



Mobile Phone Use: it's time to take precautions

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It is usually through the newspapers that we first find out about new scientific research, and we tend to uncritically accept what is written as factual. Behind the scene however, the articles are usually written by harried reporters under tight deadlines. They simply don't have the time, or often the inclination, to verify the accuracy of the press releases that arrive at their desks. All too often they just reprint, with some 'creative input', the words they received. And all too often these words are about research funded and controlled by industry.

So even when the science is clean and factual, it can be progressively spun and refocused - both deliberately and unconsciously - to produce a change of emphasis, without any identifiable distortion of the real scientific conclusions.

A Case in Point: The Danish mobile phone study

This study, titled, "Cellular Telephones and Cancer - a Nationwide Cohort Study in Denmark" by C. Johansen, et al., was recently published in the *Journal of the National Cancer Institute* in February 2001.¹ The *Australian* newspaper, on February 7th reported this study under the heading, "Mobiles Get Clean Bill Of Health", - which seems to be par for the course around the world.

The *Australian* report says:

"Mobiles phones are safe to use after all. Despite the scares, a survey of 420,000 Danish mobile users found no evidence that the devices increase cancer risk. It's the biggest and most comprehensive study yet, and according to the American Physical Society, [Robert L. Park, see below] its 'rock-solid database make it difficult to take issue with the report's conclusion'. The study, published in today's *Journal of the National Cancer Institute*, says mobile users are no more likely than anyone else to suffer brain or nervous system cancers, leukemia or salivary gland tumours."

Another media release reported that: "Mobile phones, even when used regularly for as long as 18 years, don't increase the risk of developing brain cancer... The study was of 420,000 Danes who used cell phones for between four and 18 years."

Within days of the Journal publication, this industry-funded study was being promoted around the world as the final proof that mobile phones were safe to use, with little attention being paid to the source of the funding, or the actual words in the study conclusions. In Denmark, home country of the study, one major newspaper headline read "Go and use your mobile phone - nothing to worry about now".

However, despite these repeated assurances of the study's "rock-solid database" and claims of finality on the cell phone-health question, the opposite is true. While the study included over 420,000 subjects, drawn from all Danish mobile phone users from 1982 to 1995, only several thousand had used mobiles for more than 10 years. In fact the majority of those studied had only used them for about 3 years. The report also questions the reliability of its own measurements of mobile phone use, and the authors themselves caution that "our study may currently have too few heavy users to exclude with confidence a carcinogenic effect on brain tissue following intensive, prolonged use of cellular telephones."

So how does a study with such inconclusive outcomes, hedged by

doubts about the reliability of short term use with long-term incubation period diseases, come to be promoted around the world as final proofs of cellphone safety?

Cancers don't arise overnight, and the prevailing scientific opinion is that it may take at least 10 years of mobile phone exposure before epidemiologists are able to detect any significant increase in related cancers - if such a causal connection exists. Adult brain tumours typically have latencies of more than 10 years. So when the majority of users have only had their phones for three years, it is obvious that this would tend to dilute statistical significance in the study almost to a point of absurdity.

Two recent American epidemiological studies, also looking at short-term use of mobile phones, found no evidence of an increased risk of brain cancer. The National Cancer Institute (NCI) study, led by Drs. Peter Inskip, Martha Linet and Robert Tarone, found average mobile phone usage of under 3 years had no significant increase in brain cancer and concluded that "these data do not support the hypothesis that the recent use of hand-held cellular telephones causes brain tumors, but they are not sufficient to evaluate the risks among long-term, heavy users and for potentially long induction periods." This would certainly be the case, considering that only 35 of the NCI's 782 brain tumour cases had an average phone use over 15 minutes per day and only 52 had used a mobile phone for more than 3 years.²

The American Health Foundation (AHF) study, led by Joshua Muscat, looked at an average duration of use of 2.8 years for brain tumour cases. Mr. Muscat concluded that "The data showed no correlation between the use of cellphones and the development of brain cancer." However, out of a total of 469 brain tumour cases in the AHF study only 13 had used their phones for more than 20 minutes daily and only 17 had used a mobile phone for 4 years or more.³

Commenting on the NCI and AHF studies in the *Melbourne Age* newspaper on December 22, Dr. David Samuels from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) said that, "Ionizing radiation, such as X-rays, which are a known carcinogen and which cause a number of cancers, can take up to 20 years" to have an effect. "Therefore these studies haven't been going on long enough."

How the experts can get it all wrong

In an editorial discussion which accompanied reporting of the Danish study in the *Journal of the national Cancer Institute*, Dr. Robert L. Park wrongly claims that the famous 1997 NCI Linet study on childhood cancer and residential EMFs as: "...was done on such a scale and with such attention to potential sources of error that it left little room for challenge."⁴

The fact is that the Linet study has been constantly challenged ever since by many of the top world experts in this field. Parks also accepts without question the Linet study claim "that any link between the occurrence of acute lymphoblastic childhood leukemia and exposure to EMFs is too weak to detect or to be concerned about."

Yet dozens of other studies of the same kind have found such linkages and an international team of leading epidemiologists has found that a pooled analysis of data from nine different EMF studies found that children exposed to 4 mG or more were twice as likely to develop leukemia.⁵

In fact, the Linet study only came to that conclusion by excluding children with EMF exposures over 2 mG. And below this level of exposure it is widely accepted from previous epidemiological studies that EMF does not have a statistically significant association with childhood leukemia.

Subsequent re-analysis of the Linet data quite clearly shows that, if a 3 mG cut off level had been used instead of 2 mG, the conclusion would have been just the opposite.⁶ In fact, this study is now widely used by both sides of the debate, because when these higher exposure levels are included rather than treated as anomalies, the statistics show there is a significant risk. (For an analysis of the NCI Linet study see the article "Powerline Frequency Electromagnetic Fields and Human Health - Is it time to end further research?", *ACNEM Journal*, Vol 17 No1, June 1998)

Although the Danish study has only recently been published, it is already under fire. The day after its release, a panel of scientists in Denmark debated the findings and questioned the validity of drawing conclusions of safety.

In summing up, the panel chairman Professor Albert Gjedde, a respected brain specialist, said the study was inconclusive and recommended that a proper study be undertaken, using better protocols. Professor Gjedde remarked that the group in the Danish study was not compared with a control group of people who had brain tumours. Michael Repacholi, head of the WHO's EMF research project also noted this and commented that as it was not done according to the rules put down by the WHO, the study was therefore inconclusive.

Professor Gjedde expressed concern that children could be more vulnerable, because their brain cells are still growing, and therefore EMF had the potential to lead to more serious brain damage than in adults. He advised extreme caution in accepting assurances of safety, and suggested Denmark should reduce children's exposure to mobile phone emissions to a minimum. He concluded that the question of other bioeffects unrelated to cancer also need further investigation; looking at possibilities that microwave fields from mobile phones could interfere with the brain's own electric fields, and in the long run, damage brain function.

Possible microwave effects other than cancer: a brief history of Soviet vs. Western radio frequency & microwave (RF/MW) research

While most of the current research with mobile phone use examines the possibility of brain cancer, a far different picture is seen in the former Soviet Union medical literature, where a condition of "Microwave sickness" has long been accepted by many scientists.

During the second world war, concerns began to be raised in the USSR that military personnel may be subject to health hazards from working with radar. In the cold Siberian winters, servicemen soon found that standing in front of the radar antenna was a great way to keep warm but rumours began to circulate that it also caused sterility.

In the 1940s various American military and government agencies also began investigating the possibilities of RF/MW-induced health hazards. While they claimed to have found no evidence of hazards they did recommend that radar and radio operators should avoid prolonged exposure as a precautionary measure.

In the late 1940s and early 1950s several new studies came to light that raised the possibility of health hazards involved with the use of microwaves. In 1948 two USA studies reported a possible link with cataract development and testicular degeneration in dogs. These studies were mostly ignored, largely because the companies that had developed microwave technology for the military began to see consumer commercial possibilities. This was the time when wide commercial

use of microwaves saw the development of diathermy equipment, civilian radar and later microwave ovens - all of which were seen as the wonders of that age.

In the techno-euphoria that followed the war, there was little interest in funding research which could put a damper on expanding business opportunities. Then the Cold War began and military uses of radar and other new equipment were seen as paramount to the national interest. So any related human-health research became even more hidden and clothed in secrecy.

However in 1953 a study of workers at Hughes Aircraft Corporation found excessive amounts of internal bleeding, leukemia, cataracts, headaches, brain tumours, heart conditions and jaundice in those employees working with radar.⁷ As a result, the USA military was forced to initiate the first 'open and public' investigation into the biological effects of microwaves. The aim was to establish "tolerance levels" for both single and repeated exposures, because it was generally accepted that standard thresholds of tolerance exposure must exist. Since little research data of this kind existed at that time, it was decided that the known ability of microwaves to heat up tissue (its 'thermal effects') would be the main criteria, and with a safety margin applied, this has been the foundation of all so-called Western safety standards since.

The decision to choose tissue heating as the key exposure parameter was based more on a lack of scientific data than for positive reasons; however it quickly gained favour with both the military and industry as it created something that could be claimed as a safety standard, and avoided (without openly dismissing) the possibility that low-level, non thermal health effects could exist without tissue heating.

The 'thermal school of thought' quickly became the accepted norm with Western standard-setting organisations and as a result the vast majority of 'science based' research was directed at short term, high level exposures. Research into prolonged environmental level exposures that did not cause tissue heating was not encouraged, simply because it was perceived as a possible threat for technological development.

This situation was well described by Dr. Rochelle Medici, a researcher on animal behaviour, who said, "It is as though scientists had retreated from doing challenging, frontier studies because such work engendered too much controversy or elicited too much criticism. We are left with 'safe' but meaningless experiments. The results of such experiments are a foregone conclusion".

In the USSR, however, a vastly different political and economic system resulted, paradoxically, in giving their scientists far more democratic and academic freedom (and funding) than their Western counterparts in choosing the focus of their research efforts. Private corporations did not exist and the Soviet military was exempt from having to comply with exposure standards. They could happily design and deploy their equipment without fear of conflict with regulations, or research findings. The result was the lowest EMF standard worldwide, designed to provide protection against prolonged, low level (non-thermal) exposures.

While microwave thermal effects are accepted by both Western and Soviet scientists, it was only the Russians who expanded their own research to include extensive studies with human workers who were exposed to non-thermal electromagnetic fields. This research, gathered from actual human exposure experience, led to the recognition of a condition called "Microwave Sickness", characterised by the following symptoms: increased agitation (emotional upheavals) in combination with nervous exhaustion, fatigue, muscle weakness, reduced intellectual activity, absent-mindedness / inability to concentrate, increased sensitivity to external factors such as noise, bright light, disturbed dreaming / sleeplessness, headaches, attacks of giddiness / dizziness, unstable gait, cold hands and legs, heart problems such as palpitations, fast or slow heart beat, breathing problems, overactive thyroid and irregularities in the menstrual cycle.⁸

The relevance of 'Microwave Sickness' to mobile phone use is that, when a phone is being used with the antenna near the head, the microwave exposure to brain tissue can be in the range of the exposures reported to cause microwave sickness. In addition, various mobile phone surveys in several countries have found that users report similar symptoms which they link to their use of the mobile phone. They complain of frequent headaches, fatigue, burning sensations, dizziness, concentration difficulties and memory loss.

Not everyone experiences these symptoms of course, but some people appear to be much more sensitive than others. Such biological (rather than psychological) differences have been widely reported in research in such areas as microwave hearing, where some people are certainly able to detect the direct effects of high-frequency radio waves on the nerves of their inner ears.

A public Health Issue?

The past few decades have been a time of unprecedented technological development which is increasingly altering the way we live, work and communicate, with the widespread use of the mobile phone the most visible symbol of this technological revolution. We currently have over 4 million users in Australia. In America, about 30% of the population own a mobile phone, while the Nordic countries are world leaders with 40% of Danes, 50% of Norwegians and Swedes, and almost 60% of Finns using them. In Britain nearly half of all British children aged 7 to 16 now have a mobile phone. Nokia has estimated that by the end of year 2000 there were more than 700 million users of mobile phones around the world.

At the same time, this technology is now giving rise to important questions about the possible long term health consequences of mobile phone use. Because of the many millions now using them, even if only a small percentage of users are adversely affected, that would still equate to a significant public health issue due to the potential number of victims.

Are mobiles proven to be "safe"?

Back in 1995, an Optus brochure titled: "Health effects of Mobile Phones" said that:

"After more than 6000 scientific studies the world over, there is still no convincing evidence of any adverse health effects caused by electromagnetic fields from mobile phones... the international body of scientific research concludes there is no link between mobile phones and adverse health effects."

This viewpoint has not changed much since. For instance, in a letter to the *Australian* newspaper on February 6, 2001, Keith Anderson from the Australian Mobile Telephone Association assured readers that mobile phones were safe because they are designed, built and tested to meet "science-based safety standards" and that phones with this "accreditation are safe".

However, what is not said by the industry is that their often quoted 'international body of scientific research' and 'science-based safety standards' are irrelevant to mobile phone use. They almost exclusively refer to research into biological effects from short term (acute) exposure to high level RF/MW exposure - yet most of the disease conditions which are believed to be relevant to RF/MW exposure are those with long low-level incubation periods - and are multi-causal (cancer, Alzheimers, immune system compromises).

A fact admitted by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). To quote:

"Most of the established biological effects of exposure to RF fields are consistent with responses to induced heating... Most

studies examined endpoints other than cancer, many examined physiological and thermo-regulatory responses, effects on behaviour and on the induction of lens opacities (cataracts) and adverse reproductive outcome following acute exposure to relatively high levels of RF fields. Very few studies are relevant to the evaluation of RF exposure on the development of cancer in humans."

What is obvious from the ICNIRP statement is that the research needed to give an assurance of safety for mobile phone use has not yet been done. It is unscientific and profoundly irresponsible for the industry to refer to unrelated research and attempt to use them as proof of safety for mobile phone use.

A hot consumer item

Various research indicates that between 20% to 60% of the energy emitted from a mobile phone is absorbed by the user's head. The percentage absorbed depends on the design of the phone, type of aerial or antenna (the stubby ones which you cannot extend are worse because they concentrate energy into the user's brain), and how far it is to the nearest base-station mast, as the weaker the base station signal, the more the phone will power up to maintain contact with the network.

Mobile phone use can actually heat up brain structures. This was admitted in a March 1997 Australian Government Discussion Paper:

"Human exposure to RFR [Radio Frequency Radiation] is greatest from mobile phone handsets because of the method of use, with the transmitting antenna of the mobile phone handset close to the head. There is evidence that localized hot spots of energy deposition in the brain may occur as a consequence of internal reflections."

Besides the antenna, the case of a mobile phone also emits microwaves, due to a lack of proper shielding in the case. Because of this, many mobile phones have detectable emissions out of the base of the phone which 'couples' with the hands-free ear piece wire and delivers microwaves into the ear piece. The extent of this problem very much depends upon the type of phone used.

The WTR and George Carlo

As a result of a widely publicised court case in the early 1990s in America, where it was claimed a fatal brain tumour was caused by extensive mobile phone use, the Cellular Telephone Industry Association (CTIA) set up the Wireless Technology Research (WTR) research program in 1993. This research program was funded to the tune of \$27 million "to identify and solve any problems concerning consumers' health that could arise from the use of these phones".

In February of 1999, George Carlo, head of the WTR's research program, and who had previously maintained the industry line that mobile phones were safe, stunned the industry with a report that he presented to the annual convention of the CTIA. Specifically Dr. Carlo reported to the industry convention that:

1. The rate of death from brain cancer among handheld phone users was higher than the rate of brain cancer death among those who used non-handheld phones that were away from their head;
2. The risk of acoustic neuroma, a benign tumour of the auditory nerve, was 50% higher in people who reported using cell phones for 6 years or more; moreover, that relationship between the amount of cell phone use and this tumour appeared to follow a dose-response curve;

3. The risk of rare neuro epithelial tumours on the outside of the brain was more than doubled, a statistically significant risk increase, in cell phone users as compared to people who did not use mobile phones.

Importantly Dr Carlo stated that “appropriate steps have not been taken to protect consumers during this time of uncertainty about safety” and that industry is “missing a valuable opportunity by dealing with these public health concerns through politics, creating illusions that more research over the next several years would help consumers today and false claims that regulatory compliance means safety”. Dr. Carlo also said that he “was alarmed that parts of the industry have ignored the scientific findings suggesting potential health effects, have repeatedly and falsely claimed that wireless phones are safe for all consumers including children, and have created an illusion of responsible follow-up by calling for and supporting more research”.¹⁰

In his just published book, *Cellphones: Invisible Hazards of the Wireless Age*, Dr. Carlo exposes the tricks and deception that the industry uses globally to confuse the science and distort the evidence. From a litigation point of view this is a gold-mine for the lawyers for, as with the tobacco litigation, they stand to make millions if they can convince juries that a widely-used consumer product is possibly harmful to health. Importantly, a lawyer does not have to establish absolute causality, s/he just needs evidence that the industry has systematically covered up and confused the scientific evidence to make it difficult for the consumer to judge. Taking this line, in January of this year, the American superlawyer Peter Angelos took on the cell phone industry with an \$800 million mobile phone-cancer lawsuit in Maryland. Angelos who became famous for his litigation against the asbestos and tobacco industries has won more than \$1 billion in personal injury law suits.¹¹

Some animal studies indicating adverse effects

The use of specially bred mice and rats for laboratory research has long been the accepted form for evaluating possibly toxic chemical substances for effects on humans. This has also been the main method for attempting to determine any adverse effects from exposure to microwave radiation, similar to that which is emitted by mobile phones.

- A. A team of scientists funded by Telstra, investigating claimed links between cellular phones and cancer, turned up a significant finding of concern. They used 200 lymphoma-prone mice as highly sensitive detectors of possible cancer promotion over their short life-span. Half of them were exposed and half not, to pulsed digital phone radiation. The work was conducted at the Royal Adelaide Hospital and it revealed a highly-significant doubling of cancer rates in the exposed group. The mice were subject to GSM-type pulsed microwaves at a power density roughly equal to a cell-phone transmitting for two thirty minute periods each day.¹²

The industry and governments’ general response to these findings was that they should not be applied to humans - which, if it were true, would condemn billions of dollars of similar rodent research each year to the scrap heap.

- B. Investigating the possible effects of cell phone radiation on long-term memory function, Dr Henry Lai of the University of Washington, conducted a series of experiments on 100 rats in 1999. He filled a large tank with opaque, milky water and gave the rats six swimming trials where they learned to find safety platforms hidden just below water level and therefore out of sight.

He found that the rats exposed to short bursts of low-level microwaves forgot the location of the safety platforms quickly, while the unexposed control rats retained these important spacial memories.

Dr Lai said about the findings: “The long-term memory of virtually all the ‘exposed’ rats appeared to have been affected. . . Short-term memory loss is being unable to remember something which you have just done or glanced at. Long-term memory is something which has been learned or recalled and stored in the brain. The data from this latest study is certainly a cause for concern.”¹³

In an earlier 1994 study on microwave exposure effects on short term memory in rats’ ability to negotiate a maze, Lai and co-workers found a similar effect.¹⁴

- C. Dr. Lai and co-workers also have 4 papers published on DNA damage with microwave exposure. They have observed DNA damage in the brain cells of live rats after only two hours of relatively low-level microwave exposure. The frequencies used by Dr. Lai were above normal cell phones, but close to the new PCN mobile phones widely used by American and European teenagers, and the lowest intensity at which DNA strand breaks were discovered was well within the range of mobile phone exposures.^{15,16,17,18}
- D. Researchers at Lund University, Sweden, carried out experiments in 1999 on a possible effect of mobile phone radiation on the brain’s blood-brain-barrier, a biological filter which isolates the brain and central nervous system from material in the blood supply which could create problems with memory and processing functions. Nervous tissue can’t be replaced if attacked by the body’s immune responses, so toxins and certain substances, such as the protein albumen, need to be prevented from entering the brain tissue, where they could have long-term toxic effects.

The researchers used rats and exposed them to microwaves which mimicked mobile phone emissions. After two minutes’ exposure, the rats’ blood-brain barrier opened up, allowing the protein albumen to enter the brain. Even when the microwaves were not strong enough to heat up the rats’ heads, the scientists detected the effect deep in the centre of their brains.

Professor Leif Salford, the neurologist who carried out the research, said: “We saw opening of the blood-brain barrier even after a short exposure to radiation at the same level as mobile phones. . . We are not sure yet whether this is a harmful effect, but it seems that molecules such as proteins and toxins can pass out of the blood, while the phone is switched on, and enter the brain. . . We need to bear in mind diseases such as MS and Alzheimer’s which are linked to proteins being found in the brain.”

Professor Salford said his team came up with the same findings when they repeated the experiment. “So we think we are on to something very significant,” he said. Proteins are a normal part of the blood, but can cause nerve damage if they manage to get into the brain.¹⁹ Salford has been doing BBB work for decades, and is now discovering these effects at such low RF/MW levels because the sensitivity of his toxic detection system has been progressively improving over the years.

- E. Similar research, conducted by researchers at the University of Munster, Germany, found that microwaves at the frequency of 1.8 GHz significantly increase the permeability of the blood-brain barrier to sucrose in rat brain cells in vitro.²⁰
- F. In a paper titled “Potential for Interaction Between Specific Classes of Prescription Drugs and RF Fields from Hand-Held Portable Telephones”, scientists from Canada’s Radiation Protection Bureau (RPB) cautioned that RF/MW radiation can “increase the permeability of the blood-brain-barrier and modulate the action of some psychoactive drugs”.²¹

A few human exposure studies of concern

- A. Recent research by Lebedeva et al., from the Russian Academy of Sciences, found direct cortex stimulation as a result of mobile phone exposure. In a series of experiments with 24 volunteers, using a cellular phone type exposure, they found evidence of “brain functional changes” that continued after exposure was stopped.²²
- B. Other Russian research, examining the influence of cell phone microwave radiation on the central nervous and cardiovascular systems, as well as temperature changes in the heads of cell phone users, found that ultra high [microwave] frequency radiation induces significant changes in local temperature and in physiologic parameters of central nervous and cardiovascular systems”.²³
- C. In a British government-funded study, Dr. Alan Preece found that Cellular phone radiation produced faster reaction times in tests on 35 volunteers exposed to continuous and pulsed microwaves. Preece believes that microwave effects below thermal levels cannot be ruled out, and notes that “heat shock proteins” can also cause increased blood flow.^{24,25}
- D. A world-renowned sleep laboratory at the University of Zurich has also published a research paper in *NeuroReport* which suggests use of mobile phones just before going to sleep can disturb the normal sleeping EEG patterns. The researchers found that exposing volunteers to digital mobile phone radiation (GSM) for 30 minutes while awake significantly alters their EEG activity after they fall asleep, compared to unexposed controls. In an accompanying commentary in *NeuroReport*, Dr. Michael Petrides notes that: “The currently available literature suggests that some aspects of cognitive function and some direct measures of brain physiology may be affected by exposure to electromagnetic fields of the type emitted by cellular telephones.”²⁶
- E. Dr. Bruce Hocking, at one time the Chief Medical Officer of Australia’s national telecommunications carrier Telstra, has examined 40 mobile phone users who complained of unpleasant sensations, such as a burning feeling or a dull ache mainly occurring in the temporal, occipital or auricular areas. The symptoms often began minutes after beginning a call, but could come on later during the day. Symptoms usually ceased within an hour after the call, but could last until evening. Symptoms did not occur with a normal handset, and were different from ordinary headaches. There were several reports suggestive of intra-cranial effects. Three respondents reported symptoms associated with wearing their mobile phone on their belts. Dr Hocking concluded: “Cranial and other diverse symptoms may arise associated with mobile phone usage. Physicians and users alike should be alert to this.”²⁷
- F. A 20-year study of servicemen (in Poland) has established the strongest link yet between mobile phones and cancer. Research by Polish scientists shows a high cancer death rate among soldiers exposed to microwave radiation - at levels comparable to that emitted by mobile phones when in use. This is believed to be the first significant study which shows a link between humans, microwave radiation and cancer.

The team checked the medical records of servicemen who were exposed to the radiation between 1970 and 1990. It then compared their medical histories and death rates to a group of soldiers who were not exposed. Researchers found those exposed - largely through using military equipment - were more likely to get some cancers. They were also more likely to develop a whole range of cancers 10 years earlier than those who had not been exposed. There were higher death rates from cancers of the skin, brain, blood, digestive system and lymphatic system among the exposed group. The Polish paper concludes: “To our knowledge, the data for the first time presents a hint that there exists a relation

between cancer risk and exposure in microwave radiation fields”. Dr. Neil Cherry from Lincoln University in New Zealand has found that, depending on the model of phone used, exposures to the head may exceed the highest exposure mentioned in the Polish study.^{28,29}

- G. Researchers from the University of Essen, Germany, found that mobile phone use may be associated with cancer of the eye. The researchers conducted a hospital-based study of uveal melanoma and occupational exposures to different sources of electromagnetic radiation. They interviewed a total of 118 women and men with uveal melanoma and 475 controls matched on sex, age and location. They found a significantly elevated risk for users of RF/MW transmitting devices such as radio sets and mobile phones. Other sources of electromagnetic radiation such as high-voltage lines, electrical machines, complex electrical environments, VDUs and radar units were not associated with eye cancer.³⁰

Heat-shock-proteins and RF/MW: a possible mechanism

Dr Peter French, at the Centre for Immunology, St Vincents Hospital, Darlinghurst (Sydney), has been conducting research into the possible production of ‘heat shock proteins’ in the brain as a result of mobile phone use and will be publishing his findings in the near future.

The production of heat shock proteins is a natural defensive measure taken by cells against biological damage resulting from protein unfolding. There is a wide range of heat shock proteins made, but they all perform similar functions in that they bind to any unfolded proteins and assist in refolding them. This can be caused by heat stress, some chemicals and possibly also by exposure to non-thermal RF/MW.

At first this may seem to be okay, as the cells are reacting to an external stress in order to prevent cell damage. However, in a review of the research into heat shock proteins and their role in cancer, published late last year in the *Journal of the National Cancer Institute*, the authors mention research which has found that turning on heat shock proteins repeatedly can cause cells to turn cancerous.³¹ There is, as of yet, no research published that has specifically looked at whether or not heat shock proteins are produced in the brains of mobile phone users, but there is every reason to consider this a likelihood:

- Microwaves at non-thermal power levels have been shown to elicit the heat shock protein response in organisms.³²
- Microwave radiation can cause physiological changes in brains and brain cells.
- Mobile phone use can actually heat up brain structures, as mentioned earlier.

There are indications that the heat shock protein response may be turned on by a brief microwave exposure but can take a number of hours to disappear out of the system. This would be of concern for heavy users of the mobile phone, as heat shock proteins may be chronically present and over a number of years increase the chances of cancer. Another possibility also warrants investigation. Perhaps in heavy users the heat shock protein response ‘shuts down’ under repeated activation. In this case the natural cell protective response would then not be present in situations where it is needed. Either way, this is not a desirable response and further investigation should be a priority.

Implications for new technology.

Dr. French theorises that microwave induced protein unfolding is not done by heating but resonance with water molecules that are associated with the protein. If this the case, then many of the new telecommunications devices which operate around the 2.4 Ghz frequency, may elicit a greater production of heat shock proteins.

What about home cordless phones?

Though cordless phones operate at lower frequencies and power levels than mobile phones people do tend to use them for extended periods of time. This may be of concern, especially for children and teenagers who may tend to be heavy users of household cordless phones while at home.

Special concerns for children's use of mobile phones

In 1999 the British Government established an independent expert group called the Stewart Inquiry, to examine possible health effects of mobile phones, base stations and transmitters. They concluded in April of 2000 that, on balance, the current evidence did not suggest that mobile phone technologies put the health of the general population of the UK at risk. However, they cautioned that the gaps in knowledge meant that it is not possible at present to say that exposure is without potential adverse health effects and as such, a precautionary approach was needed. Taking special consideration of the growing numbers of children using mobile phones the committee stated:

“If there are currently unrecognized adverse health effects from the use of mobile phones, children may be more vulnerable because of their developing nervous system, the greater absorption of energy in the tissues of the head... and a longer lifetime of exposure. In line with our precautionary approach, we believe that the widespread use of mobile phones by children for non-essential calls should be discouraged. We also recommend that the mobile phone industry should refrain from promoting the use of mobile phones by children.”³³

On December 8, 2000 the German Academy of Pediatrics issued a statement advising parents to restrict their children's use of mobile phones and is calling for stricter RF/MW exposure limits. “Unnecessary, frequent and extended use are to be strongly discouraged. Children only need mobile phones to communicate very infrequently, in exceptional situations” the Academy said. It advised that all mobile phone users should keep conversations as “brief as possible” but that additional precautions are appropriate for children in view of “special health risks” associated with their growing bodies.³⁴

Considering research into an increased adverse health effect on children from radiofrequency exposure, the most important is a Latvian study on 966 school children, some conceived, born and raised in the area of a Russian early warning radar station. Motor function, memory and attention significantly differed between those exposed and those not. Children living in front of the station had less developed memory and attention, their reaction time was slower and their physical endurance was decreased. The study authors proposed the hypothesis that these adverse effects are the results of chronic electromagnetic radiation effects.³⁵

In a recent Australian Senate inquiry, CSIRO Telecommunications and Industrial Physics chief Gerry Haddad warned that the new telecommunications exposure standards being drafted neglected to take a high enough level of protection, particularly in relation to children. Mr. Haddad said: “Restrict use of mobile phones to children for essential purposes . . . A precautionary principle would seem to be

a good idea.” Dr. Haddad complained that the CSIRO's view had been rejected in the formulation of new emission standards that stopped short of advising that children be restricted in their mobile phone use.³⁶

Taking a Precautionary Approach

If you look behind most battles over major public-health issues in the last few decades - over asbestos, pesticides, herbicides, dioxins, PCBs, cigarettes and general environmental pollution - the questions always resolve down to one of the public health activists insisting on government regulators taking a “precautionary approach”, and the industries concerned lobbying for the strict application of “scientific proof” before restrictive measures are imposed.

The corporations know well that ‘scientific proof’ is virtually impossible until the damage has been done, and with life-long cumulative damage, this will take another generation. They also know that the “strict application of sound science” will keep them off the hook for years to come.

In the cell phone area, the argument is much the same. With long-term diseases such as brain cancer, it is clearly impossible to establish any form of ‘scientific proof’ which can be sustained in a court “beyond all reasonable doubt”, in the course of just a few years. Therefore, sensible regulators tend to take into account the potential for widespread community damage to health and happiness. They then make precautionary judgments accordingly, based on the best scientific evidence available at the time, even though some of these findings may be disputable.

Such measures have served Australia and the USA well in the past; for instance, in protecting the USA from the full ravages of thalidomide, and possibly today in protecting the USA and Australia from such problems as mad-cow and foot-and-mouth diseases. As globalisation increasingly tends to merge us into a single world-wide market place without a corresponding system of global regulation of corporate activities or independent funding of the essential community health research, such precautionary measures become even more important at both a personal and national level.

Countering this precautionary approach is the increasing power of corporations over politicians, and the skills developed by corporate lobbyists, polling companies, and public relations consultants in manipulating public opinion. These groups are now being aided and abetted by scientists who are sometimes overtly corrupt, but more likely to just be corrupted by the system of research funding and control.

Or as Joseph Hotchkiss of Cornell University so succinctly put it:

“A host of techniques exist for manipulating research protocols to produce studies whose conclusions fit their sponsor's predetermined interests. These techniques include adjusting the time of a study (so that toxic effects do not have time to emerge), subtle manipulations of target and control groups or dosage levels, and subjective interpretations of complex data. Often such methods stop short of outright fraud, but lead to predictable results. Usually associations that sponsor research have a fairly good idea what the outcome will be, or they won't fund it.”

For the estimated 700 million mobile phone users today, the assurances of safety by the cell phone industry are indefensible when you look at the science, and the obvious industry attempts to influence it. In the opinion of a growing section of the world's legal fraternity, the industry's attempts to “pervert the course of science” will be their undoing, exactly as it happened to the tobacco corporations.

However, it is not only the mobile phone manufactures (and sellers) who should be concerned. George Carlo, former head of the American

cell phone industry's WTR project, has warned of general corporate liability as an issue. Carlo said that CEOs "need to ensure that their companies' employees operate cell phones and other wireless devices in a manner that reduces health risks associated with [cell phone] radiation - or face the consequences."

The same view was expressed on an SBS [TV] *Insight* program on mobile phone hazards by Solicitor Peter Cashman from Maurice Blackman & Cashman:

"There is now sufficient evidence in my view that any responsible employer who allows their employees to be exposed ought to be taking preventative measures, ought to be providing remote handsets, ought to be looking at the design of the devices and ought to be trying to minimise the duration of exposure. Interestingly, some of the more modern phones are now being redesigned to try to minimize the risk, although the industry doesn't want to broadcast that. They do not want to suggest that the earlier designs may have been deficient - therefore exposing them to potential liability."

For both the individual, employee and employers who use mobile phones, now is the time to err on the side of caution by following what is known as the precautionary approach, better known as the precautionary principle.

A UK definition of the precautionary principle concluded:

"We must act on facts using scientific information. That does not mean we must sit back until we have 100% evidence about everything. Where the public health is at stake, the risks can be so high and the costs of later corrective action so great, that prevention is better than cure. Where there are significant risks of damage to public health, we should be prepared to take action to diminish those risks, even when the scientific knowledge is not conclusive, if the likely balance of costs and benefits justifies it"

Examples

- A. The North Shore Hospital, which is also Sydney's main medical teaching institution, has, as a precautionary measure, issued advice to staff in March of last year (2000) to avoid unnecessary use of mobile phones to minimise potential risk from microwaves. This hospital is also involved in the currently running NSW mobile phone / brain tumour study that is examining brain tumour patients' use of mobile phones;
- B. Also last year, the British Public and Commercial Services Union, representing some 266,000 members, issued advice to its members on ways to reduce microwave exposure from cell phone use.

Recommendations

- A. For the reasons mentioned above, children should be discouraged from using mobile (and cordless) phones as their developing bodies can be more prone to radiation damage;
- B. Incoming mobile phone calls should be kept as brief as possible and returned on a conventional wired phone;
- C. When a mobile phone is being used it should be held away from the body as much as practical, not pressed against the head or clipped to a belt. Some phones have an in-built loudspeaker/microphone that allows conversations with the antenna held away from the head;
- D. As much as possible, use pagers or the mobile phone's message bank service and return calls on a conventional phone;
- E. There have been conflicting reports that use of hands-free kits with mobile phones may still expose the user to microwave emissions

due to a 'coupling effect' with the earpiece lead. The extent of this problem very much depends upon the type of cellular phone used but generally hand free kits do greatly reduce exposure. Hands free kits are now available for most cell phones, incorporating ferrite filters in the wire to eliminate any microwave emissions going into the ear piece. They should be used in preference to the 'non-filtered' ones.

References

- 1 Johansen C, Boice JD, McLaughlin JK, Olsen JH. "Cellular Telephones and Cancer - a Nationwide Cohort Study in Denmark." *J Natl Cancer Inst*, Vol. 93, No.3, pp. 203-207, Feb. 7, 2001.
- 2 Inskip PD, Linet M, Tarone R et al. "Cellular telephone use and brain tumors." *N Engl Med*, Vol. 344, pp. 79 -86, Feb. 2001.
- 3 Muscat JE, Malkin MG, et al. "Handheld cellular telephone use and risk of brain cancer." *JAMA*, Vol. 284, pp. 3001-3004, 2000.
- 4 Park RL. Editorial comment, *J Natl Cancer Inst*, Vol. 93, No.3, pp. 166-167, Feb. 7, 2001.
- 5 "Leading Epidemiologists See Childhood Leukemia Risk at 4 mG." *Microwave News*, Vol. 20, No. 5, pp.1, 11-13, Sept/Oct 2000.
- 6 Maisch D, Rapley B. "Powerline Frequency Electromagnetic Fields and Human Health - Is it the time to end further research?" *ACNEM Journal*, Vol. 17, No.1 pp. 5-16, June 1998.
- 7 McLaughlin JR. *A survey of possible health hazards from exposure to microwave radiation*. Hughes Aircraft corp., Culver City, Ca, USA 1953.
- 8 Hecht K, Balzer HU. *Biological Effects of Electromagnetic Fields on Humans in the Frequency Range 0 to 3 GHz: summary and results of a study of Russian medical literature from 1960 - 1996*. Berlin 1997.
- 9 *International Commission on Non-Ionizing Radiation Protection. Health Issues Related to the use of hand-held Radiotelephones and Base Transmitters*. June 1995.
- 10 Letter from George Carlo, head WTR to Michael Armstrong, CEO of AT&T Corp. & October 1999.
- 11 "Mega-Lawyer Peter Angelos Joins Mobile Phone-Cancer Fray." *Microwave News*, Vol. 20, No. 5, pp.1, Nov/Dec 2000.
- 12 Repacholi MH, Basten A, Gebiski V, Noonan D, Finnie JH, Harris AW "Lymphomas in Eu-Pim1 Transgenic Mice Exposed to Pulsed 900 MHz Electromagnetic Fields." *Radiation Research*, Vol. 147, pp. 631-640, 1997.
- 13 Wang BM and Lai H. "Acute exposure to pulsed 2450-MHz microwaves affects water maze learning in the rat." *Bioelectromagnetics* 21:52-56, 2000.
- 14 Lai H, Horita A and Guy AW. "Microwave irradiation affects radial-arm maze performance in the rat." *Bioelectromagnetics* 15:95-104, 1994.
- 15 Lai H and Singh NP. "Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells." *Bioelectromagnetics*, Vol. 16 pp 207-210, 1995.
- 16 Lai H and Singh NP. "DNA: single- and double-strand DNA breaks in rat brain cells after acute exposure to low-level radiofrequency electromagnetic radiation." *Int. J. Radiat. Biol.*, Vol. 69, pp 513-521, 1996.
- 17 Lai H and Singh NP. "Melatonin and a spin-trap compound blocked radiofrequency radiation-induced DNA strand breaks in rat brain cells." *Bioelectromagnetics*, Vol. 18, pp 446-454, 1997.
- 18 Lai H, Carino MA and Singh NP. "Naltrexone blocked RFR-induced DNA double strand breaks in rat brain cells." *Wireless Networks Journal*, Vol. 3, pp 471-476, 1997.
- 19 Persson BRR, Salford LG and Brun A. "Blood-brain barrier permeability in rats exposed to electromagnetic fields used in wireless communication." *Wireless Network*, Vol. 3, pp 455-461, 1997.

- 20 Schirmacher A, Winters S, Fischer S et al. "Electromagnetic fields (1.8 GHz) increase the permeability to sucrose of the blood-brain barrier in vitro. *Bioelectromagnetics* Vol. 21 No. 5, pp 338-345, July 2000.
- 21 Canada Health Agency "Need for Cell Phone-Drug Reaction Data". *Microwave News*, Vol.19, No. 2, pp 10, March/April 1999.
- 22 Lebedeva NN, Sulimov AV et al. "Cellular phone electromagnetic field effects on bioelectric activity of human brain." *Crit Rev Biomed Eng*, Vol. 28, No. 1-2, pp 323-337, 2000.
- 23 Khudnitskii SS, Moshkarev EA, Fomenko TV. "On the evaluation of the influence of cellular phones on their users." *Med Tr Prom Ekol*, Vol. 9, pp 20-24, 1999.
- 24 Preece AW et al. "Effect of a 915 MHz simulated mobile phone signal on cognitive function in man." *Int J Radiat Biol*, Vol. 75, No. 4, pp 447-456, 1999.
- 25 UK Study: Mobile Phones Can make the Brain Work Faster. *Microwave News*. Vol. 19, No. 2, pp 1& 11, March/April, 1999.
- 26 Huber R, Graf T et al. "Exposure to pulsed high-frequency electromagnetic field during waking affects human sleep EEG." *NeuroReport*, Vol. 11, No. 15, pp 3321-3325, Oct.2000.
- 27 Hocking B. "Preliminary report: symptoms associated with mobile phone use." *Occup Med (Lond)*, Vol. 48, No. 6, pp 357-360, 1998.
- 28 Szmigielski S. "Cancer morbidity in subjects occupationally exposed to high frequency (radio frequency and microwave) electromagnetic radiation." *Science of the Total Environment*, Vol 180, pp 9-17, 1996.
- 29 Cherry N. "Criticism of the Proposal to Adopt ICNIRP Guidelines for Cellsites in New Zealand & Australia." *Radio Frequency & Microwave Radiation 100kHz - 300 GHz*. pp: 109-112, April 2000.
- 30 Stang A, X Anastassiou, G et al. "The possible role of radio frequency radiation in the development of uveal melanoma." *Epidemiology*, Vol. 12, pp 7-12, Jan. 2001.
- 31 Jolly C, Morimoto RI et al. *Journal of the National Cancer Institute*, Vol. 92, pp: 1564-1761, Oct. 2000.
- 32 De Pomerai DI et al. "Effects of stress-inducing microwave radiation on life-cycle parameters in the nematode *Caenorhabditis elegans*." Presented at the 20th Annual meeting of the Bioelectromagnetics Society, St. Pete Beach, Florida. USA, June 1999.
- 33 Independent Expert Group on Mobile Phones *Mobile Phones and Health*, pp 121, 28 April 2000
- 34 German Academy of Pediatrics. "Keep Kids Away from Phones." *Microwave News*, Vol. 21, No. 1, pp 5, Jan/Feb 2001.
- 35 Kolodynski AA, Kolodynska VV. "Motor and psychological functions of school children living in the area of the Skrunda Radio Location Station in Latvia." *The Science of the Total Environment*. Vol. 180, pp 87-93, 1996.
- 36 Kearney, S. "Kids phone usage fears", the *Sunday Tasmanian*, March 18, 2001.

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