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| Electrify Fruit Flies  Can electromagnetic fields (EMF) from power lines, home wiring, airport and military radar, substations, transformers, computers and appliances cause brain tumors, leukemia, birth defects, miscarriages, chronic fatigue, headaches, cataracts, heart problems, stress, nausea, chest pain, forgetfulness, cancer and other health problems?  **Reason For Choosing Topic**  The reason that I personally went for this topic and pulled Jay along was that I was almost affected by a power line that might have been installed underneath my feet. Pacific Gas & Electric Co. wanted to bury the 230,000 cable two to three feet under Benedict Court, Hearst Drive and Bernal Avenue to carry electric power from its Vallecitos Road overhead lines through Pleasanton to a PG&E Vineyard Avenue substation at Bernal and Stanley. The new cable would have been part of a multi-million-dollar Tri-Valley upgrade PG&E has said is necessary to meet growing electric demand in Pleasanton, Livermore, Dublin and San Ramon (Pleasanton Weekly). My family�s homeowner�s dues skyrocketed for the legal fees incurred while fighting this power line. I do not know if it was luck or not, but the power shortage occurred an PG&E had bigger issues to deal with other than a power line that would cost them millions of dollars that they did not have.  **Background on EMFs**  Electromagnetic fields are present everywhere in our environment but are invisible to the human eye. Electric fields are produced by the local build-up of electric charges in the atmosphere associated with thunderstorms. The earth's magnetic field causes a compass needle to orient in a North-South direction and is used by birds and fish for navigation. One of the main characteristics which defines an electromagnetic field (EMF) is its frequency or its corresponding wavelength. Fields of different frequencies interact with the body in different ways. One can imagine electromagnetic waves as series of very regular waves that travel at an enormous speed, the speed of light. The frequency simply describes the number of oscillations or cycles per second, while the term wavelength describes the distance between one wave and the next. Hence wavelength and frequency are inseparably intertwined: the higher the frequency the shorter the wavelength (EMR Alliance, *EMF Grassroots Handbook*).  **EMF Effects On Body**  Tiny electrical currents exist in the human body due to the chemical reactions that occur as part of the normal bodily functions, even in the absence of external electric fields. For example, nerves relay signals by transmitting electric impulses. Most biochemical reactions from digestion to brain activities go along with the rearrangement of charged particles. Low-frequency electric fields influence the human body just as they influence any other material made up of charged particles. When electric fields act on conductive materials, they influence the distribution of electric charges at their surface. They cause current to flow through the body to the ground. Low-frequency magnetic fields induce circulating currents within the human body (WHO). If sufficiently large, these currents could cause stimulation of nerves and muscles or affect other biological processes. Both electric and magnetic fields induce voltages and currents in the body. Heating is the main biological effect of the electromagnetic fields of radiofrequency fields. In microwave ovens this fact is employed to warm up food. The levels of radiofrequency fields to which people are normally exposed are very much lower than those needed to produce significant heating (Tarkin). The heating effect of radio waves forms the underlying basis for current guidelines. Scientists are investigating the effects of extremely low frequency (ELF, frequencies up to 300 Hz) fields, intermediate frequency (IF, 300 Hz to 10 MHz) fields, radiofrequency (RF, 10 MHz to 300 GHz) fields on the body.  **Studies On EMF**  Numerous studies have produced results going both ways. One side gives ample evidence that electromagnetic fields are attributed to a diffuse collection of symptoms. Reported symptoms include headaches, anxiety, suicide and depression, nausea, fatigue and loss of libido. General eye irritation and cataracts have sometimes been reported in workers exposed to high levels of radiofrequency and microwave radiation. A number of epidemiological studies suggest small increases in risk of childhood leukemia with exposure to low frequency magnetic fields in the home (Wertheimer & Leeper). At least some of these health problems may be caused by noise or other factors in the environment, or by anxiety related to the presence of new technologies. The other side shows that electromagnetic fields cause no harm at all with again reliable evidence. Some experts are convinced that the threat is real like Ross Silverman and Jay Bell (now experts). Dr. David Carpenter, Dean at the School of Public Health, State University of New York believes it is likely that up to 30% of all childhood cancers come from exposure to EMFs. The Environmental Protection Agency (EPA) warns "There is reason for concern" and advises prudent avoidance". Martin Halper, the EPA's Director of Analysis and Support says, "I have never seen a set of epidemiological studies that remotely approached the weight of evidence that we're seeing with EMFs. Clearly there is something here."  Concern over EMFs exploded after Paul Brodeur wrote a series of articles in the New Yorker Magazine in June 1989 (Brodeur).  "Electromagnetic fields are associated with the development of leukemia, brain cancer and other serious diseases."  "Most unsettling of all, perhaps, is the fact that the pulsed VLF and ELF magnetic fields found routinely within a radius of about two feet from the average CRT computer terminal can be as strong as, or even stronger than, the sixty-hertz magnetic fields found inside the homes in which Wertheirner and Savitz discovered children to be dying unduly of cancer."  **Paul Brodeur**, writer, ***The New Yorker Magazine***, author of ***Currents of Death*** (Simon and Schuster), and ***The Great Power Line Coverup*** (Little, Brown).  Because of Paul Brodeur's reputation his articles had a catalytic effect on scientists, reporters and concerned people throughout the world. In November 1989, the Department of Energy reported, "It has now become generally accepted that there are, indeed, biological effects due to field exposure." The EMF issue gained more publicity in 1990 when alarming reports appeared in Time, the Wall Street Journal, Business Week and popular computer publications. ABC's Ted Koppel and CBS's Dan Rather both aired special segments on EMFs.  In addition to the long-term health concerns, buying a house with high fields will be an economic disaster. In a few years, when power line radiation is as well known as asbestos and radon, a house with high fields will be practically impossible to sell (Casper). Already there are hundreds of lawsuits regarding EMFs and property devaluation like the one that we just had in Kottinger Ranch.  By 1990, over one hundred studies had been conducted worldwide. Of these, at least two-dozen epidemiological studies on humans indicated a link between EMFs and serious health problems. In response to public pressure, the Environmental Protection Agency (EPA) began reviewing and evaluating the available literature. In a draft report issued in March 1990, the EPA recommended that EMFs be classified as a Class B carcinogen - a "probable human carcinogen and joined the ranks of formaldehyde, DDT, dioxins and PCBs. After the EPA draft report was released, utility, military and computer lobbyists came down hard on the EPA. The EPA's final revision did not classify EMFs as a Class B carcinogen Rather; the following explanation was added:  "At this time such a characterization regarding the link between cancer and exposure to EMFs is not appropriate because the basic nature of the interaction between EMFs and biological processes leading to cancer is not understood."  This unusual logic appears on the same page as the following:  "In conclusion, several studies showing leukemia, lymphoma and cancer of the nervous system in children exposed to supported by similar findings in adults in several occupational studies also involving electrical power frequency exposures, show a consistent pattern of response that suggest a causal link. "  When questioned about the contradictory nature of these statements, the EPA responded that it was "not appropriate" to use the probable carcinogen label until it could demonstrate how EMFs caused cancer and exactly how much EMF is harmful. This explanation did not satisfy many critics who claim that the EPA's upper management was influenced by political and economic considerations exerted by utility, computer and military lobbyists (Sugarman). A draft report prepared for the Environmental Protection Agency (EPA) generally endorses a 2 mG exposure limit. It would take effect immediately for new day care centers, schools and playgrounds, as well as for new transmission lines near existing housing. The EPA funded the report. Dr. Joe Elder, EPA's program officer for the NCRP study in Research Triangle Park, NC, called the committee's report "the first comprehensive review of the world's literature on EMF health effects."  **Types of Studies Possible Dealing With EMF**  Muckraking from authors like Paul Brodeur has caused a mix of studies in different research areas for the evaluation of a potential adverse health effect of electromagnetic fields. Different types of studies investigate distinct aspects of the problem. Laboratory studies on cells aim to elucidate the fundamental underlying mechanisms that link electromagnetic field exposure to biological effects. They try to identify mechanisms based on molecular or cellular changes that are brought about by the electromagnetic field; such a change would provide clues to how a physical force is converted into a biological action within the body. In these studies, single cells or tissues are removed from their normal living environment, which may inactivate possible compensation mechanisms (Milburn & Oelbermann). Another type of study, involving animals**,** is more closely related to real life situations. These studies provide evidence that is more directly relevant to establishing safe exposure levels in humans and often employ several different field levels to investigate dose-response relationships (Pinsky). Epidemiological studies or human health studies are another direct source of information on long-term effects of exposure. These studies investigate the cause and distribution of diseases in real life situations, in communities and occupational groups. Researchers try to establish if there is a statistical association between exposure to electromagnetic fields and the incidence of a specific disease or adverse health effect. However, epidemiological studies are costly. More importantly, they involve measurements on very complex human populations and are difficult to control sufficiently well to detect small effects. For these reasons, scientists evaluate all relevant evidence when deciding about potential health hazards, including epidemiology, animal, and cellular studies (Young).  Epidemiological studies alone typically cannot establish a clear cause and effect relationship, mainly because they detect only statistical associations between exposure and disease, which may or may not be caused by the exposure. Imagine a hypothetical study showing a link between electromagnetic field exposure in electrical workers of the company "X-Electricity" and an increased risk of cancer. Even if a statistical association is observed, it could also be due to incomplete data on other factors (lurking variables) in the workplace. For example, electrical workers may have been exposed to chemical solvents with the potential to cause cancer. Moreover, an observed statistical association may be due only to statistical effects, or the study itself may have suffered from some problem with its design. Therefore, finding an association between some agent and a specific disease does not necessarily mean that the agent caused the disease. Establishing causality requires that an investigator consider many factors. The case for a cause and effect link is strengthened if there is a consistent and strong association between exposure and effect, a clear dose-response relationship, a credible biological explanation, support provided by relevant animal studies, and above all consistency between studies (Tarkin). Research continues to try find that disguised cause and effect relationship. Human health studies are very good at identifying large effects, such as a connection between smoking and cancer. They are less able to distinguish a small effect from no effect at all. If electromagnetic fields at typical environmental levels were strong carcinogens, then it would have been easy to show that by now. By contrast, if low level electromagnetic fields are a weak carcinogen, or even a strong carcinogen to a small group of people in the larger population, that would be far more difficult to demonstrate. In fact, even if a large study shows no association we can never be entirely sure that there is no relationship. The absence of an effect could mean that there really is none. But just as well it could mean that the effect is simply undetectable with our method of measurement (WHO). Therefore, negative results are generally less convincing than strong positive ones.    ([Intro1](http://docs.google.com/introduction.html))([Intro2](http://docs.google.com/intro2.html))([Intro3](http://docs.google.com/intro3.html))([Intro4](http://docs.google.com/intro4.html))  [[Home](http://docs.google.com/home.html)][[Introduction](http://docs.google.com/introduction.html)][[Hypothesis](http://docs.google.com/hypothesis.html)][[Procedure](http://docs.google.com/procedure.html)][[Data](http://docs.google.com/data.html)][[Conclusions](http://docs.google.com/conclusions.html)][[Bilio/Links](http://docs.google.com/biblio.html)]  [[2002 Projects](http://docs.google.com/AP2002/index.html)][[2001 Projects](http://docs.google.com/index.html)][[2000 Projects](http://docs.google.com/AP2000/index.html)][[1999 Projects](http://docs.google.com/AP99/index.html)][[1998 Projects](http://docs.google.com/AP98/index.html)] |