

# **Cell phone radiation poses a serious biological and health risk:**

**Dr Neil Cherry**

**7th May 2001**

**Environmental Management and Design Division  
P.O. Box 84  
Lincoln University  
Canterbury, New Zealand**

**Cell phone radiation poses a serious biological and health risk:**

Dr Neil Cherry  
Lincoln University  
Canterbury  
New Zealand

7/5/01

[neil.Cherry@ecan.govt.nz](mailto:neil.Cherry@ecan.govt.nz)

## **The Issue:**

Thousands of people are using cell phones for hours each day. They are exposing a very sensitive organ, their brain, to higher mean intensities than military personnel are exposed to when repairing radar. The military personnel show significant increases in cancer and a wide range of illnesses. Even at the very low mean levels that people experience living within 10 km of radio and TV towers, significant increases in cancer has been observed.

Analogue cell phones emit an analogue modulated RF/MW signal similar to an FM radio or TV signal. The digital cell phones radiate a pulse RF/MW signal similar to radar. Biological and epidemiological effects from EMR exposure across the spectrum show the same or similar effects.

Many people continue to drive while talking on their cell phones. Attention deficit and neurological effects on the user's brain make accidents much more likely.

Very young children and teenagers are becoming regular to heavy users of cell phones while their brains and bodies are in a much more vulnerable state than elderly people. With cancer and neurodegenerative disease latencies of decades, the possible adverse effects will take some time to become evident. By which time it will be too late for thousands of people.

There is growing concern about cell phone interference with cardiac pacemakers. If cell phone signals can interfere with an electronic pacemaker, then it is likely to also interfere with human hearts that are arrhythmically unstable.

### Biophysical Principles:

Radiant energy is absorbed into human bodies according to three main processes. The first is the Aerial Effect where bodies and body parts receive and absorb the RF/MW signal with resonant absorption that is a function of the size of the body parts and the wavelength of the RF/MW signal. For an adult male about 1.8 m tall the optimal absorption frequency is close to 70 MHz, Figure 1. This has a wavelength of 4.3m. The body acts like a half-wave dipole interacting strongly with a half wavelength close to the body size. A monkey interacts with a wavelength of 1m and a half wavelength of 0.5m. This is similar to the absorbcency of a human child.

The Aerial effect also relates to body parts such as arms and heads. A typical adult head has a width of 15 cm. This is a half wavelength for a 1 GHz microwave signal, close to that used by most cell phones.

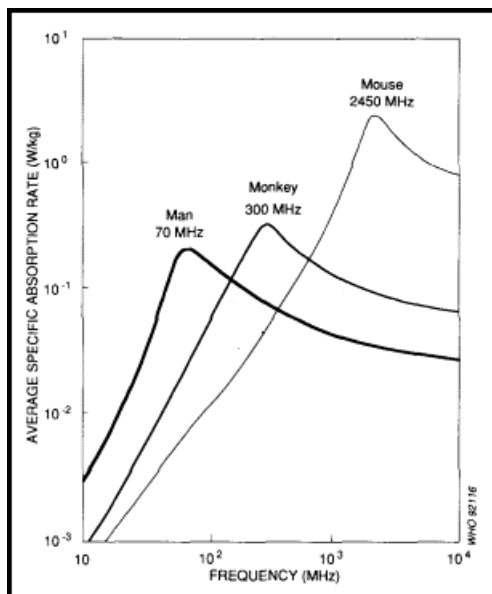


Figure 1: Average SAR for 3 species exposed to 10 W/m<sup>2</sup> with E vector parallel to the long axis of the body, from Durney et al. (1978).

Cellphone-type radiation is in the 0.9 to 1.8 GHz range, i.e.  $0.9 \times 10^9$  to  $1.8 \times 10^9$  Hz. Hence according to Figure 1 neither children nor adults are close to the optimum absorption rate but babies and infants bodies, whose dimensions lie between "monkey" and "mouse", are close to the optimal absorption for cell phone-type radiation.

A person with a height  $h$  (m), acting as an aerial in an RF electric field  $E$  (V/m) at a carrier frequency  $f$  (MHz), has a current induced in them which flows to earth through their feet, given by, Gandhi et al. (1985):

$$I_h = 0.108 h^2 E f \text{ (mA)}$$

This induced current flows mainly through high water content organs. In flowing to ground the current passes through the ankles. These consist mainly of low conductivity bones and tendons and have an effective cross-sectional area of 9.5 cm<sup>2</sup> for an adult, despite the actual physical area is of the order of 40 cm<sup>2</sup>. The formula for  $I_h$  also allows for the effective absorption area of the person, which is somewhat greater than their actual cross-sectional area, because of the attraction of the surrounding field to an earthed conductor. These aerial considerations are more pertinent to whole-body exposures

to cell sites.

Cell phone aerials for digital phones typically occupy the length of the body of the phone and extend a few centimeters out of the top of the phone body. Cellphone radiation for the phone's aerial is quite close to the user's head and can be intense enough to cause a warming sensation.

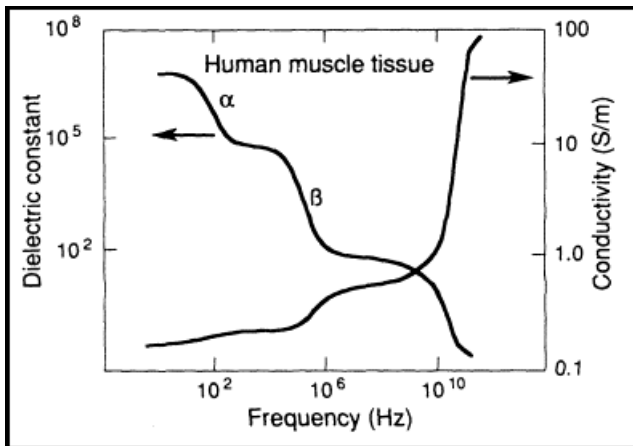


Figure 2: The dielectric constant and conductivity of typical biological tissue as a function of frequency, Schwan (1985).

The second mechanism involves the coupling of the signal to the tissue as the signal penetrates the tissue and interacts with the cells and layers of tissue. This process is related to the dielectric constant and conductivity of the tissue types, which vary significantly with the carrier frequency, Figure 2.

The third biophysical absorption process involves resonant absorption by biological systems in the brain and cells. Resonant absorption occurs when a system with a natural frequency is stimulated by an imposed signal of a similar frequency or harmonic frequency. Radio and TV receivers use both the aerial principle and the resonant absorption principle. The aerial resonantly absorbs the carrier frequency and carries it as an induced current to the receiver. Here a tuned circuit oscillating at the same frequency resonantly absorbs the carrier wave and uses decoding circuitry to extract the encoded message contained in the amplitude, frequency or digital modulation imprinted on the carrier wave.

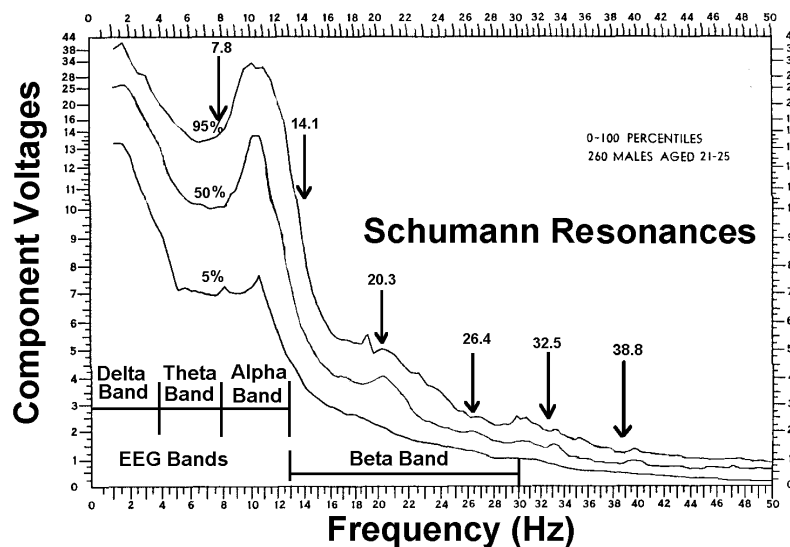


Figure 3: Comparison of the frequency spectra of the human EEG from 260 young males showing the 5%, 50% and 95%ile bands, adapted from Gibbs and Gibbs (1951), and Schumann Resonance peaks, from Polk (1982).

Figures 4 and 5 confirm the relationship shown in Figure 3, using independently derived spectra of the

daytime human EEG, Figure 4 and the Schumann Resonance spectrum, Figure 5. The figures have been aligned to have a common horizontal frequency scale.

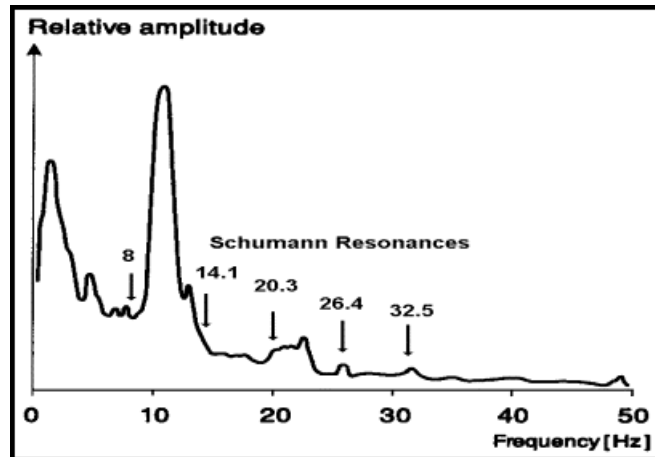


Figure 4: A typical EEG spectrum, with the Schumann Resonance peaks superimposed.

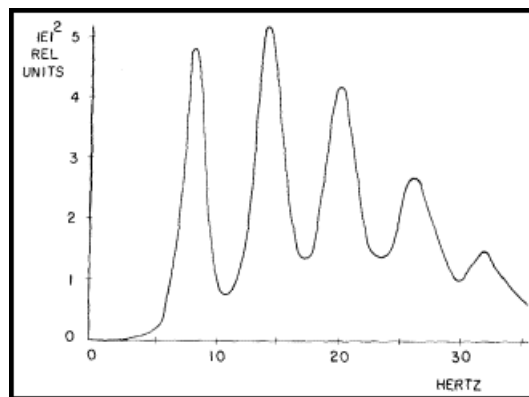


Figure 5: Daytime Schumann Resonance Spectrum, Polk (1982).

Figures 3-5 show that the frequency range of the primary peaks of the Schumann Resonances coincide with the frequency range of the human EEG. Upper Schumann peaks also associated with small peaks in the EEG. This shows a resonant interaction and supports the probability of an actual use by the brain or the Schumann Resonance signal. Figure 6 shows that this occurs in a study showing a significant dose-response correlation between the intensity of the 8-10 Hz Schumann Peak and human reaction times.

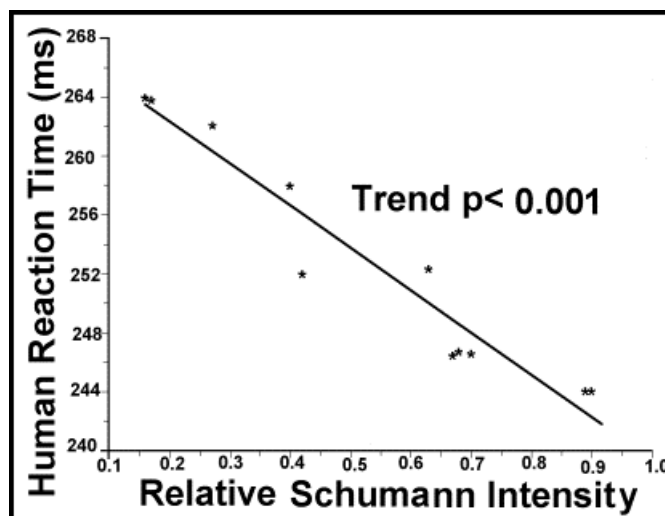


Figure 6: Human reaction times as a function of Schumann Resonance 8-10 Hz Relative Intensity, for

49,500 subjects tested during 18 days in September 1953, at the German Traffic exhibition in Munich. Derived from data in Figure 3 of König (1974b). Trend:  $t = 10.414$ , 2-tailed  $p < 0.001$ .

Cellphone radiation is shown to interact with human EEG patterns and to alter them and to change reaction times. The GSM signal has a pulse frequency of 217 Hz and a modulation at 8.34 Hz. This is in the Schumann Resonance and EEG spectral primary frequency range.

Effects shown for electromagnetic radiation, especially radio and radar signals, but also electrical occupations:

Such signals have been shown to:

#### **Neurological Activity:**

- Alter brain activity, including EEG and reaction times, memory loss, headaches, fatigue and concentration problems, dizziness (the Microwave Syndrome), Gordon (1966), Deroche (1971), Moscovici et al. (1974), Lilienfeld et al. (1978), Shandala et al. (1979), Forman et al. (1982), Frey (1998).
- Impair sleep and learning, Altpeter et al. (1995), Kolodynski and Kolodynska (1996)
- Increase permeability of the blood brain barrier (a mechanism for headache), Frey et al. (1975), Alberts (1977, 1978) and Oscar and Hawkins (1977).
- Alter GABA, Kolomytkin et al. (1994).
- Increase neurodegenerative disease including Alzheimer's Disease, Sobel et al. (1995, 1996), Savitz et al. (1998a,b)
- Highly significant Increased permeability of the blood brain barrier for 915 MHz radiation at SAR = 0.016-0.1 ( $p=0.015$ ) and SAR = 0.1-0.4 ( $p=0.002$ ); Salford et al. (1994).
- Increase the Suicide Risk, Baris and Armstrong (1990), Perry et al. (1991), Van Wijngaarden et al. (2000).

#### **Cardiological Activity:**

- Alter blood pressure and heart rhythm (heart rate variability) Bortkiewicz et al. (1995, 1996, 1997) and Szmigielski et al. (1998).
- Increases Heart Disease and heart attack mortality, Forman et al. (1986), Hamburger, Logue and Silverman (1983), Savitz et al. (1999)

#### **Immune System Activity:**

- Impairs the immune system Quan et al. (1992), Dmoch and Moszczynski (1998), Bruvere et al. (1998)

#### **Reproductive Activity:**

- Reduces sperm counts in radar exposed military personnel, Weyandt et al. (1996)
- Increases miscarriage and congenital abnormalities, Kallen et al. (1982), Larsen et al. (1991), Ouellet-Hellstrom and Stewart (1993).
- Doubles the incidence of twins in the families of radar exposed personnel, Flaherty (1994).
- Significantly alters the leaf structure of plants exposed to a radar, Magone (1996).
- Significantly reduces the radial growth of pine trees, Balodis et al. (1996).
- Reduced fertility of mice exposed to an RF field (27.12 MHz), Brown-Woodman et al. (1989).
- Increased fetal/embryo lethality in mice exposed to 2.45 GHz microwaves, Nawrot, McRee and

Galvin (1985).

- Radio exposures completely cause complete infertility in mice over 3 to 5 generations at mean exposure levels of 1.05 and 0.17mW/cm<sup>2</sup>, respectively, Magras and Xenos (1997).

#### **Genotoxic Activity:**

- Reduce melatonin and alter calcium ions, Abelin (1999), Burch et al. (1997, 1999) Bawin and Adey (1976), Blackman et al. (1988, 1989, 1990).
- Enhances heat shock proteins at extremely low exposure levels in a highly reproducible manner showing that they are not stimulated by heat but in reaction to a 'toxic' protein reaction, Daniells et al. (1998), and down to 0.001W/kg (0.34mW/cm<sup>2</sup>) using 750MHz microwaves, de Pomerai (2000).
- Damages chromosomes. Heller and Teixeira-Pinto (1959), Tonascia and Tonascia (1966), Yao (1982), Garaj-Vrhovac et al. (1990, 1991, 1992, 1993, 1999), Timchenko and Ianchevskaia (1995), Balode (1996), Haider et al. (1994) and Vijayalaxmi et al. (1997) have reported significant chromosome aberrations from RF/MW exposures. In the Mar/Apr 1999 edition of Microwave News it is reported that Drs Tice, Hook and McRee
- Alters DNA, Ali and Behari (1994).
- Breaks DNA strands, Lai and Singh (1995, 1996, 1997).
- Alters gene transcription activity, Phillips et al. (1992, 1993).
- Neoplastically transform cells, Balcer-Kubiczek and Harrison (1991).
- Enhances cell death in a dose response manner for signal intensity and exposure time, Garaj-Vrhovac et al. (1991).
- Enhances cell proliferation in a dose-response manner for exposure time, Mattei et al. (1999).
- Enhances Ornithine Decarboxylase (ODC) activity, a measure of cell proliferation rate, Byus et al. (1988), Litovitz et al. (1997).
- Enhances free radicals, Phelan et al. (1992).
- Increased cancer in rats and mice, Prausnitz and Susskind (1962), Szmigielski et al. (1988) and Chou et al. (1992)

#### **Cancer Epidemiology:**

- Increase the incidence of many types of cancer, including leukaemia, brain tumor, testicular cancer, genitourinary and breast cancer, Robinette et al. (1980), Milham (1985, 1988), Szmigielski (1996), Hocking et al. (1996), Dolk et al. (1997 a, b), Beall et al. (1996), Grayson (1996), Thomas et al. (1987), Lilienfeld et al. (1978), Zaret (1989), Davis and Mostofl (1993), Hayes et al. (1990), Tynes et al. (1996), Cantor et al. (1995), and many others.

These biological and health effects are consistent with the biological understanding that brains, hearts and cells are sensitive to electromagnetic signals because they use electromagnetic signals for their regulation, control and natural processes, including those processes monitored by the EEG and ECG. There is overwhelming evidence that EMR is genotoxic, alters cellular ions, neurotransmitters and neurohormones, and interferes with brain and heart signals, and increases cancer.

#### **Cell Phone Radiation Research:**

For years the cell phone companies and government authorities have assured us that cell phone are perfectly safe. For example, they claim that the particular set of radiation parameter associated with cell phones are not the same as any other radio signal and therefore earlier research does not apply.

They also mount biased review teams who falsely dismiss any results that indicate adverse biological and health effects and the flawed pre-assumption that the only possible effect is tissue heating. There is a very large body of scientific research that challenges this view. Now we have published research, primarily funded by governments and industry that shows that cell phone radiation causes the following effects:

### Neurological Activity:

- Alters brain activity including EEG, Von Klitzing (1995), Mann and Roschkle (1996), Krause et al. (2000).
- Disturbs sleep, Mann and Roschkle (1996), Bordely et al. (1999).
- Alters sleep EEG after awake exposure, Huber et al. (2000).
- Alters human reaction times, Preece et al. (1999), Induced potentials, Eulitz et al. (1998), slow brain potentials, Freude et al. (1998), Response and speed of switching attention (need for car driving) significantly worse, Hladky et al. (1999). Altered reaction times and working memory function (positive), Koivisto et al. (2000), Krause et al. (2000).
- Brain cortex interaction as shown by significantly altered human EEG by cellphone radiation, during a 15 minute exposure, Lebedeva et al. (2000).
- Weakens the blood brain barrier ( $p < 0.0001$ ): Persson, B.R.R., Salford, L.G. and Brun, A., 1997.
- A Fifteen minute exposure, increased auditory brainstem response and hearing deficiency in 2 kHz to 10 kHz range, Kellenyi et al. (1999).
- While driving, with 50 minutes per month with a cell phone, a highly significant 5.6-fold increase in accident risk, Violanti et al. (1996); a 2-fold increase in fatal accidents with cell phone in car, Violanti et al. (1998); impairs cognitive load and detection thresholds, Lamble et al. (1999). In a large Canadian study Redelmeier and Tibshirani (1997) the risk of collision when using a cellphone was 4 time higher, RR = 4.3, 95%CI 3.0-6.5. Calls close to the time of collision has RR =4.8 for 5 minutes and RR = 5.9,  $p < 0.001$ , for 15 minutes.
- Significant changes in local temperature, and in physiologic parameters of the CNS and cardiovascular system, Khdnisskii, Moshkarev and Fomenko (1999).
- Causes memory loss, concentration difficulties, fatigue, and headache, in a dose response manner, (Mild et al. (1998)). Headache, discomfort, nausea, Hocking (1998).

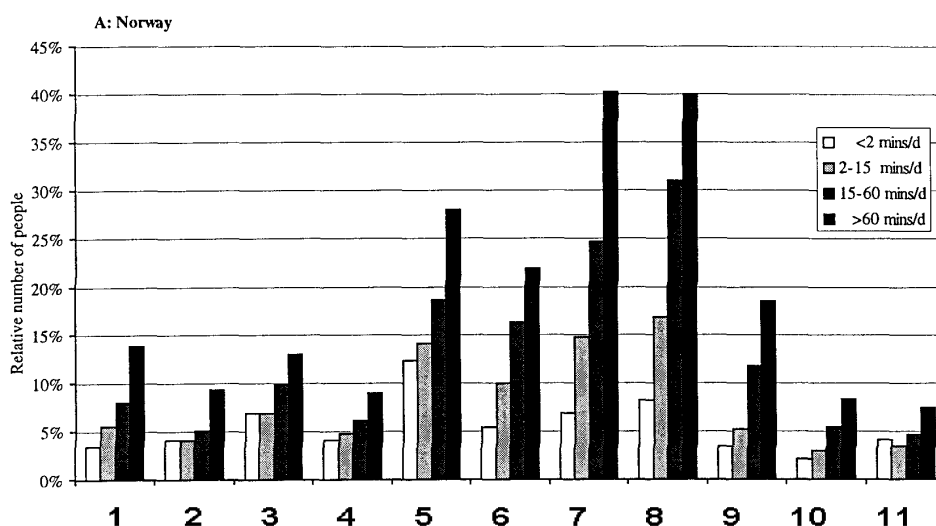


Figure 7: Prevalence of symptoms for Norwegian mobile phone users, mainly analogue, with various categories of length of calling time per day, Mild et al. (1998).

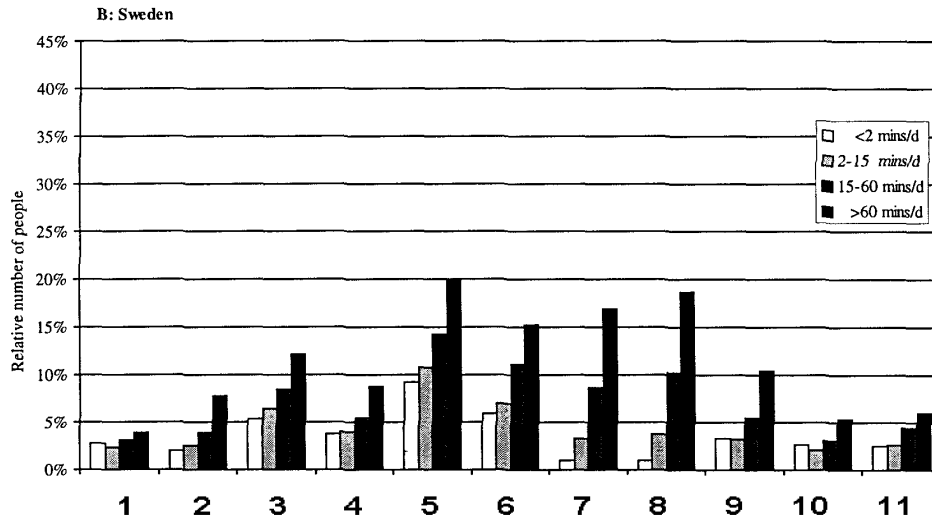


Figure 8: Prevalence of symptoms for Swedish mobile phone users, mainly digital, with various categories of length of calling time per day, Mild et al. (1998).

These are the same symptoms that have frequently been reported as "Microwave Sickness Syndrome" or "Radiofrequency Sickness Syndrome", Baranski and Czerski (1976) and Johnson-Liakouris (1998).

**Cardiac Activity:**

- Cardiac pacemaker interference: skipped three beats, Barbaro et al. (1996); showed interference, Hofgartner et al. (1996); significant interference,  $p < 0.05$  Chen et al. (1996); extremely highly significant interference,  $p = 0.0003$ , Naegeli et al. (1996);  $p < 0.0001$ , Altamura et al. (1997); reversible interference, Schlegal et al. (1998); significantly induced electronic noise, Occhetta et al. (1999); various disturbances observed and warnings recommended, Trigano et al. (1999)
- Significantly increases blood pressure, Braune et al. (1998)

**Hormone Activity:**

- Reduces the pituitary production of Thyrotropin (Thyroid Stimulating Hormone, TSH):

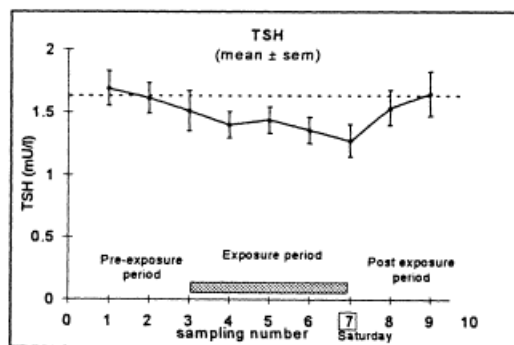


Figure 9: A significant reduction in Thyrotropin (Thyroid Stimulating Hormone) during cell phone use, de Seze et al. (1998).

- Reduces melatonin significantly, Burch et al. (1997, 1998). A GSM cellphone reduces melatonin, but not significantly in a very small sample (N=18) of subjects, de Seze et al. (1999).
- A reported but yet to be published Australian Study, EMRAA News, June 2000, used a Clot Retention Test on blood samples to detect hormonal changes. A group of 30 volunteers used a

Nokia 6150 cellphone for 10 minutes on each of two consecutive days. The CRT test showed significant changes in the thyroid, pancreas, ovaries, testes and hormonal balance.

### **Reproductive Activity:**

Decreases in sperm counts and smaller tube development in rat testes, Dasdag et al. (1999).

Increases embryonic mortality of chickens, Youbicier-Simo, Lebecq and Bastide (1998).

### **Genotoxic Activity:**

- Breaks DNA strands, Verschaeve et al. (1994), Maes et al. (1997), which is still extremely significant  $p < 0.0001$ , at  $0.0024 \text{ W/kg}$  ( $1.2 \text{ mW/cm}^2$ ), Phillips et al. (1998).
- Produces an up to three-fold increase in chromosome aberrations in a dose response manner from all cell phones tested, Tice, Hook and McRee, reported in Microwave News, March/April 1999. The findings were the same when the experiment was repeated and Dr Tice is quoted as stating: "There's no way you're going to get positive results twice over four different technologies as a chance result."
- Doubles c-fos gene activity (a proto oncogene) for analogue phones and increases it by 41 % for digital phones, Goswami et al. (1999), altered c-jun gene, Ivaschuk et al. (1997), Increased hsp70 messenger RNA, Fritz et al. (1997).
- Increases Tumour Necrosis Factor (TNK), Fesenko et al. (1999).
- Increases ODC activity, Penafiel et al. (1997).
- DNA synthesis and cell proliferation increased after 4 days of 20 min for 3 times/day exposure. Calcium ions were significantly altered, French, Donnellan and McKenzie (1997). Decreased cell proliferation, Kwee and Raskmark (1997), Velizarov, Raskmark and Kwee (1999)
- Doubles the cancer in mice, Repacholi et al. (1997).
- Increases the mortality of mobile phone users compared with portable phone users, RR = 1.38, 95%CI: 1.07-1.79,  $p = 0.013$ , Rothman et al. (1996).
- Increases human brain tumor rate by 2.5 times (Hardell et al. (1999)). Associated with an angiosarcoma (case study), Hardell (1999)
- Hardell et al. (2000), for analogue phones OR = 2.62, 95%CI: 1.02-6.71, with higher tumour rates at points of highest exposure.
- Significantly increases the incidence of eye cancer (Uveal Melanoma), by between OR = 4.2, 95%CI: 1.2-14.5, and OR = 10.1, 95%CI: 1.1-484.4, Stang et al. (2001).

### **United States, Motorola Study Morgan et al. (2000)**

High Exposure	RR = 1.07 (0.32-2.66) n = 3
Moderate Exposure	RR = 1.18 (0.36-2.92) n = 3
High/Mod vs Low	RR = 1.13 (0.49-2.31) n = 6

This project underestimated cancer rates by using a high cancer reference group.

Carlo and Schram (2001) report that in the industry funded WTR (Wireless Technology Research)

programme Dr Joseph Roti Roti confirmed the Tice, Hook and McRee research showing that cellphone radiation significantly damaged DNA through observed micronuclei formation.

Muscat et al. (2000) report elevated brain cancer in cellphone users in the United States, with cerebral tumors occurring more frequently on the side of the head where the mobile phone had been used, (26 vs 15 cases, p=0.06) and for a rare brain cancer, neuroepitheliomatous, OR = 2.1, 95%CI: 0.9-4.7. Mean use of cell phones was 2.5 years for cases and 2.2 years for controls, showing that a small increase in cellphone use (0.3 years) produces a large increase in brain cancer risk.

### Cell phone users in Denmark Johansen et al. (2001)

Duration of digital subscription	<1 yr	1-2yrs	3 yrs
Relative to reference group SIR	0.7	0.9	1.2
Relative to <1 yr group RR	1.0	1.29	1.71

Other cancers are set out in "Table 2" below. Over 67 % of phone users had used their phones for 2 years or less. The reference group had a higher than average cancer rate than the age range of cell phone users, underestimating the cancer rates. This is shown by Standard Incidence Ratios (SIR) of some groups being as little as 0.6. For example SIR for users for <1 year is 0.7.

Site of cancer (ICD-7)‡	Men				Women			
	Obs	Exp	SIR	95% CI	Obs	Exp	SIR	95% CI
All cancers (140-205)	2876	3327.6	0.86	0.83 to 0.90	515	497.6	1.03	0.95 to 1.13
Brain, nervous system (193)	135	142.8	0.95	0.79 to 1.12	19	18.5	1.03	0.62 to 1.61
Salivary glands (142)	7	9.0	0.78	0.31 to 1.60	0	0.7	---	---
Leukemia (204)	77	79.6	0.97	0.76 to 1.21	7	6.6	1.07	0.43 to 2.70
Other cancers								
Pharynx (145-148)	32	51.5	0.62	0.42 to 0.88	4	1.7	2.43	0.65 to 6.22
Esophagus (150)	42	57.1	0.74	0.53 to 0.99	3	2.0	1.53	0.31 to 4.46
Stomach (151)	63	81.2	0.78	0.60 to 0.99	2	4.5	0.45	0.05 to 1.61
Colon (153)	190	199.4	0.95	0.82 to 1.10	22	22.7	0.97	0.61 to 1.47
Rectum (154)	133	133.1	1.00	0.84 to 1.18	12	10.6	1.13	0.58 to 1.98
Liver (155)	18	29.8	0.60	0.36 to 0.96	2	2.0	1.00	0.11 to 3.61
Pancreas (157)	57	69.1	0.82	0.62 to 1.07	5	6.9	0.73	0.23 to 1.70
Larynx (161)	53	65.3	0.81	0.61 to 1.06	2	1.6	1.24	0.14 to 4.48
Lung (162)	301	460.7	0.65	0.58 to 0.73	34	39.1	0.87	0.60 to 1.22
Breast (170)	5	5.0	0.99	0.32 to 2.32	152	141.3	1.08	0.91 to 1.26
Cervix uteri (171)	---	---	---	---	37	27.5	1.34	0.95 to 1.85
Corpus uteri (172)	---	---	---	---	18	17.6	1.02	0.60 to 1.61
Ovary (175)	---	---	---	---	24	22.0	1.09	0.70 to 1.62
Prostate (177)	159	175.6	0.91	0.77 to 1.06	---	---	---	---
Testis (178)	187	166.6	1.12	0.97 to 1.30	---	---	---	---
Kidney (180)	104	101.3	1.03	0.84 to 1.24	7	6.7	1.04	0.42 to 2.15
Bladder (181)	233	239.3	0.97	0.85 to 1.11	12	9.0	1.34	0.69 to 2.33
Melanoma (190)	123	142.7	0.86	0.72 to 1.03	21	26.3	0.80	0.49 to 1.22
Other skin (191)	567	614.8	0.92	0.85 to 1.00	79	79.1	1.00	0.79 to 1.24
Eye (192)	8	12.4	0.65	0.28 to 1.27	0	1.1	---	---
Thyroid (194)	13	12.9	1.01	0.54 to 1.72	4	4.4	0.92	0.25 to 2.35
Non-Hodgkin's lymphoma (200, 202)	109	116.7	0.93	0.77 to 1.13	11	10.6	1.04	0.52 to 1.86
Hodgkin's lymphoma (201)	27	30.6	0.88	0.58 to 1.29	3	2.6	1.18	0.24 to 3.43
Other and unspecified cancers	233	331.1	0.70	0.62 to 0.80	35	32.7	1.07	0.75 to 1.57

\*Ever use of a cellular telephone (NMT 450, NMT 900, or GSM).  
†Obs = observed; Exp = expected.  
‡ICD-7 = International Classification of Diseases, 7th revision. NMT = Nordic Mobile Telephone System; GSM = General System for Global Telecommunications.

Table two shows that even with little cellphone use, and even with the use of a high cancer reference group, there are several elevated cancers approaching significance: Testicular cancer SIR = 1.12, 95%CI: 0.97-1.30, Cervical cancer, SIR = 1.34, 95%CI: 0.95-1.85, Female Pharynx cancer, SIR 2.43, 95%CI: 0.65-6.22, Esophagus cancer, SIR = 1.53, 95%CI: 0.31-4.46 and female breast cancer, SIR = 1.08, 95%CI: 0.91-1.26.

## **Conclusions:**

To date over 50 studies have shown adverse biological or human health effects specifically from cell phone radiation. These research results to date clearly show that cell phones and cell phone radiation are a strong risk factor for all of the adverse health effects identified for EMR because they share the same biological mechanisms. The greatest risk is to cell phone users because of the high exposure to their heads and the great sensitivity of brain tissue and brain processes. DNA damage accelerates cell death in the brain, advancing neurodegenerative diseases and brain cancer. Brain tumour is already an identified risk factor. Cell phones are carried on people's belts and in breast pockets. Hence liver cancer, breast cancer and testicular cancer became probable risk factors.

Altered attention and cognition, as well as the diversion of talking on a phone while driving is a significant risk factor for accidents and fatal accidents.

Some cardiac pacemakers are susceptible to active cell phone signals, recommending keeping cell phones away from hearts and pacemakers.

Because the biological mechanisms are shown and EMR has been observed to significantly increase the following effects, there is extremely strong evidence to conclude that cell phones are a risk factor for breast, liver, testicular and brain cancer. It is also probable that we will observe a very wide range of other effects including cardiac, neurological and reproductive illness and death. Since cell phone radiation cause many cell damages including DNA and chromosome damage, all of these effects will also be caused by cell sites.

Dose-response studies of neurological, cardiac, reproductive and cancer effects in human populations all point to a near zero exposure level of no effect, Cherry (2000). Since cellphone radiation mimics RF/MW radiation effects which mimics ELF biological and health, the adverse effects occur across the spectrum and includes cellphone radiation, with a safe exposure level of zero.

Hence a risk reduction and public health protection based on keeping exposure below a level that doubles the risk, identifies 0.1 mW/cm<sup>2</sup> as the maximum acceptable exposure. This should allow a mean life-time exposure to be less than 0.01mW/cm<sup>2</sup> which is necessary to reduce the risk of neurological effects. The lower level is necessary because of the exquisite sensitivity of the brain.

## **References:**

Abelin, T., 1999: "Sleep disruption and melatonin reduction from exposure to a shortwave radio signal". Seminar at Canterbury Regional Council, New Zealand. August 1999.

Alberts, E.N., 1977: "Light and electron microscopic observations on the blood-brain barrier after microwave irradiation. In Symposium on Biological effects and measurement of Radio Frequency/Microwaves, HEW Publication (FDA) 77-8026, pp 294-309.

Alberts, E.N., 1978: "Reversibility of microwave induced blood-brain barrier permeability". Radio Science Supplement.

Altpeter, E.S., Krebs, Th., Pfluger, D.H., von Kanel, J., Blattmann, R., et al., 1995: "Study of health effects of Shortwave Transmitter Station of Schwarzenburg, Berne, Switzerland". University of Berne, Institute for Social and Preventative Medicine, August 1995.

Altamura G, Toscano S, Gentilucci G, Ammirati F, Castro A, Pandozi C, Santini M, 1997: "Influence of digital and analogue cellular telephones on implanted pacemakers". Eur Heart J 18(10): 1632-4161.

Balcer-Kubiczek, E.K. and Harrison, G.H., 1991: "Neoplastic transformation of C3H/10T1/2 cells following exposure to 120Hz modulated 2.45 GHz microwaves and phorbol ester tumor promoter". Radiation Research, 125: 65-72.

Balode, Z., 1996: "Assessment of radio-frequency electromagnetic radiation by the micronucleus test in Bovine peripheral erythrocytes". The Science of the Total Environment, 180: 81-86.

Balodis, V., Brumelis, G., Kalvickis, K., Nikodemus, O., Tjarve, D. and Znottina, V, 1996: "Does the

- Skrunda Radio Location Station diminish the radial growth of pine trees?". *Sci. Tot Environ* 180: 57-64.
- Barbaro V, Bartolini P, Donato A, Militello C, 1996: "Electromagnetic interference of analog cellular telephones with pacemakers". *Pacing Clin Electrophysiol* 19(10): 1410-1418.
- Baris, D. and Armstrong, B., 1990: "Suicide among electric utility workers in England and Wales". *Br J Indust Med* 47:788-789.
- Bawin, S.M. and Adey, W.R., 1976: "Sensitivity of calcium binding in cerebral tissue to weak electric fields oscillating at low frequency". *Proc. Natl. Acad. Sci. USA*, 73: 1999-2003.
- Beall, C., Delzell, E., Cole, P., and Brill, I., 1996: "Brain tumors among electronics industry workers". *Epidemiology*, 7(2): 125-130.
- Blackman, C.F., Benane, S.G., Elliott, D.J., and Pollock, M.M., 1988: "Influence of Electromagnetic Fields on the Efflux of Calcium Ions from Brain Tissue in Vitro: A Three-Model Analysis Consistent with the Frequency Response up to 510 Hz". *Bioelectromagnetics*, 9:215-227.
- Blackman, C.F., Kinney, L.S., House, D.E., and Joines, W.T., 1989: "Multiple power-density windows and their possible origin". *Bioelectromagnetics*, 10: 115-128.
- Blackman, C.F., 1990: "ELF effects on calcium homeostasis". In "Extremely low frequency electromagnetic fields: The question of cancer", BW Wilson, RG Stevens, LE Anderson Eds, Publ. Battelle Press Columbus: 1990; 187-208.
- Borbely, AA, Huber, R, Graf, T, Fuchs, B, Gallmann, E, Achermann, P, 1999: Pulsed high-frequency electromagnetic field affects human sleep and sleep electroencephalogram. *Neurosci Lett* 275(3):207-210.
- Bortkiewicz, A., Zmyslony, M., Palczynski, C., Gadzicka, E. and Szmigielski, S., 1995: "Dysregulation of autonomic control of cardiac function in workers at AM broadcasting stations (0.738-1.503 MHz)". *Electro- and Magnetobiology* 14(3): 177-191.
- Bortkiewicz, A., Gadzicka, E. and Zmyslony, M., 1996: "Heart rate in workers exposed to medium-frequency electromagnetic fields". *J Auto Nerv Sys* 59: 91-97.
- Bortkiewicz, A., Zmyslony, M., Gadzicka, E., Palczynski, C. and Szmigielski, S., 1997: "Ambulatory ECG monitoring in workers exposed to electromagnetic fields". *J Med Eng and Tech* 21(2):41-46.
- Braune, S, Wrocklage, C, Raczek, J, Gailus, T, Lucking, CH, 1998: Resting blood pressure increase during exposure to a radio-frequency electromagnetic field. *Lancet* 351(9119):1857-1858.
- Brown-Woodman, P.D., Hadley, J.A., Richardson, L., Bright, D. and Porter, D., 1989: "Evaluation of reproductive function of female rats exposed to radiofrequency fields (27.12 MHz) near a short-wave diathermy machine". *Health Physics* 56(4): 521-525.
- Breve, R., Feldmane, G., Heisele, O., Volrate, A. and Balodis, V., 1998: "Several immune system functions of the residents from territories exposed to pulse radio-frequency radiation". Presented to the Annual Conference of the ISEE and ISEA, Boston Massachusetts July 1998.
- Burch, JB, Reif, JS, Pitrat, CA, Keele, TJ, Yost, MG, 1997: Cellular telephone use and excretion of a urinary melatonin metabolite. Abstract of the Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, delivery & Use of Electricity, San Diego, CA, 1997, pp.110.
- Burch, J.B., Reif, J.S., Yost, M.G., Keefe, T.J. and Pitrat, C.A., 1998: "Nocturnal excretion of urinary melatonin metabolite among utility workers". *Scand J Work Environ Health* 24(3): 183-189.
- Byus, C.V., Kartun, K., Pieper, S. and Adey, W.R., 1988: "Increased ornithine decarboxylase activity in cultured cells exposed to low energy modulated microwave fields and phorbol ester tumor promoters". *Cancer research*, 48(15): 4222-4226.

- Cantor, K.P., Stewart, P.A., Brinton, L.A., and Dosemeci, M., 1995: "Occupational exposures and female breast cancer mortality in the United States". *Journal of Occupational Medicine*, 37(3): 336-348.
- Chen WH, Lau CP, Leung SK, Ho DS, Lee IS, 1996: "Interference of cellular phones with implanted permanent pacemakers". *Clin Cardiol* 19(11): 881-886.
- Cherry, N.J., 2000: "Evidence that electromagnetic radiation is genotoxic: the implications for the epidemiology of cancer and cardiac, neurological and reproductive effects". Proceedings of the conference on EMR Health Effects, European Parliament, Brussels. 28th June 2000.
- Chou, C-K., Guy, A.W., Kunz, L.L., Johnson, R.B., Crowley, J.J. and Krupp, J.H., 1992: "Long-term, low-level microwave irradiation of rats". *Bioelectromagnetics* 13: 469-496.
- Daniells, C, Duce, I, Thomas, D, Sewell, P, Tattersall, J, de Pomerai, D, 1998: "Transgenic nematodes as biomonitors of microwave-induced stress". *Mutat Res* 399: 55-64.
- Dasdag, S, Ketani, MA, Akdag, Z, Ersay, AR, Sar,i I, Demirtas ,OC, Celik, MS, 1999: Whole-body microwave exposure emitted by cellular phones and testicular function of rats. *Urol Res* 27(3):219-223.
- Davis, R.L. and Mostofl, 1993: "Cluster of testicular cancer in police officers exposed to hand-held radar". *Am. J. Indust. Med.* 24: 231-233.
- Deroche, M., 1971: " Etude des perturbations biologiques chez les techniciens O.R.T.F. dans certains champs electromagnetiques de haute frequence". *Arch Mal. Prof*, 32: 679-683.
- De Mattei, M., Caruso, A., Traina, G.C., Pezzetti, F., Baroni, T., and Sollazzo, V., 1999: "Correlation between pulsed electromagnetic fields exposure time and cell proliferation increase in human osteosarcoma cell lines and human normal osteoblast cells in vitro". *Bioelectromagnetics* 20: 177-182.
- De Pomerai, D., Daniells, C., David, H., Duce, I., Mutwakil, M., Thomas, D., Sewell, P., Tattersall, J., Jones, D., and candido, P., 2000: "Non-thermal heat-shock response to microwaves". *Nature* May 25,
- de Seze R, Fabbro-Peray P, Miro L, 1998: GSM radiocellular telephones do not disturb the secretion of antepituitary hormones in humans. *Bioelectromagnetics* 19(5):271-8.
- Dmoch, A. and Moszczynski, P., 1998: "Levels of immunoglobulin and subpopulations of T lymphocytes and NK cells in men occupationally exposed to microwave radiation in frequencies of 6-12GHz". *Med Pr* 49(1):45-49.
- Dolk, H., Shaddick, G., Walls, P., Grundy, C., Thakrar, B., Kleinschmidt, I. and Elliott, P., 1997a: "Cancer incidence near radio and television transmitters in Great Britain, I - Sutton-Colfield transmitter". *American J. of Epidemiology*, 145(1):1-9.
- Dolk, H., Elliott, P., Shaddick, G., Walls, P., Grundy, C., and Thakrar, B., 1997b: "Cancer incidence near radio and television transmitters in Great Britain, II All high power transmitters". *American J. of Epidemiology*, 145(1):10-17.
- Donnellan M, McKenzie DR, French PW, 1997: Effects of exposure to electromagnetic radiation at 835 MHz on growth, morphology and secretory characteristics of a mast cell analogue, RBL-2H3. *Cell Biol Int* 21:427-439.
- Eulitz, C, Ullsperger, P, Freude, G, Elbert ,T, 1998: Mobile phones modulate response patterns of human brain activity. *Neuroreport* 9(14):3229-3232.
- Fesenko, EE, Makar, VR, Novoselova, EG, Sadovnikov, VB, 1999: Microwaves and cellular immunity. I. Effect of whole body microwave irradiation on tumor necrosis factor production in mouse cells. *Bioelectrochem Bioenerg* 49(1):29-35.
- Flaherty, J.A., 1994: "The effect of non-ionising electromagnetic radiation on RAAF personnel during World War II". *Australian Family Physician* 23(5): 902-904.

Forman, S.A., Holmes, C.K., McManamon, T.V., and Wedding, W.R., 1982: "Physiological Symptoms and Intermittent Hypertension following acute microwave exposure". *J. of Occup. Med.* 24(11): 932-934.

Freude, G, Ullsperger, P, Eggert, S, Ruppe, I, 1998: Effects of microwaves emitted by cellular phones on human slow brain potentials. *Bioelectromagnetics* 19(6):384-387.

French PW, Donnellan M, McKenzie DR, 1997: Electromagnetic radiation at 835 MHz changes the morphology and inhibits proliferation of a human astrocytoma cell line. *Bioelectrochem Bioenerg* 43:13-18.

Freude, G, Ullsperger, P, Eggert, S, Ruppe, I, 2000: Microwaves emitted by cellular telephones affect human slow brain potentials. *Eur J Appl Physiol* 81(1-2):18-27.

Frey, A.H., Feld, S.R. and Frey, B., 1975: "Neural function and behavior: defining the relationship in biological effects of nonionizing radiation". *Ann. N.Y. Acad. Sci.* 247: 433-438.

Frey, A.H., 1998: "Headaches from cellular telephones: are they real and what are the impacts". *Environ Health Perspect* 106(3):101-103.

Fritze K, Wiessner C, Kuster N, Sommer C, Gass P, Hermann DM, Kiessling M, Hossmann KA, 1997: Effect of global system for mobile communication microwave exposure on the genomic response of the rat brain. *Neuroscience* 81(3):627-639.

Garaj-Vrhovac, V., Fucic, A, and Horvat, D., 1990: "Comparison of chromosome aberration and micronucleus induction in human lymphocytes after occupational exposure to vinyl chloride monomer and microwave radiation"., *Periodicum Biologorum*, Vol 92, No.4, pp 411-416.

Garaj-Vrhovac, V., Horvat, D. and Koren, Z., 1991: "The relationship between colony-forming ability, chromosome aberrations and incidence of micronuclei in V79 Chinese Hamster cells exposed to microwave radiation". *Mutat Res* 263: 143-149.

Garaj-Vrhovac, V., Fucic, A, and Horvat, D., 1992: The correlation between the frequency of micronuclei and specific aberrations in human lymphocytes exposed to microwave radiation in vitro". *Mutation Research*, 281: 181-186.

Garaj-Vrhovac, V., and Fucic, A., 1993: "The rate of elimination of chromosomal aberrations after accidental exposure to microwave radiation". *Bioelectrochemistry and Bioenergetics*, 30:319-325.

Garaj-Vrhovac, V., 1999: "Micronucleus assay and lymphocyte mitotic activity in risk assessment of occupational exposure to microwave radiation. *Chemosphere* 39(13): 2301-2312.

Gibbs, F.A.G. and Gibbs, E.L.G., 1951: "Atlas of electroencephalograph, Volume 1: Methodology and Controls". Addison Wesley Publishing Co. USA.

Gordon, Z.V., 1966: "Problems of industrial hygiene and the biological effects of electromagnetic superhigh frequency fields". *Moscow Medicina* [In Russian] English translation in *NASA Rept TT-F-633*, 1976.

Goswami, P.C., Albee, L.D., Parsian, A.J., Baty, J.D., Moros, E.G., Pickard, W.F., Roti Roti, J.L. and Hunt, C.R., 1999: "Proto-oncogene mRNA levels and activities of multiple transcription factors in C3H 10T 1/2 murine embryonic fibroblasts exposed to 835.62 and 847.74 MHz cellular telephone communication frequency radiation". *Radiat Res* 151(3): 300-309.

Grayson, J.K., 1996: "Radiation Exposure, Socioeconomic Status, and Brain Tumour Risk in the US Air Force: A nested Case-Control Study". *American J. of Epidemiology*, 143 (5), 480-486.

Haider, T., Knasmueller, S., Kundi, M, and Haider, M., 1994: "Clastogenic effects of radiofrequency radiation on chromosomes of *Tradescantia*". *Mutation Research*, 324:65-68.

Hamburger, S., Logue, J.N., and Sternthal, P.M., 1983: "Occupational exposure to non-ionizing

radiation and an association with heart disease: an exploratory study". *J Chronic Diseases*, Vol 36, pp 791-802.

Hanson Mild, K, Oftedal, G, Sandstrom, M, Wilen, J, Tynes, T, Haugsdal, B, Hauger E, 1998: Comparison of symptoms experienced by users of analogue and digital mobile phones: a Swedish-Norwegian epidemiological study. *Arbetslivsrapport* 23.

Hardell, L, Reizenstein, J, Johansson, B, Gertzen, H, Mild, KH, 1999: Angiosarcoma of the scalp and use of a cordless (portable) telephone. *Epidemiology* 10(6):785-786.

Hardell, L, Nasman, A, Pahlson, A, Hallquist, A, Hansson Mild, K, 1999: Use of cellular telephones and the risk for brain tumours: A case-control study. *Int J Oncol* 15(1):113-116.

Hardell, L, Nasman, A, Hallquist, A, 2000: "Case-control study of radiology work, medical X-ray investigations and use of cellular telephones as risk factors". *J of General Medicine*.  
<[www.medscape.com/Medscape/GeneralMedicine/journal/2000/v02.n03/](http://www.medscape.com/Medscape/GeneralMedicine/journal/2000/v02.n03/)>

Hayes, R.B., Morris Brown, L., Pottern, L.M., Gomez, M., Kardaun, J.W.P.F., Hoover, R.N., O'Connell, K.J., Sutsman, R.E. and Nasser, J., 1990: Occupational and Risk for Testicular Cancer: A Case Control Study. *International Journal of Epidemiology*, 19, No.4, pp 825-831.

Heller, J.H., and Teixeira-Pinto, A.A., 1959: "A new physical method of creating chromosome aberrations". *Nature*, Vol 183, No. 4665, March 28, 1959, pp 905-906.

Hladky, A, Musil, J, Roth, Z, Urban, P, Blazkova, V, 1999: Acute effects of using a mobile phone on CNS functions. *Cent Eur J Public Health* 7(4):165-167.

Hocking, B., Gordon, I.R., Grain, H.L., and Hatfield, G.E., 1996: "Cancer incidence and mortality and proximity to TV towers". *Medical Journal of Australia*, Vol 165, 2/16 December, pp 601-605.

Hocking, B, 1998: Preliminary report: symptoms associated with mobile phone use. *Occup Med (Lond)*;48(6):357-360.

Hofgartner F, Muller T, Sigel H, 1996: "Could C- and D-network mobile phones endanger patients with pacemakers?". *Dtsch Med Wochenschr* 121(20): 646-652,. [Article in German]

Huber, R., Graf, T., Cote, K.A., Wittmann, L., Gallman, E., Matter, D., Schuderer, J., Kuster, N., Bordely, A.A. and Achermann, P., 2000: "Exposure to high-frequency electroamgnetic field during waking affects human sleep EEG". *Neuroreport* 11(15): 3321-3325.

Ivaschuk, O.I., Jones, R.A., Ishida-Jones, T., Haggren, Q., Adey, W.R. and Phillips, J.L., 1997: "Exposure of nerve growth factor-treated PC12 rat pheochromscytoma cells to a modulated radiofrequency field at 836.55 MHz: effects on c-jun and c-fos expression". *Bioelectromagnetics* 18(3): 223-229.

Johansen, C., Boice, J.D., McLaughlin, J.K. and Olsen, J., 2001: "Cellular telephones and cancer - a nationwide cohort study in Denmark". *J Nat Cancer Inst* 93(3): 203-207.

Kallen, B., Malmquist, G., and Moritz, U., 1982: "Delivery Outcome among Physiotherapists in Sweden: is Non-ionizing Radiation a Fetal Hazard? *Archives of Environmental Health*, 37(2): 81-84.

Kellenyi, L, Thuroczy, G, Faludy, B, Lenard, L, 1999: Effects of mobile GSM radiotelephone exposure on the auditory brainstem response (ABR). *Neurobiology* 7:79-81.

Khudnitskii, SS, Moshkarev, EA, Fomenko, TV, 1999: [On the evaluation of the influence of cellular phones on their users]. [Article in Russian] *Med Tr Prom Ekol* (9):20-24.

Kolomytkin, O., Kuznetsov, V., Yurinska, M, Zharikova, A., and Zharikov, S., 1994: "Response of brain receptor systems to microwave energy exposure". pp 195-206 in "On the nature of electromagnetic field interactions with biological systems", Ed Frey, A.H., Publ. R.G. Landes Co.

Koivisto, M, Revonsuo, A, Krause, C, Haarala, C, Sillanmaki, L, Laine, M, Hamalainen, H, 2000:

Effects of 902 MHz electromagnetic field emitted by cellular telephones on response times in humans. *Neuroreport* 11(2):413-415.

Kolodynski, A.A. and Kolodynska, V.V., 1996: "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.

König, H.L., 1974: "Behavioural changes in human subjects associated with ELF electric fields". In "ELF and VLF electromagnetic field effects", M.A. Persinger Ed, Publ. Plenum Press, New York.

Krause, C.M., Sillanmaki, L., Koivisto, M., Haggqvist, A., Saarela, C., Revonsuo, A., Laine, M. and Hamalainen H., 2000: "Effects of electromagnetic field emitted by cellular phones on the EEG during a memory task". *Neuroreport* 11(4): 761-764.

Kwee, S, Raskmark, P, 1997: Radiofrequency electromagnetic fields and cell proliferation. Presented at the Second World Congress for Electricity and Magnetism in Biology and Medicine, Bologna, Italy, June.

Lai, H. and Singh, N.P., 1995: "Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells". *Bioelectromagnetics*, Vol 16, pp 207-210, 1995.

Lai, H. and Singh, N.P., 1996: "Single- and double-strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation". *Int. J. Radiation Biology*, 69 (4): 513-521.

Lai, H., and Singh, N.P., 1997: "Melatonin and Spin-Trap compound Block Radiofrequency Electromagnetic Radiation-induced DNA Strands Breaks in Rat Brain Cells." *Bioelectromagnetics*, 18:446-454.

Lamble D, Kauranen T, Laakso M, Summala H, 1999: "Cognitive load and detection thresholds in car following situations: safety implications for using mobile (cellular) telephones while driving". *Accid Anal Pre* ;31(6):617-623.

Larsen, A.I., Olsen, J., and Svane, O., 1991: "Gender specific reproductive outcome and exposure to high frequency electromagnetic radiation among physiotherapists". *Scand. J. Work Environ. Health*, Vol.17, pp 324-329.

Lebedeva, N.N., Sulimov, A.V., Sulimova, O.P., Kotrovskaya, T.I. and Galius, T., 2000: "Cellular phone electromagnetic field effects on the bioelectric activity of human brain". *Crit. Rev Biomed Eng* 28(1-2): 323-327.

Lilienfeld, A.M., Tonascia, J., and Tonascia S., Libauer, C.A., and Cauthen, G.M., 1978: "Foreign Service health status study - evaluation of health status of foreign service and other employees from selected eastern European posts". Final Report (Contract number 6025-619073) to the U.S. Dept of State, July 31, 1978.

Litovitz, T.A., Krause, D., Penafiel, M., Elson, E.C. and Mullins, J.M., 1993: "The role of coherence time in the effect of microwaves on ornithine decarboxylase activity". *Bioelectromagnetics* 14(5): 395-403.

Maes A, Collier M, Van Gorp U, Vandoninck S, Verschaeve L, 1997: Cytogenetic effects of 935.2-MHz (GSM) microwaves alone and in combination with mitomycin C. *Mutat Res* 393(1-2): 151-156.

Magone, I., 1996: "The effect of electromagnetic radiation from the Skrunda radio location station on *Spirodela polyrhiza* (L.) Schleiden cultures". *Sci Total Env* 180: 75-80.

Mann, K, Roschke, J, 1996: Effects of pulsed high-frequency electromagnetic fields on human sleep. *Neuropsychobiology* 33(1):41-47.

Milham, S., 1982: "Mortality from leukemia in workers exposed to electric and magnetic fields". *New England J. of Med.*, 307: 249-250.

Milham, S., 1985: "Silent Keys", *Lancet* 1, 815, 1985.

Milham S., 1985: "Mortality in workers exposed to electromagnetic fields. *Environ Health Perspectives* 62:297-300.

Milham, S., 1988: "Increased mortality in amateur radio operators due to lymphatic and hematopoietic malignancies". *Am. J. Epidemiology*, Vol 127, No.1, pp 50-54.

Milham, S., 1996: "Increased incidence of cancer in a cohort of office workers exposed to strong magnetic fields". *Am. J. Ind. Med.* 30(6): 702-704.

Morgan, R.W., Kelsh, M.A., Zhao, K., Exuzides, K.A., Heringer, S and Negrete, W., 2000: "Radiofrequency exposure and mortality from cancer of the brain and lymphatic/hematopoietic systems". *Epidemiology* 11(2): 118-127.

Moscovici, B., Lavyel, A. and Ben Itzhac, D., 1974: "Exposure to electromagnetic radiation among workers". *Family Physician* 3(3): 121.

Muscat, J., Malkin, M.G., Thompson, S., Sjore, R.E., Stelman, S.D., McRee, D, Neugut, A.I. and Wynder, E.I., 2000: "Handheld cellular telephone use and risk of brain cancer". *JAMA* Dec 20, 284(23): 3001-3007.

Naegeli B, Osswald S, Deola M, Burkart F, 1996: "Intermittent pacemaker dysfunction caused by digital mobile telephones". *J Am Coll Cardiol* 27(6):1471-1477.

Nawrot, P.S., McRee, D.I. and Galvin, M.J., 1985: "Teratogenic, biochemical and histological studies with mice prenatally exposed 2.45 GHz microwave radiation". *Radiation Research* 102(1): 35-45.

Occhetta E, Plebani L, Bortnik M, Sacchetti G, Trevi G, 1999: "Implantable cardioverter defibrillators and cellular telephones: is there any interference?". *Pacing Clin Electrophysiol* 22(7): 983-989.

Oscar, K.J. and Hawkins, T.D., 1997: "Microwaves alteration of the blood-brain barrier system of rats". *Brain Research* 126: 281-293.

Ouellet-Hellstrom, R. and Stewart, W.F., 1993: "Miscarriages among Female Physical Therapists who report using radio- and microwave- frequency electromagnetic radiation." *American J. of Epidemiology*, 138 (10): 775-86.

Persson, B.R.R., Salford, L.G. and Brun, A., 1997: "Blood-brain barrier permeability in rats exposed to electromagnetic fields used in wireless communication". *Wireless Network* 3: 455-461.

Penafiel, L.M., Litovitz, T., Krause, D., Desta, A. and Mullins, J.M., 1997: "Role of modulation on the effect of microwaves on ornithine decarboxylase activity in L929 cells". *Bioelectromagnetics* 18(2): 132-141.

Perry, F.S., Reichmanis, M., Marino, A. and Becker, R.O., 1981: "Environmental power-frequency magnetic fields and suicide". *Health Phys* 41(2): 267-277.

Phelan, A.M., Lange, D.G., Kues, H.A, and Lutty, G.A., 1992: "Modification of membrane fluidity in Melanin-containing cells by low-level microwave radiation". *Bioelectromagnetics* 13: 131-146.

Philips, J.L., Haggren, W., Thomas, W.J., Ishida-Jones, T. and Adey, W.R., 1992: "Magnetic field-induced changes in specific gene transcription". *Biochem Biophys Acta* 1132(2): 140-144.

Philips, J.L., Haggren, W., Thomas, W.J., Ishida-Jones, T. and Adey, W.R., 1993: "Effect of 72 Hz pulsed magnetic field exposure on ras p21 expression in CCRF-CEM cells". *Cancer Biochem Biophys* 13(3): 187-193.

Phillips, J.L., Ivaschuk, O., Ishida-Jones, T., Jones, R.A., Campbell-Beachler, M. and Haggren, W., 1998: "DNA damage in molt-4 T-lymphoblastoid cells exposed to cellular telephone radiofrequency fields in vitro". *Bioelectrochem Bioenerg* 45: 103-110.

Polk, C., 1982: "Schumann Resonances". In *CRC Handbook of Atmospherics*, Vol 1, pp 111-177,

Prausnitz, S. and Susskind, C., 1962: "Effects of chronic microwave irradiation of mice". IRE Trans Biomed Electron 9:104-108.

Preece, AW, Iwi, G, Davies-Smith, A, Wesnes, K, Butler, S, Lim, E, Varey, A, 1999: Effect of a 915-MHz simulated mobile phone signal on cognitive function in man. *Int J Radiat Biol* 75(4):447-456.

Quan, R., Yang, C., Rubinstein, S., Lewiston, N.J., Sunshine, P., Stevenson, D.K. and Kerner, J.A., 1992: "Effects of microwave radiation on anti-infective factors in human milk". *Pediatrics* 89(4):667-669.

Redelmeier, D.A. and Tibshirani, R.J., 1997: "Association between cellular-telephone calls and motor vehicle collisions". *New England J Medicine* 336(7): 453-458.

Repacholi, MH, Basten, A, Gebiski, V, Noonan, D, Finnie, J, Harris, AW, 1997: Lymphomas in E mu-Pim1 transgenic mice exposed to pulsed 900 MHz electromagnetic fields. *Radiat Res* 147(5):631-640.

Robinette, C.D., Silverman, C. and Jablon, S., 1980: "Effects upon health of occupational exposure to microwave radiation (radar)". *American Journal of Epidemiology*, 112(1):39-53, 1980.

Rothman KJ, Loughlin JE, Funch DP, Dreyer NA.,1996: Overall mortality of cellular telephone customers. *Epidemiology* 7:303-305.

Salford, L.G., Brun, A., Stuesson, K., Eberhardt, J.L. and Persson, B.R.R., 1994: Permeability of the Blood-Brain Barrier induced by 915 MHz electromagnetic radiation, continuous wave and modulated at 8, 16, 50 and 200 Hz.

Savitz, D.A., Checkoway, H. and Loomis, D.P., 1998a: "Magnetic field exposure and neurodegenerative disease mortality among electric utility workers". *Epidemiology* 9(4):398-404.

Savitz, D.A., Loomis, D.P. and Tse, C.K., 1998b: "Electrical occupations and neurodegenerative disease: analysis of U.S. mortality data". *Arch Environ Health* 53(1): 71-74.

Savitz, D.A., Liao, D., Sastre, A., Klecjuner, R.C., and Kavet, R., 1999: "Magnetic field exposure and cardiovascular disease mortality among electric utility workers". *Am. J. Epidemiology*, 149(2): 135-142.

Schirmacher, A, Bahr, A, Kullnick, U, Stoegbauer, F, 1999: Electromagnetic fields (1.75 GHz) influence the permeability of the blood-brain barrier in cell culture model. Presented at the Twentieth Annual Meeting of the Bioelectromagnetics Society, St. Pete Beach, FL, June.

Schlegel RE, Grant FH, Raman S, Reynolds D 1998: "Electromagnetic compatibility study of the in-vitro interaction of wireless phones with cardiac pacemakers". *Biomed Instrum Technol* 32(6): 645-655.

Shandala, M.G., Dumanskii, U.D., Rudnev, M.I., Ershova, L.K., and Los I.P., 1979: "Study of Non-ionizing Microwave Radiation Effects on the Central Nervous System and Behavior Reactions". *Environmental Health Perspectives*, 30:115-121.

Sobel, E., Davanipour, Z., Sulkava, R., Erkinjuntti, T., Wikstrom, J., Henderson, V.W., Bucjwalter, G., Bowman, D. and Lee, P-J., 1995: "Occupations with exposure to electromagnetic fields: a possible risk factor for Alzheimer's Disease". *Am J Epidemiol* 142(5): 515-524.

Sobel, E., Dunn, M., Davanipour, D.V.M., Qian, M.S. and Chui, M.D., 1996: "Elevated risk of Alzheimer's disease among workers with likely electromagnetic field exposure. *Neurology* 47(12): 1477-1481.

Stang, A., Anastassiou, G., Ahrens, W., Broman, K., Bornfeld, N. and Jockel, K-H., 2001: "The possible role of radiofrequency radiation in the development of Uveal Melanoma". *Epidemiology* 12(1): 7-12.

Szmigielski, S., Bielec, M., Lipski, S. and Sokolska, G., 1988: "Immunological and cancer-related aspects of exposure to low level microwave and radiofrequency fields". In: *Modern Bioelectricity*

(Marino A ed). New York, Marcel Bekker, pp861-925.

Szmigielski, S., 1996: "Cancer morbidity in subjects occupationally exposed to high frequency (radiofrequency and microwave) electromagnetic radiation". *Science of the Total Environment*, Vol 180, 1996, pp 9-17.

Szmigielski, S., Bortkiewicz, A., Gadzicka, E., Zmyslony, M. and Kubacki, R., 1998: "Alteration of diurnal rhythms of blood pressure and heart rate to workers exposed to radiofrequency electromagnetic fields". *Blood Press. Monit*, 3(6): 323-330.

Thomas, T.L., Stolley, P.D., Stemhagen, A., Fontham, E.T.H., Bleecker, M.L., Stewart, P.A., and Hoover, R.N., 1987: "Brain tumor mortality risk among men with electrical and electronic jobs: A case-control study". *J. Nat. Canc. Inst.*, Vol 79, No.2, pp 233-238., August 1987.

Tice, R., Hook, G. and McRee, D.I., 1999: "Genetic Damage from Cellphone Radiation". Proc. 30th Annual Meeting of the Environmental Mutagen Society, Washington DC, March 1999.

Timchenko, O.I., and Ianchevskaia, N.V., 1995: "The cytogenetic action of electromagnetic fields in the short-wave range". *Psychopharmacology Series*, Jul-Aug;(7-8):37-9.

Trigano AJ, Azoulay A, Rochdi M, Campillo, A., 1999: "Electromagnetic interference of external pacemakers by walkie-talkies and digital cellular phones: experimental study. *Pacing Clin Electrophysiol* 22(4 Pt 1): 588-593.

Tynes, T., Hannevik, M., Anderson, A., Vistnes, A.I. and Haldorsen, T., 1996: "Incidence of breast cancer in Norewegian female radio and telegraph operators". *Cancer causes Control.*, 7(2): 197-204.

Van Wijngaarden, E., Savitz, D.A., Kleckner, R.C., Dai, J. and Loomis, D., 2000: "Exposure to electromagnetic fields and suicide among electric utility workers: a nested case-control study". *Occupational and Environ Medicine*, 57: 258-263.

Velizarov, S, Raskmark, P, Kwee, S, 1999: The effects of radiofrequency fields on cell proliferation are non-thermal. *Bioelectrochem Bioenerg* 48(1):177-180.

Verschaeve, L., Slaets, D., Van Gorp, U., Maes, A. and Vanderkom, J., 1994: "In vitro and in vivo genetic effects of microwaves from mobile phone frequencies in human and rat peripheral blood lymphocytes". *Proceedings of Cost 244 Meetings on Mobile Communication and Extremely Low Frequency field: Instrumentation and measurements in Bioelectromagnetics Research*. Ed. D, Simunic, pp 74-83.

Vijayalaxmi, B.Z., Frei, M.R., Dusch, S.J., Guel, V., Meltz, M.L. and Jauchem, J.R., 1997a: "Frequency of micronuclei in the peripheral blood and bone marrow of cancer-prone mice chronically exposed to 2450 MHz radiofrequency radiation". *Radiation Research*, 147: 495-500.

Violanti, J.M., 1998: "Cellular phones and fatal traffic collisions". *Accid Anal Prev* 30(4): 519-524.

Violanti, J.M. and Marshall, J.R., 1996: "Cellular phones and traffic accidents: an epidemiological approach". *Accid Anal Prev* 28(2): 265-270.

Von Klitzing, L, 1995: Low-frequency pulsed electromagnetic fields influence EG of man. *Phys. Medica* 11:77-80.

Yao. K.T., 1982: "Cytogenetic consequences of microwave irradiation on mammalian cells incubated in vitro". *J Hered* 73(2): 133-138.

Youbicier-Simo, BJ, Lebecq, JC, Bastide, M, 1998: Mortality of chicken embryos exposed to EMFs from mobile phones. Presented at the Twentieth Annual Meeting of the Bioelectromagnetics Society, St. Pete Beach, FL, June.

Weyandt, T.B., Schrader, S.M., Turner, T.W. and Simon, S.D., 1996: "Semen analysis of military personnel associated with military duty assignments". *Reprod Toxicol* 10(6):521-528.

Zaret, M.M., 1977: "Potential hazards of hertzian radiation and tumors. NY State J Med,146-147.