

# Mobile phone radiation and health

From Wikipedia, the free encyclopedia

**Mobile phone radiation and health** concerns have been raised, especially following the enormous increase in the use of wireless mobile telephony throughout the world (as of August 2005, there were more than 2 billion users worldwide). This is because mobile phones use electromagnetic radiation in the microwave range. These concerns have induced a large body of research (both epidemiological and experimental, in non-human animals as well as in humans). Concerns about effects on health have also been raised regarding other digital wireless systems, such as data communication networks.

The World Health Organization has concluded, based upon the consensus view of the scientific and medical communities, that serious health effects (e.g. cancer) are very unlikely to be caused by cellular phones or their base stations<sup>[1] [2]</sup>, and expects to make recommendations about mobile phones in 2007–08.

However, some national radiation advisory authorities, including those of Austria,<sup>[3]</sup> France,<sup>[4]</sup> Germany,<sup>[5]</sup> and Sweden<sup>[6]</sup> recommend to their citizens measures to minimize exposure. Examples of the recommendations are:

- Use hands-free to decrease the radiation to the head.
- Keep the mobile phone away from the body.
- Do not telephone in a car without an external antenna.

However, the use of "hands-free" was not recommended by the British Consumers' Association in a statement in November 2000.<sup>[7]</sup>



A Greenfield-type tower used in base stations for mobile telephony

## Contents

- 1 Health hazards of handsets
  - 1.1 Thermal effects
  - 1.2 Non-thermal effects
    - 1.2.1 Blood Brain Barrier effects
    - 1.2.2 Electrical sensitivity
    - 1.2.3 Genotoxic effects
    - 1.2.4 Mobile phones and cancer
    - 1.2.5 Sleep and EEG effects
- 2 Health hazards of base stations
- 3 Occupational health hazards
- 4 Safety standards and licensing
- 5 Lawsuits
- 6 Precautionary principle
- 7 See also
- 8 References

- 9 External links
  - 9.1 Independent Organisations
  - 9.2 Government
  - 9.3 Industry
  - 9.4 Web news aggregators

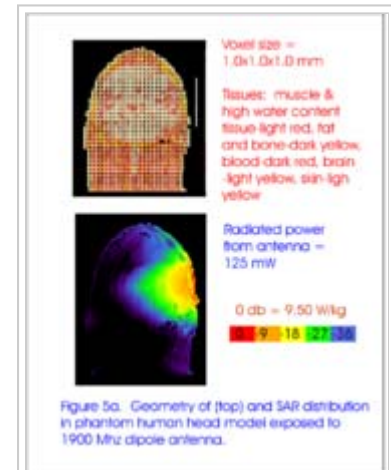
## Health hazards of handsets

Part of the radio waves emitted by a mobile telephone handset are absorbed by the human head. The radio waves emitted by a GSM handset, can have a peak power of 2 watts, and a US analogue phone had a maximum transmit power of 3.6 watts. Other digital mobile technologies, such as CDMA and TDMA, use lower output power, typically below 1 watt. The maximum power output from a mobile phone is regulated by the mobile phone standard it is following and by the regulatory agencies in each country. In most systems the cellphone and the base station check reception quality and signal strength and the power level is increased or decreased automatically, within a certain span, to accommodate for different situations such as inside or outside of buildings and vehicles.

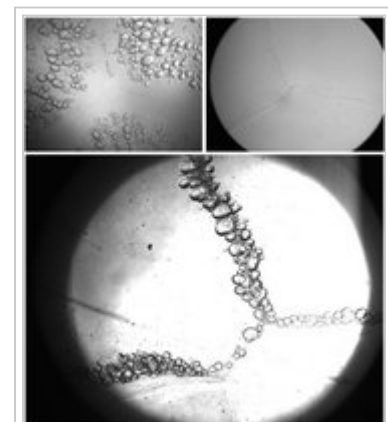
The rate at which radiation is absorbed by the human body is measured by the Specific Absorption Rate (SAR), and its maximum levels for modern handsets have been set by governmental regulating agencies in many countries. In the USA, the FCC has set a SAR limit of 1.6 W/kg, averaged over a volume of 1 gram of tissue, for the head. In Europe, the limit is 2 W/kg, averaged over a volume of 10 grams of tissue. SAR values are heavily dependent on the size of the averaging volume. Without information about the averaging volume used comparisons between different measurements can not be made. Thus, the European 10-gram ratings should be compared among themselves, and the American 1-gram ratings should only be compared among themselves. SAR data for specific mobile phones, along with other useful information, can be found directly on manufacturers' websites, as well as on third party web sites.<sup>[8]</sup>

### Thermal effects

One well-understood effect of microwave radiation is dielectric heating, in which any dielectric material (such as living tissue) is heated by rotations of polar molecules induced by the electromagnetic field. In the case of a person using a cell phone, most of the heating effect will occur at the surface of the head, causing its temperature to increase by a fraction of a degree. In this case, the level of temperature increase is an order of magnitude less than that obtained during the exposure of the head to direct sunlight. The brain's blood circulation is capable of disposing of excess heat by increasing local blood flow. However, the cornea of the eye does not have this temperature regulation mechanism. Premature cataracts have not been linked with



Calculated specific absorbed radiation (SAR) distribution in an anatomical model of head next to a 125 mW dipole antenna. Peak SAR is 9.5 W/kg over 1 mg. (USAF/AFRL).



cell phone use, possibly because of the lower power output of mobile phones.

It has been claimed that some parts of the human head are more sensitive to damage from increases in temperature, particularly in anatomical structures with poor vasculature, such as nerve fibers.

### **Non-thermal effects**

The communications protocols used by mobile phones often result in low-frequency pulsing of the carrier signal.

Some researchers have argued that so-called "non-thermal effects" could be reinterpreted as a normal cellular response to an increase in temperature. The German biophysicist Roland Glaser, for example<sup>[9]</sup>, has argued that there are several thermoreceptor molecules in cells, and that they activate a cascade of second and third messenger systems, gene expression mechanisms and production of heat shock proteins in order to defend the cell against metabolic cell stress caused by heat. The increases in temperature that cause these changes are too small to be detected by studies such as REFLEX, which base their whole argument on the apparent stability of thermal equilibrium in their cell cultures.

### **Blood Brain Barrier effects**

Swedish researchers from the University Lund, Salford, Brun, Perrson, Eberhardt and Malmgren, have studied the effects of microwave radiation on the rat brain. They found a leakage of albumin into brain via a permeated blood-brain barrier.<sup>[10]</sup>

### **Electrical sensitivity**

Some users of mobile handsets have reported feeling several unspecific symptoms during and after its use; ranging from burning and tingling sensations in the skin of the head and extremities, fatigue, sleep disturbances, dizziness, loss of mental attention, reaction times and memory retentiveness, headaches, malaise, tachycardia (heart palpitations), to disturbances of the digestive system. Reports have noted that all of these symptoms can also be attributed to stress.

### **Genotoxic effects**

Research published in 2004 by a team at the University of Athens had a reduction in reproductive capacity in fruit flies exposed to 6 minutes of 900 MHz pulsed radiation for five days.<sup>[11]</sup> Subsequent research, again conducted on fruit flies, was published in 2007, with the same exposure pattern but conducted at both 900 MHz and 1800 MHz, and had similar changes in reproductive capacity with no significant difference between the two frequencies.<sup>[12]</sup> Following additional tests published in a third article, the authors stated they thought their research suggested the changes were "...due to degeneration of large numbers of egg chambers after DNA fragmentation of their constituent cells ...".<sup>[13]</sup>

In December 2004, a pan-European study named REFLEX (Risk Evaluation of Potential Environmental Hazards from Low Energy Electromagnetic Field (EMF) Exposure Using Sensitive in vitro Methods),

Microscope photographs of lenses incubated in organ culture conditions for 12 days. Right frame shows Control lens with no damage. Bottom frame demonstrates the effect of microwave radiation on bovine lens sutures for a total exposure of 192 cycles (1.1 GHz, 2.22 mW). Each cycle lasts 50 min followed by 10 min pause. In the absence of microwave radiation, the bubbles are generated by temperature increase to 39.5 °C during 4 h; see left frame. Credit: IsraCast Technology News [2]

involving 12 collaborating laboratories in several countries showed some compelling evidence of DNA damage of cells in in-vitro cultures, when exposed between 0.3 to 2 watts/kg, whole-sample average. There were indications, but not rigorous evidence of other cell changes, including damage to chromosomes, alterations in the activity of certain genes and a boosted rate of cell division.<sup>[14]</sup>

### Mobile phones and cancer

In 2006 a large Danish study about the connection between mobile phone use and cancer incidence was published. It followed over 420,000 Danish citizens over 20 years and showed no increased risk of cancer.<sup>[15]</sup> The German Federal Office for Radiation Protection (BfS) consider this report as inconclusive.<sup>[16]</sup>

In order to investigate the risk of cancer for the mobile phone user, a cooperative project between 13 countries has been launched called INTERPHONE. The idea is that cancers need time to develop so only studies over 10 years are of interest.<sup>[17]</sup>

The following studies of long time exposure have been published:

- A Danish study (2004) that took place over 10 years and found no evidence to support a link.<sup>[15]</sup>
- A Swedish study (2005) that draws the conclusion that "the data do not support the hypothesis that mobile phone use is related to an increased risk of glioma or meningioma."<sup>[18]</sup>
- A British study (2005) that draws the conclusion that "The study suggests that there is no substantial risk of acoustic neuroma in the first decade after starting mobile phone use. However, an increase in risk after longer term use or after a longer lag period could not be ruled out."<sup>[19]</sup>
- A German study (2006) that states "In conclusion, no overall increased risk of glioma or meningioma was observed among these cellular phone users; however, for long-term cellular phone users, results need to be confirmed before firm conclusions can be drawn."<sup>[20]</sup>
- A joint study that draws the conclusion that "Although our results overall do not indicate an increased risk of glioma in relation to mobile phone use, the possible risk in the most heavily exposed part of the brain with long-term use needs to be explored further before firm conclusions can be drawn."<sup>[21]</sup>

Other studies on cancer and mobile phones are:

- Tumour risk associated with use of cellular telephones or cordless desktop telephones, that states: "We found for all studied phone types an increased risk for brain tumours, mainly acoustic neuroma and malignant brain tumours".<sup>[22]</sup>
- A Swedish scientific team at the Karolinska Institute conducted an epidemiological study (2004) that suggested that regular use of a mobile phone over a decade or more was associated with an increased risk of acoustic neuroma, a type of benign brain tumor. The increase was not noted in those who had used phones for fewer than 10 years.<sup>[23]</sup>
- The INTERPHONE study group from Japan published the results of a study of brain tumour risk and mobile phone use. They used a new approach: determining the SAR inside a tumour by calculating the radiofrequency field absorption in the exact tumour location. Cases examined

included glioma, meningioma, and pituitary adenoma. They reported that the overall odds ratio (OR) was not increased and that there was no significant trend towards an increasing OR in relation to SAR-derived exposure. <sup>[24]</sup>

- A self-published meta-study by Dr. Vini Khurana, an Australian neurosurgeon, presented a growing body of evidence that using handsets for 10 years or more can double the risk of brain cancer and that this is thus more dangerous than smoking. <sup>[25]</sup>

### Sleep and EEG effects

Some studies have claimed to show that mobile phone signals affect sleep patterns and possibly delay sleep onset during exposure. <sup>[26]</sup> In another clinical study, carried out by Sweden's Karolinska Institute and Wayne State University in the US, the authors concluded their research suggested an association between RF exposure and adverse effects on sleep quality within certain sleep stages, though participants were unable to determine better than chance if they had been exposed to actual radiation or sham exposure. <sup>[27]</sup> The UK National Health Service criticized the research because of the small sample size used, and because of the 53% of participants who reported sensitivity to mobile use, a proportion unlikely to be representative of the general population. The NHS also criticized the press for inaccurate reporting of the study. <sup>[28]</sup>

## Health hazards of base stations

Another area of worry about effects on the population's health have been the radiation emitted by base stations (the antennas on the surface which communicate with the phones), because, in contrast to mobile handsets, it is emitted continuously and is more powerful at close quarters. On the other hand due to the attenuation of power with the square of distance, field intensities drop rapidly with distance away from the base of the antenna. Base station emissions must comply with ICNIRP guidelines of a maximum power density of 4.5 W/m<sup>2</sup> for 900 MHz and 9 W/m<sup>2</sup> for 1800 MHz. <sup>[29]</sup>

These guidelines are set for short term heating, which is the only understood mechanism of electromagnetic fields on biological tissue. The ICNIRP guidelines are distrusted by some scientists, such as the BioInitiative group <sup>[30]</sup>, who report that the existing standards for public safety are inadequate to protect public health.

A 2002 survey study by Santini *et al.* in France found a variety of self-reported symptoms for people who reported that they were living within 300 metres (984 ft) of GSM cell towers in rural areas, or within 100 m (328 ft) of base stations in urban areas. Fatigue, headache, sleep disruption and loss of memory were among the symptoms reported. <sup>[31]</sup> Similar results have been obtained with GSM cell towers in Spain, <sup>[32]</sup> Egypt, <sup>[33]</sup> Poland <sup>[34]</sup> and Austria. <sup>[35]</sup> It is, however, important to note that these surveys do not show statistically significant clustering or causality and those complaining of adverse symptoms may be displaying the nocebo effect, unless this is controlled in the study.

However, a study conducted at the University of Essex concluded that mobile phone masts were unlikely to be causing these short term effects in a group of volunteers who complained of such symptoms. <sup>[36]</sup> The study has been criticised as being skewed due to drop-outs of test subjects, <sup>[37]</sup>, although electrical sensitivity lobby groups have praised the study as a whole, <sup>[38]</sup> and these criticisms were answered by the authors.

As technology progresses and data demands have increased on the mobile network, towns and cities have seen the number of towers increase sharply, including 3G towers which work with larger bandwidths. Many measurements and experiments have shown that transmitter power levels are relatively low - in modern 2G antennas, in the range of 20 to 100 W, with the 3G towers causing less radiation than the already present 2G network. An average radiation power output of 3 W is used. The use of 'micro-cell geometries' (large numbers of transmitters in an area but with each individual transmitter running very low power) inside cities has decreased the amount of radiated power even further. The radiation exposure from these antennas, while generally low level, is continuous.

Experts consulted by France consider it is mandatory that main antenna axis not to be directly in front of a living place at a distance shorter than 100 meters.<sup>[39]</sup>

## Occupational health hazards

Telecommunication workers who spend time at a short distance from the active equipment, for the purposes of testing, maintenance, installation, etc. may be at risk of much greater exposure than the general population. Many times base stations are not turned off during maintenance, because that would affect the network, so people work near "live" antennas.

A variety of studies over the past 50 years have been done on workers exposed to high RF radiation levels; studies including radar laboratory workers, military radar workers, electrical workers, amateur radio operators. Most of these studies found no increase in cancer rates over the general population or a control group. Many positive results could have been attributed to other work environment conditions, and many negative results of reduced cancer rates also occurred.<sup>[40]</sup>

## Safety standards and licensing

In order to protect the population living around base stations and users of mobile handsets, governments and regulatory bodies adopt safety standards, which translate to limits on exposure levels below a certain value. There are many proposed national and international standards, but that of the International Commission for Non-Ionizing Radiation Protection (ICNIRP) is the most respected one, and has been adopted so far by more than 80 countries. For radio stations, ICNIRP proposes two safety levels: one for occupational exposure, another one for the general population. Currently there are efforts underway to harmonise the different standards in existence.<sup>[41]</sup>

Radio base licensing procedures have been established in the majority of urban spaces regulated either at municipal/county, provincial/state or national level. Mobile telephone service providers are, in many regions, required to obtain construction licenses, provide certification of antenna emission levels and assure compliance to ICNIRP standards and/or to other environmental legislation.

Many governmental bodies also require that competing telecommunication companies try to achieve sharing of towers so as to decrease environmental and cosmetic impact. This issue is an influential factor of rejection of installation of new antennas and towers in communities. The safety standards in the U.S. are set by the Federal Communications Commission (FCC). The FCC has based its standards primarily on those standards established by the Institute of Electronics and Electrical Engineering (IEEE), specifically Subcommittee 4 of the "International Committee on Electromagnetic Safety".

## Lawsuits

In the USA, a small number of personal injury lawsuits have been filed by individuals against cellphone manufacturers, such as Motorola<sup>[42]</sup>, NEC, Siemens and Nokia, on the basis of allegations of causation of brain cancer and death. In US federal court, expert testimony relating to science must be first evaluated by a judge, in a Daubert hearing, to be relevant and valid before it is admissible as evidence. In one case against Motorola, the plaintiffs alleged that the use of wireless handheld telephones could cause brain cancer, and that the use of Motorola phones caused one plaintiff's cancer. The judge ruled that no sufficiently reliable and relevant scientific evidence in support of either general or specific causation was proffered by the plaintiffs; accepted a motion to exclude the testimony of the plaintiffs' experts; and denied a motion to exclude the testimony of the defendants' experts.<sup>[43]</sup>

## Precautionary principle

In 2000, the World Health Organization (WHO) recommended that the precautionary principle could be voluntarily adopted in this case.<sup>[44]</sup> It follows the recommendations of the European Community for environmental risks. According to the WHO, the "precautionary principle" is "a risk management policy applied in circumstances with a high degree of scientific uncertainty, reflecting the need to take action for a potentially serious risk without awaiting the results of scientific research." Other less stringent recommended approaches are prudent avoidance principle and ALARA (*As Low as Reasonably Achievable*). Although all of these are problematic in application, due to the widespread use and economic importance of wireless telecommunication systems in modern civilization, there is an increased popularity of such measures in the general public. They involve recommendations such as the minimization of cellphone usage, the limitation of use by at-risk population (such as children), the adoption of cellphones and microcells with ALARA levels of radiation, the wider use of hands-off and earphone technologies such as Bluetooth headsets, the adoption of maximal standards of exposure, RF field intensity and distance of base stations antennas from human habitations, and so forth.

## See also

- Bioelectromagnetism
- Mobile phones and driving safety
- Electromagnetic radiation and health
- Wireless electronic devices and health (computer data wireless)
- Specific absorption rate
- Radiation biology
- Electrical sensitivity
- Non-ionizing radiation

## References

1. ^ What are the health risks associated with mobile phones and their base stations?. *Online Q&A*. World Health Organization (2005-12-05). Retrieved on 2008-01-19.
2. ^ Electromagnetic fields and public health: mobile telephones and their base stations. *Fact sheet N°193*. World Health Organization (June 2000). Retrieved on 2008-01-19.
3. ^ Information: Wie gefährlich sind Handystrahlen wirklich? (German). Marktgemeinde Pressbaum. Retrieved on 2008-01-23.

4. ^ Téléphones mobiles : santé et sécurité (French). Le ministère de la santé, de la jeunesse et des sports (2008-01-02). Retrieved on 2008-01-19. Lay article in **(English)** making comment at Gitlin, Jonathan M. (2008-01-03). France: Beware excessive cell phone use—despite lack of data. *Ars Technica*. Retrieved on 2008-01-19.
5. ^ Precaution regarding electromagnetic fields. Federal Office for Radiation Protection (2007-12-07). Retrieved on 2008-01-19.
6. ^ Exponering (Swedish). Swedish Radiation Protection Authority (February 2006). Retrieved on 2008-01-19.
7. ^ UK consumer group: Hands-free phone kits boost radiation exposure. *cnn.com*. Cable News Network (2000-11-02). Retrieved on 2008-01-19.
8. ^ For example, two listings using the European 10 g standard: of more current models at Mobile Phones UK. *Mobile Phones UK web site*. Landmark Internet Ltd. Retrieved on 2008-01-19.; of phones from 2005 and earlier at The Complete SAR List For All Phones (Europe). On-Line-Net - Web Design & Internet Services (as SARValues.com). Retrieved on 2008-01-19. (a listing of US phones from 2005 and earlier, using the US 1 g standard, is also available at the SARValues site)
9. ^ Glaser, Roland (December 2005). "Are thermoreceptors responsible for “non-thermal” effects of RF fields?" (PDF). *Edition Wissenschaft* (21). Bonn, Germany: Forschungsgemeinschaft Funk. OCLC 179908725. Retrieved on 2008-01-19.
10. ^ Salford, Leif G.; Arne E. Brun, Jacob L. Eberhardt, Lars Malmgren, and Bertil R. R. Persson (June 2003). "Nerve Cell Damage in Mammalian Brain after Exposure to Microwaves from GSM Mobile Phones" (in English). *Environmental Health Perspectives* **111** (7): 881–883. United States: National Institute of Environmental Health Sciences. PMID 12782486. Retrieved on 2008-01-08.
11. ^ Panagopoulos, DJ; Karabarbounis, A; Margaritis, LH (2004-12-01). "Effect of GSM 900-MHz mobile phone radiation on the reproductive capacity of *Drosophila melanogaster*" (in English). *Electromagnetic Biology and Medicine* **23** (1): 29–43. London, UK: Taylor & Francis. ISSN 1536-8378. OCLC 87856304. doi:10.1081/JBC-120039350. Retrieved on 2008-01-15.
12. ^ Panagopoulos, DJ; Chavdoula, ED; Karabarbounis, A; Margaritis, LH (January 1, 2007). "Comparison of bioactivity between GSM 900 MHz and DCS 1800 MHz Mobile Telephony Radiation" (in English). *Electromagnetic Biology and Medicine* **26** (1): 33–44. London, UK: Informa Healthcare. ISSN 1536-8378. PMID 17454081. OCLC 47815878. doi:10.1080/15368370701205644. Retrieved on 2008-01-14.
13. ^ Panagopoulos, DJ; Chavdoula, ED; Nezis, IP; Margaritis, LH (January 10, 2007). "Cell death induced by GSM 900-MHz and DCS 1800-MHz mobile telephony radiation" (in English). *Mutation Research* **626** (1–2): 69–78. Amsterdam, Netherlands: Elsevier. ISSN 0027-5107. PMID 17045516. OCLC 109920000. Retrieved on 2008-01-15. “Our present results suggest that the decrease in oviposition previously reported, is due to degeneration of large numbers of egg chambers after DNA fragmentation of their constituent cells, induced by both types of mobile telephony radiation. Induced cell death is recorded for the first time, in all types of cells constituting an egg chamber...”
14. ^ *Risk Evaluation of Potential Environmental Hazards From Low Frequency Electromagnetic Field Exposure Using Sensitive in vitro Methods*, Munich: VERUM Stiftung für Verhalten und Umwelt, 2004, <[http://www.itis.ethz.ch/downloads/REFLEX\\_Final%20Report\\_171104.pdf](http://www.itis.ethz.ch/downloads/REFLEX_Final%20Report_171104.pdf)>. Retrieved on 20 January 2008 Undertaken as EU research contract QLK4-CT-1999-01574
15. ^ <sup>a</sup> <sup>b</sup> Schüz, J; Jacobsen, R; Olsen, JH; Boice, JD; McLaughlin, JK; Johansen, C (December 2006). "Cellular Telephone Use and Cancer Risk: Update of a Nationwide Danish Cohort". *Journal of the National Cancer Institute* **98** (23): 1707–1713. Oxford University Press. ISSN 0027-8874. PMID 17148772. OCLC 90861566. doi:10.1093/jnci/djj464. Retrieved on 2008-01-20. “Among long-term subscribers of 10 years or more, cellular telephone use was not associated with increased risk for brain tumors ..., and there was no trend with time since first subscription. ...CONCLUSIONS: We found no evidence for an association between tumor risk and cellular telephone use among either short-term or long-term users. Moreover, the narrow confidence intervals provide evidence that any large association of risk of cancer and cellular telephone use can be excluded.”
16. ^ Comments on the Danish cohort study on mobile phones (German). Bundesamt für Strahlenschutz (2007-02-22). Retrieved on 2008-01-20.
17. ^ The INTERPHONE Study. International Agency for Research on Cancer. Retrieved on 2008-01-20.
18. ^ Lönn, S; Ahlbom, A; Hall, P; Feychting, M (2005-03-15). "Long-Term Mobile Phone Use and Brain Tumor Risk". *American Journal of Epidemiology* **161** (6): 526–535. Oxford, UK: Oxford University Press. ISSN 0002-9262. PMID 15746469. OCLC 111065031. doi:10.1093/aje/kwi091. Retrieved on 2008-01-20.
19. ^ Schoemaker, MJ; Swerdlow, AJ; Ahlbom, A; Auvinen, A; Blaasaas, KG; Cardis, E; Christensen, HC; Feychting, M; Hepworth, SJ; Johansen, C; Klæboe, L; Lönn, S; McKinney, PA; Muir, K; Raitanen, J;

- Salminen, T; Thomsen, J; Tynes, T (2005-10-03). "Mobile phone use and risk of acoustic neuroma: results of the Interphone case-control study in five North European countries". *British Journal of Cancer* **93** (7): 842–848. London: Cancer Research UK. ISSN 0007-0920. PMID 16136046. OCLC 111975508. doi:10.1038/sj.bjc.6602764. Retrieved on 2008-01-20.
20. ^ Schüz, J; Böhler, E; Berg, G; Schlehofer, B; Hettinger, I; Schläefer, K; Wahrendorf, J; Kunna-Grass, K; Blettner, M (2006-03-15). "Cellular phones, cordless phones, and the risks of glioma and meningioma (Interphone Study Group, Germany)". *American Journal of Epidemiology* **163** (6): 512–520. Oxford, UK: Oxford University Press. ISSN 0002-9262. PMID 16443797. OCLC 108576662. doi:10.1093/aje/kwj068 10.1093/aje/kwj068. Retrieved on 2008-01-20.
  21. ^ Lahkola, A; Auvinen, A; Raitanen, J; Schoemaker, MJ; Christensen, HC; Feychting, M; Johansen, C; Klæboe, L; Lönn, S; Swerdlow, AJ; Tynes, T; Salminen, T (2007-04-15). "Mobile phone use and risk of glioma in 5 North European countries". *International Journal of Cancer* **120** (8): 1769–1775. Hoboken, NJ: John Wiley & Sons. ISSN 0020-7136. PMID 17230523. OCLC 123857774. doi:10.1002/ijc.22503 10.1002/ijc.22503. Retrieved on 2008-01-20.
  22. ^ Tumour risk associated with use of cellular telephones or cordless desktop telephones. L. Hardell, K. Hansson-Mild, M. Carlberg, F. Söderqvist
  23. ^ Lönn, S; Ahlbom, A.; Hall, P.; Feychting, M. (November, 2004). "Mobile phone use and the risk of acoustic neuroma" (in English). *Epidemiology* **15** (6): 653–659. Lippincott Williams & Wilkins. ISSN 1044-3983. PMID 15475713. OCLC 44996510. doi:10.1097/01.ede.0000142519.00772.bf. Retrieved on 2008-01-08. "Conclusions: Our findings do not indicate an increased risk of acoustic neuroma related to short-term mobile phone use after a short latency period. However, our data suggest an increased risk of acoustic neuroma associated with mobile phone use of at least 10 years' duration."
  24. ^ Takebayashi, T; Varsier, N; Kikuchi, Y; Wake, K; Taki, M; Watanabe, S; Akiba, S; Yamaguchi, N (2008-02-05). "Mobile phone use, exposure to radiofrequency electromagnetic field, and brain tumour: a case-control study". *British Journal of Cancer* **98** (3): 652–659. London: Nature Publishing Group. doi:10.1038/sj.bjc.6604214. ISSN 0007-0920. PMID 18256587. Retrieved on 2008-03-12. Lay summary – *Reuters* (2008-02-05). "'Using our newly developed and more accurate techniques, we found no association between mobile phone use and cancer, providing more evidence to suggest they don't cause brain cancer,' Naohito Yamaguchi, who led the research, said."
  25. ^ Khurana, Vini (2008-03-20). Mobile Phone-Brain Tumour Public Health Advisory. Retrieved on 2008-04-05. Lay news article Lean, Geoffrey. "Mobile phones 'more dangerous than smoking'", *The Independent*, Independent News & Media, 2008-03-30. Retrieved on 2008-04-05.
  26. ^ Hung, CS; Anderson C; Horne, JA; McEvoy, P (2007-06-21). "Mobile phone 'talk-mode' signal delays EEG-determined sleep onset". *Neuroscience Letters* **421** (1): 82–86. East Park, Ireland: Elsevier Science Ireland. ISSN 0304-3940. PMID 17548154. OCLC 144640846. doi:10.1016/j.neulet.2007.05.027. Retrieved on 2008-01-22.
  27. ^ Arnetz, BB; Akerstedt, T; Hillert, L; Lowden, A; Kuster, N; Wiholm, C (2007). "The Effects of 884 MHz GSM Wireless Communication Signals on Self-reported Symptom and Sleep (EEG)- An Experimental Provocation Study" **3** (7): 1148–1150. Cambridge, MA: Progress in Electromagnetics Research Symposium. ISSN 1931-7360. doi:10.1010.2529/PIERS060907172142. Lay summary – *BBC* (2008-01-21). "Our results suggest that RF exposure under these conditions is associated with adverse effects on sleep quality within certain sleep stages."
  28. ^ Mobile effect on sleep. *Behind the Headlines*. National Health Service (2008-01-21). Retrieved on 2008-01-22.
  29. ^ Exposures from Base Stations. *Mobile Telephony and Health*. Health Protection Agency. Retrieved on 2008-01-31. "Average exposures were found to be 0.002% of the ICNIRP public exposure guidelines and at no location was exposure found to exceed 0.2% of the guidelines."
  30. ^ BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF). The BioInitiative Working Group (2007-08-31). Retrieved on 2008-02-09.
  31. ^ Santini, R; Santini, P; Danze, JM; LeRuz, P; Seigne, M (January 2003). "Survey Study of People Living in the Vicinity of Cellular Phone Base Stations". *Electromagnetic Biology and Medicine* **22** (1): 41–49. London: Informa Healthcare. doi:10.1081/JBC-120020353. ISSN 1536-8378. OCLC 88891277. Retrieved on 2008-02-09.
  32. ^ Navarro, Enrique A; Segura, J; Portolés, M; Gómez-Perretta de Mateo, Claudio (December 2003). "The Microwave Syndrome: A Preliminary Study in Spain". *Electromagnetic Biology and Medicine* **22** (2): 161–169. London: Informa Healthcare. doi:10.1081/JBC-120024625. ISSN 1536-8378. OCLC 89106315. Retrieved on 2008-02-09.

- Oberfeld, Gerd; Navarro, Enrique A; Portoles, Manuel; Maestu, Ceferino; Gomez-Perretta, Claudio (2004). "The Microwave Syndrome: Further Aspects of a Spanish Study", in Kostarakis, P: *Biological effects of EMFs : Proceedings, Kos, Greece, 4-8 October 2004, 3rd International Workshop*. Ioannina, Greece: Electronics, Telecom & Applications Laboratory, Physics Dept., University of Ioannina : Institute of Informatics & Telecommunications, N.C.S.R. "Demokritos". ISBN 9602331526.
33. ^ Abdel-Rassoul, G; Abou El-Fateh, O; Abou Salem, M; Michael, A; Farahat, F; El-Batanouny, M; Salem, E (March 2007). "Neurobehavioral effects among inhabitants around mobile phone base stations" (PDF). *NeuroToxicology* **28** (2): 434–40. New York, NY: Elsevier Science. doi:10.1016/j.neuro.2006.07.012. ISSN 0161-813X. PMID 16962663. OCLC 138574974. Retrieved on 2008-02-10.
  34. ^ Bortkiewicz, A; Zmyslony, M; Szyjkowska, A; Gadzicka, E (2004). "Subjective symptoms reported by people living in the vicinity of cellular phone base stations: review" (in Polish). *Medycyna pracy* **55** (4): 345–352. Warsaw: Panstwowy Zaklad Wydawnictw Lekarskich. ISSN 0465-5893. PMID 15620045. OCLC 108011911. BL Shelfmark: 5536.020000. Retrieved on 2008-02-10.
  35. ^ Hutter, H-P; H Moshhammer, P Wallner, M Kundi (May 1, 2006). "Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations" (in English). *Occupational and Environmental Medicine* **63** (5): 307–313. London, UK: the BMJ Publishing Group. doi:10.1136/oem.2005.020784. ISSN 1351-0711. PMID 16621850. OCLC 41236398. Retrieved on 2008-01-07.
  36. ^ Eltiti, S; Wallace, D; Ridgewell, A; Zougkou, K; Russo, R; Sepulveda, F; Mirshekar-Syahkal, D; Rasor, P; Deeble, R; Fox, E (November 2007). "Does short-term exposure to mobile phone base station signals increase symptoms in individuals who report sensitivity to electromagnetic fields? A double-blind randomized provocation study". *Environ Health Perspectives* **115** (11): 1603–1608. doi:10.1289/ehp.10286. ISSN 0091-6765. PMID 18007992. OCLC 183843559. Retrieved on 2008-02-10. Lay summary – *Study finds health symptoms aren't linked to mast emissions University of Essex* (2007-07-25).
  37. ^ Randerson, James. "Research fails to detect short-term harm from mobile phone masts", *The Guardian*, Guardian Media Group, 2007-07-26. Retrieved on 2008-02-11. "Prof Fox estimates that there is a 30% chance that the experiment missed a real effect because of the smaller numbers."
  38. ^ "Phone mast allergy 'in the mind'", BBC, 2007-07-25. Retrieved on 2008-02-11.
  39. ^ [http://www.sante.gouv.fr/htm/dossiers/telephon\\_mobil/zmirou/chap\\_ii.pdf](http://www.sante.gouv.fr/htm/dossiers/telephon_mobil/zmirou/chap_ii.pdf) page 37
  40. ^ Moulder, JE; Erdreich, LS; Malyapa, RS; Merritt, J; Pickard, WF; Vijayalaxmi (May 1999). "Cell phones and cancer: what is the evidence for a connection?". *Radiation Research* **151** (5): 513–531. New York: Academic Press. ISSN 0033-7587. PMID 10319725. OCLC 119963820. Retrieved on 2008-02-10.
  41. ^ International Commission for Non-Ionizing Radiation Protection home page. Retrieved on 2008-01-07.
  42. ^ Wright v. Motorola, Inc. et al., No95-L-04929
  43. ^ Christopher Newman, et al. v Motorola, Inc., et al., [1] . "Because no sufficiently reliable and relevant scientific evidence in support of either general or specific causation has been proffered by the plaintiffs, as explained below, the defendants' motion will be granted and the plaintiffs' motion will be denied."
  44. ^ Electromagnetic Fields and Public Health - Cautionary Policies. *World Health Organization Backgrounder*. World Health Organization (March 2000). Retrieved on 2008-02-01.

## External links

### Independent Organisations

- WHO International EMF Program
- International Commission on Non-Ionizing Radiation Protection (ICNIRP)
- Independent Expert Group on Mobile Phones (IEGMP), UK
- The International Commission for Electromagnetic Safety (ICEMS)

### Government

- FDA Cell Phone Facts
- FCC Radio Frequency Safety
- Medline Plus, by US National Library of Medicine and National Institutes of Health (NIH)

## Industry

- MMF Mobile Manufacturers Forum

## Web news aggregators

- A Biomedical Science and Engineering Clearinghouse on Electric and Magnetic Fields. EMF-Link.
- Council on Wireless Technology Impacts (CWTI)
- Microwave News Reporting on electromagnetic fields and radiation since 1981.
- EMF Portal International EMF Information Source and Database of Scientific Literature on Bioelectromagnetic Interaction, Aachen University Hospital, Germany.
- Research Association for Radio Applications (FGF) German non-profit organization, that funds scientific research on potential environmental effects of electromagnetic fields. Broad offer of information.

### Mobile Phones

**General:** History | Development | Features | Network operators |  
**Radiation & health** | Standard comparison | Frequencies | SIM | WAP  
 | XHTML-MP  
 Cellular Devices

**Culture:** Blogging | Dating | Driving safety | Gambling | Gaming |  
 Learning | Ringxiety

**Other:** Smartphones | Electronic waste

Retrieved from "[http://en.wikipedia.org/wiki/Mobile\\_phone\\_radiation\\_and\\_health](http://en.wikipedia.org/wiki/Mobile_phone_radiation_and_health)"

Categories: Mobile phones | Public health | Radiobiology

Hidden categories: All articles with unsourced statements | Articles with unsourced statements since January 2008 | Articles with unsourced statements since June 2007 | Articles with unsourced statements since February 2007 | Articles with unsourced statements since December 2007

---

- This page was last modified on 5 April 2008, at 15:46.
- All text is available under the terms of the GNU Free Documentation License. (See **Copyrights** for details.)  
 Wikipedia® is a registered trademark of the Wikimedia Foundation, Inc., a U.S. registered 501(c)(3) tax-deductible nonprofit charity.