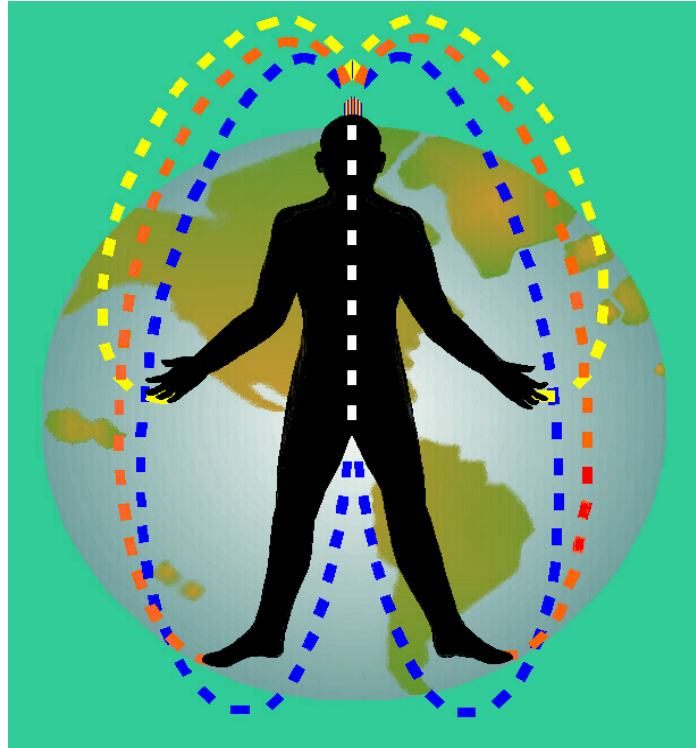


# BioElectroMagnetics Health Effects



## BIOLOGICAL EFFECTS OF ELECTROMAGNETIC FIELDS (EMFs)

Electrical Hypersensitivity (EHS) -- Potential Mechanisms, With Tie-ins With Fibromyalgia, Chronic Fatigue, Chemical Sensitivity, Hypothyroidism (Type II), Stress & Women's Health. Personal Experiences. Potential Causes, Symptoms & Therapies.

Prudent Avoidance of EMFs in the Home & Office.  
Building Your "Buzzstick" For Audio Detection Of Electric Fields & EMFs.  
Chronic Fatigue Syndrome: Is Prolonged Exposure to EMFs a Factor?  
Birds, Bees, Bat-Rays. Butterflies & Buzzards -- Electrosensory Organisms.

Cellular/Mobile Phone Health Issues. Radiation Shields.  
Head-Level Cell Phone Antenna Microwave Intensities (SAR Levels)

Status of Recent Research Projects in Bioelectromagnetics.  
Contacts, Books & References For Support & Information.

Effect of Computer Monitors on Human Skin  
Therapeutic, Pulsed EMF, Quantron Resonance System (QRS)

Edited by James B. Beal, EMF Interface Consulting, © 2005

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# Bioelectromagnetics Health Effects

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"Before I conclude, I would beg one thing (if it be not too great a favor) from the gentlemen of the Faculty, and indeed from all who desire health and freedom from pain, either for themselves or their neighbors. It is, *that none of them would condemn they know not what. That they would hear the cause before they pass sentence. That they would not peremptorily pronounce against electricity, while they know little or nothing about it. Rather let every candid man take a little pain to understand the question before he determines it.* And then his own senses will show him, whether it is a mere plaything, or the noblest medicine yet known in the world."

...John Wesley, 1759

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"We are a peculiar people. **We often demand to know** why and how something works before we ask if it does. It isn't enough for us to experience something and to accept it. We can't accept something of value until we are convinced that it is logical, **that the system fits within some preconceived mechanism, or that it has been "proven" to work.**"

...S. Eabry, 1994

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"Verily, we know nothing. Truth is buried deep. We know nothing for certain, **but only the changes produced in our body by the forces that impinge upon it.**"

Democritus, 450-370 B.C.

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## Letter from the Editor

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There is a great variability and tolerance to environmental elements within members of the human race, depending upon gender, genetics, health, geographical location, and cultural and personal belief systems, to mention a few complexities! Over the years a lot of medical and psychological application-range knowledge has been gathered which fits the majority of human psychophysiological problems, producing the "average person profile". But what about those persons we are finding who do not fit the "profile"? These would be individuals of extraordinary sensitivities, often body and sensory oriented, or intuitive, who may be admired, imitated, ignored, suppressed or judged as "handicapped", depending on how they use their "gifts", and how their health is affected. The increasing number of people who are hypersensitive to chemical and EMF factors are giving us important clues about how and where we are affecting our indoor and outdoor environments in ways which may be hazardous to our long-term health. These people by birth, accident, or discipline are examples of the incredible range and sensitivity we see every day in other living creatures (if we but open our eyes and minds!).

With modern technology, medical care, communication, and information collection and dissemination systems, we can now learn more about these individuals. They can be assisted with their personal problems and talents, and the incredible ranges of their body, brain, mind, spirit, and environmental interaction factors determined. Also, as we uncover more useful data at the "creative edge" in the study of these life processes, certain medical and psychological anomalies, formerly classified as superstitious nonsense, are becoming "new cures or discoveries", with new words replacing the older unacceptable terminologies.

I've watched bioelectromagnetics emerge over the past 45 years, and have always felt that many answers to "unexplained phenomena" awaited more sensitive instruments to measure the electric and magnetic fields associated with living systems. As an aerospace engineer involved in extending the limits of the possible, I've been able to follow the medical applications of space research and watch the "impossible" and "nonsensical" become useful and applicable.

During my work from 1982-1986, at Martin Marietta Manned Space Systems in New Orleans, I jointly developed an electrostatic cooling (ESC) process (and patent) to improve aluminum welds on the Space Shuttle external fuel tank. The last 6 months of statistical weld tests required my all-day presence next to the high voltage and current welding equipment and high voltage ESC system. Shortly after project completion (early 1987) I started having acute attacks of hives (urticaria) any time I ate beef, mutton, or pork. This protein intolerance to red meat products is a minor malady at the present time with very little affect on my lifestyle. However, this personal experience, with what I perceive as effects of very strong EMFs over a few months of time, attracted my attention as a potential long-term health issue that requires further exploration. See page 33 for details.

There appear to be trends in animal and primate research over the years indicating that continual long-term exposure to individually specific EMF pulse rates, intensities and waveforms, may produce hypersensitive reactions in some people. Persons already hyper-allergenic to many chemicals claim that EMF transients from powerlines, home appliances, electrical wiring, office equipment and switches are one more irritating factor to avoid.

We now have the tools and are starting the research into "inner space". It is an exciting era of developing our understanding of the holistic nature of our human body, brain, mind, spirit and environmental interactions. Shall we extend the limits of the possible?

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## Contents Caveat\* Editorial

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**\*Caveat n** [L, Let him beware] *.a: a warning enjoining one from certain acts or practices, (e.g., "shooting the messenger"...jb) b: an explanation to prevent misinterpretation.*

**Interrelated health issues of body, mind, emotions, spirit and environment:** This document was developed over the years to provide information useful to a variety of people who have personal interests in recent complementary medical discoveries, and in research, potential therapies and applications that involve these issues.

In this document I've tried to provide useful information and supportive historical background for both concerned and affected persons with no technical background, as well as the interested person with technical expertise who needs references and selected research excerpts for further professional study, research and application.

**Effects of electromagnetic fields (EMFs) on, and from, living systems not the whole story:** There are many complexities in this situation, and little understanding (and little research inclusion) of the overall interactions of environmental factors of air, food, water, electrical field (EFs) gradients (often called electrostatic fields), magnetic fields (MFs) and electromagnetic fields (EMFs). Considering the complex interactions of these many factors in life processes, other interacting areas (genetic, biochemical, subject age and health, etc.) must be addressed to some extent. There is no "silver bullet" single cause to long-term health effects. Thus, the information herein -- by its very nature of being preliminary, incomplete, and sometimes controversial -- will vary in technical content/quality, research status, complexity and acceptability/believability by medical, technical and scientific professionals.

**It is my responsibility as a networker to filter and share this new, and developing, information** with those who have "a need to know" and who wish to consider new ideas. I am a retired aerospace engineer, using my own 45-year observational background, of effects of EMFs on living systems, to select the best and most useful recent data for you, **in my opinion**. For those of you who question some of the brief "gray-area" studies, anecdotes, observations, excerpts and conclusions herein, I have provided extensive references for further investigation.

**The subjects in this document** range from easily-understood and applied self-help healing approaches and anecdotal personal accounts, to some technical discussion of medical therapies and detailed research results. The technical discussions have been held to a minimum, with references provided for those with the expertise and interest to investigate further.

**It is my hope** that this brief overview of "enforming" information and references will inspire curiosity, investigation, and more all-inclusive attitudes about wellness, healing, living and caring -- for ourselves, our environment, and each other. May it expand reader comprehension in many areas and inspire a sense of personal responsibility for one's own wellness and the beauty, the fragility and incredible sensory capabilities of the dynamic life processes involving **body, mind, emotions, spirit and environment**

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***"Don't bite my finger! Look where I'm pointing!"***

***...neurophysiologist Warren McCulloch***

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## Editorial: Don't Confuse Me With Facts, My Mind Is Made Up!!

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**The "Philosophy of "Oh!":** Too much bias against electrical and/or electromagnetic hypersensitivity, or any subject, can close the mind to worthwhile investigations just as much as complete acceptance without evaluation. One should take all data and file for future verification and correlation with observed experience without bias.

*"There is mystery in life. One should hesitate before believing or disbelieving. If you hear of some incredible experience, don't say 'I believe' or 'I disbelieve.' Say, 'Oh?'. Appreciate that mystery of life. Understand that only by saying 'Oh?' that the true scientific and philosophic impulse can be expressed. The philosophy of 'Oh?' can lead you to new discoveries of self."*

.....Alan Vaughn

Simply because electrical and/or electromagnetic hypersensitivity has seemed at first acquaintance so improbable, it has the dangerous capacity, when investigated, to convert skeptics into polarized believers and enthusiasts; their confidence may improve their results, but is also diminishes their powers of self-criticism. **Here 'polarization' means 'focused on one issue only', looking for neat and simple answers**, to the exclusion of other, complex, interacting factors, e.g., genetics, age, gender, work/home/earth environments, belief systems, chemical sensitivities, diet, exercise, etc.. (*An example of "The more I learn, the less I want to know!"*)

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**"Reality continues to ruin my life."**

.....Calvin, to Hobbes

Calvin and his pet tiger, Hobbes, are coasting down a steep mountain side at high speed in Calvin's red wagon, dodging trees and rocks on the way down.

**Calvin:** "Once you know things, you start seeing problems everywhere. And once you see problems, you feel like you ought to try to fix them. And fixing problems always seems to require personal change. And change means doing things that aren't fun! I say phooey to that! But, if you're willfully stupid, you don't know any better, so you can keep doing whatever you like! ***The secret to happiness is short-term stupid self-interest!***"

**Hobbes:** We're headed for that cliff!

**Calvin:** I don't want to know about it.

WAAAUGGHHH!! (As over the edge they go, and splatter all over the landscape below!)

**Hobbes:** I'm not sure I can stand so much bliss!

**Calvin:** Careful! We don't want to learn anything from this.

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***There is a principle, which is proof against all argument,  
and which cannot fail to keep a man in everlasting ignorance.  
That principle is: Condemnation Before Investigation.***

....H. Spencer

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## Health Effects of Powerlines, Electrical Equipment & Other Aspects of Electromagnetic Fields (EMFs)

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**James B. Beal**

Latest research (not influenced by electric company funding) indicates that your local power line **is not** the primary source of 'electromagnetic pollution'. Home and business interior wiring, equipment or appliance motor and transformer EMF sources, and grounding to metal pipes seem to play a much more important part, especially where we spend hours of our time in one place, working or sleeping. The intensity of the alternating current (a.c.) and associated EMF present is only one of several factors to consider in a large number of environmental variables!

There appear to be trends in animal, primate, and human research over the years which indicate that continual long-term EMF exposure of individually specific pulse rates, intensities and waveforms, may produce hypersensitive reactions in the living systems exposed [1-4, 7-10,19,21,25, 26]. Persons already hyperallergenic to many chemicals claim that EMF sources from nearby powerlines, home appliances, transformers, and switches are one more irritating factor to avoid. These trends have caused popular concern, controversy and confusion, stimulating government, industry, and legal actions regarding the biological effects of power frequency electric and magnetic fields [15-18,24].

Research programs are finally beginning to investigate the unwanted raw signals (**transient spikes & surges**) which may be on your local power lines, on your water pipes or generated by home appliances and wiring. Interest is being focused on the sharp pulse repetition rates (how many times per second), and what other frequencies or waveforms are present besides the normal 60 cycle [also, called Hertz (Hz)] power line frequency. Information about the **length of exposure time**, when the exposure occurs (**especially at night**), the EMF field intensity (milliGauss), and the interactions with people and other living systems in the environment is now being gathered. We are becoming more aware in recent months of the sensitivity of various life forms to EMF via the reactions of their sensory systems [20], immune system effects [8,9], allergy reactions [10,21], etc. So it is not simply 60 Hz magnetic field strength that determines whether or not a given EMF will have biological effects. Undesirable transients on the power line and in the home or business will vary, depending on what is switching on and off, how often, how long and when (day or night, weekdays or weekends). Five recent epidemiological studies in the United States and Sweden [6,14] have shown **weak, but consistent**, cancer correlations with proximity to transformers, the local wiring code and the number of appliances in the home. Because a specific subject EMF sensitivity profile has not been developed yet, it is likely that the weak epidemiological results were diluted by the overall test population age and locations selected, and the variability in human immune system response to irritating stimuli.

### **Repetitious transients and surges (pulse spikes):**

These may occur on power lines into, but the more influencing transients are created by factors in home and business wiring, appliances and equipment. **This repetitious long-term exposure may provide a kind of irritation or suppression factor**, posing potential hazards to our health. EMF effects have been discovered, **at night**, reducing brain pineal melatonin hormone production, which affects immune system efficiency, especially in older persons [8,9]. These effects appear to be caused by the sharp rise and fall of the pulse spikes created by **motors and switches** (electric blanket thermostat switch, for example) turning on and off. That's the reason for '**prudent avoidance**' of operating electric blankets and waterbed heaters by children and pregnant women. Dr.'s Wilson and Reiter made these discoveries during the

past decade at Pacific Northwest Laboratory and University of Texas Health Science Center, respectively [7,8]. This points to a probable irritating or suppressing type of influence which would create symptoms in a variety of confusing ways, due to personal health and immune system factors [4]. Those at risk would be persons (primarily women) **exposed for years in constant proximity** to power line components (transformers, sub-stations), appliances (electric blankets, hair dryers), power tools, switching systems, and other sources of potential rapid transient (switching) EMF [1].

There is strong stimulus-response evidence, verified by eye pupil variations, that continual long-term exposure can result in allergic reactions to EMFs of particular pulse rates, intensities and waveforms [10,21]. Environmentally ill (EI) persons with compromised immune systems, already hyperallergenic to many chemicals, often find that EMF transients are irritating factors.

As more data accumulates on what EMF factors are the most hazardous, precision line surge suppressors, current balancing transformers [23], for control of voltage and current transients, may become increasingly important. These methods will be beneficial, not only for computers and critical electronic systems, but also in improving our personal long-term health. These devices would be on power lines, in industries and in the home. Motors, switches and switching systems will have built-in rise-time suppression circuits so spikes would be eliminated or reduced. **Proper grounding (3-wire plugs), and complete cut-off** (pull the plug or breaker) of unused electrical systems are approaches used by EI persons now in their business, sleeping and major home activity areas.

#### **Future Shock, Prizes and Surprises from Bioelectric and EMF Research:**

There are many beneficial, as well as potentially hazardous, biological interactions with the artificial EMF and natural (geomagnetic) environments in which we live and work. It has long been established (35+ years) that electromagnetic therapies of **controlled** specific pulse-type (sharp rise time or square-wave) waveforms and pulse rate frequencies can produce: (1) visual [5] and hearing effects [22] (without lights or speakers), (2) induce sleep and anesthesia, (3) suppress pain, (4) ease depression, (5) improve tissue and bone growth healing [19], and, (6) successfully treat addictions to hard drugs, alcohol and tobacco. The applications mentioned above are considered the body-penetrating effects of the magnetic field pulsing components and have been primarily conducted in other countries. Electromagnetic therapies appear to be rapidly emerging as the medicine of the future.

In *this* country the electric field is not considered a health factor, because it does not penetrate the body. However, note that the acupuncture system, found in all living things, is associated with healing. It is more primitive than the nerve system [19], and has discrete electrical components that change slowly with time. It appears to be affected by mind, body and environmental changes, and thus may respond to electric field changes (natural and artificial). Perhaps the acupuncture total body surface system acts as a sort of 'transceiver', transmitting and receiving **subliminal information** on many different levels about EMF variations (external and internal) which may then stimulate (or indicate) body, mind and healing reactions.

The **specific information signals transmitted from** the life processes of biosystems (microorganisms to elephants), plays a survival role in detection of food, enemies, and mates. The **information transmitted to** biosystems from extremely small electrical and electromagnetic factors in the natural earth (geomagnetic) environment also seems to play a survival role. This is apparent in navigation, migration, biological rhythms, and detection of weather and earth changes, both subtle and catastrophic, e.g., seasonal variations, weather fronts, hurricane/tornado proximity, and earthquakes [2,3,20]. How much of this do we humans use or react to unconsciously in our daily life and how much is latent talent which can be trained? Consider the incredible sensitivities of the Australian aborigines and martial arts masters. As understanding increases about our health dependence on natural and artificial EMF factors, our environmental awareness will be increased. See pages 86 and 111 for details.

Thousands of research reports on bioeffects of low-power extremely low frequency (ELF) EMF, radio frequencies (RF) and modulated (mixed frequency) fields on humans and other living systems have been missed because they were not published in medical journals. Some of the best reports are in journals **relating, not primarily to the research results, but to the methodologies involved**, e.g., appearing in industrial, electronics, physics, communications, life sciences, and obscure specialty publications [3,4,6,12,13,20,21,25]. How does one publish original research in a new area with few or no peers available for 'peer review', as required in the established medical and scientific journals?

In addition, the physical and mental problems reported for the 'sick building syndrome' (11) may involve long-term exposure to variations and mixtures of ELF/EMF, improper light spectrum balance, and low frequency sound or vibrations, as well as poor air circulation and chemical irritants/pollutants.

Sensitive, inexpensive, portable EMF measuring, recording, imaging and analysis systems have recently evolved from space and satellite research programs. The use of Expert Systems to process large numbers of variables, miniaturized 'smart' sensors for continuous monitoring, and high-resolution imaging systems, now provide us the opportunity to study the **long-term, low exposure rate, multi-faceted, complex challenges to health** that are being encountered in this culture.

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**FLASH!!LAST MINUTE INFO, 10/18/2001, SEE <http://www.feb.se/ARTICLES/Ollej.html>**  
**MYSTERY IN THE SKIN:** Screen dermatitis, the effect of computer work on human skin. interview with Dr. Johansson. Professor Johansson has been outspoken and committed to this scientific field. He started in the 1980's and he been an advocate for the electrosensitive persons in Sweden as well as around the world. **This interview will go into what he has discovered in the skin of those injured by computer monitors, and also what remains to be done.**

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## Comments on NIEHS Working Group Report & Future NIEHS Director's Report to Congress

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**NOTE:** *Known as EMFRAPID, the Electric and Magnetic Fields Research and Public Information Dissemination Program was approved by Congress as part of the 1992 Energy Policy Act. As cooperative partners in the EMFRAPID effort to determine the degree, extent, and significance of any quantifiable EMF health risks to the public, NIEHS and DOE (Department of Energy) will ultimately research and develop exposure reduction techniques--if deemed appropriate by public health standards.*

*A future report to Congress--currently in preparation by the NIEHS director--will address the extent to which EMF exposure affects human health. As an objective scientific judgement, this final report will be the product of extensive critical review and evaluation of the scientific research literature. An interim step in this process is the NIEHS Working Group Report published in August 1998. This report, entitled "Assessment of Health Effects from Exposure to Power-Line Frequency Electric & Magnetic Fields," is available at the NIEHS EMFRAPID Program world-wide-website: [www.niehs.nih.gov/emfrapid/home.htm](http://www.niehs.nih.gov/emfrapid/home.htm) and in hard copy or CD-ROM on request by mail: EMFRAPID Program/LCBRA, NIEHS, NIH, P.O. Box 12233, MD A3-06, Research Triangle Park, NC 27709; by fax: 919-541-1479; or by e-mail: <emf-rapid@niehs.nih.gov>*

*These comments, and those of James Beal which follow, were presented, at the NIEHS Public Forum, held 14 September 1998, Tucson AZ, in conjunction with the DOE/EPRI Annual Review of Research on Bioeffects of Electric & Magnetic Fields.*

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### E. Marcos Barnes, P.E.

**Prologue:** We are--individually, societally and economically--solidly bound to electricity, an energy-commodity without which no technological society could function. And inseparable from our electricity is its manifestation, EMF, from which virtually everyone has some measure of exposure. One might say we have an inescapable intimacy with electricity and EMF, their being as ubiquitous in our everyday lives as air and water.

Against this social and economic backdrop are the Working Group's conclusions, the themes of which are:

- In view of the aggregate of all research to date, there is no consistent, or persuasive evidence that EMF is a human carcinogen,
- but that EMF is a "possible human carcinogen."

These two mutually-conditioning statements, as they stand, amount to bounteous justification for further EMF health effects research. Moreover, the critical need for continued research is clearly implicit in the general substance of the Working Group Report's "Final Summary and Evaluation."

In particular, the Working Group says: "The overall body of evidence has...laid a foundation for furthering understanding of the biological effects, mechanisms, and exposure circumstances that may be related to the possible carcinogenicity and other adverse human health effects of exposure to ELF EMF."

From my and other people's perspective, this assembly of twenty years' research findings--from North America and elsewhere--constitutes an extraordinary scientific infrastructure and priceless data base, that lays the foundation, the guiding path to further enlightenment. This aggregate has a momentum, so to speak.

Support and funding for continuation of the DOE Research Program--ongoing for fifteen years--is crucial and imperative.

Future research proposals and funding from the various agencies should be sought and encouraged. Terminating or financially depriving the DOE program is tantamount to squandering the last twenty years' research efforts which have brought us to a threshold point beyond which may lie a clearer and deeper understanding of possible EMF health effects. In the public interest, we can not afford to stop short of potentially consequential future knowledge and illumination, especially--as stated earlier--given our extreme dependency on electricity and our intimacy with its manifestation, EMF.

As we know, the epidemiology is feeble and murky--an indeterminate mixed bag. And we have no clearly-demonstrated, biologically-plausible mechanisms on which to hang anything. The exploration of several hypotheses has yet to spawn anything of real substance. Could the effort to clearly identify a biological mechanism(s)-- relevant to a quantifiable public health risk--end up as scientifically unfeasible? Maybe so, maybe not. Might EMF exposure likely be an acceptable risk to most people? We don't know.

And although it's conceivable that we may never determine what people (if any) in the population do have a higher biological susceptibility and risk from a particular EMF exposure condition, and what that unique exposure parameter might be, we will never really know--one way or the other--without continued research.

NIEHS is strongly urged to incorporate this message into it's Report to Congress.

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### **James B. Beal**

As represented in the NIEHS Report, It has been necessary, in the complex areas of electric field (EF) and electromagnetic field (EMF) effects on living systems, to combine our efforts in the interrelated disciplines. This forms a higher order group of 'bridging' sciences to help identify and solve present-day long-term health problems. Progress in one branch feeds back into all others with various repercussions. Topics in modern biology, such as genetics, aging, cancer, molecular biology and even bioelectromagnetics appear to be intimately connected and are developed together. These interconnections are reflected in the enormous amount of preliminary, incomplete, and sometimes conflicting, research in the NIEHS Report. This report is just beginning to open up the complex, higher order of understanding needed to solve the long-term environmental health impacts resulting from modern technology. It will provide some understanding and perspective concerning the overall effect of technology on water, food, air, and in the living space around us. These environmental effects may then impact behavior, psychological and physiological factors in higher and lower order biosystems. (Isn't it reassuring that modern technology is busy trying to solve all the problems that modern technology has created?)

It is important to note here that with human beings, additional health problems are created by psychological needs to identify outside causes of dis-eases and suffering. This often results in Idiopathic Environmental Intolerance (IEI), e.g. multiple sensitivities and symptoms relative to air, water, food and living space factors (EFs & EMFs).

In my 40 years of collecting and networking data about biosystem reactions to electrical field gradients, electromagnetic fields (ionizing and non-ionizing), and air ion effects [1], some characteristics seem to emerge. Changing electric field gradients, pulsed electromagnetic fields and air ion concentrations (natural and artificial) seem to play a complex part as natural environmental living space bio-information signals that can be beneficial or detrimental [2-9]. These aspects of electrical phenomena, in the long-term health effects area, may be considered low-level environmental stresses [10]. The reported negative health effects of electrical factors on humans may be partial by-products of stress, psychologically amplified by media reports of symptoms, therefore, seeing a power line or electrical equipment may touch off a bizarre series of pathologies on the spot [11]. **This does not mean all behavioral and systemic reactions are mental in nature**, as indicated in reference 11, however, this is an important consideration in designing research and environments utilizing human beings and successful treatment of electromagnetic hypersensitivity (EHS). Dr. Carl Blackman reports that a stress-perturbed (hyper-sensitive) system may become more sensitive as additional stresses are imposed.

As support of the above statements, persons who have fibromyalgia often find their lives complicated by multiple chemical sensitivity (MCS) which in turn may progress into **electrical hypersensitivity (EHS)**. There are also chronic fatigue, sleep problems and heart irregularities involved, which are some of the symptoms reported in recent reports of EMF exposures of humans. All of the above maladies seem related and are exacerbated by any additional stress, often leading to a locked-in "fight or flight" reaction. In pilot studies, conducted at the Houston Health Science Center, the above presenting symptoms have been successfully treated as a "thyroid resistant" systemic condition (Hypothyroidism, Type II) not detectable with standard TSH thyroid blood tests. Megadoses of inexpensive thyroid hormone T3, stepped up gradually over a lengthy treatment time, reverses symptoms and restores the patient to a normal lifestyle [12]. These conditions seem to primarily affect women (80%/20%). In June this past year a biomarker for stress level measurement (Hyaluronic Acid) was discovered in Israel, which is applicable to fibromyalgia and rheumatoid arthritis [13, 14]. Studies are beginning in Houston using the thyroid hormone therapy with this new biomarker as a **measurable** backup to patient subjective statements about their sensitivity. There is good reason to believe this new therapy will be very useful in treating EHS, since preliminary results in achieving a cure have been successful.

We need to note that since Presman published his pioneer work in 1970, "*Electromagnetic Fields and Life*" [15], it has become more and more evident that biosystems can emit electric and electromagnetic signals and show ultrasensitive responses in areas throughout the whole spectral range from below one Hertz up to the ultraviolet and above. This sensitivity in transmitting and receiving EMFs is evident in many species of fish, birds, insects and animals [16-25]. In particular, biological resonances and biosystems in stress appear to initiate sensitive reactions under the influence of electric field gradient changes and/or EMFs (natural and artificial) and this may occur at various spectral intervals ("windows").

The recent bioscience investigations into dissipative structures, deterministic chaos, coherent excitations [26-28], as well as solitons [29] and other oscillations in the sensitive liquid crystal substances [30-32] in living tissue, seem to originate from evolutionary development within electrical and magnetic factors in the environment [33-37]. These effects in living systems seem to range from the sub-atomic up through molecules, organelles, cells and the complete organisms, including humans.

Within the framework of electrical and EMF bio-information, a basic explanation of biological processes is emerging, e.g., communication, health, aging, cancer, biological rhythm regulation, and biochemical control. As these complex factors are investigated further the interrelation between all these different areas becomes evident and applicable to human needs.

Spin-off of this preliminary, **and I stress preliminary**, NIEHS report is now (and into the future) penetrating into other important health areas. These are **health areas where answers have not been and are not presently forthcoming, based upon present medical and biosystem**



**knowledge and models.** We need new, more disciplinary-inclusive models to handle the non-linear complexities of biological systems.. **Research about electrical and EMF factors is basic to the understanding of all life processes [38].** This type of research will support the long-term maintenance of health, and increase understanding about the impact of our technology on our environment, immune systems [39-40] and life styles.

The NIEHS Report *in vivo* research (humans, animals, insects, fish) is, for the most part, statistically inconclusive or marginally supportive. Considering my 40 years of gathering, analyzing and sharing technical data in this area, this may be due to:

1. Insufficient consideration (monitoring/recording) and/or lack of knowledge of influencing natural environmental and biological factors [41-45].
2. Increasing specialization (reductionism) in the sciences in recent years. This may provide 'security' for the scientist or researcher, but it seriously curtails curiosity and applications to the interconnections, complexities and problems of the real world.
3. A belief that it is impossible for living systems to be acutely sensitive to environmental variations of electric and magnetic fields down to the quantum level [27, 28, 46-48].

**Question:** When will the scientists, biophysicists, engineers, government/Industry labs, and the public ever learn to look at (observe and appreciate) the exquisite sensitivity of living creatures to particular areas of the broad electromagnetic spectral range of the natural environment into which we all evolved [33-37]? (Never underestimate the power of the human mind to resist the inroads of useful knowledge!)

4. Item 3 belief fixation leads to a lack of interest and basic research funding into the electric and magnetic sensing capability ranges of living systems.

It is advised that future in-vivo research be conducted in a setting which replicates the test subject's natural environment as closely as possible, monitoring and recording deviations in:

#### **Natural Environmental Influencing Factors Which Must Be Considered:**

1. Air ion levels (positive and negative ion concentrations).
2. Air composition/balance of, and identification of, constituents.
3. Microorganisms in air, which may be from air conditioning system or other conditions in the environment.
4. Barometric pressure changes and altitude.
5. Electrical field gradients.
6. EMFs and electrical fields in subject's natural and test environment. These fields may be introduced by equipment (transformers, for example), or poor grounding on pipes and other metal structures. These can introduce strong, fluctuating magnetic fields of several amperes! Spikes, transients and unusual waveform shapes and harmonics can be introduced from equipment cycling on and off, e.g., dimmer-type switches, air conditioning system cycling pulses, control motors, appliances, etc.
7. Day/night timing lengths, light levels and sunlight quality, as in the natural environment
8. Longer exposure to factors of interest--days or weeks (not minutes or hours), seem required for long-term effects to become evident. Latency (delay time) seems built-in to living systems for accommodation of environmental cyclic changes that often act as a survival

stimulant, then go away. Action-stimulating unchanging long-term "survival information signals" from artificial environments may create subliminal, health-affecting, "fight-or-flight" stresses in the test subject.

9. Earth geoelectromagnetic fields and influential variations due to earth/moon/sun positions and activity, plus effects of local weather changes. This ties into the Cyclotron Resonance effect, which is usually neglected in lab studies.

*"It may be coincidence that the geomagnetic field has changed orientation several times, a few millennia apart, and it may also be circumstantial that species die-offs have coincided with those same orientation changes [49] but it is no coincidence that the Resonance effect tends to influence atomic motion, separate from any other influence, as the law is well understood (see any good college Physics text). Could it be that a reduction in this atomic motion, as the graphic representation of this relationship indicates [50], reduces normal chemical reactions, hampering the survival of a species? The connection is more than coincidental. As most Laboratories are enclosed within structures that divert (or reduce) the Geomagnetic field, study conditions are rendered unrealistic. Because the background magnetic field is different from lab to lab, and since alternating magnetic fields interact with the geomagnetic field to produce conditions that are different from effects produced with alternating or geomagnetic fields separately, replicability is essentially voided [51]."*

The past 45 years of investigation into bioeffects of electrical factors has just scratched the surface. The technical ability to handle the interrelated complexities of non-linear biosystems and environments is growing daily. We are beginning to recognize (reluctantly) some of the biosystem problems technology has created over the long-term (the truth shall make you free, but first there will be much anxiety, anger and running around in circles ignoring the obvious!)

**We will have to unlearn some of the past things we have learned, using the new things we have learned (and are still learning), in order to better comprehend the exquisite patterning and ultrasensitivity of life processes to the electrical factors around us.** It is often not so much that we reach our research goals, but what applicable knowledge and discoveries we encounter in blazing new trails along the 'creative edge' of our work.

It is an exciting era of developing our understanding into a new area of research already yielding valuable knowledge about, and applications to human health. The initial research, in the NIEHS Report, and hints from the past, opens and begins paving the way in extending the limits of the possible.

The elimination or cut-back of NIEHS programs assessing health effects of electric and magnetic fields, at this stage of preliminary development, further delays answers to crucial mental, physical and environmental health issues and needs.

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"Science's seeming approximation to consistency, stability, and system  
is sustained by damning the irreconcilable or the unassimilable."  
.....Charles Fort, *The Book of the damned*

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## The Buzzstick: For Prudent Avoidance of EMFs

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### How You Can Construct An Inexpensive Detector for AC Electric & Magnetic Fields In Your Home and Work Areas

**Background:** The Buzzstick was developed as an inexpensive educational tool to indicate with sound, to persons unfamiliar with EMF fundamentals, the **general** location and intensity of EMFs around equipment and appliances. The stronger the magnetic or electric field, the louder the buzzing sound will be. No claims are made for accuracy of these instruments; *they are for detection only* so that one can make a personal choice about one's long-term stay in the proximity of the field detected. "Long-term," as used here, refers to many hours in the same location, day or night, but most importantly, at night where you sleep (*see melatonin book reviews, pg.106 & addendum*) You can begin to locate EMFs in your home and working areas with your buzzstick and lower the field intensity by prudent avoidance of the field source [*see pg. 19*] or removing the source.

When equipment or appliances are turned on in your home or workplace, both magnetic and electrical fields are present (current is flowing, creating the electromagnetic field [EMF]) and the magnetic field can be detected. When the switch is turned off no current is flowing through the circuit and equipment to create the magnetic field.

The two detectors on the Buzzstick detect not only the regular 60 Hz (Hertz -- cycles/second) power frequencies operating at 110 and 220 volts, but also other low frequencies from 0.1 Hz up to 300 Hz. You will find that the buzzing sound will change with different frequencies or combinations of frequencies.

**Recommendations:** Proper grounding, shielding, balancing, phasing, or rewiring, to lower or eliminate the field intensity, will require services of a *trusted* professional electrician who can accept that persons may be hypersensitive to EMFs (*contact IBE, page 109 for recommendations and references in your area*). More expensive equipment and professional expertise are required to determine the on-site variations in intensities, frequencies, waveforms and what kind of long-term periodic spikes or transients are in your power circuits (which may have more potential long-term biological effects on one's health than exposure to a strong field intensity). However, location of strong fields, especially in the bedroom near your head, can be determined and prudently avoided, to reduce any potentially harmful exposures. For example, one can move the bed a foot or two from the wall circuit with a bookcase headboard; the electric clock radio and phone answering machine can be placed 3-4 feet away. The use of halogen, fluorescent, or high intensity reading lamps near the bed is to be avoided. Because strong fields can be induced into metal from nearby electrical wiring, the optimum bed frame and mattress would contain no metal, therefore one might consider a wooden bed frame and/or a futon (cotton) mattress, if one's sensitivity to EMFs is high enough. For the same reason, thick lamps completely of wood, ceramic or glass are best, *with no external metal*, excepting the metal tube encasing the wire-to-the-bulb socket.

#### How to Construct Your Own Buzzstick:

**Items Required: (Note: If Design #1 RS 43-231B out of stock, go to Design #2)**

1. **Design #1:** *Radio Shack Telephone Listener\**, Catalog No. 43-231B, with cost of \$11 -- this 3" wide x 1 1/2" thick x 4" length white plastic amplifier and speaker is equipped with a 3' 6" cable. The cable leads to a cylindrical **magnetic field detector** coil that attaches by rubber suction cup to the end of the telephone handset. The detector coil picks up the callers' voice and amplifies it so it can be heard by others in the room or it can be tape recorded. The detector is sensitive to a very wide bandwidth of magnetic fields besides the normal 60 Hz.

**Design #2:** *Radio Shack Telephone Amplifier*<sup>®</sup>, Catalog No. 43-229, with cost of \$11, also. This 2.5"x2.5"x0.5" thick gray and white box contains the amplifier, speaker and magnetic sensor coil all in one unit and is more compact, but less sensitive.

2. The *A. W. Sperry Electrical Wiring Detector*, for finding electrical fields, can be purchased at your local superstore for home builders (Home Depot, for example) for about \$18-20. The gray plastic unit is 1 1/2" wide x 1/2" thick x 7" length with a tiny speaker, a green "power on" light and a red light that glows when an electrical field is detected by the sensor in the tapered end. Speaker is of poor quality and not very loud.

3. **Design #1:** A round three foot length of hollow, thin-wall PVC pipe (or equivalent non-metal material) of 1.0" diameter will be required for attachment of the two detector units. A 90° PVC elbow for a 1.0" diameter pipe will be required to house the magnetic coil on the detector end. Two PVC caps can be used, one to cover the elbow after the coil is inserted and the other cap on the handle end

**Design #2:** A round three foot length of hollow, thin-wall PVC pipe (or equivalent non-metal material) of 1.0" diameter will be required for attachment of the two detector units. A 90° PVC elbow for a 1.0" diameter pipe will be required at the end to provide an extension tube as a holder for the magnetic field sensor to one side. This produces an "L" shaped end on the handle where the sensors are mounted

4. **Designs #1 & #2:** (Optional) If you have some electrical expertise, you can create a "deluxe" buzzstick by installing a *double-pole, double-throw switch* in the handle cap to provide a quick change back and forth from electrical to magnetic field detection. The Sperry Unit speaker can be bypassed into the Radio Shack Unit amplifier and speaker, through the switch (cutting off the magnetic coil sensor when the Sperry is activated). This provides a much louder sonic response to electrical fields through the volume switch on the magnetic detector.

### **Putting It Together:**

**Design #1:** Glue the 90° elbow to the end of your 3' long pipe. Drill a 1/4" diameter hole 14" from the handle end of your pipe. Thread the 3' 6" wire and its miniplug into the elbow and down the pipe interior and out the drilled hole. The cylindrical magnetic sensor (telephone pickup) with its rubber cup will then fit snugly into the open end of the elbow, at 90° to the pipe. Put the cap over the open end of the elbow, thus sealing the magnetic sensor inside.

With screws, clamps, and/or tape, attach the Sperry Unit so that the tapered end with the built-in sensor is at the very end of the pipe (on top of the elbow) for closest approach to powered equipment or wires. Do not obstruct the unit speaker or on/off-volume switch on the side, and provide easy access to replace batteries as needed.

Attach the amplifier/speaker box of your Radio Shack Telephone Listener at the handle end of your pipe with two short flat-head metal-tapping screws with 1/4" diameter heads. Note that the plastic amplifier/box has two 1/4" diameter slotted holes spaced 3" apart in the back. Install the first screw 9" from the handle end and the second screw 12" from the handle end. Leave about 1/16" of each screw head above the pipe surface so you can place the back of the plastic box over the screw heads and slide them down the slots in the box for a snug fit of the box against the pipe. Insert the miniplug from the magnetic sensor (installed in the pipe elbow end) into the amplifier/speaker box, put the pipe cap on the handle end, and you are ready to use your buzzstick. The special switch installation can be made in the cap of the handle end, if desired

**Design #2:** Glue the 90° elbow connector to the "sensing" end of your 1.0" diameter, 3' pipe, then insert a short pipe extensions (about 2") into a 90° angle connector at the ends, then figure out some sort of fork arrangement to insert into the tube end and rigidly hold the magnetic field sensor by the sides where the elastic strap attaches. The magnetic detector coil is on the bottom of the sensor, opposite the speaker. Bottom, top and on-off/volume control

switch of the sensor must be clear. A good holder from a 0.25-0.50" thick sheet of plastic could be slotted and glued into the pipe extension. Provide easy access/removal of the detector to replace batteries, as needed

With screws, clamps, and/or tape, attach the Sperry Unit so that the tapered end with the built-in sensor is at the very end of the 3" handle. Do not obstruct the unit speaker or on/off-volume switch on the side, and provide easy access/removal to replace batteries as needed.

### Operation of the Buzzstick:

(a) A. W. Sperry Unit for a.c. electric fields -- Turn on rotary on/off - volume switch (green light comes on) and rotate to full volume. The tiny built-in speaker will buzz when the detection end is placed near an a.c. source wire or other electrical field. This shows that an electrical field is present, whether the equipment is turned on or not, thus supporting the reason for shutting off the circuit breakers to the bedroom at night or pulling the plugs on electrical devices in the bedroom if you feel you are electrically sensitive (ES), or just wish to avoid artificial EMFs.

(b) *Radio Shack Telephone Listener\**, Catalog No. 43-231B for a.c. magnetic fields -- Initially, adjust the rotary volume control switch to '0', then turn on the unit by pressing down the rectangular switch. Assuming you are standing away from any strong EMFs (powerlines, wires, or equipment), gradually, rotate volume switch clockwise, until you hear a gentle hissing sound. (**Note:** This unit is very sensitive and if you are close to a strong magnetic field and the volume is set high when the unit is turned on, permanently damage may result!). The closer you approach a source of a.c. magnetic fields (motors, transformers, dimmer switches, clocks, wrist watches, TV, computer monitor (CRT), the louder the buzzing, humming or clicking noises. The sound will change with different frequencies and devices. You may be interested in monitoring the strong magnetic fields around your analog watch (see pg. 92) or at the driver's area in your car when starting and running the engine

(c) *Radio Shack Telephone Amplifier®*, Catalog No. 43-229 for a.c. magnetic fields -- turn the on-off rotary volume control switch on and to full volume, then explore sources of magnetic fields, as described above. Adjust volume to suit. This unit is adequate, but less sensitive, than the other one.

**Note:** For best performance, check your batteries frequently to be sure they are fully charged.

**Surveying an Area:** The most important places to examine for strong EMFs are the areas where you spend most of your time, such as your bedroom (#1), your kitchen/dining area, and your working area. Next, check your children's rooms (especially any monitoring systems), around couches and chairs (and associated lamps), bathrooms, and entire building, inside and out. Wave your buzzstick in a back and forth scanning motion close to walls, floors & ceilings, because magnetic fields from transformers, wires, equipment, etc. can penetrate almost anything; however, electric fields can be easily shielded with a grounded metal screen or foil. Remember, putting distance between yourself and strong fields, magnetic or electric, is generally your easiest and best bet.

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***We shall require a substantially new manner of thinking  
if mankind is to survive!***

***.....Albert Einstein***

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## On Treating Symptoms and Not The Causes

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### THE FENCE AND THE AMBULANCE

'T WAS A DANGEROUS CLIFF, AS THEY FREELY CONFESSED,  
THOUGH TO WALK NEAR THE CREST WAS MOST PLEASANT:  
FOR OVER ITS TERRIBLE EDGE HAD SLIPPED  
A DUKE AND MANY A PEASANT.  
SO THE PEOPLE SAID SOMETHING WOULD HAVE TO BE DONE,  
THOUGH THEIR PROJECTS DID NOT AT ALL TALLY;  
SAID SOME, "PUT A FENCE AROUND THE EDGE OF THE CLIFF";  
SOME, "AN AMBULANCE DOWN IN THE VALLEY."

AND THE CRY OF THE AMBULANCE CARRIED THE DAY,  
FOR IT SPREAD THRU THE NEIGHBORING CITY;  
THE CLIFF IS ALL RIGHT IF YOU'RE CAREFUL, THEY SAID;  
BUT EACH HEART WAS BRIMFUL OF PITY  
FOR THOSE WHO HAD SLIPPED O'ER THE TERRIBLE CLIFF;  
AND THE PEASANTS IN HIGHWAY AND ALLEY,  
GAVE POUND AND GAVE PENCE, NOT TO PUT UP THE FENCE,  
BUT THE AMBULANCE DOWN IN THE VALLEY.

"FOR THE CLIFF IS ALL RIGHT IF YOU'RE CAREFUL," THEY SAID,  
"AND IF FOLKS EVER SLIP, OR ARE DROPPING,  
IT ISN'T THE SLIPPING THAT HURTS THEM SO MUCH  
AS THE SHOCK DOWN BELOW WHEN THEY'RE STOPPING."  
THEN AN OLD SAGE REMARKED: "IT'S A MARVEL TO ME,  
THAT FOLKS GIVE FAR MORE ATTENTION  
TO REPAIRING RESULTS, THAN TO STOPPING THE CAUSE;  
THEY'D FAR, FAR BETTER AIM AT PREVENTION."

"OH, HE'S A FANATIC,!" THE OTHERS REJOINED,  
"DISPENSE WITH THE AMBULANCE NEVER!  
HE'D DISPENSE WITH ALL CHARITIES, TOO, IF HE COULD;  
BUT, NO, WE'LL PROTECT FOREVER.  
AREN'T WE PICKING FOLKS UP, JUST AS FAST AS THEY FALL;  
AND SHALL THIS MAN DICTATE TO US; SHALL HE?  
WHY SHOULD PEOPLE OF SENSE STOP TO PUT UP A FENCE,  
WHEN THEIR AMBULANCE WORKS IN THE VALLEY?"

..... Anonymous.

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### "FENCES": THE SEQUEL

"WHAT?! PUT UP A 'FENCE'? YOU REALLY ARE DENSE!!  
IMAGINE THE JOBS YOU'D BE SNUFFING!  
THE AMBULANCE DRIVERS AND THE MEDICINE MEN,  
WHO'LL CAREFULLY REPLACE YOUR STUFFING!

THE FEDERAL BUDGET WILL ONLY BEGRUDGE IT.  
THE ECONOMY'S IN SUCH A TIZZY!  
WHATEVER WOULD HOSPITALS DO ALL THE DAY,  
IF THE PATIENTS THEY'RE HEALING WERE TAKEN AWAY.  
THE THOUGHT OF IT MAKES ME QUITE DIZZY."

"WELL, IF 'FENCES' YOU SCOFF, WHERE DO YOU GET OFF  
IN FORCING YOUR VIEWS UPON OTHERS?  
HOW MANY MUST DIE BEFORE YOU JUST TRY  
THE PREVENTATIVE ROUTE, MY DEAR BROTHERS?"

"THE 'FENCE' WILL IMPAIR THE VIEW FROM UP THERE,"  
SAY VALLEY FOLKS IN THE MAJORITY.  
"ITS NOT THAT THE 'FENCE' WILL SPURN CLIMBING INTENTS,  
IT'S THEIR LACK OF RESPECT FOR AUTHORITY."

THIS EXAMPLE I SAY IS UNIQUE IN NO WAY  
TO THE BUSINESS AND PUBLIC MENTALITY.  
WE'VE ALL HAD TO TRAIN TO NOT USE OUR BRAIN  
AND REJECT ANY CHANGE AUTOMATICALLY

IT IS A GOOD THING: TO THE PUBLIC WE BRING  
A TEMPORAL MEANS OF SALVATION.  
FOR IF LOWER LIMITS AREN'T SET THE EXPOSURE WE GET  
WILL BRING US HOSPITALIZATION.

LETTING HUMANS PATROL THEIR OWN SELF-CONTROL  
IS A WISDOM THAT NOW IS PROMOTED,  
BUT AS RESEARCH EXPANDS AND THE PUBLIC DEMANDS,  
LOWER LIMITS WILL BE WISELY DENOTED

WHAT I'M TRYING TO SAY IN A ROUND ABOUT WAY  
IS THAT LIMITS ARE GOOD -- NO DENYING,  
BUT WHEN LOWER LIMITS ARE NEEDED AND CANNOT BE HEDED.  
TO THE AMBULANCE WE'LL SOON BE FLYING

WITH INTERNET SPEED AND A WILL TO PROCEED,  
IN WAYS LEGAL AND HUMANE PROGRESSIVE  
OUR HEALTH WE'LL PROTECT, AFTER ALL IT'S OUR NECK,  
-- FOR EXPOSURE IS NOW TOO EXCESSIVE.!

.....Daniel J. Beal & James B. Beal, 2/97

"Fences', the Sequel" was the collaborative effort of James B. Beal and his son Daniel, completed on 2/20/97. It is a rejoinder to the anonymous work: "The Fence and the Ambulance," and should always be published as such.

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## Human Sensitivities To Electrical & Electromagnetic Fields: Details and Research About Health Perils & Promises

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James B. Beal

*The critics have labeled prudent avoidance a dangerous and dumb idea. However, others would argue that it represents a common-sense strategy for dealing with some difficult social and scientific dilemmas.*

*.....M. Granger Morgan, (Public Utilities Fortnightly,*

*3/15/92)*

### Brief Summaries Of Possible Interacting Mechanisms

**Introduction:** It is concluded that many mechanisms, known and unknown, must interact in life processes to support the ultra-sensitive electrical and electromagnetic field (EF and EMF) detection and broadcast capabilities of all living creatures. When some of the mechanisms that maintain body balance (homeostasis) are overloaded by long-term EF and EMF exposures, it seems that various health problems occur with a multitude of symptoms that often defy conventional solutions.

With the present and growing state of new knowledge in this complex area, there is much confusion and controversy generated by industry, government, research approaches and the communication media, all of whom, understandably, have large investments in facilities and equipment which generate, transmit, and utilize electric and electromagnetic power. For those of you who are concerned about your long-term health, this document presents information, which may be useful in determination, of what changes may be necessary in your life style and how to practice reduction and/or 'prudent avoidance' of known EF and EMF sources.

This is a basic document that tries to summarize how life processes may have originated in the EF and EMF environments of prehistoric and pre-life earth. Some discussion is presented about the extraordinary EF & EMF receiving and broadcast capabilities of many creatures in all the different categories from microorganisms to mammals. This information provides perspective to support and clarify why humans also have sensitivities to EF and EMF that can be used to heal (electrotherapies) or harm (uncontrolled long term exposure).

Please note that there is still very little human perspective/awareness anywhere about our LONG-TERM relationship with the earth and all other living things. We are a product of our natural earth environment and respond to some subtle degree (and sometimes not so subtle!) to the same geoelectromagnetic and atmospheric factors which affect all other living things. We can, and are, affecting the balance of Nature, which in the long-term will affect us....it's called feedback!

Brief summaries are provided here regarding the more obvious mechanisms, the detection and transmission capabilities of living systems and the reported health effects and ailments which occur. Those who wish more details can review the references provided herein, or contact the author.

**Background: Liquid Crystals (LCs)** are basic to life processes and sensory mechanisms. With some of the orderliness of crystalline solids and some of the freedom enjoyed by molecules in a liquid, liquid crystals are important for biology (they form the membranes around the cells in our bodies), and probably play a large part in our memory and all our known sensory receptions of light, sound, temperature, pressure (touch), odors and taste. Artificial and refined LCs have become everyday items in our lives because of their advantages in flat-plate LC television and computer displays (EF and EMF sensitivity), detection of temperature, pressure and chemical

changes, and, recently, high-density molecular data memory storage devices (3 billion bits per square inch) [1]. The lipid molecules of biological membranes exist in an LC state and provide a matrix for membrane proteins to perform their function. Not only lipids, but other major classes of compounds (proteins, carbohydrates and nucleic acids) exist in LC phases under well-defined conditions. Therefore, it is very important to know the properties of LC materials in order to better understand EF and EMF-related biological processes [2, 3].

**The paired planetary resonator and wave interaction hypotheses [4-7]** may be key determinants of biological structure (EMF fields intensities and changes acting as an 'information field') These seem to offer detailed and useful explanations about origination of liquid crystal and electric and electromagnetic field relationships. These are the two unique complementary hypotheses proposing the evolution of an ultra-sensitive protein (LC) transmitting and receiving biological communications mechanism reacting to static (direct current) and time-varying (alternating current) fields. The intense electrical and magnetic fields of Precambrian earth may have supplied the intense energies required as environmental factors and the catalytic sources for the beginning and evolution of living systems [8, 9].

**The integrated mechanisms model [10]** could explain many of the variable research results. Weak EMFs that produced localized changes in charge density could alter the conditions required for liquid crystal conditions, and consequently produce small changes within the viable limits of the system. Changes in phospholipid membrane properties or variations of specific cations, e.g., Na<sup>+</sup> (sodium), K<sup>+</sup> (potassium), Ca<sup>++</sup> (calcium), known to be controlled by membrane properties have been frequently reported in ELF research. Rhythmicities in heart cells are intrinsically related to lipid levels. Lipid solvents, which change membrane selectivities to the ionic milieu, are important anesthetics and toxicants. The membrane selectivity may be what is affected by the electroanesthetic/electrosleep process [11]. The reported intense attraction of peripheral nerves to magnetic fields also seems dependent upon lipid structure.

**Biogenic magnetite [12-15]**, molecular magnets found in all living creatures, seems to play a most important part. Analysis suggests that individual crystals of magnetite could contribute enough mechanical energy to activate trans-membrane ion channels.

LC properties in living systems may provide the basic support for several of the background mechanisms proposed to explain the biosystem effects of natural and artificial EMFs. In this case the LCs in their various biosystem forms may react to amplify unusual internal or external energy inputs, transmitting their sensing reactions to stimulate other systems, e.g., immune system response, melatonin production, various symptoms, etc.. Biogenic magnetite is found primarily in the brain and highly enervated ethmoid sinus area in humans. It is also found in specific brain areas of insects, fish, birds and mammals, and more concentrated in the brains of migratory creatures which must get their cues from geomagnetic variations and patterns [16-20].

Since biogenic magnetite seems to be everywhere in the environment, internally and externally, it may have played a basic role in the initial development of living systems and various sensing mechanisms. There is much evidence that biological forms follow the energy patterns laid down by the waveforms of the environment. Electromagnetic vibration can rearrange molecules and macro-molecules into patterned forms (sound, RF, microwave, heat, light, etc.) Lissajou or Chladni figures produced in liquid and solids, appear as structural biological patterns in simple organisms (diatoms, for example) [6].

**Induced electric currents (eddy currents) mechanism: [21]** During the past decade, a number of reports indicated that the mammalian pineal gland is magnetosensitive in terms of spatial orientation. This indication is based on observations that artificial alterations of the direction of the earth's magnetic field (MF) markedly decreased the gland's capability to synthesize melatonin. It was shown that magnetic field exposure itself did not affect the pineal. Rather, induced eddy currents in the animals, resulting from rapid On/Off switching transients

of the artificially applied MF, affect the pineal gland either directly, or, more likely, indirectly, via an action on the neural input. The eddy current mechanism is most likely the explanation.

Every rapid change of a MF produces an electric field. Depending on the tissue exposed to such a field, an appropriate eddy current occurs, depending on the tissue's conductivity. Hence, if an animal is exposed to a rapidly changing MF, an induced eddy current occurs that may affect the nervous system. This conclusion is supported by the observation that a nerve's synaptic transmission is affected by exposure to electric fields.

The above mechanism may interact with biogenic magnetite and other metal ions in biosensor tissues and fluids, perhaps combining with other mechanisms mentioned herein, thus stimulating various liquid crystal and cellular responses to the information perceived.

**Non-Linear Mechanisms** [22] research indicates that low-intensity, nonlinear, extremely low frequencies (ELF) and low intensity ELF pulse-modulated fields influence various physiological and behavioral processes in cells, tissue, animals, and humans [23-35]. Major shifts in calcium efflux occur with fields that produce very small gradients in the extracellular space (interstitial fluids) surrounding cell membranes [36]. The extracellular fields are far below transmembrane gradients associated with a typical synaptic depolarization. This implies that cells can act as sensitive detectors of ELF signals. This apparent capability has led to specific alteration of cell function, including hormone and insulin decrease, accelerated wound healing and bone growth, interference with nerve conduction, entrainment of cell transcription processes, and alteration of brain chemistry.

The effects range from alteration of the firing rates of neurons in the brain, calcium-ion binding disruption on cell surfaces in the brain, to response time...[and] respiration rate changes, and even putting an animal to sleep...[and] spectral components in the kHz range appear to cause effects selectively in bone tissue.

Behavioral modification in animals [10] as the result of weak (as low as 10 microwatts/cm<sup>2</sup>) microwaves include induction of grooming responses, altered heart and respiration rates, epileptiform seizures, and various others. The lower the power, the more immediate the effect [23, 24], provided an effect was present (Is there a homeopathy tie-in here?). Also noted is an adaptivity to the signals. The greatest response occurs on first exposure; repeated exposures yield a decreasing effect. It was reported at the May 1993 meeting of the American Geophysical Union (discussed in Science 260:1590) that three epilepsy patients demonstrated bursts of epileptic brain activity a few seconds after being exposed to a moderate EMF a bit weaker than that of a household appliance. Note: references 23, 24 and 67 are also relevant here.

We have demonstrated that Mast cells in the brain can be degranulated in rats, dumping stores of histamine, heparin, and other substances into the brain [10, 37].

It has been repeatedly demonstrated that cells can sense the EMF environment and respond to three orders of magnitude lower than self-generated fields. The dielectric behavior [6, 9, 38] of biosystems in conjunction with nonlinear excitation can give rise to solitary, nondispersive 'soliton' waves [22,39,40]. More than 90% of living matter consists of polar molecules of proteins, nucleic acids, lipids, carbohydrates, and water. Depending on microscopic properties, the energy supply may either make a system hot or result in a new type of order.

These observations [22, 36, 41-43, 69] indicate that investigation of nonlinear molecular information transfer processes may provide a fundamental quantum mechanical model of the life process itself as well as the fantastic data storage/retrieval and holographic nature of mind [69] and memory [1]!

**Combined self-organized macroscopic and microscopic mechanisms** [44] present a unique combination of mechanisms to deal with both the energetic and the informational aspects

occurring during biological EMF coupling. The simulation results demonstrated EMF response patterns showing dependencies on:

- a. The field frequency, in a nonlinear, resonance-like fashion ('frequency windows'.)
- b. The field amplitude, in a nonlinear, resonance-like fashion ('amplitude windows'.)
- c. The combination of appropriate static (DC) and time-varying (AC) fields.
- d. The internal biodynamical state of the field-exposed system.
- e. The system's capacity for high-gain amplifications of initially small microphysical field effects.
- f. The system's capacity to stabilize and maintain field effects in the presence of relatively large incoherent (noise) perturbations.

The model predicted that amplitude and frequency-dependent resonances and the other complex dynamical behaviors may result from primary field interactions in combination with self-organized biochemical states.

It was suggested that neither thermodynamic/energetic concepts nor bioinformational concepts alone would lead to realistic models of EMF biological interactions; only approaches capable of integrating energetic and informational mechanisms.

One can see from the above brief summaries that the various interacting biological mechanisms, known and unknown, at different levels, can be affected by a large number of factors relating to time, environment, health, stress, and diet.

### **Biosystem Effects Associated With EMFs**

Geoelectromagnetic signal information may play a survival role in: [45-47] navigation, migration/location/orientation, and biological rhythms. There is also anticipation and detection of subtle or catastrophic changes in seasonal variations, weather, hurricane/tornado, and earthquakes.

How much of this information do we humans use or react to unconsciously in our daily life and how much is trainable latent talent? Consider the excellent sensitivities of the Australian aborigines and martial arts masters. As understanding increases about our long-term health dependence on natural and artificial EMF factors, our environmental awareness will be increased (on several levels!).

Trends indicate, in insect, fish, bird, primates and human research that continual long-term exposure to EMF pulse rates, intensities and waveforms in specific ranges, may produce behavioral, physiological, and psychological reactions in the living systems exposed [25, 45, 46, 48-57].

EMF signal information between biosystems [45, 47] includes detection/avoidance of predators, self-protection, communication, detection/attraction of food and mates and establishing territory.

Discussion. Research to date, primarily on aquatic lower vertebrates, clearly indicates that these animals can sense very weak electric fields. So far, this ability has been found in many marine and freshwater fish, several amphibian species; and the platypus. Sharks and rays are most sensitive to frequencies below 50 Hz and stimuli to 1 microvolt per centimeter. Many electric fish emit signal pulses of a broad range of frequencies or in continuous waves of constant frequency depending on species. The discharge of an electric eel can be in excess of

600 volts. Studies of "specialists" such as electric fish will continue to provide insight fundamental to understanding the more complex nervous systems of higher animals, and finally, humans.

### **Human Reactions To EMFs**

It has long been established (30+ years) that controlled specific pulse-type (sharp rise time or square-wave) waveforms and various frequencies can be used for:

- a. Electrotherapies [25-27, 58, 59] -- allergy suppression, pain suppression, bone healing and addiction treatment.
- b. Electrosleep/electroanesthesia [11] -- insomnia & ulcer treatment and surgical interventions.
- c. Prosthetics [40, 60, 61] -- noninvasive, wearable, heart pacemakers and artificial, noncontact visual and audio brain inputs (without light or sound).

**Discussion.** Known EMF factors used in medical applications on humans utilize the whole spectrum of EMF energies and pulses from direct current, to ionizing radiation, involving various combinations of frequency, waveforms, intensity, rise/fall time, temporal gradients, pulse rates, polarization, etc. These are already providing invaluable inputs for medical and psychological diagnoses and applications.

Unknown time-varying EMF power frequency factors, primarily from exposure at work or in the home, not specifically powerlines, may involve all of the above, especially additional long-term spikes and transients which may occur in the electrical system, plumbing and appliances of the bedroom sleeping area or in all-day limited-movement working areas.

The applications and research mentioned above are considered the body-penetrating effects of magnetic field pulsing components, principally conducted in other countries.

In this country the electric field is not considered a health factor, because it does not penetrate the body. However, the whole-body acupuncture system, in all living things, is associated with healing. It is more primitive (analog) than the nerve system (digital) [55], and has discrete electrical components that change slowly with time. It appears to be affected by mind, body and environmental changes, and thus may respond to electric field changes (natural and artificial). Perhaps the acupuncture total body surface system acts as a sort of 'transceiver', transmitting and receiving subliminal information on many different levels about EMF variations (external and internal). These 'information' variations may, through liquid crystal detection/amplification, stimulate (or indicate) body, mind and healing reactions, to maintain body health balance (homeostasis).

### **Electromagnetic Hypersensitivity Syndrome (EHS) [70]**

The role of mast cells in immunological reactions in animals [10, 22] and humans is known, but the mechanisms are not readily apparent. However, one of the most frequent experimental EMF results is involved with immunological responses. Histamine-related diseases such as arthritis, allergies, asthma, smooth muscle spasms, emboli, angina pectoris or edema are the most frequent diseases which are supposedly influenced by electric and magnetic field shielding [62] in those persons with EHS.

It appears that long-term EMF exposure may act as a promoter, an immune system irritant (in addition to any chemical sensitivities present), thus overloading the body's defense mechanisms. Environmentally ill (EI) persons with compromised immune systems often find

that EMF transients are one more irritating factor to avoid. The manifesting symptoms may then vary over a wide range, depending upon individual immune system factors, health history, home/work stress situations, and environment -- not just cancer or Alzheimer's increases, but increases in a host of dis-eases often considered 'minor', e.g., allergies, headaches, fatigue, insomnia, etc.

If the above are valid, and an EHS subject profile is not clearly determined for specific group evaluations, then epidemiological studies may be diluted by the general population and confidence ratios will remain low [63]. It appears the general population is not yet seriously affected enough in a specific medical area, to make a case for widespread serious concern in the medical community (yet), because we do not know how many manifesting minor symptoms may be caused by long-term exposure (which may be precursors for major symptoms in years to come!).

News about symptoms, supposedly caused by EMF long-term exposures, have caused popular concern, controversy, confusion, and much initial condemnation without investigation. The public concern about environmental pollution effects has stimulated government, industry, and legal actions to investigate the biological effects of power frequency EMFs.

Research programs are finally beginning to investigate these anomalous raw signals (transient spikes & surges). We are becoming more aware in recent months of the sensitivity of various life forms to EMF via their sensory system reactions [47], immune system effects [49, 51-53, 64], allergy reactions [25, 54], behaviors, etc. Night time EMF effects have been discovered which reduce brain pineal melatonin hormone production, which in turn affects immune system efficiency, especially in ill and/or older people [51, 52].

Potential Initiating/Promoting Factors: [54] Individuals with multiple sensitivities, including EMFs, have reported reactions to various types of electrical equipment, including powerlines, transformers, electronic office equipment (such as typewriters and computer terminals), video display terminals (VDT's), household appliances (such as hair dryers), telephones, battery-powered analog watches, digital clocks, other digital electronic devices, and fluorescent lights.

Most common symptoms are skin symptoms [57] manifest as irregular reddening, pinkness or redness, rashes, blushing, prickly sensations, aches, tightness, itching and sensitivity to light.

Nervous and Behavior symptoms [23, 24, 65-68] include dizziness, prickly sensations (like sunburn), flu-like feelings, fatigue, weakness, headaches, breathing problems, perspiration, depression, irritability, heart palpitations, difficulties in concentration and forgetfulness, brain seizure induction. Porphyria appears to have a connection (ties in to chemical intolerance, which often accompanies EHS).

Most of those who are hypersensitive experience the problems in connection with work at computer terminals (sometimes laptops), but other sources can also be named: fluorescent lights or electrical wiring and machinery. Many sensitive people, with continued exposure, develop extremely serious problems and have to take extended sick leaves. In Sweden about 120 cases of occupational illness due to computer terminal work are reported annually: 30 to 40 of these cases concern hypersensitivity to electrical fields.

**Determining Extent and Nature of EHS:** [54] (also, see pages 39, 48, 97)

An individual's life record and medical history of chemical, electrical, and environmental aspects must be obtained for perspective and determination of applicable therapies.

In general, changes in environment (prudent avoidance of electrical and electromagnetic fields), toxin exposure reduction, a balanced diet, daily exercise, and reduction in personal stress factors are the most likely actions one can take to strengthen one's immune system.



**Author's Personal Experience With Strong Long-Term EMF Effects:** From 1982-86, at Martin Marietta Manned Space Systems in New Orleans, I jointly developed an electrostatic cooling process (and patent) to improve aluminum welds on the Space Shuttle External Fuel Tank. In the 1986 final statistical test panel work on the welding process, it was necessary for me to be next to the operating system several hours a day for about six months. A 25V/125A pulsed-arc welding system was used, mixed with the 35,000 volts and 250 microamperes of the cooling corona wind air jet impinging on the cooling weld bead at the weld torch. Twice during final tests unusual dizziness forced me to briefly leave the area. Shortly after project completion I started having acute attacks of hives (urticaria) any time I ate beef, mutton, or pork (protein intolerance). Within a few minutes my joints and sinuses would begin to swell, and intensely itching wheals would erupt, spreading all over my body. The allergist said my case was unusual. I avoid red meats, because the hypersensitivity remains. No problems with poultry and sea foods; health remains excellent, otherwise. So, you can understand, based on personal experience, that I feel that the human EHS is a health issue that requires further exploration for the benefit of the public and the medical profession.

### **Conclusions:**

1. Liquid Crystals may play a part in the life processes of all biosystems, interacting with natural and artificial EMFs in detection, info storage/retrieval, and stimulus/response. LCs seem to play a part in the near-quantum-energy sensory detection capabilities of biosystems and the electromagnetic hypersensitivity syndrome in humans. As understanding of LCs and their interactions with complementary mechanisms increases, many medical and psychophysiological benefits may be realized.
2. To determine extent and nature of human sensitivities to EMFs, it will be advantageous to study in more depth, those persons who exhibit the EHS symptoms.
3. Electromagnetic therapies may emerge as the medicine of the future.

### **Questions:**

1. Are LCs basic to the understanding of how biosystems sense light (vision), temperature (hot/cold), mechanical stress (touch), chemicals (smell/taste) and EMFs? Does biogenic-magnetite play a part here?
2. Biosystem brains and bodies collect and store, during a lifetime, phenomenal amounts of retrievable data and high-speed responses to survival threats. Are the properties of LCs involved in memory storage and retrieval?
3. Is there any LC connection with the genetic transmission of growth and instinctual survival information?
4. Since the range of EHS symptoms may be broad, and because of possible undiagnosed or misdiagnosed symptoms, how many persons may be marginally affected, in mental institutions, in hospitals, seriously incapacitated at home, or labeled as having "psychotic episodes"?

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***If something happens that is not consistent with our present knowledge, it is necessary for us to expand our awareness of the variable space of nature and provide a modeling concept that included both all that we know plus this new fact. That is what we must start projecting to the people who say: 'Look, I don't understand it; therefore it doesn't happen.' We have to get them to start thinking along the lines of, 'Nature is so much more than I thought, let's expand our thinking and include this.' Then they can feel comfortable because they don't have to throw away what they already know, because what they already know isn't wrong. It merely means that it's not complete.***

....Dr. Bill Tiller

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### **Enzyme that Destroys Toxins Linked to Gulf War Illnesses (Study Finds Those with Lower Levels More Susceptible)**

From *Dallas Morning News*, 16 June 1999 (Discovered 14 October 2001 in long lost files!)

An enzyme that destroys chemical toxins may provide an answer to a paradox of the Persian Gulf War: why some veterans exposed to certain chemicals became ill and others did not.

Veterans born with low levels of the enzyme, known as "type Q paraoxonase," or PON-Q were more likely to suffer brain damage from exposure to low levels of nerve agents and pesticides, according to a study published Wednesday.

"It's very low in the sick guys and normal in the guys who are well -- and its specific function is protecting from nerve gas," said Dr. Robert Haley, chief of epidemiology at the University of Texas Southwestern Medical Center at Dallas and one of the authors.

Researchers say that the findings published Wednesday in *Toxicology and Applied Pharmacology* **may have implications for nonveterans who have been exposed to pesticides and other organophosphates. Some individuals have a genetic predisposition of produce low amounts of the enzyme the study found.**

**ATTENTION RESEARCHERS, PLEASE NOTE:** Could this be a clue to a "susceptibility test" for potential and occurring chemical and electrical sensitivities?? See pages 48-65

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## Multi-Level Stresses, Women's Health, and Hemi-Sync®

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Many persons, primarily women, have become chronically miserable, easily fatigued, and painfully hypersensitive with a variety of manifesting symptoms, due to stresses brought about in part by toxic **long-term** environmental factors. These factors may involve undesirable exposures to chemical/particulate pollutants, electromagnetic/electric fields and other irritants which interfere with the normal body immune system, coping abilities, healing efforts and a healthy lifestyle. Exciting medical research has been initiated this year, regarding system metabolic functions. This research primarily involves previously undiagnosable thyroid-related symptoms in persons who are **thyroid-resistant rather than thyroid-deficient [1-2]**. For example, in addition to fibromyalgia (FMS) being a phenotypic expression of thyroid hormone resistance, so too appear to be chronic fatigue syndrome (CFIDS), gulf war syndrome (GWS), **electromagnetic field sensitivity (EMFS)**, multiple chemical sensitivity (MCS), premenstrual syndrome (PMS), and breast silicone implant rejection syndrome. *Persons afflicted with these seemingly-related dis-eases are especially affected by the many forms of stress we encounter every day, e.g., psychological, physiological, spiritual and environmental.*

Strong psychosomatic overtones are related to all of the above symptoms, especially if they occur in women. It is a sad commentary on our male-dominated allopathic western medical system that psychological causes are primarily blamed for the symptoms. Little is done to determine concurrent physiological or environmental factors. *However, until a dependable biomarker is available to measure physiological effects, from whatever causes, whether physical mental or environmental, it will be difficult to get the medical attention necessary to treat the above listed conditions. That is, unfortunately, the current primary medical mind-set.*

A biomarker, **Hyaluronic Acid [3]**, was discovered in 1997 and may become useful in further studies of related metabolic problems mentioned above. Of course, mental stress over time, from whatever cause, affects body functions and immune system efficiency, thus any kind of healing therapy, to be effective in avoiding relapse, must consider post-therapy interacting factors of mind, body, spirit and environment.

For example, let us begin to consider here the stress-reduction capabilities of Hemi-Sync® sound therapy for these previously untreatable dis-eases, combined with prudent avoidance of stress factors. This is where, **with a knowledgeable physician**, the use of Hemi-Sync to promote sleep, relieve pain, and reduce stress [4-7] is recommended as a supportive therapy to accompany specified drugs, and backed up with biomarker confirmation of patient health status.

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### More Specific EHS Details

As indicated earlier (pg 31) EHS is a syndrome where the subject has symptoms when he/she is in proximity of electrical equipment or wiring. The symptoms are commonly related to work with video display units or other office equipment. In severe cases, sensitivity to all types of electrical equipment, home appliances, and powerlines seems to be present, even when equipment is plugged in, but not operating (an electric field is still present in the wiring). EHS often appears in persons with severe multiple chemical sensitivities (MCS), which in turn is

sometimes present in fibromyalgia-afflicted subjects (primarily female). Onset of symptoms may range from immediate to several days in proximity of the EMF source.

Research, since 1965, supports the potential of serious health hazards of long-term exposure to electromagnetic and electric fields, **but what biomechanisms are affected?**. Due to funding availability, research has recently been concentrated primarily on cancer in children and adults, Alzheimer incidence in adults, and related EMF effects on suppression of melatonin hormone (an important hormone for immune system health support). Long-term EMF effects on the prevalence of other disease symptoms are being double-checked in subjects previously tested in high EMF environments. Since there are at least 5 or 6 known EMF metrics (aspects) to consider in long-term exposure, the exact metric (more likely a combination of metrics in a local environment, not a laboratory) has/have not been determined yet. At this time pulsed transients (sudden signal changes) and digital on/off switching spikes in intermittent power systems seem to have the most effect as stressors and effects on body hormone systems (melatonin). This is hypothesized from the type of impulses utilized in healing electrotherapies. This also correlates with the 'information' signals in nature (sudden spikes or repetitive non-uniform pulses in the earth's slowly changing normal geomagnetic and electrical field background). Animals, birds and fish utilize this information for survival, i.e. for detection of enemies, mates, food, location or environmental threats (storms, earthquakes, seasonal changes).

Strong psychosomatic overtones are related to EHS as well as with multiple chemical sensitivity (MCS). Until a dependable biomarker is available to determine physiological effects, it will be difficult to treat EHS, MCS or related dysfunctions, other than with stress-reduction and prudent avoidance techniques. Of course, mental stress, over time, affects body functions and immune system efficiency, thus **any kind of healing therapy, to be effective, must consider mind, body, and environment interacting factors during the healing process and afterward to prevent relapse.**

Claimed symptoms are roughly of two types: skin and central nervous system. Skin symptoms (mast cell increase) are blotches and redness (like sunburn or rosacea), sensations of heat and burning, tingling and aches. CNS symptoms are vertigo and fainting, reduced sensibility, tiredness and weakness, headache, spasms, and nausea. Symptoms reduce or go away entirely when subject is away from work and electrical devices on weekends or on vacation. Severe cases of EHS often must often leave the city and try to live in some remote location in the country, far from any powerlines or electrical systems. Those who do this soon enough, and who have the support and means to maintain such a secluded lifestyle for awhile, often recover their health. They are then able to return home, where, by prudent avoidance of long-term EMF exposure from any source near their bodies (especially in the bedroom), they are able to maintain their health and prevent relapse.

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### **Comments on Stress, New Therapies, Women's Health Issues, & Change**

*It is my opinion* that unusual, inexpensive and easily applied new medical discoveries cannot confront corporate organizations with huge vested medical interests and expect to get any results (other than negative feedback and controlled negative test results). It will require much energy, personal funds and venture capital to attract the attention of the intelligent technically interested concerned public, and maybe a few environmentalists. However, little or no attention will be received from politicians and the general public until they are directly affected. This seems to be the prevalent attitude -- cultivated by the media, large corporations, and the public -- e.g., "don't confuse me with facts, my mind is made up," "ignore it and it will go away," or "give me a pill (or therapy) that will make me well, so I can continue doing what made me sick in the first place!"



So, we have to play some games and do an end-run around the obstructing elements. Possibly, the way to do that is to prove beyond all doubt (??) that there is physical damage being done to us by long-time exposure to our technology -- toxic elements in our air, food, water, and environment. That's a tough issue, since a lot of bodies (and "bottom lines") have to fall fast and in specific ways to remove all doubt. Since that avenue does not appear feasible, let's take a look at some other information and potential approaches

Through the media (and its confusing messages), so far we've become somewhat aware of chemical pollution, but have been ignor-trotting around the evidence. ("Never underestimate the power of the human mind to resist the inroads of useful knowledge" -- especially when it affects the bottom line or life-style)

Humans have always been in a stressful environment...stress is a necessary part of life, growth and survival. It used to be only coping with the natural environment...now we have all kinds of **long-term additional artificial stresses** from strong and/or catalytic chemicals, electrical fields, sound, light, etc. These artificial environmental stresses cause additional psychological stresses, which in turn result in numerous physiological problems (psychoneuroimmunological effect), and even spiritual stresses. Interference with biological rhythms, from beliefs (real or imagined) and work situations, play an enormous part here in the long term.

Due to the negatively-stressed content of the Internet, TV, radio, newspapers, movies and magazines (and your friends sharing their aches, pains, and gripes), many persons are continually stuck in the "fight or flight" syndrome (some women seem to be especially vulnerable, particularly after childbirth stress). These negative stresses cause problems with low body temperature, weight gain, rapid fatigue, headaches, memory impairment, hypersensitivity to pain, and a host of 'miserias" which seem to have no medical backup verification biomarkers (**yet!**) to indicate a problem (or group of problems, all at the same time).

hat we need now is something that doesn't make any sense at all...since what has made sense is not working or working too slow!) .....IF these biomarkers and the planned studies work out, then a very large amount of attention (especially of women) would be attracted to these issues. The tremendous evidence of long-term technological/environmental stress affecting everyone's health would become plainer; **the attention-getting aspects of the effects on control of body weight alone would be staggering!**

What I'm trying to do is to attract funding sources and the attention of women to this issue which primarily affects them...and as a block they could raise enough hell to get something done! **Hell hath no fury like a woman (or women) scorned!** *The medical profession and corporate powers (mostly male) have done a great job of molding women's minds and bodies to their expectations!!*

**What professions are paid the least and are the most important to human nurturing, healing, creativity, learning, growth, social services and business?? These would be mothers, nurses, therapists, the various creative arts, teachers, councilors, social workers, and secretaries -- primarily female.**

Maybe I'm a dreamer and a "**hopeless optimist**" (is that an oxymoron?), but I've never been one for direct confrontation, unless you have an approach which can confuse and overwhelm from an unexpected direction. So, I'll continue on with support of this new medical research avenue and see what will happen.

I realize that there are some "Catch-22" situations here. As several of my e-mail contacts clearly pointed out last year, the development of an inexpensive therapy for these various ailments might result in the various corporations saying, "just take two Hemi-Sync tapes and/or your T3 medicine regularly to reduce your stress level, and shut up, or lose your job!"

However, finally admitting that the technology is causing illness would certainly bring about some sort of beneficial change (**and lots of lawsuits!**). Do you really think that the public would stand for such treatment -- especially the more affected and effective element -- **the women??**

Think about it.....(and pass it on, especially on the Internet!

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### **Hypothyroidism (Type II), The Stress Connection & Potential Therapies For EHS & Other Sensitivities**

Since June of 1997 it has been most exciting, gathering information on a potential new therapy which seems to offer, at last, to the chemical and electromagnetic field (EMF) hypersensitive individual, a substantial hope for recovery from a host of troublesome symptoms. (Fibromyalgia, Chronic Fatigue and other related dysfunctions seem to be involved also)

Many other persons in this world (primarily women) may also benefit, who suffer various related psychophysiological, life-threatening and non-life-threatening symptoms relating to hypersensitivity. These are symptoms that do not respond well to the modern medical approaches of tests, drugs and surgery. Tests do not show any clear-cut pathologies; the prognosis is normal; however, the patient knows that he or she has some sort of severe system disturbance. Some medications offer temporary relief and 'dulling' of symptoms, but the quality of life is severely compromised and side effects may occur, as the medications usually become stronger and stronger to get the same effect. Addictions and a long-term variety of medications and doctors may result, with no cure in sight.

**This new potential therapy, and its important implications relating to stress, seems to clarify a lot of 'miraculous cures' and 'spontaneous remissions'** which relate to drastic life style changes, practices of affirmations, visualizations, and meditation, certain exercises, diets and healing environments. *Of course the hereafter-mentioned system metabolic thyroid hormone T3 therapy probably wouldn't be required in the first place if we all knew how to handle stress in a positive way!!*

One way to determine if this potential therapy will benefit you is to examine your body temperature several times a day and average it. If it averages below 98°F over several days there is the possibility that you may have a hypothyroid metabolic imbalance. **Note** that low temperature is not always associated with thyroid problems and fibromyalgia. *Consult a knowledgeable physician for consideration of body temperature in conjunction with other symptoms*). The simple *long-term* treatment is with the readily available and inexpensive Thyroid hormone, T3 (Cytomel), which is the body *system* metabolic regulator at cell surface and interior (*not primarily in the thyroid gland*). The thyroid gland is highly sensitive to various types of mental, physical and chemical *stress* and inherited genetic tendencies to react to stress. Stresses produce a metabolic reaction -- the 'fight or flight' response, which becomes "locked in". (The body seems to become "thyroid hormone T3 resistant" at the cell level.) T3 is made by the principal thyroid gland hormone T4, which levels can be measured. For persons with testable T4 thyroid gland problems the use of medical artificial T4 will bring relief temporarily (because T3 is generated by the new T4 and sometimes included in the T4 medication, but affectivity tends to go down with continued use). Artificial thyroid hormone T3 (time release form) must be **carefully** administered in µg (microgram) steps, over many days, supervised by a knowledgeable physician, in a "ramp-up" treatment process far beyond the maximum normally permitted dose of 25-30 µg. Patients must reliably monitor and report their symptoms, pulse and body temperature several times each day. Dramatic relief of symptoms is usually obtained before the 250 µg super-dose (considered the 95% response level). Patients seem to vary enormously in the amount of initial T3 super-dose required to bring symptom

relief. This will bring low body temperature back up to normal for awhile until relapse. **Note:** this type of therapy not recommended for persons with a history of heart problems. A lot of major and minor physical problems, caused by the low body temperature and enzyme dysfunction, will then also disappear. A few days from first remission of symptoms, relapse can occur. A lower dose then is required until eventually the body will finally take over and **no more T3 medication is required.** Of course the **elimination or reduction of stressful factors, mental, physical and environmental, is a big help** to keep body temperature and pulse at normal values. Enzyme function slows down below 98°F, so bothersome multiple sensitivities may develop, depending on one's personal immune system, environmental situation, internal and external stress factors, diet, exercise, etc.

Only within the past four years has the discovery been made that this kind of therapy may reverse chemical and electrical sensitivity and clear up another area: fibromyalgia [1-2]. It may also be very effective against various types of fatigue, including chronic fatigue!

Women are afflicted with this form of hypothyroidism 4 to 1, compared to men, with childbirth being the principle stress affecting them, which *also may produces weight gain.* Most sensitive persons noted to date seem to be those who have had a lot of famine stresses in their genetic history, and survived. Irish, and Scandinavian fair-haired persons with light eye coloring -- blondes, redheads -- tend to be likely hypothyroidism, Type II, candidates (as witness the "screen dermatitis" problems with computer monitors) [8]. One of the most sensitive genetic combinations observed to date seems to be Irish/American Indian combinations!

I have a very personal interest now in hypothyroidism, Type II. Since finishing up an aerospace welding project in 1986, I have had protein intolerance. If I eat red meat (beef, pork or mutton) an outbreak of very uncomfortable itchy hives occurs within 4 hours. This appears to have been caused by long term (4+ hours per day, 5 days a week) pulsed EMF exposure, within 2 feet of a pulsed-arc welding system of approximately 25 volts and 150 amps. This exposure was additionally complicated by the manual adjustments needed on my patented and successful weld cooling system, which used 30,000 volts and 250 microamps!! Since obtaining info on this Type II Hypothyroidism, I've been monitoring my body occasionally and have averaged 97.7°F. So the evidence seems to point to a very minor case for me, due to excessive long-term pulsing EMF exposures of mixed frequencies and high intensities.

FLAME RETARDANTS IN COMPUTERS AS TOXIC AS PCBs - UNKNOWN THREAT  
From Lief Sodergren in Sweden <lief.sodergren@skandia.se>

May 26, 1996 -- *Svenska Dagbladet*, (conservative daily newspaper) reports that several types of flame retardants are as dangerous as the prohibited PCB and DDT. Flame retardants are used in everything from computers to textiles and they are increasingly being distributed in the environment. Like PCB, flame retardants are found in seals in Svalbard, in fish and fish-eating birds in the Baltic and now new analysis have found flame retardants in human blood. Scientists fear that reproduction will be affected. Up to 30 percent of the plastic casing in a computer or TV can consist of flame retardants. **A group of flame retardants, PBDE are almost identical in their chemical structure to PCB which BINDS TO THE THYROID GLAND** (*jb emphasis*) which regulates many functions such as behavior, hunger, if one feels cold or warm, explains professor Aake Bergman, professor of environmental chemistry at the Univ. of Stockholm.

We now have indications from the Netherlands that flame retardants bind in the same way as PCB does.

MERCURY FROM DENTAL AMALGAM.  
[from Christoph Reuss (creuss@hitline.ch)]: June 3, 1977

Mercury lowers body temperature in four ways:

- ✓ *Directly affects the thyroid gland's function -- hypothyroidism.*
- ✓ *Renders the existing thyroid hormone unavailable for the body's use, as it bonds to the thyroid hormone molecule receptor sites.*
- ✓ *Affects mitochondrial metabolic processes at cell level -- cell's "heater".*
- ✓ *Lowers blood oxygen levels, as it bonds to the receptor sites on the hemoglobin molecule.*

And of course it also affects "system function" and the immune system in general (T-cells etc.).

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### **Research Notes On "Thyroid Resistance" (Hypothyroidism, Type II) & Gulf War Syndrome**

***Background Note:** The study mentioned in Reference 1 is an example of several conducted by Dr. Lowe with Dr. Garrison and others. For more comprehensive information about the approach to the use of thyroid hormones in the treatment of Fibromyalgia and related dysfunctions, contact [1] Dr. Lowe, [www.drloewe.com](http://www.drloewe.com)*

John Lowe [1] created a compound anomaly. First, although he is arguably the world's foremost authority on thyroid hormone, he is a chiropractor, among other things, and chiropractors are not supposed to contribute landmark work to the allopathic world. In this, he follows a long tradition that nearly all great discoveries are made by workers who undertook a major shift in scope at a later point in their careers. This is expected that senescent paradigms like allopathic generate all manner of anomalous detritus that allopathics themselves are loathe to investigate; therefore, it is likely to be a non-allopath that picks up the ball and runs with it.

Second, the detritus he picked up and ran with in the first place was an anomaly of the allopathic paradigm generated by the discovery of assays for thyroid hormone, **thereby rendering all hypothyroid patients who were thyroid-resistant, rather than thyroid-deficient, undiagnosable.**

Third, in proving that he could select candidates for treatment with a near 100% success rate he was able to run double-blind studies (again, anomalous that a chiropractor would do such a thing) that **had absolutely overwhelming "p" values. (zero to six decimal places on only 12 crossovers)**

Fourth, it is predicted that we should be able to formulate multiple daughter hypotheses from the original work, and sure enough, we can say that in addition to fibromyalgia (FMS) being a phenotypic expression of thyroid hormone resistance, so too appear to be chronic fatigue syndrome (CFIDS), gulf war syndrome (GWS), **electromagnetic hypersensitivity (EHS)**, multiple chemical sensitivity (MCS), PMS, and breast silicone implant rejection syndrome.

**Note** that Dr. Garrison has carefully and successfully treated extreme EHS patients with cyclic megadoses of T3. *It is **absolutely essential** that any treatment be done under a knowledgeable physician's care.*

The new **hyaluronic acid biomarker** was discovered and confirmed in Israel in 1997 for FMS [3]. *HA serum levels were **10 times greater** in FMS patients compared to healthy controls.* How extensively the HA biomarker in serum levels can be used as a determining factor in successful treatment of the other six syndromes/sensitivities, mentioned herein, remains to be seen in new research studies.

The thyroid-resistant condition, called by Dr. Garrison "Hypothyroidism, Type II", has been investigated since the early 90's by Dr. Wilson. Information about Dr. Wilson's work and therapies with T3 may be obtained from the Wilson's Syndrome Foundation, P.O. Box 539, Summerfield, FL 34492, or phone 800-621-7006. An information package with audiotape can

be obtained for about \$60.00, containing "Wilson's Syndrome, Miracle of Feeling Well " (a book for the patient), a "Doctor's Manual for Wilson's Syndrome," an Information Magazine and a Single Doctor Referral service (by zip code).

Also try the Internet Server, AOL -- Health & Fitness category. Click on Illnesses & Treatment, then Allergies and Asthma, then the BHMN Message Boards under Allergies, Immune Disorders, then look under Wilson's Syndrome. (Oh yes, be aware there is another medical condition called **Wilson's Disease**. This is a genetic predisposition to store excess copper in the body. This is NOT the one you want.) The "Cold Body Page" is also a very informative and interesting website at <<http://www.mall-net.com/mcs/coldbody.html#Doctors>>.

**Typical Strict T3 Dosage Regimen:** Each day the patients temperature and pulse rate is checked first thing in the morning before they get out of bed, and then again **every two hours all day while they are awake**. These are recorded religiously on the forms provided.. If their pulse rate goes consistently faster for two days in a row, they cut back on the last size dose that did not cause a faster pulse. The dose is not increased again until the next appointment.

Improvement is not expected at all until the dose gets at least to 75 mcg. Half of all thyroid-resistant patients will be better by the dose of 150 mcg. The other half will have to go higher. Nearly all will find relief by the dose of 250 mcg.

Thyroid hormone is EXTREMELY powerful. **An excess of it is always dangerous.** This is why you **must** be under a physician's care, proceed slowly and check your pulses and temperatures so often.

Besides faster pulse rate, other signs of too much thyroid are:

- Too many bowel movements--more than 2 per day.
- Trembling of hands and fingers.
- Worsening of anxiety or nervousness.
- Increase in hair falling out.
- Worsening handwriting.
- Leakage from the bladder.

If these things start to happen in a patient, they must cut back to the last size dose that did not cause them, and call their physician. If these things are already happening before they start using Cytomel (T3), they should only report them if they are getting worse as the dose goes up.

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## **Potential Multi-Level Stress Management & Syndrome Relief With Hemi-Sync™ Sound Therapy Tapes**

It should be noted that there are scores of stress management methods and therapies available, from aerobics to meditation to yoga, and each particular method has its enthusiastic support from persons who have had miracle cures not possible with currently-known western medical practices. The major healing effect seems to be through practice, belief and intention. Researched over many years, The Monroe Institute Hemi-Sync (hemispheric synchronization) sound therapy has long had an excellent reputation of successful application in stress situations where dis-ease is a significant health factor (The Positive Immunity Program is a good example). Toxic long-term environmental types of stress, however, for some individuals, may pose additional serious, physiological problems requiring some form of physical energy support (environmental, chemical and/or electrical therapies).

Incorporating Hemi-Sync as a vital part of the medical treatment before, during and after the healing process, as a stress management approach, is highly recommended. The use of Hemi-Sync as a healing adjunct to physiological therapy will require a knowledgeable psychotherapist and physician working as colleagues in a healing process coordinated with the patient. A patient who has intention to become well (using their own personally-selected Hemi-Sync program) may substantially reduce or eliminate the T3 dose (and other medications) initially

required to bring the body back into a healthy state. It is also likely that the continued use or availability of Hemi-Sync methods would give the patient confidence and awareness in handling personal and environmental incipient stress conditions which could initiate a relapse. This is an obvious area for further research exploration in holistic healing.

The idea that a patient would take active responsibility for their own healing process and health maintenance is still considered radical in the current medical paradigm; however, the times are changing fast with the advent of successful complementary and inexpensive medical choices, considering the present health-care system problems. The Monroe Institute (TMI) is in a unique position with successful programs available which can enable a motivated individual to control or eliminate the stresses which may affect their personal wellness.

TMI has always been on the "creative edge" of frontier research and now may be headed for the benefits of respectability as a support organization offering medical therapies before, during and after a healing process associated with stress affected illnesses. TMI has specialized information and expertise, developed through four decades of continuing research and experimentation. TMI is far ahead in practical applications of the scientifically proven stress reduction effects of Hemi-Sync. The Monroe Institute visionary professionals also support in-depth personal self-discovery and transformation through programs, research, education and innovation.

#### Note:

The use of selected Monroe Institute Hemi-Sync sound therapy tapes, such as the Positive Immunity Program, and the various individual sleep tapes, may be considered for persons with sleeping problems, fibromyalgia, chronic fatigue and immune dysfunction syndromes (including chemical and electrical sensitivities),.

For further information, and references 4-7, please **contact The Monroe Institute**, 62 Roberts Mountain Rd., Faber, VA 22938-9749, Ph: 804-361-1252, fax 804-361-1237, email: [Monroelnst@aol.com](mailto:Monroelnst@aol.com) website: [www.monroeinstitute.org](http://www.monroeinstitute.org)

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**For more comprehensive information about [hypothyroidism](#), [thyroid hormone resistance](#), [Fibromyalgia](#) and related metabolic dysfunctions**, contact Dr. John C. Lowe, Director of Research, Center for Metabolic Health, Fibromyalgia Research Foundation, 1007 Pearl St., Suite 280, Boulder, CO 80302,, Ph: 303-413-9100 fax: 303-938-1265. Details on Website: <<http://www.drloewe.com>> E-mail: <[MetabolicHealth@aol.com](mailto:MetabolicHealth@aol.com)> For his new book on "*The Metabolic Treatment of Fibromyalgia*," contact the McDowell Publishing Company at: <<http://members.aol.com/mcdpubco/>>

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***"Today we know more. But what do we know about what we don't know?  
 Seventy years ago there was no quantum mechanics,  
 somewhat over eighty years ago there was no atomic nucleus, no electron.  
 At the end of the last century, Wien advised Planck to become a pianist,  
 rather than a physicist, because physics was a closed subject.  
 How many Plancks are there now who are playing the piano rather than doing physics?  
 And how much new physics is there to be discovered?"  
 We still don't know why most molecules act biologically as they do,  
 why andosterone makes you a man rather than a woman,  
 and why estrogen and progesterone produce 'mother love.'  
 We must try everything we can. There is still lots and lots to explore."***

.....Albert Szent-Gyorgyi, 1966

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***Let not wisdom scoff at strange notions or isolated facts. Let them be explored.  
 For the strange notion is a new vision and the isolated fact a new clay,  
 possible foundations of tomorrow's science.***

.....Edward F. Adolph (Fregly & Fregly 1982)

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***Today's mighty oak is just yesterday's nut that held its ground!***

.....Anonymous

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## Chronic Fatigue Syndrome --MCS & EHS Interaction Concerns

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### Are Chemicals, Low Frequency EMFs, Powerlines & Microwave Frequencies Co-Factors to Consider In Prolonged Exposures?

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Published in the September 98 issue of "The Journal of the Australasian College of Nutritional And Environmental Medicine, based in Melbourne Australia.

**ABSTRACT:** This paper outlines a brief description of the illness commonly known as Chronic Fatigue Syndrome (CFS) which is becoming increasingly common in modern westernised countries. While CFS has become somewhat of a 'catch-all' of medical symptoms, it is still commonly diagnosed by exclusion of other diseases rather than a specific, unique symptomology.

One feature of the disorders commonly termed CFS is a depressed immune system. This paper attempts to link the impaired immune function associated with CFS to possible chronic low level exposure to extremely low frequency (ELF) electromagnetic fields (EMFs). The evidence includes both in-vivo and in-vitro studies in both human and animal systems. In particular, the recent link between ELF EMFs, melatonin and the immune system are outlined.

The authors conclude that although the link between ELF EMFs and cellular dysfunction are far from proven, sufficient evidence exists to suggest a causal link. Lack of full scientific certainty should not be used as a reason for postponing prudent avoidance of ELF EMFs, particularly in cases where CFS has already been diagnosed.

**KEY WORDS:** Chronic Fatigue Syndrome; CFS; electromagnetic fields; EMF; 50 - 60 Hz; melatonin; prudent avoidance.

**Introduction:** With any illness characterised by chronic fatigue, such as CFS, Chronic Fatigue (CF) and Immune Dysfunction Syndrome (CFIDS), Chronic Epstein-Barr Virus (CEBV), Myalgic Encephalomyelitis (ME), and Multiple Chemical Sensitivity (MCS), the important outcome is a severely dysfunctional immune system.

Evidence that these conditions involve an immunological disorder is accumulating rapidly. Within the past few years various abnormalities have been found in the immune system of CFS patients, for example. These include alterations in the activity and cell surface structure of two important types of white blood cells: natural killer cells and T-lymphocytes. In some patients subtle changes have been found in the levels of neuroendocrine hormones in the brain. Evidence indicates that CFS is associated with, if not directly caused by, a persistent, low-level impairment of the immune system.

Irrespective of the 'trigger' of the condition, whether it be viral, an environmental factor, a genetic predisposition, stress, or a combination of these factors, any additional contributing



factors which may also detrimentally affect the immune system should be identified, investigated and eliminated (or reduced) as part of the treatment. In this regard a co-factor may be considered anything that may cause hormone disruption and biological changes at a cellular level, thus interfering with immune system function. This co-factor may not have initiated the condition, but exposure to it may further stress an already affected immune system. As long as such a situation exists, any treatment is unlikely to have any lasting effect.

Existing evidence indicates that exposure to environmental level 50 - 60 Hz EMFs may be an immune system stressor with the potential to cause hormone disruption and changes at a cellular level. Therefore, EMF exposure should be evaluated as a potential risk factor for people suffering from disorders with the common feature of unexplained chronic fatigue.

**Chronic Fatigue Syndrome (CFS):** CFS is a general label used to describe a debilitating illness, the cause of which is still unknown. CFS is also referred to as CFIDS (Chronic Fatigue and Immune Dysfunction Syndrome), CEBV (Chronic Epstein-Barr Virus), ME (Myalgic Encephalomyelitis), as well as several other designations. It is a complex illness which has been intensively studied for the past 40 years without firm conclusions as to its cause. Diagnosis is done largely by exclusion of other possible diseases.

Clinical CFS is characterised by incapacitating fatigue (experienced as exhaustion and extremely poor stamina) of at least 6 months duration, neurological problems and a constellation of symptoms that can resemble other disorders, including: mononucleosis, multiple sclerosis, fibromyalgia, AIDS-related complex (ARC), Lyme disease, post-polio syndrome and autoimmune diseases such as lupus. These symptoms tend to wax and wane but are often severely debilitating and may last for many months or years. All segments of the population (including children) are at risk, but women under the age of 45 seem to be the most susceptible. As with most diseases, CFS affects people differently. Not everybody reaches the severe end of the CFS spectrum (1).

There is a difference between CF and CFS. CF is a fairly widespread symptom in the community, whereas CFS is an unexplained debilitating fatigue of at least 6 months duration which severely reduces the level of activity. CFS is considerably less common. In addition to persistent and extreme fatigue, usually with an abrupt onset accompanied by an 'infectious-like' illness, other CFS symptoms that have been identified include the following: substantial impairment in short-term memory and concentration, depression, sore throat, tender lymph nodes, muscle pain, multi-joint pain without joint swelling or redness, unusual headaches, unrefreshing sleep, cognitive function problems (such as spatial disorientation and impairment of speech and/or reasoning), visual disturbances (blurring, sensitivity to light, eye pain), chills and night sweats, dizziness and balance problems, sensitivity to heat and cold, irregular heartbeat, abdominal pain, diarrhoea, irritable bowel, low temperature, numbness or a burning sensation in the face or extremities, dryness of the mouth and eyes (Sicca syndrome), hearing disorders, menstrual problems including PMS and endometriosis, hypersensitivity of the skin, chest pains, rashes, allergies and sensitivities to odours (including chemicals and medications), weight changes without changes in diet, hair loss, lightheadedness, fainting, muscle twitching and seizures (2).

Research suggests that CFS results from a dysfunction of the immune system, involving a disruption of fundamental Central Nervous System (CNS) mechanisms, such as the sleep-wake cycle and the hypothalamic-pituitary-adrenal axis (3). One study found that more than a quarter of CFS patients had abnormal brain scans, and subtle changes have been found in the levels of neuroendocrine hormones (4). Other research has found electrolyte disturbances which sometimes included permanent changes in cell membranes' ability to pass electrolytes, permanent biochemical changes in mitochondrial function and disturbances of insulin and T3-thyroid hormone functions (5).

In 1989, Hickie, Lloyd and Wakefield, at the Prince Henry Hospital in Sydney, published results which show a significant reduction in the absolute number of peripheral blood lymphocytes in the total T-cell population and in two T-cell subsets as well as a significant reduction in T-cell function. They also found reduced immunoglobulin (antibody) levels (6). In a later paper, further alterations in peripheral blood T lymphocytes and impaired natural killer cell cytotoxicity were reported (7).

Based on physical and laboratory findings, many scientists believe that viruses are associated with CFS and may be directly involved in causing the syndrome. Several viruses have been studied to determine what, if any, part they play. These include enteroviruses, herpes viruses (especially human herpes virus-6, or HHV-6) and newly discovered retroviruses (8).

Originally it was thought that the EBV, a herpes virus that causes mononucleosis, was the cause of this syndrome. However, researchers now believe that EBV activation (when it exists) is a result of or a complication of CFS rather than its cause (9). To date, no virus has been conclusively shown to be an essential element of CFS.

There is one school of thought that holds that CFS is essentially a psychological disorder. This is because several of the symptoms seen in CFS patients are also seen in psychiatric illnesses, notably depression and anxiety disorders. Estimates of 28%-50% have been claimed for the occurrence of depression in CFS sufferers, while 15%-25% is the comparable rate in the general community. Depression sometimes appears before the onset of CFS. This suggests that depression might be a cause and not a consequence of the syndrome, or that depression may be the first manifestation of the illness in some patients. Sleep disorders which usually accompany depression would also exacerbate CFS, possibly through the disruption of melatonin activity. The overlap in symptoms between CFS and depression unfortunately blurs the distinction between a possible psychological or physical cause. However, in view of evidence that depression itself sometimes has a physical cause and responds best to physical treatments, there is some evidence that in CFS sufferers, depression may be a result of an active viral infection or an immunological disorder (10). It is also possible that many CFS sufferers become depressed as a consequence of the limitations placed on them by their illness (11). Research efforts are directed toward identifying and isolating the fundamental agent(s) responsible for triggering immune system disruption in persons with CFS. There are on-going studies of immunological, neurological, endocrinological and metabolic abnormalities and risk factors such as genetic predisposition, age, sex, prior illness, other viruses, environmental factors and stress. It may eventually be found that CFS is multi-factorial in origin with no single factor identifiable as the cause.

One factor that may play a role in CFS is prolonged exposure to low level 50-60 Hz EMFs. We now turn our attention to examining the known biological effects of low level ELF EMFs, particularly those concerning impairment of the immune system.

**Powerline Frequency Magnetic Fields & the Immune System;** As an indicator of the possibility that exposure to low level 50 - 60 Hz EMFs may play a role in chronic fatigue / immune system dysfunction, we must look for evidence that human exposure to these fields may cause changes at a cellular level, such as hormone disruption and calcium ion efflux (12), which may have the potential to adversely impact on the immune system.

**NCRP Draft Report Guidelines (1995):** The biological effects of EMFs were examined in great detail by an expert committee of the US National Council on Radiation Protection and Measurements (NCRP), a congressionally chartered organisation which was contracted by the Environmental Protection Agency (EPA) in 1983 to conduct a review of the biological effects of ELF EMFs.

Work was discontinued in 1986 due to funding cuts at the EPA, but resumed in 1991. In early 1995 the draft of the 800-page NCRP report was leaked to the New York based publication Microwave News, which published the report's findings in August 1995. The final report was

supposed to be publicly available in early 1996, but has received such intense industry opposition to its findings that its final outcome remains uncertain.

The Committee's membership was described by chairman Dr. Ross Adey as "carefully selected to cover the great majority of societal interests on this scientific problem, including power industry engineers, epidemiologists, public health specialists as well as molecular and cellular biologists"(13). The draft report generally endorses a 2 mG (0.2uT) exposure limit, having immediate implications for new day care centres, schools and playgrounds, and for new transmission lines near existing housing.

A somewhat more flexible policy would be applied to new housing and offices. For existing facilities, the committee recommended a more gradual approach with stronger restrictions phased in over time if the evidence of a health risk continues to grow.

The NCRP Committee states that, "In key areas of bioelectromagnetic research, findings are sufficiently consistent and form a sufficiently coherent picture to suggest plausible connections between ELF EMF exposures and disruption of normal biological processes, in ways meriting detailed examination of potential implications in human health." (14)

From studies on humans, the committee cites evidence for a link between EMFs and: 1) childhood and adult cancer, including leukemia and brain cancer; 2) teratological effects and other reproductive anomalies; 3) neuroendocrine and autonomic responses which, separately or collectively, may have pathophysiological implications; 4) neurochemical, physiological, behavioural and chronobiological responses with implications for development of the nervous system.

From laboratory studies the committee notes that EMFs: 1) affect cell growth regulation in animal and tissue models in a manner consistent with tumour formation; 2) increase tumour incidence and decrease tumour latencies in animals; 3) alter gene transcriptional processes, the natural defence response of T-lymphocytes and other cellular processes related to the development and control of cancers; 4) affect neuroendocrine and psychosexual responses.

In relation to the effect of low level EMFs on the pineal hormone, melatonin, the Committee concluded that: There has been a strong focus on ELF field actions in the pineal gland, relating to effects on synthesis and secretion of the pineal hormone melatonin, and on a broad series of regulatory functions mediated by this hormone. Melatonin plays a key role in controlling the 24-hour daily biological rhythm. Disturbance of the normal diurnal melatonin rhythm is associated with altered oestrogen receptor formation in the breast, a line of experimental evidence now under study, or possible links between ELF field exposure and human breast cancer. Further, melatonin has general properties as a free radical scavenger, with the possibility of a preventative role in oxidative stress, recognized as a basic factor in a broad spectrum of human degenerative disorders, including coronary artery disease, Parkinson's and Alzheimer's diseases, and aging." (15)

According to the Committee, problematic sources of ELF EMFs include local electrical distribution systems as well as high-voltage power transmission systems. Particular appliances, including electric blankets and video display units also rate highly as problem sources along with "various occupational environments". The committee states that the evidence points to human health hazards in everyday exposures to EMFs, particularly magnetic fields exceeding 2 mG (0.2uT) and electric fields at intensities in the range 10-100V/m (volts per metre).

"There is an implication that a significant proportion of the world's population may be subjected to a low level of risk, but a risk factor with significant societal consequences, by reason of its pervasive nature and the serious consequences for affected individuals." (16)

**Magnetic Field Exposure at the Cellular Level:** The inter-relationships between various cellular processes, are far too complex for a thorough discussion here. However, the scientific

evidence accumulated to date from cell biology, biochemistry and bioelectromagnetics gives an excellent understanding of these processes and how EMFs may possibly interact with these processes. It is important to note that laboratory findings are not necessarily fully applicable to real life situations. Cell-level experiments are intended to detect and characterise an effect in a system simpler than a multi celled organism. As such, in vitro experimental results are not affected by endogenous homeostatic [repair] mechanisms encountered in the whole organism and thus may be more sensitive to applied fields (17).

The hormone, melatonin, and the neurotransmitters, serotonin and dopamine, are neurochemical messengers that aid in central nervous system transmission, or in the case of hormones, travel throughout the body to effect cellular changes. There are believed to be more than 100 transmitters and hormones that allow a complex interaction among the CNS, the endocrine system, and the immune system.

The cell membrane, where transmitters and hormones bind or cross into the cytoplasm, is the likely site of any interaction with external man-made EMFs. There are receptor sites both on the cell membrane and inside the cell to which these chemical messengers bind, starting a cascade of chemical events that may eventually alter the cell's behaviour in one of many ways.

An apt description of the cellular communication process was given by Dr W. Ross Adey, the former Associate Chief of Staff for Research and Development at the Pettis Memorial VA Medical Centre at Loma Linda, California, and NCRP committee chairman: It is generally agreed that the first detection of ELF and ELF-modulated RF/microwave fields occurs on the membranes that enclose all cells. These complex cell membranes act as detectors, amplifiers, and couplers of weak surface electrical and chemical signals to the cell's interior. Cells also communicate with neighbours by outward signals, faintly "whispering together" electrically and chemically, through signals that are also sensitive to imposed EMFs." (18)

It is not necessary for external EMFs to penetrate into the cell interior in order to cause changes inside the cell, as reported by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) in 1996:

"By influencing signal transduction pathways, which in turn can regulate cell proliferation, cell differentiation, and even transformation to a cancer phenotype, ELF-EMFs can potentially be involved in a host of disease processes without ever penetrating the cell membrane in any significant manner."(19)

In summary, EMFs can bring about fundamental changes in both electrical and chemical signalling in the CNS. One chemical messenger that has been shown to be particularly susceptible to the influence of weak ELF EMFs is melatonin.

**Melatonin:** Both human and animal circadian rhythms are synchronised with the natural day/night cycle. The major control gland over this natural cycle is the pineal gland which secretes the neurohormone, melatonin. In mammals, light falling on the eye's retina during the day, produces signals which are biochemically amplified to stimulate the pineal gland to reduce its melatonin output. At night the absence of light allows the pineal gland to produce melatonin. Melatonin directly enters the bloodstream through which it has access to every cell in the body, passing directly to receptors in the nucleus (20).

In the cell nucleus, melatonin plays a role in regulating gene expression. The ability of melatonin to enter all cells is essential for one of its other important functions, which is to act as a scavenger of highly toxic oxygen-based free radicals. The production of these free radicals is a consequence of the utilisation of oxygen by all aerobic organisms. About 1 - 2% of inspired oxygen ends up as toxic free radicals, a by-product of the respiration cycle. These oxygen radicals can damage macromolecules such as DNA, proteins and lipids. This damage is referred to as oxidative stress (21).

Because of its ability to eliminate free radicals, melatonin is regarded as an efficient cell protection and oncostatic agent. At night the increasing level of melatonin helps eliminate the build up of free radicals thereby allowing DNA synthesis and cell division to occur with a far lower chance of damage. Melatonin also inhibits the release of oestrogen, prolonged exposure to which may increase the risk of breast cancer (22).

According to Brzezinski, melatonin may enhance the immune system and counteract stress-induced immunosuppression by augmenting the immune response (23).

**The Melatonin Hypothesis:** In 1987 Stephens et al. suggested that EMFs reduce melatonin production by the pineal gland and that melatonin suppresses the development of breast cancer (24). They proposed that EMFs may operate as a co-factor in the development of some cases of this type of cancer. Since then, results from five in vitro studies, conducted in three major laboratories, using human breast cancer cell cultures, have shown that low level powerline frequency magnetic fields in the order of 12 mG (1.2 uT) can block melatonin's ability to suppress breast cancer cells (25). This is known as the melatonin hypothesis. In addition, several human exposure studies have found lowered levels of melatonin in people exposed to EMFs. (Section 2.3)

At the Second World Congress for Electricity and Magnetism in Biology and Medicine, held in Bologna, Italy, in June of 1997, the program bulletin states that:

"A number of experimental studies have been conducted to test the [melatonin] hypothesis. Although the literature is still evolving and consensus is being built, it is fair to say, a) there exists credible scientific support for the hypothesis and, importantly, b) this support encompasses in vitro, in vivo, and epidemiological research. The melatonin hypothesis, thus, currently represents one of the more well documented/tested interactions in the field of bioelectromagnetics." (26)

In 1988 Liburdy reported that "The melatonin hypothesis invokes a general mechanism that has relevance to all hormone-dependent tissue responsive to oestrogen and/or prolactin, such as human mammary epithelial tissue, ovarian tissue and prostate tissue" (27).

A further study found that office-place EMF exposure was apparently related not only to a decrease in melatonin levels but also to an increase in the level of the stress hormone adrenocorticotrophic hormone (ACTH) (28). The implications for CFS are obvious, for chronically high levels of ACTH are known to suppress immune function. While the evidence for a link between ELF EMFs and melatonin is strong, other chemicals are known to be affected too. One of these is calcium ions which are critical for the proper functioning of all cells.

**Calcium Ions, Protein Kinases & Ornithine Decarboxylase:** In their comprehensive review of the effects of EMFs on molecules and cells, Goodman et al. note that the EMF effect on calcium flux has been the subject of intense scrutiny because of the important physiological role of calcium and its relationship to membrane changes. The results are equivocal, but most in vitro experiments performed on human tissues show enhanced calcium flux in response to radio-frequency and ELF fields. Liburdy and his colleagues in particular have examined the effectiveness of the magnetic or electric field component in altering calcium flux and their combined data strongly supports the conclusion that the electric field component is responsible for altered calcium flux. They suggest that the electric field operates by inducing an opening of the calcium channel in the membrane rather than by increasing calcium mobilisation from the endoplasmic reticulum (29).

The possible connection between EMFs, calcium ions and immune system function was summarised by Cherry:

"ELF and RF/MW, modulated at ELF frequencies, change the oscillation frequency and amplitude [of calcium ion signalling] and change the influx and efflux of calcium ions in and around the

cell membrane. The changing oscillation frequency and amplitude is related to the immune response of the cell and shows that the oscillating applied field produces an antibody-like reaction as though the cell has been attacked. The influx and efflux changes relate to the signal transduction pathway in which calcium ions participate. This is one of the biochemical pathways which regulate cell behaviour. This is altered by the applied oscillating electromagnetic field. Since signal transduction controls cell division, cell differentiation and cell proliferation, this EMR-induced alteration to signal transduction has the strong potential to participate in tumour formation or promotion. Alteration of T-lymphocytes and other immune system factors suggests that EMR exposure causes immunosuppression, partially through induced calcium ion efflux" (30).

Changes in cellular calcium flow are known to stimulate a group of enzymes called protein kinases, which play an important role in regulating several cellular functions. Two recent studies found evidence that inside cells, EMFs can activate certain signalling pathways, for example, protein kinase activity has been associated with cancer. Specifically these research groups discovered that the products of a particular class of oncogenes, Src tyrosine kinases, are rapidly activated by EMF exposure. The functions of other key cellular elements facilitating the cancer-promoting function of these tyrosine kinases also seem to be amplified five- to ten-fold. In addition, the results of these studies demonstrate that EMFs may alter biochemical events in the immune system that determine our susceptibility to infections (31).

It has been reported by Uckun that EMFs can disrupt the "growth regulatory balance" in cancer cells (32). Uckun also reports similar EMF-induced activity in a different, but related, enzyme system where it was found that cells exposed for 5 to 15 minutes to EMFs, similar in strength to those found in electric razors (1000 mG / 100uT), caused a 5 to 10-fold increase in the activity of a gene associated with the formation of leukemia (33). Referring to this research, Adey states that, "This is another piece of evidence, which we first began to see in the 1980s, pointing to the importance of protein kinases as a key intracellular communication system that is sensitive to both ELF and modulated RF fields" (34). The possibility exists that the immune system is compromised by external EMFs which may alter chemical messengers, resulting in erroneous instructions being sent to internal cellular regulation systems.

Uckun found that elevated activation of the enzyme tyrosine kinase by EMFs may represent the initial manifestation of EMFs' biological influence, leading to a cascade of biological events. He also reported the activation of a second tyrosine kinase, known as BTK, "Because you don't have any hormone production without activation of tyrosine, the new findings may also explain provocative hormonal perturbations linked to EMF exposures" (35).

Another important enzyme involved with cell growth is ornithine decarboxylase (ODC), which is required for DNA replication. ODC is always present during cell growth and plays a critical role in cell transformation, but increased levels are considered a marker for the type of cell activity connected with cancer growth. Research by Litovitz et al. into ODC activity has shown that at the applied frequencies of 55 and 65 Hz, there is a significant (two-fold) increase in ODC activity in L929 cells exposed to a magnetic field of 100 mG (10 uT). The authors conclude that modification of its [ODC] enhancement by an applied field is of general interest for questions of EMF exposure. We suggest, however, that the coherence phenomenon noted in these experiments is likely of more widespread consequence, and that other biological responses with demonstrated EMF sensitivity will display comparable coherence dependence." (36).

The evidence we have so far reviewed would suggest a link between EMFs and calcium levels, melatonin levels, protein kinase and ODC activity. Thus it is not unreasonable to conclude that CFS, which may be an indicator of metabolic disruption, is partly a manifestation of exposure to low level EMFs.

**Human Experiential Field Studies & Hormone Disruption:** In the previous section we note the possible link between EMFs and melatonin flux. A preliminary study in 1997 of 60 workers at a

Finnish garment factory found "a highly significant effect" of EMFs in reducing nocturnal melatonin levels. Magnetic field (MF) measurements were taken for the two types of machines used in the factory and operators were assigned to high or low exposure groups, based on the type of machine they were using, with average exposures either above or below 10 mG (1.0uT). Non industrial workers who were not exposed to MFs were the controls. The results of this study found strong effects of both magnetic field exposure on night time levels of melatonin. No difference was found in melatonin levels on week nights and Sunday nights, indicating "that the possible suppression caused by magnetic field exposure is chronic, with little recovery during the weekend" (37).

A 1996 study of 192 electric utility workers by Reif and Burch found that some EMF exposures are associated with low levels of melatonin. They found a significant association between MF exposures and lower daytime melatonin levels on the second and third of three days of measurement (38). The lack of an effect on the first day (following a weekend or equivalent) may indicate a cumulative effect of exposure. Some studies have suggested that EMF effects on melatonin may depend on whether the field is continuous or intermittent. Reif and Burch found that magnetic fields in the home that were "temporally coherent" (less intermittent) had a very significant association with lower melatonin levels at night. They concluded that the intensity and temporal characteristics of MFs may both play a role in the suppression of melatonin (39).

Visual display units (VDUs) have also been implicated as a significant source of MF radiation. According to Arnetz and Berg, office workers who used VDUs had a significant reduction in circulating levels of melatonin over the course of a working day. No such change was found during days at the office with no VDU use. Levels of the stress hormone, ACTH, increased during the working day and this showed a strong correlation with workers' subjective assessment of mental strain, but in contrast, mental strain did not significantly correlate with melatonin levels (40). Davis (Fred Hutchinson Cancer Centre in Seattle Washington), found that low-level MFs can reduce the nocturnal release of melatonin in women. While the effect was small, it occurred at milliGauss levels and followed a dose-response trend. Davis called the findings "intriguing" given the "very low level of exposure" which reflects "real-world" conditions, but cautioned that the biological significance of the results is not known at this time. Davis stated, "This is the first time we are seeing evidence that relatively small changes in magnetic fields at night can be associated with decreases in melatonin levels that night among humans living in a normal environment" (41). Davis argues that melatonin inhibits the production of other hormones such as oestrogen. Thus a drop in melatonin has the potential to cause other hormones to surge (42).

As with the laboratory research these human field exposure studies indicate a possible link between EMFs and hormone disruption which may be a co-factor in the development of CFS. The link has not been firmly established but further investigation is certainly warranted.

**Depression & EMF Exposure:** Research in the United States and Britain has found clinical depression to be the major factor in suicides in both countries. There are many types of depression, from seasonal depression (Seasonal Affective Disorder) which normally occurs in the winter months to low level chronic depression that may linger for months or years. Among the symptoms of clinical depression are weight loss, early waking, diminished sex drive and a general feeling of hopelessness. On the contrary, some people have what is called atypical depression which is characterised by weight gain and spending much of the day asleep.

In 1978, Perry published the findings of an EMF survey which examined the addresses of some 600 suicides reported in the Birmingham U.K. area and found that in homes where the magnetic field was above 1 mG (0.1 uT) the relative risk of depressive illness was elevated (43). Perry and Pearl conducted a study of 43 high-rise blocks with over 3,000 housing units (a total of approximately 6,000 occupants). The aim of the research was to determine whether there was any correlation between occupants' level of depression and their proximity to EMFs. Participants suffering from certain types of heart disease and from depression were more likely to be living near the main electrical supply cables in the apartment blocks. Magnetic field strengths

measured in all 43 blocks with a single rising cable showed significantly higher magnetic field exposures in the apartments 'near' the cable. These fields averaged 3.15 mG (0.315 uT) nearest the cable and 1.61 mG (0.16 uT) in the 'distant' apartments. A further finding was that if only those blocks with under floor or storage electric heating were considered, the proportion of cases of depression in occupants living in apartments categorised as 'near' the rising cable rose to 82% (44).

Changes in serotonin levels are known to be associated with depression. For example, lowered levels of this chemical in the brain have been linked to an increase in suicide frequency (45). Wolpaw examined the brain functions of monkeys exposed to 60 Hz magnetic fields. He measured the levels of neurohormones in the spinal fluid of monkeys thus exposed for three weeks. It was found that the levels of serotonin and dopamine were significantly depressed immediately following exposure, and that only the dopamine returned to normal levels several months after (46).

Low nighttime melatonin concentrations have been reported in patients with depression, and patients with Seasonal Affective Disorder have phase-delayed melatonin secretion (47).

Robert Becker, a leading researcher on EMF exposure and depression, summarises his own work, and that of others as follows: "It seems that there may be two types of clinical depression: one that is produced by simple psychosocial factors, and one that is produced by some external factor that influences the production of these psychoactive chemicals by the pineal gland. In view of the known relationship between the pineal gland and magnetic fields, it is advisable that the search for the responsible factor include an evaluation of the effect of abnormal electromagnetic fields " (48).

**Other Relevant Research Findings:** Since 1979 when, in a seminal paper, Wertheimer and Leeper first reported a correlation between exposure to power line MFs and childhood leukemia, there have been well over 30 major epidemiological studies examining the EMF / cancer question. Few studies, however, have looked for evidence of association between environmental power-frequency magnetic field exposure and immune-related illnesses in humans.

In one notable study, Beale et al. examined eight immune-related and chronic illnesses (variables) in a group of 560 adults living near extra high voltage transmission lines in Auckland New Zealand. Using a cross-sectional design to examine the dose-response relationship between MF exposure of adults in their homes and prevalence of these illnesses, five of the eight health variables showed a linear dose-response relationship with exposure. After adjustment for possible confounding, significantly elevated odds ratios were obtained both for asthma and combined chronic illnesses at higher exposure levels. As reported in the paper abstract, "The results are consistent with a possible adverse effect of environmental magnetic field exposure on immune-related and other illnesses" (49).

Human peripheral blood lymphocyte activity may be affected by exposure to electric fields. For example, Coghill et al. (1998), exposed human peripheral blood lymphocytes in mu-metal-enclosed (EMF shielded) cultures to the donor's own endogenous electric field overnight and tested for viability by trypan blue exclusion. This showed a 70% viability. The controls (no endogenous electric field) and sham-exposed (same gold wire feed, but unattached to body) both showed about 50% viability. When they fed a 50 Hz electric field into the lymphocyte cultures (same power density, same period of exposure, same temperature, etc.) the viability fell to 40%. This study suggests that 50 Hz electric fields (not magnetic) adversely affect human peripheral blood lymphocytes (50). A decrease in human peripheral blood lymphocytes could be implicated in the development of CFS.

A 1998 study by Bonhomme-Faivre et al. found "evidence that chronic human exposure to environmental low frequency EMFs ... can cause neurovegetative, hematological and immunological disorders". Specifically they found that a group of workers who were exposed to



MFs ranging from 0.9 mG (0.09 uT) to 66 mG (6.6 uT) had significantly lower lymphocyte counts than a similar control group not exposed to these levels. The exposed group also reported significantly more occurrence of subjective conditions - mental and physical fatigue, depression, melancholy, irritability, fainting and diminished libido - than did the control group. Of particular interest with this study were two workers who had exposures from 3 mG to 66 mG (0.3 uT to 6.6 uT) and worked full-time above transformers. Both were found to have depressed lymphocyte levels which quickly returned to normal when they stopped working in that area (51). Finally it can be noted that not all researchers agree that environmental-level 50-60 Hz EMFs are causally related to hormone disruption and changes at the cellular level. This group supports the assumption that the small electric fields and currents induced in the body's tissues from external EMFs are smaller in magnitude than both internally produced fields and even the thermal noise of liquid phase solutions. This assumption has been challenged by Gandhi who has found evidence that the fields induced in the human body by power lines and appliances, essentially all strong artificial EMF sources - are much larger than the fields generated naturally inside the body. Gandhi used a computer model to calculate the electric and magnetic fields in the 41 - 70 Hertz frequency band from internal and external sources. He found that even the largest natural fields generated by the heart are hundreds of times smaller than those induced by standing under a high-voltage line or by using a hair dryer. Gandhi stated "My assumption was that what is already in the body is pretty substantial, but that turns out to be incorrect, . . . It is time for people to reject false assumptions" (52).

The work of Gandhi and others has led the current authors to examine mechanisms which might offer some explanation of how weak environmental EMFs might affect living systems. One possible mechanism which is now gaining popular support among biologists is stochastic resonance (53). This novel application of stochastic resonance theory to biological systems is currently being explored in the authors' laboratories.

**Conclusions:** With the illness loosely termed Chronic Fatigue Syndrome, regardless of the cause, or causes, the primary outcome is an immune system which is markedly compromised. Considering this, it is advisable for medical practitioners working with CFS patients to advise them to avoid situations that may place an additional stress on their immune systems.

Current scientific evidence indicates that prolonged exposure to EMFs, at levels that can be encountered in the environment, may affect immune system function by affecting biological processes in ways similar to that seen with CFS. Considering the increasing incidence of CFS in the community, it is the opinion of the authors that medical practitioners should advise patients about the prudent avoidance of EMFs. It is usually a relatively simple matter to locate sources of EMF and generally to avoid them. The lack of full scientific certainty should not be used as a reason for postponing measures to prevent exposure to any potentially harmful source. If measures generally reducing EMF exposure can be taken at reasonable expense and with reasonable consequences in all other respects, every effort should be made to reduce exposure to the lowest possible level.

**Caveat:** The authors express the strong view that they do not support nor condone the use of any unscientifically proven devices that claim to cleanse or protect the body from EMFs.

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### **"Idiopathic Environmental Intolerance." in the Modern Office**

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**Initial Comments On the Blood-Brain-Barrier:** We have heard of the research that indicates that microwaves can open up the blood-brain-barrier but consider the following message that indicates chemical exposure may do the same thing.

Research in Sweden and Australia have clearly found that the modern office environment can expose workers to a large mix of volatile organic chemicals, some of which are mentioned below. If these chemicals are shown to breach the blood-brain-barrier with the consequences mentioned below, this needs to be a major health consideration in the office environment.

To quote:

"Viral assaults that are easily handled by the immune system, may, in fact, cross into the brain [from chemical exposure], wreaking a havoc that would be tackled by an intact immune system "outside" the Central Nervous System (CNS)."

From a Chronic Fatigue Syndrome (CFS) study that I have been involved with, It is noted that some of the subject's initial flu-like onset of the condition came on soon after working in rooms filled with office equipment, mainly computers. ( A high school, university, call centre and newly renovated office).

Please consider the following:report from chemically intolerant (MCS) investigator **Susan Jannarone** <[Jannarone@aol.com](mailto:Jannarone@aol.com)>

**Potential Viral Component of CFS & MCS:** Although I have known him "by telephone" for three years, I recently met with renowned Gulf War researcher Mohamed Abou-Donia, head of Cancer Research and Neurobiology at Duke University in Durham, North Carolina. I also met with Dennis Goode, a cell biologist at the University of Maryland. I present the following paper as an analogy and beginning of evidence for a cause of CFS, for all CFS patients who recognize the probable viral component of their illness, yet may not fully understand the accompanying reasons why the chemical, pharmaceutical, and medical professions and the US government are so hesitant to recognize the illness, currently known as M.E. or CFS. It should be known that for many sufferers the disease crosses over into Chemical Sensitivity Syndrome, now renamed by the chemical industry "Idiopathic Environmental Intolerance."

#### **The Case For Effects of Pesticides (Aromatic Hydrocarbons) On the Blood-Brain-Barrier:**

The first point that I would like to make to the patient community is to summarize the points made by Dennis Goode, Ph.D. to the Maryland State Department of Entomology and the Maryland State Health Department regarding the aerial spraying of malathion as a weapon against mosquito-bearing "West Nile Virus". His persuasive argument, accompanied by his partner and wife, actually halted the spraying of Malathion for the West Nile Virus in the state. Research had been done on Halothane and Nitrous Oxide that showed that either of those Aromatic (Ring-shaped) Hydrocarbons, almost identical to the "inerts" found in pesticides, herbicides and fungicides, specifically, xylene, toluene, naphthalene and benzene (the building block for all the aromatic hydrocarbons) actually "caused" animal morbidity from West Nile Virus by allowing the virus to breach the blood-brain barrier. Dennis' argument was a straight-forward

one: people are MORE likely to contract West Nile Virus when the government sprays malathion and other pesticides (with the toxic waste from industry) than they are if the spraying is not done at all. The so-called "inerts" determined by four state attorney generals to be substances so hazardous as to be required to be disposed of under Superfund Regulations, carry the pesticides and are known generally to be Aromatic Hydrocarbons. As the study below shows, the longer the exposure to Aromatic Hydrocarbons, the more likely mice mortality from the West Nile Virus.

**Events Affecting CFS Development:** Many individuals develop CFS following events such as trauma, dental work, surgery, stress, chemical exposures and other events. Many recognize that a viral infection of some sort occurred. The viruses may vary, and in fact, radical researchers who support new viral theories are the least likely to be funded, currently. In the past we have been stymied by the variety of seeming causes of CFS. We now know that all of the events patients report have a single common thread--precipitating events reported by patients are known to cause a breach in the blood brain barrier.

When we hear about "stress" we must equate that with the equation in mice studies in which the mice are bound and unable to run free. The compilation of stress, plus chemicals, on mice further opens the blood brain barrier to the likelihood of viral/bacterial entry.

NOTE: AND IF MICROWAVES ALSO OPEN THE BBB WOULD THIS ALSO INCREASE THE LIKELIHOOD OF VIRAL/BACTERIAL ENTRY??? MAYBE USING YOUR MOBILE WHILE HAVING THE FLU IS NOT A GOOD THING! (See **Research paper "Influence of High-Frequency Electromagnetic Radiation At Non-Thermal Intensities On the Human Body", page 100..jb**)

By rapidly developing chemicals and spreading them over every inch and inserting them into almost all consumer products, industry may have surpassed the human body's ability to evolve in order to cope with them.

Viral assaults that are easily handled by the immune system, may in fact cross into the brain, wreaking a havoc that would be tackled by an intact immune system "outside" the CNS.

**Indoor Sources of Aromatic Hydrocarbon Air Pollution:** According to Dr. Rosalind C. Anderson, just some of the sources of indoor air aromatic hydrocarbon releases are air fresheners, wall coverings, paints, adhesives, permanent markers, copy machines, laser printers, carpeting, perfumes (based in solvents), carbonless carbon paper and moth flakes (naphthalene). We can include disposable diapers and fabric softeners in this seemingly disconnected group of chemicals, which are common in that they all belong to the class of aromatic hydrocarbons. This is not to say that aliphatic (in chains) hydrocarbons such as methane, ethanol, propane, and butane are not similarly capable of crossing the blood brain barrier. These, however, are recognized by medicine as to be avoided and properly handled.

Mohamed Abou-Donia, Ph.D. addressed the "Synergistic effects of chemicals in the nervous system" at a recent seminar. He related his work on Gulf War Research. He cited "to look at them, his test subjects appeared normal. In fact, they were sick. They could not do simple behavioral tests and their memory was profoundly affected."

When I met with Dr. Abou-Donia, we talked for three hours and as fate would have it both depression and behavioral conditioning were subjects that came up. A Duke study group for depression was seeking participants by posting flyers on back of the doors in the restroom stalls. I asked Dr. Abou-Donia about depression (typically in my attempts at humor; I asked if the flyers were on the doors in the men's rooms) and he said "No, they are not" and related that the same receptors in the brain that are affected by "pesticides" also are related to depression. We hurried back to his office, because Dr. M. Abou-Donia walks quickly and resolutely and he showed me the results of sperm in the testes, each photograph reflecting: OP's (Organophosphates) at high doses, OP's at low doses, OP's with stress and without stress. As

we said goodbye, I happened to be standing near the Behavioral Modification Center. I pointed to the door and mused: "Would it help me if I tried this, I asked?" No, Susan, it would not, was his response, as he ran up stairs three at a time to make an appointment.

### **Personal Bouts with Depression and Memory Loss:**

Dr. Abou-Donia was completely aware that I was lost in the building and that I have short-term memory problems. "None of us wear perfume here, so you should be ok," he assured me without having been asked. For me, it was not an embarrassment to tell Dr. Abou-Donia that in order to avoid pesticides I was living out of my car and that in order to travel to North Carolina I had rented a hotel room and dressed there, but could not sleep in the room due to solvents. He did not seem the least bit surprised, but did seem worried about me, but then everyone does seem worried when a middle-aged woman lives from a car, expensive one or not. "Where will you be going?" he asked, with a kindness I have seen possibly a handful of times. I simply could not answer at that point. It would not be until I returned home 75 days later after hiking on the Appalachian Trail and sleeping in my car that I would have the stamina to confidently write about my impressions.

**Healthy Male-Biased Studies, Chemicals & the Blood-Brain-Barrier:** Abou-Donia had said recently at a gathering organized by Cynthia Wilson, co-founder of CIIN, "Everyday chemicals break down the blood-brain barrier, allowing chemicals, bacteria, viruses, diseases to invade the brain." Dr. Abou-Donia also stated that research into the impact of chemicals is funded only for research that uses healthy males, NEVER females, pregnant women or fetuses; however, 80% of those with chemical illnesses are women, a situation demanding correction." (my emphasis...jb)

So, in reading the following research, one can understand that at no time will industry, pharmaceuticals and/or government come hand-in-hand to the CFS community with answers. The ADA will probably not discuss the concurrent placement of mercury fillings and nitrous oxide used for many years by dentists. The liability is simply too great.(my emphasis...jb) Those whose anesthesia may have allowed a virus to cross into the brain may not easily consult with the anesthesiologist about the disease, either. Many combinations of patient reports are brought into cohesive focus by the simple information that is provided in the research that has already been done. We are challenged to bring the answers to those in power who have brought the illness to us. Without CFS community understanding of these issues I doubt that will happen.

**Important Studies Supporting Comments Herein:** Ben-Nathan D, Kobiler D, Rzotkiewicz S, Lustig S, Katz Y., "CNS penetration by noninvasive viruses following inhalational anesthetics.", Dept. of Infectious Diseases, Israel Institute for Biological Research, Ness-Ziona, Israel. <ben@iibr.gov.il>

The effects of **inhalational anesthetics** on brain penetration by the neurovirulent noninvasive West Nile virus (WN-25) were studied in mice. WN-25 injected intracerebrally causes encephalitis and kills adult mice, but when injected intraperitoneally (i.p.) it is unable to invade the brain and kill. Under stress conditions, this strain causes encephalitis and death even after i.p. inoculation. In the study described in this paper, we used two inhalational anesthetics, a single short-term exposure to 2% halothane for 10 min in oxygen, or 70% nitrous oxide (N<sub>2</sub>O) for 30 min in air. Both inhalational anesthetics induced WN-25 encephalitis and death in 33% and 20% of the tested mice, respectively. Exposure of inoculated mice to halothane for prolonged periods or for repeated exposures (two or three times) markedly increased the mortality rate (up to 75%). Exposure to 30% CO<sub>2</sub>, a known modulator of blood-brain barrier (BBB) activity, was used as a positive control (80% mortality). No death was observed in the control non-exposed injected mice. Virus levels were found to be more than 10<sup>7</sup> plaque-forming units (PFU)/brain in all moribund mice. Additional parameter demonstrating the "stressor-like" nature of inhalation anesthetics was the induction of a significant decrease in weight of the lymphoid organs of inoculated mice. We suggest that inhalational anesthetics induces BBB breaching with

subsequent entrance of the noninvasive WN-25 virus into the brain, causing encephalitis and death.

PMID: 11268425 [Pub. Med. - indexed for MEDLINE]

**Personal CFS Experience & Summary Comments on Plausible Cause of CFS:** Taken together, all of the researchers I have spoken with (outside of mainstream) reach a similar conclusion for the treatment of my condition. Inside mainstream, doctors simply look to pharmaceuticals. All of the researchers, some of which I have written about in the past, included chemical exposures as an element of the illness. As I have said previously, Johns Hopkins diagnosed me with the Chronic Fatigue Syndrome in 1995 following an abnormal tilt test and nine months of patient visits. Following the failures at Hopkins I realized that there is a time to ask for help and a time to reinvent oneself. I hope that my correspondence allows others to understand the resounding significance of the above study, which was funded and used only so as to decide whether or not to have patients have surgery in the same time periods during which spraying was done for the West Nile Virus. I imagine it is credible that the research was intended to protect hospitals and doctors from lawsuits. However, the CFS community must be able to see from this example and the quotations I have provided, that we now have a scientifically plausible cause of the Chronic Fatigue Syndrome.

Should individuals find any way whatsoever to oxygenate their body, the study does show that CO<sub>2</sub>, a problem in polluted cities, may in fact be a functional part of the syndrome.

For those of us who recognize ourselves that we are chemically intolerant, a complete lifetime neurotoxic limit may have been achieved. **Significant periods away from air-borne toxins may allow the body to become more resilient, but years of avoidance and oxygen therapy would probably be required.**(my emphasis...jb) Research at Battelle and by Clement Furlong at the University of Washington indicates that some of us are "mounting an immune response" to chemicals in small quantities after repeated exposures or larger exposures. Recently Dursban and Diazanon were removed from the market. We belong to the Dursban generation. Only a handful of cases of personal injury even made it to court, yet the chemical should never have come on the market. The chemical is suspected of having been "souped up" with its "oxone." This illegal situation will pass, hardly noticed. Other similarly damaging chemicals have resulted in individuals with "syndromes" that are similar but fail to fit into neat cookie-cutter arrangements such as diabetes, for example.

No other viral theories are rendered impotent by the blood-brain, chemical, viral theory. In many ways, the CFS community will be more dependent on the honesty and integrity of our overseers in medicine, industry and government. And as usual, it may be the moribund mouse who is our saviour.

Please print this as I have intended it, part essay, part excerpts and with the research paper above. I would expect that I have spent at least 60 days obtaining the information that I am providing.

Sincerely,

**Susan Jannarone <Jannarone@aol.com> Copyright 2001**

**Reply to Email Comments on Above IEI Article:**

Received on 9/27/2001 from Don Maisch)

The incidence of CFS symptoms is rising in most industrialised countries and there is still no known cause. In most cases the onset is marked with **flu like symptoms** which leads many researchers to conclude that the cause may be viral. The question is: Is there a common factor in the initial flu like symptoms and why does it lead to such a debilitating condition. Any theory

that attempts to explain what is happening deserves consideration, especially if there is evidence that chemical exposure is linked to CFS symptoms.

Consider:

**Increase in CFS amongst students:** I have in front of me the education supplement from The Age newspaper, dated 25 November 1997 that is titled: "Just Too Tired, Chronic Fatigue Syndrome". It goes into the alarming increase in CFS amongst Victorian (Australia) students over the last few years. The same increase has been seen to be taking place in NSW (Australia) schools, the increase has been seen in Japanese, UK and American schools as well.

From limited inquiries that I have made, it seems that a common new factor in these school's environments may be the introduction of new computers, in rooms without adequate ventilation to remove the toxic emissions that are known to outgas from computers and other office equipment. In The Age education supplement, one student who developed CFS writes of her experience and specifically notes the symptoms while trying to use her computer.

In Sweden there has been an ongoing coordinated research effort to design environmentally safe office buildings and they have clearly identified electrical equipment in the office environment as a significant source of toxic chemicals. And these chemicals are linked to ill health, including symptoms reported in CFS.

Alarmingly, research by the Karolinska Institute in Sweden has found that since 1972, levels of brominated flame retardants in human breast milk are dramatically increasing annually. These were virtually undetectable before that date. The health impacts on the future children are unknown but these chemicals are related to PCBs which are known to be harmful.

The Bill Moyers report "Secrets of the Chemical Industry" on my web site mentions a current US study that is identifying around 80 synthetic chemicals in virtually everyone's blood tested. In that report, Dr. Philip Landrigan, Chairman of the Preventative Mt. Sinai School of Medicine states that "We are conducting a vast toxicological experiment, and we are using our children as the experimental animals. **As the chemical load continues to increase in our children, what will be the outcome?** (my emphasis jb)

**Recommended reading:** ( Available from EMFacts):

"*No Risk in the IT environment*" published by the Swedish Union of Clerical and Technical Employees in Industry.

"*Chemical emissions from office-equipment*" The Swedish Institute of Production Engineering Research

"*Sick Building Syndrome : Photocopiers & Printers Share the Blame*" The Commonwealth Science and Industrial Research Organisation

"*Fact Sheet: Ventilation and Air Quality in Offices*" US Environmental Protection Agency.

**Indoor Air Quality:**, This is a problem reasonably easy to correct and well understood but it IS NOT BEING CORRECTED and, at least in Australia, numerous calls for improved air quality in offices go unheeded. Call Centres are still being constructed with all the equipment outgassing directly into the working spaces, to be recirculated by the building's air conditioning system.

The CSIRO has done numerous air quality surveys in Australian office buildings and call centres and their findings are of concern. Many new offices have VOC levels well in excess of the allowable standards. The CSIRO has called for better indoor air quality standards but to no avail. In Standards Australia there even has been attempts to relax the indoor standards.



The Swedes have engineered solutions by having a separate ventilation system designed to take chemical emissions out of the building. To the best of my knowledge this has never been contemplated in Australia.

In Australia the Government's concerns are mainly on controlling chemical emissions into the outside environment. Indoor emissions are not a priority.

The solutions are there, its just that our economic (ir)rationalists who run the show are only concerned with keeping costs down. As soon as you mention that it will cost a bit more to eliminate the problem and improve worker health they turn off. Improved worker productivity further down the track is not as important as immediate costs savings, and so the problem continues. In my opinion economic rationalists are Australia's Teleban.

Various Australian officeplace surveys have identified high levels of stress (88%) in the environment (call centres). When you look at the symptoms reported in these surveys there is a big potential health problem.

A Tasmanian University based survey identified officeplace chemical pollutants as a major health problem that could lead to major litigation if not corrected.

***There certainly is the need for more research into this area but who will fund it?***

**Blood-Brain-Barrier Effects of EMFs:** In 1995, Dr. Ross Adey, one of the world's most respected and senior research scientists stated:

***"The laboratory evidence for non-thermal effects of both ELF [power frequency] and RF/microwave fields*** (my emphasis..jb) now constitutes a major body of scientific literature in peer-reviewed journals. It is my personal view that to continue to ignore this work in the course of standard setting is irresponsible to the point of being a public scandal."

It is likely that a combination of pathologies, dose, time of exposure and personal immune characteristics will ultimately establish casual ties to CFS/IET.

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***Blessed are the flexible  
for they shall not be bent out of shape!***

***.....Cathy Kachur, "The Human Tune-Up"***

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***"There are no foolish questions and no man becomes a fool  
until he has stopped asking questions."***

***...Charles P. Steinmetz***

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## Potential Hazards of Microwave Radiation

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### 1977 Hearings Before U.S. Senate, 95th Congress on Microwave & Radiowave Communication Long-Term Bioeffects & Vested Interests

Hearings Before the Committee On Commerce, Science, & Transportation  
United States Senate, Ninety-Fifth Congress  
First Session On Oversight of Radiation Health & Safety

June 16-29, 1977, Serial No. 95-49, Page 1219-1222  
U.S. Government Printing Office, Washington, D.C.: 1977

University of Oregon Health Sciences Center, Portland, OR, June 12, 1977

Hon. Warren G. Magnuson,  
Chairman, The Senate Commerce Committee,  
Russell Old Senate Office Building,  
Washington, D.C.

Dear Senator Magnuson: Your hearings on the adequacy of United States safety standards for microwaves and radiowaves are timely indeed. In recent years evidence has steadily mounted concerning the likelihood of low power level microwave cumulative dose effect hazards. **It has also become apparent that certain federal agencies and private contractors have vested interests in obstructing the public scrutiny and adequate research support for accurate determination of the risks of these apparent hazards.** Most people do not realize that certain types of non-ionizing radiation (e.g. microwave and radiowaves) can have similar effects to the readily recognized dangers of ionizing radiation (X-rays and gamma rays), with the principal difference being the much lower incidence of tissue damage due to the much lower energy content of the non-ionizing radiation. However, the lifetime accumulation of non-ionizing radiation dose, the damage to the posterior capsule of the ocular lens, and the suspicion of increased cancer risk are all characteristics in which the effects of non-ionizing radiation resemble those of ionizing radiation. The continuing rapid increase in use of radiowaves for military and civilian communication and sensor systems as well as the growing popularity of microwave cooking in the home, means that **it is imperative to develop accurate and adequate health risk estimates from sources which cannot be accused of vested interest in health hazard information suppression.** This will require epidemiologic and experimental research of a whole array of circumstances over considerable periods of time because of the intricate influence of environmental variables and the latent period between exposures and potential chronic disease manifestations.

A volunteer member of our faculty, Mr. William Bise, has been instrumental in bringing to our attention the fact that foreign scientists have gathered a great deal of evidence suggesting the existence of significant hazard from low level microwave radiation. He is an experienced radio broadcaster and has formed a non-profit corporation (Pacific Northwest Center for the Study of Non-Ionizing Radiation) for the purpose of promotion and support of investigation of these hazards. He is writing to you under separate cover. We endorse your efforts to look into this matter and anticipate the eventual facilitation of radiowave health hazard investigation as a result.

Sincerely,  
Wm. E. Morton, M.D., DrPH, Professor

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*NOTE: I have selected supportive excerpts from one of the two submittals by William Bise at this hearing. Pertinent references to the work he performed at the time and to which he refers in his submittals are presented below for those who want more detail that can be presented here. Also, see the 25-year research review of the research of Rauscher and Bise herein, page 103, which includes more detail and a summary of the references stated below.....jb*

**Pacific Northwest Center for the Study of Non-Ionizing Radiation, Portland, OR, June 6, 1977**

Hon. Warren G. Magnuson,  
U.S. Senate, Russell Senate Office Building, Washington, D.C.

Dear Senator Magnuson: Enclosed is material that I would like to submit in lieu of verbal testimony in the upcoming senate subcommittee hearings on microwaves.

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The material describes a pilot study of central nervous system radiofrequency (RF) effects which I conducted on ten human volunteers at a power level on the order of 67 microvolts per meter intensity, previous to founding a non-profit research corporation. As you know, Public Law 90-602 set the so-called safe level for human exposure to this energy at about 185 volts per meter. The pilot study findings suggest that brain waves (and possibly behavior) are affected at specific frequencies at substantially lower power levels of RF than people can be exposed to in their daily lives. **Whereas further research is necessary to verify or deny the pilot study findings, it is my opinion that a meaningful risk factor already exists for the population at large.**

\*===== (see references below and page 103, herein)

Electronics engineers are dedicated to designing, building and maintaining better and ever more sophisticated products for radiating and detecting all kinds of electromagnetic waves. With the exception of careful respect for high voltages, currents and power, a good engineer will insist that low-power microwaves or radiowaves cannot possibly affect human behavior and/or health. As an engineer who held that view for fourteen years, I can attest to this fact. Except for a rather dramatic **incident in 1970 involving my wife**, who was nearby while I was troubleshooting some gear with a low-power microwave generator, I might not have done a pilot study of RF effects; and I might still have remained unconvinced that low-level microwaves/radiowaves are hazardous at specific frequencies.

Since I became a clinical instructor in environmental medicine at the University of Oregon Health Sciences Center, it has become apparent to me that most physicians are unaware that low-level radiowave biological effects can mimic many symptoms of various defined diseases. **I have found the entire subject of radiowave hazards very unpopular to science, business, industry and the military; perhaps because recognizing these hazards would cause so many necessary changes in these various areas.**

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**I hope that there is something that your committee can elicit from the upcoming hearings to at least inform, if not protect, the people of the United States from electromagnetic hazards. The specialization of science unfortunately limits the scientists' ability to bridge the interdisciplinary gap necessary to realize the urgent need for a joint effort of investigation into low power level microwave hazards.**

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Sincerely, William Bise

## References:

1. Bise, W. "Low Power Radio-Frequency & Microwave Effects on Human Electroencephalogram & Behavior." *Physiological Chemistry & Physics*, Vol. 10, No. 5, pp 387-398, **1978**.
2. Stocklin, P.L. & Stocklin, B. F. "Low Power Microwave Effects on the Human Electroencephalogram **supporting the Results of Bise.**" *Physiological Chemistry & Physics*, Vol. 13, pp 175-177, **1981**.

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## Mobile Phone Adverse Health Concerns

Alasdair Philips

When I was a child, back in the early 1950s, I was bought a new pair of shoes. The manufacturer had just introduced a wonderful new pedascope machine to check how well your shoes fitted your feet. Even today, I clearly remember the wonder at being able to wiggle my toes and see them move inside my shoes. The machine used X-rays at quite a high level to give real-time images on a simple screen. It was ten years before Dr. Alice Stewart produced research which showed that there was no safe level of X-rays, and even then few listened. In fact she was almost outcast from the medical establishment, and it was about another twenty years before the real danger from medical X-rays was acknowledged. Now, in the late 1990s the UK National Radiological Protection Board (NRPB) is trying to persuade hospitals to minimize patient X-ray exposure, and leading Medical Research Council researchers admit that there is no "completely safe" level of ionizing radiation. The 1998 Royal College of Radiologists guidelines sets out the current rationale for restricting X-ray doses.

Asbestos has been strictly controlled since 1970, and the use of most dangerous types banned. Despite this, deaths from mesothelioma (an asbestos induced cancer of the pleura/lungs) are rising consistently and the UK death rate is not expected to peak until about 2020. The time between the first exposure and death is now accepted as often being between 20 and 50 years. Most environmental cancers in adults take longer than ten years from initiation to detection. The eating of BSE infected meat possibly causing CJD many years later is another example.

**Mobile phones:** Mobile phones emit microwaves. If microwave or pulsed low frequency electromagnetic fields (EMFs) do turn out to be carcinogenic, even if we backdate it five years, we should not be expecting to see much in the way of induced cancers for another ten years. In the meantime we discover that almost all the major phone manufacturers are quietly and prudently patenting EMF reducing cases and aeriels.

Despite the impression that mobile-phone companies give in their literature, little work has been done on long term human health implications of mobile-phone use. Current mobile-phone users are acting as involuntary, and often unsuspecting, test subjects. Past research into microwave radiation effects on health, including recent cell-phone studies, certainly give cause for concern. Even Dr. John Stather, the Assistant Director of the NRPB stated: "Until recently we believed any harmful effects from microwaves were due to their heating effects, which would be negligible at the low powers used by mobile phones. Now there might be another effect at work and we are much less certain." (Sunday Times 21 September 1997)

**Public awareness:** Public awareness of possible dangers was probably triggered originally by the Reynard brain tumor case in 1992. About eight lawsuits alleging that cellular phones caused brain tumors have been filed in the USA. Although no cases has so far succeeded they have set the stage and raised safety questions in many people's minds. It has raised old specters such as the thalidomide tragedy - the result of a product being used widely before adequate long

term research had been carried out. The first part of a major new study of 11,000 mobile phone users was released on 14th May 1998 [1] and although ignored by main BBC News programs, it was given front page banner headlines by the Daily Express on Friday 15th May. This showed little difference for heating, fatigue and headache effects between NMT analog and GSM digital phones, but did highlight a three to six-fold increase in fatigue and headaches for heavy mobile handset users and up to a 48-fold increase in the sensation of heat on the user's ear, face or head. The first of the study's more detailed findings were shown at the Bioelectromagnetics Society (BEMS) Annual Meeting in Florida in June 1998 and showed significantly more concentration and memory loss symptoms in regular users of the GSM digital phone handsets.

Only a week earlier news had been reported that on Tuesday 5th May the Cwmbran Magistrates Court issued a Summons under section 10 of the UK Consumer Protection Act, 1987 for Roger Coghill to bring a private criminal action against a retail distributor of Orange and Motorola mobile phones. The Magistrate ruled that there was enough scientific evidence (before the new 'Mild' evidence mentioned above) to issue a Summons and allow the case to go forward. His action claims that the distributors failed to affix required labels to their handsets warning of possible health risks to users from prolonged conversations as is required by the 1987 CP Act as there is now reasonable evidence of handset use causing possible adverse health effects. He has now filed an updated claim and the pre-trial review is scheduled to be heard on 2nd September 1998. [2] A research letter published in the Lancet [3] by a German team showed a statistically significant increase on blood pressure in people who used a GSM phone for 30 minutes. Although the rise was only about 5% it showed an important biological effect and received national media attention.

**Exposure levels:** Despite what some mobile phone companies are saying, mobile phones do radiate microwaves similar to those used in a microwave oven to cook food. Between 20% and 80% of the energy is absorbed by the user's head. The percentage absorbed depends on the design of the phone, type of aerial or antenna (the stubby ones which you cannot extend are worse for pushing energy into the user's head), and how far it is to the nearest base-station mast.

Thermal exposure results in a measurable and significant rise in body tissue temperature and is the basis for cooking food in microwave ovens. When maximum levels were set in the 1950s, they were based on field levels the human body could withstand without causing a 1°C rise in body temperature. The possibility of non-thermal effects was discounted. Most national and international bodies (including the UK National Radiological Protection Board) set a rise of 1°C (6 minutes average for local exposure, 15 minutes for whole body) as the maximum permissible long-term temperature rise, although some chose to set the figure lower than this, between 0.2°C and 1°C.

Non-thermal exposure means that no energy is transferred which could cause a measurable temperature rise. Athermal means that although some heating energy is transferred, the blood etc. will transfer the heat away from the tissue such that the overall temperature rise is limited to below that classified for thermal exposure.

Despite considerable evidence in published scientific literature for biological effects of electromagnetic radiation in the RF/MW range of the spectrum at specific absorption rates (SARs) far too low to produce a heating response, this still continues to be the case. However, the conclusions section of the NRPB "Doll Report", on non-ionizing radiation effects, states: "Animal studies conducted at frequencies above about 100 kHz have provided some evidence for effects on tumor incidence...". [4]

**Cancer implications:** Although brain tumor cases have been rising fairly steadily over the last fifteen years, these are not the most likely outcome of high levels of mobile communications handset use. In 1998 a study reported that brain tumor incidence was rising in Western

Australia and questioned whether mobile phone use might be responsible [5]. However, if there are long term large-scale

cancer implications, then it is more likely that they will be adult myeloid leukemias and multiple melanomas. Back in the early 1980s Sam Milham reported excess leukemia's among amateur radio operators, with deaths from acute and chronic myeloid leukemias nearly three times higher than expected. We do know of a number of digital (GSM) phone users who have developed Hodgkin's Disease in the lymph glands in their neck on the side where they normally used their phones for a couple of hours each day [6].

In 1980, Dr. John Holt had a letter published [7]. This showed that between 1951-59, 50% of patients with CML in Queensland survived for 55 months following diagnosis. In 1960 and 1961 three large TV broadcast stations were commissioned in the area. In the period 1963-67, 50% of patients with CML only survived for 21 months. This dramatic change could not be explained by any medical personnel, protocol or therapy changes.

In the mid-1980s Stanislaw Szmigielski reported that Polish military personnel exposed to RF energy showed elevated leukemia levels. He has just published a 1996 update [8]. This is a study of all Polish military personnel for 15 years (1971-85), approximately 128,000 people each year. Of these about 3700 (3%) were considered to be occupationally exposed to radio-frequency and/or microwave radiation.

The largest increases were found for chronic myelocytic leukemia (CML), with an astounding increase (Odds Ratio) of 13.9 (95% CI 6.72-22.12,  $p < 0.001$ ), acute myeloblastic leukemia (AML) with an OR of 8.62 (95% CI 3.54-13.67,  $p < 0.001$ ), and non-Hodgkin's lymphomas with an OR of 5.82 (95% CI 3.54-13.67,  $p < 0.001$ ).

In 1996 Lai & Singh showed single and double DNA strand breaks in brain cells of rats exposed to 2.45 GHz SARs of 1.2 W/Kg (comparable with levels in the heads of mobile phone users), giving rise to real concerns.[9] If someone is completely healthy, and has a strong immune system, then mobile-phone use may well not give them long-term health problems. Some people can smoke twenty cigarettes per day for fifty years and not develop lung cancer, and yet the dangers of smoking are now generally accepted, even by the manufacturers. It has been repeatedly shown that a few minutes exposure to cell phone type radiation can transform a 5% active cancer into a 95% active cancer for the duration of the exposure and for a short time afterwards. [10]

A team of scientists funded by the Australian communications giant, Telstra, to investigate claimed links between cellular phones and cancer has turned up probably the most significant finding of adverse health effects yet. The study looked at 200 mice, half exposed and half not, to pulsed digital phone radiation. The work was conducted at the Royal Adelaide Hospital by Dr. Michael Repacholi, Professor Tony Basten, Dr. Alan Harris and statistician Val Gebiski, and it revealed a highly-significant doubling of cancer rates in the exposed group. [11]

The mice were subject to GSM-type pulsed microwaves at a power-density roughly equal to a cell-phone transmitting for two thirty minute periods each day; this was a pulsed transmission as from a digital cell-phone handset. Using NRPB figures most GSM digital cell-phones will be putting between 10 and 30 times more radiation into the user's head than the Repacholi mice were subject to! [12]

If there are cancer connections with the use of mobile phones, they are most likely to be expressed in adult leukemias which typically take between 10 and 30 years to appear and be diagnosed. It is therefore unlikely that the trend will start to be seen for at least another five years, although the harm is being done now.

Short-term exposure of rats is no answer. Cancer is being increasingly recognized as an organizational systems problem, and no short-term speeded up animal experiments are likely to give the same results as extended period chronic exposure to the human biosystem.

**Shorter term problems with very important health and work efficiency implications:** We now receive frequent calls from regular mobile-phone users reporting headaches, loss of concentration, skin tingling or burning or twitching, eye 'tics', very poor short-term memory, buzzing in their head at night, and other less common effects. Headaches often come first and/or skin effects. Then concentration and short-term memory tends to deteriorate. At first it can be missing the turning off a motorway that you intended to take. Then it is forgetting appointments. It usually firstly affects learning or remembering NEW facts, similar to early signs of dementia. Things you learnt long ago are still usually there, but new things just don't seem to go in to your memory any more. Users also report excessive tiredness. Many reports are from engineers who used their phones extensively and were very skeptical of EMF adverse health effects until they started to experience them.

The symptoms bear a close resemblance to those in a study of a Latvian pulsed radio location station which emits 24 short VHF pulses of 154 -162 MHz each second. In a study of 966 children aged 9-18 years old, motor function, memory and attention were significantly worse in the exposed group. Children living in front of the station had less developed memory and attention, their reaction time was slower and their neuromuscular endurance was decreased. The RMS field levels at their houses were low, typically only 1V/m, and a maximum level of 6V/m or 10 mW/cm<sup>2</sup>. [13] In a study near the Latvian radio station, differences in micronuclei levels in peripheral erythrocytes were found to be statistically significant in the exposed and control groups. This is possible evidence of genetic changes caused by non-thermal levels of pulsed radio-frequency radiation.[14] Reports linking RF energy with asthenias had been reported by Charlotte Silverman back in 1973, and again in 1980, as what she called "radio wave sickness".[15]

**Maximum exposure levels:** At cellular telephone frequency bands of 900 MHz and 1.8 GHz, the current UK NRPB investigation levels raised the UK permitted levels to 10 Watts per Kg in the head. The 1991 USA ANSI/IEEE C95.1 guidelines set the SAR at 1.6 W/Kg, and the CENELEC pre-standard states 2 W/Kg for the public. GSM Cellular-phones can deliver well over 2 W/Kg into head tissue during their output pulses, but they are said to comply because the average power is only about one-eighth of the pulse power (GSM & PCN digital phones), as up to eight calls share one channel using Time Division Multiple Access (TDMA) with each handset pulsing in one of eight time slots.

Unlike the earlier analog phones, the digital GSM ones emit a series of short pulses at a basic repetition rate of 217 Hz. Pulsed microwaves have been shown to be more biologically active than continuous radiation of the same frequency and power level. Take an operating digital GSM mobile-phone near an ordinary medium wave radio and you will hear a buzzing noise. These pulses are also picked up and detected by the cells inside the user's and other nearby people's heads. In fact, up to 80% of the transmitted power can be absorbed by the user's head, which means that their brain cells are being "hit" by these radiation pulses two hundred and seventeen times every second.

In addition, GSM digital phones and the new DECT cordless phones also both put high levels (several microtesla) of low frequency magnetic fields into the user's head. These may be more responsible for the dementia (memory) effects than the pulsed microwaves. The newer American Code Domain Multiple Access (CDMA) system works differently and doesn't emit the sharp-edged low frequency magnetic pulses. The digital RF signal more resembles a noisy analog signal and is also likely to be less bioactive. There is increasing pressure for Europe to replace the TDMA GSM system with a "third generation" CDMA system within the next ten years. The NRPB, and others, average the power from a digital phone over 1 second, and so divide the pulse power by eight. They correctly argue that the tissue has time to cool down between

pulses, and then go on to deduce that no damage will therefore take place. This is similar to saying that placing a hammer on a "cell" (an egg, for example) exerting a small steady force, will produce the same effect as hitting the egg, using eight times the force briefly once a second. As most practical engineers know, when trying to loosen a stuck nut and bolt, the effect of constant pressure on the spanner is FAR LESS than when tapping the spanner with a hammer. In 1993, as the NRPB raised its permitted microwave levels, two military research bases in the USA reduced their permitted levels of radio frequency exposure (30 MHz to 100 GHz) from  $100 \text{ W/m}^2$  ( $10 \text{ mW/cm}^2$ ) down to  $1 \text{ W/m}^2$  ( $0.1 \text{ mW/cm}^2$  or  $100 \text{ } \mu\text{W/cm}^2$ ). This is because they acknowledged that there is now an overwhelming body of published evidence for the existence of non-thermal biological effects of high-frequency radiation. [16]

**Some non-thermal effects:** Important non-thermal biological effects have been demonstrated which could account for the development of cancer, asthma and the lowering of male fertility. Cell membranes carry charge and surface receptors (usually proteins) are highly charged. Signals are transduced into the cell interior where growth, development and cell division are regulated by processes which involve ions. These features have been shown to alter their behavior in the presence of imposed external electromagnetic fields. Documented changes include alteration of the permeability of the cell membrane, alteration of the signal transduction processes which regulate cell behavior and involve calcium ions, ornithine decarboxylase, protein kinase C and cAMP. One study has indicated that microwaves can alter DNA synthesis, enzyme activity, ion transport, cell proliferation and the cell cycle [17].

Low frequencies (generated by the pulsed nature of GSM cell-phone signals -217, 32 & 2 Hz) have been previously shown to lower lymphocytes ability to 'mark' cancer cells and to depress the ability of other lymphocytes to destroy the 'marked' aberrant cells. Low level microwaves have also been shown to alter both the immune response [18] and EEG activity [19] in rabbits. Microwaves at only  $1 \text{ mW/cm}^2$  (one-tenth of the NRPB Guidance level) have been shown to affect cAMP-independent kinase activity [20], and calcium ion ( $\text{Ca}^{2+}$ ) efflux from chick cerebral hemispheres [21]. Continuous digital GSM phone operation near fertilized chicken eggs kill most of the embryos [22].

Cancerous tissue has increased conductivity compared with normal tissue. In 1974, Dr. John Holt, the first Medical Director of the Institute of Radiotherapy and Oncology of Western Australia, and Dr. Nelson were able to show that the specific effect of RF energy on cancer was to radiosensitize a malignancy. Some cancers could have their radio-sensitivity increased by a factor exceeding 100 times. As non-electrical heating of cancer cells to  $41.8^\circ\text{C}$  increased radio-sensitivity by a factor of 2 to 3 and 434 MHz increased sensitivity by 100 to 150 times at less than  $38^\circ\text{C}$ , this is a non-thermal effect. Every cancer demonstrated an increase in sensitivity; those normally treated with radiotherapy showed a maximum; those not usually treatable by X-ray therapy were minimal. [23]

Dr. Peter French of the Centre for Immunology, St. Vincent's Hospital, Sydney, Australia, has been carrying out experiments on a range of human and animal cell lines using 835 MHz exposure at  $4.9 \text{ mW/cm}^2$ , 3 times per day for 7 days. He has shown effects on cell growth, shape, secretion of histamine and gene transcription. Dr. French is the immediate past President of the Australia and New Zealand Society for Cell Biology. [24]

Microshield Industries launched a new EMF shielding mobile phone case range in 1996. Even "Industry" tests show that it does typically reduce the power absorbed by the user's head by around 20 dBm (i.e. by a factor of around 99%). Many purchasers of these Microshield cases are now expressing delight at having found a way of using their phones without apparently experiencing short and medium term adverse side effects. There are now other firms (e.g. Nett Ltd.) manufacturing shielding devices and even some manufacturers (e.g. Hagenuk) producing "low leakage" phones. Almost all the major manufacturers have now patented and produced 'low radiation into the user's head' models! (*See page 110 for Additional Information...ed.*)



**Base station masts:** There is currently growing public concern about the number of base station masts that are being erected, and the effect these may have on both health and on property values. The field strengths from masts is low and is unlikely to be more of a problem than any other form of RF data communications., however increasing worries are surfacing about all levels of RF energy, especially when digital signal bursts are transmitted. When one looks at what few epidemiological studies that have been done to date on RF/MW (radio frequency electromagnetic energy) human exposure, there is ample evidence of adverse health effects to warrant concern. The UK NRPB regularly uses the words “substantiated”, “firm”, and “proven” evidence regarding the results of epidemiological (i.e. of populations of people) studies. Epidemiological studies on human populations do not, and generally can not, look for “proof” or “substantiation” but increases in incidence of a disease, or relative risk ratios.

Epidemiological studies on tobacco and asbestos did not “prove” that these carcinogens cause cancer; they do show, however, a significantly increased risk of developing cancer from exposure. This is not “substantiation”, but that did not prevent the health authorities from taking corrective action. It is unfortunate that with electromagnetic radiation, however, industry and its supporters insist an absolute cause - effect relationship must be proven before corrective action be taken.

***The following recent studies do not “substantiate” anything in relation to exposure to RF/MW; they are dealing with the increase in incidence of adverse health effects such as cancer. They are, however, relevant and should be taken into account when formulating policy:***

a) A preliminary study by Dr. Bruce Hocking compared cancer rates in three municipalities within a 4 km radius of Sydney TV towers with rates in adjacent areas further away. The study found children living within the 4 km radius had a relative risk of 1.6 for leukemia, compared with the control group. The RR for mortality was higher at 2.3, and highest at 2.8 for lymphoblastic leukemia. [25] The calculated power levels were around 0.02 to 8 mW/cm<sup>2</sup>.

b) In 1987, a similar study identified higher rates of cancer among those living near the TV and radio broadcast towers in Hawaii. Drs. Anderson and Henderson of the Hawaii Department of Health found in residential areas with 12 communication towers, a relative risk for cancer, including leukemia, of 1.375 (37.5% increase). [26]

c) A study of cancers around the BBC Sutton Coldfield transmitter mast (Dolk, et al, 1997) found a statistically significant doubling of adult leukemia within 2 km, and a significant decline in risk with distance up to 10 km from the mast was also found for skin cancer. The decline with distance was also observed at 20 other high power masts, but no significant increase in overall incidence was found. [27]

d) An earlier study in 1982, conducted by Dr. Morton of the University of Oregon’s Health Science Centre found parallel trends in his study of cancer and broadcast radiation in Portland. [28]

e) Dr. Stanislaw Szmigielski, a leading epidemiologist with the Centre for Radiobiology and Radiation Safety at the Military Institute of Hygiene and Epidemiology, Warsaw, Poland has been the team leader for an on-going study of the health effects of RF/MW exposure of military personnel in Poland for the whole military population. His research found that young military personnel exposed to RF/MW radiation had more than eight times the expected rate of leukemia and lymphoma. Careful surveys of exposure revealed that 80 - 85% of the personnel were exposed to an average of less than 42 microwatts/sq. cm., with a median point near 7 microwatts/sq. cm. [8]

f) Quellet-Hellstrom and Stewart (1993) found a statistically significant 3.3 fold increase of miscarriage amongst US physiotherapists using microwave diathermy compared to a non-exposed control group. The incidence increased with the number of monthly treatments, which

could suggest a cumulative effect. With about 10 treatments per month, the exposure was about 0.04 to 0.56 microwatts/sq. cm. [29]

g) Shandala et. al. (1979) found that calcium ion efflux varies in living animal cells at 10 microwatts/sq. cm. and this level also produces brain activity changes. [30]

h) Prof. von Klitzing (1995) found changes to human brain EEG with a signal of 217 Hz modulation on a 150 megahertz (MHz) carrier with an external exposure of about 2.5 microwatts/sq. cm. [31]

(i) Professor John Goldsmith, at Ben Gurion University of the Negev, Israel, has collected evidence of several exposures to microwaves which produced elevated risks of a wide range of cancers, including childhood leukemia in children of staff, and cancers in the staff and partners at the US Embassy in Moscow and other eastern European US embassies. These cancers were associated with a reported maximum exposure of between 5 and 15 microwatts/sq. cm. and mean exposures between 1 and 2.4 mW/cm<sup>2</sup>, recorded near the outside walls of the embassy. Personnel exposures inside the building were estimated between 0.2 and 0.5 mW/cm<sup>2</sup>. [32]

j) To quote from Dr. Neil Cherry's (New Zealand) recent book: [33] "With these and dozens of other epidemiological studies of large populations and large numbers of workers occupationally exposed to RF/MW radiation, showing statistically significant increases of a wide spectrum of cancers, there can be little or no doubt that chronic low level exposure to RF/MW radiation produces increased cancer risk."

k) The Latvian pulsed radar station study mentioned earlier in this talk.[13]

**Who can the public turn to for advice?:** Part of my remit was to answer the question whether the public should be suspicious of soothing statements from people responsible for advice on these matters.

Dr. Alastair McKinlay, of the UK NRPB, is the vice-Chair of the 'Expert Group' set up by the European Commission. He is quoted as stating: "What is now required is a lot more research in the microwave frequency part of the electromagnetic spectrum, where mobile phones operate. This is not because there is concern about health effects, but that such research makes sense to quell any public concern." [34] The EC Committee has recommended a 24 million ECU (about £20m) funding program for research into mobile phone safety.

Dr. John Stather, Asst. Director of the NRPB was recently quoted in several press articles [35] as admitting: "Until recently, we believed any harmful effects from microwaves were due to their heating effects, which would be negligible at the low powers used by mobile phones. Now there might be another effect at work and we are much less certain."

**Conclusions:** Powerwatch believes that, although much more research needs doing, regular mobile-phone use is likely to have adverse health consequences in many people who use them.

The newer, digital, ones are likely to have more biological effects than the older, analog, ones.

Although existing evidence does not yet conclusively prove that there are any long-term adverse health implications, we feel that we need to advise people to use them as little as possible.

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34. *Electronics and Wireless World*, p. 821, Nov. 1996.
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## Cellphone Power Ratings Comparison

### Microwave Radiation Specific Absorption Rate (SAR) Defined

SAR (specific absorption rate) is an indication of the amount of radiation that is absorbed into a head while using a cellular phone, the higher the SAR rating the more radiation that is absorbed into the head.

A SAR value is a measure of the maximum energy absorbed by a unit of mass of exposed tissue of a person using a mobile phone, over a given time or more simply the power absorbed per unit mass. SAR values are usually expressed in units of watts per kilogram (W/kg) in either 1g or 10g of tissue.

You can find your phone model number at the back of your phone under the battery. **The FCC maximum radiation load SAR limit on a cell phone is 1.60 Watts/kilogram of user body weight. (Calculated for adults, NOT children!!...jb)** An English study says children should not use cell phones <[www.iegmp.org.uk](http://www.iegmp.org.uk)>

**Note that in the lists below the cellphones with the lowest SAR values emit the lowest amount of radiation.**

**Head Level Cellphone Antenna SAR Level Intensity:** The results below are the highest rating with the phone next to the ear. -The FCC did not put on their website SAR data on phones certified before 1998. You can e-mail the manufacturer of your phone and tell them you want the SAR data on your phone. Some manufacturers' emails are at the end of this article. In Europe, the European Council Recommendation 519/1999/EC for exposure guidelines has adopted the recommendations made by the International Commission on Non-Ionising Radiation Protection (ICNIRP Guidelines 1998). In the US, the FCC, Federal Communications Commission, sets the radio frequency safety guidelines that all phones must meet before being sold in the US. Current reference standards and limits (status January 2001)**SAR Information:** Models will begin to be reported after 10 th of October 2001. This is based upon the new harmonized CENELEC testing standard EN50360/1 which was adopted in August 2001 .

In relation to models currently in production on 1st Oct 2001, for countries that have adopted the ICNIRP limits or have no national regulation, manufacturers expect to complete the provision of SAR information by 31st March 2002. In the case of countries with unique standards or regulations, these will be treated on a case-by-case basis.

There is concern at the moment over the use of cellular phones and their possible health implications. All the research is inconclusive so the bottom line is, cellular phones may be a potential health hazard. Because of this uncertainty major governments throughout the World are recommending that users adopt The Precautionary Approach:

The British Government supported the Stewart Group in their conclusion: "We conclude therefore that it is not possible at present to say that exposure to RF radiation, even at levels below national guidelines, is totally without potential health risks, and that the gaps in knowledge are sufficient to justify a precautionary approach. ***Latest British Position: See "Phones CAN make you ill", by Fiona McRae, Daily Mail - Britain, September 12, 2005*** [http://www.dailymail.co.uk/pages/live/articles/health/healthmain.html?in\\_article\\_id=362073&in\\_page\\_id=1774](http://www.dailymail.co.uk/pages/live/articles/health/healthmain.html?in_article_id=362073&in_page_id=1774)

The French Government, following a similar intense review of research, recommended in January 2001 that users should adopt an approach based on the Precautionary Principle with the general overall objective of reducing average exposure of the public to the lowest possible level.

The Food and Drug Administration (FDA) in the US announced in October 99 that: "***The cellular industry should design mobile phones in a way that minimizes any RF exposure*** to the user that is not necessary for the device to function"

So how can a concerned user adhere to the precautionary principle and reduce the threat from potentially harmful radiation ? Please checkout the cell phone website link below, and the information on page 110, for types of shielded headsets, and cellphone radiation shields available. Considering personal usage, and exposed antennas vs enclosed antennas, flip top phones ***with exposed antennas away from head, are best. Additional features of importance are speaker phone and headset capabilities.***

The SAR rating of phone models is now being displayed on all mobile phone packaging in both the US and the UK, which will enable users to make informed choices when purchasing a handset. The website <[www.sarvalues.com](http://www.sarvalues.com)> brings this important information free of charge to all cellular users and also provides useful links to other Websites containing information. The SAR values, indicated below, are primarily useful for high and low comparisons.

### **TEN HIGHEST SAR RATING CELLPHONES**

Maximum Absorption is 1.6 w/kg Averaged in 1 gms of Tissue (IEEE\ANSI)

| <u>Manufacturer &amp; Model</u> | <u>SAR rating W/Kg</u> |
|---------------------------------|------------------------|
| Motorola V120C                  | 1.55                   |
| Motorola V70                    | 1.55                   |
| Motorola P8767                  | 1.55                   |
| Motorola ST7868                 | 1.53                   |
| Motorola ST7868W                | 1.53                   |
| Panasonic Allure                | 1.51                   |
| Ericsson T28 World              | 1.49                   |
| Nokia 5170i                     | 1.49                   |
| Panasonic EB-TX210              | 1.49                   |
| Panasonic EB-TX220              | 1.49                   |

TEN LOWEST SAR RATING CELL PHONES

| <u>Manufacturer &amp; Model</u> | <u>SAR rating W/Kg</u> |
|---------------------------------|------------------------|
| Motorola MPx200                 | 0.2                    |
| Motorola Timeport L7089         | 0.22                   |
| Qualcomm pdQ-1900               | 0.2634                 |
| T-Mobile Sidekick               | 0.276                  |
| Samsung SGH-S100                | 0.296                  |
| Samsung SGH-S105                | 0.296                  |
| Sony Ericsson Z600              | 0.31                   |
| Mitsubishi G360                 | 0.32                   |
| Siemens S40                     | 0.33                   |
| Motorola ST7790                 | 0.34                   |

NOTICE: The websites below gives SAR evaluations of many additional cellphone models, too numerous to mention here. Please contact it for additional details and information

Links to other Mobile Phone SAR Data websites

<http://sarvalues.com/>

CONTACT INFORMATION FOR SOME CELLPHONE MANUFACTURERS

**Audiovox**  
 800/645-4994  
 acc\_customerservice@audiovox.com

**Denso**  
 southfieldpr@denso-diam.com  
**Ericsson**  
 800/374-2776  
 questions.se@support.sonyericsson.com

**Kyocera (Qualcomm)**  
 800/349-4478  
 phone-help@kyocera-wireless.com

**Mitsubishi**  
 service@mitsubishiwireless.com

**Motorola**  
 800/331-6456  
 rfhealth@motorola.com & <http://www.Motorola.com/rfhealth/sar.html>

**Nokia**  
888/665-4228  
CustomerCare@NokiaUSA.com

**Panasonic**  
pan18766@pas.mei.co.jp

**Sanyo**  
webmaster@dt.sanyo.co.jp

**Sony**  
questions.se@support.sonyericsson.com

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## Articles On Potential Hazards Of Microwave Radiation

### Potential Hazards of Low-Level Microwave Radiation

**NOTE:** This letter sent by Bill P. Curry, Ph.D to the editor of the Glen Ellyn News, Glen Ellyn IL

**Editor:** I am a former staff physicist at Argonne National Lab. This letter is in response to the letter of Jeffrey Gahrin in the Oct. 9, 1998 issue, titled "Water tower heats up." Jeff Gahrin stated "An Internet search revealed that 'studies' have found dangers, but the evidence put forth has not been accepted as good science." I challenge that statement. Gahrin should read the frequently asked questions (FAQ) by Dr. John Moulder at the Medical College of Wisconsin, (as I think he did) but disregarded Moulder's comments and read his references instead. I have been investigating this issue since early spring (1998), have read numerous papers from refereed journals, some of which I shall cite here, and have attended two scientific meetings dealing with this and related subjects, and I think a consistent picture of vulnerability is emerging.

There are some electrosensitive individuals who have allergy-like responses when exposed to microwave radiation and some other forms of EMF radiation, as well. I have personally met a number of these people, and a journal article about their plight to which I have just been referred is C.W. Smith, R.Y.S. Choy and J.A. Monro: "The Diagnosis and Therapy of Electrical Hypersensitivities," *Clinical Ecology* 6:119-128 (1989).

In vitro studies in the laboratories of Professors Martin Blank and Reba Goodman at Columbia University have shown that low level sinusoidal magnetic fields can affect biological enzyme reaction rates, and cells go into a protective mode when bombarded with AC magnetic fields and generate "heat shock proteins", which are nature's way of protecting cells against lethal and environmental stresses. The fluctuating magnetic field intensities in which these events occur are quite low and the frequency range extends over several thousand Hz, incorporating the frequency range of audio modulation of cell phones and the pulsing rate (approximately 200 Hz) of PCS phones. Their work is cited in *Cell Stress and Chaperones*, 3: 79-88 (1998) and *Bioelectromagnetics* 18:111-115 (1997).

In four different laboratories (Lawrence Berkeley National Lab, University of California Riverside, US. Environmental Protection Agency Lab, and Battelle Pacific National Lab) investigators have found low level sinusoidal magnetic fields can block the ability of Melatonin and Tamoxifen to inhibit breast cancer cell growth. This work is too recent to be published yet, but I heard papers on it in a recent meeting in Tucson. Also, Mice that were genetically predisposed to have lymphatic cancer were found to be more likely (by a statistically significant ratio) to develop cancer in the presence of fields simulating pulsed cellphone radiation than predisposed mice not exposed to the radiation. M.H. Repacholi, A Basten et al: "Lymphomas in Eμ-Pim1 Transgenic Mice Exposed to Pulsed 900 MHz Electromagnetic Fields" *Radiation Research* 147:631-640 (1997).

DNA strand breakage and failure of DNA repair mechanisms upon exposure to electromagnetic fields have been reported in several articles, one of which is H. Lai and S.P. Singh: "Acute low-intensity microwave exposure increases DNA single strand breaks in rat brain cells," *Bioelectromagnetics* 16:207-210, (1995). Another is H. Lai and S.P. Singh: "DNA Single and double strand breaks in rat brain cells after acute exposure to low-level radio frequency electromagnetic radiation." *International Journal of Radiation Biology* 69:513-521, (1996). Microwave fields were found to increase the mutation rate of DNA in the presence of a carcinogen over that due to the carcinogen alone. A Maes, M Collier et al: "954 MHz microwaves enhance the mutagenic properties of mitomycin C." *Environmental Molecular Mutagens* 28:26-30, (1996).

Epidemiological studies have shown that Children living near a certain radar installation were more prone to leukemia than the general population, S. Milham: Leukaemia clusters, *Lancet* 2, 1122 (1963). In ham radio operators classified by age and license class (experience level), the technician class (experience level just beyond novice permits more powerful transmitters) has 60% higher standardized mortality rate due to leukemia than the general population, in S. Milham: Carcinogenicity of Electromagnetic Fields, *European Journal of Oncology* 3: 93-100 (1998). c) Epidemiological data from all over the world showing an association of cancer and other maladies are analyzed in J.R. Goldsmith: "Epidemiologic evidence relevant to radar (microwave) effects," *Environmental Health Perspectives* , 5:1579-1587 (1997). Also, Dr. Goldsmith has compared microwave radiation, including cellphone radiation, with other public health issues in J.R. Goldsmith: "From sanitation to cell phones: participants and principles involved in environmental health protection," *Public Health Reviews* 25: 124-149, (1997).

Published on Oct. 16, 1998 under the title "Scientist Warns of Antenna Radiation."

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email: <bpcurry@att.net> Home page: <<http://www.EMSciTek.com>>

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### **First Cell Phone-Headache Study Out**

Bruce Hocking, "Preliminary Report: Symptoms Associated with Mobile Phone Use," *Occupational Medicine*, 48, pp. 357-360, August 1998.

"Forty respondents from diverse occupations described unpleasant sensations such as a burning feeling or a dull ache mainly occurring in the temporal, occipital or auricular areas. The symptoms often began minutes after beginning a call, but could come on later during the day. The symptoms usually ceased within an hour after the call, but could last until evening. Symptoms did not occur when using an ordinary handset, and were different from ordinary headaches. There were several reports suggestive of intracranial effects....75% of cases were associated with digital mobile phones." (See Microwave News for May/June 1997 and May/June 1998)

From Microwave News, pg 13, Nov/Dec 1998. Printed with permission of Microwave News, P.O. Box 1799, Grand Central Station, New York, NY 10163, Ph: 212-517-2800, fax 212-734-0316, email: <[mwn@pobox.com](mailto:mwn@pobox.com)>, website <<http://www.microwavenews.com>>

**Finagle's Creed: Science is Truth -- don't be misled by facts!**

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## Of Mice and Men

Stewart Fist, Independent Australian Investigative Journalist

My column (5/97) on the dangers of GSM-pulsed cellular phone radiation raised the hackles of many people in the industry. I was flooded with e-mails on the subject, mostly from engineers. By far the most common objection was that the Adelaide Hospital research[1] was conducted on mice. They want human proof. Taking each e-mailer as a volunteer, I now have 400 engineers willing to be caged and zapped with radio for a year or two, before being autopsied for tumors.

The cellular phone industry thinks it is on a winner with this Men-Aren't-Rodents line. In the USA, the industry association has put out an advisory to carriers, telling them how to counter the Adelaide Hospital findings. This memo states: "The mice were exposed to radiation that was more than 1,000 times higher than average exposure in the service area covered by a typical cell site". They forgot to mention that exposure power-densities matched the average on the side of the head. But the main thrust of their counter-attack is at the use, not only of mice, but specially sensitive mice. So here, I am just going to answer some of the more obvious objections raised.

***\*\*The mice were "genetically engineered to have cancer" and were "injected with a cancer gene" - so this can not be related to humans or to cell phone users.\*\****

There are a few different ways to look at this, all equally valid.

The first is to point to our legacy of 150 years of medical research, and the fact that the mice here are 'detectors'. In any investigation trying to determine a cause-effect relationship, scientists will use the most sensitive detectors available at the time because they don't have forever to prove a point. Obviously this study doesn't attempt to answer all questions about human cell-phone interactions. It just tries to solve, once and for all, the question whether cell-phone radiation can promote tumors. For years the cell phone industry has been denying this is possible, despite the accumulation of evidence. So, this is just another paper on the pile -- but it has probably caused the pile to reach critical mass.

The second approach is to put the transgenic stuff in perspective. Twenty two of the 100 unexposed mice got cancers, and 43 of the exposed group. This is a high rate of cancers in 18 months. However it is not the absolute numbers that matter, but the fact that the radiated group \*doubled\* their cancer formation -- and we now know that these problems are cumulative. If the experiment had continued, even more would have died, but probably the ratio would remained much the same. This strain of transgenic mice was bred in Amsterdam in 1986 by genetic breeding over ten years. Note: I said 'sensitivity' not 'susceptibility'. There are many laboratory strains of normal mice which have very high tumor rates naturally (high susceptibility: low sensitivity). They have tumor rates far higher than these transgenic mice. In fact, the transgenic 'detectors' are a modified strain of low-susceptible mice, engineered to be highly sensitive to lymphomas. In engineering terms, these mice would be said to have a high signal-to-noise (sensitivity) ratio. You must be careful not to make assumptions here about absolute noise levels. So these results says to me that the dangers inherent in 18 months of handset radiation were equal in weight to a decade of special sensitivity breeding. And that worries the hell out of me. Translated to humans, it probably points to the increased dangers that perhaps the top percentile (in terms of susceptibility) of the population may have. That is, say, 40,000 of the 4 million cell-phone users over with a couple of years of use. I don't think we can abandon this group lightly.

Thirdly, it should be pointed out that, in the control group, only 22 of the hundred mice had cancers in their 18 month lifetime. Normally mice live two years or so, so roughly a quarter of the controls had cancer and half of the exposed group. Humans live 80 years, and we know that roughly one-quarter of us get cancer at some time. This means that the mouse

susceptibility-rate is high, in terms of \*years\*, but not in terms of \*life-time exposures\*. Fortunately these days, medical intervention keeps human mortality rates low, but, in life-time terms, these 'susceptible' mice are a reasonably good proxy for human cancer invasion rates.

***\*\*It was an experiment which says nothing about actual use.\*\****

The advisory put out by the US Cellular Telephone Industry Association (CTIA), says: "The investigators themselves emphasized that the design of the study was experimental and the findings cannot be related to human health or to the safety of wireless phones." This instantly raises the question: Why then, did they bother to do it? After all, Telstra funded it to the tune of half a million dollars, so you'd think there was some relevance! Perhaps they were just funding a holiday home for retired laboratory mice? And, gee whiz! Fancy that. A research program designed to be "experimental"! In fact, the Adelaide research is more than just significant -- both to humans and to cell phone use. As reported, the results are above the 1 percent level of confidence usually credited by scientists as being "highly significant", and humans get cancers in the same way as mice. DNA is DNA.

***\*\*This study exists in isolation -- it needs replication.\*\****

All studies need replication; and replication of the replication; and then replication of those findings, if you've got the funds. The cell phone companies have the funds, but they don't fund replication studies -- not when adverse effects are found, anyway. Telstra has known about this study for at least a year, but I haven't heard about their plans for replication. The CTIA suggests that, whenever questioned by a journalist, the carriers quote the phrase: "The results of no single study can be conclusive and must be replicated to see if the same results occur." . This sounds reasonable, if you haven't been following the cell-phone health research for a few years, as is the case with most journalists. However those of us who have been following this, and the tobacco industry controversy, will find this mantra surprisingly familiar. The Adelaide Hospital research follows the Lai-Singh study in Seattle (among many others) which showed a radical increase in double-strand DNA breaks in rat-brains following 2 hours of exposure to microwaves. The year before Lai and Singh had reported a large number of single-strand breaks, and the year before something similar .... and so on back to the 1990s. So, to a degree, this work just confirms Lai-Singh and a large number of other cell (in vitro) and animal (in vivo) studies showing cancers and other complications following reasonably low level exposure to microwaves. The US defense forces have been doing such work for years, as have the Swedes, and the Russians before them. I also have a dozen other more recent independent studies I could show you, including a large number by Dr. Ross Adey and Dr. S.F. Cleary dating back to the '80s, and more recent work on direct DNA effects by Dr. S. Sarkar in India, and others. These studies all show the same thing. Microwaves can drastically alter DNA and it is highly likely that they cause or promote cancers -- specifically lymphomas, leukemias and breast cancer - even though, in population terms, the result may be low in incidence. However we've only had cell phones for a few years. In every case when such a discovery is announced, the industry and government reply has been to utter in strangely mechanical tones: "This is a single study. More research needs to be done. Replicate. Replicate. Replicate" *But then no one funds the replication.*

***\*\*No one is able to identify any specific disease linked to cell-phone use.\*\****

Non-ionizing radiation seems to be related to a wide range of diseases and conditions, such as Alzheimers, head- and jaw-aches, sleep and attention disorders (melatonin), and skin and allergy problems. The spectrum of possible effects is so wide that it looks suspicious. To one side in the debate it looks suspiciously like psycho-somatic problems, and to the other side it looks suspiciously like the broad-spectrum effects of cigarette smoke.

***\*\*Why are the scientists involved not taking a more active political position, if the findings are so significant?\****

This must be the only time in recent history when so much money and energy has been put into convincing the media that important research is of little value -- by the funding organization, Telstra, and by those directly associated with the research! It is important to realize that the scientists involved in studies of this kind often have a vested interest in hosing down the story; they know this is a highly politicized issue. Scientific professional reputations rest on appearance of "caution"; science assumes skepticism. So they generally assume the "academic-non-believer" role, and fear the press will sensationalize their results with "Cell phones give you cancer" stories. The best way to achieve this balance is to be seen as reluctant virgins. But they ought to remember their basic physics: nature abhors a vacuum.

#### Reference:

[1] Repacholi et al., Lymphomas in mice exposed to 900 MHz pulsed EMFs, *Rad. Res.* 1997;147(5):631- 640

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### Possible Adverse Health Effects From Cellular Phone Use

#### Don Maisch

**Quoted from the Australian Government Discussion paper, 26 March 1997:** (Strategy for an Australian research program into possible health issues associated with exposure to communications equipment.) Prepared by the Department of Communications and the Arts, Department of Health and Family Services, Australian Radiation Laboratory, Therapeutic Goods Administration, AUSTEL and the CSIRO:

"Human exposure to RFR is greatest from mobile phone handsets because of the method of use, with the transmitting antenna of the mobile phone handset close to the head. There is evidence that localized hot spots of energy deposition in the brain may occur as a consequence of internal reflections. Therefore, it is most appropriate that some studies focus on the pulsing conditions employed in the Global System for Mobiles (GSM) operation at both 900 and 1800 MHz, the conditions which apply in the Australian mobile phone network. Possible synergism between RFR exposure and other factors should also be considered."

Quoted from U.S. Industry magazine Radio Communications Report, 3 March 1997. Quoting Michael Volpe, spokesman for Wireless Technology Research (WTR), formally known as the Scientific Advisory Group (SAG), an industry-funded research group set up to conduct RF cancer research on behalf of the Cellular Telecommunications Industry Association (CTIA):

"In fact the SAG and WTR have repeatedly made public statements which confirm the contention that existing data and studies do not rule out the possibility that cellular telephones cause ill health effects such as brain cancer."

Quoting The Washington Post, 6 April 1997, in the article "*Still Waiting for the Call - Do Cellular Phones Cause Brain Tumors? Researchers' Inability To Provide an Answer So Far Is Only Raising More Questions*".

"Motorola's head of cellular operations at the time, Edward Staiano, told reporters that "thousands" of studies showed there was no link between cellular phones and ill-health effects. That was something of an overstatement: While studies on the health effects of radio

waves were indeed common, the industry could not cite any studies in which cellular telephones specifically had been tested for their impact on human tissue or organs."

Quoting Dr. Bruce Hocking, former Chief Medical Officer for Telecom, during the 7:30 Report of 7 May 1997, discussed the Royal Adelaide Hospital mice study which found over a two-fold increase in cancer in the mice exposed to a digital phone frequency

"This is an indicator that exposure to mobile phone frequencies, such as could be used by mobile phone users, seems to dispose to the development of cancer."

On 7 May 1997 Dr. Hocking presented the results of a study of neurological symptoms in 40 mobile phone users. When asked about this study on the 7:30 report of May 7, he replied:

"Yes, these are studies I've been doing on people who use mobile phones and who develop symptoms when using the phones. This arose from some other observations I've made when working for Telstra that staff and some customers were developing symptoms. I've now followed that up with a detailed survey of over 40 people around Australia who have developed symptoms. They complained mainly that they developed a burning or dull feeling on the side of the head where they have using their mobile phone. It tends to come on several minutes after they made their call and may last for hours. Associated with this they may get feelings of nausea, disturbances in their vision and, at times, other neurological symptoms."

When asked by the 7:30 Report presenter "With all due respect to these people, how do you know they are not just psychosomatic symptoms?" Dr.Hocking replied:

"Yes, this question has been asked by quite a few people. First of all there is the consistency of symptoms. People from all over Australia with no connections, produce a rather similar story. Secondly, there are now reports coming from overseas, Scandinavia, Great Britain and America of people getting similar kinds of symptoms. Thirdly, there is a statement from the Dept. of Communications recently out about the development of "hot spots" in the brain. This means a concentration of energy which would give a possible explanation for these symptoms. Fourthly, and most interestingly, these symptoms were in fact observed over 30 years ago in a lab set up."

Presenter, 7:30 Report: "Bruce Hocking, while all these studies are proceeding, what about the issue of prudence, particularly for young kids, with fast growing cells, using mobile phones.?"

"Well, I think this is one of the things which should be taken on board, arising from the Adelaide and other studies. That whilst we might seek to set perfection with further studies, there is already some information there which must strike a cautionary note for many people. This would lead to strategies of prudent avoidance, for example, I think there should be restraint on the marketing of mobile phones directly to young children."

Presenter, 7:30 Report: "You, I think, Are critical on the way the government has approached this. What is the basis of this criticism?"

"I think that if you look at the overall policy management of this issue, of both the health and public concern that goes with it, there's a couple of things. First of all, I think it's a mistake to put the major responsibility for this issue into the Department of Communications and the Arts. They have a potential conflict of interest. They are a major revenue raiser for the government, from license fees as well as the proposed sales of Telstra and of future frequencies for mobile phones. They would not be wanting to create too much concern that some of these products may be unhealthy to the public, as that would impact on their revenues, and yet they are responsible for the dissemination of information regarding this. I think it would be fairer to the government and the public alike if the responsibility for all health - health public issues were moved firmly into the Department of Health, in the Public Health Branch area and administered out of there."

(Dr. Bruce Hocking on the 7:30 Report, 7 May 1997)

Quoting Dr. Brendon Nelson, Liberal party backbencher, speaking for minister for Health Michael Wooldridge, on the 7:30 Report of 7 May 1997. Discussing the Royal Adelaide Hospital study.

". . . and what it shows is that there is a biological effect from electromagnetic energy, and in particular, that emitted by mobile phones." . . . "In itself, we are aware, and we have quite honestly stated that there appears to be some kind of hot-spot . . . that may be attracted to one part of the brain. Now whether that has an adverse impact, WE DON'T YET KNOW."

And still it keeps coming!!....

This must be the only time in recent history when so much money and energy has been put into convincing the media that important research is of little value -- by the funding organization, Telstra, and by those directly associated with the research! It is important to realize that the scientists involved in studies of this kind often have a vested interest in hosing down the story; they know this is a highly politicized issue. Scientific professional reputations rest on appearance of "caution"; science assumes skepticism. So they generally assume the "academic-non-believer" role, and fear the press will sensationalize their results with "Cell phones give you cancer" stories. The best way to achieve this balance is to be seen as reluctant virgins. But they ought to remember their basic physics: nature abhors a vacuum.

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## Cell Phone Use Considerations

Purchase a cellphone with an **external antenna away from the head** (usually the "flip-top" type cellphone). "**Speaker phone" capabilities are important**, allowing use away from the head. Purchase a phone with the lowest radiation (SAR) output. (See <http://sarvalues.com/>).

If possible, use a cellphone outside. The metal shell of a car or building shields and reduces the cellphone signal strength. This requires a higher power signal to get outside **when you speak**, thus the head is exposed to more intense signal radiation from the phone antenna.

More power is required to transmit a voice message than to receive a message, so try to listen more than you speak.

As cellphone users are aware, cellphone antenna towers can be much further away in the countryside than in the city, and the more distant the tower the more power is required to reach it. Consider that it is estimated that 80% of the power goes into your head!!

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## Birds, Bees, Bat-Rays, Butterflies & Buzzards (?): Electrosensory Organisms

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## Birds

In the Austin American Statesman, Austin TX paper of October 8, 1998, appeared the following article:

2,000 HOMING PIGEONS LOSE THEIR BEARINGS, DISAPPEAR (The Washington Post)

Homing pigeons, as the name suggests, are supposed to find their way home. But more than 2,000 of the creatures have disappeared this week and no one can explain it.

The birds lost their way during two separate homing pigeon races held Monday. Out of 1,800 birds competing in a 200-mile race from New Market, VA to Allentown, PA, about 1,500 have vanished. And in a 159-mile race from western Pennsylvania to suburban Philadelphia, 700 out of 900 pigeons are missing.

Most of the pigeons would have been back in their lofts within a few hours. Although it's not unusual to lose a few birds during a race -- a hungry hawk, for example, might snag a few racers -- this week's loss is extraordinary, organizers of the two events say.

"There is something in the air," said Gary Moore, who was the "liberator" for the 150-mile race, deciding when and where the birds were released. "To lose this many is just unbelievable."

Was it sun spots? A UFO? The currents of El Nino?

It's hard to come up with an answer pigeon enthusiasts say, because no one knows how homing pigeons do what they do.

*>>Disagree here, because lots of research on pigeon homing capabilities has been done. It has been determined that pigeons use about 3 methods 1) visual cues during the day 2) geoelectromagnetic hints, & 3). star patterns at night. Blinded pigeons -- or pigeons in a fog -- still get home and "windmill" slowly in to a landing. Blinded pigeons with tiny permanent magnets attached to their heads produced totally confused birds!.....jb<<*

Moore's theory is that the disappearance may have something to do with CELLULAR PHONE ACTIVITY (my emphasis...jb). It's widely accepted that the pigeons use electromagnetic fields to help the navigate and cellular phone calls might interfere with that process, he speculated.

Most long-distance races are held on weekends when cellular phone activity is lower. But the two races in question were postponed from Sunday to Monday because of rain.

Sun spots also can send the pigeons off course, but the sun activity that day was low, organizers say.

Jim Efftting, who lost 34 of the 37 birds he entered in the race to Allentown, also thinks that something very peculiar must have messed up the birds' innate tracking systems. He says the birds took a wrong turn and could be in North Carolina by now. The three racers of his that finally made it home arrived Tuesday afternoon. They were exhausted, and it was obvious they had been flying lost for hours, said Efftting, who lives in Emmaus, PA.

What's certain is that with each passing day, the chances that the birds will survive are decreasing. Unlike their wild pigeon brethren, these speed machines don't know how to feed themselves in the wild and are easy prey.

**Editorial Note:** An interesting supporting article appeared in the proceedings of a symposium and workshop held in Snowmass-at-Aspen CO, in 1973 [1] and sponsored by the National

Science Foundation in concert with the Neuroelectric Society, the International Institute for Medical and Biological Engineering, Marquette University and The Medical College of Wisconsin :

There is an important chapter in the Proceedings about the action of large flocks of blackbirds and starlings, where hundreds of birds all turn, in milliseconds, and NONE OF THEM COLLIDE [1]. The video shown at the conference illustrated the rapid twisting and turning as the flock flew in close formation. VERY impressive...as though all were of one mind! There was no twisting or wave motion indicative of visual or auditory cues! It was theorized that the birds used some sort of proximity detection sensory system based on microwave phenomena, since the structure of bird feathers was somehow related to microwave antennae! (also see [2])

ABSTRACT: [1]

*The apparently synchronous turning and wheeling of flocks of several bird species, particularly starlings (*Sternus vulgaris*), has long been a phenomena of curiosity and interest.*

*The recent series of reports suggesting that birds may be able to detect the earth's magnetic field makes the hypothesis that turning movements in bird flocks may be coordinated by electromagnetic means more attractive. Such a signal would be instantaneous, could reach all birds in the flock regardless of their position relative to the signal source, and **could carry sufficient information** for turning movements. Analysis of films of turning flocks of birds and experimental studies of startle reaction times in birds in our laboratories have suggested that the electromagnetic radiation model could provide a parsimonious explanation for the observed behavior of the birds.*

There are several other presentations in the above book, relative to microwave sensitivity of living systems to extremely low intensity fields, and I remember one chapter in particular in this area by Dr. C. Romero-Sierra and J. Bigu del Blanco, Dept of Anatomy, of Queen's College in Kingston, Ontario [3].

The above book, while expensive is worth having as an excellent early reference to bioeffects of electric field gradients, magnetic fields, microwave, and air ion effects.

### **Buzzards (?)**

I've noted an interesting phenomenon about 8 miles south-southeast of here (Wimberley, Texas). This tower, each morning and afternoon all summer, has been a prime roosting spot on every cross-member for dozens of vultures (turkey buzzards)!! They may be getting an EMF radiation buzz and/or may be waiting for something to die! Seems quite symbolic, in several ways, of this whole microwave communication and cellphone long-term bioeffects situation. I've noted many communication towers in my travels and have seldom seen birds on any of them. This is the first tower I've noted with so many birds and all of the same species. This might also be a good example of how one can make snap decisions, based on insufficient data and reach erroneous conclusions. Since I'm not familiar with buzzard habits, it may be that the tower is just a convenient elevated roost, on a hill near a highway, where good road-kill scavenging is available. Can't help wondering though....

**Email response from: Bert Dumpe <Bdumpe@worldbank.org>, 11 Nov 1998:**

Jim: I reported on the birds. the story you report verbatim as it appeared in the Washington Post seems to have been edited. The initial WP report put the number of the original population of birds starting the race at 3000. In addition, from their release point in Virginia, the birds were traveling to various destinations; a town in New Jersey, Brooklyn, NY, Allentown and

Pittsburgh, PA. Most of the birds were lost enroute, and a HANDFUL alighted on property along the way or deviation thereto. Rest of the birds were not found, which remains the case to date.

Generally the FIRST report of an incident is the most factual. Thereafter, the cover-up starts and the story is watered down and factual omissions prevail. This seems to be the case in the Texas version of the story. For instance, when the story broke, the bird racers positively stated that (paraphrased) "the electromagnetic RF emissions from cellphone devices and antennas changed the aerosol, which would affect the birds' sense of direction." This positive statement is from people who study bird biology and have sufficient knowledge to know "what environmental pollutants or objects would interfere with the birds' mission and hinder the chances of a successful race."

Re your statement of the "vultures." Interesting, and unusual. Can you send me copies of any pictures you take? This is unusual because generally birds (warm red-blooded) have been avoiding microwave towers, and often when they do alight on the towers large numbers of birds are found on the ground dead. Creatures normally found on towers, up to the height of the antennas, are roaches (cold-blooded). Your hypothesis is probably correct; "the vultures sense death in the air." Sometime ago in one of my newsletters, I reported that birds migrating to Capistrano and points south for the winter disappeared over New Mexico. It is altogether possible that as well as disappearing, the birds are merely falling from the sky as has been reported in various places. In addition, any birds that would pass over the towers will be half dead and easy prey. This is also a reported fact.

As for research on the magnetite in the head of birds, which I mentioned when this lost birds story was reported, this has already been done extensively. In fact, Kaune the researcher who co-authored the Linet NCI powerline study, was one of those who researched this. And you know what this turncoat said about powerline emissions being benign. Researchers at Johns Hopkins and elsewhere already researched biomagnetite in the brain of animals and humans. With the loss of birds, death and deformity of reptiles (e.g., frogs, lizards) one had to be pretty thickheaded, a real bozo, or terribly dishonest not to know that electrification of the air is deadly. The worst is yet to come.

## **Bees, Bat-rays and Butterflies**

**Alasdair Philips <aphilips@gn.apc.org>, 21 Nov 1998**

Our cheap transistor radios can pick up and separate out hundreds of radio signals at levels of a few hundreds of microvolts/metre. More sophisticated communications receivers can work down to levels of about 10 microvolts/metre. Radio-astronomers work on informational signals from stars at less than 1 microvolt/metre - this is a power level of about 0.000 000 000 001 microwatt/cm<sup>2</sup> (1 attowatt/cm<sup>2</sup> !!). We can now detect and create pictures from signals from spacecraft at our outer planets using transmit powers similar to those use by mobile phones of a few watts!

Honeybees have been shown to be sensitive to magnetic flux differences of 1 nanotesla (10 microGauss) [4][Theoretically humans could also be sensitive down to less than this level (pineal thermal noise c. 0.24 nanotesla - Smith, 1985). Various sea creatures can detect voltage gradients of a few 10's of microvolts/metre.

Biological stochastic resonance from regular pulsing EMFs can effectively amplify coherent signals (like power EMFs) by vast amounts.

What arrogant nonsense to suggest that living systems need to be "cooked" before they realize they are being bombarded by signals and that microwaves of 100 volts/metre are harmless to us.



On your butterfly question...many years ago (c.1969) I went to a Friday evening London 'Royal Institution' lecture by Professor Eric Laithwaite of Imperial College London - the guy who developed the principle of the linear electric motor which is now widely used - whose hobby was/is butterflies and moths. At the time everyone was talking about pheromones, and undoubtedly these are used in the mating attraction process, however... he discovered that if the female (I think) was enclosed in a sealed plastic box the mates still appeared from long distances away, but if she was enclosed in a (electromagnetically screened) Faraday cage full of air holes only butterflies who were very close were still attracted. He repeated these experiments on many occasions and came to the conclusion that the patterns on the butterflies wings were actually tuned circuits in the very high microwave region (far-far-infra red) and each variety had its own unique RF/microwave signature enabling mates of the same variety to home in using their antennae and own wing resonators as tuning selectors. The main energy probably came from the sunlight possibly modulated by wing flapping.

Our mainstream, crude, gross, simplification of life into simple electro-chemical building blocks completely misses the mysteries of what "life" is and how sensitive it can be if we open ourselves up to the amazing, wonderful, cosmic universe in which we live. I do not know how we will achieve the paradigm shift in thinking needed but I sense that it is slowly starting to happen. I hope so, anyway. Matthew Fox (USA) and his Creation Spirituality movement is part of the change, along with the deep ecology movement.

... and I am meant to be a down-to-earth nuts-and-bolts engineer!

Hang on in there folks!

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2. Tanner, J.A., Romero-Sierra, C. and Davie, S.J.: "Non-Thermal Effects of Microwave Radiation On Birds." *Nature*, 216:1139, 1967.
3. Llaurodo, J. & Sances, A., et al., "Biologic & Clinical Effects of Low-Frequency Magnetic & Electric Fields" Springfield, IL, Chas. C. Thomas Pub. Co.,1974. Chapter IX, Bigu del Blanco, J. & Romero-Sierra, C., "*Microwave Radiometric Techniques: A Means to Explore the Possibility of Communication in Biological Systems*", pgs. 123-136.
4. Keeton, *British Birds*, 72, 451-70]
5. Bastian, J., "Electrosensory Organisms." *Physics Today*, pgs 30-37, Feb 1994.

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**What you don't know is not half so apt to hurt you as what you know that ain't so!  
.....Old adage**

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Further Comments on EMF Bioeffects Reduction:  
Laptop Computers, Watches and Environment

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I've had a number of recent email inquiries about the long-term EMF bioeffects from laptop computers and other EMF long-term health safety issues, so here is additional information which may help in your various situations

As indicated in this publication, electrical sensitivity, chemical sensitivity, chronic fatigue, and fibromyalgia (and many other symptoms) are often quite closely associated. About 80% of persons with the above sensitivities are women. The Gulf War Syndrome is the latest similar health situation with men which has attracted attention.

One major health factor is cellular resistance to the metabolic T3 thyroid hormone (cell receptors inactive, perhaps due to long-term chemical (pesticides, heavy metal compounds, etc.) exposures, often in youth)...lotsa hypothyroid symptoms, but no indication in the TSH thyroid blood tests, so doctors often mystified about what to do.

It seems that chemicals (natural & artificial--in air, food and/or water) and EMFs are **biological stress factors** most persons, with healthy immune systems, can handle to some extent. Long-term stress, whether mental, physical, or environmental (and the combinations of M/P/E) if severe enough, will eventually affect some body system(s) in a harmful way when the immune system overloads. The symptoms and pathology will vary depending on the individual. That's what drives doctors crazy, when someone, usually a women, comes in with a variety of illnesses. Most medications are designed to treat one specific illness....with more than one illness presents, you have side effect problems and on and on.

But, I repeat myself and digress. Now (finally!) as to laptops and EF and EMF mitigation:

Laptops are preferable, considering electrical field (EF) & EMF intensity levels, over a regular PC with harddrive and monitor. However there are some **important use considerations**:

1. Be sure the laptop chassis is well grounded when you use it. This means a wire from a metal stud or screw in the laptop chassis to a ground in the wall or a copper rod in the ground. Double-check your wall socket to be sure you have a good ground (Not only for laptop, but for every other regular electrical appliance, equipment or light in the house). NOTE that any metal object not grounded will pick up by induction, hold and radiate EMFs and EFs in the vicinity. This includes metal chair frames, metal bed springs and frames, metal trim in lamps, etc.-- use wood, glass or ceramic as much as possible in your total living environment.
2. For the electrically sensitive, and those whose immune system is compromised. It will be of great benefit to have ALL electrical appliances, equipment, or lights in the home/office three-wire grounded -- that is. the power cord should have neutral, hot, and ground wires. This is because there is always an EF around hot wires whether the wires are powering something or not. There is recent research from England ([www.cogreslab.co.uk/](http://www.cogreslab.co.uk/)) indicating that people, and other living things are sensitive to EF changes in the earth environment also! (That is the varying earth EF in which all life evolved)
3. Of course the grounding of a laptop may reduce its portability and use in some cases, so, If not grounded, minimize the use of a laptop (or any wireless transmitting/receiving device, cell phone, pager, computer, etc.) in your lap or near your head (if not grounded--cell phones and pagers can be shielded).

The EMF shielding mobile phone case was developed by Microshield Industries in 1996. It typically reduces the power absorbed by the user's head by around 20 dBm (i.e. by a factor of around 99%). Microshields are available for nearly 100 different models of 17 makes of mobile phones. Radiation is reduced in three ways: 1) Woven polyester/nickel shielding material to reduce microwave and low frequency pulses, 2) Keypad and display utilize a transparent

shielding of fine wire mesh, and 3) Major radiation emission from antenna shielded by the Microshield™ aerial guard. The Microshield™ is priced at £39.95 plus post and packing (\$66.32 at present exchange rate). Contact: Microshield House, 59 Southbury Rd., Enfield, EN1 1PJ, United Kingdom. Ph: +44 181 363 3333, fax: +44 181 372 3232  
email: <sales@microshield.co.uk> website: <<http://www.microshield.co.uk/>>

4. The only shield so far developed that can be used on a laptop would be a small size "glare reduction screen" with the EF ground capability. You can get these at all computer stores for the regular PC monitor (around \$50-\$60). This screen eliminates the EF from the liquid crystal display (LCD) laptop screen. Laptop screens put out lots of EF and not much EMF; PC monitors have lots of both EF, EMF, and ultraviolet radiation (UV). Its very difficult to eliminate EMFs; not difficult to eliminate EFs, especially with a grounded chassis.

5. Since the keyboard is built in to the laptop, your fingers may be getting a lot of EMF exposure from the harddrive under the keyboard. It may be possible to get a separate keyboard and plug it into the laptop for extended desktop use -- also, I seem to remember seeing something recently about the more expensive laptops using a solid state replacement for the harddrive (no moving motor parts).

NOTE: If your EMF sensitivity becomes too severe, you can purchase one of the computerized data projectors for lectures or home theater (2,000-\$4,000). You can remotely project your computer monitor display on a large screen or wall and only have, on a long extension cable, the keyboard and mouse near your body.

6. Since your health is an important issue here (or you would not be looking for help in this area of EMF sensitivity) it's necessary to take steps to strengthen your immune system.

Most persons with fibromyalgia, chemical sensitivity, chronic fatigue and/or electrical sensitivity have serious sleep problems/deficiencies. Recently, several cases of severe fibromyalgia and chemical sensitivity with sleep problems were successfully treated with a strong week-long dose every night of a special stereophonic sleep CD entitled "Deep 10 Relaxation" from The Monroe Institute in Virginia (about \$20).

Researched over many years, The Monroe Institute (TMI) Hemi-Sync (hemispheric synchronization) sound therapy has long had an excellent reputation of successful application in stress situations where dis-ease is a significant health factor (The Positive Immunity Program is a good example). You can contact The Monroe Institute, Ph: 804-361-1252, , Email: <Monroelnst@aol.com>, Website: <<http://www.monroe-inst.com/>>

A weekend Sleep Better Workshop, using selected Monroe Institute Hemi-Sync sound therapy tapes, may be considered for persons with sleeping problems, fibromyalgia, chronic fatigue and immune dysfunction syndromes (including chemical and electrical sensitivities),. For further information please call or write: Scott & Sharon Taylor, **Expanded Awareness institute**, RR1, Box 236C, St.Peter MN 56082, phone & fax 507-387-6777, email: <aware@prairie.lakes.com>

For more comprehensive information about the use of thyroid hormones in the treatment of Fibromyalgia and related dysfunctions,.contact Dr. John C. Lowe, Director of Research, The Fibromyalgia Research Foundation, Ph: 713-666-0882. For details about his work refer to his website: <<http://www.drloewe.com>>. For his new book "*The Metabolic Treatment of Fibromyalgia*," contact McDowell Publishing Company at <<http://members.aol.com/mcdpubco/>>

### Watches

Stefano Manfroi <stefano@biologica.com>asks in his email of 02/19/2001:

*Is the common quartz wrist analogic watch, like Swatch, that we have always in contact*

*with our wrist, good for health? They emit a pulsed electromagnetic field from the electric solenoid coil inside. I've measured with a EMF Meter and this electromagnetic pulse field in some watches is really high. (from 0 to 10 mG or more) and this is going on all the time we have it on the wrist.*

The pulses from the watch seem to act as a biological stressor over a long time-period and can be irritating to a person who is electrically sensitive (they cannot wear one because it makes them ill!). In addition the watch is located on your wrist where major acupuncture meridians travel to important acupuncture points on your hand. My website at <[www.emfinterface.com](http://www.emfinterface.com)> (and this document) will give you background on bioeffects of EMF repetitious transients and surges (pulsed spikes), similar to those from your watch.

The acupuncture system in the body has electric direct current (DC) EF characteristics and generally changes slowly with time (analogue) and in various rhythms (daily, monthly, yearly). Environment, body and mind stresses, however, can rapidly affect the electrical characteristics of the acupuncture system. Also, acupuncture treatments can be given by trained acupuncturists with electrical instruments which use pulses. This was investigated in detail at least 20 years ago by Dr. R.O. Becker. (Some of his research is described in "*The Body Electric*", William Morrow and Co. Inc., New York, 1985)

Basically, the less electrical or electromagnetic stress you have around your body, the better, for long-term health. This means preferable NO EMF equipment or wires where you sleep and very little electrical equipment where you work or spend a lot of time during the day. All electrical equipment should be three-wire grounded. This is best because if electrical systems are not properly shielded and grounded there is always an electrical field around the wires, when the wires are "hot" whether the wires to the equipment, light, or appliance are turned on or not! This is especially important if you have health problems, a weak immune system, multiple chemical sensitivities, or are very young or very old.

So it would be better for you NOT to wear an analog watch -- maybe you could find a wind up wrist or pocket watch somewhere. Perhaps a cheap digital watch would work, because, as a solid state device, they do not have the pulsed EMF characteristic. As a general rule, it would probably be best not to wear any kind of battery-powered watch because of the acupuncture system sensitivity. I have an analog watch like yours (and keep it in my briefcase).which I use in my lectures to show people how strong the signal is and why it would not be a good idea to wear one (especially 24 hours a day!).. Basically, you are giving yourself long-term electrotherapy without knowing what the long-term health results will be!

If you take the cheapest AM/FM radio you can buy (Radio Shack, \$7-\$10) and put your analog watch up against the antenna at top or back of the radio case (NOT the extendable whip antenna, which is for FM) you will clearly hear the "tik-tik-tik" of the internal solenoid coil. Volume control should be about maximum, and station dial on lower end of scale (500-600 kc) where there is no station broadcasting. (or see page 22, herein, about use of the EMF detection feature of the Buzzstick or the Radio Shack telephone listener instrument on it)

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## **Some Thoughts About Possible Ways to Describe EMF Bioeffects**

From Clas Tegenfeldt, BEMI - Better Electromagnetic Environment, Tornevalla Gamla Skola, S-590 62 Lingham, Sweden, Email: <[tegen@bemi.se](mailto:tegen@bemi.se)>, Website: <<http://www.bemi.se>>

Take any amount of energy and ask yourself is this harmful? Let us say it is 100 Watt-hours (Wh), is a health hazard or not? If we put those 100 Wh into an incandescent light bulb we would probably say it is harmless and indeed beneficent. If we put those 100 Wh into moving a car it would not be that harmful to smash that car into a wall or something since the impact wouldn't be that hard would it? But put those 100 Wh into moving a bullet, would that be

dangerous to your health? No if you point the gun towards someone else, yes if you receive that bullet and absorb the energy in a tiny fraction of a second on impact. The same energy absorbed over a longer time will not even be noticed.

About the "impossibility" to get any biological effect from a low "nonthermal" quantity of energy, think about this scenario: You have 40 metric tons moving at a speed of 100 km/h, any engineer or researcher could tell you that it is utterly impossible that you could stop that moving mass with just a few (I mean just a few) photons constituting such a tiny energy that most just discard it as zero. But IF those photons were hitting the human eye of the truck driver and (s)he perceived those photons as a red light? Then a cascade effect would take place that transformed those few photons into a nerve signal into a muscle movement into a hydraulic/pneumatic amplified braking of the vehicle! Thus **it always depend on the context** if any quantum, however small, of energy can have an effect on a system or not!

To take a somewhat more "thermal" ;- ) example, a small surface charge made by triboelectric mechanisms can give a discharge that may ignite oil vapor and blow the whole oil refinery up into the upper atmosphere. A small surface charge is not thermal, even though the explosion is. Talk about amplification!

It is in fact /possible/, until shown wrong, that the biological systems /may/ have such cascade effects from certain EMFs. It is probably wrong to assume that any field, of any kind, any frequency, any strength, any direction, any polarization, any modulation, any combination of these, would have exactly the same impact, wouldn't it? So, there are some parameter dependency for the sensing of the field(s). What are those parameters? Who can say with confidence that he knows?

Then how come some people go on stubbornly to advocate that ONLY power or absorbed power is the ONLY parameter sensible to measure or discuss? There are a vast multidimensional parameter space to investigate, if one focuses on only one there is a high probability that one fails to understand the phenomenon.

The only real question of fundamental importance is this: Can an electromagnetic field in any way at all influence a biological system?

- \* Yes! By heating tissue.
- \* Yes! By photons in the eye.
- \* Yes! By mechanical movement of biomagnetite.
- \* Yes! By mechanical movement of small hairs in a strong electric field.
- \* Yes! By DC magnetic fields in navigation/orientation of birds, etc.
- \* Yes! By sensing of electric fields in nanovolts/m by sharks (*rays, & other fishes too!* [5]...*jb*)

So, we KNOW there are effects, and we should already know those are NOT thermal in nature. We do not understand the mechanisms at work. We desperately need to use ALL possible ways to characterize fields! ALL! Then we may stumble across the right one, sooner or later.

Think again of those lonely photons hitting the truck drivers eye, that is an example of an electromagnetic wave giving a far-reaching biological and technical effect that is completely and utterly "athermal" in nature... :-)

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## Selections from Research in Bioelectromagnetics

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**The Oct 1998 20th Annual International Conference of the IEEE  
Engineering In Medicine & Biology Society in Hong Kong -- EMBS 98**

Three abstracts of interest:from weblink.<<http://www.ee.cuhk.edu.hk/ee/conference.html>> :

9.1.1-1 Dr. Robert Cleveland 1010

Paper Title: ***Health and Safety of Radio Frequency Radiation: US Military Research & Exposure Standards.*** Authors: Murphy MR, Merritt JH, 31 Oct 1998.

Abstract: The military services of the U.S. develop and use large numbers of electromagnetic energy emitting devices. Incumbent upon the services is the responsibility to maintain the health and safety of their personnel as well as protection of the environment. To discharge this responsibility, the services have been in the forefront of research in the biological effects of exposure to microwave and radio frequency radiation since the 1950s. In addition, the services have been leaders in establishing human health and safety exposure standards.

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9.2.1-3 913

Paper Title: ***Human Responses to Weak EMF Are Biologically Plausible Because "Ordinary" Electrically Excitable Channels Can Account for An Extreme Sensitivity to Electric Fields in Sharks and Related Species.*** Authors: Wachtel H, Beeman D, Pottenger J, 30 Oct 1998

Abstract: The possibility that humans could respond to weak electric or magnetic fields (EMF) is often dismissed on the basis that our species does not have the type of cellular or molecular apparatus that enables other animals to be "hypersensitive" to electric fields. In this paper we examine the proposition that extreme electrical hypersensitivity in sharks and similar species could be accomplished using rather "ordinary" ionic channels arranged in favorable geometries so as to produce an avalanching response. In particular, we have used GENESIS programs to model shark electroreceptor cells with a variety of calcium channels and realistic geometries. We have found that certain of these arrangements allow the model cell to be almost as electrosensitive as are the real cells. Among other things, these results imply that human cells having similar "ordinary" channels could have architectures that make them responsive to fairly weak EMF.

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9.2.1-5 909

Paper Title: ***Effects of Pulsed Electromagnetic Radiations Emitted Video Display Terminals on Human Spermatogenesis.*** Authors: North MO, Laverdure AM, Surbeck J, Tritto J, 30 Oct 1998.

Abstract: We studied a possible action of the radiations emitted by a video display terminal (VDT) on human spermatogenesis. Explants were originated from a 35 years old patient who presented a left varicocele (grade 4). Biopsies were taken off in the two organs and divided in several parts. Except one untreated control, the other samples were cultivated for 24 hrs : one sample (non-exposed) was simply cultivated without any particular treatment and the two others were exposed at 50 cm in front of a computer which one was equipped by an experimental system in the aim of testing its efficacy to insure an efficient protection against the radiations (exposed and exposed-protected). On all samples, histopathologic and meiotic studies were done. The results demonstrate a noxious effect of the pulsed electromagnetic radiations (PEMR) on human spermatogenesis. This effect insures appearance of disorganization of the seminiferous tubules, decrease of spermatide number, increase of apoptotic cells and of pycnotic cells and typical toxic meiotic impairment (asynapsis, chromosome breakdowns, synaptonemal complex fragmentation, abnormal sex-vesicle). This toxic effect was more pronounced in the varicocele-weakened testis. In the two cases, normal and brittleness testis, presence of the experimental system insures an efficient protection against the noxious effect of the PEMR.

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## VDT's Affect Fertility

Andrea Moro <a.moro@mi.flashnet.it>, Feb 26, 1997

NEW YORK (Reuters) -- **Women whose jobs expose them to solvents, chemical dusts, pesticides, and video display terminals (VDTs)** may be putting their fertility on the line, a new study shows. Such occupational exposures may double or even triple the risk of infertility, say Iowa researchers.

They found that women who were exposed to volatile organic solvents, pesticides, or chemical dusts had a higher risk than normal of having problems with their fallopian tubes, a higher risk of ovulation failure, and a higher risk of endometriosis. Endometriosis was also more common in women exposed to video display terminals, and these women also had higher rates of cervical-factor infertility.

"This is one of the first female-occupational risk studies that has examined medically defined infertile women whose spouses had been medically diagnosed as fertile," says lead study-author Dr. Elaine M. Smith, professor of preventive medicine and environmental health at the University of Iowa College of Medicine, Iowa City.

In a report published in the Journal of Occupational and Environmental Medicine, Smith and her colleagues point to previous studies linking a higher prevalence of spontaneous abortion among dental assistants exposed to nitrous oxide and anesthetic gases, and among women exposed to non-ionizing radiation from VDTs.

Results of the current study were based on a comparison of 281 women diagnosed with infertility and 216 fertile women. Study participants came from both rural and urban areas of Iowa and Illinois.

Women who were exposed to solvents (paint-related solvents, cleaners, resins, and hair sprays) while on the job had at least a 1.74 times greater likelihood of being infertile due to ovulation problems. Job exposure to pesticides was linked with a 3.02 times greater risk of ovulatory problems, and the risk was 2.66 times greater in women who had been exposed to chemical dusts.

"Solvents and dusts (mostly wood and agriculturally related dusts) were also associated with a higher risk of tubal-factor infertility," the researchers note. Solvents increased the risk by 1.95 times and chemical dusts by 2.87 times.

The authors note that much of the commercial wood in this country is treated with preservatives, primarily pesticides, to protect against mold, fungi, and insects. Other chemicals added to wood include arsenic.

Agricultural dusts contain a variety of chemicals including pesticides and aflatoxins, toxic chemicals found in grain dusts that previous studies have linked to birth defects.

In terms of endometriosis, women with occupational exposure to solvents had a 2.13 times higher risk, and women exposed to chemical dusts had a 3.63 times greater risk.

The Iowa researchers say VDT exposure "was more likely to be found among women diagnosed with endometriosis and cervical-factor infertility," compared with women with no occupational history of such exposures. Women working around VDTs had a 3.69 times greater risk of endometriosis and a 2.65 times greater likelihood of having cervical-factor infertility.

Smith and her co-authors also note that hobbies involving painting, woodworking, and gardening can be linked to significantly increased infertility risks. These hobbies often involve exposure to solvents or pesticides.

"Thus, the significant findings from chemical agents used in hobbies are consistent with those identified for occupational exposures," the researchers state.

But they point out that having these hobbies did not boost the chances of infertility among women who were exposed to solvents and pesticides on the job.

The Iowa team says more studies are needed that measure amount and duration of exposure to see if these factors play significant roles in occupational risks to fertility.

Reference: *Journal of Occupational and Environmental Medicine* (1997;39(2):138-146)

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## **Annual DOE/EPRI Review of Research on Biological Effects of Electric & Magnetic Fields from the Generation, Delivery & Use of Electricity**

**NOTE:** For the latest status on EMF biological effects research and more details on the summaries below, you may order **free** copies of Project Abstracts for 1994, 1995, 1996, 1997 and 1998. Request abstract copies from W/L Associates, Ltd., 120 W. Church St., Frederick, MD 21701, Ph: 301-663-1915.

Summary of abstract A-50 from the 1994 Review: E. Sobel, et.al., ***Occupational Exposure To Electromagnetic Fields As A Risk Factor For Alzheimer's Disease.***

In this study the relationship between presumed occupational exposure to EMF and Alzheimer's disease (AD) was studied. Seamstresses, dressmakers and tailors were over-represented among cases. We therefore measured a small opportunistic sample of 4 factory and 2 home sewing machines. We found that the EMF exposures from these machines are among the highest for any profession. Occupational EMF exposure was the only risk factor analyzed in any of the data sets. Therefore, multiple comparisons is not a problem in our analyses. EMF may be an important risk factor for AD with biological plausibility. Some of the pathways by which AD plaques and, perhaps, tangles develop are calcium ion dependent. AD also had inflammatory components. EMFs may cause production of antibodies to neuronal calcium ion channels. This may initiate an inflammatory process and disrupt calcium homeostasis. Excess calcium influx along with inflammatory processes may precipitate a cascade of events leading to plaques and tangles and then neuronal death.

Average magnetic field exposures, in milliGause (mG) compared with estimated average exposures from 6 hours of sewing: 64.7 mG for a Sewing Machine Operator vs. 23.6 mG for an Electric Power Line & Cable Worker and 19.5 mG for a Welder/Flame Cutter

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Summary of abstract A-44 from the 1995 Review: J. S. Reif, et.al., ***Melatonin Levels in Electric Utility Workers.***

Magnetic fields have been shown to induce changes in production of the pineal hormone melatonin (see book reviews, herein). A study to evaluate the effects of magnetic field and ambient light exposures on melatonin production in electric utility workers is in progress. Preliminary data indicates a clear daily variation, providing preliminary evidence that magnetic field exposures that occur during the day in electric utility workers are associated with decreased night time melatonin production.



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Summary of abstract A-45 from the 1995 Review: **A. Sastre, et.al., Heart Rate Variability In Magnetic Fields: Continuous versus intermittent exposure.**

Two years ago we reported that intermittent exposure to a magnetic field altered the normal variability inherent in human cardiac rhythm. A second exposure study with a large sample of volunteers reported similar results. In this study a third human exposure study was undertaken to determine if a continuous magnetic field exposure would produce differential effects on heart rate variability. No significant decreases or increases in any factors were noted. The results of the present study, when taken together with our earlier data, are consistent with the hypothesis that intermittence of magnetic field exposure may be an important factor in human cardiac responses that result from those exposures.

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Summary of abstract A-46 from the 1995 Review: **Z. Davanipour, E. Sobel, et.al., Occupational Exposure To Electromagnetic Fields And The Risk Of Amyotrophic Lateral Sclerosis.**

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease. Previously, "electrical" occupations and severe electrical shock have been associated with the occurrence of ALS. The purpose of this study was to investigate possible risk factors for ALS, including occupational exposures. Data on occupational EMF exposure were analyzed first and are presented here. The results indicate that occupational exposure to EMF may increase the risk of ALS, particularly long-term exposure (italics...ed.)

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Summary of abstract A-47 from the 1995 Review: **E. Sobel, et.al., Elevated Risk Of Alzheimer's Disease Among Workers With Likely Occupational Electromagnetic Field Exposures.** (See summary of abstract A-50 from the 1994 Review, herein)

This study was undertaken to determine whether previous results indicating an increased risk of AD associated with occupations with likely EMF exposure could be replicated. The results of this study were consistent with previous findings and strengthens the hypothesis that EMF exposure is etiologically associated with the occurrence of AD. Because of the use of different types of controls, particularly demented controls, the results indicate that EMF exposure may be specific for AD and not other dementias.

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Summary of poster board P-64 from the 1995 Review: **C. Wallach, Electromagnetic Hypersensitivity. (Also see Electrosensitive Research, herein.)**

Objectives: (1) To highlight the existence and growing incidence of the Electromagnetic Hypersensitivity Syndrome (EHS). (2) to identify sources of reliable data thereon, and (3) to announce the discovery of what may be the first effective EHS therapeutic approaches. Introduction: Heretofore, oncogenesis has been the main focus of investigations of biological effects of extremely low frequency (ELF) fields, and although becoming recognized in Europe, in the U.S. little consideration has been given to the less aggressive but highly debilitating EHS phenomenon which appears to simulate allergy and, in some cases, manifests symptoms of an auto-immune disease. First, we wish to promote EHS as a significant new focus for research in the fields of Medicine and Biophysics. Secondly, we present and discuss recently formed EHS organizations as sources of epidemiological data in the U.S., Sweden, Germany and Australia for scientists interested in pursuing this subject.

Definitions: EHS is defined as physiological or biochemical reaction in the presence of relatively weak low frequency (LF) and ELF fields radiated by power lines and electrical machinery. It appears to occur only in a small but growing population of mature adults. The symptoms, which vary with individuals, include one or more of the following: debilitating fatigue, tachycardia, subdermal burning sensations, respiratory distress, acute headache pain, joint pain, nausea, cognitive confusion and vertigo. Cause and effect are clearly established by the fact that symptoms disappear almost immediately when the field or the subject is removed from the environment (with or without the knowledge of the subject).

Intervention Methods: Until recently the only treatment has been isolation of the subjects from all sources of EM fields at a considerable sacrifice of occupation and living conditions. Although it is too early to speak of a cure, two possible palliative treatments have recently been explored. One, developed in Switzerland, addresses the autoimmune reaction and involves identification and pharmacological destruction of the maverick antibodies, the second, even more promising modality, involves what appears to be a non-invasive desensitization process consisting of a 5- to 10-minute exposure of the subject to extremely short (<1 ms) high-amplitude magnetic pulses.

Discussion: This paper presents extracts from hundreds of case histories to establish the validity of the syndrome, and the first report to the scientific community of an etiological theory and possible treatment modalities.

For detailed information contact Charles Wallach, Behavioral Research Associates, 21450 Chase St., Suite 238, Canoga Park, CA 91304-2637, 818/882-7128, e-mail: wallach@ix.netcom.com.

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Summary of **Research Highlights** from the 1998 Review :

**A major source of EMF in passenger cars is now known to be the rotating steel-belt radial tires.** Formally investigated by Jacobs, Feero, Brecher, and sponsored by DOE through the U.S. Department of Transportation, the research findings show that automotive variable-frequency magnetic fields are due to the residual magnetism of steel belting in tires (in addition to other sources). Simply put, a steel-belt radial car tire is essentially a rotating permanent magnet. Typically, it seems the strongest of the "tire-produced" fields are found in the car's back seat and run as high as high as 25 mG. The fields are also found on the right and left sides of the front floorboard area, near the front tires. Although the potential health-risk aspects of this exposure source are unknown, an interesting research question was raised. Since many cases of melanoma (a variety of skin cancer) are known to occur on body extremities it was suggested that an interesting area of research would be to determine (from U.S. cancer registries) whether or not a higher incidence of malignancies has occurred on the left foot--rather than the right foot. If it is found that the left foot has a significantly higher incidence of melanoma cases, this fact may be important, since a typical passenger-car driver's left foot is in a much stronger magnetic field than his right foot. The point was then made that melanoma incidence--left or right foot--should be investigated in countries with right-hand-drive vehicles, such as Great Britain, Ireland, New Zealand, Australia, and South Africa. If it were found in these countries that melanoma was significantly occurring more on the right foot (than the left) what might this imply? (prepared by: E. Marcus Barnes, P.E., EMF Health Effects Consultant Ph./Fax (512)-338-1816)

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## **Influence of High-Frequency Electromagnetic Radiation at Non-Thermal Intensities on the Human Body**

(A synopsis of work by Russian and Ukrainian researchers --)

Nikolai Nikolaevich Kositsky<sup>1</sup>, Aljona Igorevna Nizhelska<sup>2</sup>, and Grigory Vasil'evich Ponezha<sup>3</sup> 14 June 2000,  
Kiev, Ukraine

From the <sup>1</sup>Informational Support Laboratory, <sup>2</sup>Special Measurements Laboratory, and <sup>3</sup>Quantum Physics  
Laboratory, Scientific Research Center of Quantum Medicine "Vishuk".

Commissioned by EMFacts Consultancy, Australia\* and Powerwatch, England.  
Partially funded by the Foundation for Children with Leukaemia.

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<emfacts@trump.net.au> Web: <http://www.tassie.net.au/emfacts/>

**jb comments:** This paper has 142 references, 31 pages, and many detailed tables of experimental results. Only Introduction and Conclusions are presented here. For details of research, a complete copy may be requested from the EMFacts Consultancy above.

## 1. Introduction:

This review examines primarily direct experimental studies of the effects of low-intensity high frequency electromagnetic fields (HF EMF) on biological subjects, including humans. Unlike epidemiological observations, direct experiments allow parameters of the acting EMF to be established more accurately, the condition of the subject to be monitored before and during exposure and for a certain period afterwards, and scientific hypotheses on the mechanisms of the effects to be verified. Clinical experiments done with the intention of improving the condition of the patients are the only legitimate experiments on people, and for this reason, published articles more often deal with the positive effects of HF EMF. One should consider, however, that EMFs with therapeutic effects comprise only a minuscule portion of all acting fields, and that there is a large probability of harmful effects from incidental generalized exposure, as confirmed in experiments on animals.

Currently we still do not know the specific receptor in humans for perception of extremely high frequency electromagnetic radiation (EHF EMR). Nevertheless, the presence of sensory reactions has been established during local peripheral exposure of humans to EHF EMR [Andreev, Belyi and Sit'ko, 1985]. At this moment in time, the following can be considered established:

- 1) Humans are capable of differentiating reliably between exposure to EHF EMR and a sham exposure;
- 2) Electromagnetic sensitivity in humans is determined by the biotropic characteristics of the EHF EMR: frequency, power, time and place of exposure;

The most typical reaction in humans is of a resonant character and is observed during changes in the exposure frequency [Andreev, Belyi and Sit'ko, 1985].

The use of extremely low power EHF EMR of  $10^{-19}$  W/Hz in millimeter wave resonance therapy for treating people involves selection of an individual frequency which has the maximum therapeutic effect [Andreev, Belyi and Sit'ko, 1985; Sit'ko, Skripnik and Yanenkpo, 1999].

- 3) The so-called points of Chinese acupuncture play a particular role in this reception, and are notable for having been used for thousands of years in treating practically all systems of the human body.

## 12. Conclusions:

The following actions of HF EMR at non-thermal intensities on biological systems are possible.

- 1) Frequencies of  $10^9$  (1 GHz) to  $10^{12}$  (1,000 GHz) are similar to the frequencies of oscillation of protein molecules, DNA and RNA; of membranes and other parts of cells, and of conformational transitions in enzymes, which creates the possibility of resonant absorption of HF EMR.

- 2) The organism as a whole may have its own resonant frequencies: from living cells to human beings [Sit'ko and Yanenko].
- 3) EHF fields, modulated at low frequencies close to the rhythms of the brain, heart and internal organs, have a strengthening action. Modulation at infra-frequencies in the range of 5-16 Hz exerts a strongly negative effect on humans and animals.
- 4) Absorption of EMF in biologically active points is many times more effective than in other parts of the skin, and this energy influences the internal organs and the body as a whole through the system of Chinese meridians.
- 5) At the moment of cellular division, genetic information becomes "open," chromosomes become immobile and far more susceptible to the influence of HF EMR. An external resonance field may induce expression of genes connected with cancer and change the program of cellular development.
- 6) **Manifestation of the effects of EMF depends on conditions of health and age: healthy adults have minimal sensitivity; embryos, children, elderly persons, and those with hidden psychological or physical disorders experience significant effects, all the way to lethal outcomes.**
- 7) Combination with other deleterious factors: ionizing radiation, toxic substances (*pesticides, outgassing of computers and electronics...jb*), geomagnetic anomalies and stress significantly increase the effects of HF EMR.
- 8) Accumulated discord in the work of cells during chronic and quasiperiodic irradiation leads to confused biorhythms, scattered attention, indistinct phases of sleep and arousal; the body is not in a condition to make a recovery.
- 9) The effects of HF EMR occur through the hormonal system and immune system with amplification and accumulation of effects; and through catalysts of cellular respiration and biosynthesis. These reactions are non-specific, and it is often difficult to connect them with the fact of irradiation by EMF at non-thermal intensities.
- 10) Occurrence of a narcotic-type dependency (by stimulating production of endorphins) is possible under regular irradiation with HF EMR.

Much research in the field of biological effects of EMF makes it possible to define **the most sensitive systems in the human body: nervous, immune, endocrine and reproductive**. These systems of the body are critical. The reactions of these systems must without fail be considered in evaluating the risks of EMF exposure to a population.

On the level of a nerve cell, of structural formations for transmission of nerve impulses (synapses), and on the level of isolated nerve structures, significant deviations occur during exposure to EMF of low intensities. Higher nervous activities, including memory, change in people having contact with EMF. These persons may have a tendency to develop stress reactions. Certain structures of the brain have heightened sensitivity to EMF. **Changes in the permeability of the blood-brain barrier may lead to unexpected unfavorable effects.** (*viral attack possibilities??...See pg 61...jb*) Especially high sensitivity to EMF is displayed in the embryonic nervous system.

Under exposure to EMF, processes of immunogenesis are disturbed, most often in the direction of suppression. It has also been established that in animals irradiated with EMF, the nature of the infectious process changes -- the course of the infectious process is aggravated. Initiation of autoimmunity is connected not so much with changes in the antigenic structure of tissues, as with pathology in the immune system, the result of which is that it reacts against normal tissue antigens. In agreement with this concept, the basis of all autoimmune conditions consists,

firstly, of immunodeficiency in the thymus-dependent cellular population of lymphocytes. EMF can cause non-specific suppression of immunogenesis, increase in the formation of antibodies to fetal tissue, and stimulation of an autoimmune reaction in the body during pregnancy.

Considering the important role of the cerebral cortex and hypothalamus in the expression of psychological functions in humans, one may anticipate that prolonged repeated exposure to maximum permissible HF EMR may lead to psychological disorders.

Public health norms in force in all countries, however, are based only on regulation of the energetic load determined by the intensity and duration of contact with EMF and do not enable application of maximum permissible limits to be extended to conditions of exposure to EMF with complex physical characteristics, in particular, with specific model of modulation. When standardizing allowable levels of HF EMR the following should also be considered:

- The category of users of the device-radiator or those undergoing irradiation (children, elderly, diseased, etc.);
- The biological activity of the basic range of HF EMR of the source-radiator, harmonics, modulation, polarization, and also the spatial configuration of the radiation.

People who are constantly subject to exposure to HF EMR in connection with professional activities must be examined regularly. People with heightened sensitivity should not be allowed to do these activities, or at least should be aware that such activities are contraindicated.

As research has shown, super-low power HF EMR is highly effective in its action on humans. It does not appear possible to lower the allowable norms to such a level.

An alternative way out of the situation is seen in the development of a program of individual diagnostics and creation of a data bank on the effects of HF EMR on the health of the nation in order to substantiate conclusions. In addition to general methods of examination, monitoring the health of individuals subjected to HF EMR exposure may involve such special methods as LCS (laser correctional spectroscopy) study of blood plasma, electropuncture diagnosis of the reaction of the body to specific HF EMR exposure and other methods applied during treatment with HF resonance therapy for objective monitoring of the reaction of the body to exposure (cellular microelectrophoresis, infrared thermography, factor analysis of immune system indicators, etc.) The first method allows mass examination of health conditions to be done quickly and cheaply with identification of signs characteristic of that type of exposure. The other methods allow individual reactions of people to be determined over a specific range and power of exposure or to a specific source of radiation. These kinds of examinations should be available to all who want them. All these methods are far more informative if they are applied dynamically. A number of large-scale immunological methods exist for quick monitoring of human health conditions [Malykhin].

The results of all examinations should be processed centrally at the government level for making safety standards for HMF EMR more precise, for clarifying the possible statistical connections between HF EMR exposure and increased numbers of genetic anomalies in the population, and for determining the level of danger from HF EMR to the health of the nation.

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## **Thermal and Nonthermal Mechanisms of the Biological Interaction of Microwaves\***

By John Michael Williams (02/15/2001)  
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\*Posted at *arXiv* as physics/0102007. The original version of this paper was submitted to the US Federal Communications Commission (the NTIA) as a *Comment* response on the question of unlicensed operation of ultrawide-band (UWB) devices. The author, and not the UWB Working Group itself, bears full responsibility for everything in this paper.

**jb comments:** This paper has 8 references 15 pages, and several detailed tables, graphs and equations of experimental results. Only the Abstract and selected Conclusions, with supporting references, are presented here. For details of research and recent studies, a complete copy may be requested from Williams, above.

#### **Abstract:**

Research in the past on the biological effects of microwaves often has been based on faulty assumptions. The major flaw has been the premise that microwaves only produce thermal effects in tissue. This premise easily may be proven illogical and physically incorrect. Furthermore, assuming only thermal effects leads one to an optimist's error of quantification in which calories are counted instead of joules. Past investigations have been misled both by these assumptions and by stereotyped experiments using only narrow-band radiation sources. Recent studies show that wide-band microwaves bring out biological effects which are unrelated to those caused by heat flow. A review by Kenneth Foster provides a basis for criticism and improved understanding.

#### **Conclusions:**

The list of comments above, as well as the final "paradox" discussion in KF2000, seem to show that the problem of microwave-tissue interaction, especially for UWB microwaves, is not well understood by the majority of researchers or writers who have been publishing papers in this field. Therefore, the lack of controversy claimed by KF2000 should be replaced by serious questioning of the assumptions underlying the reportedly widespread agreement.

It is interesting that KF2000 does not cite Lu *et al* (1999), who have found that UWB microwaves can cause a drop in blood pressure in rats. Speculation as to the apparently nonthermal mechanism of the Lu *et al* findings might have been interesting.

Durney, *et al* (1999, ch. 4.1.4) cite several studies and some theory justifying the weakly nonthermal action of microwaves. It also should be noted that two reviews have appeared after KF2000 in *Lancet*: One phenomenological (Hyland, 2000), and the other epidemiological (Rothman, 2000). Hyland speculates that nonthermal interactions may depend strongly on individual differences, this being a reason clear effects have not yet been recognized more widely. Rothman points out that the death rate from auto accidents because of cell phones is far higher than could be any as-yet undiscovered increase in the cancer rate. **In view of Lu *et al*'s (1999) results, one might hope for caution in introducing wideband cellphones--which might cause fainting at the wheel!** (my emphasis...jb)

It is hoped that, whatever the parameters of biological interaction with microwaves, they might be elucidated soon, so that appropriate filtering and limitation of adaptive routines might be designed in to wireless devices, guaranteeing that they would be harmless to the humans using them. We do not at present have a good guarantee.

#### **References:**

Foster, K. "Thermal and Nonthermal Mechanisms of Interaction of Radio-Frequency Energy with Biological Systems", *IEEE Transactions on Plasma Science*, 2000, Vol. 28 (1), pp. 15-23 (February issue).

Lu, S. T., Mathur, S.P., Akyel, Y., and Lee, J. C. "Ultrawide-Band Electromagnetic Pulses Induced Hypotension in Rats". *Physiology and Behavior*, 1999, 65(4/5 - January), 753 - 761

Durney, C.H., Massoudi, H., and Iskander, M.F. *Radiofrequency Radiation Dosimetry Handbook* (4<sup>th</sup> ed., online; updated 1999). Brooks Air Force Base (USAFSAM-TR-85-73), Armstrong Research Laboratories (AL/OE-TR-1996-0037). Available at <<http://www.brooks.af.mil/AFRL/HED/hedr/reports/handbook/home.html>>

Hyland, G.J. "Physics and biology of mobile telephony". *Lancet*, 2000, 356, 1833 - 1836 (November 25 issue).

Rothman, K.J. "Epidemiological evidence on health risks of cellular telephones". *Lancet*, 2000, 356, 1837 - 1840 (November 25 issue).

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## Response of Physiological Parameters to Low Frequency and Low Intensity Pulsed Magnetic Fields. (Excerpts)

E.A. Rauscher, Ph.D. and W. L. Bise, Sc.D.  
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Published in *Frontier Perspectives*, Vol 8, No.2, pp. 26-32, Fall 1999, 27 References, by **Center for Frontier Science**, Temple University Ritter Hall (003-00), Philadelphia, PA 19122, (215) 204-8487, Email: [V2058A@VM.Temple.Edu](mailto:V2058A@VM.Temple.Edu), Website: <http://www.temple.edu/CFS>

**Background Purpose of Our Experiment:** In this paper we briefly present our research on biological effects of specific frequencies, multiple frequency mixes, and waveforms of magnetic and electromagnetic field emissions from a specifically designed multi-coil emitter probe designed by one Bise. The primary frequency range that we utilized in this study was from approximately 3 Hz (cycles per second) to 76 Hz. We have conducted extensive experimentation involving field effects on such physiological parameters as electroencephalogram (EEG), (electrocardiogram) ECG, and galvanic skin response (GSR) by externally generated, low frequency, low intensity, magnetic, and electromagnetic fields. We have also developed a theoretical model that describes some aspects of the process of information processing in the human body. **This work has been conducted over the last 20 years and may give new insights into central and peripheral nervous system functioning as well as cardiac physiology.** By way of comparison, at a 45-degree latitude (about the San Francisco Bay area latitude) the earth's steady-state magnetic field strength is about 0.5 Gauss and is relatively constant. The field strength we utilized in these studies was anywhere from 0.002 G to about 15.000 G. But these fields are complex, i.e., consist of many combinations of different frequencies, waveforms, and intensities. Furthermore, they are time-varying as opposed to constant such as the earth's relatively steady-state fields. The reason we believe these fields can have effect on biological processes in humans, as well as canines and rats (which we have also suited) is that they match some of the natural electromagnetic signals used in transfer of information associated with life processes, which I what we could term biocybernetics.

We have found significant variations in the alpha brain wave amplitude and shifts in alpha power spectrum dominant frequency under the influence of certain very specific fields. Most importantly, some of these changes have been observed under strict double-blind conditions in which neither the experimental subject nor the person interacting with him knew whether the entraining fields were turned on or off, treated and control runs respectively. We believe that producing such effects, that is utilizing fields to make contact with the human Neurologic and hemodynamic system, will allow us to enhance biologic functioning particularly to overcome Neurologic deficiencies and abnormalities.

The specific manner in which external fields affect a biological system as beneficial, harmful or benign depends on several factors. Beneficial or harmful effects occur when contact is made in such a manner where the external field informational content matches within a certain range of the internal signal processing. By way of analogy, mammals need a certain amount of salt to survive that is beneficial, too little or too much salt "does not match" the requirements and hence is harmful. The nonlinearities of external fields, and biological processing makes these systems potentially incredibly sensitive to external fields

**Other Related Research on Beneficial Effects of ELF on Humans:** Two specific aspects that have come out of our research are two Food and Drug Administration approved studies. The first study involved a clinical test of a pain reduction system that we have developed and patented. This system utilizes pulsed magnetic fields emitted from small coils that can be placed over the site of injury or chronic pain patients or areas sensitive to manual palpitation. This first study had four patients with chronic lower back pain who were treated over a two-months period and were blind as to whether the device, called a magnetic pain reduction system, the MPR-7644 device, was operating or not. When treatments were delivered with the device operating normally, we designated such treatments as "Active Treatments." On the other hand, when the treatments were given with the device turned off (unknown to the patient), we designated such treatments as control. Stable baseline levels of subjectively reported pain were obtained for all patients prior to the initiation of either active or sham treatments.

Positive and statistically significant results were obtained for each patient individually at  $<.02$  level of significance. Independent probabilities gives us a  $p$  value of less than  $10^{-6}$ . Further research is planned to examine the applicability of this device for a number of clinical conditions that involve chronic pain.

The second application of our research has been the development of a pulsed magnetic field device to stabilize the cardiac rhythm in patients with second-degree heart block and other cardiac arrhythmias. This device, called a PMC-27A, is also patented and has received an investigational device exemption from the FDA for clinical trials in humans. Significance of this and other studies were at the  $>.001$  level. The incredible sensitivity of biological systems to extremely low-intensity magnetic fields of highly complex combinations of waveform, different frequencies, and intensities is of interest not only because it may help physicians in the clinical setting but to help scientists to better understand information processing in living systems. See Table 2 for the intensities, current, potential, and frequencies associated with various organ systems of the human body in order to enhance biologic functioning.

**Concluding Remarks:** We have a unique and unheralded opportunity to utilize external pulsed non-invasive fields to correct certain biologic informational abnormalities and enhance the quality of life. We are on the threshold to obtaining a new and unique understanding of biological information processing. **In some of our experiments subjects in a separate laboratory room with eyes and ears blocked from sounds and sight in the signal generating laboratory identified signal form visual patterns correctly for three male subjects for 12 trials, each correct.\*** In the words of R. O. Becker in response to our research "this work is extremely important because it carries our whole knowledge of what perception is a whole lot further." The research into the effects of electromagnetic fields on living systems will carry our understanding a lot further and allow us to move another step further in finding our place in the universe.



**Table 2: Effects of ELF Magnetic Fields on Various Systems of the Body, Making contact with Effecting and Enhancing Biological Process**

<u>Organ</u>	<u>Magnetic Field Magnitude</u>	<u>Current</u>	<u>Potential</u>	<u>Frequency</u>
Brain, EEG	680 $\mu$ G	10 $\mu$ A	1 $\mu$ V	304 Hz
Pain Reduction CNS	10 to 15 G	0.1 mA	1 mV	71.25 Hz
Cardiac, ECG	0.1 to 2 G	0.1 mA	1 mV	7.6 Hz

**Please note a supporting reference from the research mentioned above, e.g.:**

Rauscher, E. A. & Bise, W.L. (1987), "Magnetic Field Flux Induction Into the Visual system of Humans". Ninth Annual Conference of the engineering in Medicine and Biology Society.

**\*Author's Personal Experience:** On Monday April 16,.2000, on my way to a conference in Council Grove, KS, I stopped for breakfast about 10 a.m. at a restaurant in northern Oklahoma. As I ate breakfast while reading the morning paper, I noted my vision gradually going "blotchey-blank".in both eyes. The paper was becoming almost impossible to read and eyestrain was increasing (not to mention my anxiety!). For some time I have had glaucoma in my left eye with this same type of "blotchey-blank" spots in the visual field. I became afraid that all of a sudden this condition had happened to my right eye also, and I would not be able to drive on to my meeting. What to do?! I closed my eyes for a few seconds and noted a faint moving white display effect in my upper visual field similar to a TV screen with the image all squinched up vertically into a wide band -- no detail, just movement in white and black

After breakfast, while sitting in the car in front of the restaurant wondering what was happening to me, my eyesight slowly returned to normal. Back on the road, it finally occurred to me, based on past personal experience with electrical stimulation of visual effects and aware of the research of Rauscher and Bise, above, that I may have been sitting in some sort of intense EMF focal point or standing wave. No one else in the restaurant seemed affected at the time and I didn't have enough presence of mind to check into the situation any further...just wanted to get away from there! On my return from my meeting on April 21<sup>st</sup>, I stopped at the restaurant again and check out the location. I noted a tall communication antenna behind (about 200 ft away) a nearby motel to the northeast and a microwave cell tower about i/2 mile directly north. These may have had something to do with the situation at the time. I hypothesize that both antennas could have been operating at the same time, producing some sort of modulation effect.. I had lunch at the restaurant, but there was no repeat of the experience at that time.

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*"A human being is part of the whole called by us "universe," a part limited in time and space. He experiences himself, his thoughts and feelings, as something separated from the rest....a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest to us. Our task must be to free ourselves from this prison by widening our circle of understanding and compassion to embrace all living creatures and the whole of nature and its bounty."*

.....Albert Einstein

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## Recent Books Of Interest

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**Wilson, B., Stevens, R, et al. "Extremely Low Frequency Electromagnetic Fields: The Question Of Cancer." Battelle Press, Columbus OH, 1990. (Approximately \$60)**

The book focuses on two well-documented biological effects of ELF exposure and suggests how these phenomena might be related to the carcinogenic process. The first of these effects is the impact of ELF exposure on the pineal gland and its production of melatonin. Evidence is presented that suggests ELF exposure results in decreased production of melatonin, much in the same way that increased exposure to light does. There is also an extensive discussion on how this process may affect the development of hormone-related cancers, such as breast cancer. The second major focus is on calcium-ion binding and transport at the cell membrane level. An extensive review of the evidence relating ELF exposure to calcium-ion homeostasis is followed by a discussion of how this association may be involved in the carcinogenic process. Included in the background sections are chapters on the physical aspects and measurements of ELF, circadian biology, pineal gland physiology, and oncogenes. The section on observed effects included chapters on the effects of ELF on the pineal gland, neural and neuroendocrine systems, and calcium homeostasis at the cell membrane level. The section on possible mechanisms included chapters on cell membrane amplification and on ion cyclotron resonance effects of ELF exposure. The final section includes chapters on the potential roles of ELF in carcinogenesis via its effects on the pineal gland and calcium homeostasis.

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**Ho, Mae-Wan, "The Rainbow and the Worm: The Physics of Organisms", World Scientific Pub. Co., Pte. Ltd., 1998. (About \$18.00)**

Mae-Wan Ho examines the question, "What is life?" using insights from physics, biology, and chemistry. She is a professor and research scientist who works outside of the mainstream, to say the least. She is best known for her activism against genetic engineering. Her writings take a "holistic" perspective on science; she tries to achieve understanding of the big questions (life, free will, etc) by combining ideas from many different fields. The book is not flaky or meta-physics. It won't tell you about life energies or world consciousness. It is also not a layman's introduction to any particular established field, as many science books are. Rather, it is a new look at "life," somewhat scientifically rigorous (she is a professional researcher) but presented so that it's accessible to non-scientists. She has a chapter describing how life operates far from the thermodynamic equilibrium, which was very interesting. On the other hand, the final chapter about optics is somewhat far-fetched in my opinion. The book's ideas are generally outside of the mainstream. All in all, it is a refreshing change for those of you who like science books. It's a short book, and worth the few hours it takes to read it. I would highly recommend it as pleasure reading for amateur science fans, or as a book that actual scientists with some time on their hands can read for a new perspective. I think it will not appeal to most conservative professional scientists, who tend to reserve their respect for researchers who are experts in a small and established field. Finally, don't worry about the equations; you can skip them and get the general idea.

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**Levitt, B. "Electromagnetic Fields: A Consumer's Guide to the Issues and How to Protect Ourselves." Harcourt Brace & Co., New York, 1995. (Approximately \$15)**

This book is one of the most comprehensive resources available to consumers today. It explains why and where EMFs occur, which illnesses may have a strong connection to them, and how your doctor's knowledge may be limited.

It is a frank, balanced, accessible, and very readable publication where science writer Levitt sorts through the complex social and medical issues. From power lines to radio towers, consumer products to government regulations, she explores our ever-increasing EMF environment and shows us what we can do to live more safely within it. This is recommended reading for community planners and all those concerned with personal and family health and well-being.

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***Possible Health Effects of Exposure to Residential Electric and Magnetic Fields, October 1996.*** The National Academy Press release of the National Research Council's long-awaited publication. (Reviewed by E. Marcus Barnes, P.E., EMF Health Effects Consultant, Aerodyne Laboratories, Austin, TX 78730, Ph. 512-338-1816)Background: In 1991, U.S. Congress mandated the National Academy of Sciences (NAS) to review EMF health effects research literature and determine if there was sufficient basis from which to assess any human health risk from EMF exposure, specifically in residential settings. Responding to legislation directing NAS to work with U.S. Department of Energy, a sixteen-member interdisciplinary committee was convened by the NRC and charged with producing the report -- a 314-page comprehensive review and in-depth analysis of epidemiologic and laboratory research, now available to the public. Commentary: The committee states in the executive summary "...the current body of evidence does not show that exposure to [these] fields presents a human-health hazard," while acknowledging that biologic effects from EMF exposure, nevertheless, do, exist. They go on to say "no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects." At the November DOE/EPRI/EPA five-day meeting in San Antonio, several committee members, and other scientists, openly expressed their disapproval of how certain (but not all) of the national press characterized the NRC report, typically headlining that there was no link between EMF and cancer, or that EMF health effects simply didn't exist. In the scientific community, it is generally acknowledged that a weak statistical link between childhood leukemia and historical EMF exposure estimates does exist -- as demonstrated in four residential epidemiologic studies. The questions at hand are, why the link exists, and whether or not it is a causal one, since none of the studies relied on actual measured fields for exposure assessment, but rather on powerline wire code classification (one used historical calculated fields). And while the absence of a directly-observed association between EMF and leukemia doesn't preclude a possible risk, it can render it less believable, especially since there is no known, generally recognized, plausible biological process on how EMF could (directly or indirectly) cause or promote cancer in the first place. Yet, given the scientific evidence we do have, and that certain EMF biological effects do indeed exist, a potential risk can't be categorically ruled out. In view of this state of scientific uncertainty and public concern, the committee says "Continued research is important, however, because the possibility that some characteristic of the electric or magnetic field is biologically active at environmental strengths cannot be totally discounted. If ongoing or future research should uncover evidence of potential mechanisms that could lead to such a result, research should be continued to follow those leads and address that possibility." Hardbound copy of the report are available for \$39.95 plus \$4 shipping from National Academy Press, 2101 Constitution Ave., NW, Lockbox 285, Washington, DC 20055, or through internet: <http://www.nap.edu/bookstore>.

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**Sagan, L.A., "Electric And Magnetic Fields: Invisible Risks?", Gordon and Breach, 250 pages, June 1996 Paperback US\$19.95.** Source: University of Toronto Press, 250 Sonwil Drive, Buffalo, NY, Ph.: 1-800-565-9523, Fax: 1-800-221-9985, Em: <utpbooks@gpu.utcc.utoronto.ca>

This is an excellent, reader-friendly text on the EMF health effects issue. Although intended for the lay reader, the book provides a solid background, history, and dispassionate discussion on residential and occupational research findings and their implications. Recommended for anyone wanting to delve into and become more familiar with the topic and yet not be

"overwhelmed" with the science. Selected Contents: \* Recent Emergence of the EMF Issue \* Electric and EMF \* EMF Exposure Assessment \* Mechanisms and Dose: How Does EMF Interact with Biological Systems? \* EMF in the Laboratory \* What is Risk Assessment? \* Epidemiology \* EMF and Cancer \* Disease Clusters \* EMF and Reproduction \* and Neurobehavior \* Quantifying the Risks of EMF: A Preliminary Effort \* What Should We Do? \* EMF Options Management

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**Oschman, J.L., "Energy Medicine: The Scientific Basis", Churchill Livingstone, Harcourt Publishers Limited, 2000. (About \$40.00)**

This book is a solid cornerstone of the bridge linking rigorous scientific theory and intuitive, energy healing techniques. Great lengths are taken to explain how a person's thought processes, including their beliefs about themselves, have a very real physical manifestation in the form of electrical pulses which generate magnetic fields which are detected by and affect the entire body. Energy therapy such as polarity, Reiki, and acupuncture have been shown to work at the same frequency range of the electromagnetic spectrum as pulsed electromagnetic field (PEMF) therapy. PEMF has been used by Western medicine for some time to aid in the healing of bone which is not healing on its own. (See Bassett C A L 1995 Bioelectromagnetics in the service of medicine. In: Blank M (ed) Electromagnetic fields: biological interactions and mechanisms. Advances in Chemistry Series 250. American Chemical Society, Washington DC, pp 261-275) The problem with many books on all types of energy healing are the moments when well-meaning but hopelessly uninformed authors try to explain the "why" of their practice. Why does energy healing work? What is the physiological mechanism for this phenomenon? While authors whose practice is informed by their psychic knowledge (Barbara Brennan, Rosalyn Bruyere, etc.) are certainly valuable, James Oschman is successful in this book because he is first and only a scientist. He has no agenda to defend the validity of energy healing at all costs. In fact, you get the sense that he would be just as happy DISproving the phenomenon. And his objectivity in showing that in fact there IS a scientific basis for the practice is what makes this book absolutely priceless. The topics covered are surprisingly far-ranging. The author is so reasonable, and his claims so well-documented that even the most open-minded might find themselves taking a new look at topics they never considered. The chapters on crystal healing and the emotional impact of posture, respectively, are particularly fascinating. His description of the physical body as a liquid crystalline system, the mechanics of how movement strengthens this system, and how the physical liquid crystal interacts with and is the basis for the energetic system is remarkable.\* What this book is not: This book is not an instruction manual. There are no instructions as to how to practice any of the many techniques covered. The book is for people who already know how to do these things or people who don't want to know HOW but rather WHY IT WORKS. A fabulous reference for those who would like to give clients a more lucid explanation for why various forms of energy healing might work, or at least more current theories on the topic.

**\*Note:** For more info on liquid crystals and life processes, see the Mae-Wan Ho book listed above and discussed in pages 27 and 33 in this BEM Health Effects Update publication.

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**Nothing is so incredible to us  
as that which we do not wish to believe!!**  
....Anonymous

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**International Institute for Bau-Biologie & Ecology, Inc.**

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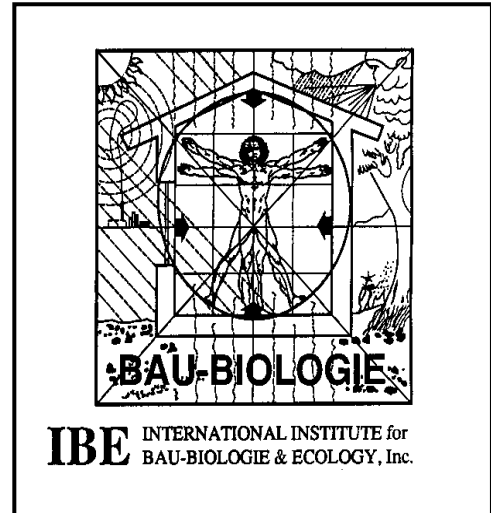
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The Institute's main purpose is to educate, to help people realize that health hazards such as electromagnetic radiation and polluted indoor air may exist in their homes and workplaces. Even though they may not be aware of them, ignorance of these hazards may not only have an effect on their health but also, in a wider sense, on their survival on this planet. Beyond this, Bau-biologie suggests ways to eliminate, or at least ameliorate, such problems using knowledge that has been compiled in Europe over the past three decades.

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**Additional Contacts For Information**

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**Bioelectromagnetics Society (BEMS):** An international scientific society founded for the purpose of promoting research concerned with the interaction of electromagnetic energy with biological systems. For membership and publications details, contact: The Bioelectromagnetics Society, 7519 Ridge Road, Frederick, MD 21701

**Technology Alternative Corporation:** For those concerned about ELF, EMF, Power Line & Computer VDT or CRT Radiation, Technology Alternatives offers Ultra Low Radiation Computer Monitors and Gauss meters to measure fields at home, school and work. When it comes to computer monitors, Technology Alternatives offers a guaranteed level of 0.1 milligauss at 20 inches! All other monitors in the market only offer a guaranteed level of either 2.0 at 12 inches (TCO), or 2.5 at 20 inches (MPR). TAC, 1950 NE 208 Terrace, Miami, FL 33179, 1-800-222-3003 (Tech Sales Specialist), FAX 1-305-933-8858, website [www.safelevel.com](http://www.safelevel.com).

**EMR Network:** This group will address public health issues related to cell phones and towers, radio and TV broadcasting and radar. Power line issues will also be on the agenda. Besides offering information to concerned citizens, and advice to activists, the EMR Network will press for credible, impartial science on the possible health effects of non-ionizing radiation. The Network will lobby for federally funded research on possible health effects of wireless telephone radiation, to be directed by the Environmental Protection Agency. They will be active in the legislative arena as well and will argue for a revision of the FCC's RF/MW exposure limits. Contact Libby Kelley at 936-B Seventh Street, Suite 206, Novato, CA 94945, 415-892-1863, <[info@emrnetwork.org](mailto:info@emrnetwork.org)> Web: <<http://www.emrnetwork.org>>

**Microwave News:**, Louis Slesin, Ed., P.O. Box 1799, Grand Central Station, New York, NY 10163, Ph. 212-17-2800, fax 212-734-0315, website: <<http://www.microwavenews.com>> email: <[mwn@pobox.com](mailto:mwn@pobox.com)>. An excellent source for the latest information on EMF bioeffects.

**Safe Living Technologies, Inc.** Offers environmental testing services, equipment and EMF/RF shielding for homes, offices and industries. Their high quality instruments and supplies for detection, monitoring and shielding EMFs, cover the whole spectrum from low frequency thru microwave. Ph: 519-240-8735 (o) 519-821-5724 (fax) Web: [www.safelivingtechnologies.ca](http://www.safelivingtechnologies.ca)

**For more comprehensive information about hypothyroidism, thyroid hormone resistance, Fibromyalgia and related metabolic dysfunctions**, contact Dr. John C. Lowe, Director of Research, Center for Metabolic Health, Fibromyalgia Research Foundation, 1007 Pearl St., Suite 280, Boulder, CO 80302,, Ph: 303-413-9100 fax: 303-938-1265. Details on Website: <<http://www.drloewe.com>> E-mail: <[MetabolicHealth@aol.com](mailto:MetabolicHealth@aol.com)>

**The EMF shielding mobile phone case** typically reduces the power absorbed by the user's head by by a factor of around 99%. Microshields are available for most makes of mobile phones. Radiation is reduced by: 1) Woven polyester/nickel shielding to reduce microwave and low frequency pulses, 2) Keypad and display utilize a transparent shielding of fine wire mesh, and 3) Major radiation emission from antenna shielded by the Microshield™ aerial guard. The Microshield™ is priced at £39.95 plus post and packing (\$66.32 at present exchange rate). Contact: Microshield House, 59 Southbury Rd., Enfield, EN11PJ, UK. Ph: +44 181 363 3333, fax: +44 181 372 3232 em: <[sales@microshield.co.uk](mailto:sales@microshield.co.uk)> web: <[www.microshield.co.uk/](http://www.microshield.co.uk/)>

**Conductive Shoes, for elimination of electrostatic charge buildup**, (*like going barefoot on the earth!*) are available from Iron Age Safety Footwear, Ph:-866-476-6243 (toll free), web: [www.IronAgeShoes.com](http://www.IronAgeShoes.com). See 2005 catalog, pg. 46, sport/work shoe 936 (about \$90)

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**(in disturbing biological processes at the weak levels of interest!)"**

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**Roger Coghill MA (Cantab.) C. Biol. M I Biol. MA (Environ. Mgt)**  
**Tamara Galonja-Coghill MSc**

Sadly most of the UK bioelectromagnetics research is Govt. funded too, except our own independent laboratory, that is.

Most in this field, including Ross Adey, have for years been searching for a robust mechanism to explain weak electromagnetic field interactions at non-thermal levels. Most of the existing hypotheses favour the magnetic component, because this is the only component the establishment has allowed to be funded. Ross suggests an electric field hypothesis ("whispering cells") but confines his explanation to the cell reception side, without involving the transmitting capability of the brain, which completes the picture in multicellular organisms.

The truth of the matter is that it is the electric component which is the active parameter in disturbing biological processes at the weak levels of interest (Ross Adey's 1976 paper with Suzanne Bawin was a study of the electric field, and before him the discoveries of Abood also noted these weak electric field effects; also Herbert Frölich recognised that the information carrier had to be electric; in fact the earliest Russian studies were also in favour of the electric field, because they reasoned that if anything has changed since the arrival of HV powerlines it was the electric not the magnetic field component).

My laboratory was the first and still is, to report that electric fields in the bedplace of children with leukaemia were clearly showing dose response relationships supporting a causal relationship. We had no support and indeed great opposition from the UK establishment in carrying out our research. Even after peer reviewed publication our study was deliberately excluded by most reviewers of the epidemiological literature, on the express request of funding agencies.

Finally the UK Bristol group under Henshaw and Preece is acknowledging the importance of the electric field, but they still have problems with the establishment: for example their work is being rubbished by the NRPB. Their other problem is that their hypothesis has important flaws. The UK National Childhood cancer study is also reluctantly incorporating the electric field, but their data collection protocols are deliberately flawed: it is no good collecting measurement of the electric field any where else than the bedplace of the cases and controls, but the UKCCCR study is collecting these in room centres.

Having in 1998 created a microbiology unit thanks to funding from the Foundation for Children with Leukaemia (who has helped us financially for some years) we have finally managed to uncover the mechanism which has eluded detection to date, and come up with an experimental support so robust that we have replicated it here seven times during the last year.

This mechanism is effectively that motile cells such as lymphocytes, on which tumour immunity depends, are programmed directly and their viability is maintained by the brain's endogenous fields at levels too low for thermal effects. Though scientists have known about EEG records since Hans Berger reported them in the 1920s, their functional significance has remained unexplained. It is only now clear that these weak endogenous fields from the brain are playing a role far more important than previously realised. We have shown that lymphocytes in vitro given the benefit of these fields (which are inevitably electric not magnetic) remain significantly more viable than cells unexposed to them. Moreover we have just found out that the endogenous fields on a non-donor of the cells have no such beneficial effect: in other words only the endogenous fields of the donor of the lymphocytes can address the cells via signaling through the intercellular saline body fluids of the organism.

Fighter planes during the war saw the same problem of recognition and used single sideband techniques to ensure that only friendly planes could receive the signals from home base. Glycoproteins on cell surfaces are similarly unique for signal reception from the brain of the donor.

The enormity of this advance in biological knowledge is as great as Harvey's discovery of the circulation of blood.

Endogenous fields are perturbed by artificial external fields, because by the laws of physics electric fields are additive ( $E = E_1 + E_2$ ). Such perturbations are carried by the saline aqueous solutions of the body almost losslessly and at nearly the speed of light. Again, we have shown by experiment that lymphocytes exposed to artificial fields (both ELF and modulated RF/MW) exhibit depressed viability, using the standard lab test of trypan blue exclusion. And again this experiment is completely replicable.

In short there now exists a completely plausible explanation for weak electromagnetic field effects, supported by experiment, and in fact variations of our experiments on lymphocytes have been reported in other labs such as that of Maria Scarfi, Pio Conti, Ross Adey, and Dan Lyle over the years, but without the insight which our endogenous field studies provide.

Our UK lab is now preparing these studies for peer review publication, but we are already aware that there will be mighty efforts to try to stop their acceptance, and even when such efforts fails the studies will probably be ignored by the establishment for some time. For example we invited the new head of the NRPB, a representative of the cellphone industry, and a Professor at Oxford University to attend a replication of the lymphocyte experiments at our laboratory, but so far have had no response.

Nevertheless the truth will eventually out, and the fundamental importance of these findings will be recognised throughout science. Both Robert Becker and Ross Adey were so close to this discovery that we can still not understand why they didn't get there before Tamara and me.

Date: Sun, 3 Jan 1999 04:12:13 EST

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*For every vision there is an equal and opposite revision!*

*...Thal's Law*

**EARTH FIRST! We'll strip-mine and 'civilize' the other planets later!**

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**MYSTERY IN THE SKIN:**  
**Screen Dermatitis, the Effect of Computer Work On Human Skin.**



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<http://www.feb.se/ARTICLES/OlleJ.html>

An interview with associate professor Olle Johansson at the Experimental Dermatology Unit, Department of Neuroscience, Karolinska Institute, Stockholm, Sweden.

Mr. Helge Tiainen, former head of the Nokia Consumer Electronics in Sweden once said that "The results of Olle Johansson's research could very well deeply shake the world's electronics industry, but mankind still has to know!"

Some interests might feel threatened by the results of his research, but professor Johansson has been outspoken and committed to this scientific field. He started in the 1980's and he has since been continuously very productive and an advocate for the electrosensitive persons in Sweden as well as around the world. This interview will go into what professor Johansson has discovered in the skin of those injured by computer monitors, and also what remains to be done.

He has written a number of important scientific original articles as well as a great number of commentaries and debate articles in the daily newspapers. He has been awarded a series of prestigious awards, such as the Nokia Monitor Award, the Environmental/Medicin Award from the Swedish Cancer and Allergy Foundation and the SIF-Award (The Swedish Clerical and Technical Employees Union).

Altogether, his publication list within the field of neuroscience contains more than 450 original papers, review articles and conference summaries, and he has been a co-author of papers in high-impact journals, such as Nature and Science. His skill as a lecturer is very well documented and his overall knowledge in the areas of the neurosciences, health effects of electromagnetic fields, and in experimental dermatology is esteemed at the highest level.

FEB: What made you first interested in studying people who had suffered injuries from working in front of computer monitors?

Professor Johansson: It all started in the 1980's after having listened to a radio programme in which Ms Kajsa Vedin from Gothenburg, herself very active from a union point of view and the author of an excellent analysis entitled "In the shadow of a microchip" (about the occupational risks involved in computer-based work), asked for expertise in neurology. As a neuroscientist I thought I was close enough, and I strongly believed that the issues she wanted to highlight, using the conventional repertoire of scientific "tools", ought to be easily investigated. I did not realise at all that there were other forces not wanting to see such studies initiated, but very soon I understood that these very clear-cut and simple and obvious investigations proposed by Kajsa Vedin would be very, very hard to start. The same type of propositions soon were brought forward by many other persons including the two journalists Gunni Nordstrom and Carl von Schéele, who later published their first book, "Sjuk av bildskarm" ("Ill from VDT work"; Tidens Forlag, 1989, ISBN 91-550-3484-5). Unfortunately, most of these proposed studies are still not brought into life, 15 years later.

FEB: Many people abroad think that because electrosensitivity is so well known in Sweden, that we have conducted many important studies also. But this is not the case. Why is this?

Professor Johansson: The reason is simple, I am afraid. It is not because of lack of ideas and projects, on the contrary, the only reason is lack of funding. This fact has been very important, thus, more or less putting a dead end to the pursuit of knowledge here in Sweden. It is sad, very sad, since I strongly believe a lot would have been understood today if scientists could have been in a situation to properly investigate this enigmatic disease. And, a great deal of unnecessary suffering among the patients could, thus, have been avoided.

FEB: Did you ever doubt the people who claimed to have been injured using computer monitors?

Professor Johansson: For me it was immediately clear that persons claiming skin reactions after having been exposed to computer screens very well could be reacting in a highly specific way and with a completely correct avoidance reaction, especially if the provocative agent was radiation and/or chemical emissions -- just as you would do if you had been exposed to e.g. sun rays, X-rays, radioactivity or chemical odours. The working hypothesis thus became that they reacted in a cellularly correct way to the electromagnetic radiation, maybe in concert with chemical emissions such as plastic components, flame retardants, etc., something later focussed upon by professor Denis L. Henshaw and his collaborators at Bristol University (this is covered in Gunni Nordstrom's book "Morklaggning - Elektronikens rattslosa offer" (Hjalmarson & Hogberg Forlag, 2000, ISBN 91-89080-41-6)).

Very soon, however, from different clinical colleagues a large number of other 'explanations' became fashionable, e.g. that the persons claiming screen dermatitis only were imagining this, or they were suffering from post-menopausal psychological aberrations, or they were old, or having a short school education, or were the victims of classical Pavlovian conditioning. Strangely enough, most of the, often self-made, 'experts' who proposed these explanations had themselves never met anyone claiming screen dermatitis and these 'experts' had never done any investigations of the proposed explanatory models. The explanations were soon revealed to be excuses of a scientifically fraudulent nature! It is interesting to see that science at that time was mere witchcraft. It remains for skilful journalists to inquire how this came about.

FEB: You created the name "screen dermatitis", a clinical term to explain the cutaneous damage developed in the late 1970's when office workers, first mostly women, began to be placed in front of computer monitors. Many of them became ill and developed cutaneous and neurological problems. Several clinical dermatologists, headed by the late professor Sture Lidén, instead talked about union-driven fears, mass media-based psychoses, imagination phenomena, Pavlovian conditioning and so forth. But you came to a totally different conclusion. Why?

Professor Johansson: I refused to reduce people to an ill-defined psychologic home-made diagnosis, without any support even among experts in psychology and psychiatry. Instead, I called for action along lines of occupational medicine, biophysics and biochemistry, as well as neuroscience and experimental dermatology.

I support the democratic principle that citizens are allowed to be ill even in a disease, i.e. a new diagnosis, that is not yet acknowledged by the medical establishment. All diseases were once a "new diagnosis", and the medical profession strongly has doubted asbestosis, cold urticaria, AIDS, the mad cow disease, skin lice, etc. I usually end my lectures with a quotation from Albert Einstein "The important thing is not to stop questioning". I have never stopped asking questions and I am using the answers to put into place the ever-growing number of pieces of a very, very complicated and enigmatic puzzle.

FEB: Mr. Helge Tiainen, former head of the Nokia Consumer Electronics in Sweden, in February 23, 1994, said that "The results of Olle Johansson's research could very well deeply shake the world's electronics industry, but mankind still has to know!" You have received death threats, and been generally harassed. Do you think this has anything to do with your attempts to let "mankind know" ?

Professor Johansson: Unfortunately, yes

FEB: Your Ph.D. thesis was about neuropeptides in the central and peripheral nervous system. Are they also involved in the reactions in the skin of the electrically sensitive?

Professor Johansson: This is a very important question you bring up! This is something we have wanted to study for many years, but so far we have not been able to pursue these lines of interest due to lack of funding. Since the persons claiming electrosensitivity/screen dermatitis report cutaneous sensations, such as itch, pricking pain, redness, etc., of course the peripheral as well as the central nervous system must be involved. And, by understanding alterations in the chemical neurotransmitter or neuromodulator levels, synthesis, break-down, release and re-uptake, much could be learnt and understood about the basis for these avoidance reactions based upon signals transmitted via the classical sensory and autonomic pathways.

The reaction pattern definitely points to a true biophysical effect, and not to anything else. And, finally, if you take into consideration the large number of publications showing severe changes or damages from low- or high-frequency irradiation of cells, tissues and non-human experimental animals, such alterations cannot ever be understood as "post-menopausal stress reactions", "imagination" or "techno-stress alterations"!

FEB: You have in 1995 shown that histamine can exist in nerves in the skin. What does this mean?

Professor Johansson: Already in 1953, the Swedish Nobel Laureate, professor Ulf von Euler had shown that peripheral nerves biochemically could contain histamine. It was argued at that time that it only was due to a contamination of histamine from mast cells present around the peripheral nerves. However, further physiological experiments indicated that maybe there could be both central neurons containing histamine (recently proved) as well as peripheral nerves in various target organs.

Using a histamine-based immunohistochemistry we could then, in 1995, show images revealing the presence of histamine-immunoreactive nerves in the skin (1). Naturally, such a finding is of paramount importance, since all studies on histamine effects in the skin have been based on the assumption that the histamine only is released from local mast cells. So, for instance regarding itch, now we have had to reconsider the function of nerve terminal-derived histamine, something also of the greatest impact for areas such as electrosensitivity.

(1) Johansson O, Virtanen M, Hilliges M, "Histaminergic nerves demonstrated in the skin. A new direct mode of neurogenic inflammation?", *Exp Dermatol* 1995; 4: 93-96

FEB: When you look at a biopsy from an electrically sensitive person, what do you usually find?

Professor Johansson: We are right now in the process of examining a larger number of facial skin samples, and from them the most common finding is a profound increase of mast cells. Nowadays we do not only use histamine, but also other mast cell markers such as chymase and tryptase, but the pattern is still the same as reported previously for other electrosensitive persons (2). Furthermore, increases of similar nature have now been demonstrated in an experimental situation employing normal healthy volunteers in front of visual display units, including ordinary house-hold television sets (3).

Among earlier studies, one paper (4) ought to be mentioned. In it, facial skin from so-called screen dermatitis patients were compared with corresponding material from normal healthy volunteers. The aim of the study was to evaluate possible markers to be used for future double-blind or blind provocation investigations. Differences were found for the biological markers calcitonin gene-related peptide (CGRP), somatostatin (SOM), vasoactive intestinal polypeptide (VIP), peptide histidine isoleucine amide (PHI), neuropeptide tyrosine (NPY), protein S-100 (S-100), neuron-specific enolase (NSE), protein gene product (PGP) 9.5 and phenylethanolamine N-methyltransferase (PNMT). The overall impression in the blind-coded material was such that it turned out easy to blindly separate the two groups from each other. However, no single marker was 100% able to pin-point the difference, although some were quite powerful in doing so (CGRP, SOM, S-100). However, it has to be pointed out that we cannot, based upon those results, draw any definitive conclusions about the cause of the

changes observed. Whether this is due to electric or magnetic fields, a surrounding airborne chemical, humidity, heating, stress factors, or something else, still remains an open question. Blind or double-blind provocations in a controlled environment (3) are necessary to elucidate the underlying causes for the changes reported in this particular investigation.

(2) Johansson O, Liu P-Y, ""Electrosensitivity", "electrosupersensitivity" and "screen dermatitis": preliminary observations from on-going studies in the human skin". In: Proceedings of the COST 244: Biomedical Effects of Electromagnetic Fields - Workshop on Electromagnetic Hypersensitivity (ed. D Simunic), EU/EC (DG XIII), Brussels/Graz, 1995; 52-57

(3) Johansson O, Gangi S, Liang Y, Yoshimura K, Jing C, Liu P-Y, "Cutaneous mast cells are altered in normal healthy volunteers sitting in front of ordinary TVs/PCs - results from open-field provocation experiments", J Cutan Pathol, 2001, in press

(4) Johansson O, Hilliges M, Han SW, "A screening of skin changes, with special emphasis on neurochemical marker antibody evaluation, in patients claiming to suffer from screen dermatitis as compared to normal healthy controls", Exp Dermatol 1996; 5: 279-285

FEB: You made a sensational finding when you exposed two electrically sensitive individuals to a TV monitor. When you looked at their skin under a microscope, you found something that surprised you. What?

Professor Johansson: I guess that you are aiming at one of the early papers (5). In this article, we used an open-field provocation, in front of an ordinary TV set, of 2 patients regarding themselves as suffering from skin problems due to work at video display terminals. Employing immunohistochemistry, in combination with a wide range of antisera directed towards cellular and neurochemical markers, we were able to show a high-to-very high number of somatostatin-immunoreactive dendritic cells as well as histamine-positive mast cells in skin biopsies from the anterior neck taken before the start of the provocation. At the end of the provocation the number of mast cells was unchanged, however, the somatostatin-positive cells had seemingly disappeared. The reason for this latter finding is discussed in terms of loss of immunoreactivity, increase of breakdown, etc. The high number of mast cells present may explain the clinical symptoms of itch, pain, edema and erythema. Naturally, in view of the present public debate, the observed results are highly provocative and, I believe, have to be taken much more seriously.

(5) Johansson O, Hilliges M, Bjornhagen V, Hall K, "Skin changes in patients claiming to suffer from "screen dermatitis": a two-case open-field provocation study", Exp Dermatol, 1994; 3: 234-238

FEB: You mention mast cells in the skin. A doctor, John Holt, in Australia has written to us saying that when working with microwaves (to irradiate cancer cells) he has observed that the microwaves from cell phones cause a doubling of histamine (which are released from mast cells) and that such electrosmog from mobile phones could be the cause of the ever increasing asthma and other allergies. Does his reasoning make any sense?

Professor Johansson: It certainly does! I have put forward this hypothesis many years ago, in public here in Sweden, and I am now happy to finally see more and more data gathering to support this idea. I and my collaborator, dr. Shabnam Gangi, have also addressed this in two recent publications (see below).

FEB: You and your partner Shabnam Gangi have presented a theoretical model for how mast cells and substances secreted from them (e.g. histamine, heparin and serotonin) could explain sensitivity to electromagnetic fields. Could you, please, explain this? And also, please, explain the function of the Langerhans cells and how long it takes for them to return.

Professor Johansson: Yes, we have published two papers of theoretical nature (6,7). They bounce off from known facts in the fields of UV- and ionizing irradiation-related damages, and use all the new papers dealing with alterations seen after e.g. power-frequency or microwave electromagnetic fields to propose a simple summarizing model for how we can understand the phenomenon of electrosensitivity. I strongly recommend the readers of this interview to familiarize themselves with these publications, since I fully believe they have a lot to offer as food for further thoughts.

In the first paper, in the journal *Experimental Dermatology* (6), we describe the fact that an increasing number of persons say that they get cutaneous problems as well as symptoms from certain internal organs, such as the central nervous system and the heart, when being close to electric equipment. A major group of these patients are the users of video display terminals, who claim to have subjective and objective skin- and mucosa-related symptoms, such as pain, itch, heat sensation, erythema, papules, and pustules. The central nervous system-derived symptoms are, e.g. dizziness, tiredness, and headache. Erythema, itch, heat sensation, edema and pain are also common symptoms of sunburn (UV dermatitis). Alterations have been observed in cell populations of the skin of patients suffering from so-called screen dermatitis similar to those observed in the skin damaged due to ultraviolet light or ionizing radiation. In screen dermatitis patients a much higher number of mast cells have been observed. It is known that UVB irradiation induces mast cell degranulation and release of TNF-alpha. The high number of mast cells present in the screen dermatitis patients and the possible release of specific substances, such as histamine, may explain their clinical symptoms of itch, pain, edema and erythema. The most remarkable change among cutaneous cells, after exposure with the above-mentioned irradiation sources, is the disappearance of the Langerhans' cells. This change has also been observed in screen dermatitis patients, again pointing to a common cellular and molecular basis. The results of this literature study demonstrate that highly similar changes exist in the skin of screen dermatitis patients, as regards the clinical manifestations as well as alterations in the cell populations, and in skin damaged by ultraviolet light or ionizing radiation.

In the second publication (7), from the journal *Medical Hypotheses*, the relationship between exposure to electromagnetic fields and human health is even more in focus. This is mainly because of the rapidly increasing use of such electromagnetic fields within our modern society. Exposure to electromagnetic fields has been linked to different cancer forms, e.g. leukemia, brain tumors, neurological diseases, such as Alzheimer's disease, asthma and allergy, and recently to the phenomenon of electrosensitivity and screen dermatitis. There is an increasing number of reports about cutaneous problems as well as symptoms from internal organs, such as the heart, in people exposed to video display terminals. These people suffer from subjective and objective skin and mucosa-related symptoms, such as itch, heat sensation, pain, erythema, papules and pustules (cf. above). In severe cases, people can not, for instance, use video display terminals or artificial light at all, or be close to mobile telephones. Mast cells, when activated, release a spectrum of mediators, among them histamine, which is involved in a variety of biological effects with clinical relevance, e.g. allergic hypersensitivity, itch, edema, local erythema and many types of dermatoses.

From the results of recent studies, it is clear that electromagnetic fields affect the mast cell, and also the dendritic cell, population and may degranulate these cells. The release of inflammatory substances, such as histamine, from mast cells in the skin results in a local erythema, edema and sensation of itch and pain, and the release of somatostatin from the dendritic cells may give rise to subjective sensations of on-going inflammation and sensitivity to ordinary light. These are, as mentioned, the common symptoms reported from patients suffering from electrosensitivity/screen dermatitis. Mast cells are also present in the heart tissue and their localization is of particular relevance to their function. Data from studies made on interactions of electromagnetic fields with the cardiac function have demonstrated that highly interesting changes are present in the heart after exposure to electromagnetic fields.

(6) Gangi S, Johansson O, "Skin changes in "screen dermatitis" versus classical UV- and ionizing irradiation-related damage--similarities and differences. Two neuroscientists' speculative review", *Exp Dermatol* 1997; 6: 283-291

(7) Gangi S, Johansson O, "A theoretical model based upon mast cells and histamine to explain the recently proclaimed sensitivity to electric and/or magnetic fields in humans", *Med Hypotheses* 2000; 54: 663-671

FEB: Some electrically sensitive have symptoms similar to heart attacks after exposure to electromagnetic fields. Any comment on that?

Professor Johansson: One could speculate that the cardiac mast cells are responsible for these changes due to degranulation after exposure to electromagnetic fields. However, it is still not known how, and through which mechanisms, all these different cells are affected by electromagnetic fields. In this article (7), we present a theoretical model, based upon the above observations of electromagnetic fields and their cellular effects, to explain the proclaimed sensitivity to electric and/or magnetic fields in humans.

FEB: You have been called a scientist who has climbed down from his ivory tower to get in contact with the real world people live in. Has this been a hindrance to you?

Professor Johansson: Unfortunately, yes, to a very, very large degree. For readers interested in this, I warmly recommend the books by Gunni Nordstrom and Carl von Scheele (8-10). They are of great value for persons wanting to acquaint themselves with the political implications and impact of the phenomenon of new diagnoses in our society.

(8) "Sjuk av bildskarm" by Gunni Nordstrom and Carl von Schéele (Tidens Forlag, 1989, ISBN 91-550-3484-5)

(9) "Faltslaget om de eloverkansliga" by Gunni Nordstrom and Carl von Schéele (Tidens Forlag, 1995, ISBN 91-550-4083-7)

(10) "Morklaggning - Elektronikens rattslösa offer" by Gunni Nordstrom (Hjalmarson & Hogberg Forlag, 2000, ISBN 91-89080-41-6)

FEB: How would you depict the world the electrically sensitive live in?

Professor Johansson: As a healthy individual it is always very hard to try to describe patients' own situation, so I would rather have someone else to answer this. But, in essence, it must be a very tough daily life, having to always (very much as an allergic or asthmatic person) look out for situations of provocative nature. And, where today would you find an electric environment equal to e.g. the 1950's? Or, even more mind-boggling, where would you find a high-frequency milieu the same as last year? Nowhere, I guess, since the growth of all such systems is so rapid and quickly covers us all. Therefore, to enable the basic freedom of choosing where to live, where to work, etc., is impossible in relation to the electrosensitive persons' requirements. And, thus, the question of electrosensitivity becomes a question about democracy!

FEB: Why do you think some people become electrically sensitive and others do not?

Professor Johansson: This is also a most important and interesting question. As you know, in any kind of disease, not everyone is ill, and not at the same time. Everyone will not get cancer, everyone will not break a leg, everyone will not have malaria. This is governed by the biological statistical rules of the natural variation. But, maybe you should turn the issue around somewhat. Perhaps all healthy persons, i.e. in the sense not being electrosensitive, ought to be extra happy for the electrosensitive ones, since they have acted as a warning for all of us? It could be, that we will owe them a lot since they reacted in time to something which the main

bulk of mankind did not. Furthermore, the possibility is also that the electrosensitive persons will turn out to be tomorrow's great winners, given the fact that this Summer, twentyone world-leading scientists during a gathering in the French city Lyon, within IARC's (IARC = International Agency for Research on Cancer) expert panel, have concluded low-frequency magnetic fields as a possible cancer risk (=group 2B, containing in addition i.a. diesel and petrol fumes, chloroform, welding fume, lead and DDT). For children exposed to such low-frequency magnetic fields above 0.4 microTesla the cancer risk is doubled. (Therefore, I ask myself: How will people feel after having spent their everyday working hours at or around Vasagatan in Stockholm where the low-frequency magnetic field 1.2 meters above ground is between 0.3 and 2.2 microTesla, or in the commuter trains having levels between 1 and 100 microTesla in the traveller's compartment!?)

FEB: Does it worry you that children use mobile telephones?

Professor Johansson: Yes, definitely. And, as you know, also the British government has, in December last year, taken firm action in respect to this question.

FEB: How will we look on mobile telephones in ten years?

Professor Johansson: Hopefully without any remaining questions, scepticism or fear. I look forward to see the question-marks around this technology resolved, and a well-documented and 100% responsible, human-friendly technology being presented. And, hopefully, tomorrow's human-friendly technology will be made by Swedish companies, in that way creating a 'healthy wealth' for our country.

FEB: What do you tell people who suggest that electric sensitivity is purely imagined or psychological?

Professor Johansson: Well, I always ask them to then, in parallel, explain all the peer-review-published results around effects of, often very weak, electromagnetic fields on molecules, cells, tissues, organs and various non-human experimental animals, i.e. situations which cannot at all be understood in terms of imagination or psychology. In failing this task, I then ask them to return to the first statement regarding humans, and to scrutinize and re-evaluate it. As you understand, people at that moment suddenly lack scientifically sound arguments, and most of them also confess this. As you know, in the same way it is also very easy to say that all Finns carry knives, but when you look upon this statement in a scientific way it is even easier to show that it is not true!

FEB: There are many self-appointed 'experts' who have made life difficult for the electrically sensitive. Are they always scientists?

Professor Johansson: I am, and have always been, very surprised to see how sloppy some of my colleagues address important issues such as the above. Very often one has to realize that all 'experts' are not true scientists and scholars. Furthermore, it is also very annoying to see that 'experts' claiming, for instance, "that the best way to treat electrosensitive persons is to completely ignore them through silence", did not have to face any personal consequence...!? Nothing happened to them, their position was not questioned, their competence as physicians was not questioned, their suitability as representatives for the medical profession was not questioned. Nothing! What kind of society is that?

I am also very disturbed by the fact that even if the electrosensitive persons were victims of an illusion, where in the Swedish health and law system does it say that you can treat them so badly as several have done? When I attended the medical school I was taught the very opposite: You should always address patients with kindness, a will to learn and help, support them, meet them and their concerns in a most respectful way, and so on. Where did that disappear? It seems as our world-famous Swedish health insurance policy contains very big

gaps through which electrosensitive people, as well as other new diagnoses, fell, and still fall, head down!

FEB: Do you know of anyone else in the world who has taken biopsies of electrically sensitive individuals?

Professor Johansson: Yes, the assistant professor and histopathologist Bjorn Lagerholm at the Karolinska Hospital in Stockholm did that already in the middle of the 1980's. He also found an increase in the mast cell number, but, unfortunately, he could never publish it.

As a matter of fact, his interest very much started with a female bank employee that had received a work injury compensation for skin changes after sitting in front of a visual display monitor. Bjorn Lagerholm described in great detail her skin changes, which turned out to be very similar to the kind of cutaneous alterations you may encounter in connection with ultraviolet light or X-ray damage. It is to be noted that Bjorn Lagerholm's reputation as a histopathologist was, and is, undisputed. He had examined at least 10,000 biopsies from other skin diseases before this particular case. In addition to her, he also examined nearly 100 further screen dermatitis cases, all having the same skin changes.

Bjorn Lagerholm wrote an article in the Swedish Medical Journal ("Lakartidningen") to describe his observations. Apart from this he was never able to pursue his ground-breaking and very elegant studies. They would be buried for several years, until I and my collaborators re-initiated them in the early 1990's.

FEB: Some doctors say that the radiation from a computer monitor could not possibly affect the human skin. The nerves are not that superficial, but what do you say?

Professor Johansson: This is completely wrong! The idea of the deeply buried nerve fibers were put forward by the late professors David Ingvar and Bernard Frankenheuser. However, we shortly after published the first true demonstration of the epidermal nerves in human skin (11), followed by an ultrastructural identification (12) as well as a detailed description and quantification of these very superficial nerves (13).

(11) Wang L, Hilliges M, Jernberg T, Wiegleb-Edstrom D, Johansson O, "Protein gene product 9.5-immunoreactive nerve fibres and cells in human skin", Cell Tissue Res 1990; 261: 25-33

(12) Hilliges M, Wang L, Johansson O, "Ultrastructural evidence for nerve fibers within all vital layers of the human epidermis", J Invest Dermatol 1995; 104: 134-137

(13) Johansson O, Wang L, Hilliges M, Liang Y "Intraepidermal nerves in human skin: PGP 9.5 immunohistochemistry with special reference to the nerve density in skin from different body regions", J Peripher Nerv Syst 1999; 4: 43-52

FEB: Exactly how superficial are these nerves in the skin? When a person places his or her hands on a computer keyboard which gives off electromagnetic fields, can these fields affect the person enough to cause RSI (Repetitive Strain Injury). In Sweden this phenomenon is called "mouse arm" and is quite common.

Professor Johansson: The nerves come as close as 10-40 micrometers from the stratum corneum, which could be, in e.g. the face, in itself very thin, thus, these nerves are very superficially located. Whether this is the cause for RSI, I honestly do not know, but, naturally, it is definitely a possibility to take into careful consideration.

FEB: The skin is the largest organ of the body. It is also our foremost protector against the outside world. How does this protection-process work?



Professor Johansson: This is a very large question, and it would take too much space and time to answer it in full detail. But, in brief, one could understand the skin as a very sensitive 'antenna system' containing, in addition, special sensory organs, such as the eyes, the nose and the ears. The function of the skin is, among many, to always guide us in an ever-changing environment, thus, enabling us to avoid tissue-damaging threats, such as heat, cold, UV-light, X-rays, radioactivity, etc. In the center of this avoidance system is, of course, our nervous system which will help us to go in the right direction, away from some situations, maybe including e.g. electromagnetic fields from computer screens and cellular telephones? The future will tell us if I was right or wrong.

FEB: Does it seem alarming to you that so many people have reactions in their skin that point to the skin having defensive reactions from say computer work. What of the risk of developing cancer if the skin is always in a defensive mode?

Professor Johansson: Yes, the whole concept of skin reactions is frightening, especially since the skin cancer forms, such as malignant melanoma and basalioma, are so quickly increasing their incidence. I have asked, over and over again, many colleagues if they really can rule out the surrounding electromagnetic fields as an important background factor for such cancers, and mostly they just do not even answer me.

FEB: Helmut Kohls wife recently committed suicide due to a severe and lengthy light sensitivity condition. She had to remain in total darkness and could never go out. Many electrically sensitive have experienced precisely the same light sensitivity after their work with computers. You have written about a woman who became so light sensitive after working with a computer that she had to live in total darkness. Could you tell us more about what goes on in the skin to cause such sensitivity to light.

Professor Johansson: Yes, to begin with, light sensitivity is increasing as a general problem in the population, and reports have been published in several countries about this. The reason behind it is not known, but from our work one could just speculate around the heat-, light- and UV-adsorbing cellular layer in the epidermis, the so-called melanocytes and their production of the pigment melanin. In the above-mentioned case-report (14), it was evident that this layer, for some unknown reason, was, more or less, completely gone. We used protein S-100 and HLA-DR (human histocompatibility complex class II (subregion DR)) as markers, and it was found that the immunoreactive dendritic cells were dramatically decreased in number, especially in the epidermis.

One could imagine that e.g. increased levels of light or UV-light, or increased levels of other frequencies of electromagnetic fields, such as microwaves, have led to a wear-down of the protective cellular shield in the skin after a long-term continuous irradiation period. If such a damage takes place, maybe the first sign would be light sensitivity in parallel to a modest electrosensitivity. However, if the damage proceeds naturally the situation could be very difficult for the patient, finally leading to a life in basically complete darkness. Several such cases have been reported, but too few studies have been done, again due to lack of funding. In our own case report (14), we could also demonstrate that vitamin A was effective as a treatment for the patient. During the vitamin A treatment, the patient was to a large extent rehabilitated regarding her general light sensitivity, however, she was still sensitive to the presence of electric equipment, although not as much as before. The metabolism of vitamin A should be considered, since, in the human visual system, vitamin A is converted to alpha-cis-retinol, which is an essential chromophore component of rhodopsin, the photoreceptor protein of the retinal rods and is therefore essential for human vision. Maybe vitamin A influences cutaneous (as well as other) cellular systems similar to the retina. One explanation is that the patient for a time lost her melanocytes (or melanocytic content) as seen with the S-100 immunofluorescence, in response to an external or internal provocation. As a reaction to this, also her HLA-DR positive dendritic cells were affected. The vitamin A may have been capable of restoring this balance, at least partially.

(14) Johansson O, Liu P-Y, Enhamre A, Wetterberg L, "A case of extreme and general cutaneous light sensitivity in combination with so-called 'screen dermatitis' and 'electrosensitivity' - a successful rehabilitation after vitamin A treatment - a case report", J Aust Coll Nutr & Env Med 1999; 18: 13-16

FEB: You conducted a blind test to see if electrically sensitive persons reacted to microwaves from mobile phones, What was the outcome?

Professor Johansson: I, and my collaborators, have done a series of such tests, some done here in Stockholm, some in Goteborg and also some in Linkoping. The experiments in Stockholm and Goteborg failed, maybe due to the fact that the surrounding environment could not be controlled from the point of low- and high-frequency signals, which may have interacted with the tests subjects. However, the study in Linkoping (15) was done in the country-side, more than 1 kilometer from the nearest live electric power source. One person was actually able to respond correctly to a mobile phone-based double-blind provocation experiment, 9 times out of 9 tests ( $p < 2/1000$ ), both in the 'acute' phase as well as in the 'chronic' phase ( $p < 1/1000$ ). This would mean that there may very well be negative health effects from such mobile telephones, most likely depending on their high-frequency fields.

(15) Johansson O, "Eloverkanslighet samt overkanslighet mot mobiltelefoner: Resultat fran en dubbel-blind provokationsstudie av metodstudiekaraktar", Enheten for Experimentell Dermatologi, Karolinska Institutet, Stockholm, Rapport nr. 2, 1995; ISSN 1400-6111

FEB: The author and journalist Gunni Nordstrom has in an interview expressed herself in the following way: "The government seems to listen to those who have the right message, the message they wish to hear. Sometimes one wonders if the authorities have these reports custom-made or if someone in the background is masterminding all important positions and is handing out investigations to those with the correct beliefs or to the untalented. The independent thinkers get their heads chopped off as soon as possible at any rate." Do you find this to be true?

Professor Johansson: This is, naturally, impossible to precisely know at this stage, but from a speculative point of view one must say that it is odd, very odd to say the least, that the appointed experts nearly always seems to be persons that, for instance, you in the FEB would not propose. And, also when it comes to representatives in international organizations only 'yes-sayers' are invited, and never any 'whistle-blowers'. From a philosophical point of view this can prove to be sad and badly wrong, since, without the latter, companies, authorities as well as governments can be fooled and tricked into the completely wrong corner. And, to fool your own government is, as far as I know, high treason, right? Personally, if I were the prime minister, I would be very afraid never to listen to the 'whistle-blowers' since it could be a big, big mistake, from a public health point of view, not to!

FEB: You mentioned "whistleblowers". There have been many attempts to wear you down. Most recently you were asked to move your laboratories to a corridor containing all the rooms for household garbage, radioactive waste, dead animal carcasses, etc.! Does it come a time when it is no longer worth being a "whistleblower"?

Professor Johansson: For the future, I would like to propose to governments and likewise to ensure that scientists dealing with new, provocative research, even with a great impact on the general economy, that they should be given a 'safety net', i.e. their personal situation, their career possibilities, etc., must be protected and not in any way hampered by the fact that they deal with the 'wrong' kind of scientific field. How, otherwise, would you have future young scientists wanting to throw away all their personal possibilities? Otherwise, I am deeply afraid that there will come a time when it is no longer worth being a "whistleblower".

FEB: Have you received sufficient funding?

Professor Johansson: No, never. And if not the Swedish Cancer and Allergy Foundation would have been around, I do not think I would have had the strength to carry on. But they have always argued for the importance of new, courageous and daring science, and along the lines of cancer, allergy and their connection to the environment. This has also become a leading star for me.

FEB: What if you suddenly got unlimited funds. What would you like to pursue?

Professor Johansson: I guess, to begin with, that I would try to accurately characterize the electrosensitive patients from a clinical as well as cellular point of view. Depending on the results, I would then continue with more detailed studies based on theories emanating from the above data. It is, more or less, impossible to say at this point what such studies would be. One thing I would, for sure though, is to employ some additional personnel since I have been very much left alone through-out the years.

FEB: What about the EU work for a safer electromagnetic environment?

Professor Johansson: Within this context, one very interesting, and on-going, movement is the EC-based "The European framework for protection from exposure to electromagnetic fields". About it, to begin with, there are some general comments to be made. The EC does not seem to be interested in yet another 'BSE scandal', therefore they are carefully keeping an eye on the issues around health effects and health risks (N.B. Note the difference between health effects, identified and calculated health risks and unknown health risks) from electromagnetic fields, especially from high-frequency telecommunication, such as mobile telephony. Furthermore, the EC does not regard the above-mentioned irradiation systems to be proven safe. On the contrary, I believe they strongly understand it could be a major mistake to whole-body irradiate the whole European (as well as the world's) population, 24 hours around.

FEB: We often hear about "safe levels" of exposure and that there is "no proof of health effects". What is your response to these seemingly reassuring statements?

Professor Johansson: It is very important to realize, from a consumer's point of view, that "no accepted proof for health effects" is not the same as "no risk". Too many times, 'experts' have claimed to be experts in fields where actually the only expert comment should have been: "I/we just do not know". Such fields were e.g. the DDT, X-ray, radioactivity, smoking, asbestos, BSE, heavy metal exposure, depleted uranium, etc., etc., etc., where the "no risk"-flag was raised before true knowledge came around. Later on, the same flag had to be quickly lowered, many times after enormous economic costs and suffering of many human beings. Along those lines, it is now (regarding "the protection from exposure to electromagnetic fields" issue) very important to clearly identify the background and employment (especially if they sit, at the same time, on the industry's chairs) of every 'expert' in different scientific committees, and likewise. It is, of course, very important (maybe even more important?) to also let 'whistleblowers' speak at conferences, to support them with equal amounts (or even more?) of economical funding as those scientists and other 'experts' who, already from the very beginning, have declared a certain source or type of irradiation, or a specified product, to be 100% safe.

FEB: Should the precautionary principle always be our guide?

Professor Johansson: In the case of "protection from exposure to electromagnetic fields", it is of paramount importance to act from a prudence avoidance/precautionary principle point of view. Anything else would be highly hazardous! Total transparency of information is the key sentence here, I believe consumers are very tired of always having the complete truth years after a certain catastrophe already has taken place. It shall be noted, that today's recommendation values for mobile telephony, the SAR-value, are just recommendations, and not safety levels. Since scientists observe biological effects at as low as 20 microWatts/kg, is it then really safe to irradiate humans with 2 W/kg (i.e., with 100.000 times stronger radiation!), which is the recommendation level for us? And, furthermore, it is very strange to see, over and over again, that highly relevant scientific information is

suppressed or even left out in various official documents, as high up as at the governmental level of society. This is not something that the consumers will gain anything good from, and, still, the official declaration or explanation (from experts and politicians) very often is: "If we (=the experts) would let everything out in the open, people would be very scared and they would panic." Personally, I have never seen this happen, but instead I have frequently seen great disappointment from citizens who afterwards have realized they have been fooled by their own experts and their own politicians...

Another misunderstanding is the use of scientific publications (as the tobacco industry did for many years) as 'weights' to balance each other. But you can NEVER balance a report showing a negative health effect with one showing nothing! This is a misunderstanding which, unfortunately, is very often used both by the industrial representatives as well as official authorities. The general audience, naturally, easily is fooled by such an argumentation, but if you are bitten by a deadly poisonous snake, what good does it make for you that there are 100 million harmless snakes around?

FEB: In her book "Morklaggning - Elektronikens rattslosa offer" (10), the author and journalist Gunni Nordstrom has identified a group of Swedish obfuscators, mainly Lidén, Berg, Hillert, Arnetz and Bergkvist, who have attempted to put a psychological stamp on what you would term "screen dermatitis". These people have, Gunni Nordstrom claims, written a series of articles in international journals, always quoting one another, always making sure not to mention your findings. This has, as FEB has evidence of, hindered doctors and others to understand the electrically sensitive in other countries, causing them much suffering. How can one prevent a similar scenario for future health risks, or does one always have to go through an obfuscating or denying phase before admitting to the true facts?

Professor Johansson: Well, I certainly hope not! According to the work of professor Klas Amark at the Stockholm University this has, unfortunately, always been the case previously, but, of course, this tendency must be completely altered in the future. No democratic and humanitarian society can hold up such principles as you indicate in your question. We have to meet the future health problems in a much more 'grown-up' fashion!

FEB: What do you see in the future?

Professor Johansson: The future is not dark, not at all, but bright for all kind of "human-friendly technologies", including low-irradiation and low-emitting products. For, after all, who could sell a computer screen today with the slogan: "THIS IS A HIGH-LEVEL IRRADIATION SCREEN"!?

Professor Johansson will gladly answer your questions, but due to a heavy workload, he might not be able to answer all questions. Therefore, try to be as brief as possible.

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**"That which is looked upon by one generation as the apex of human knowledge is often considered an absurdity by the next, and that which is regarded as a superstition in one century, may form the basis of science for the following one!  
.....Paracelsus**

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**The Therapeutic, Pulsed EMF, Quantron Resonance System (QRS)**

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In this publication I have primarily stressed the potentially hazardous biological interactions with the artificial EMF and natural (geomagnetic) environments in which we live and work. However, if uncontrolled EMFs can cause health problems, then EMF therapies of **controlled** specific pulse-type (sharp rise time or square-wave) waveforms and pulse rate frequencies can, based on 35+ years of research: (1) induce sleep, (2) suppress pain, (3) ease depression, (4) improve tissue and bone growth healing. (the first FDA-approved magnetic therapy device for non-healing fractures used micro-Tesla fields), (5) alter cell membrane permeability, and, (6) stimulate immune system activity. It appears that PEMF therapies are rapidly emerging as a more natural basic approach to healing and immune system stimulation, as an adjunct to more effective drug treatment and with fewer potential side effects. Electromagnetic therapies appear to be rapidly emerging as the medicine of the future.

Increasingly, people have been asking for a more holistic approach to health maintenance and scientists are now focusing their attention on the beginnings of the disease process (prevention), rather than on alleviating the symptoms. Poor health and dysfunction ultimately begin at the cellular level of the human body. Ultimately it seems we are only as healthy as our cells.

It is estimated there are around 70 billion cells in the human body. Through normal wear and tear, millions of them must be regenerated every minute of the day and night. We are now familiar with the concept that ultimately everything is energy. We see this demonstrated by both the electrical and magnetic components basic to functioning of the human body. A healthy human cell has a trans-membrane charge of 70 to 90 millivolts, but the charge in unhealthy cells can be as low as 40 millivolts. At that level, the cell is unable to carry out its complex metabolic functions.

It is difficult for an unhealthy person to restore this cell energy in our modern day society. We have sedentary lifestyles, poor nutrition, are mentally and physically stressed and live with the interference of the man-made high-frequency magnetic fields of cell phones, televisions, computers, power lines, etc. This unnatural and stressful environment exceeds by many times the earth's electromagnetic field variations. **The artificial fields interfere with and swamp the sensitive balance and information exchange** of the electromagnetic components of our bodies and cells. This is a balance and information exchange for health, survival, migration, and mating established over billions of years of evolutionary development,.

With the introduction of the QRS, the results of recharging the cells to their correct level of function are extremely beneficial and often dramatic: the entire cell metabolism is stimulated: blood cells are regenerated and the blood supply moves more freely with more oxygen; the immune system is strengthened; vitamins and minerals are better absorbed; the respiratory system becomes more efficient; the nervous system is relaxed; bone structure becomes more dense and organs such as the liver, kidneys and spleen are able to rid themselves of impurities.

*The QRS is programmed to imitate nature in its pure form, i.e., the electromagnetic fields of our planet and the delicate balance of the electrical & magnetic processes, which cause actions in our bodies on a cellular level. What we are seeing with the assistance of the QRS is the power of the body to reclaim its natural state of health once cell energy is restored.*

**Static vs. Pulsed Magnetics** (by Dr. G. Fischer, Co-inventor Quantron Resonance System):

Static magnets produce a constant magnetic field, not depending on time factors. The Quantron Resonance System, QRS, produces a time-variable magnetic field, so the induced mechanical force generated by the electromagnetic field changes too.

For a medical therapy, you need variable (in time and frequencies) magnetic fields.

Static magnets only push the ions at the vessel walls. The inflow of ions in to the cells (one of the QRS patents) is only induced by pulsed magnetic fields (references: Andrew A. Marino, "Modern Bioelectricity" and also Thews "Vegetative Physiology") Furthermore, pulsed EMF (in particular the 200 hertz frequency of the QRS impulse) produces resonance and thus influence in the *erythrocyte* membrane and so enhances the blood stream tension with release of *nitric oxide*, NO.

DEFINITIONS:

*Erythrocyte*: a red blood cell, formed in the red bone marrow and, in all mammals, lacking a nucleus: it contains hemoglobin and transports oxygen to all tissues of the body.

*Nitric oxide*: (NO) is a gas that transmits signals in the organism. Signal transmission by a gas that is produced by one cell, penetrates through membranes and regulates the function of another cell represents an entirely new principle for signaling in biological systems. For the discovery of nitromono-oxygen as a signal molecule for the cardiovascular system, Robert F. Furchgott, Ferid Murad, and Louis J. Ignarro (USA) were awarded the 1998 Nobel Prize for Medicine.

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For information on effective treatments of the Quantron Resonance System contact the distributor, Body Fields USA, Inc., at <[www.quantronmedicine.com](http://www.quantronmedicine.com)>, For rental, purchase or financing details, please contact dealer, James B. Beal, EMF Interface Consulting, POB 2112, Wimberley, TX 78676-7012, Ph: (512) 847-0371, Email: EMFEFFECTS@aol.com, Website: <[www.emfinterface.com](http://www.emfinterface.com)>.

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See Body Fields Website <[www.quantronmedicine.com](http://www.quantronmedicine.com)> for details on two pain reduction studies in Austria: "**Using Magnetic Fields to Increase Flexibility and Reduce Pain with Respect to Ailments of the Ambulatory Apparatus**," By Dr. W. Kobinger, Dr. G. Fischer, Dr. T. Barovic, Dr. Z. Turk, Dr. N. Skat, Dr. D. Zivac., July & November 1995.

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## Author's Background

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James Beal, B.S. (M.E.) was a Staff Engineer in the Advanced Processes Technology Department while at Martin Marietta Manned Space Systems, in New Orleans, LA. He was responsible for determination of new nondestructive evaluation (NDE) technologies and processes (Digital X-ray, eddy current, electrostatic cooling) which may be applied to improve performance of current Space Shuttle External Fuel Tank materials and welds. He is co-owner of patent 4,924,937, "Enhanced Electrostatic Cooling Apparatus," a process to cool and strengthen thin aluminum welds on the External Tank.

Prior to the above position, he was associated jointly with the Miami Heart Institute and Parkinson Foundation for two years as Research Engineer, providing technical support for research in electrotherapy, acupuncture electrophysiology, and environmental improvements to aid in healing processes. Before that he was with NASA for ten years at Marshall Space Flight Center in Huntsville, Alabama, on the Saturn V Apollo Space Program. At NASA/MSFC he developed NDE applications (acoustic, ultrasound, microwave, eddy current and thermal methods) for inspection of space launch vehicles.

In recent years he has been investigating potential applications of electromagnetic field (EMF) effects for environmental improvements to enhance long-term mental and physical health, and improve the healing process. Recently he has been supporting research about toxic elements in our breathing, eating, sleeping and working environments. These are elements which can cause health-stress in system metabolic functions related to electrical and chemical sensitivities, fibromyalgia, chronic fatigue, and a host of other problems not responding to current medical treatment (**and primarily affecting women's health**).

Detailed reports have been presented for, and published by, the Neuroelectric Society, The Institute of Electrical and Electronics Engineers, the Journal of Holistic Health, the John E. Fetzer Institute, The Institute of Noetic Sciences, The Brain/Mind Bulletin, The Center For Frontier Sciences and the DOE/EPRI Annual Review.

He has obtained numerous grants for travel and lectures in the areas of bioelectromagnetic field effects, and the future impact of environmental electromagnetic field effects ("perils and promises"). Papers have been presented in the U.S.A., Canada, England, Netherlands, Switzerland, Israel, Czechoslovakia, Puerto Rico, and Mexico.

Mr. Beal retired in June 1992 from Martin Marietta. He has initiated **EMF Interface Consulting** to supply information to individuals, researchers, public utility companies, industry, and the legal profession. Services include home, office and property EMF inspections, research data support, information networking, writing, and lecturing about potential health effects of electromagnetic fields on, and from, living systems.

**Associations:** Institute of Noetic Sciences (charter member #15 -- 1972-2005), The Menninger Clinic (technical consultant - Voluntary Controls Program--1984-1994), John E. Fetzer Institute (technical consultant--1985-1995), The Monroe Institute (Advisory Board--1972-2005), The Gladys Taylor McGarey Foundation (Advisory Board--1991-2005), The Institute for Neuroscience and Consciousness Studies, Inc. (Staff--Biomedical Energetics--1994-2005).

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