CHF 15.00

Harmonisierung von Mobilfunkstrahlen

Wissenschaftliche Blutbild-Untersuchung über die Wirksamkeit des FOSTAC CHIP

Englische Originalstudie
der COGHILL LABORATORIES
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PROTECTIVE EFFECT OF A DEVICE ("FOSTAC") CLAIMED TO REDUCE RADIATION FROM CELLPHONE HANDSETS.

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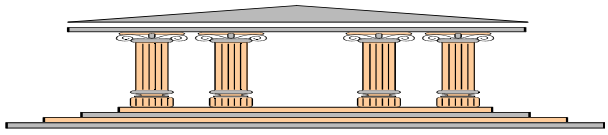

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INTRODUCTION

Large scale and rapidly increasing public demand for mobile telephony services has meant a proliferation of cellphone handsets and their associated base stations throughout the united Kingdom, and indeed throughout the world. There are presently some 30 million UK users, a quarter of whom are under 18 years old, and some 500 million users worldwide. Virtually none of these existed a mere two decades ago, which in terms of human evolution is a neglible time period.

Ever since the introduction of radar in WW2 there have arisen concerns based on observation both public and scientific over the possible health hazards of exposure to the radiations inevitably emitted by these installations. Even by the 1970s a US Congress Committee (ERMAC) concluded that unless an urgent research programme was instituted industrialised societies may be exposed to adverse sequelae affecting the entire population.

Many peer reviewed studies now confirm that RF/MW radiations at levels far below those needed for thermal insult and well below the present regulatory guidelines are capable of adverse effects on cells *in vitro*, on tissues and organs, on whole live animals, on human beings in a laboratory controlled environment, and on people in their epidemiological setting. (See Cherry, June 2000 for review). Such studies identify at least nine biophysical endpoints, namely:

Example studies

calcium ion efflux	Bawin & Adey, 1976; Blackman, 1985, 1990
melatonin reduction	Kolomytkin et al., 1995;Rosen, Barber & Lyle, 1998
DNA strand breakage	Lai & Singh, 1997a; Svedenstal et al., 1998
chromosomal aberrations	Garag-Vrhovac et al., 1993; Maes et al., 1993
leukaemia	Dolk et al., 1997a,b; Michelozzi, 1998
solid tumours of brain	Balcer-Kubiczek & Harrison,1991;Szmigielski, 1991
immune deficiency	Brueve et al., 1998; Dmoch & Moszczynski 1998
miscarriage	Lindbohm et al., 1992; Magras & Xenos, 1997
neurological effects	Lilienfeld, et al, 1978; Beale, 1997; Mild et al., 1998

These studies are merely representative of a much larger body of evidence. Nevetheless despite intensive and mainly industry-guided/funded research the regulatory authorities

(ICNIRP, NRPB etc.), though accepting that there exist biological effects at lower than thermal levels, seem reluctant to recommend guidelines based on exposures at below thermal insult levels.

The Government-appointed Stewart Committee Independent Expert Group reported in May 2000 on the possible health hazards of handsets and masts. It recommended a policy of prudent avoidance, in line with European environmental legislation embodied in the 1993 Maastricht Treaty, which states:

Title XV1 Environment Article 130r

1. Community policy on the environment shall contribute to pursuit of the following objectives:

- protecting human health
- preserving, protecting and improving the quality of the environment

The Precautionary Principle is a risk management policy applied in circumstances with a high degree of scientific uncertainty, reflecting the need to take action for a potentially serious risk without awaiting the results of scientific research.

ALSO

For countries of the European Union, the Treaty of Rome states that
"Community policy on the environment….shall be based on the Precautionary principle".

As a result of the case Newport B.C v S.S. for Wales and Browning Ferris Environmental Services Ltd (1998) Env LR at 174 and (1998) JPL 377, health considerations and public concern can in principle be material considerations in determining applications for planning permission and prior approval. The present Government believes that the current ICNIRP guidelines are sufficient to comply with these concerns, but the history of radiation guidelines has been one of constant downward revision. Moreover the DETR's Consultation document of July 2000 has incorrectly interpreted the Stewart Committee's recommendation since in para 6.38 The IEGMP states *"There is now scientific evidence however, which suggests that there may be biological effects occurring at exposures below these guidelines",* and in para 6.39 *"We conclude therefore that it is not possible at present to say that exposure to RF radiation, even at levels below national guidelines, is totally without potential health effects, and that the gaps in knowledge are sufficient to justify a precautionary approach".*

In practise, local planning authorities and the Cellphone system operators could work with levels well below present guidelines. Based (perhaps erroneously) on power flux density, or its equivalent in specific absorption rates by the body's tissue (SAR) the present National Radiological Protection Board (NRPB) investigation levels for base station transmission frequencies are 36.9 to 100 Watts per square metre (W/m^2). These values are equivalent to electric field strengths between 100 and 194 Volts per metre

(V/m). The former USSR recommended a limit of only 1 $\mu W/cm^2$ at one time, but later modified it to 24 $\mu W/cm^2$.

Another international regulatory body, the International Commission of Non Ionising Radiation Protection (ICNIRP) recommends much lower levels for public exposure than the NRPB, namely 4.5 to 10W/m^2 and 35 to 61 V/m. These conflicting views were noted by the Stewart Committee, who recommended a change in the UK to align with the lower ICNIRP values.

One expert consultancy (Powerwatch) suggests a sensible practical level might be say 3 Volts per metre electric field strength. Commenting on the Stewart Group report they say:

(i) Council planning departments should work with local communities in identifying suitable sites for masts, usually away from sensitive sites such as schools and residential housing. Where masts need to be sited in residential areas, then the antennas should be mounted as high as possible, and in every case above the roof levels of nearby properties, in order to achieve exposure levels "as low as practicable".

(ii) Clause 1.43 of the Stewart Report states that "planning authorities should have the power to ensure that the RF fields to which the public will be exposed will be kept to lowest practical levels that will be commensurate with the telecommunications system operating effectively". In practice this is typically 500 fold less in power terms than ICNIRP guidance! Even the cellular telephony industry agree that they can work to 3 volts per metre (3 $\mu W/cm^2$). approx.) or less, public exposure signal levels - at 1800 MHz this is about a 350 times lower maximum power than permitted by ICNIRP.

Low height street furniture (lamp post) masts near to houses will virtually never comply with the Stewart 1.43 advice. In many cases cellular operators are now installing many of these because of the difficulties they have had in the past in gaining approval for full size (15m or higher) masts. In almost all cases an appropriately sited full size mast or ones on the roof of a big building, will offer lower levels of RF and microwave exposure to nearby residents. The Cellular Operators do have the right to have an adequate number of suitable located masts. It is vital that local planning authorities, in conjunction with local communities, identify suitable sites for masts to avoid these difficulties.

In June 2000 an international conference was held at Salzburg with 23 invited scientific speakers from at least eleven countries. This event arose out of a 1998 international conference in Vienna where a declaration was made that microwaves can cause biological effects below levels where thermal warming occurs (the so-called Vienna Declaration). At the Salzburg conference 19 of the invited speakers reached agreement on a maximum exposure limit for GSM base stations of 1$\mu W/m^2$ (0.1$\mu W/cm^2$), which is three orders of magnitude below the ICNIRP recommendations, and one order of magnitude below Powerwatch's recommendation. This scotches any suggestion that the concerns over masts originate solely from the lay public or the media.

Salzburg city has succeeded in achieving a level of less than the conference recommended level of 1μW/m^2 through extensive co-operation between the local government, citizen's groups, and two of the four GSM providers (source Gerd Oberfeld, Salzburg local govt. officer, in *No Place to Hide* 2(4), September 2000: article by Monica Kauppi).

SCIENTIFIC STUDIES: A BRIEF REVIEW

The scientific evidence of adverse health effects from RF/MW radiation at the sort of levels emitted by cellphones and base stations is of five main categories:

a) subcellular studies (e.g. effects on DNA, enzymes, and heat shock proteins)
b) cellular studies (e.g. on cells of the immune system)
c) studies on experimental animals
d) human laboratory studies
e) epidemiology

Subcellular studies

Damage to DNA (mutagenic as opposed to genotoxic action) is expressed in several ways including the number of single or double strand breaks, chromosomal aberrations, or sister chromatid exchange (SCE). Only one recent study (on human lymphocytes from RF antenna workers) found increased chromosomal aberration (Maes et al., 1993, 1995). Moreover most of the recent studies examining effects on sister chromatid exchange have used a lymphocyte model. Stewart reviewed 8 of these but only one found any increased frequency of SCE post exposure (Khalil et al., 1993). By contrast four of five studies on micronuclei formation did find effects.

Three of four recent studies on DNA reported effects The most discussed subcellular studies are those of Drs Henry Lai and N. P. Singh from University of Washington, Seattle, who using a novel assay (the Comet assay). reported both single and double strand breaks in rat brain tissues after four hours exposure at 2.45 GHz (equivalent to an SAR of 0.6 and 1.2 W/kg).. The effect has not been replicated by another study (Malyapa et al., 1997a,b), but some questions remain over the differences in protocol used in the studies.

Not so well publicised but with greater support via replication are the studies on ornithine decarboxylase (ODC), a key enzyme regulating the synthesis of substances called

polyamines which can trigger DNA synthesis, cell growth, and differentiation. These studies report a rise in ODC levels in response to amplitude modulated MW (Byus et al., 1988; Litovoitz, et al., 1993; Penafiel et al., 1997).

Gene expression studies have focused on the oncogenes c-fos, and c-jun. Out of six studies reviewed by Stewart only one (Walters et al., 1995) found no effect. Most effects were seen when the SAR levels were around 1.5W/kg or higher. However at Nottingham University De Pomerai and colleagues reported that after seven hrs exposure to a mobile phone at 750MHz the heat shock proteins of a transgenic nematode worm were elevated (Daniells et al., 1998; de Pomerai et al., 1999)

Though evocative, and important when taken together these subcellular studies do not by themselves mean that cellphone or mast exposure bio-effects are harmful. They do however convince scientists that bio-effects are possible well below thermal limits.
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Cellular studies

These are easiest, cheapest, and quickest to carry out, but the standard criticism is that it is not easy to extrapolate from an *in vitro* study to effects on real live people. Nevertheless a large number of cellular studies taken together present a formidable argument, and this is what is already in place when considering base station bio-effects. Typical of those in the literature is that by Siannette Kwee of the University of Aarrhus, who used cells from human amniotic fluid and human skin fibroblasts to report that after only 20 minutes exposure to 960MHz RF radiation of only 0.021-0.21 SAR mW/kg (about the same strength as mobile phone base stations, and much lower than cellphone emissions) a decrease in cell growth occurred compared with controls (Kwee and Raskmark, 1998).

A similar study from Moscow, Russia (Gapeyev, Kolomyceva et al, 2000) reported that after 20 minutes exposure at 150$\mu W/cm^2$ and 42 GHz the phagocytic activity of human neutrophils declined by 50 percent. Most of the white blood cells of the immune system are neutrophils, which act by encapsulating and ingesting the toxin of interest (phagocytosis). The effect was far faster than suppression caused by injection with the chemical carbon tetrachloride.

Live animal studies

These are expensive and often long term projects and depend often on the life span of the chosen animal model. The criticism of such studies, arguably more pertinent in radiation studies where resonance effects will vary dependent on the size of the irradiated object, is that one cannot argue that factors affecting an animal will have the same consequences on human subjects. Though there are several well designed studies showing increased cancer subtypes in animals exposed to cellphone radiations, (e.g. Repacholi et al., 1997; Guy.

Chou et al., 1985; Huang and Mold, 1980 Szmigielski 1982 etc.) and a number of anecdotal reports, there are few peer reviewed studies relating to base station exposure levels. Those cited above however are still at levels (e.g. circa 100μW/cm^2) well below those needed for thermal insult.

A major 1993 World Health Organisation review of electromagnetic fields from 300Hz to 300GHz (Environmental Health Criteria No. 137) lists some 170 animal studies relevant to high frequency exposure, but mainly at 2.45 GHz, This is somewhat higher than the 1.8GHz frequency used in cellphone transmissions, but not significantly so. Of the studies reviewed by WHO adverse effects were seen in around 130 of them.

Typical among the earliest animal studies were those of Prausnitz and Susskind.(1962) which studied the effects of chronic (19 months) microwave irradiation on mice, and those of Frey and Feld (1975) which investigated rat responses to exposure at 1.2 GHz. The former used a power density of 1mW/cm^2 and a frequency of 9.2 GHz, and reported inter alia higher testicular atrophy among the 60 rats exposed vs. the 40 rats of the control group. The latter reported penetration of the anaesthetised rat blood brain barrier as measured by fluorescein.

Many of the animal studies during the next decade or so used 2.45 GHz, the frequency of microwave ovens. Only in the 1990s did studies concentrate more on power densities and frequencies pertinent to cellphones, but their findings often mirrored the findings of earlier studies at different exposure characteristics. A recent Lund University, Sweden study for example (Salford et al., 2000) involving over a thousand rats also reported that the blood brain barrier was made more permeable as a result of exposure to RF/MW radiation (915MHz) below SAR values of 1mW/kg. The authors concluded that *"It cannot be excluded that non-users in the vicinity of the cellular phone users may be influenced by these weak effects. Likewise, the radiation from antennas of base stations may be harmful at longer distances than hitherto suspected"*.

Arguably the most well-known of the cellphone related studies on live animals (among eleven promotional studies reviewed in 1999 by Stewart's expert group) was that conducted by Repacholi et al., (1997) on transgenic mice. The results showed a two-fold increase in lymphoma incidence in the exposed group, exposed to 900GHz for one hour each day for 18 months at power densities equivalent to an SAR of 0.008 to 4.2 W/kg. None of the other 1990s promotional studies reported adverse effects however.

The possibility that effects where found may be connected with resonance effects makes it difficult to extrapolate arguments from small mammal studies to human beings. The small size of such animals means their resonant frequencies will be higher than those for humans.

Human studies

These are more convincing since they report the effects of exposure under controlled conditions, where some if not all potential confounding factors can be ruled out. Such studies are beginning to emerge in the literature. Preece et al., (1999), and Koivisto (2000) both reported decreased reaction times during exposure to Cellphone handsets, but the studies were poorly designed with few volunteers, and badly analysed in statistical terms.

Another area of interest has been the effect on EEG records. Some half dozen studies (Reiser, 1995; Mann & Roschke, 1996; Urban et al., 1996; Krause et al., 2000 etc.) suggest that brain function is being affected by cellphone radiations, though there is no equivalent data on masts.

Other recent studies have reported a lowering of blood pressure during or after cellphone frequency exposure (Braune et al., 1998a,b). These support the original 1960/70s Russian studies of RF exposure (e.g. Drogihina 1966; Sadcikova, 1974) which uncovered much the same thing.

Epidemiology

An Swedish epidemiological study of brain tumours (Hardell, Nasman et al., 2000) has just reported that the use of cell phones significantly increases the risk of a solid tumour of the brain on the same side of the head by 2.5 times. This does not mean to say that exposures to base station power densities would have the same effect.

A much larger joint Norway-Sweden self-reporting questionnaire study of 11,000 users (Hanssen Mild et al., 1998) found that odds ratio of incidence of five parameters including headaches and cheek warmth increased with duration of daily exposure. In Sweden 13 percent of users suffered headaches (Norway, 30 percent)

Though there still does not exist a peer-reviewed epidemiological study showing adverse bio-effects from base stations, several other large studies of people living near RF/MW installations do give grounds for concern:

a) the North Sydney, Australia study (Hocking 1996)
b) the UK High power transmitters study (Dolk et al., 1997a,b)
c) the Chinese tri-University study (Chiang, Yao, et al., 1989)
d) the Polish Military studies (Szmigielski 1988, 1998)
e) The Schwartzenberg transmitter study (Alpeter and Abelein, 1995)
f) The Skrunda radar study (Kolodynski and Kolodynska, 1996)
g) Serdiuk and Serdiuk (1989)

A closer consideration of these gives an indication of what radiation levels are necessary to invoke adverse health effects.

Dr Neil Cherry of Lincoln University New Zealand argued (in a 136 pp. monograph July 1997) that the appropriate level for protection should be as low as 0.1μW/cm2 if cancer risk is to be avoided and 0.01μW/cm2 if children's impairment, chronic fatigue syndrome, and other bio-effects are to be avoided.

His conclusions were based on five main studies reporting adverse health effects:

Study:	***Subject***	***Exposure range ($\mu W/cm^2$)***	***Risk ratio range***
Szmigielsky,1988/96	Polish army	<7-14	3.0-13.9
Lilienfeld e al. 1976	Moscow Embassy	<0.1-2.4	1.7-5.0
Robinette, 1980	Korean War	?	1.9-3.3
Dolk et al. 1997a,b	21 UK sites	<0.05-1.6	1.01-3.57
Hocking 1996	North Sydney	<0.04-1.6	1.61-2.74

However he was also aware of the Chinese tri University study (Chiang, Yao et al., 1989) and the Skrunda radiolocator studies (Kolodynski et al, 1996).

The NRPB produced a document (NRPB R321) measuring the levels of radiation near selected cellphone base stations (Mann, Cooper et al. 2000). It is a misleading document, since it purports to argue that the 17 sites measured are typical whereas in fact they are well down the scale in terms of power density. They were chosen only because of public concern in the localities of interest, but nowhere is it stated that these sites were the entirety of sites where the public were showing concern, so arguably the sample is biased from the start. Further by expressing their results as a fraction of their own permitted guidelines the NRPB are prejudicially inferring the correctness of their own recommendation.

Nevertheless some interesting facts emerged from R321, and it also provides a good and detailed non-technical overview of how mobile telephony works. None of the sites measured were microcells but all were macrocell masts. Whereas most macrocells emit power in the order of 20-50 Watts, only seven of the 17 measured emitted power above 10 Watts and only three above 20 Watts, so the sample was not very representative.

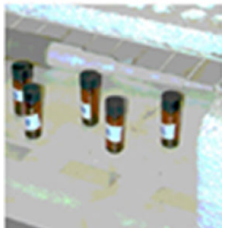
The maximum power density found ($8mW/m^2$) was at 60 metres from a mast sited on a school building. Power density generally ranged between $10\mu W/m^2$ to 1 mW/m^2 on all but four of the outside locations, meaning that the remaining 87 measurements were all taken indoors, again leading to generally lower readings. Where the readings exceeded $1mW/m^2$ the base station emissions dominated the total from all other origins, and other environmental signals had little effect. Finally there is some evidence that the signal strengths did not fall off with distance.

Comparing these figures with the recommendations not of NRPB or ICNIRP, who base them on thermal considerations, but with exposures seen in epidemiological studies reporting ill health in the sample populations persuades one that exposures are already relatively high. There is a plausible explanation of how in biophysical terms radiations in the order of 10 $\mu W/cm^2$ can perturb common organic ions such as calcium, potassium or sodium.

Against this background we tested a device ("FOSTAC^{TM} chip")claimed to give protection against radiations from cellphone handsets and pagers, by means of measuring its ability to protect the viability of human peripheral blood lymphocytes in vitro compared with sham exposed and controls.

METHOD AND MATERIALS

Human peripheral blood lymphocytes were isolated from a healthy 60 years old male donor by differential centrifugation on Histopaque (Sigma-Aldrich Chemicals ltd.) from 30 ml of whole blood obtained via venipuncture of *v.cubitale* into vacutainers containing anticoagulant (K2), and maintained in RPMI 1640 nutrient with antibiotics and antimycotics.. Four standardized samples of the culture were placed in 2ml phials sealed with a plastic cap and pre-sterilised at 121degrees C under pressure. There was about 0.5 of culture in each sample. All glassware and instruments were handled in a purified air laminar flow unit to avoid bacterial contamination.



The coded samples post exposure, awaiting trypan blue staining.

One phial was connected to a 30cm. gold wire which led to a fully charged and active Philips C12 GSM mobile phone set on stand-by, inside which, next to the battery, the FOSTAC chip had been applied in the way advised by the manufacturers.. This sample is called the **Protected** sample. It was exposed in this way for an 8 hrs period.

The second phial also had a gold wire insert but this was sealed into the cap. This is called the **Sham Exposed** sample, and for the duration of the exposure period it was confined in a double skinned mu metal container at the same ambient temperature.

The third phial was also connected by a 30cm gold wire to a Philips C12 GSM cellphone, but had no FOSTAC chip attached. This sample is called the **Exposed**

sample, and it was exposed for a simultaneous period of 8 hrs in a different room at some distance from the Protected sample.

The fourth phial was sealed similarly but was placed apart from any cell phone, in a different room. This was called the **Control**.

After the exposure period the samples were coded and given to a colleague for staining with trypan blue dye to establish which were viable and blind counting under alight microscope (Olympus BX50) using a hemoctyometer (Sigma Brightline). Viable and non-viable cells in each sample was counted in ten hemocytometer squares according to recommended laboratory practise.

RESULTS

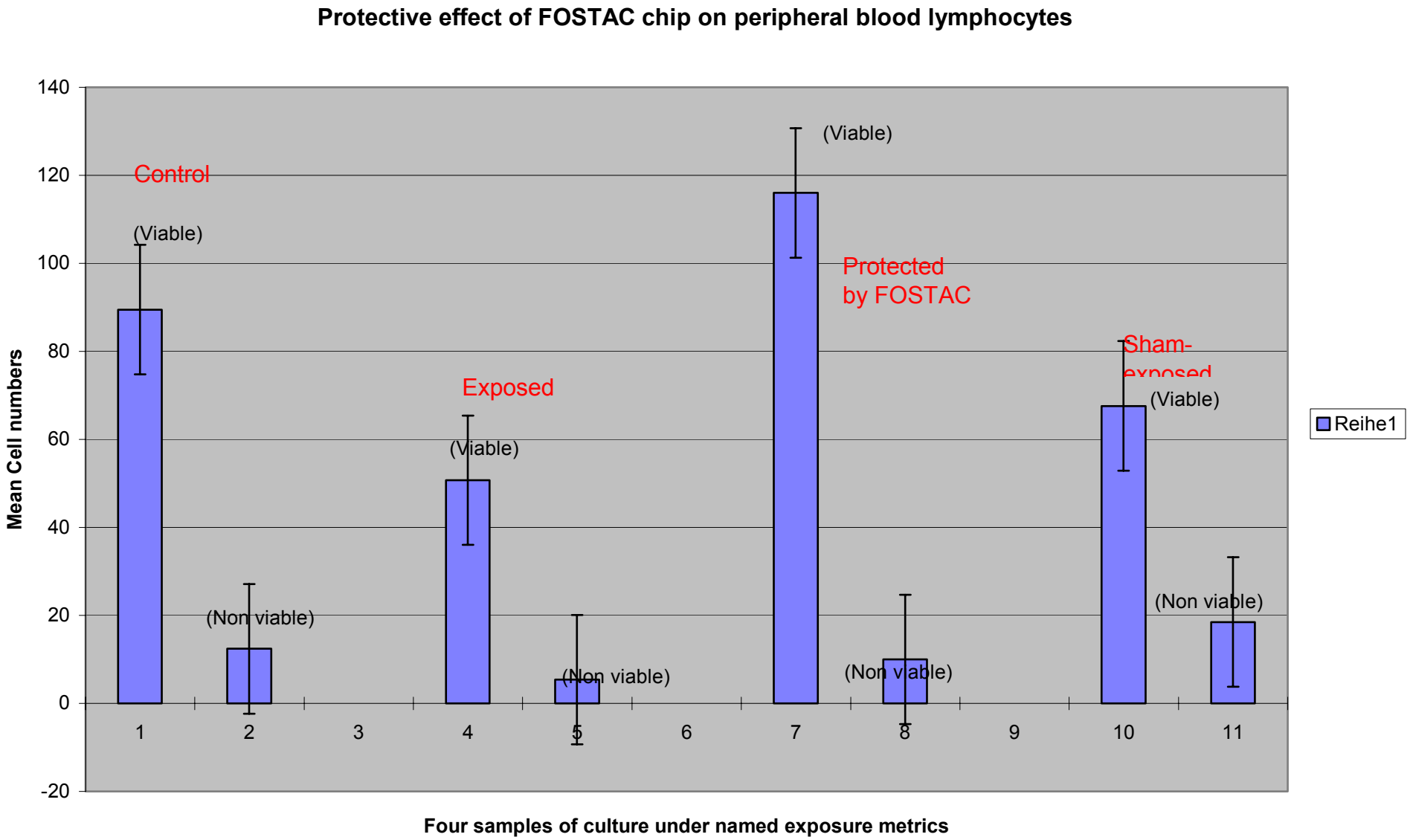
These are first given numerically below:

Table 1: Viability of Human peripheral blood lymphocytes exposed to Cellphone radiations

Run no. ***Control*** ***Exposed*** ***Protected*** ***Sham-exposed***

Code no.	1		2		3		4	
count	viable	nonviable	viable	nonviable	viable	nonviable	viable	nonviable
1	84	11	49	5	108	9	72	24
2	79	8	58	2	114	8	68	25
3	88	10	51	12	108	11	77	19
4	89	15	47	11	123	6	70	21
5	76	14	45	7	115	15	73	18
6	95	13	56	7	121	8	69	20
7	81	12	52	9	118	7	61	11
8	88	12	48	0	119	10	70	18
9	94	9	55	0	106	12	55	13
10	121	20	46	1	128	14	61	16
Totals	895	124	507	54	1160	100	676	185
Means	89.5	12.4	50.7	5.4	116	10	67.6	18.5
SDs	12.7	3.4	4.5	4.5	7.2	3	6.6	4.4
% viable	87.8		90.4		92.1		78.5	

These results are presented graphically below:


Protective effect of FOSTAC chip on peripheral blood lymphocytes
Mean Cell numbers
140
120
100
80
60
40
20
0
-20
Control
(Viable)
(Non viable)
Exposed
(Viable)
(Non viable)
(Viable)
Protected
by FOSTAC
(Non viable)
Sham-
exposed
(Viable)
(Non viable)
1
2
3
4
5
6
7
8
9
10
11
Four samples of culture under named exposure metrics
Reihe1

These results confirm that the FOSTAC device had a protective effect on human peripheral blood lymphocytes.

Since the relation between the exposed and protected sasmples is a linear one, (i.e. the data are not skewed) the standard test (the z test, see Colton, Statistics in Medicine, 1974, p138) for a difference between two means can be applied to these data to see if the results are statistically significant.

The calculation is :

$$z = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{\sigma_2 x}{nx} + \frac{\sigma_2 y}{ny}}}$$

Therefore z = (116-50.7/$\sqrt{}$ $4.5^2/10 + 7.2^2/10$ = 24.25 which is highly significant.
The standard z-test for significance (difference between means) therefore shows that comparing the protected cells with the exposed cells confirms a statistically significant difference. Moreover, the control and sham exposed samples were, as expected, relatively less and more viable as would be expected.

DISCUSSION

It would seem counter-intuitive for a small gold-plated disc inserted inside any cellphone to have the capability of improving the viability of human white blood cells exposed to the cellphone's radiations. One has to ask what mechanism might be at work, understandable in terms of the normal slife sciences and physics?
The Swiss producers of the FOSTAC provide some documentation about their device, stating *"The FOSTAC chips are treated with a special procedure and become a kind of antenna - receiving and passing on Tachyon energy. Tachyon energy changes negative into positive, creates order in disorder, so that ... the microwaves are no longer harmful to living organisms".*

The basic material of the FOSTAC chip is an alloy and 18 carat gold plated. The distributors also supply a two page pamphlet on "tachyon energy", described as a non-frequency-specific natural catalyst for the self-healing process. The distributors also offer another four page pamphlet on zero point energy. It is not part of this study to determine the validity of these explanations, but the precise below attempts to summarise the distributor's explanations.
What the producers appear to be saying in brief is that the material universe is in reality a condensed form of energy with a continuum of frequencies and wavelengths.

This energy flows according to modern physics, say the distributors, from a source described as zero point energy ("ZPE"). The chip is said to transduce the radiation from one range of (adverse) electromagnetic frequencies into another (beneficial) range.

The producers' description of ZPE is of a limitless and omnipresent energy which permeates the universe, and redefines a tachyon as a particle moving faster the speed of light, following the ideas of Philip Callahan. The distributors point readers of their pamphlet to the work of Ernst Wall and his book *The Physics of Tachyon*, but we are unequipped to comment on these unusual areas of physics. We prefer to offer the more plausible explanation that multi cellular organism have their own endogenously originating fields which are disturbed by artificial fields and radiation of modern technologies. We have demonstrated the protective effect of the donor's endogenous field *(Electro and Magneto Biology,* March 2000). We speculate that the FOSTAC device is energised by Cellphone radiations to emit masking or compensating radiations which benefit the endogenous field rather than perturbing it, by some means which we do not understand.

A more comprehensive account of ZPE is given by Dr Glen Rein, which follows. It includes an account of his work with non-Hertzian fields and lymphocytes.

NON-HERTZIAN SCALAR ENERGY AND ELECTROMAGNETIC- ENERGY: THE BIOLOGICAL CONNECTION

Glen Rein, Ph.D.

ABSTRACT

This article will briefly review the evidence for a biological role for non-Hertzian fields and present recent experimental evidence (obtained by the author and other non-orthodox scientists) to support the hypothesis that they are a likely component of the bio-energy body and are involved with the body's own intrinsic healing mechanisms.

The crystalline transduction theory is presented as a new theory to explain how exogenous non Hertzian fields are utilized by the body to bring about profound changes at the cellular level resulting in facilitation of the healing process. In addition, the Information Matrix Theory is discussed as a mechanism to explain the interaction with non Hertzian fields with the atomic nucleus. These theories are based on contemporary scientific research from quantum electrodynamics, quantum chromodynamics and bioelectromagnetics. This multidisciplinary approach may form the basis for a new branch of science referred to as quantum biology.

NON-HERTZIAN FIELDS

The umbrella term non-Hertzian will be utilized here to reference a type of subtle energy which for the last ninety years has been reported in the literature as radiant energy (Moray), morphogenic fields, empty fields, motional fields (Hooper), time reversed waves, longitudinal standing waves and "scalar" waves. Other terms like chi, healing energy, bioplasma and orgone energy refer to energy which may also be non-Hertzian or a mixture of subtle and classical fields. The term non-Hertzian will be used here to refer to this subtle energy in order to distinguish it from the classical electromagnetic (EM) fields described by Hertz and Maxwell and from quantum potential fields described in modern quantum electrodynamics. Einstein used the term "subtle" to refer to energy which could not be measured by ordinary detectors. Eccles uses the term to define the probabilistic analysis of quantum mechanical events in the brain. Bohm uses the term to characterize layers in the infolded order.

Unlike EM fields and quantum fields, non-Hertzian fields cannot be measured by conventional electronic equipment. It is proposed that biological systems are sensitive to non-Hertzian energy and

therefore may be used as "bio-detectors". Although such energy has not been measured in the body and is not being considered by the bio-medical community (they barely recognize a functional role for conventional EM fields), it is likely to be involved in biological processes since quantum mechanical analyses of biological systems has recently indicated their inherent nonlinearity.

Classical electromagnetic field theory developed by Maxwell, Faraday and Hertz describes the interaction of EM energy with matter in terms of forces acting on elementary particles (electrons, protons and neutrons).

The realization that accurate description of our three dimensional (3D) universe requires the introduction of quantum mechanics as well as classical EM field theory. Experimentally observed anomalies, including the EPR paradox and the Calcutta paradox are best explained by quantum mechanics. Key concepts in quantum mechanics include unbroken wholeness, non-locality, coordinated organization, information in form, higher dimensions of reality, independence of space and time and a unified quantum field underlying all forces acting on matter.

Bohm's theory of implicate orders infolded within our 3D explicate reality forms the basis for understanding the relationship between non-Hertzian fields and classical EM fields. Bohm's theory introduces the quantum potential as a ubiquitous pool of information which co-ordinates higher degrees of organization of a system whose distinct parts can communicate non-locally. The importance of quantum potentials and their associated quantum fields in our macroscopic 3D universe was experimentally demonstrated by generating quantum fields in the absence of classical EM fields and showing their ability to alter the wave function of electrons. These results indicate that quantum potentials are independent of classical EM fields and that they do not obey the laws of classical EM field theory. Bohm's idea that potentials underlie fields is supported by the mathematical demonstration that electric and magnetic fields are derivatives of the magnetic vector potential and the electrostatic scalar potential.

It is proposed here that non-Hertzian fields are fundamental unified fields which underlie quantum potential fields. This fundamental energy, which cannot be measured by conventional EM field detectors, is referred to as non-Hertzian because it does not obey the laws of classical electromagnetic field theory as first outlined by Maxwell and Hertz. It is proposed that quantum potential fields are mathematical derivates of this fundamental subtle energy, analogous to the fact that conventional EM fields are derivates of potential fields. It is possible that non Hertzian fields regulate the hidden variables which control the seemingly random event of quantum mechanics. The properties of non-Hertzian fields will be discussed from the perspective of modern quantum electrodynamics.

Bearden has a slightly different interpretation of the
relationship between potential fields and non-Hertzian fields, or scalar waves. Bearden has proposed the existence of artificial potentials in contrast to Bohm's unstructured natural potentials. According to Bearden, both the natural and artificial potentials are composed of

virtual particles, although only the latter is organized into a substructure. This organized structure can be intentionally imposed on an artificial potential experimentally using scalar- electromagnetics. Scalar electromagnetics is based on the presence of a scalar term in the original quaternion equations Maxwell used to describe electromagnetic fields. According to the ' theory, a scalar wave is generated by oscillations in the contraction and relaxation of stationary electrons. Scalar waves are proposed to contain conventional EM waves moving in positive time and contain positive energy as well as a superimposed negative time/negative energy time wave. This positive energy wave
interacts with negatively charged electrons whereas negative energy waves interact with the positively charged protons in the nucleus.

Scalar waves are believed to propagate/translate only if the overall symmetry of a system is broken. Breaking of symmetry is associated with local curvature of space/time and the conversion of virtual particles into observable elementary particles. Negative time, negative energy and negative entropy are all associated with breaking symmetry and the generation of scalar waves. In addition, scalar waves have other unusual properties, including propagation at supraluminal velocities without loss of energy, independence of the 1/r2 fall off, convergence, antigravity and the ability to carry information.

Bearden further proposed that the two types of energy waves can be separated by canceling two EM vectors 180 degrees out of phase Mathematically, crossing two quarternion equations results in cancellation of the vector
components with the scalar terms remaining intact. Experimentally this can be done with a caduceus coil or with a Hooper coil. In both cases a zero sum vector space is generated. According to Bearden, artificial potentials would be generated in this way.

The proposal that potentials are composed of virtual particles is based on the idea that the vacuum (or spacetime) is not empty but is also composed of a chaotic distribution of virtual particles. The notion of an energy which exists in a vacuum in the absence of motion, e.g. at zero degrees, suggested that the vacuum is not empty. In fact, the term empty wave has been suggested to describe this energy. A basic tenet of general relativity, according to Einstein, is that local curvature of spacetime

*addition of time to the 3D universe) is not possible. Spacetime has been mathematically modeled as a vacuum where the virtual particle fluxes are constant and an equilibrium exists between particles and anti- particles. It is proposed that the local curvature of spacetime is possible and would result in changes in the magnitude of the vacuum potential. These oscillations in the virtual energy of the vacuum could therefore account for the zero-point energy (ZPE). It has been proposed that higher dimensions.are contained within the vacuum. These hyperdimensions of the vacuum are believed to be the source of the ZPE. Thus, under certain situations, the random, incoherent ZPE can be "brought down" into our 3D universe and made coherent. The concept of higher dimensions is well established in quantum electrodynamics and has recently been elaborated upon in Everett's "Many Worlds Interpretation of Quantum Mechanics" which proposes that hyperspace is composed of an infinite number of dimensions.

An elegant description of how the ZPE can be cohered has been presented in the Virtual Plasma Model (King) which explains how the ZPE can manifest (cohere) in our 3D space. According to this model, the ZPE normally passes through our 3D space randomly and therefore does not interact with it. However, in certain situations, the ZPE flux can be slightly twisted (or orthorotated) into our 3D space, thereby generating virtual particles which in turn generate elementary particles. Virtual particles can also generate a virtual plasma, which, according to the theory, can interact non-linearly with the ZPE. In this way a small amount of the infinite ZPE can be tapped or made coherent and used to provide enough energy to form the macroscopic meta-stable objects in our 3D space. Thus, the theory predicts that the ZPE can be tapped and used to generate coherent, structured macroscopic phenomenon in out 3D space. Although the theory contradicts the third law of thermodynamics, it does offer an explanation for experimentally observed vortex rings in plasma physics and the anomalies associated with "free energy*' devices.

King's model provides an elegant explanation of the scalar wave in terms of quantum mechanics. According to King, scalar waves propagate in hyperspace and are guided by vortex rings. Under the proper conditions, the ZPE can be orthorotated into our 3D space and manifest as a scalar wave with no net energy propagating in our 3D universe. By confining the propagation of the scalar wave to the higher dimensions, gauge theory invariance is not contradicted. This also explains our inability to directly measure scalar waves.

The possibility that non-Hertzian fields preferentially interact with the nucleus would make them unique in comparison with EM vectors, which preferentially effect electrons. The interaction between non-Hertzian fields and electrons has been described as incoherent and diffuse whereas nuclear interactions are believed to be coherent, resulting in a "charging" of the nucleus by exciting it's protons (Bearden, Puharich). By acting as a capacitor, the nucleus may be chargeable and dischargeable, thereby accumulating non-Hertzian fields. This theory further suggests that the addition of positive energy to the nucleus would increase the mass of the atom, whereas negative energy would decrease the mass (Bearden). Such nuclear interactions are predicted to result in the emission of virtual particles (Bearden) possibly originating from quarks contained within each proton (Puharich). Virtual particles were first described by Dirac, who postulated the existence of a virtual particle "seal, from which elementary particles and anti-particles emerge. These ideas suggest that protons from nuclei in different molecules can transfer information to each other via long-range, macroscopic, quantum communication channels. This type of non-Hertzian interaction between nuclei in all atoms and molecules would not be confined to the standard limitations of electromagnetic forces, thereby explaining some of the paradoxes in modern quantum physics.

The idea of long-range communication channels between nuclei has been extended by the author and presented as the Intramolecular Matrix Theory.The theory proposes that communication exists between nucleons (protons and neutrons) within a nucleus, as well as between nuclei within the same molecule. The local forces within the nucleus are mediated by the ZPE, as dictated in quantum electrodynamics, whereas medium- range channels are postulated to exist between nuclei with a molecule. It is further proposed that the crossing channels within the nucleus and within the atomic structure of each molecule form a complex quantum information network (or matrix). The information which characterizes the unique physical and chemical properties associated with a given molecule is believed to be stored at the intersection points between communication channels. Finally, the theory predicts that the information matrix can be stimulated using the appropriate frequencies of exogenous non-Hertzian fields. These fields would therefore carry the quantum information associated with a given molecule's matrix. As we shall see later in this report, the theory is supported by direct experimental data.

GENERATING NON-HERTZIAN FIELDS

Although non-Hertzian energy cannot be directly measured, several devices have been built which theoretically generate non-Hertzian waves. Most of these devices generate non-Hertzian waves by interacting (bucking) two equal EM fields 180 degrees opposed, to cancel EM vectors. In psychotronics, this is achieved with a cadueus coil or a Hooper coil. In non-linear optics it is achieved using four-wave mixing.In this technique an EM field (E3)is introduced into a vector canceled space (vectors El and E2 are 180 degrees opposed and equal in magnitude), thereby generating a non-Hertzian wave (E4) with a much greater amplitude than the E3 input vector field. This approach allows for amplification of non-Hertzian waves. Another technique in non-linear optics is phase conjugation. Here EM fields are reflected off a non-linear mirror, thereby generating a non Hertzian wave which is referred to as a phase conjugate replica of the original EM vector. The replica travels backward in time and retraces the path taken by the original EM vector. This technic was first used by Raymond Rife in the 193O's, when he built his high powered microscope. The microscope utilized the convergence property of phase-conjugate waves, thereby minimizing distortion normally associated with diverging EM vectors.

Non-linear interactions in plasma physics can also be used to generate non-Hertzian waves. The complex non-linear interactions among the different types of plasma waves within a plasma structure has been well described in plasma theory. Abruptly pulsing a plasma will theoretically generate non-Hertzian waves. Propagation of non-Hertzian emissions from plasma tubes has been described in terms of a self-focusing mechanism. Such emissions are the basis of

the cancer curing machine of Priore and the beam ray generator of Raymond Rife.

Finally, the emerging field of psychotronics uses radionics and free-energy devices which may generate non-Hertzian fields. With the use of hyperspatial engineering, psychotronic devices have been built by modifying audio amplifiers and doping crystal lattices in transistors. Although these electrical circuits do not follow the principals of traditional engineering, they exhibit properties consistent with the emission of non-Hertzian waves.

The devices described above should theoretically generate non-Hertzian fields. Support for this conclusion is based on the numerous

reportings of anomalous behavior associated with these devices in regard to temperature, inertia, gravity or mass measurements. Such anomalies were first observed by Tesla as ball lightning during his Colorado Springs experiments with his magnifying coil. These anomalies are likely to be explained by the theoretical quantum physics just described. Since some psychotronics devices have been used with biological systems and biological systems have been recently modeled using quantum mechanics, anomalous biological behavior may also be expected from these devices. Such biological implications have received little attention.

BIOLOGICAL SIGNIFICANCE

Evidence exists which suggests that these non-Hertzian fields will affect biological systems and may be involved in the natural healing process. It has therefore been suggested that quantum mechanical events mediated by non-Hertzian fields may link chemical and EM events in biological systems. Furthermore, theories suggest how subatomic quantum events can influence macroscopic processes in biological systems. However, the exact role and mechanism of action of quantum non-Hertzian fields in biology will require further experimentation.

DelGuidice has mathematically characterized the quantum mechanical propagation of EM fields in structured water and referred to such propagation as non-Maxwellian. His studies clearly support a role for non-Hertzian phenomenon in biological systems and indicates a key role for water. The physiological role of structured water surrounding biomolecules and at the surface of the plasma membrane has received some attention from the scientific community. Using proton Nuclear Magnetic Resonance (NMR), this "interfacial" water has been shown to be more structured and organized than bulk water, where decreased hydrogen bonding between individual water dipoles results in a more random orientation. A functional role for structured water is indicated by experiments where the hydrogen bonds are intentionally broken, causing a shift in the orientation (or the "order parameter") of the biomolecules (e.g. glycoproteins on the plasma membrane). Structured water in biological systems is characterized by altered electrical properties (e.g. dielectric constant and conductivity) and readily and reversibly converts to random bulk water. Thus structured water and bulk water are in equilibrium.

Although water is composed of hydrogen and oxygen ions, the hydrogen ion has been the focus of attention in terms of understanding the role of non-Hertzian ZPE. Puthoff considered the ground state of the hydrogen atom as ZPE determined state and used quantum electrodynamics to calculate the amount of ZPE absorbed and emitted by hydrogen. Puharich also uses the hydrogen molecule in describing the subnuclear origin of scalar energy. As previously discussed, Puharich has proposed that scalar waves originate in the monopoles and anti-monopoles, which are located within the protons. Puharich has extended these ideas into the biological arena by proposing that non-Hertzian fields are emitted from the body during the laying-on-of hands healing and originate from the hydrogen bonds which hold DNA strands together.

Bearden has also extended his hypothesis to include biological systems. Bearden proposes that each cell in the body is composed of subatomic biopotentials. The biopotentials, which are located in the atomic nuclei, are composed of disordered, unstructured charge patterns of scalar energy which form virtual substructures. Scalar energy absorbed by the cells will charge and organize the biopotentials, unlike EM fields which only change the magnitude of the biopotentials. Cells which are in open exchange with their extracellular environment, also discharge their biopotentials by releasing structured scalar photons as well as conventional photons. The scalar photons released from diseased cells, which have a characteristic information pattern associated with the particular disease, can communicate the diseased energy pattern to all cells in the body. Bearden also proposes that all disease could be cured if we could isolate the diseased energy pattern, apply it to a phase conjugate mirror and generate it's time reversed scalar wave. This scalar wave, which would contain the healing pattern for that particular disease, could then be used to treat the patient. A parallel approach would be to generate the scalar information
pattern from an antibody isolated from the diseased patient's blood. A scalar wave with this information would charge the immune system resulting in a permanent scalar immunization.

BIOLOGICAL EVIDENCE

Although there are several theories for the role of non-Hertzian scalar energy in biological systems, there is relatively little direct experimental evidence. Several different approaches give indirect experimental evidence to support this hypothesis. one line of research focuses on the biological role of light (or biophotons). Popp

discovered that biophotons are stored and released from within the helical structure of-the DNA molecule and observed that biophotons are coherent in nature. Popp hypothesizes that the biophotons which he could measure originate from a holographic virtual EM field which permeates the whole body and is involved with the healing process. Although Popp's biophotons are coherent and originate from DNA, the proposed biological source of scalar waves, their non-Hertzian nature has yet to be proved. coherence may be either quantum mechanical or non-quantum mechanical in nature.

Experimental data from scientific studies involving laying-on-of hands healing, remote viewing and remote influencing of random number generators may be interpreted as evidence that the body generates non-Hertzian fields. Independence of time and distance has been most convincingly demonstrated by John's extensive data with random number generators. Similar phenomenon have been observed with healers. Geller has apparently been able to redirect the growth of a sprouted kidney been back to its original unsprouted state: a possible biological example of time reversal. Manning was able to influence the adhesion of cultured tumor cells and could focus his intention to only one petri dish amidst a stack of four. This is an example of convergence.
These phenomenon exhibit properties consistent with those outlined above for non-Hertzian waves.

As an alternative to using biological tissues as a source for quantum biological fields, a different approach would be to generate them artificially (as discussed above) and study their effects on biological systems. Although numerous studies indicate that weak EM fields have a wide variety of biological effects, similar experiments with non-Hertzian fields have not been considered by bioelectromagnetic researchers. In the 1920's and the 1930's several unorthodox EM field generators appeared which may have also generated non-Hertzian fields. For example, the plasma tube generator of Priore had profound biological activity on the inhibition of tumor growth in animals. More recently free energy devices, radionic devices and other psychotronics devices have been built which may also generate non-Hertzian waves. The ability of these devices to modify biological systems has generally not been studied scientifically. Although radionics and psychotronics devices like the Interro and the SE-5 are effective "clinically", their circuitry does not follow conventional engineering principals, and the quantum physics described above cannot readily predict the nature of the subtle energy that they generate.

Several years ago, the Teslar shielding device was introduced which trapped EM fields inside a Mobius strip and theoretically generated a non-Hertzian field between 7 and 8 Hz. A decrease in overall amplitude and shift toward lower frequencies in EEG recordings from individuals exposed to this device has been reported (Byrd). Following exposure to harmful environmental EM fields, EM-sensitive individuals wearing the shielding device showed normalized readings on E.A.V. electro-acupuncture and Interro diagnostic devices.

Despite these encouraging preliminary results, the belief of the individuals treated may also be a contributing factor. In order to eliminate placebo effects and to determine whether the presumed non-Hertzian fields emitted from the device might have direct effects at the cellular level, the author designed a series of *in vitro* experiments using nerve cells and immune cells grown in tissue culture. Biological effects were measured in the presence and absence of the mobius strip in order to determine the relative contributions of the EM and the non-Hertzian fields to the biological response. In the presence of the mobius strip both EM and non-Hertzian fields would be present, whereas removal of the mobius strip would generate only an EM field. Since it is unknown to what extent the two fields couple, this approach does not yield direct information about the effects of non-Hertzian fields in the absence of an EM field, presumably of the same frequency.

The PC12 neuronal cell line was chosen for initial studies since the author had previously shown that the functional properties of the neurotransmitters (e.g. norepinephrine) present in these cells resemble those in the normal brain. It was further demonstrated that norepinephrine release was increased and norepinephrine uptake was inhibited when the cells were exposed to weak EM fields. Norepinephrine uptake was reassessed, using the same standard biochemical protocol, following a thirty (30) minute exposure of the cells to the two shielding devices. Results from six independent experiments indicated that both devices caused a small inhibition of norepinephrine uptake. In the presence of the mobius strip and additional 20% effect was observed. The results therefore indicated for the first time that non-Hertzian fields can have even more profound biological effects than conventional EM fields.

Since the immune system is a key focal point for healing a wide variety of diseases, additional experiments were done to determine whether non-Hertzian fields could stimulate the growth of T-cells or

lymphocytes (critical white blood cells involved with cellular immunity). Using standard biochemical techniques, lymphocytes were isolated from the blood of healthy volunteers and grown in a tissue culture for two days in the presence of radioactive thymidine. The rate of thymidine incorporation into replicating DNA is a quantitative measure of the amount of cell division. ' Both shielding devices increased the growth of the lymphocytes. As in the previous experiments with nerve cells, the addition of the non-Hertzian field increased the biological response, in this case by an additional 76%.

These initial studies were the first to demonstrate a direct effect of non-Hertzian fields at the cellular level and indicated that such effects could occur in the absence of placebo effects. An additional direct effect of the shielding device on stimulating the RAD-6 gene was subsequently reported (Puharich). This gene codes for protein involved in DNA repair in response to harmful UV radiation. The shielding device may therefore activate repair mechanisms following exposure to harmful EM radiation.

The inability to adjust the output frequencies and amplitudes of the shielding device is a severe limitation for further research. Therefore, in collaboration with T. Gagnon, the author conducted a more extensive study using a modified caduceus coil which Gagnon had developed to treat cancer. The delivery system, referred to as Structured- Electromagnetic Quotient Stimuli (S-EMQS), consists of two concentric windings within a coil carrying current in opposite (anti-parallel) directions. The input current (3 mA) consists of a series of S-EMQS envelopes repeated at 5 microsec intervals. Each envelope is composed - of 3-7 superimposed, computer generated, square waves varying in frequency from 2 kHz to 6 kHz. Freshly isolated human lymphocytes received four 15 minute treatments during a 12 hour period and their growth rate was determined as described above after an additional 12 hours. Control cells (those not subject to the energy treatments) exhibited low growth rates (358 cpm/10s cells).

S-EMQS generated non-Hertzian fields caused a 20-fold stimulation of cell growth (6880 cpm/10>5 cells) in the absence of chemical growth factors. EM fields are also known to stimulate lymphocyte growth, although the magnitude of this response is typically less than 1-fold. It was therefore of interest to determine whether the large effect observed here was due to the non-Hertzian fields or to the specific and complex set of frequencies used. The exact same frequency information was used as input to a second coil with the

same dimensions as the first except that current flow in the two windings was parallel (i.e. in the same direction). This coil arrangement, which would only generate transverse EM fields, gave a 3-fold lower biological effect. These results support the previous experiments with the Teslar shielding device and indicate that the pronounced biological effect observed here was only partially due to the frequency information, and more largely due to the way in which the information was delivered - via a non-Hertzian field.

Utilizing a slightly larger input current (9 mA), Rein et al. determined whether It was possible to transfer and store this frequency information into the lattice structure of water. Water charged with the non-Hertzian fields was then tested for biological activity. Using a modified S-EMQS signal (which turned out to be less biologically active than the original signal), direct exposure of the cells to the coil stimulated cell growth by 87% (relative to the control group), whereas the charged water caused a 61% stimulation. Although a detailed study to determine how long the water would hold it's charge was not completed, preliminary results indicated that the non-Hertzian frequency information remained in the water for at least three weeks. We were further able to demonstrate that the information pattern in the water could be reconstructed by subsequent exposure to a different non-Hertzian field. A second set of S-EMQS signals which were designed to inhibit lymphocyte growth were then superimposed onto the original pattern that had enhanced cell growth, thereby canceling the original stimulatory information pattern.

These results indicate that unlike conventional EM fields, which possess a limited capacity to structure and transfer their energy to water, non-Hertzian fields can store their frequency information in the lattice structure of water. The results further indicate that this frequency information can then be liberated from the water assumedly unchanged and cause the same biological effect as the original non-Hertzian field. These findings offer direct experimental evidence in support of DelGuidice's theory of non-Maxwellian propagation in water without loss of energy. The data may also explain the anomalous behavior of homeopathic remedies which have the ability to store (for very long time periods) the energetic information matrix associated with a chemical or drug. The **fact that the stored** information in the water can have the opposite biological effect as the original chemical or drug may offer a physical explanation for homeopathy. These kinds of studies may he useful clinically to

generate a set of frequencies which can override the information pattern associated with a disease and offer a novel approach for treating a wide variety of diseases.

In conclusion, the summary of the **biological experiments presented** in this article indicate

that non-Hertzian fields can produce profound direct effects on biological systems, independent of the belief of the individual, that water is a key mediator In this response.

and that the nature of this interaction is quantitatively and qualitatively different from that occurring with conventional transverse EM fields.

if EM fields are just derivates of non-Hertzian fields and the latter can interact with matter at the level of the nucleus (rather than the electron shell), non-Hertzian fields have a potential to affect biological systems at a very profound level indeed and should constitute a key role in the energy medicine of the future.

CONCLUSIONS

Notwithstanding the foregoing, the results of the exposure indicate a significant protective effect on human peripheral blood lymphocytes and an adverse effect from unprotected exposure to cellphone radiations at well below guideline maxima. We do not offer any explanation of the mechanism by which this is achieved. Moreover, these *in vitro* results do not necessarily mean that the device is also effective *in vivo*, and further research should aim to confirm the protective effect on human subjects by means of measurements of leucocyte competence before and after exposure in laboratory conditions.