

Electromagnetic fields from wireless communications and health

‘Scientific proof’ versus ‘observation’ and ‘experiences’

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According to the telecom industry, as well as to many governments, there is no ‘*scientific proof*’ that electromagnetic fields (EMF), cq. radiofrequency (RF) radiation, from cell towers, cell phones, smart phones and WiFi are hazardous to our health. Therefore they don’t find it necessary to take precautionary measures and to inform the public about the potential dangers of wireless communications. ‘*Observations*’ and ‘*experiences*’ of thousands of victims which have become electro-hypersensitive (EHS) are given no weight. No help is offered. The victims have to survive in a world which for them is becoming more and more inhabitable. With the continuously increasing radiation densities and the introduction of 4G and WiFi hotspots their numbers are increasing and their health problems are becoming more severe.

In this communication I will illustrate by many examples from history that ‘*observations*’ and ‘*experiences*’ should be considered much more important than ‘*scientific proof*’ in coming to a decision and an acceptance about whether something is hazardous or beneficial to our health or not and whether a theory or a hypotheses is correct or not. Thereafter I describe the ‘*scientific method*’ used in fact in all these cases and describe the implications when this method is applied to the subject ‘RF radiation and health’.

1. Examples

1.1 The first preventive (smallpox) vaccination by Edward Jenner in 1796 was based on his observation that milkmaids, who came in contact with cowpox, were generally immune to smallpox. There was no ‘*scientific proof*’, viruses were unknown and the ‘*scientific explanation*’ (not ‘*proof*’ !) came 100 years later.

1.2 Based on the observation in [Vienna General Hospital's](#) First Obstetrical Clinic, that doctors' wards had three times the mortality of [midwives'](#) wards, Semmelweis proposed the practice of washing hands with [chlorinated lime solutions](#) in 1847. There was no ‘*scientific proof*’, bacteria were unknown. Semmelweis's observations conflicted with the established scientific and medical opinions of the time and his ideas were rejected by the medical community. The ‘*scientific explanation*’ and ‘*scientific acceptance*’ came 40 years later.

1.3 By observation (talking to local residents) John Snow identified the source of the London cholera outbreak in 1854: a public water pump. This observation was in conflict with the then-dominant miasma theory. There was no *'scientific proof'* and the *'scientific explanation'* came 40 years later.

1.4 I now take a side step to my own field: physics. Still today there is no *'scientific proof'* of the validity of the two most important theories in physics of the 20th century: general relativity and quantum mechanics. These theories were in the beginning highly controversial and were met with strong opposition. Einstein did not get his Nobel price in physics in 1921 for the theory of general relativity of 1916 - that was too controversial - but for the photo-electric effect. General relativity and quantum mechanics have however gradually been *'accepted as being correct'* because the many predictions of the theories were all verified to be correct by experiments. That took many years.

1.5 After the discovery of X-rays (Röntgen radiation) in 1895 there followed a widespread experimentation by scientists and physicians followed by many stories of burn, hair loss and worse in technical journals of the time. Also in this case the observations preceded the *'scientific explanation'* and for a long time many physicians still claimed there were no effects from X-ray exposure at all.:

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3520298/>

1.6 The drug thalidomide was used from 1957 on in many countries all over the world, resulting in an epidemic of malformations of limbs and ears, often accompanied by malformations of internal organs. It took five years to link the observation of malformations to the drug thalidomide. The producer denied the teratogenic effects of thalidomide for years. In the historical description of this subject: <http://www.thalidomide.ca/history-of-thalidomide/>, the word combination *'scientific proof'* is absent.

1.7 The DES hormone was given to pregnant woman from 1940 to 1971. In the latter year, a report was published showing that seven of eight girls and young women (ages 14 to 22) who had been diagnosed with a rare vaginal tumor (clear cell adenocarcinoma) had been exposed prenatally to DES. Subsequent studies have shown an approximate 40-fold increased risk of vaginal/cervical clear cell adenocarcinoma in women exposed *in utero* to DES, while these so called DES daughters also suffered from other serious health problems. In the historical description: <http://en.wikipedia.org/wiki/Diethylstilbestrol>, the word combination *'scientific proof'* is absent as well.

1.8 More recently, starting from 2007, we have had in the Netherlands an outbreak of Q-fever with about 100.000 infections. At least 25 persons died and many are now chronically handicapped. It took the Dutch government three years to take action, because there was no *'scientific proof'*, as it was said, that the infected goats could transfer the infection to humans. For the complete story (in Dutch) see: <http://nl.wikipedia.org/wiki/Q-koorts>

2. Scientific "Proof", scientific evidence, and the scientific method

This subtitle is taken from: <http://www.talkorigins.org/faqs/comdesc/sciproof.html> . In this paper Douglas Theobald, professor in biochemistry, takes a formal point of view and states that '*scientific proofs*' only exist in mathematics and logic. He describes the '*scientific method*' as a general program for research in other fields. This program comprises four main steps. In practice these steps follow more of a logical order than a chronological one:

1. Make observations.
2. Form a testable, unifying hypothesis to explain these observations.
3. Deduce predictions from the hypothesis.
4. Search for confirmations of the predictions;
if the predictions are contradicted by empirical observation, go back to step (2).

Because scientists are making new observations and testing via those observations, the four 'steps' are actually practiced concurrently. New observations, even if they were not predicted, should be explicable retrospectively by the hypothesis. New information, especially details of some process previously not understood, can impose new limits on the original hypothesis. Therefore, new information, in combination with an old hypothesis, frequently leads to novel predictions that can be tested further.

If we now go back to the examples, we see that in all cases the above described '*scientific method*' gives an accurate description of what happened. Jenner, Semmelweis and Snow made observations, formed an hypothesis to explain the observations, deduced predictions which were confirmed: immunization (Jenner), lower mortality rates due to hand washing (Semmelweis) and also lower mortality rates in a following cholera outbreak due to the use of clean water (Snow). In the other examples there is not a single name associated to the observations, but several. In examples 5 to 8 the observations of severe health problems and malformations came first, followed by linking them to X-rays, drugs and infection. Thereafter followed the usual opposition, confirmation of the predictions and finally acceptance, also '*scientific acceptance*', without '*scientific proof*'.

3. The 'scientific method' applied to 'EMF (RF radiation) and health'

If we now apply the '*scientific method*' to the subject 'EMF (RF radiation) and health' we thus have to start with observations.

3.1 The most important of these observations are the experiences of those people all over the world who describe a number of health problems which they attribute to the radiation

coming from nearby cell towers and/or WiFi and DECT phones from neighbours. The most important reasons for attributing their health problems to EMF are that:

1. Extended medical examinations have found no other cause, and
2. Their problems are significantly reduced or vanish when the EMF are significantly reduced by shielding or by moving to another place with much lower radiation density.

On one website, mine, there is one section with contributions from readers who describe their experiences with EMF: <http://www.stopumts.nl/doc.php/Verhalen/> . In that section there are hundreds of stories, many shocking. In 2014 three of these are about people who ended of their lives because they could no longer stand the torture, as they said, from the continuous exposure to EMF. These hundreds of stories, the majority from the Netherlands, a relative small country, can be considered to be the 'tip of the iceberg' since we know from these stories that it generally took the writers many years before they were able to link their health problems to the EMF in their environment. Although I had been a research physicist for 38 years, with a good knowledge of electromagnetism, it still took me five years and many medical examinations to link my own health problems, which became more and more severe, to the basis station of DECT telephone placed at four meters from my bed. I had never realized that such a basis station radiates 24 hours a day. In the stories on my website there are two from families who discovered only after 13 years that the cell towers close to their homes were the source of all their problems. The one million people in the Netherlands with unexplained health problems, often similar to those of EHS persons, are not diagnosed for possible EHS, as in Sweden and Austria. In other countries the situations are similar, with an estimated percentage of electrosensitive persons of about 3%. An inventory of the various health problems can be found in many papers and brochures, for example in: <http://www.icems.eu/docs/EMFacts-WIFI.pdf> .

3.2 Next to these observations there are many reports, review papers and peer-reviewed publications about the interaction of EMF with biological systems (humans, animals and plants).

In: http://www.emf-portal.de/db_status.php?!=e&sform=6 one finds a listing of the over 20.000 publications in this field, subdivided in various categories, similar as in the brochure just referred to above. In many of these papers biological genotoxic effects are reported at non-thermal levels of exposure. Among these effects are the formation of free radicals, chromosomal instability, altered gene expression, gene mutations, DNA-strand breaks and micro-nuclei formation. These effects are found at levels of exposure which according to the International Commission of Non-Ionizing Radiation Protection (ICNIRP) are considered to be completely safe. It is not my intention to give a survey of the very extended work in this field. Instead I refer to a some relevant surveys:

http://aaemonline.org/emf_rf_position.php a position statement from the American Academy of Environmental Medicine from 2011;

http://www.magdahavas.com/wordpress/wp-content/uploads/2010/11/Blake_Levitt-Henry_Lai.pdf a review paper (Environ. Rev. 18: 369–395 (2010)) by Levitt and Lai;

<http://www.bioinitiative.org/> the BioInitiative Report from 2012, prepared by 29 authors from ten countries, including ten MDs, 21 PhDs and three MsC, MA or MPHs. Among these are three former presidents of the Bioelectromagnetics Society, the Chair of the Russian National Committee on Non-Ionizing Radiation and a Senior Advisor to the European Environmental Agency;

http://www.powerwatch.org.uk/pdfs/20041222_reflex.pdf the Reflex report from 2004, the most extensive series of in-vitro experiments available, a joint study paid by the European Union and carried out in twelve institutes in seven countries in the EU.

http://www.safeschool.ca/uploads/WiFi_Swisscom_Patent.pdf an international patent application from Swisscom, a telecom company. In this patent application made in 2004 genotoxic damage via non-thermal pathways is recognized and described. From the patent application I quote:

‘These findings indicate that the genotoxic effect of electromagnetic radiation is elicited via a non-thermal pathway. Moreover aneuploidy is to be considered as a known phenomenon in the increase of cancer risk. Thus it has been possible to show that mobile radio radiation can cause damage to genetic material, in particular in human white blood cells, whereby both the DNA itself is damaged and the number of chromosomes changed. This mutation can consequently lead to increased cancer risk. In particular, it could also be shown that this destruction is not dependent upon temperature increases, i.e. is non-thermal.’

From all this work it is clear that genotoxic effects occur at radiation densities well below the ICNIRP limits which account only for thermal effects. There is further no question that some of these genotoxic effects, such as DNA breaks and free radical formation, may be detrimental for our health in the case of long-term (many years) exposure.

3.3 In addition to the observation of reactions of individual people to RF exposure (3.1), and the results of scientific work (3.2), it is also relevant to look at the reactions of governments and other authorities. These reacties appear to be diverse. I will give a short survey.

Electrohypersensitivity (EHS) of people is recognized as a handicap in Sweden since 2000 and in Austria by the medical authorities since 2012.

In resolutions, the Parliamentary Assembly of the EU (2009) and the Parliamentary Assembly of the Council of Europe (2011) urged the member states to recognize EHS as a handicap and to revise (lower) the limits for radiation exposure.

The International Agency for Research on Cancer (IARC), part of the WHO, classified RF radiation from mobile phones, cell towers, WiFi, etc. (2011) as 'possibly carcinogenic to humans', class 2B, the same category wherein DDT, leaded gasoline and chloroform are classified.

Precautionary measures to protect young children and to reduce or prevent use of mobile communications in schools are laid down by law in France (2010- 2014) and Belgium (2014).

Insurance companies do not insure any risk associated with (future) damage by EMF. The insurance companies AUVA (Austria, 2009) and Loyds (GB, 2010) made their own investigations, came to the conclusion that the risks are too high and made a comparison with the problems with asbestos.

Several victims of RF overexposure have been recognized and have got compensation awarded by High Courts in Italy (2012) and Australia (2013) or settled by agreement in Israël (2013), to name a few.

In the most countries in Eastern Europe, Russia included, and in some other countries like Israël and China, the radiation limits (in $\mu\text{W}/\text{m}^2$) are a factor of 100 lower than in Western Europe, the USA and Canada.

In this survey I listed the most important measures taken by governments and other authorities, but this list is far from complete.

4. Summary and Conclusions

With the examples from history I have illustrated (Sec. 1) that '*observations*' and '*experiences*' are much more important than '*scientific proof*' in coming to a decision and an acceptance about whether something is hazardous or beneficial to our health or not and whether a theory or a hypotheses is correct or not. '*Scientific proof*' has never been important and has never been defined in an undisputable way, except in the formal way as used here, namely that '*scientific proofs*' only exist in mathematics and logic.

What actually happened in all these cases is accurately described by the '*scientific method*' (Sec. 2). Observations came first followed by an hypotheses to explain them, a deduction of predictions from these hypotheses, confirmations which can be part of the '*scientific evidence*' and finally '*scientific acceptance*'.

In the application of the '*scientific method*' to the subject 'EMF (RF radiation) and health' (Sec. 3) the observations are the thousands of experiences of people who have found a direct correlation between their health problems and the RF radiation intensities and for whom the often extended medical examinations have found no other cause. In addition to

these observations there is the extended *'scientific evidence'* from the scientific studies in which non-thermal biological genotoxic effects are found. These effects can lead to permanent damage and cancer, in particular after long-term exposure. There is more evidence, namely from epidemiological studies, but these have not been discussed here.

In summary we conclude that there is abundant information to come to a general acceptance and to a *'scientific acceptance'* that electrohypersensitivity (EHS) of persons exists. The present denial in most countries has led to severe health problems for many, loss of jobs, broken marriages and isolation. The victims are often not taken seriously, they get no help and are treated sometimes as suffering from psychosomatic disorders. This has already led to suicides. The denial of the existence of electrosensitivity and of EHS in particular, which can only be explained by economic motives, can be considered to be highly immoral. Governments and the medical authorities in most countries do not take their responsibilities. To this there are only a few exceptions. Obviously the Austrian medical authorities and recently the European Economic and Social Committee (EESC) of the European Union. This committee has initially published an 'opinion':

<http://www.powerwatch.org.uk/news/2015-01-20-eesc-final-opinion.pdf>

on 'Electromagnetic hypersensitivity' in which the present situation is correctly described, implying a recognition of the existence of EHS and its relation with electromagnetic fields (EMF). Prior to the final meeting a 'counter-opinion':

<http://www.stopumts.nl/pdf/EESC-2014-05117-01-01-AMP-TRA-EN-counter%20opinion.pdf>

was put forward by Sir Richard Adams, a man with industrial ties, in particular with the introduction of smart meters in England. In this 'counter-opinion' the existence of EHS is recognized, its relation with EMF not. It came to a vote, with a victory by Richard Adams and the telecom Industry: 136 votes in favor of the 'counter-opinion', 110 against and 19 abstentions. Economic interests and telecom Industry versus Health of People: 136 to 110. Nevertheless, 110 EESC members were in favour of full recognition of EHS and its relation with EMF.

Finally, we end with a quote from WHO (2000), Tobacco Explained: The truth about the tobacco industry: <http://www.who.int/tobacco/media/en/TobaccoExplained.pdf> :

"A demand for scientific proof is always a formula for inaction and delay and usually the first reaction of the guilty ... in fact scientific proof has never been, is not and should not be the basis for political and legal action"

January 19, 2015 first version

February 6, 2015 second version