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Electromagnetic hypersensitivity

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Electromagnetic Hypersensitivity (EHS)

(historically referred to as "Microwave Sickness") is an illness that is both highly controversial and little understood. The symptoms can

vary a lot between sufferers, but will normally include some of the following: sleep disturbance, tiredness, depression, headaches, restlessness, irritability, concentration problems, forgetfulness, learning difficulties, frequent infections, blood pressure changes, limb and joint pains, numbness or tingling sensations, tinnitus, hearing loss, impaired balance, giddiness and eye problems. There have been reports of cardiovascular problems such as tachycardia, though these are relatively rare.

EHS is often faced with scepticism under the basis that people are bathed with EMFs all day long from countless sources, including light from the sun and the earth's magnetic field, so if those don't cause a problem why would other sources of EMFs Mobile? Why would the body react any differently just because it's pulsed a bit? Besides, most people aren't complaining about it - if it was a real issue, surely more people would be reporting the symptoms?

It is easiest to think of it as more of an allergic reaction to EMFs. An "abnormal response to a common exposure", that only affects a minority of the population. There are plenty of examples of this with other exposures, including even to visible light: Photosensitive epilepsy is a rare condition where visual stimuli at a certain frequency sends the person into epileptic seizures. About 0.75% of people have epilepsy, and about 5% of these people are of the photosensitive type - about 0.04% of the population in total. People with Photosensitive epilepsy are fine when exposed to light normally, but when they are exposed to light which flashes at a certain frequency - typically 16-25Hz, they go into a seizure. This condition has become an issue only in modern times due to technology, where televisions and computer monitors have started to produce the frequencies of light which can activate the epileptic fits.

In February 2006, at a meeting of the Dutch working group on EHS, Hugo Schooneveld, a neurobiologist, and himself a sufferer, showed how different radiation can have different effects on different people. He showed that there may be some delay before health effects are experienced. Indeed they can be perceived as positive at first and negative after a lengthy exposure. Sometimes low and high exposure do not have effects, but exposure in between has (called a 'window' effect, see below). He also confirmed from his clinical experience that although EMFs may only cause small effects in biological systems, small effects on a cellular level can lead to large consequences on the organ level.

These variations make the study of, and medical acceptance of, ES very difficult. We present below a very brief summary of some of the findings of the research into the effects that electromagnetic fields have on living systems, or in the laboratory. The biological changes found may lead directly to a health problem, without provoking or aggravating ES; it is not always easy to make this distinction.

If you are convinced that you are electromagnetically hypersensitive, you should consider [shielding your sleeping environment](#) to minimise the impact on your daily health.

There are many references cited for you to investigate any of the areas covered in more detail, if you wish to do so.

Powerfrequency EMFs

Powerfrequency electric and magnetic fields are produced by powerlines, substations, electricity distribution faults, electrical appliances in the home or workplace, house wiring, cables, cars, trains, etc. Many people believe that their ill-health effects arise as a result of proximity to these sources, or as a result of living in the fields they generate. People exposed to EMFs may develop an illness such as childhood leukaemia^[Ahlbom Dec 2001, Maslanyj 2007, Draper 2005], adult skin cancer^[5], breast cancer^[Hansen 2001], Lou Gehrig's disease (ALS - Amyotrophic Lateral Sclerosis) ^[Feychting 2003, Hakansson 2003, Ahlbom 2001] and miscarriage^[Lee 2002, Li 2002, Cao 2006]. The research has looked at proximity to sources and also field levels and associated ill-health.

The exposure that results in an increased risk of developing these illnesses may not be the same as that which provokes and aggravates ES. People who suffer from ES tend to have a wider range of symptoms with a less well defined clinical outcome^[Irvine 2005].

Common electrical appliances, such as televisions and computers often provoke mild to moderate symptoms in ES people^[Eriksson 1997, Stenberg 2002]. An increase in mast cells (such as found in people suffering from allergies) have been found in people watching television^[Gangi 1997, Johansson 1994, Rajkovic 2005]. Different types of lighting, especially fluorescent fixtures (including the new low-energy bulbs) are difficult for many people with ES to tolerate^[Sandstrom 1997]. This has wide implications, as fluorescent lighting is used in most offices, hospitals, shopping and leisure centres. This could make these facilities very difficult for people with ES to access. Transport such as cars, trains, planes, trams all contain equipment that give off levels of EMFs that sensitive people may find hard to tolerate.

Radiofrequency EMFs

Man-made radiofrequency (RF) radiation was first used in the 20th century by the military in radar and weaponry, although public exposure was very low as these were mostly sited in airports and military installations. The sudden surge in mobile phone usage in the late 1990s created a completely new RF environment, with people now heavily exposed to the phones themselves, the transmitting infrastructure (mobile phone base stations or masts), tablets, cordless house phones, wireless games consoles and WiFi. What is still uncertain is whether biological reactions occur at once or whether they take some time to develop. The important thing to bear in mind with regard to exposure is not the level compared with the allowed guidelines, but the level compared with what we have been exposed to in human evolutionary terms.

Most early health research work focused on occupational exposure of military personnel and some on the effects of weaponry. The first significant report (Sadzikova) describing occupational 'microwave sickness' appeared in 1974. The symptoms included fatigue, headaches, palpitations, insomnia, skin symptoms, impotence and altered blood pressure. Further occupational research ^[Forman 1982, Wayne 1984, Graham 1985, Marchiori 1995] added the following symptoms resulting from acute exposure; warming sensations, nausea, neuropathy (numbness, tingling, even paralysis in toes and fingers), stomach cramps, dyesthesia (a crushing sensation) and irritability.

In many cases, medical tests carried out on those people suffering from the symptoms (including blood pictures and biochemistry) showed no significant abnormalities ^[Graham 1985, Hocking 1988, Schilling 1997]. The symptoms often persisted for several months, even years, after the exposure, and some of the

people who had been exposed were never able to regain the level of good health they had experienced beforehand. Some exposures resulted in severe anxiety necessitating short term sedation and even admission to hospital. Psychological problems and emotional instability persisted for up to a year.

The research into sensitivity to RF has been very varied, with a number of papers finding effects on brain activity [[Aalto 2006](#), [Cao 2000](#), [Esen 2006](#), [Eulitz 1998](#), [Freude 1998](#), [Freude 2000](#)] (of which some found RF exposure actually enhanced cognitive ability [[Edelstyn 2002](#), [Koivisto Feb 2000](#), [Koivisto June 2000](#), [Krause Dec 2000](#), [Krause March 2000](#)]), altered EEG measurements [[Borbely 1999](#), [D'Costa 2003](#), [Huber 2000](#), [Huber 2005](#), [Huber 2003](#), [Huber 2002](#), [Kramarenko 2003](#)], or other recordable cellular effects [[Belyaev 2005](#), [Caraglia 2005](#), [D'Ambrosio 2002](#), [Donnellan 1997](#), [French 1997](#), [Leszczynski 2002](#)], of which some highlight a possibility that EMFs only effect cellular mechanisms on cells with a specific genetic background [[Czyz 2004](#), [Nikolova 2005](#), [Sarimov 2004](#), [Singh 1996](#)]. All of these are objective effects, and can ignore the possibilities of a nocebo effect as stimulated by the recent press coverage. There have been a number of papers finding these "Microwave Syndrome" effects from the usage of mobile and cordless phones and mobile phone base stations [[Al-Khlaiwi 2004](#), [Abdel-Rassoul 2007](#), [Santini 2002](#), [Santini 2003](#), [Oberfeld 2004](#)].

There is also a good deal of literature failing to find an effect with most of the above (with the exception that very little epidemiological work has been done on mobile phone base stations, and that which has been carried out primarily shows an effect), probably in a ratio of around 1:1 (i.e. 50% show an effect, 50% don't). However, it is also important to remember that positive and negative/null studies *do not cancel each other out*. It is very easy to fail to cater for a certain important confounding factor (even if just through lack of understanding at the time of research), and therefore far easier to fail to find an effect compared to finding an effect. Unless the studies that find an effect are flawed in some way, then 3 or 4 separately conducted studies finding the same effect is exceptionally important evidence.

It is undeniable that there is no general consensus of agreement in the literature, but it is also very clear that the probability of low power RF EMFs having non-thermal effects is very high. The extent of such effects will likely remain unclear for quite some time, but the recognition of non-thermal effects by international bodies such as WHO will open the doors to significant progress in this field - it is hard to see why they are still clinging to the old paradigm of "if it doesn't heat you, it doesn't hurt you".

Mechanisms

What the research clearly demonstrates is that biological systems may react at some low power levels and not others; they may not react at all to high levels when they do at lower ones [[Daniells 1998](#)]; they may react very differently to different frequencies.

Among proposed mechanics are that the radiation reduces melatonin levels and increases nitric oxide (NO) levels [[Yariktas 2005](#)]. Changes in melatonin and nitric oxide levels may reduce the amount of cancer fighting cells in our bodies. This may explain why no particular cancer is associated with microwave exposure; the immune system's ability to repair cancer damage is compromised, no matter in which area of the body the cancer first appears.

These changes also may promote sleeping disorders, increase cholesterol levels leading to greater risk of atherosclerosis and coronary heart disease, and increase blood pressure [[Aly 2008](#)] giving greater risk of blood clots and strokes, and changes the body's ability to cope with other toxins.

Oberfeld found brain wave (EEG) patterns changed, predicted by Hyland, as a result of RF exposure. A study by in the late 80's [Lai 1989] found that 45 minutes of exposure to pulsed microwaves affected choline uptake in the rat. Choline is a chemical precursor or "building block" needed to produce the neurotransmitter acetylcholine, and research suggests that memory, intelligence and mood are mediated at least in part by acetylcholine metabolism in the brain.

Physicists at UC Berkeley [Jensen 2007] have produced the world's smallest radio out of a single carbon nanotube that is 10,000 times thinner than a human hair. The nanotube absorbs the radio transmission and physically vibrates in response, like a tuning fork or the tiny hairlike structures inside the human ear. The multi-walled cylinders were better at picking up AM and FM transmissions and the single walled nanotubes were best for receiving the frequencies used in cell phones. It is interesting that the mechanism is by physical vibration of the nanotube in response to RF fields. This may give more pointers as to the bio-detection capability of the body, even at a cellular level and also may well invoke a bio-response. Later work [Pavicic & Trosic 2008] found that 935 MHz radiation affected microtubule proteins, which the authors believed could obstruct cell growth.

Health Protection Agency's "Irvine Report" on Electrosensitivity

Back in November 2005, the UK HPA produced the "Irvine Report" [Irvine 2005] which we have produced a [full response and analysis](#) of. It is disappointing that Public Health England have not produced a further report or analysis of this condition 10 years later.

Symptoms and Causation

The report contains references to a number of questionnaire surveys that have found statistically significant increases in "Microwave Syndrome" effects [Bergdahl 1998, Hillert 1999, Stenberg 2002, Roosli 2004], but the connection between these effects and the EMF sources are subjectively based on the participants' claims.

Some mobile phone studies which use questionnaire responses as the basis for their information, have been criticised as subject to recall bias and therefore are likely to be inaccurate. Often the criticisms suggested that the bias would result in risks being exaggerated. However, recent work by the Interphone group, an International research collaboration involving 13 countries [Vrijheid 2006], claim that heavy users tend to overestimate their total usage which, if correct, would mean that e.g. statistically significant increases may in fact be for less usage than actually reported. If so, this consequently implies that the brain tumour risk from mobile phone usage may be greater than that suggested. This uncertainty with regard to bias is likely to apply to other areas of research relying on questionnaire information.

Prevalence

The report also covers the prevalence of the condition and reports on the studies (primarily questionnaire surveys) that covered the type and proportions of people that claim to suffer from the condition [Stenberg 2002, Roosli 2004, Hillert 2002, Levallois 2002]. All of these point towards the heterogeneous nature of the syndrome, and help describe why pinning down the precise causes can be so difficult.

Provocation Studies

In an aim to pin down causation, a number of provocation studies have been carried out, where the aim is to expose the participant to EMFs and monitor their reaction. These are performed with a real and a sham (not emitting EMFs) signal,

and the participant is "blinded" as to which they are being exposed to at any point. The balance of evidence from these studies points to there being a definite psychological effect, where the participants reacted to both the sham and real exposure.

In reality, whenever someone has a fear that something may cause them harm, or a belief that it may make them feel better, there is good evidence to suggest that this belief alone can be enough to trigger a genuine physiological response. The mechanism of this response is unknown, but it is documented well enough that it is accepted as real, and known as a "placebo" or "nocebo" effect (depending on whether a positive or negative physiological response has been triggered). It seems very clear that with phenomena that have received mainstream press coverage, such as the concerns over mobile phones and their base stations, the nocebo effect becomes very real for a subset of the population that believe themselves to be at risk.

As a result, the medical profession on the whole do not recognise ES, and GPs will often refer patients to the psychiatric profession saying that their symptoms are psychological in nature. There are some medical practitioners who, from evidence in their own practice, believe strongly that the syndrome can indeed be caused, or exacerbated, by EMFs, but these are few and far between.

Nocebo and Real Effects

However, the existence of a nocebo effect does not negate the existence of a real effect, which may be greater, lesser, or approximately as strong as the nocebo effect. The only real contribution provocation studies have made so far is to prove beyond reasonable doubt that a nocebo effect is real^[Rubin 2005]. They show that a fair proportion of self-assessed electrosensitive people have the symptoms either aggravated, or amplified, by a perceived danger - **They cannot summarise that there is no real effect however, as none of the recent studies that we are aware of have controlled for this effect.**

Part of the difficulty of course lies in how to assess what response can be expected from a purely nocebo reaction. There are ways to attempt to combat this problem, such as excluding all those that seem to be unable to differentiate between sham and real exposure until you are left with either a) people that consistently react to real exposure but not sham exposure, or b) no-one left out of the original sensitive group. Another way to combat the nocebo effect would be to expose the participants (to real and sham exposures) without them knowing that the exposure had started. This removes the possibility of a reaction based on perceived risk, but is also likely to require having much more of a time commitment from the participants as tight schedules would not be possible.

Another big problem with provocation studies is how to ensure you have "relaxed" sensitive participants. Most electrosensitive people have arranged their homes in a way that they are largely free of electromagnetic fields, and as such a 4 hour journey along a motorway dotted with mobile phone masts could well be triggering a number of their responses before the tests even start. Again, this is almost impossible to control for as the research time will be relying on the "initial" measurements as a sensible baseline of subjective symptoms.

Exposure Metrics

It is also extremely difficult to try to simulate the sort of electromagnetic environment where electrosensitive people are finding their symptoms most aggravated. Naturally this is crucial for performing an accurate experiment, but there are two problems: firstly, it is both expensive and time-consuming to create equipment that produces an accurate simulation signal, such as a base station with an appropriate amount of fake "call traffic". Secondly, the more factors you add to the signal, the harder it is to pin down what exactly is causing the effects that are found.

There are also problems with removing the ambient background exposure that is present in the room, and this can only really be achieved by appropriate shielding. One recent study from this country was largely nullified by completely failing to either a) shield the test room, or b) measure the background ELF or RF radiation in the room - being based in the city of London there is a very good chance that the sham exposure wasn't a true sham^[Rubin 2006]. Another study this year, this one from Norway, removed all the components from the signal other than RF - again, without knowing precisely what the sensitive group are responding to, it is impossible to judge what effect this may have. It is helpful for assessing responses to pure RF, but not to mobile phone radiation (as it was incorrectly titled)^[Ofstedal 2007]. The latest study, by Essex University, did a good job of making very realistic exposure metrics, and shielded the room adequately. They found that there was a very clear psychological component to the participants' health effects, but also found some very interesting results that they failed to address appropriately in their analysis. Whilst the results are clearly not statistically significant, there are also some definite signs that the sensitive group were able to recognise the difference between sham and UMTS signal exposure^[Eltiti 2007]. We have a more detailed explanation for this comment and data analysis has been sent for publication in the same journal, "Environmental Health Perspectives".

Health research and politics

Like all health research, it is impossible to gauge what impact political pressure has on the information made available to the general public. Some of the research is undertaken with industry-funded money; for example T-Mobile commissioned a scientific report that concluded that mobile phone handsets masts contribute to cancer and genetic damage. The report recommended that exposure limits should be cut to 1/1,000th of our current limits. Dr Peter Neitzke, of the Ecolog Institute, which produced the report for T-Mobile (2000 and updated in 2003), accused T-Mobile of diluting the findings by commissioning other studies from which it knew that "no critical results or recommendations were to be expected". Ecolog's report concluded "Given the results of the present epidemiological studies, it can be concluded that electromagnetic fields with frequencies in the mobile telecommunications range do play a role in the development of cancer." "This is particularly notable for tumours of the central nervous system."

It is worth noting that a systematic review from 2007 ^[Huss 2007] of studies of controlled exposure to radiofrequency radiation with health-related outcomes. From a total of 59 studies in their analysis, 12 were funded exclusively by the telecommunications industry, 11 were funded by public agencies and charities, 14 had mixed funding (including industry), and in 22 the funding was not reported. They found that "studies funded exclusively by industry reported the largest number of outcomes, but were least likely to report a statistically significant result. The odds ratio was 0.11 compared with studies funded by public agencies or charities." This means that according to their data, studies funded by the cellphone industries alone were 9 times more likely to find no effect as those by purely public agencies and charities, and that this difference was significant! They concluded that "The interpretation of results from studies of health effects of radiofrequency radiation should take sponsorship into account."

Summary

Our belief is that there is now plenty of evidence to support the possibility that some people are very genuinely affected by electromagnetic radiation to varying degrees. We believe that as many as 5% of people could be affected (exhibiting typical stress symptoms such as headaches, tiredness and concentration difficulties), and a fraction of a percent affected to quite severe degrees (such as not being able to use even a mobile phone without suffering from severe symptoms).

It is unknown what exactly triggers electrical sensitivity, though a number of possibilities (such as VDUs, fluorescent lighting, mobile phones or mobile phone masts, or by chemical exposure such as a damp proof course installation, garden or farm sprays, cavity wall insulation, etc) have been suggested.

We have written an extensive book on this subject, [Electrical Hypersensitivity \(ES\), a Modern Illness](#), which includes chapters on what ES is, what triggers it, how it develops and affects people. It describes the known biology of ES and some of the theories that are being researched. Most importantly, there is a chapter on what to do if you think you have ES. The changes that are important to make, including reducing your exposure, using shielding materials in the home, having complementary therapies that help your body cope better and making lifestyle changes that will help you prevent your health from deteriorating. Remember once ES is initiated it does not seem to go away of its own accord, it frequently continues to get worse, and *can* lead to the necessity of living in an electricity-free environment with all the limitations that involves, if it is not taken seriously and acted on early enough. The book has references, information about support groups and websites of interest. If you want help to convince someone else, including your GP, that what you are suffering is real and not "all in the mind", this is well worth reading through.

Radio Interview with Magda Havas

Roman Pitt [interviewed Magda Havas](#) - Associate Professor at the Environmental Studies Department of Trent University in Ontario Canada about a disorder that comes as a result of exposure to electromagnetic fields that can be found in all things electrical around us. How severe can the disorder get to be? She is an expert on the adverse health claims regarding EMFs from electricity and explains "dirty electricity" and talks about research experiments that she has conducted with special filters and talks about what she has found are the likely benefits of using those filters.

Magda Havas has also written an excellent precautionary paper, prepared for the Board of Supervisors, City and County of San Francisco. This [51 page document](#) covers a wide range of literature and scientific findings on RF research, and presents them in a logical and progressive manner.

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