

*The Hazards of Human Exposure to Electromagnetic Fields**

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I am a physician and board certified orthopaedic surgeon. I graduated from New York University–Bellevue Medical School in 1948 and spent my entire professional career in teaching and research at the State University of New York, Upstate Medical Center, and as chief of orthopaedic surgery at the Syracuse Veterans Administration Hospital.

My research activities began in the late 1950's and centered on the functions of the minute electrical currents that naturally occur in living organisms and in the effects of externally administered electrical currents and electromagnetic fields. I have published over 150 scientific papers on this subject, authored several books and chapters in medical textbooks, received several awards for my scientific work and served on committees for the U.S. Navy and the Institute of Electrical and Electronic Engineers. Since my retirement in 1981 I have been engaged in research and consultation in this same area and in the development of medical therapeutic devices utilizing electrical currents or electromagnetic fields.

It is my considered medical opinion, based upon my experience and knowledge in this field, that the biological effects of man-made electromagnetic fields (EMFs) constitute a health hazard to much of the population of the United States and that appropriate steps are urgently required to deal with this situation. This is a complex, new, scientific area and because of its environmental aspects and their economic and military impact, it has, unfortunately become politicized. One must have a basic understanding of the present scientific data and some knowledge of the past role of the federal government before any attempts are made to rectify the situation.

It is difficult to compress the knowledge and experience of 30 years into a ten-minute statement; therefore, it should be understood that I will present a simplified overview of the situation under discussion.

When I began my research in 1958, science was certain it had buried forever the idea that electrical currents below the level of perception or external EMFs of any type had any important effects on living organisms. The accepted scientific doctrine was that the effect of EM energy on living organisms was identical to its effect on a bowl of Jello; simply heating it up only when very large amounts of

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power were applied. This subsequently became known as the “thermal effect only” view which, since it was fully in accord with the physics of the time and the biological idea that all living organisms were chemical machines, became scientific dogma. Those few scientists who reported valid experiments indicating bioeffects at levels far below the thermal were simply dismissed because true science knew that such effects simply could not occur. However, over the past 30 years this view has completely changed. We now know that very small electrical currents are generated by living organisms and that they are important regulators of growth and the operations of the central nervous system. Similarly, it has been discovered that the brain itself as well as other organs actually produce magnetic fields detectable outside of the body. Within the past decade we have found that living organisms have specific organs, developed very early in evolution, whose job it is to sense the changes that occur in the Earth’s magnetic field and alter the organisms’ behavior appropriately. Finally, only within the last year have we begun to begin to understand the actual physical mechanisms involved in these interactions between very small magnetic fields and living things. This area has grown from one in 1960 when less than a handful of scientists was involved to one today when we have three accredited scientific societies, two scientific journals devoted to this discipline in this country alone and literally thousands of scientists involved on a worldwide basis. The question no longer is one of “Do very small electromagnetic (EM) forces have any bioeffects?” but “What is the level of hazard from abnormal EM energy?”

Before 1900 the electrical environment of the Earth was far simpler than today, consisting primarily of the Earth’s magnetic field, which, contrary to common misconception, is not constant but changes in strength at the same rate as the day-night cycle and also contains frequencies from below one per second to about 30 per second. This environment has existed since life began, so living things have had about three billion years to adapt to it and develop uses for it. Since 1900, we have markedly changed this environment with the introduction of fields and frequencies that never before existed on Earth. This use of EM energy for power and communications has markedly accelerated since the end of World War II and we have now just about filled up the available space in the EM spectrum. This change in our natural environment is actually the most drastic alteration made by mankind and is far greater than any chemical contamination yet produced. This was done in the complete confidence, based upon the “thermal-effects-only” dogma, that no biological effects or actual harm to living things could occur. We now know that this was wrong. All living things are closely tied to the frequencies of our natural EM environment and the presence of abnormal, man-made fields produces serious alterations in basic life functions. It is important to contrast this effect with that of chemical pollutants which have specific actions on the body and result in specific diseases. Abnormal EM fields act at the most basic level of the organism and result in a wide spectrum of

diseases and abnormalities. It is a fallacy to equate the two and require that field exposure produces specific diseases.

There are two large classes of effects of abnormal fields; those that impinge upon the total body functions and those that affect the function of single cells.

The first is produced because mechanisms and specific structures in the brain are “designed” to perceive the normal changes in the Earth’s magnetic field for the purpose of furnishing a timing signal for biological cycles. This action is automatic and we are not aware of it. The pineal gland, buried deep within the brain, is sensitive to the normal cycle of magnetic field changes and alters its output of extremely important neurohormones in synchrony with them. These chemical messengers produced by the pineal govern the level of activity of the brain and regulate the functions of all of the body’s glands. Chronic exposure to abnormal fields results in disturbances in the biological cycles which result in the production of the stress syndrome. This state of chronic stress is characterized by a wide variety of malfunctions in the organism, ranging from weight loss to diminished capacity of the immune system and changes in brain function. Clinically, these result in declines in fertility, low birth weights, diminished resistance to infectious diseases, diminished resistance to cancers and increases in serious psychological disturbances.

The effect on cells is in the alteration of normal cell division. Exposure of any cell in active multiplication will result in an acceleration in the production of DNA and alteration in chromosome structure. These effects will be evidenced by a marked increase in the rate of cell growth and the production of genetic abnormalities. Clinically, the results will be an increase in the incidence of birth defects and genetic diseases such as Down’s Syndrome, increases in the growth rate and malignant characteristics of cancers and, quite possibly, the production of cancerous changes via genetic alterations.

It is instructive to look at the recent statistics for these general disease patterns in our society. The incidence of birth defects has approximately doubled over the past 25 years. The incidence of cancer in general is increasing approximately 1% per year and certain types have become epidemic in nature. In 1984, the National Institute of Mental Health reported the incidence of serious mental disorder in the general population was 20%, with the incidence in the under 45 age group at twice that figure. The incidence of suicide in the teen-age group had more than doubled between the years 1961 to 1981 and while firm data is not available, this increase seems to be accelerating. It is recognized that our society contains other factors that may contribute to this situation. However, the link with abnormal EM fields is the only one that extends globally to all of these conditions.

It is obvious that something needs to be done; however, before plans are made and actions taken, it is essential that the record of past actions by the regulatory agencies and other governmental entities be considered to avoid past mistakes. This record can only be characterized as either, at best, unintelligent

adherence to the “thermal-effects-only” dogma, or, at worst, a deliberate cover-up motivated by military concerns.

Evidence of biological hazards from exposure to non-thermal levels of microwaves was known to the military since the late 1950s, however, the response was to deny its existence and to devise an exposure “standard” based upon the old “thermal-effects-only” concept. To the best of my knowledge this same inadequate standard is in use today in all branches of the military. In the late 1960s the Navy was considering the construction of a very large antenna system for communicating with atomic submarines. This was to operate in the extremely low frequency (ELF) band at either 45 or 75 Hz, just below and above the 60-Hz electric power frequency. A series of experiments were performed by the Navy and in December 1973, a committee of civilian experts, of which I was one, was convened to evaluate the results. There was no question that the results indicated a strong possibility of serious health hazards from the Navy’s antenna system and, more so, from the civilian network of 60-Hz power transmission lines. In particular, the committee noted that the strength of the field from the antenna was a million times smaller than that from a 765-kV powerline and it recommended to the Navy that this information be transmitted to the White House agency responsible for EM safety. The Navy responded by burying the report and denying its existence to Congress. Shortly after the meeting, I was informed of a proposal to build a network of ultra high voltage transmission lines in New York state. Since the report was not highly classified, I notified the Public Service Commission (PSC) of the state of its existence and suggested that they request the data from the Navy. This the Navy refused and the PSC contacted me directly with the request that I, and my colleague, Dr. Andrew Marino, serve as expert witnesses in a public hearing on this question. Delays imposed by the utilities involved permitted us to conduct additional experiments at the 60 Hz power frequency, which extended and confirmed the risks found in the Navy studies. The hearings began in 1976 and during their course all grant funding from both the NIH and the Veterans Administration (VA) was withdrawn from my laboratory. On separate occasions both Dr. Marino and I were informed by representatives of the VA that our withdrawal from the hearings would result in restitution of the funding (later I was told by an admiral and former Chief of the Office of Naval Research that the Navy protested the closing of my lab in this fashion but was overruled). I refused to withdraw and the laboratory was closed in December 1980. However, the PSC accepted and implemented my recommendations for a long-term research program, which I made during the hearings. This resulted in the New York Department of Health’s Power Lines Project.

Realizing the relationship between the New York hearings and their ELF system, the Navy contracted with the National Academy of Science (NAS) to do a study of the health effects of its antenna. The report was issued after the hearings closed and in a biased and unscientific manner, it gave a completely

clean bill of health to the Navy's antenna and by implication to power lines. More recently, the Navy again commissioned a "review" of the literature in this field to be done by the American Institute of Biological Sciences (AIBS) which was issued in 1985. The scientific deficiencies in this report are even more glaring than those in the NAS report. Despite the fact that the New York report noted some positive findings and one of its recommendations has been the occasion for this hearing, the majority of it shares the same deficiencies as the NAS and AIBS studies. These defects include the application of extremely rigorous requirements to positive reports while accepting negative reports at face value, ignoring significant positive reports in the literature, using non-applicable negative reports, etc. In short, all studies done to date by public agencies with public funding have been biased, unscientific and designed to indicate a lack of harm from these EMFs.

Large amounts of public funds have also been used for many animal experiments purportedly designed to evaluate the health risks associated with such fields. Most have actually been designed, deliberately in advance, to yield negative results and any positive results obtained have not been reported or their release has been long delayed. In such contract research the "Golden Rule" applies—"He who has the gold makes the rules." In short, despite the expenditure of many millions of dollars, the actions of federal and state agencies have been not only far less than adequate to deal with this issue but suspect as well.

This is not simply a scientific issue but a very human one. A family living on a dairy farm in New York that has been theirs since 1820 has suffered an economic and medical disaster. A 765-kV transmission line was built through their land a few hundred feet from their home. Since it began operating in 1982, their cows have produced dead or defective calves and all of their chickens produced defective, unsalable eggs and then died. Their young daughter developed Hashimoto's disease, a permanent autoimmune condition of the thyroid gland, and the husband and son have developed other autoimmune diseases. Their farm is unsalable and cannot be used for collateral for them to be able to move. I called this situation to the attention of the NY-DOH Panel, suggesting that it be studied and that other similar-case situations be looked for. They took no action whatsoever. Since 1981 I have worked with a citizen's group in a rural town of about 25,000 inhabitants in New Jersey. This town ranks fifth in the nation in the concentration of microwave sources, behind New York City, Chicago, Dallas and San Francisco and just ahead of Los Angeles. The first microwave source began operating in 1974 and 11 months later the first baby with Down's Syndrome was born. Since then the microwave sources have increased, and so have the cases of Down's Syndrome until at this time the incidence is at least five times greater than normally expected. Furthermore, these cases are located in "clusters" along with other genetic and birth defects and an excess of cancers. These cluster areas appear to be locations irradiated by

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the local microwaves. Studies have been made and reports issued by the New Jersey Department of Health, the EPA and the CDC, none of which adequately addressed the problem. I have provided the sub-committee with a copy of a scientific report I recently published on this situation. At this time, basically nothing is being done.

I urge the establishment of a congressionally mandated and overseen research program aimed specifically at determining the level of risk. Whether this research program is based in a federal agency or not, it must be overseen by a panel of outside experts, drawn from many disciplines, and must include full representation by advocates for the position that such irradiation may be harmful. Full and prompt disclosure of all data and all panel deliberations and decisions must be assured. I also urge consideration of a congressional investigation of human exposure in the military forces of the U.S., and consideration of a moratorium on new construction and operation of field-producing military facilities. I am well aware of the vital role played in our society by EM forces and in no way do I advocate total cessation of their use. I urge only that risk-benefit decisions in this area be based upon valid scientific data and be made by representatives of the population at risk rather than by parties of interest. It is time to seek the truth about this vital problem.