Cataract as a side effect of unprotected exposure to microwave hyperthermia treatment of breast cancer.

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Abstract:

Some doctors around the world use microwaves in cancer treatments. There is scientific and medical evidence to support this treatment. The heating by microwaves enhances the blood circulation and enhances the locally supply of treatment drugs that are applied to enhance the death rates cancer cells. Some doctors simply as microwaves or they can treatment. They believe and they observe that this reduces the cancer tumours. Almost all of them do not know what mechanism is that enhances the Cell death rate. There is very strong evidence from many multiple independent studies that microwaves are genotoxic, that is, they damage DNA. Cells with damage to DNA have three main outcomes. They are mutated, produce cancer or produce enhanced cell rates (Apoptosis or Necrosis). Enhanced cell death rates will help to reduce the cancer. However, some doctors do not use focused treatment and protection or all other tissues. They are unaware of the toxic effects and claim that there are no side-effects. Because microwaves are genotoxic end they are associated with serious neurological, cardiac, reproductive and cancer increased rates, the 'no side-effects claim' is not correct. There is extremely strong and will establish evidence that there are serious side-effects and therefore using the treatment must be done responsibility by focusing the signal and protecting all other tissues.

Introduction:

I highly respect caring doctors who treat people with cancer because they sincerely believe that they can help them by enhancing the Apoptosis rate of the cancer cells by exposing them to thermal exposures to microwave radiation. However I, as a senior academic environmental health scientist, who has widely reviewed the scientific evidence of the biological and epidemiological evidence of the exposures to electromagnetic fields and radiation across the spectrum, I firmly believe that some doctors do not understand nor appreciate the serious side-effects of their treatment because, for example, when they expose the breast of the patient and fail to use protection of all other organs and cells from high levels of microwave radiation, not knowing the microwaves are genotoxic, they significantly damage non-cancer cells. Some claim that "no harmful side effects have been reported after 40 years of treatments". They then go on to acknowledge that there can be "a minor loss of brain function and/or liver and kidney functions". These claims are not scientifically justified.

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One of the key mechanisms of hyperthermal treatment to kill the cancer cells is to enhance the cell death through Apoptosis and Necrosis. When a substance, such and microwave radiation, damages DNA strands then the damaged cell needs to be repaired or eliminated. The cells contain mechanisms to detect genetic damage. One result of detecting unrepaired genetically damaged cells is induced cellular programmed death, Apoptosis and Necrosis. Another outcome is that the cells survive and become cancer cells. Certain organs such as eyes and the brain, do not replace the damaged and death cells and hence they are very sensitive to damage and loss of function. The eye's lens have very weak circulation and no cellular regeneration, and hence it is especially vulnerable to elevated temperature and cell damage. These processes explain the side-effects of unprotected microwave radiation exposed organs and cells in these cases.

A well-established effect of microwave exposure of eyes is the loss of transparency of the eye lens, development of cataracts and cell damage in retina cells. Together these lead to blindness. It is also well established that radiofrequency/microwave radiation causes neurological effects. These are all symptoms of natural aging. RF/microwave exposure significantly advances the aging symptoms through accelerating the damage of many more cells.

For many years it has been assumed that these effects are caused by thermal temperature increases, including the production of cataracts and other eyes damage and genotoxic effects such as chromosome aberrations. This is appropriate for this case because the microwave exposures were thermal levels and sufficient to increase temperature even as a side effect. However, dose-response relationships for chromosome aberrations and micronuclei formation and detection of extremely significant ($p<0.0001$) DNA strand breakage from non-thermal microwave exposure of 0.0024 W/kg, compared to a thermal threshold of 4 W/kg. This proves that the genotoxic cellular damage is a non-thermal, direct genotoxic effect. "Proof" is derived from over 30 studies from multiple independent laboratories, dose-response relationships and extremely statistical significance effects showing that RF/MW are genotoxic. This is strongly confirmed by many studies showing that RF/MW causes increased cancer, neurological, cardiac and reproductive effects.

My very recently published study, Cherry (2001), shows that an extremely small natural electromagnetic signal, the Schumann Resonance signal, with an intensity of about $0.1 pW/cm^2$, is the plausible biological mechanism for the human health effects correlated with Solar/Geomagnetic Activity. The health effects include cancer, neurological, cardiac and reproductive health effects. My paper presented to the European Parliament EMR Conference in June 2000, Cherry (2000), shows that there is robust evidence that RF/MW radiation and ELF fields are genotoxic and that this is confirmed by epidemiological studies showing significantly and dose-response increases in cancer, neurological, cardiac and reproductive health effects. Their threshold of "no effects" is very close to zero exposure, consistent with a genotoxic agent.

This evidence will outline the evidence that RF/MW cause cataracts from thermal exposures but that the mechanisms are consistent with non-thermal mechanisms. I will then outline the evidence that shows that RF/MW exposure is consistently associated with

the neurological symptoms experienced by treated patients. For example: the loss of concentration, memory loss (especially language), insomnia and severe depression and considered suicide.

Microwave-induced Cataracts:

Many years ago it was stated that “In humans, cases of microwave-induced cataract are well documented”, Birenbaum et al. (1969). They go on to state: “Early stages of this lens opacification process are termed incipient cataract, a condition which may lie dormant for long periods of time without materially reducing visual capability. Eventually, the opacification spread through the lens substance and becomes denser. This results in the loss of useful vision at which time the condition is recognized clinically as cataract. Ultimately, microwave-induced cataracts result in blindness.”

Even in 1953 Dr John McLaughlin, a medical consultant to Hughes Aircraft Corporation, drew up a sent to the U.S. military a report that listed “internal breeding, leukaemia, cataracts, head aches, brain tumours, heart conditions and jaundice as possible effects”, Steneck et al. (1980) and McLaughlin (1953). Dr McLaughlin’s report on cataracts was based partly on a report from the Mayo Clinic, Daily et al. (1948) showing that microwaves caused cataracts in dogs. Military researchers also reported links between microwave exposures and cataracts in dogs, Richardson et al. (1948) and Imig et al. (1948), cited by Steneck et al. (1980).

Cleary et al. (1965) also cite Richardson et al. (1948) as showing increased cataracts in animals from microwaves, but also cite two papers showing microwave induced cataracts in humans, Hirsch and Parker (1952) and Shimkhovicj and Shiliaev (1959). They noted that animal experiments had showed the disturbing possibility “that chronic low level exposure could result in an increase in the risk of cataract formation among microwave workers has been suggested by animal experiments in which cataracts were produced by repeated sub-threshold irradiation”. This demonstrates that the thermal threshold is not the limit to protect from microwave-induced cataract formation. Cleary and Pasternack (1966) added Zaret (1963) and another study showing microwave-induced cataracts in humans. Cleary and Pasternack found that microwave exposed workers had significantly more cataracts than unexposed workers, ($p<0.01$).

Hence as early as the 1960’s it was well-established that microwaves induced optical damage of eyes leading to cataracts. Two modern observations simply confirm the causal relationship. In table 21-3 below from the Ophthalmology textbook by Dr Frank Newell, Newell (1996), lists “Electromagnetic Radiation” and includes microwaves based on their heating effects, 4(d)(2).

TABLE 21-3.
Cataract without Systemic Disorders

I. Eye otherwise healthy and no systemic disease
  A. Nearly all aging cataracts
  B. Most cataracts in adults
  C. Many hereditary and congenital cataracts
II. Cataract combined with other ocular disorders but no systemic abnormalities
  A. Congenital and hereditary abnormalities (cyclopia, colobomas, microphthalmia, aniridia, persistent primary vitreous, heterochromia iridis)
  B. Acquired defects and delayed hereditary abnormalities
    1. Miscellaneous ocular diseases (glaucoma, uveitis, retinal separation, pigmentary degeneration of retina, myopia, ocular neoplasms)
    2. Retinopathy of prematurity (cataracts develop after 3 years of age)
    3. Toxicity (corticosteroids systemically or topically, ergot, naphthalene, dinitrophenol, triparanol [MER-29], topical anticholinesterase, phenothiazines)
    4. Ocular trauma
      a. Contusion (Vossius ring [pigment on anterior capsule], posterior subcapsular cataract)
      b. Laceration
      c. Retained intraocular foreign body (iron: siderosis; copper: chalcosis)
      d. Electromagnetic radiation
        (1) Infrared (iris absorption with heat coagulation of underlying lens, also true exfoliation of lens capsule)
        (2) Microwaves (focused high energy, a heating effect)
        (3) Ionizing radiation (cataractogenic dose varies with energy and type, younger lens more vulnerable)
        (4) Ultraviolet radiation
      e. Anterior ocular ischemia after retinal detachment surgery

Van Vreeswijk and Pameyer (1998) report using microwaves to induce cataracts in postmortem pigs eyes for surgical teaching purposes. They describe the process as easily reproducible and it involves a 9 second exposure in a microwave oven.

Hence there is no doubt that thermal levels of exposure to microwave radiation, such as is used in microwave hyperthermia therapy, causes alterations in the eyes' lens opacity leading to cataracts.

Etiology of Cataract Induction:

To overcome any uncertainty about the intensity of the exposure of the patient's face, head and eyes, two further aspects are explored. The first is the mechanisms involved in the etiology of cataract formation and the second is the evidence that RF/MW radiation is associated with these one or more of these mechanisms.

The Table 21-3 cited above shows that IR, UV, MW and Ionizing radiation are all causal agents for Cataract induction. Ionizing and UV radiation are the most frequently cited causes. By identifying their mechanisms for producing cataracts we can clarify the mechanisms caused by RF/MW exposures.

Anwar and Moustafa (2001) studied the effect of melatonin on eye lens of rats exposed to ultraviolet radiation. They used UV radiation in the UVA and UVB ranges between 356 and 254 nm, at an intensity of 8 $\mu W/cm^2$ to irradiate rats' eyes for 15 mins/day for one week. They showed a significant reduction in antioxidant enzymes ($p<0.05$) and highly significant

($p<0.001$) free radical damage and elevated lenticular Ca^{2+} ($p<0.001$). They administered melatonin, a naturally produced, potent antioxidant, and showed that it protected the eye lens from the oxidative stress and elevated Ca^{2+} levels, "which are considered as a important causes of cataractogenesis".

Worgul et al. (1996) were searching for a bioindicator of cataractogenicity and a measure of the doses of ionizing radiation. They concluded that micronuclei formation was the best bioindicator because they were an indication of genetic damage and were extremely long-lived.

These studies confirm that genetic damage associated with free radicals, reduced antioxidants, such as melatonin, elevated lenticular calcium ions and chromosome aberrations, including micronuclei formation, are vital parts of the etiology of cataract induction.

Non-Ionizing Radiation across the electromagnetic radiation Spectrum from ELF to RF/MW (NIRS) produces each of these biological effects, i.e. altered cellular calcium ions, reduced melatonin and chromosome aberrations including micronuclei formation.

EMR Spectrum Integration:

There are sound scientific reasons for showing that the electric and magnetic fields and electric currents induced in bodies by external electromagnetic fields and radiation use different mechanisms depending on the frequency of the external field. However these mechanism merge across the spectrum to produce an almost linear reduction on dielectric constant with increasing frequency, Figure 1, resulting in an almost linear rise in induced current, Figure 2.

There is biophysical, biological, genetic and epidemiological evidence that EMR has similar effects across the EMR spectrum from ELF to RF/MW frequencies.

Biophysics shows that there are linked interaction mechanisms across the EMR spectrum from ELF to RF/MW exposures, including the dielectric constant.

The dielectric constant is approximately the AC equivalent of the DC Resistance. As the dielectric constant decrease the conductivity increases. The dielectric properties of biological tissue depend on the water content because the interaction of the RF/MW signal with the tissues. Two types of effects control the dielectric behaviour. One is the oscillation of the free charges or ions and the other the rotation of the molecules at the frequency of the applied electromagnetic signal, Johnson and Guy (1972). This results in a progressive reduction in the dielectric constant with rising frequency of the electromagnetic signal, Figure 1.

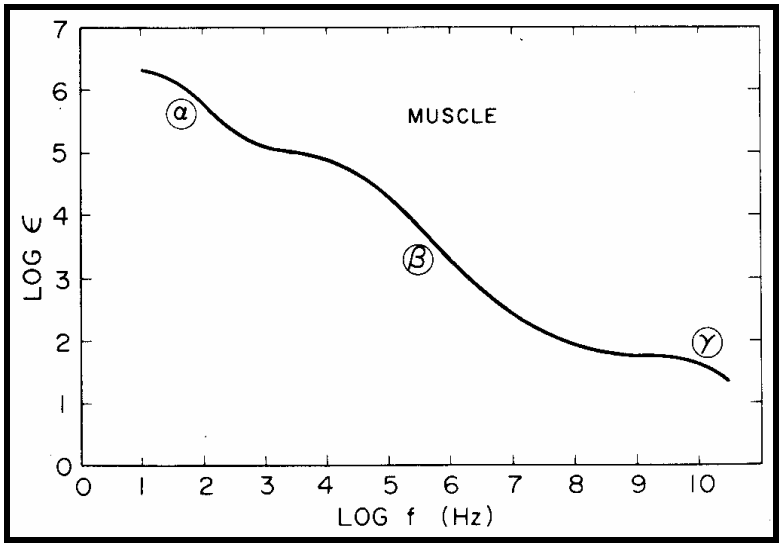

Figure 1: The dielectric constant of muscle as a function of frequency, Schwan and Foster (1980).

The significant drop in dielectric constant with increasing frequency shows a linked process across the spectrum with increasing conductivity and higher induced currents as the frequency rises. The frequency dependence of the induced current in muscle tissue, exposed to a unit external field, was modeled by Vignati and Giuliani (1998), Figure 2.

Figure 9-2 shows that for a unit induced field the ELF induced current at 100 Hz is 10^8. For RF 150 MHz frequency, the current is near 10^{14}, a million times higher the ELF frequency. At cell phone frequencies around 1GHz the induced current is about 10^{17}, a billion times higher. This indicates that the biological and health effects of ELF fields are associated with much lower induced voltages and currents. ELF fields they are shown to cause calcium ion efflux, melatonin reduction, chromosome damage, DNA strand breakage and many cancers, including leukaemia and brain tumor. Hence, since GHz signals induce far higher voltages and currents in biological tissue, they should produce similar biological and health effects, but at much lower mean field strength and signal intensity. This point of principle was proposed by Vignati and Giuliani (1998) in relation to their measurements of radiofrequency fields from high voltage powerlines. They suggested that the higher biological impact of RF fields suggested that the health effects around powerline could reasonably be associated more with the RF fields than the ELF fields.

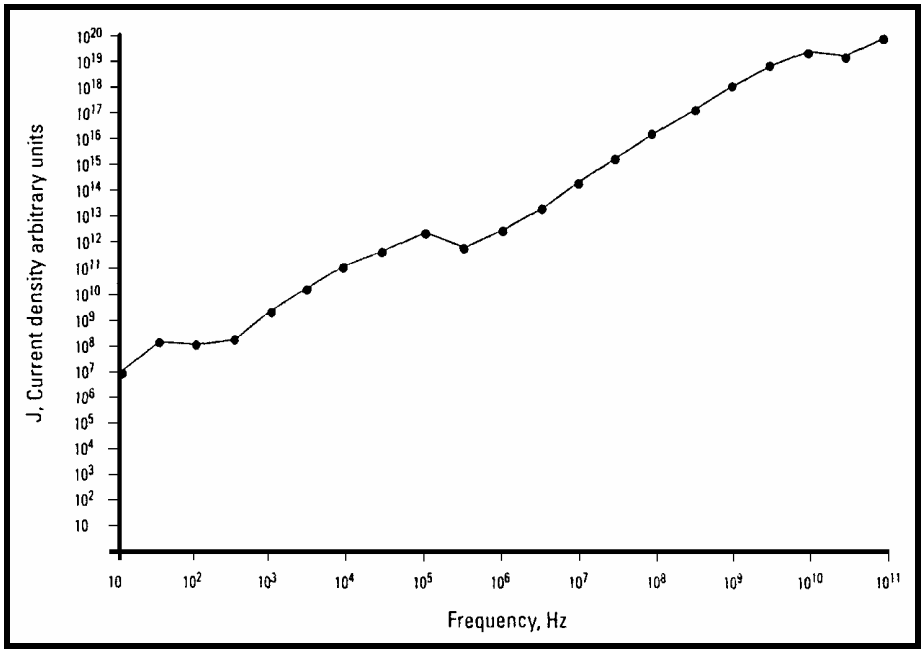

Figure 2: Induced tissue current from a unit applied field, as a function of the carrier frequency, Vignati and Giuliani (1997).

Biological research shows calcium ion efflux, melatonin reduction, chromosome aberrations, micronuclei formation, DNA-strand breakage, and cell neoplastic transformation across the spectrum from ELF to RF/MW frequencies.

Dr Ross Adey and his research teams produced many studies on calcium ion efflux from brain cells. In 1988 he published a paper that combined two of his earlier experiments to show that a 56 V/m ELF field with frequencies from 0 to 32 Hz induced significant calcium influx in chick brains. Over a similar range, covering the main EEG frequency range, a 56 V/m RF 147 MHz signal modulated at 0 to 35 Hz produced significant calcium ion efflux from the chicks brains, Figure 3, Adey (1988). The ELF field induced a 10^{-7} V/cm electric gradient in the tissues, while the RF field induced a 10^{-1} V/cm field, a million times higher. This confirms the data in Figure 2. It also shows that the higher frequency signals produce much higher electric field and current induction in tissues. They both cause significant changes of brain cells calcium ion homeostasis when ELF fields corresponding to the natural frequencies of the EEG brain activity, peaking in the alpha-band frequency.

Adey (1988) states that these ELF oscillating electromagnetic fields have tissue fields millions of times weaker than the cellular membrane potential gradient. This evidence "supports nonlinear, nonequilibrium processes at critical steps in transmembrane signal coupling". This is a fundamental resonance interaction from external fields to the cell membranes involving extremely small intensities of the exposure fields, down to about 10^{-7} V/cm in the tissue. If a 56 V/m 147 MHz signal produces 10^{-1} V/cm, then it is reasonable that a million times small field will produce about 10^{-7} V/cm in tissues. This RF field has E = 5.6×10^{-5} V/m which converts to an internal induced RF intensity 0.083 pW/cm^2. [p = pico =

10^{-12}]. This is close to the intensity of the natural ELF global signal the Schumann Resonance signal.

This research independently confirms the EMR spectrum principle that RF/MW signals induce far higher internal tissue fields than ELF fields, and produce the same biological effects, in this case altered cellular calcium ion fluxes.

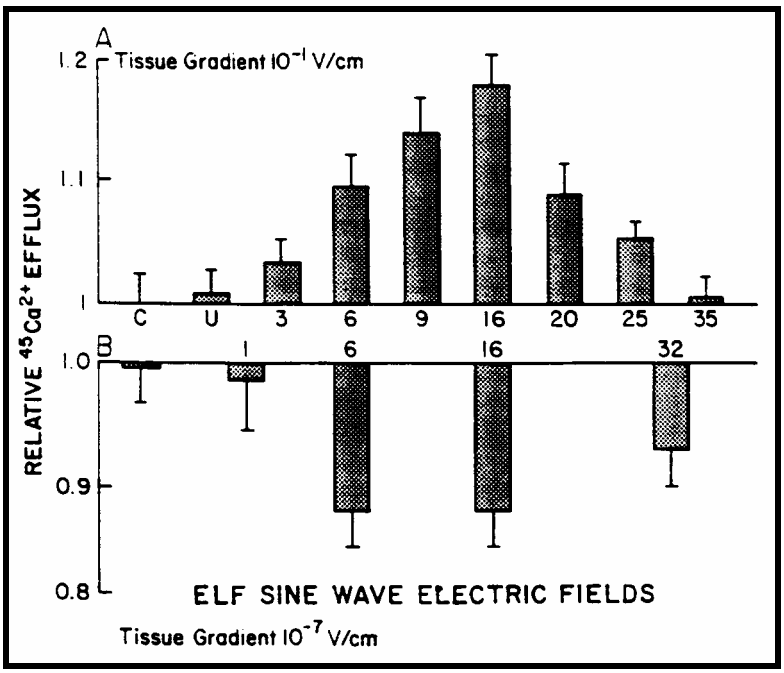

Figure 3: ELF induced calcium ion efflux from (A) an ELF modulated 147 MHz signal and (B) an ELF signal, Adey (1988).

Dr Adey and his group concentrated on the range of modulation frequencies used on the brain wave activity as measured by the EEG. This was aiming to understand how the ELF signals could interact with the natural electromagnetic signals in the brain and alter the EEG and reaction times, as had been observed by other laboratories. They confirmed that this mechanism used the alteration of the natural calcium ions in the neuron cells. These calcium ion signals help to produce the EEG signal and they regulate the release of neurotransmitters used in brain activities.

The Adey Group's studies were replicated and extended by the group in the U.S. E.P.A lead by Dr Carl Blackman. Dr Blackman's research group identified a wide range of factors that acted in "windows" that strongly suggest that the interaction process involves resonant interaction processes. They also extended the studies of the modulation frequency far beyond the EEG frequency range, out to 510 Hz. They found windows of frequency showing significant calcium ion efflux from cells, Figure 4.

It has now been established that induced calcium ion efflux/influx is dependent on a complex set of EMR carrier and modulation frequency, field intensity, temperature,

geomagnetic field windows, indicating that this is very probable a resonant interaction mechanism within the normal thermal homeostasis range.

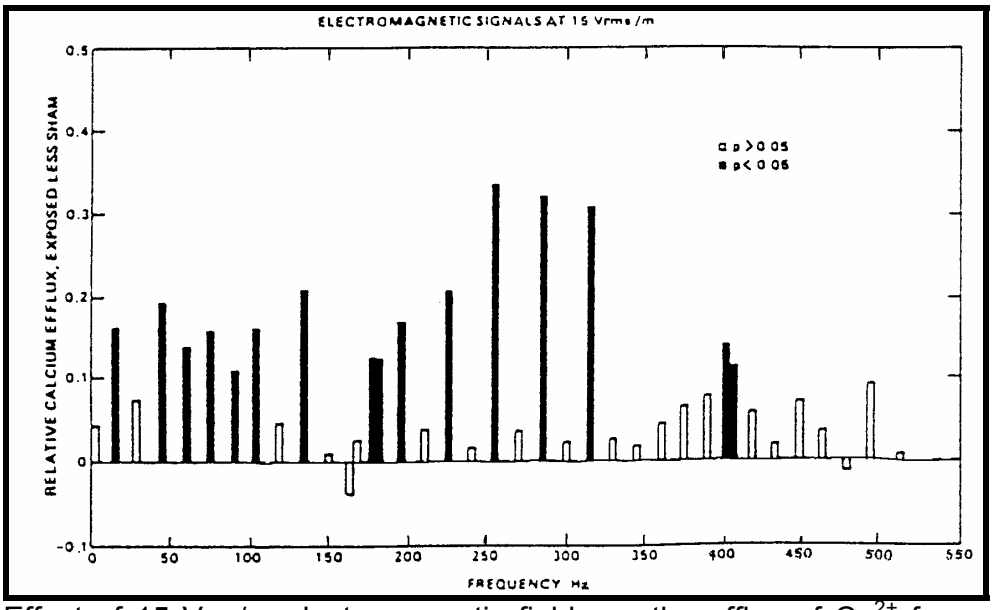

Figure 4: Effect of 15 V_{rms}/m electromagnetic fields on the efflux of Ca^{2+} from chicken brain tissue as a function of modulation frequency, Blackman et al. (1988). The solid bars show significant alteration, $p<0.05$.

Blackman et al. (1990) showed the importance of the local static magnetic field and Blackman et al. (1991) showed that Ca^{2+} efflux occurred for tissue temperatures of 36 and 37 °C and not at 35 and 38°C. They comment that these could be very good reasons why experimental outcomes have been difficult to confirm in some laboratories.

After reviewing the many studies in the published literature on EMR induced Ca^{2+} efflux. Blackman (1990) concludes:

"Taken together, the evidence overwhelmingly indicates that electric and magnetic fields can alter normal calcium ion homeostasis and lead to changes in the response of biological systems to their environment".

Blackman (1990) concludes that calcium ion efflux/influx is an established biological effect of EMR exposure. The variable nature of the response, as indicated by complex exposure 'windows', indicates that EMR acts like chemicals (plural) rather than acting like a single chemical Blackman (1998). Because modulation frequencies are critically involved, and low intensity exposures are observed under some circumstances to produce greater effects than some higher exposure conditions, resonant interactive processes are indicated and heating is definitely not involved except to establish a homeostatic range. The lowest published SAR level showing significant alteration of the calcium ion fluxes is Schwartz et al. (1990) for a 240MHz signal, SAR = 0.00015W/kg, S = 0.1μW/cm^2.

EMR induced Melatonin Reduction:

EMR Reduces Melatonin in Animals:

Light-at-night and electromagnetic radiation, are proven to reduce melatonin and hence EMR produces significant adverse health effects. The evidence for EMR is summarized here. Rosen, Barber and Lyle (1998) state that seven different laboratories have reported suppression of nighttime rise in pineal melatonin production in laboratory animals. They show that a 50μT, 60Hz field with a 0.06μT DC field, over 10 experiments, averages a 46% reduction in melatonin production from pinealocytes. Yaga et al. (1993) showed that rat pineal response to pulsed ELF magnetic fields varied significantly during the light- dark-cycle. They found that the rate-limiting enzyme in melatonin synthesis, N-acetyltransferase (NAT) activity showed that magnetic field exposure significantly suppressed NAT during the mid- to late-dark phase.

Wilson et al. (1986) exposed groups of rats to an electric field for 1 to 4 weeks. After 3 to 4 weeks the melatonin was highly significantly reduced, $p<0.001$, vs the sham exposed rats, Figure 5.

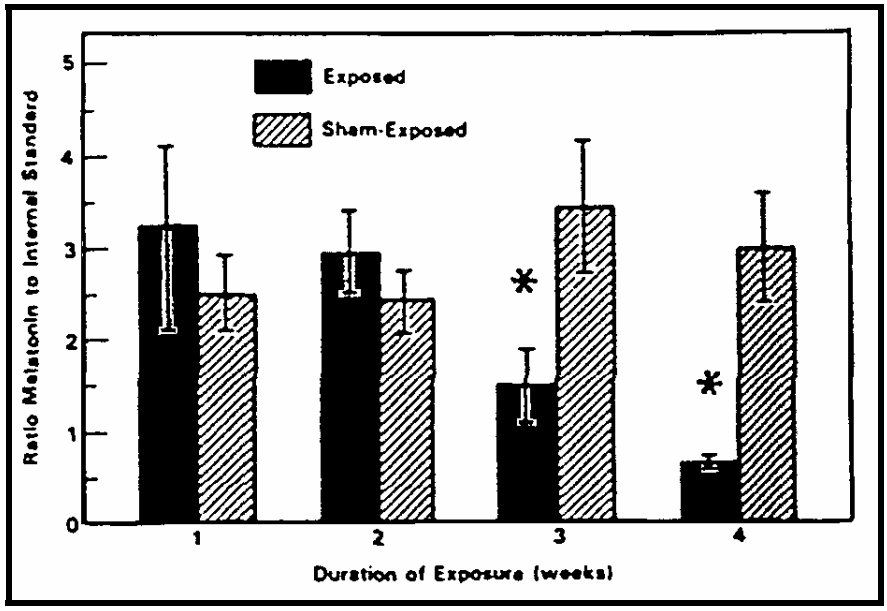

Figure 5: Pineal melatonin from chronically exposed rats to an electric field, 39kV/m, 60 Hz, for 20 hours/day and sham exposed rats, Wilson et al. (1986).

Stark et al. (1997) observed a significant increase in salival melatonin in a group of 5 cows when the short-wave radio transmitter at Schwarzenberg, Switzerland, was turned off for three days, compared to 5 cows that had much lower RF exposure. Hence there are now at least ten independent observations of melatonin reduction in animals from ELF and RF exposure.

Because of the probable windowing effect controlled laboratory experiments on animals are likely to be more variable than human studies because human beings are moving through continuously changing electromagnetic fields, passing through windows of effect and no effect, averaging an effect. The effects include reduced melatonin.

EMR Reduces Melatonin in People:

Fifteen studies from show that ELF and RF/MW exposure reduces melatonin in people and a serotonin enhancement. Evidence that EMR reduced melatonin in human beings commenced with Wang (1989) who found that workers who were more highly exposed to RF/MW had a dose-response increase in serotonin, and hence indicates a reduction in melatonin. Thirteen studies have observed significant EMR associated melatonin reduction in humans.

They involve a wide range of exposure situations, including 50/60 Hz fields, Wilson et al. (1990), Graham et al. (1994), Davis (1997) [in a dose response manner], Wood et al. (1998), Karasek et al. (1998), and Burch et al. (1997, 1998, 1999a, 2000), Juutilainen et al. (2000) and Graham et al. (2000); 16.7 Hz fields, Pfluger and Minder (1996); VDTs Arnetz et al. (1996), a combination of 60 Hz fields and cell phone use, Burch et al. (1997, 1999a), and a combination of occupational 60Hz exposure and increased geomagnetic activity around 30nT, and in an extremely significant dose-response, Burch et al. (1999b).

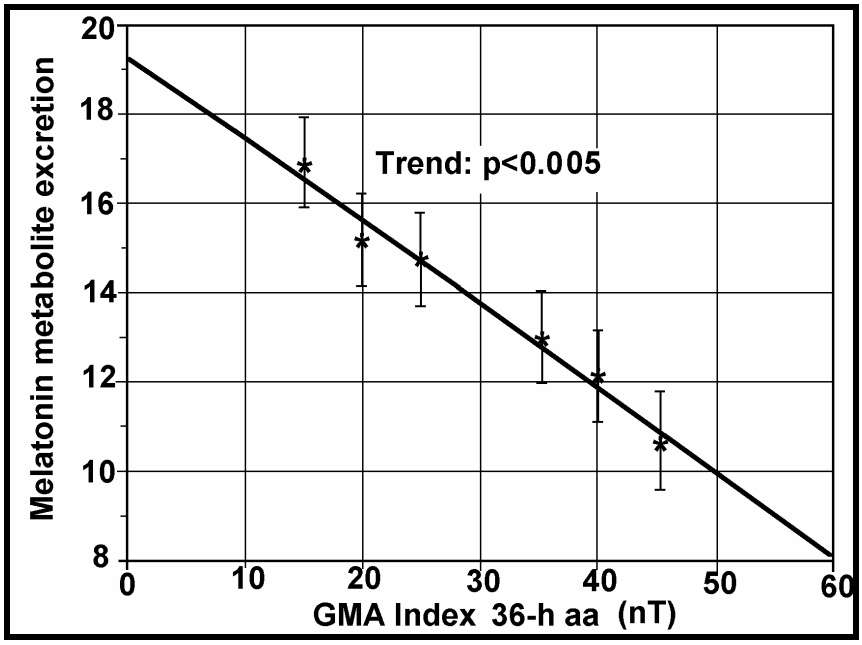

Figure 6: Reduction in the melatonin metabolite 6-OHMS in μg in urine from U.S. electric utility workers, as a function of the 36 hr global GMA aa-index, Burch et al. (1999b).

The Davis (1997) study involved residential exposures and observed nocturnal reductions in melatonin metabolite, 6-OHMS. The author states that while the effect was small it occurred at milliGauss levels and followed a dose-response trend. The effect was strongest among women who were on medication that also reduces melatonin. They showed a significant dose-response trend, with a 2- , 3- and 4-fold increase in magnetic field resulting in 8%, 12 % and 15 % reductions in melatonin, respectively.

The fifteenth human melatonin reduction study is from RF exposure as reported during the shutting down process of the Schwarzenburg shortwave radio tower, Professor Theo Abelin (seminar and pers.comm.). Urinary melatonin levels were monitored prior to and following the closing down of the Schwarzenburg short wave radio transmitter. This showed a significant rise in melatonin after the signal was turned off. This study also showed a causal relationship between sleep disturbance and shortwave RF exposure at very low residential exposure levels, in a dose-response manner and directly altered by experimental situations, Altpeter et al. (1996). Since melatonin is a regulator of sleep, this is a very substantial result.

Hence it is established from multiple, independent studies, that EMR from ELF to RF/MW reduces melatonin in animals and human beings.

Chromosome Aberrations, Micronuclei formation and DNA strand breakage:

As an initial summary to show that chromosome aberrations occur across the spectrum the following papers are cited. Chromosome aberrations significantly caused by 50/60 Hz fields, In Sweden Nordenson et al. (1988) found significant CA in 400 kV-substation workers and with 50 Hz exposures to peripheral human lymphocytes, Nordenson et al. (1984) and human amniotic cells, Nordenson et al. (1994). RF fields caused significant CA, Heller and Teixeira-Pinto (1959), and microwaves, Garaj-Vrhovac, Horvat and Koren (1990, 1991, 1992, 1993), Garaj-Vrhovac (1999). Haider et al. (1994), Balode (1996) and Vijayalaxmi et al. (1997).

DNA-strand breakage from ELF fields: Lai and Singh (1996), Svedenstal et al. (1999) and Ahuja et al. (1999); and from microwaves exposure Lai and Singh (1995, 1996, 1997), cell phones Phillips et al. (1998).

Many independent and multiple studies show that calcium ion influx/efflux, reduced melatonin, chromosome aberrations, micronuclei formation, and DNA-strand breakage. All occur across the EMR spectrum from ELF to RF/MW frequencies. This confirms the EMR Spectrum Principle.

Evidence of EMR Genotoxic:

The evidence that EMR is genotoxic is vital and is very much stronger than most scientists expect. Normally repetition and extension of an experiment shows confirmation of an effect. In EMR research for both ELF and RF/MW fields were have many multiple independent observations of chromosome aberrations, micronuclei formation and DNA strand breakage.

Heller and Teixeira-Pinto (1959) were the first published paper showing that the RF radiation caused chromosome aberration. They were looking for a new method to produce controlled chromosome aberrations in laboratories experiments. They discovered a new physical method. Tips of garlic root-tips in water were exposed to a pulsed RF field for 5 minutes, with no temperature increase. They were examined after 24 hrs and they found serious chromosome aberrations. They state: “This led us to believe that this force [the RF

field] might be used as a powerful and controlled mutagenic agent." … "The effects noted mimicked those produced by ionizing and c-mitotic substances."

The genetic material is the DNA molecule. DNA is a long double strand connected by a string of 4 substances. Small sections of the DNA are genes that contain information required for the synthesis of products. The DNA is twisted and folded to form the arms of the chromosomes, Figure 7. Hence all of the genetic substances, chromosomes, genes and DNA is formed from the DNA molecule. Hence any substance that causes chromosome aberrations, micronuclei formation, altered gene activity and DNA strand breakage is genotoxic because it alters the natural genetic codes.

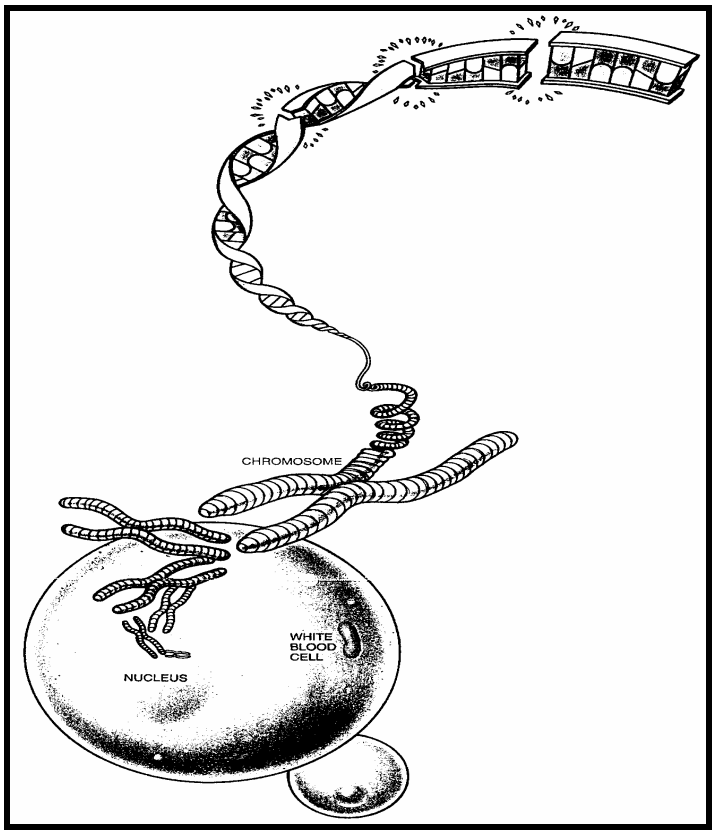

Figure 7: A schematic diagram of the structure of DNA and the formation of chromosomes.

The next analysis of chromosome aberrations published came from the blood samples taken from the staff of the U.S. Embassy in Moscow who were chronically exposed to a low intensity radar signal. Significant increases in chromosome damage was reported, Jacobson (1966) cited in Goldsmith (1997a). Comparing the 11 level 1 and 2 reference group with the 23 cases above gives:

RR = 2.09, 95%CI: 1.22-3.58, p=0.004

Yao (1982) exposed rat kangaroo RH5 and RH16 cells to 2.45 GHz microwaves, maintaining the temperature at 37°C in the incubator. After 50 passages with microwave

exposure there we 30 passages without. Significant chromosome aberrations were measured after 20 MW passages. Yao (1978) also found elevated chromosome damage in Chinese Hamsters.

Significantly elevated chromosome damage with RF/MW exposure has been observed by Nawrot, McRee and Staples (1981), Banerjee, Goldfeder and Mitra (1983a) and Garaj-Vrhovac et al. (1987). Thus before the end of the 1980's at least 7 studies had reported significantly increased chromosome aberrations (CAs) from RF/MW exposure. Since then many more studies have found that RF/MW is genotoxic and increases cell death.

Garaj-Vrhovac et al. (1990) noted the differences and similarities between the mutagenicity of microwaves and VCM (vinyl chloride monomer). They studied a group of workers who were exposed to 10 to 50 $\mu W/cm^2$ of radar produced microwaves. Some were also exposed to about 5 ppm of VCM, a known carcinogen. Exposure to each of these substances (microwaves and VCM) produced highly significant ($p<0.01$ to $p<0.001$) increases in Chromatid breaks, Chromosome breaks, acentric and dicentric breaks in human lymphocytes from blood taken from exposed workers. The results were consistent across two assays, a micronucleus test and chromosome aberration assay. Chromosome aberrations and micronuclei are significantly higher than the controls, ($p<0.05$, $p<0.001$, $p<0.0001$), for each of the exposure intensity.

Garaj-Vrhovac, Horvat and Koren (1991) exposed Chinese hamster cells to 7.7 GHz microwave radiation to determine cell survival and chromosome damage. They assayed chromosome aberrations and micronuclei and found that microwaves increased these in a dose response manner, Figure 8, to levels that were highly significantly elevated ($p<0.02$ to $p<0.01$).

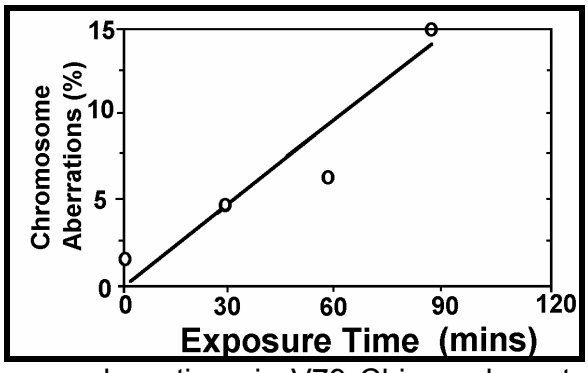

Figure 8: Chromosome aberrations in V79 Chinese hamster cells exposed to 7.7 GHz microwaves at 30 mW/cm^2, Garaj-Vrhovac, Horvat and Koren (1991).

An exposure level of 30 mW/cm^2 is usually able to slightly raise the temperature over an hour. This experiment was undertaken under isothermal conditions, with samples being kept within 0.4°C of 22°C. The consistency of the time exposure and the survival assay at non-thermal exposure levels, confirms that this is a non-thermal effect.

This is very strong evidence of genotoxic effects from RF/MW exposures. When chromosomes are damaged one of the primary protective measures is for the immune

system natural killer cells to eliminate the damaged cells. Alternatively the cells can enter programmed cell suicide, apoptosis. Garaj-Vrhovac, Horvat and Koren (1991) measured the cell survival rates. They found that cell survival reduced and the cell death increased in a time dependent and exposure dose response manner, Figure 9.

Figure 9 shows that cell death varies with time and intensity of exposure, down to very low exposure levels. An apparent 'saturation' at high levels also becoming evident. This is probably because of the lethal effect of high intensity microwaves. Since this is an isothermal experiment it raised important questions about the reasons for the cell death as acute genetic damage which is continuously related to microwave exposure down to non-thermal levels.

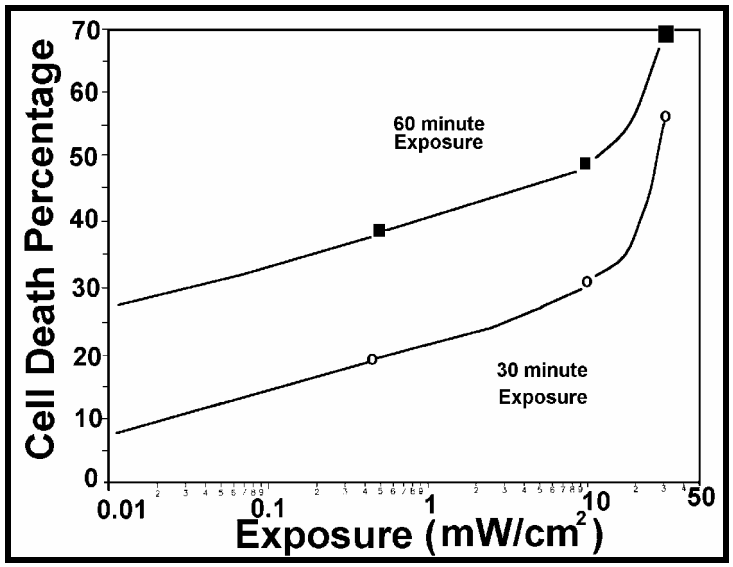

Figure 9: Cell death percentage of Chinese hamster cells exposed to 7.7 GHz microwaves (CW) for 30 minutes and 60 minutes in an isothermal exposure system, Garaj-Vrhovac, Horvat and Koren (1991).

Note that the general public ICNIRP guideline for microwaves above 2 GHz is 1 mW/cm^2, and for workers is 5 mW/cm^2. Even at 100 times below the public exposure guideline a 60 minute exposure kills 28% of the cells and 30 minutes kills 8 % of the cells. Garaj-Vrhovac et al. (1992) exposed human lymphocytes and showed that microwave radiation produced a dose response increase in chromosome aberrations, Figure 10.

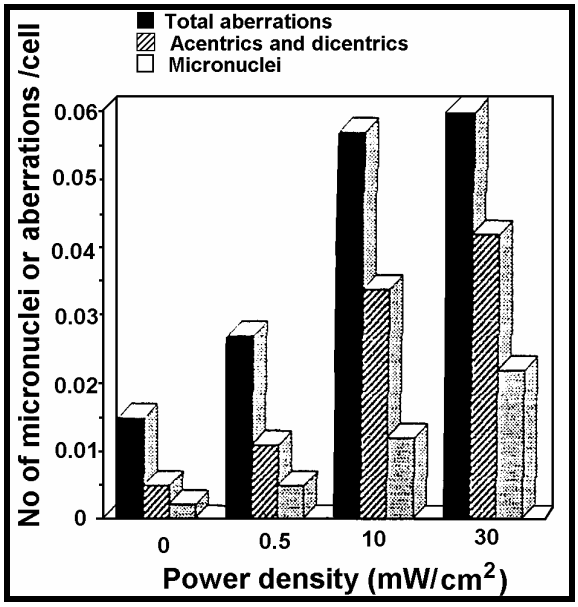

Figure 10: The relation of total chromosome aberrations. micronuclei and specific chromosome aberrations for each cell in human lymphocyte cultures in the dose of microwave radiation in vitro, Garaj-Vrhovac et al. (1992).

Having established that microwave exposure damaged chromosomes, this research group were asked to analyze blood samples from workers who had been exposed to pulsed microwaves generated by air traffic control radars while they were repairing them. Garag-Vrhovac and Fucic (1993) analysed the chromosome aberration (CA) in 6 technical staff who had experienced accidental exposure to the radar. The initial CA percentage ranged from 3% to 33%, all being significantly higher than unexposed people. The repair rate over time was monitored.

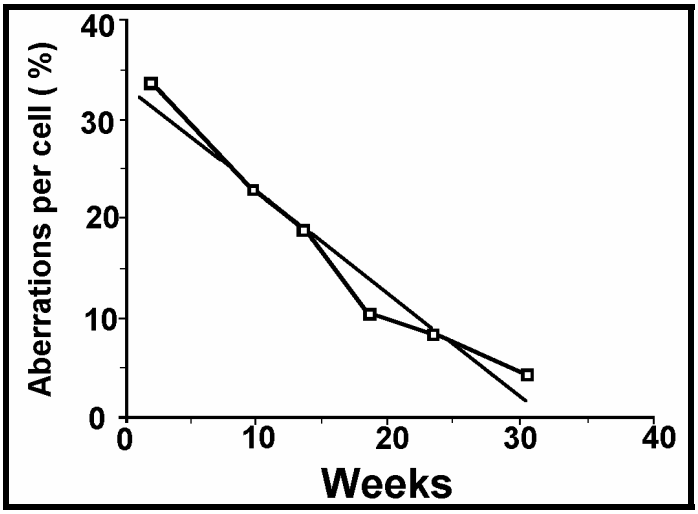

Figure 11: The time-dependent decrease in the number of chromosome aberrations for subjects with high numbers of chromosomal impairments, y = 0.318 - 0.010x, r=0.98. Garaj-Vrhovac and Fucic (1993).

Figure 11 shows the man who had 33 % CA which was followed over 30 weeks following this exposure. The repair rate follows a significant linear rate (r=0.98), dropping from 33% to 3% over 30 weeks, 1 %/week.

CA Repair rates in other workers are shown in Figure 12.

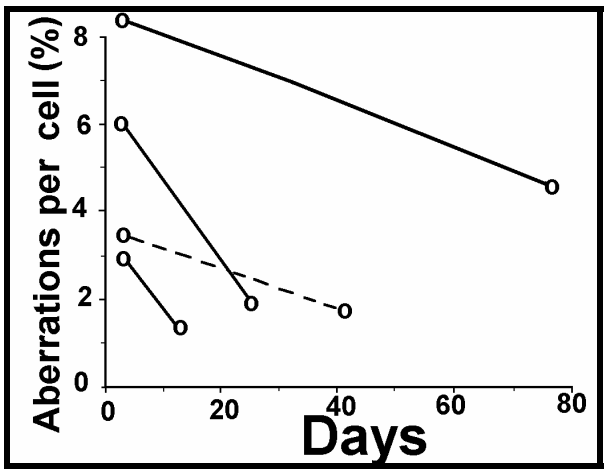

Figure 12: Decreases in human blood Chromosome Aberrations over time from microwave exposed radar repair workers, Garag-Vrhovac and Fucic (1993).

Two different rates are evident. Two at 0.6 to 1.1 %/week and two at 0.25 to 0.35 %/week. The authors note that Sagripanti and Swicord (1986) showed that microwave radiation damaged single-strand DNA and the Szmigielski (1991) showed that out of 29 epidemiological studies in the previous decade, 22 suggested a relationship between various neoplasms and exposure to electromagnetic fields.

Figure 13 shows the actual microscopic images of chromosomes in human blood taken from a radar exposed man.

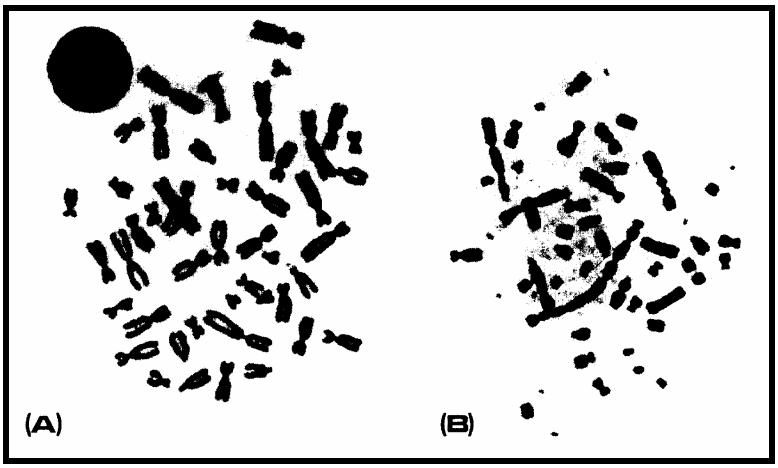

Figure 13: Chromosomes from the highly exposed subject, (a) before exposure and (B) after accidental exposure to a microwave radar signal, Garaj-Vrhovac et al. (1993).

There is no doubt that the radar exposure damaged the chromosomes. The damage is highly visible. Figure 13 shows that after microwave exposure there were many acentric, dicentric, polycentric, fragments, chromatid, ring chromosomes, chromosome breaks and chromatid interchange.

Garaj-Vrhovac (1999) found that 12 workers occupationally exposed to microwave had significantly increased chromosome damage as well as disturbances in the distribution of cells over the first, second and third mitotic divisions.

Quite independently, Maes et al. (1993) found highly significant ($p<0.001$) increases is the frequency of chromosome aberrations (including dicentric and acentric fragments) and micronuclei in human blood exposed to 2.45 GHz microwaves to 30 to 120 minutes in vitro. The micronuclei assay showed a dose response with time, Figure 14.

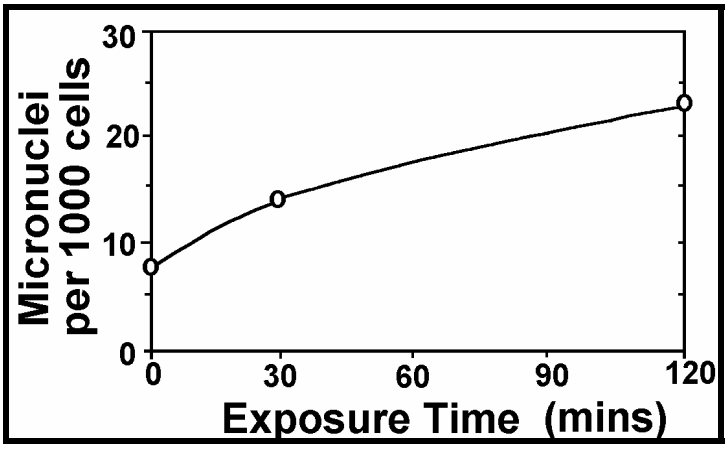

Figure 14: Micronuclei in microwave exposed human lymphocytes, the average of 4 donors, Maes et al. (1993). Exposure was to 75 W/kg, 2.45 GHz microwaves pulsed at 50 Hz, under controlled isothermal conditions

Maes et al. (1997) observed elevated CAs from microwave exposure. Koveshnikova and Antipenko (1991a,b), Haider et al. (1994) Timchenko and Ianchevskaia (1995), Balode (1996), Mailhas et al. (1997) and Vijayalaxmi et al. (1997), and Pavel et al. (1998) have reported significant chromosome aberrations from RF/MW exposures.

Vijayalaxmi et al. (1997) chronically exposed cancer prone mice to 2.45 GHz CW microwaves at an SAR of 1 W/kg for 20 hr/day, 7 days/week for 18 months. Their aim was to determine whether microwaves were genotoxic through determining if there was significant chromosome damage. They found highly significant increases in micronuclei in peripheral blood, from 8 per 2000 cells in sham exposed mice to 9 per 2000 cells microwave exposed mice, and increase of 12.5 %, $p<0.01$. There was a significant increase of 6.6%, $p<0.025$, of micronuclei in the bone marrow. They also observed a significant 41 % increase in tumours in the exposed mice compared to the sham exposed mice.

This was a totally unexpected result from this group. A great deal of effort was put into playing down the implications. They describe the increase in peripheral blood as a 0.05%, by dividing the increase of 1 by 2000. This is not a significant increase and this is not the right comparison. It is a deliberate attempt to disguise their true result that shows that microwaves are genotoxic.

Between 1990 and 2000 another 15 studies have been added to bring the total to at least 21. Concerns about the health effects of cellphones led to two studies finding that cellphone-type radiation significantly damages chromosomes. This is not surprising given the very large evidence already published showing that RF/MW damages chromosomes in similar manners to c-mitotic chemicals and ionizing radiation. This description was first given in 1959.

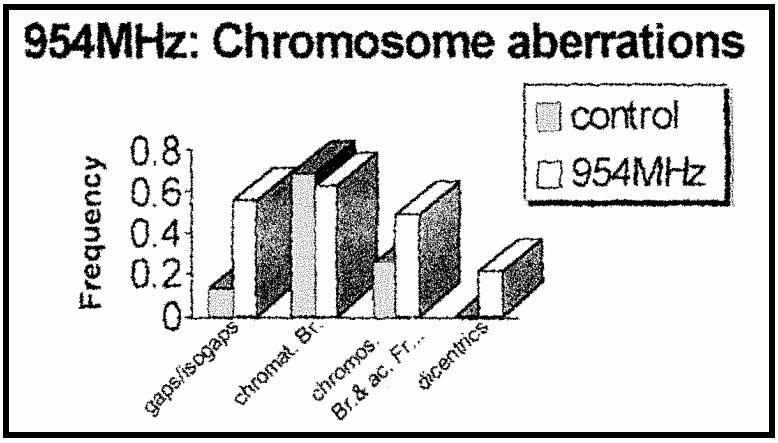

Figure 15: Cellphone radiation of 954 MHz significantly enhances several types of chromosome damage including gaps, acentric and dicentric aberrations, Maes et al. (1996)

Tice, Hook and McRee (1999) showed chromosome damage from all cell phones tested, all being statistically significant and all but one highly significant with dose-response relationships up to a factor of three increase in chromosome aberrations. They repeated the experiment and confirmed that the results were robust and not an artifact. Dr Roti Roti is reported in Carlo and Schram (2001) to have found that cellphone radiation significantly increased micronuclei formation.

Multiple independent studies, in 24 papers, show increases and most show significant increases in chromosome aberrations from RF/MW exposure. Four studies show dose-response relationships. This is more than adequate to classify RF/MW radiation as genotoxic.

The evidence that RF/MW is genotoxic is also confirmed by direct measures of DNA strand breakage, Lai and Singh (1995, 1996,1997). Two other laboratories have recorded RF/MW produced significant DNA stands breaks. Verschave et al. (1994), who used a GSM cell phone signal to expose human and rat peripheral blood lymphocytes, found significantly increased strand breaks at high, but non-thermal exposure levels.

Phillips et al. (1998) exposed Molt-4 T-lymphoblastoid cells the a range of cell phone radiation in the SAR range 0.0024 W/kg to 0.026 W/kg for both iDEN and TDMA signals. Using the basic equations, these SARs at the 813-836 MHz range [SAR = $\sigma E^2/2\rho$, σ=1 S/m, ρ=1000 kg/m^3, and S = $E^2/3.77$ μW/cm^2, E: the electric field gradient in V/m and S the exposure in μW/cm^2] result in 1.3 to 13.8μW/cm^2. A 2 hr exposure to these low levels of cell phone radiation significantly increased ($p<0.0001$) or decreased ($p<0.0001$) the DNA damage. Decreased DNA damage is evidence of increased repair that is evidence of damage, Meltz (1995). Significance at these levels is often taken as causal.

Two studies also show that cellphone radiation significantly increases gene activity. Cellphone radiation (836.55 MHz) significantly altered c-jun transcript levels, Ivaschuk et al. (1997). Cell phone radiation significantly enhances the proto oncogene c-fos activity in C3H 10T 1/2 cells, from a 40 % ($p=0.04$) increase from a digital cell phone and a 2-fold increase ($p=0.001$) from an analogue cell phone, Goswami et al. (1999).

Balcer-Kubiczek and Harrison (1991) observed a significant dose response increase of neoplastic transformation in a standard cell set (C3H/10T1/2) from a 24 hr exposure to 2.45 GHz microwaves. The transformation was assayed after 8 weeks of exposure to a known cancer promoter chemical TPA, Figure 16. The method was confirmed with a positive control using X-rays. This also showed that 60Hz magnetic fields also significantly increased neoplastic transformation.

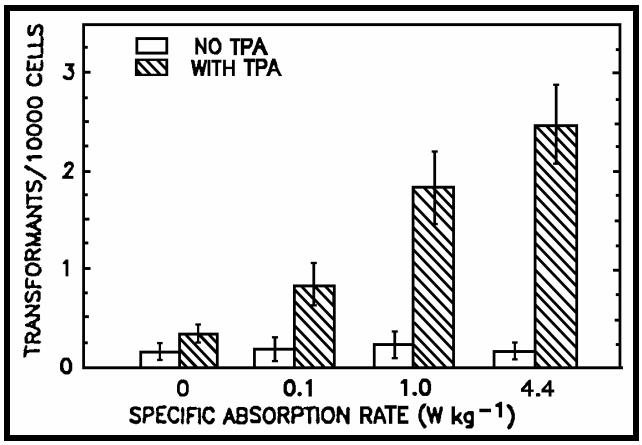

Figure 16: Dose-response relationship for induction of neoplastic transformation in C3H/10T1/2 cells by a 24h exposure to 2.45 GHz microwaves at the specific absorption rate (SAR) with and without TPA post-treatment for 8 weeks, Balcer-Kubiczek and Harrison (1991).

Taken together, over 30 studies strongly show that RF/MW exposure is genotoxic.

As shown above, genotoxic substances cause cataractogenesis, Worgul et al. (1996). The RF/MW exposure levels of the eyes in some hyperthermia cases is very high. The safe level of genotoxic substances is zero because they damage cell-by-cell. Hence I conclude

that the cataracts and blindness was caused by the RF/MW exposure in the treatment by some hyperthermia treatments.

Other Side-Effects:

Some patients report that they have serious verbal memory loss, disturbance of sleep, severe depression and considered suicide. All of these symptoms have been shown to be associated and caused by EMR exposure in occupation and resident's studies.

Cellphone usage has produced dose-response increases in several symptoms in a very large Swedish study, Mild et al. (1996), Figure 17.

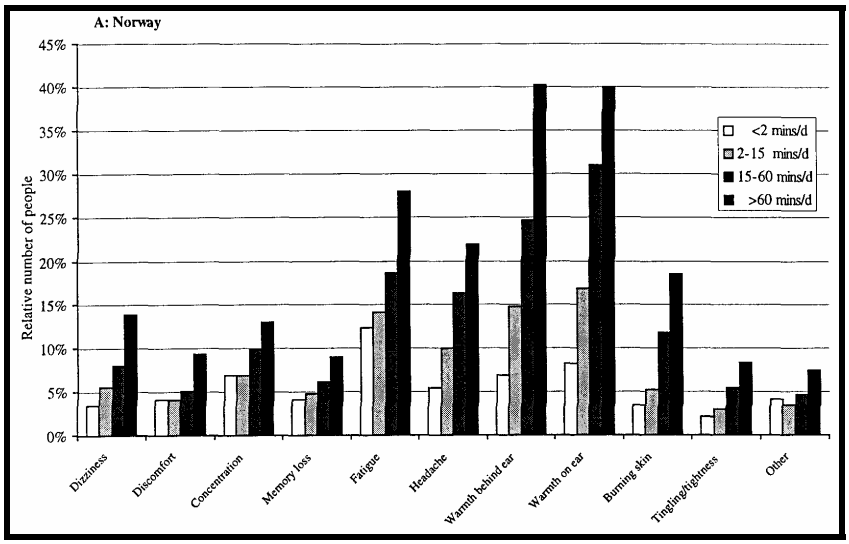

Figure 17a: Prevalence of symptoms for Norwegian mobile phone users, mainly analogue, with various categories of length of calling time per day, Mild et al. (1998).

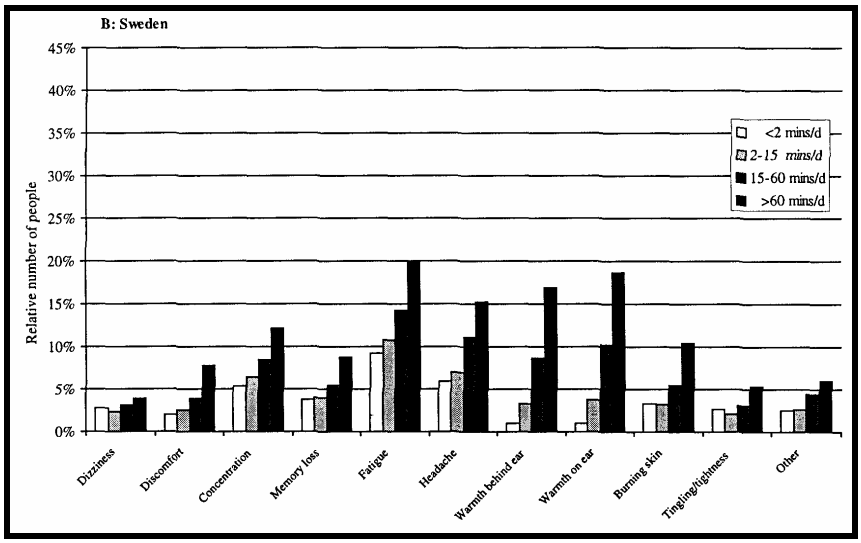

Figure 17b: Prevalence of symptoms for Swedish mobile phone users, mainly digital, with various categories of length of calling time per day, Mild et al. (1998).

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).

Sleep Disturbance near a Shortwave Radio Tower, Schwarzenburg, Switzerland:

The Schwarzenburg Study, Alpeter et al. (1995) and Abelin (1999) showed a causal relationship of sleep disturbance with exposure to a short wave radio signal. The effect is assessed as causal because of the significant dose response relationship, the variation of sleep disturbance in two experiments, one involving changing the beams and one turning the transmitter off, and the identification of significant melatonin reduction. Professor Abelin told seminars in Christchurch that they had measured a significant increase in melatonin after the tower transmission was turned off permanently compared to the levels while it was on.

Groups B, R and C are all exposed to a mean RF signal of less than 0.1μW/cm^2 and they experienced highly significant sleep disturbance and reduced melatonin. Since sleep disturbance, Mann and Roschkle (1995), and melatonin reduction has been observed with cell phone exposure, Burch et al. (1997).

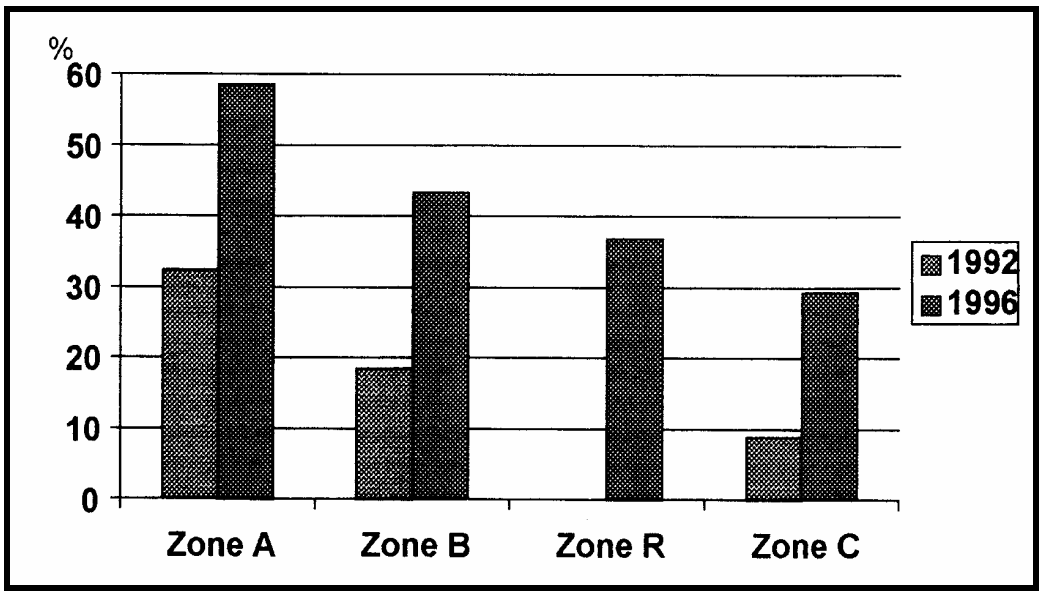

Figure 18: Adult Sleep Disturbance with RF exposure at Schwarzenburg, Switzerland, Abelin (1999).

Sleep disruption occurs in a dose-response manner with a threshold below 0.1nW/cm^2. ie. very close to zero, Figure 19.

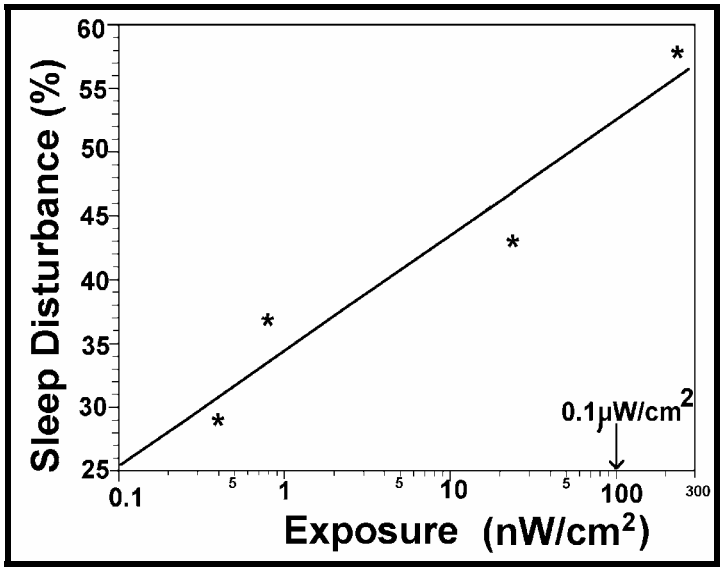

Figure 19: Dose-response relationship for Sleep Disturbance at Schwarzenburg with exposure in nW/cm^2. Note: 1nW/cm^2= 0.001μW/cm^2

Suicide in U.S. Electric Utility Workers:

A very large study of men working in U.S. electric utility companies included monitoring time weighted average ELF exposures of 2842 people and the identification of 536 deaths from suicide and 5348 controls. For recent exposure and 1 to 5 years of recent exposure there were significant dose-response relationships with cumulative exposure to electromagnetic fields. The recent exposure result is shown in Figure 20.

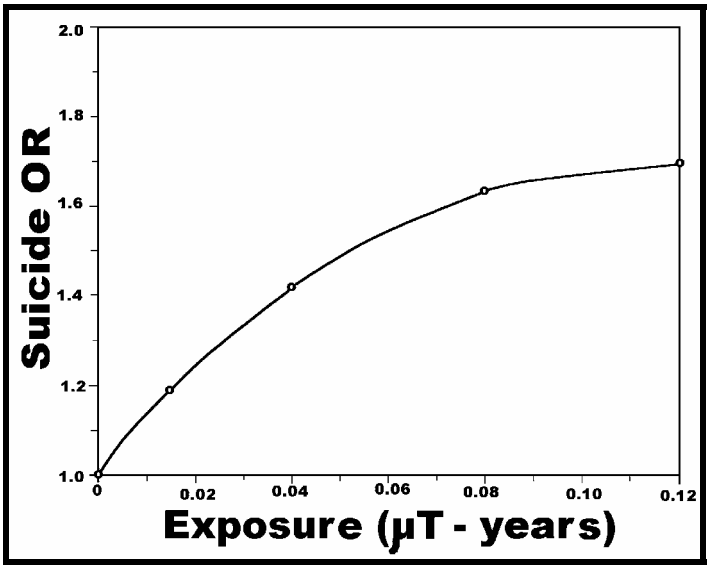

Figure 20: Dose response relationship of Suicide after recent monitored exposure to cumulative 50 Hz magnetic fields for men <50 years, adjusted for work, class, location and exposure to sunlight and solvents, Van Wijngaarden et al. (2000).

This confirms the results of Perry et al. (1981) who found a highly significant association between suicide and the exposure to magnetic fields from High Voltage Powerlines. Baris and Armstrong (1990) also found RF exposure shows a significant 53% increase in suicide or British Radio and Radar Mechanics, and 156 % increase for Telegraph radio operators.

Summary and Conclusions:

There is very strong scientific, biological and epidemiological evidence that the microwave breast cancer treatment used by some treatments can cause patient's cataract and blindness and the other side-effects, disturbance of sleep, memory loss, loss of concentration, headaches, serious depression and possible suicide. These effects were caused because when doctors fail to protect all other tissues from the Microwave exposures. I believe that most doctors using microwave hyperthermia treatment are unaware of this strong evidence that microwaves are genotoxic and this it is the reason that their cancer treatment enhances the cancer cells increases cell death rate. It is strongly important to focus the signal and protect all other tissues.

The conclusions of this evidence is confirmed from a recently published study of cellphone usage causes eye cancer. Stang et al. (2001) found that cellphone usage 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. Cellphones emit microwaves that have been shown in studies cited above to be genotoxic. It is therefore scientifically plausible and proven that microwaves, including cellphone radiation, is genotoxic and causes cancer and also causes increase risks of Cataracts.

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