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Roundtable Discussion

Biofield Research: A Roundtable Discussion of Scientific and Methodological Issues

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Richard Hammerschlag: This discussion will be among the participants of a symposium on clinical and basic science research on the biofield, held as part of the International Research Congress on Integrative Medicine and Health in Portland, Oregon in May 2012. The 7 of us are conventional biomedical researchers in physiology, clinical psychology, cell biology, biophysics, and neurobiology, who through various paths have expanded our research interests to include performing preclinical studies, clinical trials, and systematic reviews of biofield therapies, as well as basic research and reviews on what we call biofield physiology.

We should begin with a few definitions. Biofield therapies, which most commonly include external *Qigong*, Healing Touch, *Johrei*, Reconnective Healing, *Reiki*, and Therapeutic Touch, are a family of health care practices that involve either, or both, hands-on and hands-off treatment.[1,2]

We infer that such healing can occur since living systems coexist within and co-contribute to a biofield,[3,4] which we define in terms of electric, magnetic, and electromagnetic fields as well as subtle energies (energies that appear to exist but have not yet been measured). I'd like to ask Jim to provide us with a brief overview of how the concept of the biofield has evolved.

James Oschman: Medicine has a long and rich history of exploration of biofields, particularly the bioelectrical and biomagnetic fields produced by the body.[5] A little over 100 years ago, Willem Einthoven developed electrocardiography, a biofield measure used by every physician. For his discoveries, Einthoven received the Nobel Prize in Medicine in 1924. Hans Berger recorded the first electroencephalograms in 1924. Harold Saxton Burr at Yale University School of Medicine made extensive studies of the electrical correlates of physiological processes between 1932 and 1956, and concluded that every event in the body had an electrical aspect. Modern research using very sensitive magnetometers has revealed that all of the electrical events in the body have magnetic correlates, as required by Ampère's Law (1826), which states that charges in motion create magnetic fields in the surrounding space. Modern superconducting quantum interference devices (SQUIDs) have become important tools in clinical medicine for measuring the biomagnetic fields of the heart and brain (magnetocardiography and magnetoencephalography, respectively). In short, biofields are alive and well in modern medicine.

While physicians recognize bioelectrical and magnetic fields as useful for diagnosis, biofields have additional significance for biologists who view the body as very sophisticated in utilizing every form of information transfer available. As you mentioned, there are also "subtle energies," defined by William Tiller on the basis of repeatable but anomalous experimental phenomena that do not appear to involve the known forces operating in the physical universe.[6]

Richard Hammerschlag: Thanks Jim. So, in terms of biofield therapy research, we can begin by asking two different kinds of questions. The first is straightforward: Does the clinical trial literature support the effectiveness of biofield therapies as they are practiced in the real world? But inferences about biofield therapy effectiveness in humans are confounded in trials that reflect the clinical practice of combining hands-on and hands-off protocols. There is evidence, for example, that light touch of the skin reduces stress and pain, and induces a general feeling of well-being,[7] effects that appear mediated by specialized subsets of sensory neurons[8] and oxytocin release.[9]

This leads to our second question: What does the literature offer in terms of clinical trials that report using only nonphysical touch forms of biofield therapies? Related to this question are a growing number of "hands-off" studies with animals and cell cultures as healing targets.

Shamini, you and Paul Mills have addressed our first question in a thorough systematic review of biofield therapy

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clinical trials. Can you provide a brief summary of your findings?

Shamini Jain: We conducted a comprehensive review of 66 clinical studies that included both randomized controlled trials and within-subject designs to examine the current evidence base for biofield therapies across patient populations and clinical outcomes.[10]

Overall, we found that studies were of medium reporting and design quality. Through our best-evidence synthesis, we found strong evidence for reduction of pain intensity in pain populations and moderate evidence for reduction of pain intensity in hospitalized and cancer populations.

There was also moderate evidence for dementia, but there are relatively few studies in areas other than pain. Interestingly, a Cochrane review also found significant effects of biofield therapies for reducing pain intensity, compared to both sham touch and no-treatment control groups.[11]

We concluded that much more work is needed to assess clinical impact and potential mechanisms, especially with adequately powered studies.

Richard Hammerschlag: Thanks Shamini. Our second question asks what can be learned from clinical trials of biofield therapies that report using only hands-off therapy. I am completing a systematic review of 20 identified randomized controlled trials that included at least one group receiving nontouch therapy and 1 group receiving either mimic therapy or an active comparator treatment.[12] These trials included 4 studies of *Reiki*, 1 of external *Qigong*, and 15 of Therapeutic Touch.

What we found, most strikingly, was considerable heterogeneity in research design. As one example, total treatment minutes per trial ranged from 5 (one treatment of 5 minutes) to 480 (two 30-minute treatments per week for 8 weeks), revealing little consensus on "dosage."

Nevertheless, 13 of these 20 nontouch trials (65%) reported at least one statistically significant biomarker effect. The Jadad score,[13] a compact measure of quality of design and reporting, revealed a mean of 3.4 (of a possible 5), indicative of moderate study quality.

Shamini Jain: Richard, I want to echo your finding of heterogeneity in amount and timing of the intervention. In our review as well, treatment parameters showed considerable variation. From a clinical perspective, much more information is needed to determine an adequate "dose" of biofield field therapy for a particular type of ailment.

While our systematic reviews provide an overview of the state of the evidence base for biofield healing, why don't we drop down into some of the trials many of us have performed, especially as they represent a range of biofield therapies using a variety of human, animal and cell culture test systems. Susan, can you start us off by describing your study of Healing Touch (HT) on cancer patients?

Susan Lutgendorf: Our initial project, part of an NIH/NCCAM-funded center grant, assessed how the biofield intervention of HT affects immunity, depression, and treatment side-effects in patients receiving chemoradiation for cervical cancer.[14] At the University of Iowa, we randomized 60 patients before they started chemoradiation, to either HT, relaxation, or usual care. Patients received HT or relaxation therapy 4 times a week for 20–30 minutes per session, directly after each radiation treatment over 6 weeks.

A specific HT protocol, which uses both hands-on and hands-off techniques, was provided by certified HT practitioners in the College of Nursing faculty. Relaxation therapy was provided as a manualized intervention with trained research assistants. Our intent in using relaxation was to provide a credible active control condition also involving social interaction.

Our main finding was a marked reduction of natural killer (NK) cell activity in both the relaxation and usual-care groups, in contrast to only a mild decrease of NK cell activity in the HT group. This between-group difference over time was highly significant. NK cells, which target and lyse tumor cells and perform tumor cell surveillance, are an important outcome measure because their cytotoxic activity is positively related to survival in cervical cancer patients.

The HT patients also showed greater decreases in two indicators of depressed mood compared to the other groups of patients.

Ann Baldwin: My NCCAM-funded study of *Reiki* on rats also involved immune cells.[15] It was triggered by my finding that rats housed in the animal facility were being stressed by environmental noise, from machinery as well as people jangling keys, talking loudly, and repeatedly opening and shutting doors. These stressors caused intestinal inflammation as shown by degranulation of mast cells in the mesentery and intestinal mucosa and by damaged mesenteric blood vessels, as demonstrated by leakage of plasma albumin.[16,17]

These stress responses were reproducible in a more controlled way using a noise generator run at 90 decibels for 30 minutes a day,[15] and I wondered whether *Reiki* would reduce the damaging effects. We found that 15 minutes of noncontact *Reiki* prior to 30 minutes of noise every day for 3 weeks significantly reduced the amount of mast cell degranulation as well as the extent of microvasculature leakage. Sham *Reiki* was delivered by students who were naïve to biofield therapies and who mimicked the hand positions of the *Reiki* practitioner. Rats given sham *Reiki* showed no significant reduction in either stress-related biomarker.

Shamini Jain: Our NIH-funded clinical randomized controlled trial focused on persistent cancer-related fatigue,[18] a symptom that affects about a third of the cancer population up to 10 or more years post-treatment. We compared a touch-based biofield healing intervention (energy chelation) to mock healing and wait-list control groups in 76 fatigued breast cancer survivors.

We found statistically and clinically significant reductions in total fatigue for the biofield group versus the wait-list group, with levels dropping to those considered normative in the general population. Significant between-group effects on fatigue were also detected in favor of mock healing over wait-list. Of added interest, belief in receiving healing was more predictive of improved quality of life than actual group assignment, although belief did not predict fatigue changes.

We also examined diurnal cortisol variability, which is compromised in fatigued and depressed breast cancer survivors and has been linked to disease outcomes, including

mortality, in breast cancer. Biofield healing significantly increased diurnal cortisol variability toward healthy levels relative to both the mock treatment and wait-list groups, and belief did not predict cortisol variability changes. This indicated that the effects of biofield healing on cortisol variability were independent of placebo elements.

Gloria Gronowicz: I will discuss our unpublished data on the effect of Therapeutic Touch (TT) on a breast cancer mouse model. Injection of breast cancer cells into the footpad of mice induced large tumors within 26 days. Control mice received saline injections. Starting at 24 hours postinjections, noncontact TT was performed on the mice for 10 minutes, twice weekly for the entire 26-day period. A sham treatment group was also included; each group had 8 mice.

We found that cancer-induced increases in immune cells in the spleen and lymph nodes (specific T lymphocytes and B cells) were reversed in the TT mice to levels in control mice. A striking finding was that TT significantly decreased the levels of spleen-derived macrophages to normal control levels. The potential importance of this finding is the key role macrophages play in promoting metastasis of cancer cells. Similarly, cancer-related increases of serum cytokine markers (interleukins-1β and -2, interferon-γ), the macrophage protein MIP-2, and the chemokine MIG were significantly reduced to control levels by TT. Sham treatment had similar results as the untreated cancer group.

These results follow our previous NIH-funded research in which treatment of osteosarcoma cells by the same TT protocol as the mouse studies inhibited the excess matrix protein synthesis and bone formation in these cancer cells, and brought these levels down to normal osteoblast levels.[19,20]

Garret Yount: Our group recently completed a pilot study with a biofield practitioner who treated cultured human glioblastoma cells, a type of brain cancer. Six independent samples of the glioblastoma cells were grown side-by-side in subcompartments of one culture plate so that they were exposed to treatment simultaneously. We observed cell behaviors using time-lapse videomicroscopy during the 10-hour periods prior to and following the biofield treatment in comparison to untreated cells. The practitioner, seated a short distance from the cells, delivered treatment from outside a Plexiglass environmental chamber that enclosed the cells and microscope. The practitioner was instructed to try to kill the cancer cells. Control cells were handled identically but no one entered the microscope room during the treatment period.

Data analysis by a technician blinded to the treatment condition revealed that the cell death rate was indeed increased after biofield treatment but remained relatively constant in the untreated control cultures throughout the 20-hour period. Although our pilot study findings can only be considered as suggestive, we are encouraged to conduct a larger study with multiple replicate experiments and systematic negative controls.[21]

Shamini Jain: These are wonderful examples of different approaches for preclinical and clinical evaluation of biofield therapies. This seems a good point to ask the group to discuss the relative strengths and weaknesses of using humans, animals, and cell cultures as healees in these trials.

Susan Lutgendorf: A major advantage of using all levels of models in biofield research is that different models inform each other. Ultimately, we are interested in healing effects on patients, and this can only be assessed in real-world clinical populations. But, while clinical trials reveal medically related outcomes, such as dosage, compliance, and influences of pain, fatigue, depression, concurrent diseases, and quality of life, elucidation of mechanisms requires initial preclinical work. It is most important to engage in this bidirectional translational research between clinical and preclinical studies, with each informing the other to provide a more complete picture of health, illness, and treatment.

Ann Baldwin: I agree. Our goal is to understand what is happening in clinical trials with patients. But to get there, animals provide a good model for investigating biofields since presumably there is no expectation or belief to take into account, at least with rodents. Also, animals housed in research facilities are on identical diets in identical environments with identical opportunities for exercise, so there are fewer uncontrolled variables.

Also, in comparison with cell cultures, animals have an advantage of allowing us to examine the functioning of whole systems (e.g., their immune, cardiovascular, or nervous system).

Gloria Gronowicz: I also agree, and would add a further benefit of cell cultures: They are unaffected by psychosocial factors.

Garret Yount: I think it is worth pointing out additional advantages of cell culture models. Gloria mentioned that psychosocial factors are eliminated. Similarly, the potential for "extraneous healing intention" is minimized. For example, you can be pretty sure that nobody's grandmother—let alone her entire church group—is praying for the cells in the experiment, as might be the case in a study with hospitalized human subjects. This makes for much cleaner experiments since "dosage" of the intervention is more readily controlled. Along these same lines, cell cultures allow for a nearly unlimited number of genetically identical target samples, which lessens variability in treatment responses and ultimately reduces noise in the data. Cell culture studies are also less complicated by ethical considerations and are less expensive, which generally give researchers more freedom to design rigorous experimental controls.

Gloria Gronowicz: Another interesting focus of our symposium is the effect of biofield therapies on cancer. Susan has looked at HT on cervical cancer patients,[14] while Shamini has assessed biofield healing on fatigue in cancer survivors.[18] Garret has examined external *Qigong* and other biofield therapies on human glioblastoma cell cultures,[21] and I have studied cell culture and animal models of TT on osteosarcoma cells.[19,20] It is clearly of major interest to determine whether cancer cells have receptor systems in common for the various biofield treatments.

Susan Lutgendorf: Of interest in light of your comments, Gloria, is that human immune cells are highly sensitive to the sympathetic nervous system. NK cells as well as T-cells and macrophages have multiple receptors that receive signals

from the sympathetic nervous system, so they can definitely be modulated by stress. We need to explore whether biofield therapies affect stress-related pathways or if they work via independent pathways.

We also know that both endocrine and sympathetic factors directly affect specific pathways related to tumor growth (e.g., pathways related to angiogenesis, tumor invasion, and tumor cell survival). These are important future directions for biofield physiology research.

Shamini Jain: I would like to see future trials of biofield therapies examine contributions of placebo elements, such as intention, expectation, conditioning, meaning, and context. Rather than attempt to "subtract away" these phenomena, we need to examine potential *interactions* of placebo elements with perturbations of the biofield. Additionally, to capture the whole-person effect of biofield therapies within clinical contexts, studies can incorporate mixed-methods designs. In this approach, quantitative outcomes can be correlated with occurrences of spiritual and other nonordinary experiences that patients often report when receiving biofield therapies.[1,22]

James Oschman: In addition to considering the relative advantages of performing research with different types of biofield healees (receivers), we should review studies that have used devices, either to detect biofield healing or to mimic aspects of the healers. For example, bringing the hand close to the body or touching it may induce minute current flows through the tissue, and there are therapeutic devices that do this with magnets or microcurrents.

In fact, large multicenter clinical trials[23] have contributed to U.S. Food and Drug Administration approval of pulsing electromagnetic field therapy for healing nonunion fractures.[24] The fields have to be very tiny to be effective. Ross Adey described narrow frequency-power windows: The field has no effect if it is too strong or too weak, or if the frequency is too high or too low.[25] Those large clinical trials showed that healing of bone fractures are speeded by a very weak field, comparable in frequency and intensity to those some scientists have detected coming from biofield practitioners' hands during healing.

Richard Hammerschlag: As we move to discuss basic science research, there is a need to create a framework for conceptualizing and guiding the development of biofield physiology. I suggest we consider a three-part framework that involves, first, identification of physiological changes that occur in the healer to initiate healing. Second, we need to establish the receptor system(s) and transduction mechanisms in the healee that allow the person, animal, and cells to receive and process the healing. Third, of course, is the big question: What is the nature of the transmission between healer and healee?

James Oschman: We can begin by mentioning a few of the proposed receptor systems. A recent review from Turkey suggests that Merkel cells in the skin may be involved as both sensors and projectors of magnetic fields because of their content of melanin, a magnetic material.[26] I previously mentioned Ross Adey's work on frequency windows of sensory neurons. Basically these are examples of how our cells are listening.

There is also a lot of research on how cells amplify tiny signals, for example, the mechanism that enables a single photon to trigger entry of thousands of calcium ions into a retinal cell.[27] The ubiquitous cell membrane calcium channel is a huge amplifier. Also of great interest is the work of Levin's lab at Tufts exploring the central role of bioelectrical activity in cell and organ differentiation and repair.[28]

I recently described yet another potential receptor system (in a poster presentation at the 2012 International Fascia Research Congress) comprising water molecules associated with liquid crystalline arrays of collagen that are extremely sensitive to external fields. Clearly, studies that can correlate biofield healing with physiological changes are of major importance for this field of research.

Gloria Gronowicz: Jim, I recall studies that documented the ability of an energy healer to elicit, within minutes of his treatment, large calcium fluxes in the membranes of cell cultures.

Shamini Jain: Yes, those are the studies of John Ives and colleagues.[29,30] Jim, in relation to mechanistic examinations of biofield physiology, I am curious whether you have any thoughts about the types of devices that are often used in bioenergy studies.

James Oschman: One approach that came to mind when you were discussing pain is Frequency-Specific Microcurrent, which is often effective when conventional medicine is not (e.g., for treating fibromyalgia and chronic pain).[31]

In terms of devices that are being used to measure an aspect of the biofield, one that is most exciting is the SQUID, which we have briefly mentioned, which measures biomagnetic fields around the body.[32] In addition to using SQUIDs to measure magnetic fields from heart and brain, the emerging field of myography measures electrical fields associated with muscle contractions.

It turns out that, in terms of diagnosis, magnetic fields contain more information than electrical fields detected with electrodes on the skin because tissues are transparent to magnetic fields.

Ann Baldwin: Talking about the SQUID, I recently made some measurements on *Reiki* practitioners[33] to attempt to replicate experiments done over 20 years ago that detected exceptionally strong electromagnetic fields from the heart or hands of biofield practitioners.[34,35] In our study, each *Reiki* practitioner initially sat in front of the SQUID, housed in a magnetically shielded room, for baseline measures. The practitioner then sent nontouch *Reiki* to a person in the room, while their heart and hands were again monitored by the SQUID. The measurements were again repeated as they sat in the room alone sending distance *Reiki*.

This extremely sensitive instrument allowed us to record the electromagnetic field generated by each heartbeat of each practitioner as well as the electromagnetic oscillation produced by their respiratory sinus arrhythmia, but we were unable to detect any of the huge fields that energy healers were reported to have generated in similar experiments.[34,35]

A possible explanation for the nonreplication is that our studies were performed in a magnetically shielded room that prevented practitioner contact with the outside environment.

One idea suggested by Jim Oschman[36] and also by Zimmerman[34] is that the flow of energy in a practitioner is triggered by an outside environmental influence, such as Schumann resonance from the earth's electromagnetic field, which is generated by lightning in the atmosphere. Since such radiation would have been blocked from the room in our experiment, there could be no outside influence triggering the flow of *Reiki*.

James Oschman: I'm very glad you did that study.

Ann Baldwin: Thank you.

Shamini Jain: We can now move to consider future directions for our work. The discussion of the SQUID studies reminds me that one key direction is to apply better systems of instrumentation to measure phenomena that may be related to the biofield or the biofield experience.

Gloria Gronowicz: I agree. A particular need is to develop instrumentation or other objective measures to "calibrate" biofield healers. In one of our studies, a team of clinician-scientists evaluated a number of practitioners and chose only those who produced observable and replicable outcomes on patients.[37]

Richard Hammerschlag: Yes, this is a critical step at this stage of biofield research. We often talk about biofield effects as if we are studying a known and reproducible quantity of treatment. This becomes a key problem when interpreting a negative result since we cannot determine whether the healee (human, animal, or cells) is not responding or if the healer is not transmitting a strong signal. We need to keep looking for a standardized procedure for pre-experiment calibration of practitioners.[38]

Gloria Gronowicz: Apropos of that, it is most important to identify potential funding sources to enable us to perform these foundational studies needed to strengthen our preclinical and clinical research proposals. At present, it is difficult to obtain funding from mainstream sources because, as implied in reviewers' critiques, they cannot readily accept the novel biofield effects described in our publications and in the systematic reviews performed by Shamini[10] and Richard.[12] Funding is needed to improve methodology as well as to continue our preclinical, clinical, and basic science studies using larger sample sizes and additional control groups.

Richard Hammerschlag: An additional approach to strengthen biofield research would be to organize a summit meeting where practitioners from various biofield therapy traditions and organizations could dialog with biofield researchers with the aims of reviewing evidence and co-creating a strategic plan for moving this field forward.

Shamini Jain: I echo that, Richard. A strategic plan can serve not only as an important document in itself but can be of value to reference when we apply for funding. While the 7 of us, as well as other researchers, are committed to pursue biofield studies, and to support each other in the process, the reality is there is only so far we can get without funds. Varied approaches that can improve our chances for funding should be pursued.

In closing, I want to thank the participants in this stimulating follow-up to our symposium. We have provided a broad overview of both the evidence base and the challenges related to research on biofield therapies and biofield physiology. My hope, and I think I speak for all of us, is that our discussion will stimulate further interest and research opportunities in this vital emerging area of human health and healing.

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