



## Biofield therapies: Biophysical basis and biological regulations?

Zahra Movaffaghi<sup>a,\*</sup>, Mohammad Farsi<sup>b,c</sup>

<sup>a</sup> Clinical skills Center, Education Development Center, Mashhad University of Medical Sciences (MUMS), Ahmad Abad Street, Ghaem hospital, P.O. Box 91735-345, Mashhad, Iran

<sup>b</sup> Biotechnology Department, Ferdowsi University of Mashhad, P.O. Box 91775-1163, Mashhad, Iran

### A B S T R A C T

#### Keywords:

Biological fields  
Complementary and alternative therapies

Complementary and alternative medicine (CAM) is increasingly popular in biomedical health care. One area of alternative medicine, biofield therapies, claims to manipulate individuals' 'energy field' in order to enhance healing and wellbeing. This article reviews some recent studies addressing the characterization of endogenous energy fields and the way they affect the physiologic processes.

© 2008 Elsevier Ltd. All rights reserved.

### 1. Introduction

Almost 43% of the US population<sup>1</sup> and approximately one-third of the UK population<sup>2</sup> use some form of Complementary and alternative medicine (CAM). A recent House of Lords Select Committee Report (UK) concluded that there was sufficient evidence for some CAM therapies to be recommended within mainstream health care.<sup>3</sup>

One category of CAM concerns biofield therapies. This includes approaches such as Reiki, Qigong or non-contact therapeutic touch (TT)<sup>4,5</sup> which have been used to reduce pain, anxiety and promote health.<sup>6</sup> These healing modalities claim to base their mechanism of action upon modulating patient-environmental energy fields. A number of terms have been applied to this concept such as Qi, Prana or Life Force. In 1994, the National Institute of Health (NIH) referred to this specialty as 'biofield' and it was subsequently accepted by the US National Library of Medicine as a medical subject heading (MeSH).<sup>7</sup>

Researchers have attempted to study the biologic effects of these fields on biomolecules including proteins, antibiotics,<sup>8</sup> DNA conformational changes and water structure<sup>9,10</sup>; *in vitro* cells and tissues<sup>11</sup>; bacteria,<sup>12</sup> plants,<sup>13</sup> animals,<sup>14–16</sup> or the clinical effects such as hematologic,<sup>17,18</sup> immunologic effects,<sup>19</sup> healing rates of wounds<sup>20</sup> and many more.

Other studies have sought to identify any physical properties<sup>21–25</sup> or specific characteristics of biological fields upon which to determine a mechanism of actions.

The Center for Frontier Medicine in Biofield Science (CFMBS) was funded by National Center for Complementary and Alternative Medicine (NCCAM). This formed part of the National Institute of

Health (NIH) to investigate biophysical, biochemical, and psycho-physiological mechanisms of disease and healing, and the clinical application of biofield therapies.<sup>26</sup>

This article reviews recent studies that have focused upon the characterization of endogenous energy fields and the way they may regulate physiologic processes. Experimental evidence is considered with reference to the potential existence of bio-magnetic and bioelectromagnetic fields and potential mechanisms by which bioelectromagnetic fields appear to affect biological systems.

### 2. Biofield: the endogenous energy field of body

In physics, the term "energy" refers to "the capacity to do work and overcome resistance". Matter and energy are fundamentally interrelated, however, fields of force vary according to energy expressed, and information carried. The term "field" refers to "a force which can cause action at a distance". Though field effects may be weak in terms of power, they may have a measurable effect on matter.<sup>26</sup>

As a basic law in physics, when an electric current flows through a conductor, a magnetic field is created in the surrounding space. Ampere's law quantifies the relationship between an electric current and the magnetic field produced at a distance from the current flow. Long before biomagnetism could be detected in laboratories, many researchers hypothesized that the flow of bioelectricity in our body (for example, electrical signals from the heart, brain and muscles, recorded as ECG<sup>d</sup>, EEG<sup>e</sup>, EMG<sup>f</sup> recordings) could give rise to biomagnetic fields.<sup>24</sup>

Due to movement or rotation of charged particles in the body (protons, electrons, ions, and side groups such as amino

\* Corresponding author. Tel.: +98 511 8426982; fax: +98 511 8426983.

E-mail addresses: [movaffaghiz@mums.ac.ir](mailto:movaffaghiz@mums.ac.ir) (Z. Movaffaghi), [mfarsi@um.ac.ir](mailto:mfarsi@um.ac.ir) (M. Farsi).

<sup>c</sup> Tel.: +98 511 87956127; fax: +98 511 8787430.

<sup>d</sup> Electrocardiography.

<sup>e</sup> Electroencephalography.

<sup>f</sup> Electromyography.

acids), electromagnetic (EM) fields are produced in the space around body.<sup>27</sup> Specific environmental frequencies, on the other hand, are also absorbed by the biomolecules, inducing changes in the movements of component parts. So the living things, not only radiate but also absorb and respond to the frequencies.<sup>28</sup>

Every molecule and each molecular interaction in the body radiate a characteristic energy spectrum. The spectrum is an electromagnetic 'signature' or 'fingerprint' of a molecule. It is an extremely precise representation of the particles moving within it. This frequency information is so characteristic that chemists use them to identify substances.<sup>27</sup> The assembly of molecules, as in cells, tissues or organs will also produce certain collective frequencies.<sup>29</sup> Living structures and functions are orderly, and their biological oscillations are organized in meaningful ways. They contribute information to a dynamic vibratory network that extends throughout the body and into the space around it. Living systems are very sensitive to bio-information, often responding to energetic cues for survival or reproduction.<sup>30</sup>

Thus biofield focus on bioelectromagnetics and biophysical fields that form part of the regulatory role of cellular structure and function.<sup>26</sup>

Frequency information within biofields has been used to diagnose disease (like MRI<sup>g</sup>, MCG<sup>h</sup>, MEG<sup>i</sup>). However some studies have also used this frequency information for treatment<sup>31</sup> such as replicating natural dynamic frequency patterns within an externally applied EM field carrier.<sup>32</sup>

Brain waves are also dependent upon electrochemical oscillations commonly using extra low frequencies (ELF) portion of the EM spectrum. ELF oscillations have been shown to be involved with neuron synchronization,<sup>33</sup> circadian rhythmicity,<sup>34</sup> coordinating the organization of reacting components in biochemical reactions<sup>35</sup> and in wound healing.<sup>36</sup>

### 3. Conscious biofield alterations

The practice of biofield therapies appears to involve alteration in consciousness states through and conscious focusing upon the patient.<sup>45</sup> Many studies have tried to biophysically detect and record biofield alterations during this state. For instance, Connor and Schwartz used portable devices originally designed for measuring electro-pollution<sup>37</sup> to record significant increases in ELF activity in practitioners during Reiki healing. Their findings supported those of Zimmerman (1980) and Seto (1992) (both cited by Oschman<sup>28</sup>) who used SQUID<sup>j</sup> detectors and a simple magnetometer consisting of two 80000 turn coils and a sensitive amplifier respectively.<sup>28</sup> During the meditational state of biofield therapies, pulses were recorded at a variable frequency, ranging from 0.3 to 30 Hz, with primary activity in the range of 7–8 Hz. This is the same range of frequencies that biomedical researchers have found effective for facilitating healing in variety of soft and hard tissues.<sup>32</sup>

One theory proposed by Oschman,<sup>38</sup> suggests that during meditation or the mindfulness state, molecules vibrating throughout the body, tend to entrain or harmonize, so creating more balanced frequencies. This refers to the process whereby two interacting but independent oscillating systems that usually function independently, interact and fall into synchrony.<sup>38</sup> As more molecules become vibrationally entrained, the biofield appears to get stronger.

### 4. Bioenergy and biological regulations

Bioenergy receptors have been divided into three categories: molecular-level receptors, charge fluxes and endogenously generated electric and EM fields.<sup>39</sup>

Some evidence suggests that molecular-level receptor proteins on cell membranes may be one locus where applied electromagnetic fields act on the cell, thus electromagnetic forces interface with biomolecules to induce changes in shape. This modifies ligand–receptor interactions, which in turn alter the internal state of a cell.<sup>30</sup> ELF electromagnetic fields for example, could alter transmembrane Ca<sup>2+</sup> concentrations,<sup>32,39–41</sup> and induce relatively rapid phosphorylation of specific receptor proteins in T-cell membranes.<sup>39,42</sup> Hence a cascade of intra-cellular signals may be initiated, accelerated or inhibited.

Exogenous EM fields also appear capable of acting on specific regions of DNA. "Electromagnetic response elements" have been identified on promoter regions of DNA that regulate expression of several proteins in cultured cells.<sup>43</sup> Removal of the relevant base pair sequences in this region eliminates the response to EM fields, while splicing the sequence into an unresponsive gene to EM fields, leads to increased synthesis of the encoded protein.<sup>39,44</sup>

Research also suggests that charge fluxes may interact with EM fields by moving electrical charges around the body rather like a conductor.<sup>44</sup> Ions are highly sensitive to entrainment with external EM fields.<sup>29</sup> Free radicals like nitric oxide are also involved in the coupling of EM fields to chemical events in the signal cascade.<sup>45</sup>

The activity of Cytochrome oxidase and Na<sup>+</sup>/K<sup>+</sup> ATPase is altered by both electric and magnetic fields.<sup>39</sup> These enzymes are involved in electron transfer and ion pumpage via membrane-based ion pump. The process of ion binding with proteins is also one of the most likely targets for magnetic fields in living mater.<sup>46</sup>

The model of "moving charge interaction", proposes a mechanism for the biological effects of low-frequency EM fields. In this model, for example EM fields interact with DNA through acceleration of electrons moving within the helical chains. DNA conducts electrons through its stacked arrays of base pairs. Different DNA sequences have different conductivities, so interactions may be more pronounced in specific segments of DNA.<sup>44</sup>

It is hypothesized that the action of exogenous EM fields on biologic systems is mediated by endogenous energy fields resonating with and modulated by external fields. Experimental data also supports the theory that exogenous EM fields may either induce or perturb endogenous fields.<sup>28</sup> Nucetelli<sup>47</sup> observed that endogenous DC electric fields produce the same effect as physical stimuli known to activate endogenous fields and wound healing.<sup>47</sup> There is an evidence to show EEG synchrony between bioenergy practitioners and client occurs during healing.<sup>32,39</sup>

### 5. Conclusion

Concepts which have been a part of traditional medicine for thousands of years are gradually being accepted and confirmed by western science. For many years scientists perceived electromagnetic information as waste products of biological activities and as such had no physiological role other than as diagnostic tools. We are gradually learning that cells maintain integrity by extremely subtle and minute shifts in molecular and sub-molecular balance. This involves continual inter- and intra-cellular communication in order to convey chemical and electromagnetic messages.<sup>27</sup>

'Subtle energies' and 'mutual energy exchange' concepts are neither supernatural nor do they require a revision in biophysics. They go to foundation of life. An understanding of these relationships is fundamental to a wide range of CAM body mind interventions and biofield therapy approaches.

<sup>g</sup> Magnetic Resonance Imaging.

<sup>h</sup> Magnetocardiography.

<sup>i</sup> Magnetoencephalography.

<sup>j</sup> Superconducting Quantum Interference Device.

## References

1. White House Commission on complementary and alternative medicine policy. Available from: [www.whccamp.hhs.gov](http://www.whccamp.hhs.gov); March 2002 [accessed 20.07.06].
2. Ernest E. *Complementary medicine: an objective appraisal*. Oxford: Butterworth-Heinemann; 1996.
3. Hill FJ. *Complementary and alternative medicine: the next generation of health promotion, health promotion*, vol. 18(3). Oxford University Press; 2003 p. 265–72.
4. Carpenito LJ. *Nursing diagnosis*. 8th ed. Lippincott; 2000.
5. Movaffaghi Z. Therapeutic touch and its application in nursing practice. *The Scientific and Research Journal of Nursing and Midwifery School of Mashhad* 2004;5(17–18):66–9.
6. Cahil M. *Nurses handbook of complementary and alternative therapies*. Springhouse, PA: Springhouse Corporation; 1998.
7. Rubik B. The biofield hypothesis: its biophysical basis and role in medicine. *The Journal of Alternative and Complementary Medicine* 2002;8(6):703–17.
8. Benor DJ. Survey of spiritual healing research. *Complementary Medical Research* 1990;4:9–33.
9. Rein G. The in vitro effect of bioenergy on conformational state of human DNA in aqueous solution. *Acupuncture & Electro-Therapeutics Research* 1995;20:173–80.
10. Schwartz SA, DeMattei RJ. Infrared spectra alteration in water proximate to the palms of therapeutic practitioner. *Subtle Energies* 1991;1:43–54.
11. Chein CH, Tsuet JJ, Lee SC, Huang YC, Wei YH. Effect of emitted bioenergy on biochemical function of cells. *The American Journal of Chinese Medicine* 1991;19(3–4):285–92.
12. Rubik B, Brooks AJ, Schwartz GE. In vitro effect of reiki treatment on bacterial cultures: role of experimental context and practitioner wellbeing. *Journal of Alternative and Complementary Medicine* 2006;1:7–13.
13. Creath K, Schwartz GE. Measuring effect of music, noise and healing energy using a seed germination bioassay. *Journal of Alternative and Complementary Medicine* 2004;10(1):113–22.
14. Chen KW, Shiflett SC, Ponzio NM, He B, Elliott DK, Keller SE. A preliminary study of the effect of external qigong on lymphoma growth in mice. *Journal of Alternative and Complementary Medicine* 2002;8(5):615–21.
15. Mo Z, Chen KW, Ou W, Li M. Benefits of external qigong therapy on morphine-abstinent mice and rats. *Journal of Alternative and Complementary Medicine* 2003;9(6):827–35.
16. Baldwin A, Schwartz GE. Personal interaction with a reiki practitioner decreases noise-induced microvascular damage in an animal model. *Journal of Alternative and Complementary Medicine* 2006;1:15–22.
17. Krieger D. Healing by the “laying on” of hands as a facilitator of bioenergetic change: the response of in-vivo human hemoglobin. *Psychoenergetic Systems* 1976;1(2):121–9.
18. Movaffaghi Z, Hassan Poor M, Farsi M, Hooshmand P, Abrishami F. Effects of therapeutic touch on blood Hemoglobin and Hematocrit level. *Journal of Holistic Nursing* 2006;24(1):1–8.
19. Olson M, Sneed N, Lavia M, Virella G, Bonadonna R, Michel Y. Stress-induced immunosuppression and therapeutic touch. *Alternative Therapies in Health and Medicine* 1997;3(2):68–74.
20. Wirth DP. The effect of none contact therapeutic touch on the healing rate of full thickness dermal wounds. *Subtle Energies* 1990;1:1–20.
21. Hou SL, Wang XB, Li DD, Meng SF, Li YZ. Detection and analysis of ultrasonic sound signals from qigong and extraordinary function. *Journal of Chinese Somatic Science* 1993;3(1):24–8.
22. Chen KW. An analytic review of studies on measuring effects of external Qi in China. *Alternative Therapies in Health and Medicine* 2004;10(4):38–50.
23. Lunasmaa OV, Hamalainen M, Hari R, Salmelin R. Information processing in the human brain: magnetoencephalographic approach. *Proceedings of the National Academy of Sciences of the United States of America* 1996;93:8809–15.
24. Forbes MA, Rust R, Becker GJ. Surface electromyography apparatus as a measurement device for biofield research: results from a single case study. *Journal of Alternative and Complementary Medicine* 2004;10(4):617–26.
25. Movaffaghi Z. Biological fields: the physical nature. *The Scientific and Research Journal of Nursing and Midwifery School of Mashhad*, in press.
26. Center for frontier medicine in biofield science. University of Arizona and Institute for Frontier Science. Available from: <http://www.biofield.arizona.edu/CFMBS>; 2008 [accessed 02.02.08].
27. Infrared spectroscopy: identification of unknown substances. Available from: [instruct.uwo.ca/chemistry/023/Chem023IR.pdf](http://instruct.uwo.ca/chemistry/023/Chem023IR.pdf); 2008 [accessed 06.02.08].
28. Oschman JL. *Energy medicine: the scientific base*. 2nd ed. Edinburgh: Churchill Livingstone; 2000.
29. Rein G. Bioinformation within biofield: beyond electromagnetics. *Journal of Alternative and Complementary Medicine* 2004;10(1):59–68.
30. Rubik B. Energy medicine and the unifying concept of information. *Alternative therapies in health and medicine* 1995;1(1):34–9. InnoVision Communications.
31. Movaffaghi Z, Farsi M, Karimi H. Bioenergetic fields and biologic systems. *Journal of Rehabilitation* 2007;8(1):72–8.
32. Oschman JL. Clinical aspects of biological fields: an introduction for health care professionals. *Journal of Body Work And Movement Therapy* 2002;6(2):117–25.
33. Lestienne R. Spike timing, synchronization and information processing on the sensory side of the central nervous system. *Progress in Neurobiology* 2001;65:4319–25.
34. Cajochen C, Wyatt JK, Czeisler CA, Dijk DJ. Separation of circadian and wake duration-dependent modulation of EEG activation during wakefulness. *Neuroscience* 2002;114:1047–60.
35. Pokorny J. Endogenous EM forces in living cells: implications for transfer of reaction components. *Electro- and Magnetobiol* 2001;20:59–73.
36. Chiang MC, Cragoe EJ, Venable JW. Intrinsic electric fields promote epithelialization of wound. *Developmental Biology* 1991;146:377–85.
37. Schwartz GE. *Research findings at the University of Arizona. Center for Frontier Medicine in Biofield Science: a summary report*. Available from: [lach.web.arizona.edu/CFMBS\\_Report](http://lach.web.arizona.edu/CFMBS_Report); 2008 [accessed 06.02.08].
38. Available from: <http://en.wikipedia.org/wiki/Entrainment>; 2008 [accessed 06.02.08].
39. Hintz KJ, Yount GL, Kadar I, Schwartz G. Bioenergy definitions and research guidelines. *Altern Ther Health Med* 2003;9(3):A13.
40. Galvanovskis J, Sandblom J. Periodic forcing of intra cellular oscillators: theoretical studies of the effects of low frequency fields on the magnitude of oscillations. *Bioelectrochemistry and Bioenergetics* 1998;46:161–74.
41. Lindstrom E, Hansson M, Lundgren E. Analysis of the T cell activation signaling pathway during ELF magnetic field exposure, p56<sup>lck</sup> and [Ca<sup>2+</sup>] measurements. *Bioelectrochemistry and Bioenergetics* 1998;46:129–37.
42. Lindstrom E, Still M, Mattsson M, Mild KH, Luben RA. ELF magnetic fields initiate protein tyrosine phosphorylation of the T cell receptor complex. *Bioelectrochemistry* 2000;53:73–8.
43. Hartl LH, Jones EW. *Genetics: analysis of genes and genomes*. 5th ed. Massachusetts: Jones and Bartlett publishers; 2001.
44. Blank M, Soo L. Optimal frequencies for magnetic acceleration of cytochrome oxidase and Na, K-ATPase reactions. *Bioelectrochemistry* 2001;53:171–4.
45. Jajte J, Grezegorczyk J, Zmyslony M, Rajkowska E. Effect of 7 mT static magnetic field and iron ions on rat lymphocytes: apoptosis, necrosis and free radical processes. *Bioelectrochemistry* 2002;57:107–11.
46. Binhi VN. Interference mechanism for some biological effects of pulsed magnetic fields. *Bioelectrochemistry and Bioenergetics* 1998;45:73–81.
47. Nuccitelli R. Endogenous ionic currents and DC electrical fields in multicellular animal tissues. *Bioelectromagnetics* 1992;(Suppl. 1):147–57.