Selected Review of Research Projects

It is noted that all the following studies, i.e. basic science (in vitro and in vivo) as well as the double blind clinical studies, utilized Jacobson Resonators to provide electromagnetic field parameters and protocols, derived from Jacobson Resonance Theory; the first to predict that pico-Tesla range magnetic fields are physiologic, and vital for renormalizing the structure and function of tissue.

1. Effect of Magnetic Fields on Excised Mice Sciatic Nerves In-Vitro

Two studies were conducted at the Weill Medical College of Cornell University and then replicated at Fairleigh Dickson University, Department of Biological Sciences. These studies tested the effect of pT magnetic fields on excised mice sciatic nerves in-vitro. The Principle Investigator at Cornell was Prof. Brij B. Saxena, Director of Reproductive Endocrinology, Department of Obstetrics/Gynecology. The Principal Investigator at Fairleigh Dickinson was Professor Emeritus of Neuroscience, Anjali Saxena.

In the first experiment four segments of the sciatic nerve, 1.5cm in length and 1.0 mm in width were surgically excised under aseptic conditions from mice under ether anesthesia. Nerve segments were maintained in flasks and incubated. Growth medium was changed three times a week. A set of two nerve segments was exposed to 14 magnetic field settings 35 minutes each day for 5 days. The other set served as the unexposed control. Controlled cultures of excised nerve segments were removed from the incubator and also placed in-between the Resonator coils (having the coils turned off). In the second set of experiments, both sciatic nerves of 12 mice were excised aseptically to yield a total of 24 nerve segments. Six nerve segments served as the control. The remaining 18 nerves were divided into three experimental groups of 6 nerve segments each and exposed to magnetic fields daily for 15 days. Experimental groups were selected to determine (a) the effect of increased time of exposure on the dimensional and structural change of exposed nerves, (b) the effect of multiple versus single exposure on the same, and (c) a frequency and amplitude window that promotes greater effect on the growth and structure of the nerve segments. Three control and three experimental nerve segments were randomly chosen for DNA analysis. DNA was extracted for gel electrophoresis.

Results

In the first experiment, the initial dimensions of both the control and experimental nerve segments were 15mm in length and 1mm in width. At the end of the experiment the ends of the exposed nerve segments showed significantly more dendritic growth than the control. Control segments remained at their initial length, whereas the exposed segments appeared to grow in length. The final dimensions of exposed nerve segments were 20mm in length and 1.5mm in width, a 33% increase in length and a 50% increase in width.

The response of the nerve segments in the second set of experiments to

magnetic fields was similar to the first; the length and width of exposed nerve segments increased.

The light microscope observations revealed a normal and regular distribution of the axons in the exposed segments. In contrast the axons in the control nerve segments were fewer in number, had an irregular and abnormal shape, and a very narrow-band of myelination. Under the electron microscope, the exposed segments exhibited myelin sheaths with a normal distribution of microtubules and neurofilaments, Schwann cells with normal configuration, and mitochondria with condensed conformation indicative of anabolic activity. In contrast, nerve segments in the control group showed fragmented and disintegrated myelin sheath suggestive of lack of myelin synthesis, highly vacuolated Schwann cells and mitochondria with inactive and orthodox conformation.

Results of the electrophoresis of DNA extracted from control and experimental nerves showed a similar single band of DNA in 0.8% and 2.0% agarose minigel, which suggest that the magnetic fields used in these experiments did not cause DNA degradation. Both the exposed and control nerves also stained negative for the MIB- I marker, implying that the magnetic fields used in this experiment did not lead to uncontrolled cell proliferation. (11)

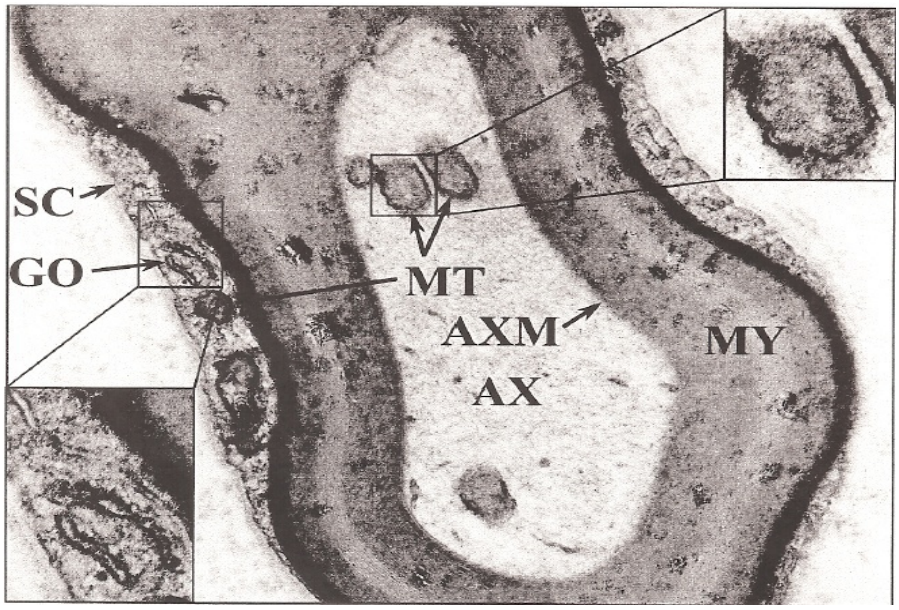
2. Restoration of Nerve Ultrastructure and Recovery from Motorneuropathy in Mice by Electromagnetic Field

The effect of electromagnetic fields (EMFs) on the restoration of forelimb grip strength and radial nerve ultrastructure was studied in mice with motorneuropathy induced by the administration of neurotoxin, 0.62% 3,3'Iminodipropionitrile (IDPN), in drinking water for 9 ½ weeks. Forelimb grip strength (lb) of mice as measured by a force gauge meter declined to 47% compared to the control group ($p<0.004$). The IDPN treated group without any EMF exposure persisted to have a 56% decrease in grip strength and radial nerve electronmicrographs showed axonal demyelination, mitochondria in an orthodox state of conformation, (nonfunctional) and uneven dispersion of neurofilaments and microtubules. In contrast, one IDPN treated group was treated with applied EMF (electromagnetic field) intensitites and frequencies that were calculated on the basis of the mass of molecules vital to nerve function using $mc^2 = BvLq$ and $f = {}^{qB}/_{2\pi m}$. During EMF exposure mice were held in a perforated Lucite box placed in a Resonator that generated the EMF between the centers of two 18" discs, 9" apart containing copper coils in Helmholtz configuration. EMF was applied twice weekly for 8 ½ weeks that resulted in as much as 87% recovery ($p<0.05$) of grip strength that was sustained after the termination of exposure at an 82% level until the 27th week of observation. The EMF exposed group also exhibited axonal remyelination, functional condensed state of mitochondria, and evenly dispersed neurofilaments and microtubules consistent with grip strength recovery. *[These results are the first to demonstrate a biological effect of EMF in vivo on the restoration of subcellular structures required for nerve impulse conduction and metabolism in nerves and consequently a grip strength recovery from motorneuropathy, under controlled experimental conditions.]*

The studies were conducted at the Weill Medical College of Cornell University, and replicated at Fairleigh Dickinson University, School of Natural Sciences. (Saxena, A., Jacobson, JI, Saxena, B., et al, 2003) (6)

Radial Nerve Ultrastructure Presented In Electron Micrographs

Fig. 1 Electron micrograph (EM) of cross sections of radial nerve of mice from control Group 1, indicating Axon (AX), Axonal membrane (AXM), Golgi bodies (GO), Microtubule (MIC), Mitochondria (MT), Myelin sheath (MY), Neurofilament (NF), Schwann cells (SC), A. (Top) GO, MT, B. (Bottom Left) MT binary fission, C. (Bottom) NF. EM Magnification x 19,000. Scale Bar = 1 μm.



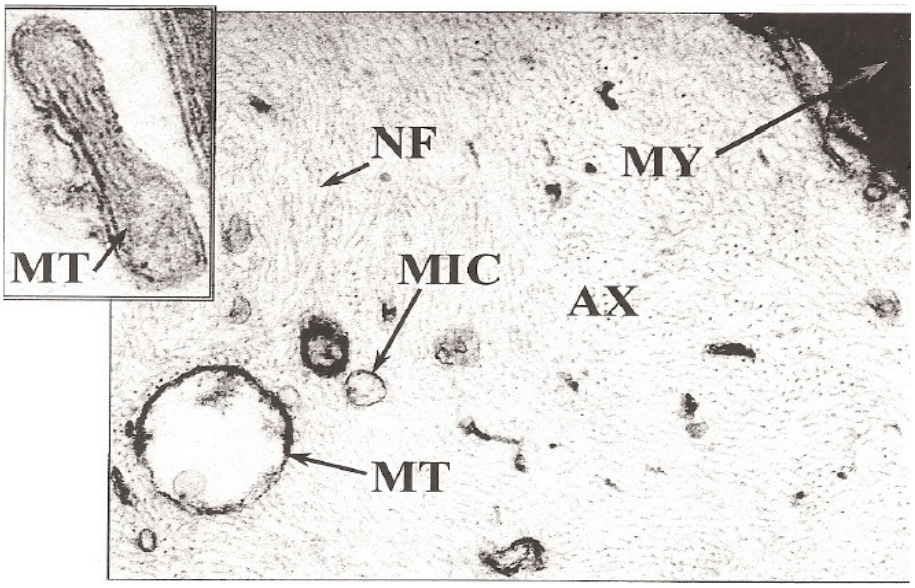
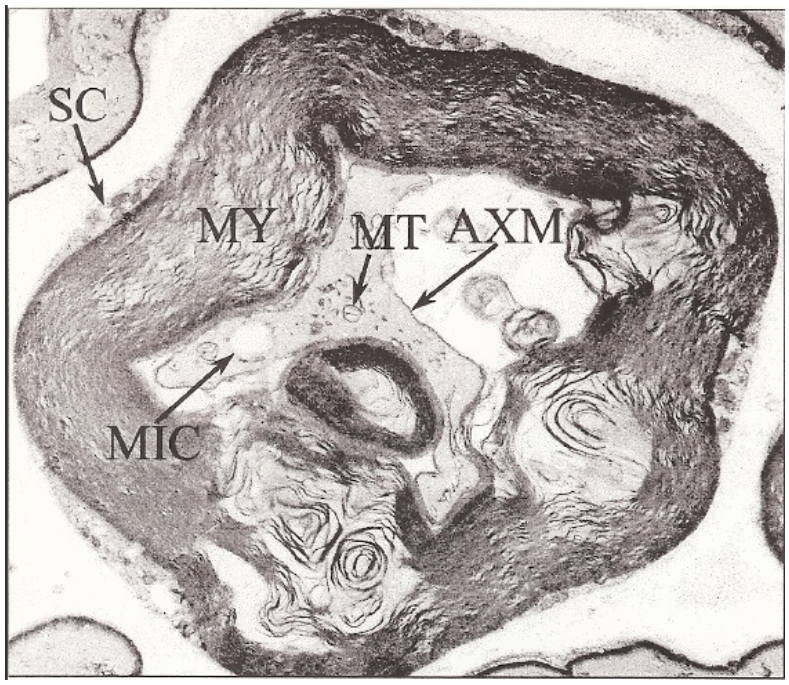


Fig. 2 Electron micrograph (EM) of cross sections of radial nerve of mice from IDPN treated Group 3 unexposed to EMF indicating Axon (AX), Axonal membrane (AXM), Microtubule (MIC), Mitrochondria (MT), Myelin sheath (MY), Neurofilament (NF), Schwanna cells (SC). A. (Top) MY, AXA, B. (Bottom) MY, AXM, MT, NF. EM Magnification x 10,000. Scale Bar = 1 µm.



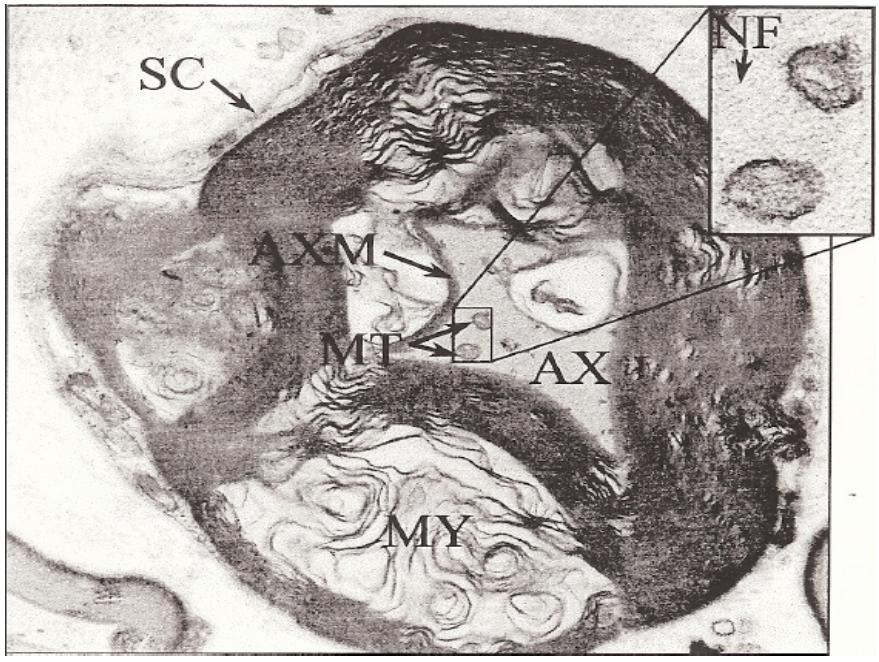
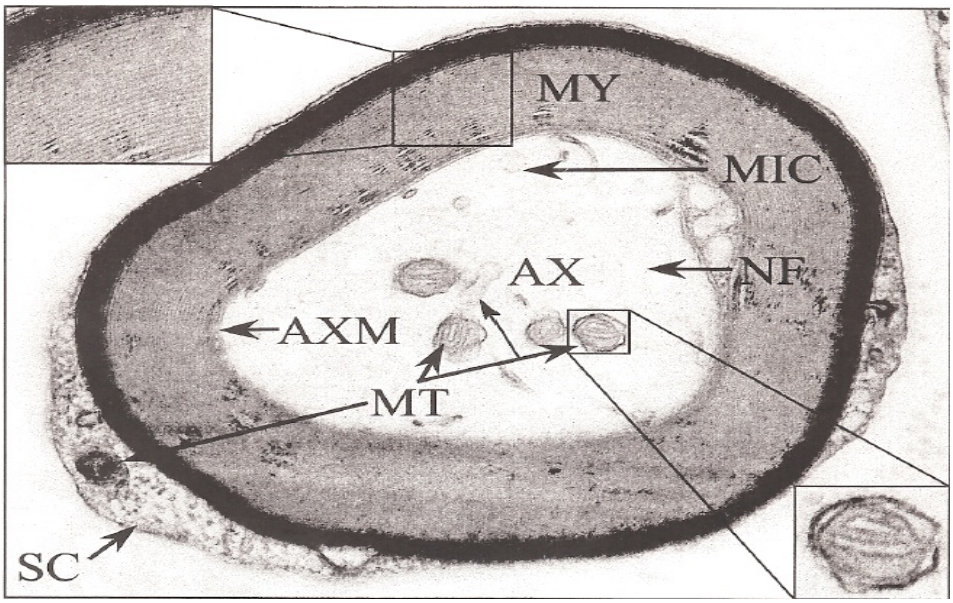
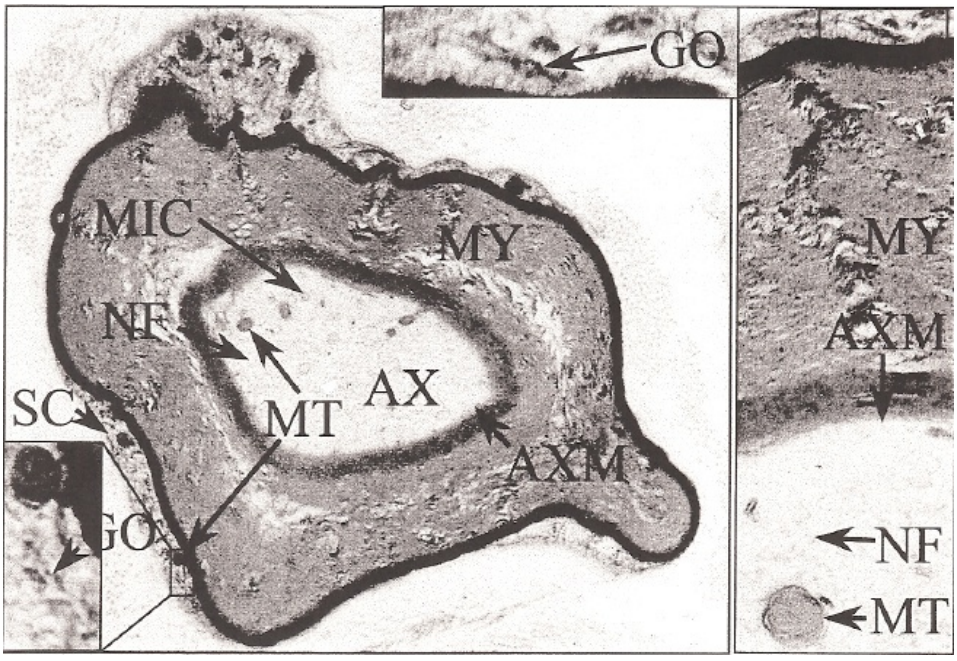


Fig. 3 Electron micrographs (EM) of cross sections of radial nerve of mice from IDPN treated Group 2 exposed to EMF, indicating Axon (AX), Axonal membrane (AXM), Golgi bodies (GO), Microtubule (MIC), Mitochondria (MT), Myelin sheath (MY), Neurofilament (NF), Schwann cells (SC). A. (Top) MT, MY, AXM, NF, MIC, B. (Bottom Left) GO, MIC, C. (Bottom Right) GO, NF, MY, MT. EM Magnification A, B x 19,000, C x 4,800. Scale Bar = 1 μm.





3. Electromagnetic Fields Affect Cardiac Rate and Rhythm

Results showed that pico-tesla range electromagnetic fields (EMFs) applied non-invasively can slow the heart rate and enhance AV block. This effect could be used in patients with atrial tachycardias (ATs) and atrial fibrillation (AF) to slow rapid ventricular rates. Other specific EMFs can actually induce autonomically based AF, which could be used to detect those at risk for developing AF. Indeed, the use of pico-tesla range electromagnetic fields to suppress atrial fibrillation may be the first step toward a completely noninvasive treatment for atrial fibrillation (Scherlag, B.J. et al, 2004). Studies were conducted at the Heart Rhythm Institute, University of Oklahoma Health Sciences Center. Studies are ongoing. (5)

Low Level Electromagnetic Fields Suppress Atrial Fibrillation Inducibility

Background: We recently reported that low level vagal nerve electrical stimulation significantly increased atrial and pulmonary vein (PV) effective refractory period (ERP) and decreased atrial fibrillation (AF) inducibility.

Methods: In 9 anesthetized dogs, via bilateral thoracotomies, multi-electrode catheters were placed on the right and left atria and all the PVs. Group 1 (n=4). The dissected vagal trunks were placed between two small (3/4 inch diameter) Helmholtz coils (HCs). The HCs were attached through resistors to a function generator which induced an AC current providing an EMF of 0.034 μGauss, frequency 0.952 Hz derived from $mc^2 = BvLq$ and $f = {}^{qB}/_{2\pi m}$ respectively. During pacing (180/min) at each site, each pacing stimulus was followed (2 ms) by a high frequency train (200 Hz, 40 msec duration) delivered during the atrial RP. The lowest voltage that induced AF was taken as the AF threshold for that site measured at baseline and then hourly during EMF application for 3 hours. Group II (n=5). An 18 inch HC was positioned across the chest, so that the heart was centered within the coil. With programmed stimulation at baseline we determined the ERP and WOV and also hourly (in sinus rhythm) for each of 3 hours during which AF was induced by rapid atrial pacing. The width of WOV in milliseconds was a measure of AF inducibility. During the next 3 hours EMF and induced AF were combined and the same parameters measured hourly. Microelectrodes inserted into the anterior right ganglionated plexi (ARGP) recorded neural firing.

Results: Group 1. The mean AF thresholds during 3 hours, increased at all sites, $p<0.05$ during the EMF application. Group 2. The mean ERPs decreased ($p<0.05$) and the mean WOVs increased ($p<0.001$) during the first 3 hours of induced AF compared to baseline. The neural firing increased both in amplitude and frequency, $p<0.05$. After 3 hours of combined EMF and induced AF these effects were significantly reversed. $P<0.05$ compared to the highest values in the first 3 hrs.

CONCLUSIONS: Pulsed EMF applied to the dissected vagal trunks or non-invasively across the chest can significantly increase AF threshold and suppress AF inducibility caused by sustained AF.

Studies were conducted at the Heart Rhythm Institute, University of Oklahoma Health Sciences Center. Studies began in 1998 and are ongoing. (5, 10)

4. Efficacy and Safety of Low Level Electromagnetic Field Treatment in Parkinson's Disease

Background: Small case series suggest extremely low level (10^{-12} Tesla) electromagnetic fields (EMF) may be useful in the treatment of Parkinson's disease (PD). No controlled studies have been previously reported.

Design/Methods: A single center, double blind, randomized, placebo controlled trial of EMF as an adjuvant to standard medical therapy in PD patients with motor fluctuations was performed in 12 subjects (6 per group). 24 sessions of 1.5 hour of total body EMF were administered over 8 weeks. Standardized motor and non-motor assessments were performed prior to treatment, at endpoint, and monthly for 3 months.

Results: The treatment group demonstrated significant improvement over placebo after 8 weeks of therapy as follows: Scale, absolute point reduction, % improvement vs % improvement placebo (unless noted all results $p < .05$): UPDRS II(ON) 5.5, 56% vs 28%: UPDRS III(ON) 9.5, 40% vs 20%, p5.054; PDQ-39(SI) 8.4, 42% vs 7%; PDQ-39(MOB) 11.67, 47% vs 6%; PDQ-39(ADL) 15.97 pts, 64% vs 9%; PDQ-39(BD) 8.33 pts, 30% vs -13%; Beck Depression Inventory II 5.73 pts, 47% vs 1%; Fatigue Severity Scale 7.66pts, 22% vs 5%, p5.12; Finger Taps (ON) 67 taps. 25% vs -5%. Importantly improvement on several scales persisted up to 2 months post treatment. No treatment related adverse events reported.

Conclusions: Low-level EMF may improve motor and non-motor features of PD beyond that achieved with standard medical therapy. These effects are long-lasting. Larger placebo-controlled studies have been undertaken to confirm and further investigate the benefit of this unique, noninvasive and potentially promising therapy.

Key Findings of Pilot II results: Baseline to Endpoint:

	Baseline	EndPoint Week 8	% Chg	Washout Week 16	% Chg
PDQ-39 (SI)-summary index QoL					
Treatment	20.01 +/-12.26	11.61 +/-7.44	(-42%)	10.86 +/-9.47	(-46%)
Control	24.52 +/-6.93	22.70 +/-6.84	(-7%)	17.96 +/-8.94	(-27%)
PDQ-39 (Mobility)-motor					
Treatment	25.00 +/-24.75	13.33 +/-13.48	(-47%)	12.92 +/-15.69	(-48%)
Control	35.42 +/-12.19	33.33 +/-16.56	(-6%)	24.58 +/-16.00	(-31%)
PDQ-39 (ADL)-activities of daily living					
Treatment	25.00 +/-18.07	9.03 +/-6.67	(64%)	17.36 +/-14.05	(-31%)
Control	22.92 +/-5.74	20.83 +/-6/97	(-9%)	18.06 +/-3.40	(-21%)
PDQ-39 (BD)-body discomfort/pain					
Treatment	27.78 +/-15.52	19.45 +/-6.80	(-30%)	16.67 +/-13.95	(-40%)
Control	22.22 +/-14.59	25.00 +/-20.41	(+13%)	25.00 +/-22.98	(+13%)
Back Depression Inventory II-depression					
Treatment	12.33 +/-4.76	6.50 +/-5.32	(-47%)	5.83 +/-4.02	(-53%)
Control	12.17 +/-7.25	12.00 +/4.94	(-1%)	11.50 +/-5.89	(-6%)
UPDRS II (On)-activities of daily living					
Treatment	9.83 +/-6.34	4.33 +/-4.08	(-56%)	5.17 +/-3.17	(-47%)
Control	11.67 +/-4.27	8.33 +/-2.25	(-28%)	8.83 +/-2.48	(-24%)
UPDRS III (On)-motor					
Treatment	23.50 +/-12.99	14.00 +/-7.56	(-40%)	15.67 +/-6.83	(-33%)
Control	29.67 +/-7.94	23.83 +/-11.44	(-20%)	27.67 +/-11.55	(-7%)
FSS-fatigue					
Treatment	34.44 +/-10.23	26.67 +/-9.29	(-22%)	28.00 +/-8.99	(-18%)
Control	35.17 +/-8.93	33.33 +/-9.65	(-5%)	35.33 +/-19.29	(+.5%)

(Klepitskaya, O., Kumar R., 2008)

5. Effects of Low Intensity and Low Frequency Electromagnetic Field Stimulation (EMFS) on Thoracic Spinal Neurons Receiving Noxious Cardiac and Esophageal Inputs

Summary:

Many patients suffering from angina pectoris are refractory to surgical and pharmacological treatments. In order to improve the quality of life, alternative methods must be developed to relieve the pain in these patients. Since low intensity electromagnetic fields provide substantial levels of pain relief in patients with different sources of chronic pain, it was proposed that electromagnetic field stimulation might be used to reduce the pain of angina pectoris. To test the effects of EMF stimulation in an animal model, small Helmholz coils were placed on both sides of the chest of anesthetized rats. A mixture of algesic chemicals that are usually released during ischemic episodes of the heart was injected into the pericardial sac to activate cardiac nociceptive afferent fibers. During the injections, extracellular action potentials were recorded from cells in the upper thoracic spinal cord. Increased cell activity during the chemical injection was interpreted as a response to a nociceptive cardiac stimulus. We found that the responses of a population of thoracic spinal neurons to the nociceptive stimulus were reduced when pico-Tesla EM field stimulation. (Jacobson Resonance derived signal parameters) was applied for 40 minutes. The activity often remained suppressed for up to two hours after terminating the stimulations. These results show that EM field stimulation can modify nociceptive cardiac afferent information that affects the processing of spinal neurons. This leads to the suggestion that this technique might be used in the future to reduce cardiac pain in patients who are refractory to surgical and pharmacologic treatments. (8, 24)

6. Low Amplitude, Extremely Low Frequency Magnetic Fields For The Treatment Of Osteoarthritic Knees: A Double Blind Clinical Study

Participating Institutions

1. Institute of Theoretical Physics and Advanced Studies for Biophysical research, The Perspectivism Foundation Jupiter Fla.
2. National Medical Research Institute, Department of Medical Physics and Neuromagnetics Boca Raton, Fla.
3. Department of Medicine, Cardiac Arrhythmia Research Institute, University of Oklahoma Health Sciences Center, Oklahoma City, Okla.
4. Department of Obstetrics/Gynecology Division of Reproductive Endocrinology, Cornell University Weill College of Medicine, New York, NY.
5. Prototyping Laboratory, John C. Stennis Space Center, Miss.

Context: Noninvasive magnetotherapeutic approaches to bone healing have been successful in past clinical studies.

Objective: To determine the effectiveness of low-amplitude, extremely low frequency magnetic fields on patients with knee pain due to osteoarthritis.

Designs: Placebo controlled, randomized, double blind clinical study.

Setting: 4 outpatient clinics

Participants: 176 patients were randomly assigned to 1 of 2 groups, the placebo group (magnet off) or the active group (magnet on).

Intervention: 6-minute exposure to each magnetic field signal using 8 exposure sessions for each treatment session, the number of treatment sessions totaling 8 during a 2-week period, yielded patients being exposed to uniform magnetic fields for 48 minutes per treatment session 8 times in 2 weeks. The magnetic fields used in this study were generated by a Jacobson Resonator, which consists of two 18-inch diameter (46-cm diameter) coils connected in series, in turn connected to a function generator via an attenuator to obtain the specific amplitude and frequency. The range of magnetic field amplitudes used were in the pico-Tesla range.

Outcome Measures: Each subject rated his or her pain level from 1 (minimal) to 10 (maximal) before and after each treatment and 2 weeks after treatment. Subjects also recorded their pain intensity in a diary while outside the treatment

environment fro 2 weeks after the last treatment session (session 8) twice daily: upon awakening (within 15 minutes) and upon retiring (just before going to bed at night).

Results: reduction in pain after a treatment session was significantly (P<.001) greater in the magnet on group (46%) compared to the magnet off group (8%).

Conclusion: Low-amplitude, extremely low frequency magnetic fields are safe and effective for treating patients with chronic knee pain due to osteoarthritis. (25)

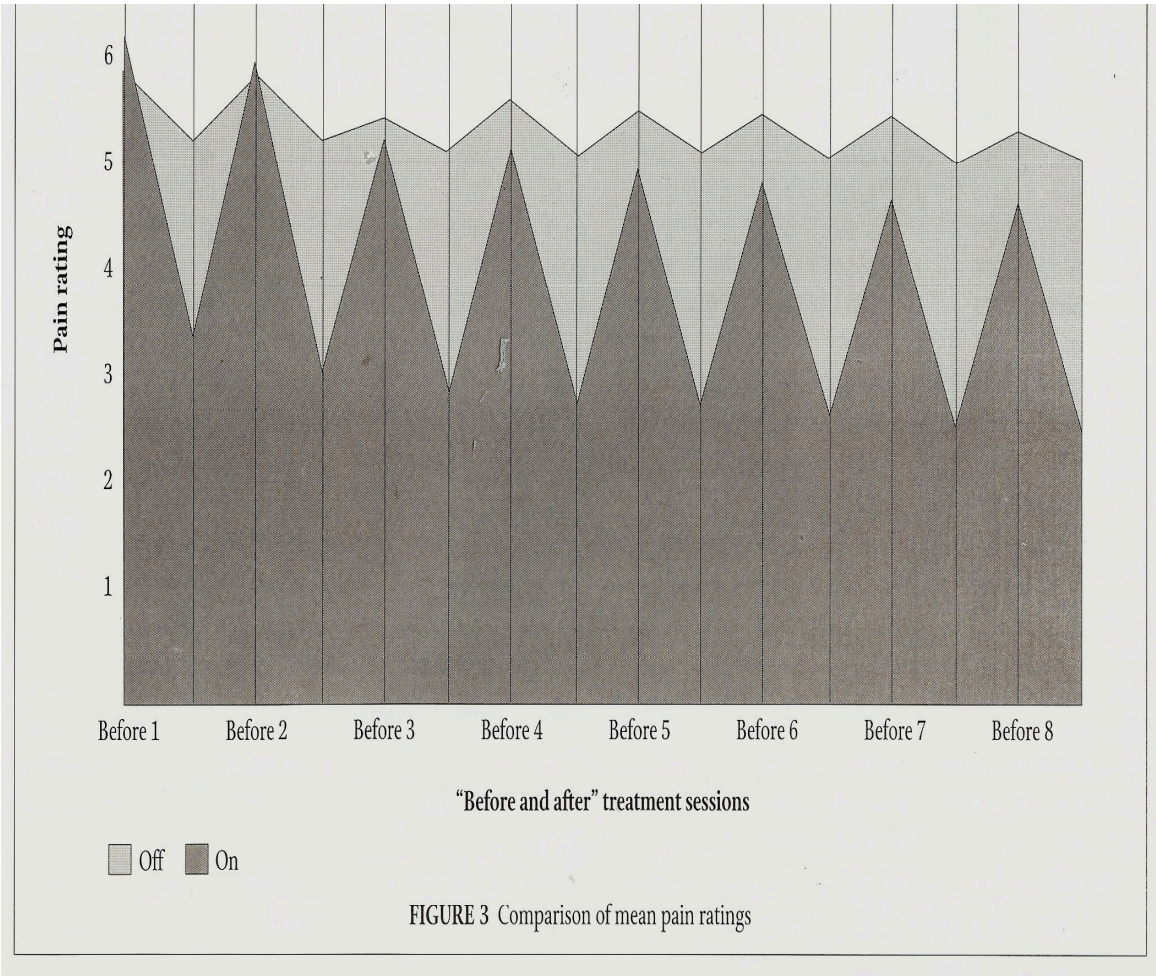


FIGURE 3 Comparison of mean pain ratings

TABLE 2 Statistics from the study of Jacobson resonance treatment (magnet on)*

Data collection period	No.		Mean	Median	Mode	SD	Variance	Skewness	SE of skewness	Minimum	Maximum	Percentiles		
	Valid	Missing										25	50	75
Magnet status	176	0												
Diary T1	175	1	6.154	6	6†	1.961	3.844	-.330	.184	1	10	5	6	8
Diary T2	175	1	3.983	4	3†	2.041	4.166	.380	.184	1	9	2	4	6
Diary T3	175	1	4.114	4	2	2.065	4.263	.277	.184	1	9	2	4	6
TS1 Before	175	1	6.069	6	7	2.039	4.156	-.489	.184	1	10	5	6	8
TS1 After	176	0	4.125	4	4	2.148	4.613	.351	.183	1	10	2	4	6
TS2 Before	175	1	5.766	6	7	2.075	4.307	-.510	.184	1	10	5	6	7
TS2 After	175	1	3.954	4	4	2.022	4.090	.202	.184	1	9	2	4	5
TS3 Before	175	1	5.257	5	7	2.151	4.629	-.233	.184	1	9	4	5	7
TS3 After	175	1	3.680	4	3†	1.965	3.863	.410	.184	1	9	2	4	5
TS4 Before	176	0	5.199	5	6	2.159	4.663	-.167	.183	1	10	3	5	7
TS4 After	176	0	3.631	3	1	2.033	4.131	.434	.183	1	9	2	3	5
TS5 Before	175	1	5.057	5	6†	2.204	4.859	-.093	.184	1	10	3	5	7
TS5 After	175	1	3.486	3	1	2.111	4.458	.528	.184	1	10	2	3	5
TS6 Before	174	2	4.994	5	6	2.130	4.538	-.196	.184	1	10	3	5	7
TS6 After	174	2	3.351	3	1	2.005	4.021	.753	.184	1	10	2	3	5
TS7 Before	176	0	4.756	5	6	2.147	4.609	-.211	.183	1	10	3	5	6
TS7 After	176	0	3.313	3	1	1.980	3.919	.519	.183	1	9	2	3	5
TS8 Before	176	0	4.676	5	6	2.243	5.032	-.172	.183	1	9	3	5	6
TS8 After	176	0	3.358	3	1	2.147	4.608	.746	.183	1	10	2	3	5

* Diary T1 indicates diary time 1, before the start of the treatment trials; Diary T2, at the end of the 2 weeks of treatment sessions, after the eighth treatment; Diary T3, 2 weeks after the end of the treatment trials; TS, treatment session.

† Multiple modes exist. The smallest value is shown.

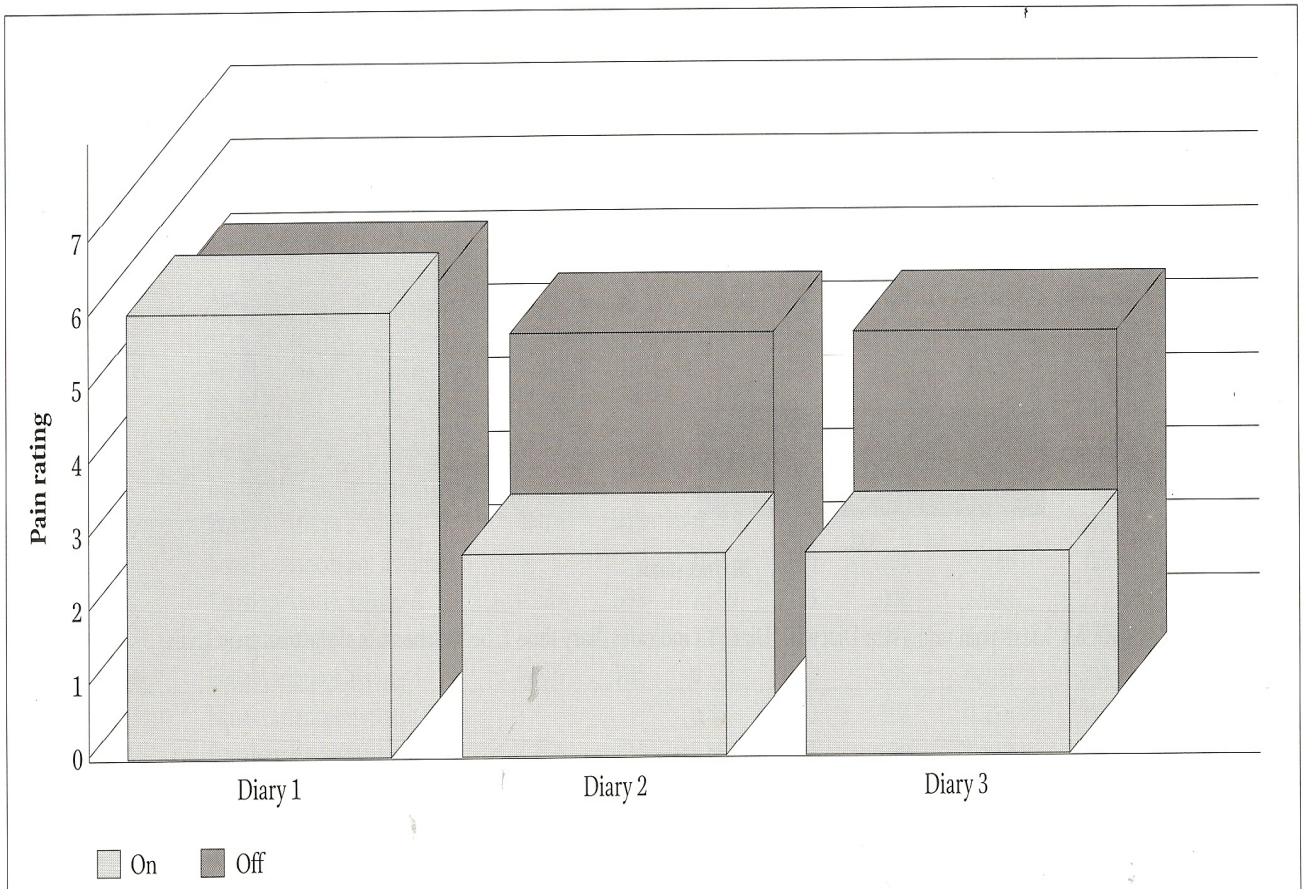


FIGURE 5 Mean pain rating from diary data. Diary T1 indicates diary time 1, before the start of the treatment trials. Diary T2 indicates diary time 2, at the end of the 2 weeks of treatment sessions, after the eighth treatment. Diary T3 indicates diary time 3, 2 weeks after the end of the last treatment session.

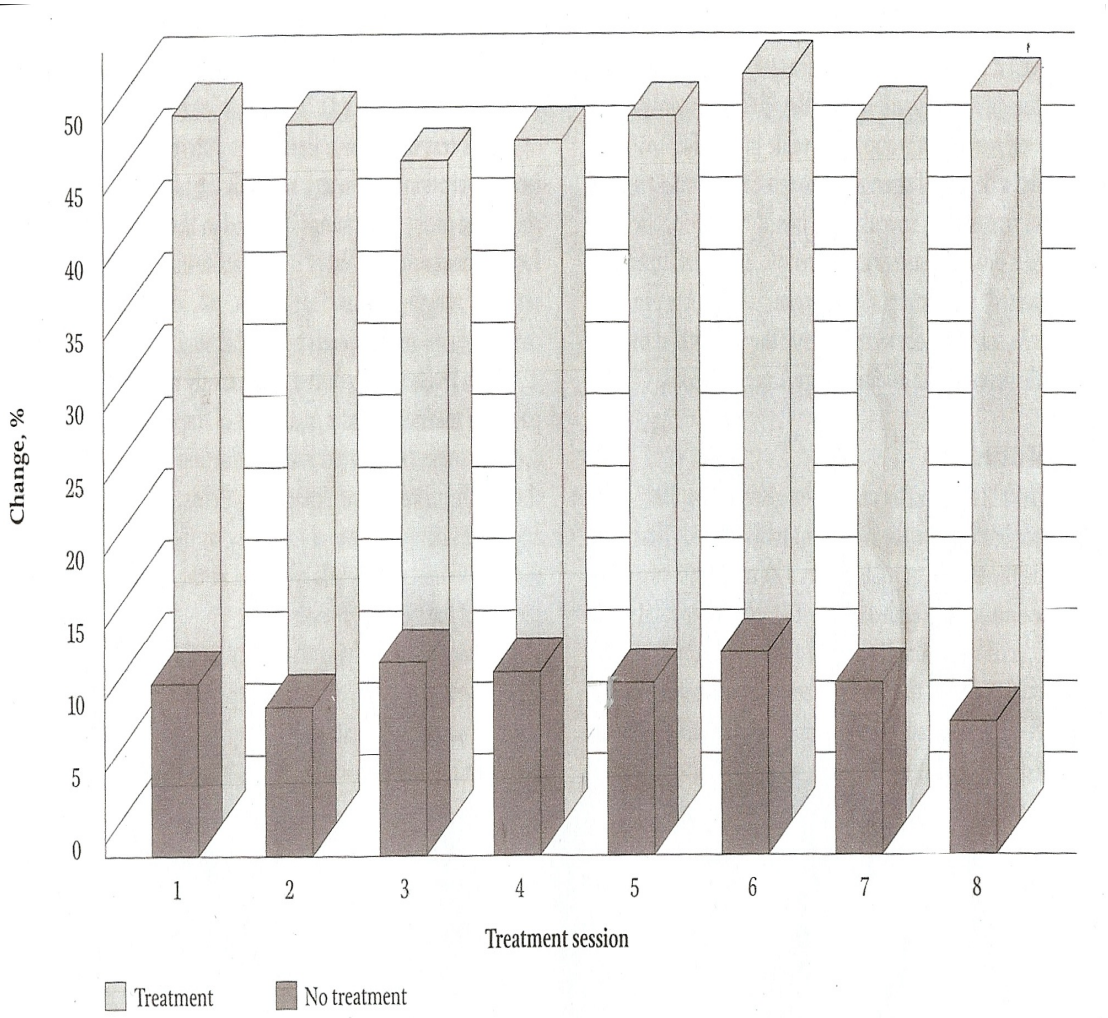


FIGURE 4 Comparison of mean percentage reduction in pain level

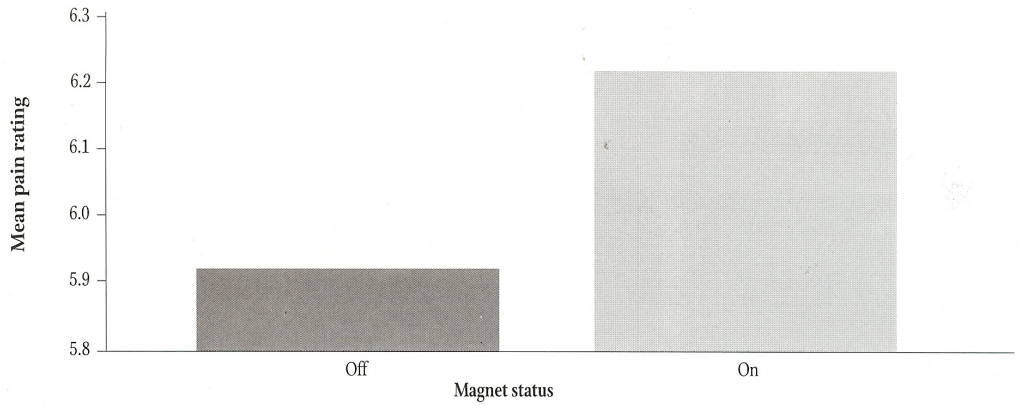


FIGURE 6A Mean pain ratings for Diary T1. Diary T1 indicates diary time 1, before the start of the treatment trials.

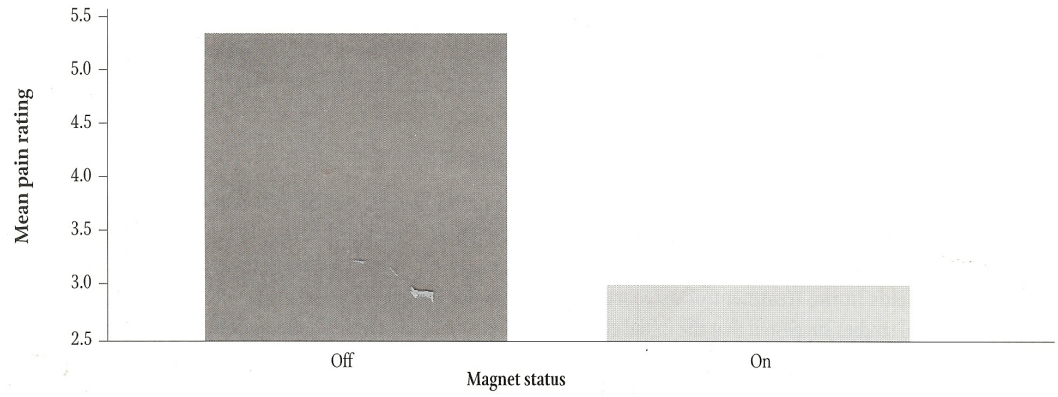


FIGURE 6B Mean pain ratings for Diary T2. Diary T2 indicates diary time 2, at the end of the 2 weeks of treatment sessions, after the eighth treatment.

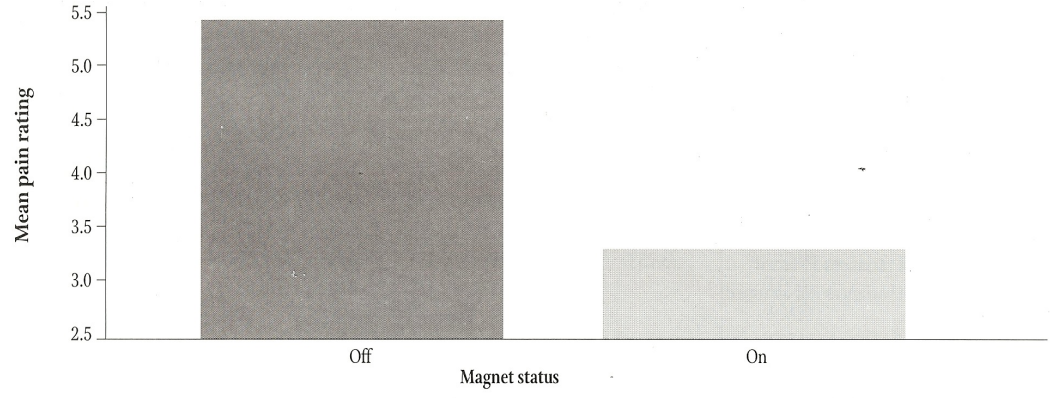


FIGURE 6C Mean pain ratings for Diary T3. Diary T3 indicates diary time 3, 2 weeks after the end of the last treatment session.

7. Effects of pico-Tesla electromagnetic field treatment on wound healing in rats

The following study was executed at the College of Veterinary Medicine, Mississippi: State University. Jacobson's Protocols and the Jacobson pico-Tesla electromagnetic therapy unit were supplied by Jacobson Resonance Enterprises, Inc.

C. Todd Trostel, DVM: Ron M. McLaughlin, DVM, DVSc; John G. Lamberth, PhD; Robert C. Cooper, DVM, MS; Steven H. Elder, PhD; Roy R. Pool, DVM, PhD; Cheng Gao, DDS, MS; Joseph A. Cromiak, PhD; Carolyn R. Boyle, PhD.

Objective

To evaluate the effects of a pico-Tesla electromagnetic field (PTEF) on healing of sutured and open skin wounds and clinicopathologic variables in rats.

Animals

64 male Fischer 344 rats

Procedure

An incision made in the dorsal aspect of the neck was sutured (n= 32) or left open to heal (32) in each group, 16 rats were not PTEF treated (controls). Wound treatment consisted of exposure to a PTEF once daily. Rats in each group were euthanatized at days 2, 4, 7, and 14. Wounds were evaluated via tensiometry (sutured wounds), digital planimetry (open wounds), laser Doppler perfusion imaging, bacteriologic culture, and histologic examination. Blood samples were collected from all rats for analysis.

Results

At day 14, sutured wounds in PTEF treated rats were stronger (ultimate stress) and tougher (strain energy) than were sutured wounds in control rats. Open wounds in PTEF treated rats contracted more quickly at days 2 and 4 than did those in control rats. Compared with control wounds, histologic changes (indicative of improved healing) in sutured and open wounds in PTEF treated rats were detected as early as day 4. Laser Doppler perfusion measurements, results of CBCs, serum biochemical analyses, and bacteriologic cultures were not different between groups.

Conclusions and Clinical Relevance

Exposure to the PTEF caused no adverse effects on clinicoathologic, histologic, or bacteriologic variables tested in this study. It appears that PTEF is a safe form of adjuvant treatment for wounds and speeds contraction of open wounds. (9)

In Vitro Cancer Cell Studies

8. The following studies were conducted from (2000), by the Department of Basic Sciences, Veterinary Medical Research, Mississippi State University

The principle investigator was Prof. Cody Coyne. The Jacobson Resonator was utilized, and picoTesla electromagnetic field (PTEMF) signal parameters were derived from Jacobson's Equation (in collaboration with Prof. Jerry Jacobson).

Preliminary Investigations and Experimental Findings

Preliminary Investigations: During the first replicate study a total of twelve multi frequency PTEMEF schedules were screened for their ability to their alter the viability and/or proliferation rate of human mammary carcinoma cell populations (HTB-126 & MCF-7) in multi well tissue culture plates. Of these twelve techniques, two were found to compromise the viability and/or proliferation rate of HTB-126/MCF-7 cell types relative to untreated negative reference controls. Over the course of subsequent replicate studies (n= 7) a total of three out of twenty three (n=3/23) multi-frequency PTEMEF schedules were observed to consistently inhibit the viability and/or proliferation rate of HTB-126/MCF-7 populations between 31% to 35% compared to untreated negative reference controls.

Subsequent investigations identified membrane associated complexes that are expressed at elevated or decreased levels in MCF-7 populations following exposure to multi-frequency PTEMEF schedules. Subsequent investigations have detected several mRNA sequences (n=3) that are expressed at higher levels (n=1) or uniquely expressed (n=2) in populations of MCF-7 human mammary carcinoma following exposure to multi-frequency PTEMEF schedules. It is our intent to publish these experimental findings in the future. However, due to the very nature of PTEMEF technology and instrumentation, there are numerous combinations of the variables of EM intensity, EM frequency, exposure duration, and exposure number that need to be evaluated in order to fully delineate the potential anti-neoplastic properties provided by this modality.

Subsequent investigations attempted to determine if vitality staining, protein fraction, and/or mRNA transcription preparations performed immediately after exposure of MCF-7 human mammary carcinoma cell populations to PTEMEF schedules influenced experimental findings. The source of these biological samples were MCF-7 human mammary carcinoma cell populations processed approximately four hours after the fifth and final PTEMEF exposure period. In addition, an attempt

was made to determine the relative biological influence of individual single frequency PTEMEF techniques contained within multifrequency PTEMEF schedules.

Collective interpretation of experimental findings reveals an ability of a multi-frequency PTEMEF schedule to induce alterations in viability/proliferation rate and expression profiles of; (i) cytosol- soluble and membrane associated protein fractions; and (ii) genetic transcription of mRNA sequences compared to negative (non-exposed) reference controls. In this context, these alterations appeared to be of a different pattern when experimental samples were immediately processed following MCF-7 exposure to the fifth and final PTEMEF schedule. In contrast, slightly different and slightly more subtle differences were appreciated when an intentional delay of several hours was implemented between the final PTEMEF schedule exposure and sample preparation. Appreciation of this observation implies that maximum alterations in protein expression and mRNA transcription may occur during or shortly after periods of PTEMEF exposure. In addition, there was also a relative difference in the biological affect exerted by individual single frequency PTEMEF techniques contained within the “master” multi- frequency PTEMEF schedule. Ultimately, these laboratory findings will serve as an experimental foundation for future research investigations devoted to delineating, (i) time-frames that PTEMEF exert a biological affect; (ii) duration PTEMEF induced molecular/ genetics alterations; (iii) identity of PTEMEF that selectively exert specific biological affects in living systems; and (iv) identify molecular/genetic “targets” that PTEMEF interact with in a manner that creates a biological affect. (26)

10. Alleviation of Chronic Pain (1999): Case Controlled and Double Blind Clinical Studies

Hospital Costa Del Sol & Hospital Serrania de Rhonda, under the supervision of Hospital Clinico de Malaga, Spain (Dr. Pedro Alonso Atienza.)

Institute of Theoretical Physics and Advanced Studies for Biophysical Research, Jupiter, Florida, USA (Prof. Jerry I. Jacobson)

Status

More than 300 patients were treated with Jacobson Resonance therapy (1999) and more than 90% of same experienced an alleviation of chronic pain. During the fourth quarter of 1999, 86 patients, with arthrosis of the knee were treated in a double-blind, randomized, placebo-controlled study. A total of 84 patients (97.7%) experienced a statistically significant immediate reduction of pain. Furthermore, a week later, approximately the same level of pain reduction had been maintained in 52 patients (60.5%).

Jacobson Resonators have been successfully guided through CETECOM homologation tests (technical standards certified by the European Union), and have complied closely with Direccion de Productos Sanitarios y Farmaceuticos (The Spanish Health Ministry), and have satisfied the European Union's Medical Device Directive, with its Jacobson Resonators being judged to be non-hazardous.

CE-Mark approval was granted on January 10, 2001.

11. Fibromyalgia: Double Blind Placebo Controlled Randomized Clinical Study

Fibromyalgia is a syndrome involving lack of stage IV sleep and chronic diffuse widespread, aching, stiffness of muscles, and soft tissues. Diagnosis conventionally requires 11 of 18 specific tender pints including the occiput, neck, shoulders, chest, elbows, gluteus, greater trochanter, and knees…etc.
4/kg touch pressure elicits a painful response; tender points are found on both sides of the body, and above and below the waist. Fibromyalgia has become an ever increasing, often debilitating condition throughout the world; and its etiology is unknown, although it has been linked to physical and emotional trauma, as well as viral infection.

A double blind, placebo controlled and a randomized clinical study was performed with three groups, A (n=5) B (n=4) and C (N=4) Groups A and B were treated with different pTEMF protocols to establish optimization of signal parameters, while group C served as the Placebo. All subjects sat in the Magnesphere. Under the same ambient conditions, except that Group C did not experience exposure to pTEMF's. Scales utilized to determine outcome included: NPI (pain scale/subject rated); FIG (quality of life scale); MOS (pain sleep scale); and ACR (pain scale/ clinician rated).

Group A Treated

- The (NPI) baseline (for the last 3 Tx) average was 7.86 and it went to 4.168, a 46.97% decrease in pain/ stiffness as determined by the patient.
- The (normalized) FIQ average baseline was 71.35, and at endpoint it was 37.48, a 47.47% decrease, showing a significant improvement in quality of life.
- The average baseline for MOS was 64.154, and at the end (day 14) the MOS was 32.034, a 50.07% improvement in sleep.
- The average for ACR /pain at baseline was 14, and at the end (day 14) it was 6.6, a 52.86% improvement.

Group B Treated

- The NPI baseline average was 7.4975, and the average of the last 3TX at endpoint was 4.5, a 39.98% improvement.
- The FIQ subtotal (normalized) baseline was 57.9885, and the endpoint (normalized) was 37.79435, a 34.82% improvement in quality of life. The MOS baseline subtotal average was 52.075, and at the endpoint (day 14) it was 34.195, a 34.34% improvement in sleep.
- The subtotal average ACR/Pain at baseline was 16.25, and at the endpoint (day14) it was 8.5, a 47.69% improvement.

Group C Untreated Control

- The NPI baseline was 8.88, and the endpoint was 7.00, a 21.21% improvement.
- The FIQ average baseline was 76.84, and at endpoint it was 56.38, a 26.62% improvement.
- The MOS average baseline was 68.74, and at endpoint it was 53.23, a 22.57% improvement.
- The ACR/Pain average at baseline was 16.25, and at endpoint it was 11.00, a 32.31% improvement.

(Each TX exposure was 60 min 10 TX were performed)

% Responders in Groups A, B and C

30% represents clinical significance

❖ **(NPI)** % Of individual responders for each group

Group A- 80%
Group B- 50%
Control Group C- 25%

Groups A and B combined: 66.67%
Group C (Control) – 25%

❖ **(FIQ)** % individual responders for each group

Group A- 60.00%
Group B- 75.00%
Control group C- 50.00%

❖ **(MOS)** % of individual responders for each group

Group A- 80%
Group B- 50%
Control Group C- 25%

These data indicate that pT EMF's may diminish pain/stiffness, improve quality of sleep and life for fibromyalgia sufferers. These effects are long lasting in most cases. Larger placebo-controlled studies need to be undertaken to confirm and further investigate the benefits of this unique, noninvasive and promising therapy.

Prof. Dr. Jerry Jacobson, theoretical physicist, biophysicist and medical researcher, is a world-renowned pioneer in the field of bio-electromagnetics. Inventor of 40 + patents and author of more than 100 scientific publications, he has lectured on the theory and practice of Jacobson Resonance throughout the world for more than 30 years. He is listed in Who's Who in the World, Who's Who is America, Who's Who in Science and Engineering, and Who's Who of American Inventors.

He currently serves as Chief Science Officer for Pico-Tesla Magnetic Therapies, LLC and Magneceutical Health, LLC. He is recipient of the Albert Einstein Genius Dedication by the American Biographical Institute and a member of the International Order of Merit, a distinction awarded by the International Biographical Centre, Cambridge, England.
For more information please see: www.pico-tesla.com and www.magneceutical.com

Also, his latest book, "Reason for Life," a compendium of his art, science, poetry and philosophy is available through www.AbbottPress.com as well as other booksellers.

Dr. Jacobson is seen here lecturing to the Oncologic Society of Sweden, at the City Conference Center in Stockholm, Sweden.

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