Cardiac Effects of Natural and Artificial EMR:

Dr Neil Cherry
Associate Professor of Environmental Health

16th December 2002

Neil.Cherry@ecan.govt.nz

© Dr Neil Cherry 2002-2005

Human Sciences Department
P.O. Box 84
Lincoln University
Canterbury, New Zealand

Cardiac Effects of Natural and Artificial EMR:

Dr Neil Cherry
Lincoln University
Canterbury, New Zealand

16/12/02

Neil.Cherry@ecan.govt.nz

Abstract:

The heart is a muscular organ whose regular coordinated contraction, called a heart beat, is regulated by an electrical pulse that initiates a cascade of calcium ions that carry the message into all the heart cells to initiate the contraction of the heart beat. Therefore it is biologically plausible that natural and artificial electromagnetic fields will interfere with the heart activity. It has been shown that external ELF fields cause altered calcium-concentrations in neurons and heart cells. Altered blood pressure is associated with the Schumann Resonance signal, along with its modulation of human heart disease and mortality rates in a homeostatic manner. Electrical and electronic workers, radio/TV workers are shown to have increased risks of heart disease and mortality. We all live in electromagnetic fields which act to contribute to increase the rate of cardiac disease and death. A new high risk factor is the usage of a cellphone. Cellphones have been shown to interfere with electronic pacemakers. Therefore it is very reasonable that they will interfere with biological pacemakers, that is, our hearts. The use of a cellphone is associated with significant increase of blood pressure. This is a symptom of hypertension and shows that there is a cardiac risk factor. This risk factor is strongly confirmed in the context of the Schumann Resonance signal effects, electrical workers effects and altered cardiac functions in radio, TV and radar exposed workers.

Introduction:

A primary principle of Environmental Health is a necessity to understand how the natural system works before we can appreciate and understand how artificial signals and chemicals can alter the natural functions and cause human health effects. Muscular contraction and relaxation is regulated by the motor neuron system for skeletal muscles. Electrical signals come from the brain through a particular circuit, through the spine, to the motor neurons in the particular muscular system. This signal initiates a coordinated alteration of the calcium ion cell messengers which alters the contraction or relaxation of those muscles.

Heart muscle cells are very similar to the skeletal muscle cells, Alberts el al. (1994). Muscle contraction is initiated by a sudden rise in cytosolic calcium ions (Ca^{2+}). For the skeletal muscle force-generating molecular interaction takes place only when a signal passes to the skeletal muscle from its motor nerve. The signal from the nerve triggers an action potential in the muscle cell plasma membrane, and this electrical excitation spreads rapidly into a series of membranous folds, the transverse tubules that extend inward from the plasma membrane around each myofibril. A signal is then laid across a small gap to the sarcoplasmic reticulum, Figure 1.

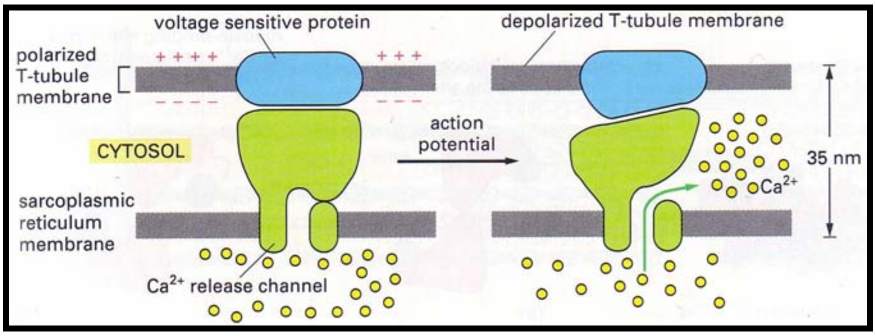

Figure 1: Schematic diagram showing how a calcium ion release channel in the sarcoplasmic reticulum membrane is thought to be opened by a voltage-sensitive transmembrane protein in the adjacent T-tubule membrane, Alberts et al. (1994).

When you see how electrical signals and ions have so many important roles in cells, controlling muscles and hearts, and many other bodily functions, through the electrical signals in the brain that are sent from the brain to the central nervous system and the motor neuron system, the opened understanding is that external electromagnetic fields can interfere with the body's systems. Certain organs such as the brain, the central nervous system and the heart, are very reliant on the electromagnetic signals and all the body's cells use many electromagnetic signals for their natural functions.

One of the earliest electromagnetic fields biological effects found and which is now well-established, is the calcium-ion efflux and influx of the cell membranes induced by extremely low-frequency (ELF) electromagnetic fields typically in the similar range of the brain EEG system frequencies. Another of the brain's most active frequencies is the alpha rhythm including 16 Hz. Dr Ross Adey's team showed that brain cells have been very strong in efflux and influx Ca^{2+} changes when exposed to 16 Hz fields and modulated RF/MW radiation Figure 2.

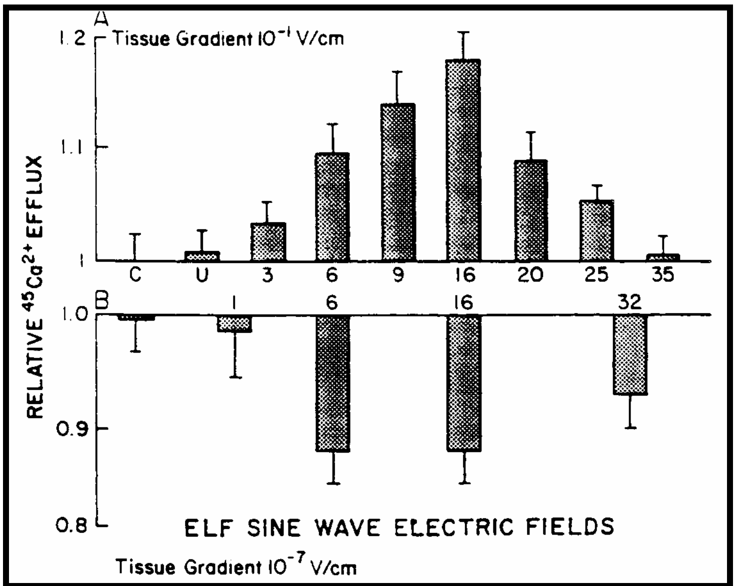

Figure 2: Relative Ca^{2+} efflux from an ELF modulated 147 MHz signal and (B) influx from the same external field strength (56V/m) but solely an ELF field, Adey (1988).

Figure 2 also indicated the strength of the induce fields in the tissue which for the RF field is 0.1V/m, a million times higher than the ELF field, 10^{-7}V/m. This I call the "EMR Spectrum Principle" because it is well-established that the higher the carrier frequency the higher the induced tissue electric gradient and induced tissue current strength. This means that biological and health effects of RF/MW exposures will be found to be much higher from much lower intensities than from ELF fields.

Dr Adey was basing his insights on a fascination with discovering how neurological tissue operated and how it was altered in extremely low level RF/MW and ELF fields. The current world leader in Ca^{2+} efflux research is Dr Carl Blackman of the U.S.E.P.A. Blackman has replicated and significantly extended the studies carried out by Dr Adey's group and other groups. Dr Blackman has produced over 20 peer-reviewed publications in this area, including several major reviews.

Blackman et al. (1989) identified multiple power density windows for Ca^{2+} efflux, using a 50 MHz carrier modulated at 16 Hz. Their results, using units of mW/cm^2, are summarized as follows:

No change	0.75		2.30		4.50		5.85		7.08			8.19	8.66		10.6	14.7
Enhanced efflux		1.75		3.85		5.57		6.82		7.65	7.77			8.82		

The intensity window data was considered as an example of non-linear dynamics because there appears to be no progressive decline in the magnitude of the effects at low exposure intensities. This data is consistent with a fractal process with a non-integer dimension which is approximately 1.4, Blackman et al. (1989).

The lowest published RF intensity that has been documented to produce significant Ca^{2+} efflux is 0.00015 W/kg from Schwartz et al. (1990). They used frog hearts, exposed for 30 mins, to a 16Hz modulated 240 MHz RF signal. This has an exposure intensity of about 0.4μW/cm^2.

Hearts use natural electric pulses to produce heart-beats. An electric pulse produces a cascade of calcium ions that cause the heart muscle to contract. The Electrocardiogram (ECG) is used to monitor heart activity and can detect heart disease through the altered electrical signals. Hence it is biologically plausible that electric signals, that are shown to interfere with artificial pacemakers, can also interfere with the natural heart-beat. This has been shown in several studies in relation to reduction of the heart rate variability (HRV). This is a known risk factor for heart disease.

Another important biophysics principal is the resonance interaction process. When an external frequency matches a natural internal frequency there is a very strong interaction from the process of resonance.

With the modern widespread use of mobile phones which expose the user's ear to much higher intensities of microwaves than radar repair workers usually receive, there is a real concern that the use of the phones and the close relation of cell site base stations near homes, cause possible or actual health effects. This review report has established that electromagnetic fields and radiation are plausibly changing non-thermal biological effects, and that resonant interactions are plausible because of the natural frequencies of the electromagnetic fields in the body. Therefore the evidence is that natural global electromagnetic fields are associated with cardiac health effects. When the evidence of cardiac effects in electrical and electronic workers is considered, along with the evidence from radio frequency and microwave exposures for workers and military personnel, then it is found in epidemiological studies that they will also have elevated cardiac disease and mortality rates.

This review will include health effects found in physiotherapists whose work involved exposures to short waves and microwaves used for diathermy of patients.

Cardiac Associations with the Schumann Resonance Signal:

Cherry (2002) shows that the Schumann Resonance (SR) signal is the highly plausible biophysics mechanism, using the melatonin mechanism, for explaining how Solar and Geomagnetic Activity (S/GMA) causes serious human health effects in homeostatic relationship to the Schumann Resonance signal intensity including cancer, cardiac, reproductive and neurological diseases and mortality. The cardiac effects are summarized below.

S-GMA related Cardiac effects:

A 35-year old cardiologist, with a family history of hypertension and stroke, used an electronic blood pressure monitor to record his blood pressure every 15 minutes for 3 years. This revealed a significant periodicity of 27.7 days in systolic and diastolic blood pressure and heart rate, which was coherent with the GMA Kp-index, Watanabe et al. (1994).

An Italian study of 447 patients with hypertension also found very significant correlations between systolic and diastolic blood pressure and GMA indices over a 5-year period, Ghione et al. (1998). A multiple correlation with potential confounding factors, such as age and date, confirmed the significant correlation with GMA. Stratifying the days into quiet, disturbed and highly disturbed GMA days consistently showed significantly higher values in the highly disturbed days for all blood pressure parameters, except for systolic night-time pressure. The difference between quiet and highly disturbed GMA days was 6 to 8 mm for the 24 hour systolic and diastolic blood pressure. The GMA indices and the blood pressure measurements contain the 27-day period. The authors concluded that these results seem to reflect a real relation between geomagnetic disturbances and blood pressure.

The solar rotation cycle is just below 28 days and it produces the same frequency in the Schumann Resonance signal, Figure 3(a), with sub-harmonic period peaks at, 28, 14, 11, 9, 7 and 3.5 days. The daily admission of patients to the Christchurch, New Zealand hospital for arrhythmic cardiac symptoms has its frequency shown in Figure 3(b) with periods of 28, 14, 9, 7, 5.6, 4.6, 3.5, 2.8 and 1.8 days. This shows a very strong relationship between the Schumann Resonance signal and the loss of synchronization of their heart's rhythm modulated by the solar 27/28 day cycle.

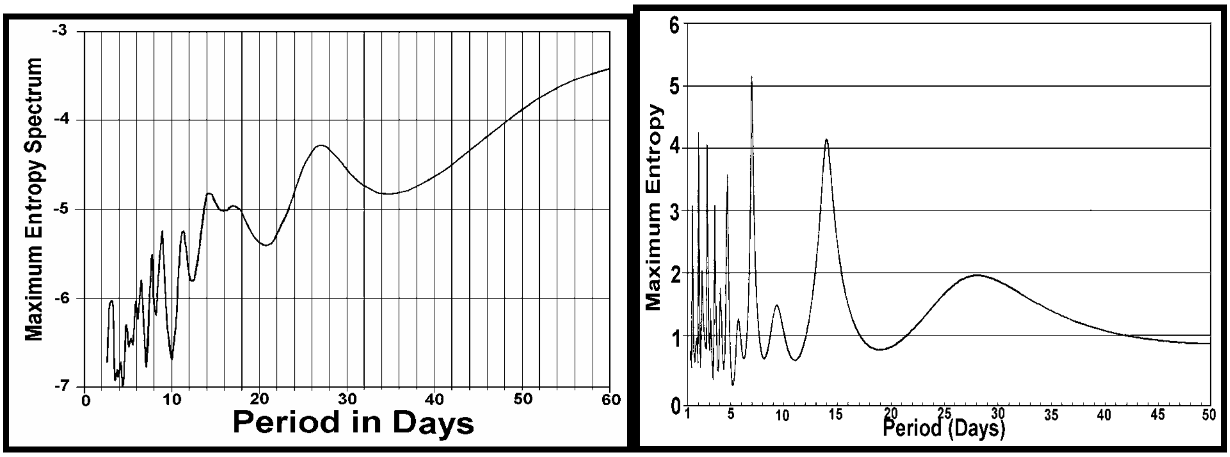

Figure 3: Maximum Entropy Spectrum of (a) The Schumann Resonance Intensity, 1997-99 (left) and (b) for the Cardiac Arrhythmia admissions to Christchurch Hospital, 1997-99 (right).

Because Melatonin is a natural highly potent antioxidant, reduced Melatonin enhances cell death. Geomagnetic activity is associated with reduced Melatonin in more than 6 published studies. Therefore it is plausible that reduced Melatonin, associated with solar and GMA, can be associated with increased rates of heart attacks. Geomagnetic Activity is also correlated with blood pressure changes in at least two independent studies. Hence a correlation with hypertension mortality was investigated and found, Table 1.

Table 1: Correlation parameters of cardiac mortality in Thailand and Sunspot Number, The gradient is the number of Cases per 100,000 people /100 sunspots, Cherry (2003).

Disease	Correlation Coefficient	t-value	p-value	Gradient
Hypertension (Male)	0.8497	6.2422	0.000012	0.7438
Hypertension (Female)	0.6653	3.4516	0.00329	0.5718

These correlations with Hypertension show some of the highest t-values and significance, confirming the sensitivity of the heart to altered electrical activity, the Schumann Resonance signal and reduced Melatonin.

Because the Schumann Resonance signal is extremely highly correlated with the sunspot number, Cherry (2002), I have produced graphs of the annual Hypertension mortality in Thailand with the annual sunspot number, Figure 4.

Two independent studies, Watanabe et al. (1994) and Ghione et al. (1998), show that human blood pressure is significantly correlated with GMA and a study shows that arrhythmic heart disease is correlated with acute variations in SR signal and another study produced here for the annual hypertension mortality is highly related to the SR signals and sunspot numbers.

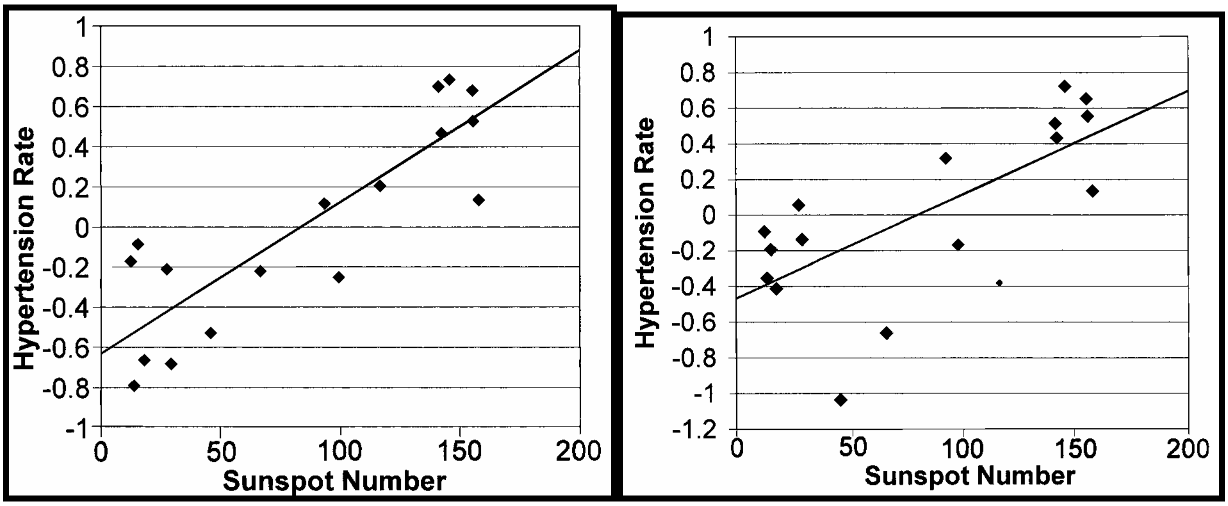

Figure 4: Annual Hypertension Mortality in Thailand related to the sunspot number as an indicator of the annual Schumann Resonance signal strength, Males (left) trend p=0.000012 and Females (right) trend p=0.0033.

Schumann Resonance-S/GMA melatonin reduction links:

Melatonin is a diurnal blood pressure regulator. S-GMA, through the Schumann Resonance signal, modulates human melatonin level, therefore these studies confirm that blood pressure change is a melatonin-related biological effect of S-GMA. Hence it is biologically plausible that extreme levels of S-GMA will cause a wide range of cardiac health effects and death.

Burch et al. (1999b) found that the strongest factor reducing melatonin in electrical workers, in addition to their occupational ELF and 3-phase exposures and cell phone usage, was the Geomagnetic Activity, in a dose-response manner, Figure 5. The Schumann Resonance signal, has a mean field strength of 0.1pW/cm^2 with a mean magnetic field strength about 1-3pT.

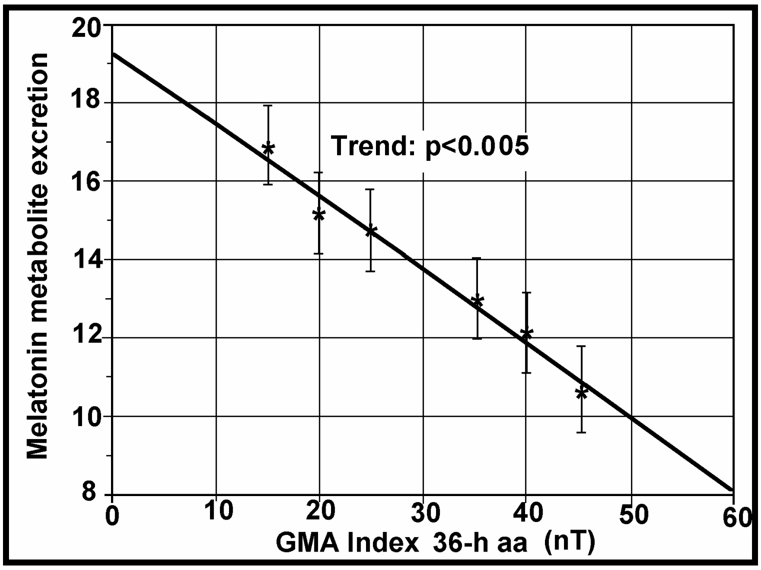

Figure 5: Reduction in the melatonin metabolite 6-OHMS in μg in urine from U.S. electric utility workers, as a function of the 36 hr global GMA aa-index, Burch et al. (1999).

Burch et al. (1999) showed a probable causal link between the Schumann Resonance signal and reduced melatonin, Cherry (2002). In addition there is Weydahl et al. (2001) and Rapoport et al. (1997, 1998, 2001). Bardasano et al. (1989) observed an extremely significant reduction ($p<0.001$) in synaptic ribbons of pinealocytes of rats during geomagnetic storms compared with quiet solar days. Thyroxine levels in a single limbic epileptic patient were highly correlated ($r = 0.66$) in a dose-response manner, with daily GMA, O'Connor and Persinger (1996). The strongest association ($r = 0.76$) was found between thyroxine levels and the Kp index during the previous night (2 am to 5 am). These analyses were carried out specifically to test the GMA Melatonin mechanism and they support it.

This is strong enough evidence to conclude that there is a causal link between reduced melatonin in people and animals and Solar/Geomagnetic Activity through the Schumann Resonance mechanism.

Reduced melatonin produces arrhythmic cardiac activity. The cardiac activity of rabbits was monitored during two GMA storms, Chibisov et al. (1995). At the initial and main phase of the storm the normal circadian structure of the cardiovascular parameter was lost. Desynchronization grew during the storm, leading to an abrupt drop of cardiac activity during the main phase of the storm. This was followed by the destruction and degradation of cardiomyocytes. The parameters of cardiac activity became significantly synchronized and the circadian rhythm restored during the storm's recovery period.

Human patients with ischemic heart disease (47-men and 33-women) were monitored for cardiac parameters daily over for 2-3 weeks, Gurfinkel et al. (1995). Changes in their microcirculations were related to GMA and to changes of atmospheric pressure. In the first day of a GMA storm pathological changes of capillary flow were detected in 71.5% of patients with acute myocardial infarction (men: 73.7%, women: 69.2%). They also observed perivascular edema, red blood aggregation, delay and slowing down of capillary flow. Similar changes were detected in 64.8% of patients with angina pectoris, (men: 73.3%, women: 56.3%). The reactions of these patients to GMA disturbances were over 2.5-times higher than the effects of atmospheric pressure changes.

GMA events are significantly correlated with increased blood coagulation and platelet aggregation, Pikin, Gurfinkel and Oraevskii (1998). Blood pressure, capillary flow, blood coagulation and aggregation changes are observed during GMA events, consistent with the effect expected with reduced melatonin in people with heart disease. Therefore, it is reasonably predicted that GMA will be associated with observable changes in cardiac disease and death when large human populations are studied.

Agadzhanian and Makarova (2001) studied changes in a number of respiration and circulation parameters during magnetic storms of varying intensities. The results were analyzed in 126 normal humans belonging to two age groups: 19-21 yr. old young men and women (29 of each) and 51-53 yr. old men ($n = 36$) and women ($n = 32$). Geomagnetic components D, H and Z were used. Systolic pressure, respiration volume, minute respiration volume and peak expiration rate were shown to be the most labile characteristics of the cardio-respiratory system responding by increases on magneto-disturbed days. The parameters under study exhibited sexual and age differences equally on quiescent and magneto-disturbed days. Adaptation to growing tension of the magnetic field of Earth involves the neuroendocrine system and manifests itself by activation of the sympathetic nervous system entailing relative shifts in the cardio-respiratory parameters under study.

GMA Related Human Cardiac Disease and Death:

Early correlations between S-GMA and heart attacks were assumed by some authors to be spurious, inaccurate and inconsistent, Malin and Srivastava (1979, 1980) and Knox et al. (1979). Results found in India were not confirmed in populations in the U.S. These were seen as inconsistent. The lack of a plausible mechanism also made these results not credible to some researchers. The masking of the natural signals effects by artificial EMR exposures in developed countries is a plausible explanation of the results. In the 1990's many other studies identified relationships that are highly significant and consistent with the original results.

With clinical measurement being able to identify highly significant changes in blood pressure, blood flow, aggregation and coagulation during GMA events, these results are highly plausible. They are mediated by melatonin in the normal diurnal and seasonal cycles. Since melatonin is also significantly correlated with levels of GMA during solar storms this will also have cardiac effects. Reduced melatonin is associated with cardiac arrhythmia and heart rate variability in clinical studies cited above.

De Bruyne et al. (1999) studied older heart patients (>55 years) and compared their heart rate variability (HRV) with their increased risk of mortality from myocardial infarction. They found that both decreased and increased HRV were significant risk factors, with increased HRV being the greater risk factor. This shows a timing related homeostatic relationship and GMA events are related to desynchronization of cardiac rhythms. Measured HRV also demonstrates anomalies in myocardial infarction, sudden death, heart failure, autonomic neuropathy and hypertension, Kerut, McKinnie and Giles (1999).

The EEG pattern, pulse rate, blood pressure and rate of sensomotor reaction were measured in a group of people. The parameters significantly correlated these physiological variables with the Kp-index, Doronin et al. (1998). They noted that the oscillations in the Kp-index had identical periods in the monitored EEG Alpha-Rhythm. This confirms the whole-body changes that occur in conjunction with GMA alteration by changing the brain and heart patterns. This supports the Model that suggests that the brain wave pattern is changed, involving alteration of ELF brain signals, and this is transferred through melatonin receptors and the autonomic nervous system to the cardiovascular system.

Cardiac Effects of High GMA:

During periods of Active Sun and increased GMA the following statistically significant effects have been observed:

- Cardiac Arrhythmia in children, Markarov (1998).

- Novikova and Ryvkin (1977) observed a consistent and significant increase in heart attack incidence and death between active and quiet GMA conditions for 1961-66 at Sverdlovsk, USSR.

- GMA is highly correlated with daily myocardial infarction incidence rates during big GMA storms, Villoresi et. al. (1998).

- GMA activity is also correlated with sudden cardiovascular death, Sitar (1990), and Ischaemic Heart Disease mortality, Otto et al. (1982).

- Monthly solar activity was highly significantly correlated with monthly hospital admissions for cardiovascular disease, Stoupel and Shimshoni (1991). Solar activity is highly correlated with GMA and SR intensity.

- Stoupel et al. (1997) observed that during periods of low solar and geomagnetic activity, solar proton fluxes were correlated with cardiovascular deaths.

- Oraevskii et al. (1998a) found that 75 % of GMA storms caused an increased of the hospitalization of patients with myocardial infarction by 30 to 80%.

- Oraevskii et al. (1998b) report that MIR space orbital station staff experienced a significantly increased heart rate, reduced heart rate variability and decreased respiratory waves, corresponding with a specific adaptation of stress-reaction. At the same time hospital patients with ischemic heart disease had a similar reaction including deterioration of the physiological status, rheologic blood characteristics and heart rate disturbances, associated with GMA disturbances.

- Breus et al. (1998) report disturbance of cardiovascular activity among MIR astronauts during the main phase of solar storms compared to the recovery phase. Similar effects were observed in rabbits.

Cardiac Effects of Low GMA;

Periods of Quiet Sun activity are significantly associated with:

- Stoupel et al. (1990) found a highly significant correlation (p=0.01) for higher pregnancy induced hypertension for monthly periods of low GMA.

- Sudden death from cardiac arrhythmia, especially paroxymal atrial fibrillation, and stroke, Stoupel (1993) and Stoupel et al. (1995a). Stoupel, Martfel and Rotenberg (1994). Stoupel, Martfel and Rotenberg conclude that their results are consistent with previous studies showing increased heart electrical instability during periods of lowest geomagnetic activity.

- Ischaemic Heart Disease for ages >70 years. Stoupel et al. (1995b).

- Stoupel et al. (1999) found a very highly significant inverse correlation (r= -0.64, p=0.0001) for a 72 month period between solar activity and stroke/ischemic heart disease death. They concluded that monthly ratio of deaths from stroke/ischemic heart disease is related to environmental physical activity.

Conclusions about Cardiac relationship to the Schumann Resonance Signal:

The cardiac studies are consistent with the Schumann Resonance Hypothesis and add considerable weight to the melatonin, homeostatic and arrhythmic factors in the Hypothesis, Cherry (2002). Blood pressure, blood coagulation, heart attack, cardiac arrhythmia and sudden cardiac death are highly correlated with GMA in a homeostatic (U shaped) manner. This data is consistent with the involvement of melatonin. Being directly supported by clinical cardiovascular monitored changes of blood pressure, capillary flow and blood aggregation, multiple studies have very highly significant correlations with solar activity and GMA. This gives robust evidence supporting a causal relationship between GMA and Ischemic and arrhythmic cardiovascular disease, heart attack and death. The highly significant correlation between S-GMA and the SR signal intensity gives robust support for the SR Hypothesis through a Melatonin Mechanism.

Given the causal link to Cardiac Health and Mortality effect to the Schumann Resonance signal with a mean intensity near 0.1pW/cm^2 and magnetic field strength of about 1-3pT, it is extremely plausible that electrical workers chronically exposed to ELF fields about a million times higher (1-3μT) electromagnetic fields will experience serious heart disease elevated rates. It is also extremely plausible that people living in vicinity to cell sites and high powered radio and TV towers, airport radars etc, with field strengths typically around 0.1 to 5μW/cm^2, 1 million to 50 million times higher than the SR signal, will experience significantly elevated cardiac health and mortality rates.

ELF Occupational Cardiac Studies:

Satre, Cook and Graham (1998) observed significantly reduced heart rate variability (HRV) in volunteers sleeping in 60Hz fields. Reduced HRV is known to be an indication of heart disease risk.

This is a powerful set of epidemiological evidence showing that EMR across the spectrum increases the incidence and mortality from arrhythmia related heart disease and from heart attack. For the total cumulative exposure the rate of rise per year for Arrhythmic Heart mortality was RR/μT-year = 1.08, 96%CI: 1.03-1.12 and for Acute Myocardial Infarction, RR/μT-year = 1.04, 95%CI: 1.03-1.06.The following graph shows the dose-response curve for Acute Myocardial Infarction (Heart Attack) in electric utility workers, Savitz et al. (1999), Figure 6.

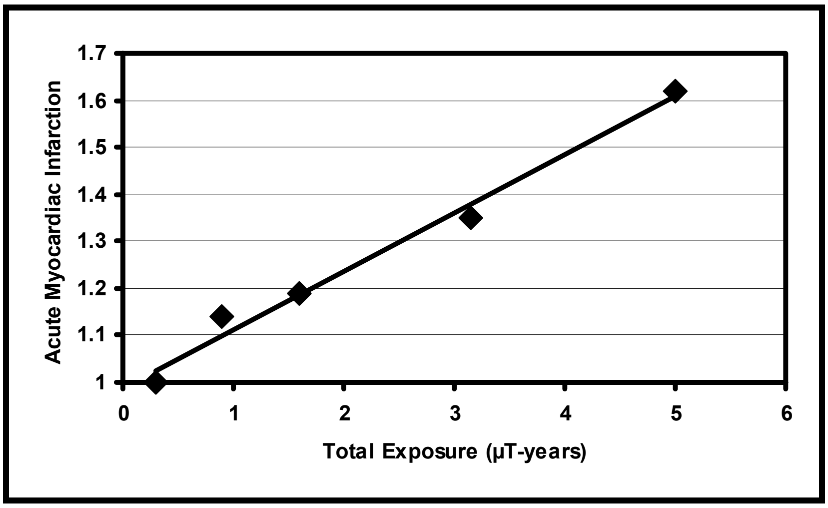

Figure 6: Acute Myocardial Infarction as a function of cumulative exposure to 60 Hz fields in U.S. electricity utility workers, Savitz et al. (1999), trend p<0.001.

Savitz et al. (1999) shows crude dose-responses for Cardiac Arrhythmia related heart disease, Figure 7, and a highly significant dose-response for Heart Attack, Figure 6, for exposed electrical occupations and for individual occupations of electrician, lineman and power plant operator.

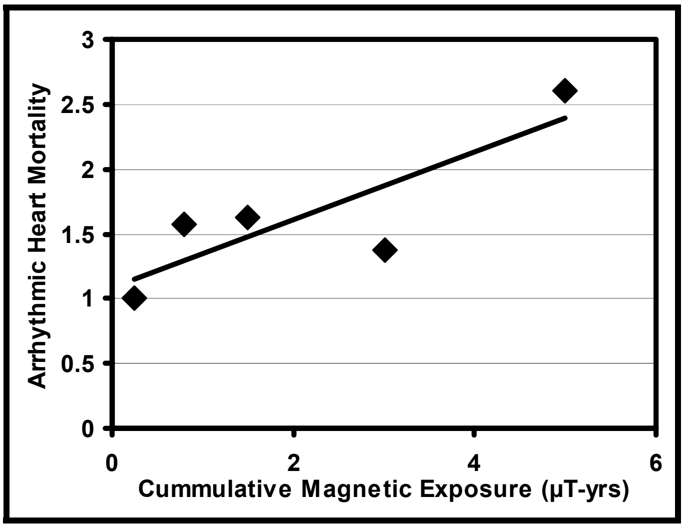

Figure 7: Arrhythmic heart disease mortality as a function of cumulative exposure to 60 Hz fields, with 5-year lag, in U.S. electricity utility workers, Savitz et al. (1999), trend p=0.07.

RF/MW Association with Heart Disease:

Extrinsic EMR signals interfere with hearts and cause heart disease and death. Bortkiewicz et al. (1995, 1996, 1997) and Szmigielski et al. (1998) found that RF exposure altered heart rate variability and blood pressure. Forman et al. (1982) present case studies of microwave exposed personnel with induced hypertension. Braune et al. (1998) showed that cell phone use significantly increased blood pressure.

The United States Embassy in Moscow was chronically exposed for over 10 years to a deliberately directed Soviet radar. The US State Department, after staff expressed concerns, got Professor Abraham Lillian of John Hopkins University to carry out a survey of staff health effects. Two reference groups were used. The general US public and comparison Eastern European Embassy staff and families. With years of tour service a number of illness rates rose significantly. In relation to the heart, the Vascular illness showed the strongest trends, Figure 7. The mean personal exposure was somewhat less than 0.1μW/cm^2.

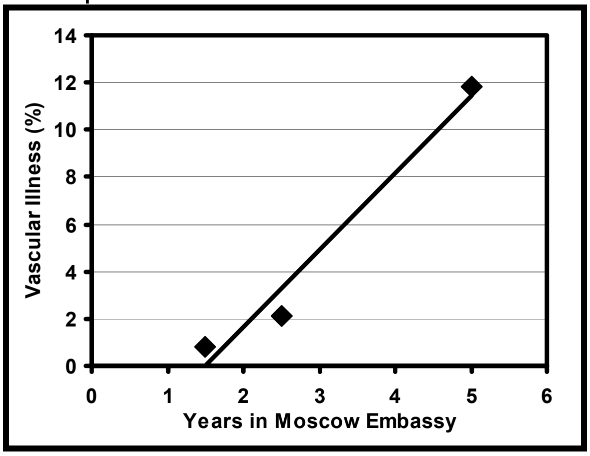

Figure 7: Vascular illness rate (%) in male staff at the United States Embassy in Moscow, for years of service while the Embassy was exposed to a very low intensity of a Soviet radar signal, Table 6.18, Lilienfeld et al. (1968). Trend p=0.004.

Seven young children of the embassy staff developed blood disorders during the first tour of duty. When compared with other US European Eastern Embassies the rate was over four times higher in the Moscow US Embassy, RR = 4.05.

The Korean War radar study, Robinette et al. (1980), assessed the relative greater radar pulse microwave exposure of U.S. Navy personnel in occupational groups of repairers versus users of the radar. Two higher exposed groups were AT and FT and a lower exposed group was ET. Comparing the cardiac mortality rate for “Diseases of the Circulatory System” in the FT+AT group compared with the ET group yields, RR = 1.27, 95%CI: 0.92-1.75, n=64. For hospital admissions, the diseases of blood forming organs yielded RR= 4.33, 95%CI: 1.53-12.3, p=0.001, and for the Circulatory system RR = 1.53, 95%CI: 1.07-2.18, p=0.007, and for Cardiovascular disease, RR = 2.03, 95%CI: 1.34-3.07, p<0.001.

These military occupational groups exposed to radar have elevated cardiac mortality and highly significantly elevated cardiac disease rates.

Hamburger, Logue and Silverman (1983) observed significant dose-responses for heart disease for male physiotherapists as a function of treatments per month with microwaves, OR = 2.51 (1.09-5.78), Trend p<0.05); shortwave, OR = 3.40 (1.56-7.39), trend p=0.005; and Combined Microwave and Shortwave, OR = 2.88 (1.21-6.70), trend p=0.025.

Dose-responses and consistent and significant elevation of disease rates and mortality gives evidence of a causal relationship. Therefore a causal relationship between radiofrequency and microwaves exposure and cardiac illness in this assessment, is causally related. This is strongly confirmed by the natural electromagnetic radiation, SR signal 0.1pW/cm^2, causal link to cardiac illness and death rates. This strongly indicates that cellphone use is likely to be a major risk of Cardiac Disease because of the extremely high levels of microwave exposure from cell phone is produced for the phone users. The Moscow Embassy data also indicates that the passive cellphone exposure is very likely to enhances the risk factors are cardiac illness. This is confirmed by an Austrian study around cell sites presented at the Ischia Congress in October 2001. The study is being carried out by Prof Michael Kundi, of the University of Vienna, and shows a dose-response rate of cardiac diseases from cell site's exposures.

Cell Phone Radiation Cardiac Activity:

Cardiac pacemaker interference:

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

Blood Pressure increase:

- Braune et al. (1998), Cellphone usage significantly increases blood pressure.

Quite often the cellphone companies fund research to challenge the independent results studies showing adverse effects linked to exposure to cell phone radiation. However, the SR signal, over a billion times weaker than the cell phone signal exposes of the user, show a significant blood pressure alteration in people and causes cardiac disease and death. Therefore it is logical and scientifically reasonable that cell sites exposures and cell phone usage will alter the blood pressure and increase the rate of cardiac diseases and mortality.

Conclusions and Recommendations:

The brain and the heart are very sensitive electromagnetically controlled organs. They work together to maintain a regulated and activity responsive circulation system to provide fluid, energy and oxygen throughout the body. Both of these organs are synchronized by the natural Schumann resonance signal. When solar energy and Geomagnetic Activity alters the Schumann Resonance signal, then neurological and cardiac functions in human populations are modulated. Because people are sensitive and reactive to this extremely subtle signal, it is not surprising that electrical workers and radar and radio exposed workers have significant and dose-response increases in cardiac disease and death rates. It is therefore strongly scientifically plausible, and confirmed by an Austrian study, that people living in the vicinity of cell sites experienced a dose-response of increase in cardiac illness. This shows that cell phone usage and passive cell phone exposure will not only interfere with electronic cardiac pacemakers but will also interfere with the natural cardiac pacemaker, the human heart. Therefore cellphone usage and the cellphone system is enhancing the cardiac illness and mortality rate in the community.

Santini et al. (2002) show that living in the vicinity of cell site exposure produces elevated neurological effects, many of which are shown in a dose-response manner. Another symptom also shown is a significantly calibrated as cardiovascular problems. A similar study in Austria, carried out by Professor Michael Kundi, found a significant dose- response relationship between cardiac disease and cell site exposure.

This provides strong support and motivation for promoting and using much safer cellular telephone technologies and sighting strategies, and accelerating the move to place radio and TV signals in fiber-optic cables to remove the genotoxic and cardiac damaging radiation and signals from the air in which people are living.

References:

Adey, W.R., 1980: “Frequency and Power windowing in tissue interactions with weak electromagnetic fields”. Proc. IEEE, 68:119-125.

Agadzhanian, N.A. and Makarova, I.I., 2001: “Influence of geomagnetic activity on the cardiorespiratory system in healthy humans”. [Article in Russian]. Aviakosm Ekolog Med 35(5): 46-49.

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D., 1994: "Molecular Biology of the cell". 3rd edition, New York, Garland Publishing, 1994.

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.

Barbaro V, Bartolini P, Donato A, Militello C, 1996: "Electromagnetic interference of analog cellular telephones with pacemakers". Pacing Clin Electrophysiol 19(10): 1410-1418.

Bardasano, J.L., Cos, S. and Picazo, M.L., 1989: "Numerical variation in synaptic ribbons of rat pinealocytes under magnetic storm conditions and on calm days".[In German] J Hirnforsch 30(60: 639-643.

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.

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.

Breus, T.K., Baevskii, R.M., Nikulina, G.A., Chibisov, S.M., Chernikova, A.G., Pukhlianko, M., Oraevskii, V.N., Halberg, F., Cornelissen, G. and Petrov, V.M., 1998: "Effect of geomagnetic activity on the human body in extreme conditions and correlation with data from laboratory observations". Biofizika 43(5): 811-818.

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. and Yost, M.G., 1999b: "Geomagnetic disturbances are associated with reduced nocturnal excretion of melatonin metabolite in humans". Neurosci Lett 266(3):209-212.

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.

Cherry, N.J., 2002: "Schumann Resonances, a plausible biophysical mechanism for the human health effects of Solar/Geomagnetic Activity". Natural Hazard 26: 279-331.

Chibisov, S.M., Breus, T.K., Levitin, A.E. and Drogova, G.M., 1995: “Biological effects of planetary magnetic storms”. [Article in Russian] Biofizika 40(5): 959-968.

Chibisov, S.M., Breus, T.K. and Illarionova, T.S., 2001: “Morphological and functional state of the heart during magnetic storm”. Bull Exp Biol Med 132(6): 1150-1153.

De Bruyne, M.C., Kors, J.A., Hoes, A.W., Klootwijk, P., Dekker, J.M., Hofman, A., van Bemmel, J.H. and Grobbee, D.E., 1999: "Both decreased and increased heart rate variability on the standard 10-second electrocardiogram predict cardiac mortality in the elderly". Am. J. Epidemiol., 150(12): 1282-1288.

Doronin, V.N., Parfentev, V.A., Tleulin, S.Zh,, Namvar, R.A., Somsikov, V.M., Drobzhev, V.I. and Chemeris, A.V., 1998: "Effect of variations of the geomagnetic field and solar activity on human physiological indicators". Biofizika 43(4): 647-653.

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.

Ghione, S., Mezzasalma, L., Del Seppia, C. and Papi, F., 1998: "Do geomagnetic disturbances of solar origin affect arterial blood pressure?". J. Hum Hypertension, 12(11): 749-754.

Gurfinkel' IuI, Liubimov, VV., Oraevskii, V.N., Parfenova, L.M. and Iur'ev, A.S., 1995: "The effect of geomagnetic disturbances in capillary blood flow in ischemic heart disease patients" Biofizika 40(4): 793-799.

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.

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]

Kerut, E.K., McKinnie, J.J. and Giles, T.D., 1999: "Modern evaluation of the hypertensive patient: autonomic tone in cardiovascular disease and assessment of heart rate variability". Blood Press Monit 4(Suppl 1): S7-S14.

Knox EG, Armstrong E, Lancashire R, Wall M. and Haynes, R., 1979: “Heart attacks and geomagnetic activity”. Nature 281(5732): 564-565.

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.

Malin, S.R.C. and Srivastava, B.J., 1979: "Correlation between heart attacks and magnetic activity". Nature 277 (22 Feb 1979): 646-648.

Malin, S.R. and Srivastava, B.J., 1980: “Correlation between heart attacks and magnetic activity--a retraction”. Nature 283(5742): 111.

Makarov, L.M., 1998: "Role of geomagnetic field in development of biorhythm profile of venticular arrhythmia onset". Klin. Med. (Mosk), 76(6):31-35.

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.

Novikova, K.F. and Ryvkin, B.A., 1977: "Solar activity and cardiovascular diseases". In "Effects of solar Activity on the Earth's Atmosphere and Biosphere". M.N.. Gnevyshev and A.I. Ol' , eds. Pp 184-200, Acad. Sci. USSR, English trans, Israel Prog. Sci. Trans, Jerusalem.

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.

O'Connor, R.P. and Persinger, M.A., 1996: Increases in geomagnetic activity associated with increases in thyroxine levels in a single patient: implications for melatonin levels". International Journal of Neuroscience, 88(3-4): 243-247.

Oraevskii, V.N., Kuleshova, V.P., Gurfinkel', Iu.F., Guseva, A.V., and Rapoport, S.I., 1998a: "Medico-biological effect of natural electromagnetic variations". Biofizika, 43(5): 844-888.

Oraevskii, V.N., Breus, T.K., Baevskii, R.M., Rapoport, S.I., Petrov, V.M., Barsukova, Zh.V., Gurfinkel' IuI, and Rogoza, A.T., 1998b: "Effect of geomagnetic activity on the functional status of the body". Biofizika 43(5): 819-826.

Otto, W., Hempel, W.E., Wagner, C.U. and Best, A., 1982: "Various periodical and aperiodical variations of heart infarct mortality in the DRG". [In German], Z Gesamte Inn Med 37(22): 756-763.

Pikin, D.A., Gurginkel', Iu.I. and Oraevskii, V.N., 1998: "Effect of geomagnetic disturbances on the blood coagulation system in patients with ischemic heart disease and prospects for correction medication". [In Russian]. Biofizika, 43(4): 617-622.

Rapoport, S.I., Blodypakova, T.D., Malinovskaia, N.K., Oraevskii, V.N., Meshcheriakova, S.A., Breus, T.K. and Sosnovskii, A.M., 1998: "Magnetic storms as a stress factor". Biofizika 43(4): 632-639.

Rapoport, S.I., Blodypakova, T.D., Malinovskaia, N.K., Oraevskii, V.N., Meshcheriakova, S.A., Breus, T.K. and Sosnovskii, A.M., 1998: "Magnetic storms as a stress factor". Biofizika 43(4): 632-639.

Rapoport, S.I., Shalalova, A.M., Oraevskii, V.N., Malinovskaia, N.K., and Vetterberg, L., 2001: "Melatonin production in hypertonic patients during magnetic storms". Ter Arkh 73(12): 29-33.

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.

Santini R, Santini P, Danze JM, Le Ruz P and Seigne M., 2002: “Investigation on the health of people living near mobile telephone relay stations: Incidence according to distance and sex”. [Article in French] Pathol Biol (Paris) 50(6): 369-373.

Sastre, A., Cook, M.R. and Graham, C., 1998: "Nocturnal exposure to intermittent 60 Hz magnetic fields alters human cardiac rhythm". Bioelectromagnetics 19: 98-106.

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

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.

Schwartz,, J.L., House, D.E., and Mealing, A.R., 1990: “Exposure of frog hearts to CW or amplitude modulated VHF fields: selective efflux of calcium ions at 16 Hz.” Bioelectromagnetics, 11: 349-358.

Sitar, J., 1990: "The causality of lunar changes on cardiovascular mortality". [In Czech.] Cas. Lek. Cesk. 129(45):1425-1430.

Stoupel, E., Hod, M., Shimshoni, M., Friedman, S., Ovadia, J. and Keith, L., 1990: "Monthly cosmic activity and pregnancy induced hypertension". Clin Exp Obstet Gynecol 17(1): 7-12.

Stoupel, E. and Shimshoni, M., 1991: "Hospital cardiovascular deaths and total distribution of deaths in 180 consecutive months with difference cosmic physical activity: a correlation study (1974-1988)". Int. J. Biometeorology 35(1): 6-9.

Stoupel, E., 1993: "Sudden cardiac deaths and ventricular extrasystoles on days of four levels of geomagnetic activity". J. Basic Physiol. Pharmacol., 4(4): 357-366.

Stoupel, E., Abramson, E., Sulkes, J., Martfel, J., Stein, N., Handelman, M., Shimshoni, M., Zadka, P. and Gabbay, U., 1995a: "Relationship between suicide and myocardial infarction with regard to changing physical environmental conditions". Int J Biometeorol 38(4): 199-203

Stoupel, E., Petrauskiene, J., Kalediene, R., Domarkiene, S., Abramson, E. and Sulkes, J., 1996: "Distribution of deaths from ischemic heart disease and stroke. Environmental and aging influences in men and women". J. Basic. Clinical Physiol. Pharmacol., 7(4): 303-319.

Stoupel, E., Abramson, J., Domarkiene, S., Shimshoni, M. and Sulkes, J., 1997: "Space proton flux and the temporal distribution of cardiovascular deaths". Int J Biometeorol 40(2): 113-116.

Stoupel, E., Petrauskiene, J., Abramson, E., Kalediene, R., Israelovich, P. and Sulkes, J., 1999: "Relationship between deaths from stroke and ischemic heart disease: Environmental implications". J. Basic. Clinical Physiol. Pharmacol., 10(2): 135-145.

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.

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.

Villoresi, G., Ptitsyna, N.G., Tiasto, M.I. and Iucci, N., 1998: "Myocardial infarct and geomagnetic disturbances: analysis of data on morbidity and mortality". [In Russian]. Biofizika, 43(4): 623-632.

Watanabe, Y., Hillman, D.C.,, Otsuka, K., Bingham, C., Breus, T.K., Cornelissen, G. and Halberg, F., 1994: "Cross-spectral coherence between geomagnetic disturbance and human cardiovascular variables at non-societal frequencies". Chronobiologia 21(3-4):265-272.