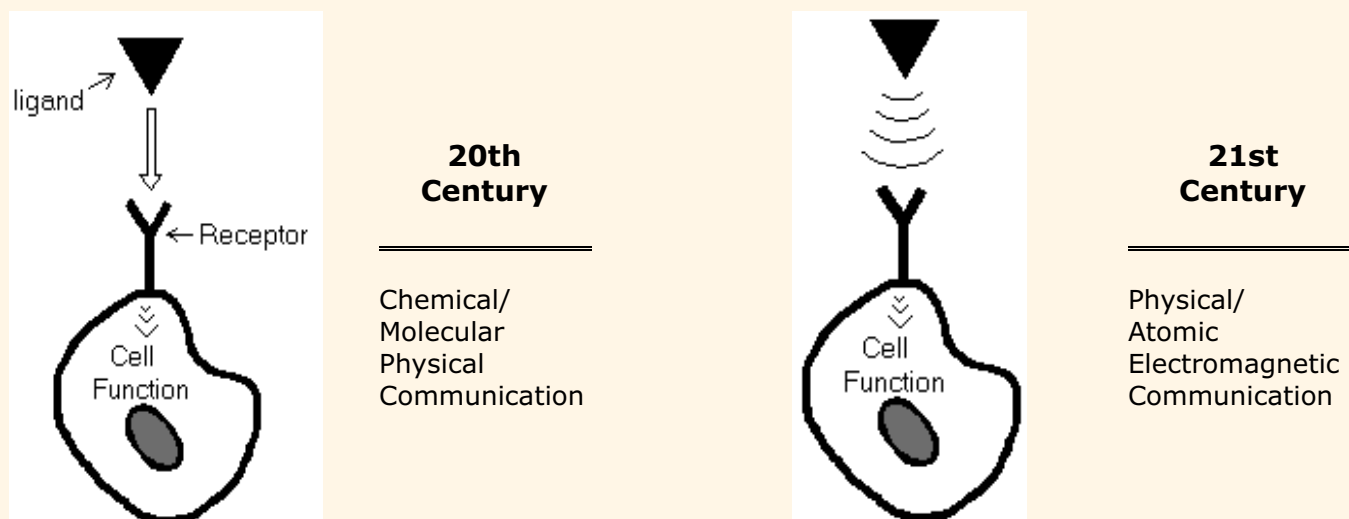
Endocrine System - Hormones secreted by ductless glands into the blood stream can exert widespread effects far from their site of origin.

Neurotransmitters - Peptides released in the brain and gut can also reach distant and local targets via the circulation or other humoral pathways.

Immune System - Difficult to define or delineate with respect to location but different components have both hard-wired as well as humoral connections to various nervous system structures and other sites.

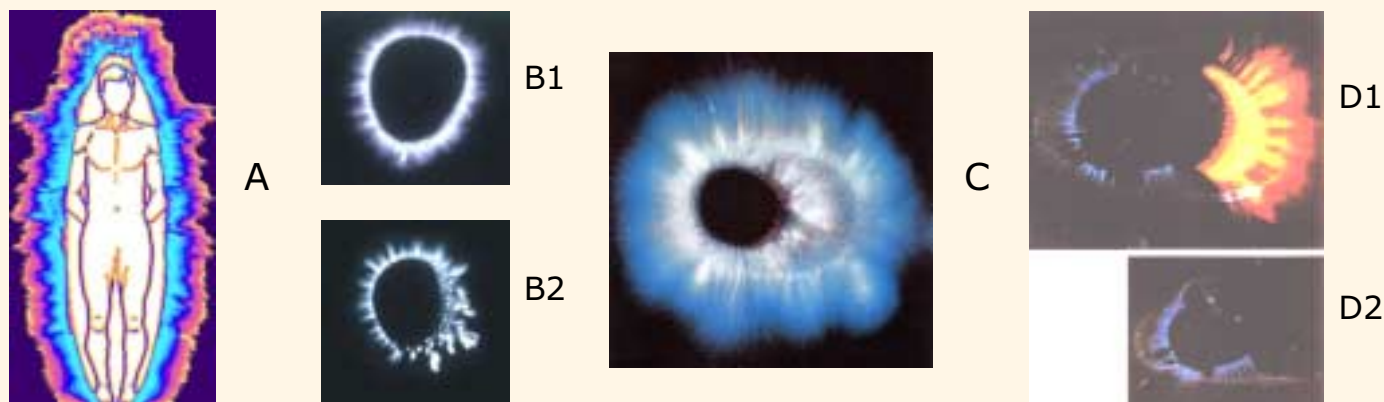
Subtle Energy Pathways? - *Chi* energy traveling through prescribed meridians and other poorly understood communication pathways such as those postulated in Nordenström's proposal of an electrical circulatory system appear to be able to transmit energy signals that are generated internally as well as from the external environment. (However, it seems clear that **all communication ultimately takes place at a physical/atomic level** rather than the current chemical/molecular model of ligand-receptor physical contact.

These two views are contrasted on the following page in diagrams adapted from a chapter I asked Jacques Benveniste to write for *Bioelectromagnetic Medicine* entitled "A Fundamental Basis for the Effects of EMF's in Biology and Medicine: The Interface Between Matter and Function."



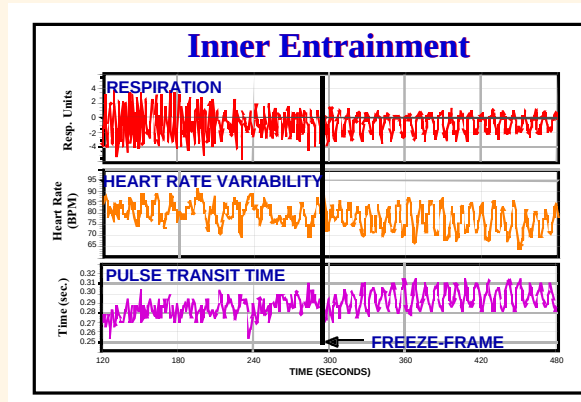
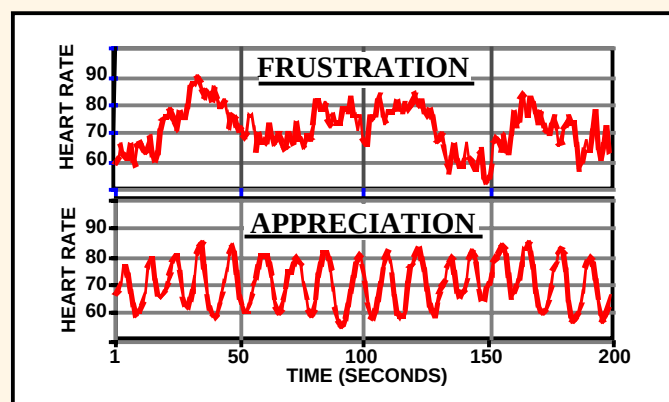
In the current view shown on the left, the size and shape of the ligand molecule (hormone, peptide, antigen) fits exactly into a receptor on the cell wall like a special key in a specific lock and it is this physical contact that initiates intracellular reactions. Such a key/keyhole concept of signaling would require random collisions on a hit or miss basis that had little statistical chance of occurring with great frequency and would therefore take a long time. This could never explain the myriad and varied "fight or flight" responses to stress that occur immediately and simultaneously throughout the body, or some instantaneous humoral antigen-antibody reactions. In the physical/atomic model to the right, the ligand molecule emits an electromagnetic signal with a frequency identical to the receptor's molecules that causes them to resonate and activate specific intracellular responses. All molecules emit specific frequencies and the ligand can co-resonate with the receptor at very low frequencies a long distance away, much as one tunes into a radio station by changing the AM or FM frequency. Thousands of specific signals might be broadcast simultaneously to different co-resonating sites that would also provide feedback on the status quo. EMF or subtle energy signaling could also come from the external milieu.

My presentation also included chapters I co-authored with Björn Nordenström and Demetri Sodi Pallares showing how electrical currents and electromagnetic fields with specific characteristics were capable of curing pulmonary malignancies and reversing far advanced metastatic cancer and terminal cardiomyopathy. A major theme of these and other chapters from *Bioelectromagnetic Medicine* squeezed into 20 minutes was that the body contains its own best pharmacy and that we need to learn how to tap into the vast innate potential for self-healing that resides in all of us. Eastern medicine approaches may point the way based on the accomplishments of some experienced meditators and other practitioners. I also provided some illustrations of how body energies could be visualized and how they differed in health and illness, with different emotions and in healers.



From left to right, **A.** Korotkov Gas Discharge Visualization camera photo of energy auras around a healthy body. **B.** Kirlian photographs of the aura around a fingertip when experiencing a feeling of love (**B1**) and anger (**B2**) showing a marked difference in strength and symmetry. **C.** Energy pattern around the fingertips of a boy and girl during a strong and loving embrace. **D.** The finger pad of a faith healer taken while treating a patient (**D1**). Note the brilliant pattern of colors and flares like lightning and (**D2**) the difference from the same healer at rest before beginning therapy.

I showed how heart rate variability (HRV) and rhythms could also reflect different emotions like frustration and appreciation utilizing HeartMath research illustrations. These also demonstrate how individuals can influence such patterns with the Freeze Frame technique to promote entrainment and synchronicity of different functions. This promotes a psychophysiology coherent state characterized by unusual cognitive clarity, awareness and deep serenity similar to that described by virtuoso meditators and yogis.



The recent availability of inexpensive hand held heart rate variability feedback devices were described that now make this and similar techniques available to a much larger audience. Another example of the inner power that resides in all of us was cited from Bill Tiller's chapter showing how intentionality could influence the pH of a solution, increase ATP to speed up larval maturation and how such mental forces could be transferred to a computer chip to exert the same effects at a later date and different location.

The star studded cast of celebrities at this event included Elizabeth Blackburn, who recently received the Lasker Award (often referred to as the U.S. Nobel Prize) for her discovery and research on telomerase as well as most of the eminent scientists referred to in the introductory essays by Drs. Olivo and Bushell. Dean Ornish described his program of diet, aerobic exercise, yoga and other stress reduction techniques to treat coronary heart disease. This is now reimbursed by Medicare and other fiscal intermediaries because of proven significant health rewards and cost reductions. More recently, it has been found that this regimen may also be effective in preventing prostate cancer and reducing mortality rates. Its similarity in so many respects to traditional Eastern medical practices raises the possibility that the benefits of these approaches may be recognized in the future. The fact that the identical treatment is effective in both coronary heart disease and cancer is reminiscent of Sodi Pallares' remarkable results in both disorders using his combination metabolic-magnetotherapy approach.

My talk included some quotations from Albert Einstein, Hans Selye and the Dalai Lama illustrating how they all came to similar conclusions about health and how to conduct one's life despite their very different backgrounds. I ended by returning to Selye's quotation from my chapter in Stress and Cancer emphasizing that good health depended entirely on good communication – good communication between the components of the internal environment

and between the organism and the external environment. This holds true for all living systems ranging upward from atoms, molecules and organs to people, families, organizations and societies. Good health depends on good communication within and without for all of these, up and down the line as illustrated below. A peptic ulcer could be due to a helicobacter infection in the stomach, family problems like a pregnant unwed daughter on drugs, job stress, concerns about a relative in a far off foreign country ravaged by war, as well as fears of environmental pollution or global warming.



John Donne summarized this four centuries ago when he wrote:

*No man is an island, entire of itself. . .
any man's death diminishes me,
because I am involved in mankind
and therefore never send to know
for whom the bell tolls;
it tolls for thee.*

And as John Muir noted,

*When one tugs
at a single thing in nature,
he finds it attached to
the rest of the world.*



This was also a theme and one of the lessons to be learned from this superb meeting.

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Paul J. Rosch, M.D., F.A.C.P.
Editor-in-Chief
www.stress.org
e-mail: stress124@optonline.net