INTRODUCTION

Biofield Science and Healing: An Emerging Frontier in Medicine

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We live in an age of unparalleled technological and scientific progress, juxtaposed with a cascading series of poor social, health, and environmental choices that could bring our species to the brink of catastrophe. Within the past 100 years alone, we have created significant advances in technologies to better control disease outbreaks, extend our lifespan, enhance global communication, increase our work productivity, and improve our overall quality of life. At the same time, we are facing major healthcare crises including diabetes, cardiovascular disease, cancer, and mental illness. Despite our best efforts and technological advances, we have not yet conquered these and other life- and health-interfering disorders. In addition, health disparities are increasing and the 100 year rise in life expectancy is flattening.[1] This continuance of human suffering, in the face of all our advancements, is leading to substantial and exponentially growing costs to individuals and to society.

A key ingredient in the recipe for advancing the evolution of human health is self-empowerment, which can only emerge with a clear recognition of one's own capacity for healing. Examples from clinical and research areas such as mind-body medicine, placebo, psychoneuroimmunology, and neuroscience, remind us that our capacity to activate our own internal healing response is within our human capabilities. Just a few decades ago, the theory that the nervous system was directly connected to the immune system was highly controversial; today, it is mainstream science—with recent scientific studies uncovering deeper discoveries of vagal-immune and vagal-microbiome communications,[2,3] and a most recent scientific report suggesting functional lymphatic vessels may reside within the brain.[4] The idea that our mental and emotional states impact our immune and cardiovascular systems in a manner that could influence disease progression as well as health, has moved from fringe to fact,[5,6] thanks to decades of careful, interdisciplinary research by scientists who continued to test their initially unpopular hypotheses. These scientists' empirical advances founded and advanced the now well-established field of psychoneuroimmunology (PNI).

Despite these groundbreaking scientific discoveries, translation of these data into interventions for patients to facilitate their own health and healing remain limited. To empower healthcare providers, their patients, and the general public to facilitate their own healing requires an advancement in knowledge and practice that can only occur through the multidisciplinary integration of perspectives on mechanisms of healing and health maintenance. Such an integration is rather daunting to embark upon, given the current culture of academic and clinical specialization, as we are taught to specialize early in our careers as academics and clinicians, and rarely have the opportunity for cross-disciplinary dialogue.

While specialization is intended to lead to discoveries through complete focus and immersion in a single area, the emergence of significant breakthroughs in science and medicine has often occurred as a result of interdisciplinary communication and collaboration. Indeed, Dr Robert Ader, cofounder of PNI, understood that the advances in his field would begin with interdisciplinary inquiry and later lead to a dissolution of arbitrary borders between disciplines, leading to a more global, networked understanding of health:

> *Disciplinary boundaries and the bureaucracies they spawned are biological fictions that can restrict imagination and the transfer and application of technologies. They lend credence to Werner Heisenberg's assertion that "What we observe is not nature itself, but nature exposed to our method of questioning." Our own language, too, must change. The signal molecules of*

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the nervous and immune systems are expressed and perceived by both systems. Therefore, it may no longer be appropriate to speak of "neurotransmitters" and "immunotransmitters." Also, to speak of links or channels of communication between the nervous and immune systems perpetuates the myth that these are discrete systems (or disciplines). On the contrary, the evidence indicates that relationships between so-called "systems" are as important and, perhaps, more important than relationships within "systems"; that so-called "systems" are critical components of a single, integrated network of homeostatic mechanisms."[7]

In the latter part of this quote, Ader suggests that what we have viewed as discrete systems are in fact parts of a larger, holistic network that guides an organism's homeostasis. We propose that such a network may be found in what is currently being termed the *biofield*, a field of energy and information that reflects and guides the homeodynamic regulation of a living system, and as such influences and is influenced by consciousness.

While the term *biofield* itself is fairly new (coined in 1992 at a National Institutes of Health meeting; see Rubik et al, this issue), discussion on the importance and role of consciousness, energy, and information to create and guide emotional, mental, and physical functioning has been described by numerous diverse cultures and used in medical systems for thousands of years (Jain et al, this issue). Despite the careful definition and description of biofield-related concepts in these cultures, our modern descriptions and understandings of such concepts and how they may relate to healing processes are still in their nascent stages. As is evident in this Special Issue, even among biofield science researchers, there is disagreement about whether vitalistic concepts such as *chi* and *prana* are essential for describing the biofield, whether the biofield can be reduced to bioelectromagnetic emanations on different levels of scale, or whether the understanding of the biofield at its core demands a new understanding of physics and biology that incorporate models of consciousness (eg, see papers by Jain et al, Rubik et al, Kafatos et al in this issue). Further, it is not well understood whether mechanisms underlying results from proximally practiced biofield therapies in pre-clinical and clinical studies (see Gronowicz, Bengston, and Yount and Jain et al, in this issue) are at all related to laboratory studies examining the effects of distant healing intention (see Radin, Schlitz, and Baur, this issue). A thorough understanding of how biofield therapies might "get under the skin" and affect physiological processes is still needed (see Hammerschlag et al, this issue). Significant issues remain in understanding whether practitioners' concepts of the biofield are aligned with researchers', as well as with each others' (see Warber et al, this issue). The questions of how to best integrate biofield practitioners into healthcare systems are crucial to address (see Guarneri and King, this issue). In addition, the increasing use of devices that are used to influence aspects of the biofield to enhance a healing response (see Muehsam et al, this issue), represents yet another frontier with respect to research and clinical application.

Biofield science, then, currently finds itself in a highly controversial, not-yet-well-understood, and sometimes academically contentious environment. Regardless of the evidence, this area is viewed by many scientists as too "fringe" to merit serious consideration (see Hufford et al, this issue for discussion of paradigm shifts). Current funding for the field of biofield science is more strongly directed toward industry applications and less toward basic science and clinical application.

Given the current controversies, challenges to conceptualization and measurement, and general lack of funding, why should we consider advancing the field of biofield science? First, the roots of biofield concepts and practice have persisted for thousands of years and remain the basis for many medical interventions and self-healing practices across the globe. Biofield concepts are rooted in indigenous schools of medicine, as evidenced by "whole medical systems" practices such as Chinese, Tibetan, Native American, African, and Ayurvedic medicine. The ongoing use of biofield-based healing practices, in terms of both self-practice and practitioner-assisted modalities, has continued to flourish over time, with increasing evidence to support their use in certain difficult-to-treat clinical populations, with no known adverse effects (see Jain et al, this issue).

Arguably, the use of biofield systems and therapies over millennia, while provocative, may not in and of itself warrant scientific investigation. However, in addition to this preponderance and longevity in clinical application based on concepts akin to biofield, recent empirical advances in bioelectromagnetics suggest that perturbation of electromagnetic aspects of the biofield (involving very weak physical energies) can substantially impact health processes (see Muehsam et al, this issue). These findings are driving industry innovation. The application of bioelectromagnetics in psychiatric and neurodegenerative disorders is growing rapidly. The global industry of neuromodulation (the use of externally applied electromagnetic signals for treatment of central nervous system-related disorders) is predicted to move from 2015 estimates of $3.65 billion to $6.20 billion by 2020.[8] Some scientists have heralded "electroceuticals" as the next wave of "big pharma," with the National Institutes of Health as well as several large pharmaceutical industries investing significant resources in mapping the body's bioelectromagnetic fields for development of further devices for medical application.[9,10] Finally, some of these approaches are becoming more readily available to consumers directly: over-the-counter neuromodulation products are now being marketed heavily by certain groups, with some questioning the ethics and

safety of such use.[11] To this end, it is essential that both the gross and subtle aspects of the biofield be mapped as clearly as possible by varied approaches.

In the spirit of fostering collaborative inquiry and accelerating strong empirical research in the area of biofield science, several organizations came together to sponsor an interdisciplinary scholarly meeting, termed "Biofield Science and Healing." The meeting, sponsored by the Miraglo Foundation, the Institute of Noetic Sciences, the Chopra Foundation, and the Samueli Institute, was held at the Pacific Pearl Center in La Jolla, California, in September 2014. As respected leaders who have been forwarding the science and practice of biofield-related areas for decades, each of these organizations saw the value in a collaborative acceleration of biofield science and practice.

Invited researchers and scholars represented a wide range of scientific disciplines, including biophysics, physics, biology, clinical psychology, psychoneuroimmunology, psychoneuroendocrinology, neurosciences, engineering, and medicine. They were joined by leading biofield practitioners who were specifically selected for having been involved in scientific studies of biofield therapies.

This special issue on Biofield Science and Healing reflects the rich, ongoing exchanges within this interdisciplinary group. It is hoped that this issue will catalyze discussion and advance multidisciplinary inquiry into biofield science. This multidisciplinary effort will be supported through the emergent collaborative backbone organization,[12] the Consciousness and Healing Initiative (CHI), which fosters interdisciplinary science and provides scientifically-based educational resources in consciousness and healing across institutions and disciplines.

Biofield research is certainly a "work in progress" and is not without its share of scientific complexities. However, its potential payoff in terms of service to society could be transformative. This special issue on Biofield Science and Healing is the reflection of a growing interdisciplinary, collaborative effort to advance this rapidly evolving science and discipline. We look forward to collectively supporting these efforts and facilitating the individual and societal health empowerment that may emerge with a clearer understanding of the biofield.

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