

# **Health Risks of Cell Phones**

# The Health Risks of Cell Phones

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**The rapid development of higher and higher intensities of man made, constantly oscillating Electromagnetic fields from new technologies is expected to continue and even accelerate, as we adopt an increasing number of systems and devices emitting such fields.**

Use of wireless communication devices, such as cellular telephones, is increasing dramatically. Presently **more than 350 million cellular phones** are in use worldwide. For years, annual growth rates in number of subscribers have been 30 to 50 %. No wonder, as these devices provide immeasurable benefits to mankind. Widespread use of cell phones and other types of handheld wireless communication devices has led to increased concerns about the long term health effects, notably cancer of the brain, degenerative conditions and brain function. With this new technology, large numbers of humans for the first time in history are applying a strong microwave radiation emitter right next to their brains. This concern prompted regulatory action and gave rise to intensive scientific research aimed at determining if there are health hazards associated with the use of cellular telephones.

Radiation in the form of electricity is present at every level of life, and it is virtually impossible, especially for city dwellers, to escape exposure to its effects. Thousands of common devices that are used daily generate electromagnetic fields. Our lives depend on electricity but it is also a silent and invisible pollutant. This pollution originates from power generators and substations, microwave and radio transmitters, satellite relay stations, power lines, building wiring, electrical outlets, fluorescent lights, electrical appliances, office machines, video terminals and cellular telephones to mention a few. All living things are closely tied to the frequencies of our natural electromagnetic

environment (7-9Hz) and frequencies from 60 Hz (electrical appliances) to higher frequencies in the megahertz range (cell phones) can produce serious alterations in basic life functions.

Electromagnetic fields have been found to have some measurable and potentially dangerous biological effects, *bio-effects*, on animal and human tissues and cells and may also present a danger to human health. The degree of a person's exposure varies by type of source as well as distance and duration. The negative influence of the fields can drop off as you move away from their source, diminishing according to the source itself. For example, fields from appliances disappear dramatically in a matter of a few feet, whereas a field caused by transmission lines may go on for hundreds of feet. The new ultra high voltage power lines have enough electricity in the air 200 feet away from the wires to light a fluorescent bulb carried in the hand of a person in the vicinity of the high voltage source!

## Facts about cell phones

While mobile phones provide time-strapped society with unprecedented opportunities for keeping in touch, they do so at a cost. There is a great and accumulating body of evidence that mobile phones are dangerous to human health.

When you talk on your mobile phone, your voice is transmitted from the antenna as radio frequency radiation (RFR) between 800 MHz and 1,990MHz – a range equal to the middle of microwave frequency. Exposure to this microwave RFR may have serious health consequences. Every cell phone model sold in the United States has a specific measurement of how much microwave energy from the phone can penetrate the brain. Depending on how close the cell phone antenna is to the head, **between 20% and 80% of the radiation emitted by a mobile phone is deposited in the user's head.** The microwave radiation is absorbed by and actually penetrates the area around the head, some reaching an inch, to an inch and a half, into the brain.

Exposure conditions for mobile phones are unique insofar as there is no other radiation-emitting device in the world, which you would press against the side of your head for long periods of time. Studies have shown that if the cell phone signal is held next to the brain there are changes in the brainwaves in 70% of people. This testing was done at a level of about 2 microwatts per sq. cm., which is only a fraction of the actual exposure experienced from the cell phone.

## Public Concern

Users around the world are definitely worried. There have been hundreds of articles in newspapers and magazines worldwide exposing the dangers of cell phone radiation. In a poll conducted in the UK by Mori (May 1999), it was reported that **40 % of regular mobile phone users are afraid of potential health problems** on the background of the scientific reports.

## Electromagnetic Radiation

To completely understand the fear and the controversy surrounding the use of cellular telephones, it is necessary to briefly describe what constitutes electromagnetic radiation and how it may cause harmful effects.

Electromagnetic fields are invisible electrical and magnetic forces that radiate from anything operating on an electrical current. Any time an electric current runs through a wire or an appliance, it produces an electromagnetic field (EMF). Electromagnetic fields are found wherever there's electricity and around any object that has an electric charge. Normally, electric fields and magnetic fields occur together, hence, "electromagnetic fields."

**Electric fields** arise from the strength of an electrical charge (i.e., 110 volts with a frequency of 60 hertz) and can radiate throughout a room at varying levels.

**Magnetic fields** arise from the charges of motion in an electrical field and they fluctuate with that current. They are produced wherever electricity is in use. The stronger the current is, the stronger the magnetic field. And just as the current varies according to the power usage, so do the magnitudes of the magnetic fields created by the current.

## Radiation

**Nonionizing radiation** falls into two categories: radio frequency (RF) radiation - with microwaves at the high end of this spectrum - and extremely low (ELF) radiation; 60 Hz power line electromagnetic fields occur at this end of the electromagnetic spectrum.

RF radiation is emitted by broadcast transmissions, radar, satellites, CB radios, RF sealers, electrical security systems, telephone relays, cell phones, sonar, VDTs (video display terminals) and, sometimes, microwave ovens. Most recently, questions concerning the effects of exposure to **electromagnetic radio frequency radiation (RF), specifically from cellular telephones**, have been raised.

RF radiation is a non-ionizing form of radiation, which in sufficient intensity can cause molecules in matter to vibrate, and has enough energy to agitate atoms without destroying them. These vibrations cause friction, which in turn causes heating which is the basis for microwave ovens. Many scientists attribute this same effect to the heating of body tissue caused by cell phones. Microwave radiation is known to be dangerous, because of its thermal effects—it can heat or cook tissue. But also because of its non-thermal effects, certain biological changes can occur without the heating of body tissue.

## Health Effects

Scientific research has found that man-made EMFs induce significant changes in the function of cells, tissues and organs. The changes observed are similar to biological processes, which scientists believe are involved in the development of adverse health conditions such as impaired brain function, cancer and Alzheimer's.

Nobody knows with certainty what long-term health consequences EMF-induced biological effects may lead to. The issue is still highly controversial. Because there is so much evidence of such interactions, there is justified reason for concern.

Research has shown that electromagnetic emissions from cell phones can cause significant biological effects.

### **Cell phones emit two types of EMF:**

From the antenna they emit microwaves and from the circuitry (body) of the phone and the battery they emit ELF fields. Carrying a mobile next to the body has health risks as the phones emit radiation even when not in use.

Many cell phone users place their handsets in their belts when they use their ear piece, thereby exposing large deposits of blood cells in the hip bone marrow or their genitals to the radiation. Furthermore, even at a distance, the radiation from a mobile phone antenna may induce significant biological effects.

Hands free device with an earpiece are also not safe. Research has shown that the earpiece acts as an antenna, conducting radiation into the head itself

Laboratory studies have shown that there are actually three factors contributing to the ability of cell phone emissions to induce potentially adverse biological effects:

- 1. Continuous wave (CW) microwaves** have been shown to have the ability to induce biological effects
- 2. ELF-modulated microwaves** have been shown to induce biological effects even more effectively than CW microwaves.
- 3. ELF fields** have been shown to induce biological effects.

Studies have shown that the radiation cell phones expose the user to has been associated with a wide range of health problems including headaches, pressure or tingling in the head, earaches, eye problems including distortion of vision, memory loss, fatigue, brain tumors, DNA alteration or damage, lymphoma in rats and changes in the brains electrical activity.

## **Research Studies**

According to the **Swedish study from the National Institute on Working Life on 11,000 cell phone users** in Sweden and Norway, cell phone users complain of a variety of symptoms from their use of cell phones. According to the scientists, the problems start at just 2 minutes or more on the cell phone per day. Symptoms such

as fatigue, headaches, burning sensations on the skin were more common among those who make longer phone calls.

In June 1998, The British Medical Journal *The Lancet* reported that radiation from mobiles causes an increase of blood pressure. **Dr Braune** and colleagues in Freiburg, Germany, attached mobiles to the right side of the heads of ten volunteers. The phones were switched on and off by remote control without the volunteers knowing. Their blood pressure rose each time by between 5-10mm Hg, probably from a constrictive effect on blood vessels. This level of increase would be more than enough to trigger a stroke or heart attack in someone at severe risk. This was the first firm evidence that mobile phone radiation could directly alter cell function in the human body.

In a study not yet published (by May 1999), scientists at Stanford University and Integrated Laboratory Systems (ILS) in Research Triangle Park, North Carolina, have found that. This was disclosed to the magazine *Microwave News* (March/April 1999) by Dr. George Carlo, chairman of Wireless Technology Research (WTR), founded and sponsored by the cellular phone industry. Dr. Carlo told *Microwave News* WTR has found links between cellular phone use and cancer.

Dr. Ray Tice of ILS, and Drs. Graham Hook and Don McRee of WTR, presented the results at **The 30th Annual Meeting of the Environmental Mutagen Society (EMS)** in Washington on March 29, 1999. The results showed an effect with all four cellular phone technologies tested analogue, CDMA, TDMA and PCS. The findings were all statistically significant, all but one of them highly so.

**The UK's National Radiological Protection Board** confirms significant absorption of microwave energy in the eyes and their sockets, brain, nose, tongue and surrounding muscles. A senior adviser to the NRPB has been reported in the British press as saying "*It is not unreasonable to suggest this might cause some damage.*" The worry is that these overt symptoms may be the precursor to more serious problems and that not all users are getting these early warning signals.

Research funded by the **New York Heart Research Foundation** as early as 1992, showed that microwave radiation caused chemical

changes in the brain similar to those present in cancerous and precancerous situations, which were still measurable more than 7 days after just one 3 minute phone call.

A study, carried out at **Bristol Royal Infirmary** in western England and sponsored by the Department of Health, offers the first objective evidence that the portable telephones may alter memory and interfere with concentration and spatial awareness. The movement of the ions into and out of cells is a vital part of brain function, and the experiment was seen as powerful evidence of how cell telephones might temporarily scramble the thoughts of their users. In the Bristol experiments, researchers fastened a transmitter that emitted microwaves identical to those produced by most mobile telephones to volunteers' heads for half an hour at a time. The volunteers were asked to perform psychological tests to measure their memory, spatial awareness, reaction time and vigilance. **Dr. Alan Preece**, who led the study, found a clear effect on participants' responses. He says his research had already persuaded him to change his own telephone for a model with lower emissions. Preece and others are investigating whether the changes are caused by the radiation heating brain tissue in the way that microwave ovens cook food. Telephones emit less power but warm up tissue when close to the head.

**The National Cancer Institute in the U.S.** did a study of people in industries that exposed their workers to microwaves. They found that in seven industries in the Eastern U.S. there has been a tenfold increase in brain tumors among employees who have worked there for twenty years. The main cause appears to be electromagnetic radiation.

**Dr. Lennart Hardell** examined brain tumor sufferers in a case controlled study and found a connection between cell phone use and cancer. Subjects using a cell phone on the right or left hand side of the head increased the risk of getting a tumor by two-and-one-half times. The research was published in the **International Journal of Oncology** (15:113-116,1999)

In 1997, **Bioelectromagnetics** published a report by **Dr. Miguel Penafiel** who found that TDMA digital cellular phone microwaves produced a significant 40 % increase in the activity of the cancer-related enzyme ODC. Continuous wave microwaves showed a less marked effect, and analogue frequency modulated phone emissions showed no significant effect.

Studies have shown that cell phones can have serious health effects on children. According to **Professor Om Ghandi, head of electrical engineering at the University of Utah**, 10-year olds absorbed 10% more radiation and five-year olds 50% more radiation than adults when using cellular phones. Scientists found the thin skulls and smaller heads of children offer less protection against microwaves and therefore my have a greater risk of damage to brain cells.

In 1997, a 28-member scientific advisory panel was assembled by **NIEHS to review publications of EMF research**. On July 24, 1998, after a one-year review of about 2,000 scientific studies, the conclusion of the NIEHS scientific advisory panel was:” *extremely low frequency EMFs should be regarded as possible carcinogens*”. The vote was 19 for and 9 against the above statement.

In October 1998, at a **scientific conference at the University of Vienna** on biological and health effects of EMF exposure from cellular phones, the following resolution was adopted: *“The participants agreed that biological effects from low-intensity exposures are scientifically established”*.

Cellular Industry sponsored research was quietly released in Australia in 1997 showed that transgenic mice exposed to pulsed digital phone radiation over 18 months had an almost **two-and-a-half times higher risk** of developing lymphatic cancer than unexposed mice. The results had been held back from publication for two years, whilst it appeared the industry arranged for the downplaying of their significance.

In research at **Washington University by Dr. Henry Lai**, rats' brains were exposed to a microwave signal (similar to what a cell phone produces). The rats had difficulty learning a maze after 45 minutes of exposure. The research showed breaks in the DNA associated with increased free radicals and increased cell deaths as well as changes in the permeability of brain cell membranes to potassium ions.

The researchers concluded that exposure to low-level RF radiation decreases certain chemical agents in the rodents' central nervous system which are essential for spatial learning.

## Action Around the World

Many countries have instituted a variety of studies to investigate these dangers and enact legislation to protect the population.

Both the **European Commission** and the **World Health Organization** have now announced 5-year research programs, which will explore further the link with brain tumors and cancer.

The **UK's Department of Health** has also just begun research into memory loss.

**British biologist and author, Roger Coghill** has also been given permission to bring a case against a provider of mobile phone equipment for failing to warn people of radiation hazards.

**EMF researcher Dr. William Ross Adey** testified before the Senate subcommittee and warned of a brain cancer epidemic from cell phone use. He recommended using cell phone only in an emergency.

In the **U.S.** there are now over 300 moratoriums in place in connection with permitting and construction wireless communication facilities, or cell towers.

**Chester County, Pennsylvania, 1999** – Pennsylvania Supreme Court sided with municipalities that refused to let Cellular One put up 12 antennas or towers for its cellular phones on the roof of the Newtown Towers apartments on West Chester Pike.

**United Kingdom, 1999** - where as many as 350,000 school children use cell phones, many are now getting lessons in the classroom on how to use their mobile phones safely. Some schools have actually denied students under the age of 16 from carrying cellular phones.

**United Kingdom, 1999** - Britain's largest police force is advising its staff to restrict calls on mobile phones to five minutes in the wake of new health fears.

**Ontario-Toronto, 1999** - The board of health endorsed a policy recommendation presented by Dr. Sheela Basrur, the Medical Officer of Health to establish protocol for future cellular tower sightings that would include public consultation. Additionally, within city limits, an output

equivalent to one hundredth of the current federal standard is imposed.

**Australia, 1999** – The Electromagnetic Radiation Alliance Australia (EMRAA) called for a ban on the advertising of mobile phones for children just before Christmas, citing a *“great deal of scientific evidence that the radiation from mobile phones is dangerous to health and children are especially vulnerable.”* said EMRAA spokesperson, Lyn McLean.

## Conclusions

Representatives of the cellular phone industry and industry associations are still claiming that their products are safe or research indicates no health risk. Claims like these are misleading the general public.

The only statement that can be made is the opposite. **There is no scientific evidence showing that cell phones carry *no* health risk.** Even though there is not yet scientific consensus as to the long-term health consequences of EMF exposures, the body of evidence presented by scientific studies should spur substantial concern, and many scientists aware of this research state that they are cutting conversations short on their cellular phones and advice other users to do likewise.

Continued safety assurances from the Government and the Cellular Industry are beginning to sound more and more like those heard about smoking, asbestos, thalidomide, Gulf war syndrome and BSE (Mad Cow Disease), to mention a few. Typically, medical research always lags behind technological advances and changes to safety standards in turn lag behind research. On this particular issue however, there is now sufficient evidence to suggest at least a recommended adoption of prudent avoidance measures.

## Available Options

With the present scientific knowledge in mind, it is obvious that something must be done to protect consumers against potential hazards associated with the EMF emissions.

The options available to consumers who are concerned about being guinea pigs in the large-scale experiment set up by the electrical, electronics and telecommunications industries are limited and impractical.

Prudent avoidance of the near field of systems and appliances emitting strong EMFs such as cellular phones and base stations, computers, hair dryers, power line systems, transformer stations, TV transmission towers, photocopying machines, food processors, microwave ovens, sewing machines, electric motors, etc. This is often not practical, and consumers may not be knowledgeable about the proximity of transformer stations, underground power lines, cell phone towers, etc. In many occupations it is not possible to cut down the use of devices like cellular phones and computers. Besides, as research has shown, nobody knows what safe levels of EMF exposures are.

### **Shielding Devices**

Shielding devices for blocking cell phone radiation are only partially effective. They only remove some of the microwave radiation and can hamper the operation of the phone. Many scientists believe that most shielding products, particularly those that cover the antenna, create an even greater health risk by causing the phone to increase its output power. When this occurs, the radiation also increases.

Shields may interfere with proper operation of the phone by shielding the connection between the phone and the base station. This may hamper the operation of the phone and cause the phone to increase its radiation output to compensate for the impaired connection, and it may decrease the range of the phone. Furthermore, even though the shields under ideal circumstances may reduce head exposures by more than 50 %, phone radiation may still be substantially higher than the threshold above which biological effects occur.

Absorbent shielding materials can become saturated, their composition weakens over time and they deteriorate. This principle applies to every type of absorption material, including shielding devices that claim to absorb radiation. As they absorb the cell phone radiation they become saturated, the head then absorbs the radiation and the cell phone raises its RF Output Power.

There are shielding devices that have been independently tested with conflicting results. One such device the manufacturers claim 90% protection, an independent source arrives at 44% protection. There are numerous shielding tests with conflicting results. They may appear clumsy and unattractive as well, often too large for small cell phones.

Effective protection must handle both the microwave radiation from the antenna that can be so damaging to the head as well as the ELF radiation from the phone circuitry that can weaken the user's body.

