Electromagnetic Radiation- Breaking Dna Or Communication Barriers !

Samarth Shukla *, Sourya Acharya**, Devendra Rajput***

ABSTRACT :

We humans are today standing at the cross roads of our achievements or have we cumulated the effects of their demerits. Well which ever way the story of man's achievements unfold , it is high time that we start to realize that we may be heading for some sort of significant genetic remake up and major pathological changes in the tissue, organ and our amazingly crafted body gifted by the almighty.

The mobile and other radio frequency devices as well as electromagnetic devices have been coming into the forefront thanks to the boom in the info tech corporate but what about their electromagnetic radiation fallout, they bang on the human body , our special senses, the tissue, the blood flow, the cells ,the DNA integrity as well as the proteonomics of our body all are subjected to dysregulated to biophysical idiosyncracies.

Ultimately in time leading to major pathological side effects, development of fatal irreversible damage as well as malignant outgrowths.

Key Words: genetic, electromagnetic, radiofrequency, DNA, proteonomics, malignant

INTRODUCTION:

With the advent in modern technologies and fast racing advancements in the field of information technology , not are we being narrowed down to one touch hand shakes and being microseconds away from one another but one can actually see and talk half way across the globe. Does one realize the price we pay for such state of art technology ! it just does not come in terms of monetary expense rather it is the body, the tissue, the cell, the DNA which bears the brunt of the so called " Electromagnetic radiation" .

Extensive analysis and studies both in terms of clinical parlance and genetic aberrations are being carried out to evaluate the actual sine qua non of the electromagnetic radioactive fallout on the human beings and all life forms as a whole. Several epidemiological surveys and extensive population target studies have been carried out specially in northern Europe and western hemisphere related to EMF fallout on humans and there by emanating cancer and diseases, but no definitive evidence could be substantiated.

Address for correspondence

Asso Prof – Dept. of Pathology, JNMC, Wardha
Asso. Prof- Dept. of Medicine, JNMC,Wardha
Asst. Prof – Dept. of Medicine,LNMC, Bhopal

DEFINING ELECTROMAGNETIC RADIATION:

"Electromagnetic radiation" covers a broad range of frequencies (over 20 orders of magnitude), from low frequencies in electricity supplies, radiowaves and microwaves, infrared and visible light, to x-rays and cosmic rays. Electric fields are created by differences in voltage: the higher the voltage, the stronger will be the resultant field. Magnetic fields are created when electric current flows: the greater the current, the stronger the magnetic field. An electric field will exist even when there is no current flowing. If current does flow, the strength of the magnetic field will vary with power consumption but the electric field strength will be constant.

Sources of Electromagnetic Radiations:

Electromagnetic fields are present everywhere in

our environment but are invisible to the human eye. Electric fields are produced by the local build-up of electric charges in the atmosphere associated with thunderstorms. The earth's magnetic field causes a compass needle to orient in a North-South direction and is used by birds and fish for navigation. Besides natural sources the electromagnetic spectrum also includes fields generated by human made sources: X-rays are employed to diagnose a broken limb after a sport accident. The electricity that comes out of every power socket has associated low frequency electromagnetic fields. And various kinds of higher frequency radio waves are used to transmit information – whether via TV antennas, radio stations or mobile phone base stations.

The Basic Facts:

Field strength: An electromagnetic field consist of an electrical part and a magnetic part. The electrical part is produced by a voltage gradient and is measured in volts/metre. The magnetic part is generated by any flow of current and is measured in Tesla.

For example, standing under a power line would expose you to an electrical voltage gradient due to the difference between the voltage of the line (set by the power company) and earth. You would also be exposed a magnetic field proportional to the current actually flowing through the line, which depends on consumer demand.

Both types of field give biological effects, but the magnetic field may be more damaging since it penetrates living tissue more easily. Magnetic fields as low as around 2 milli gauss (mG)or 0.2 micro Tesla (a millionth of a Tesla) can produce biological effects. For comparison, using a mobile (cell) phone or a PDA exposes you to magnetic pulses that peak at several tens of micro Tesla (Jokela et al,2004[1]; Sage et al, 2007[2]), which is well over the minimum needed to give harmful effects. Because mobile phones and other wireless gadgets are held close to the body and are used frequently, these devices are potentially the most dangerous sources of electromagnetic radiation that the average person possesses.

At cellular levels : Gene, Protien, DNA-
EMR (electromagnetic radiation) on Gene and Protiens:

Proteins and thereby Genes form the most important building blocks and the actual on ground messengers of providing correct step by step information for normal homeostatic, physiological as well as biochemical process in the body. Any detrimental effect on them through external sources most importantly the electromagnetic waves from mobiles , internet wi fi etc can have extremely minimal to severe repercussions on the gene functions like their normal protoncogenic or tumor suppressor modes to regulation of nuclear transcriptions to Apoptosis.

No matter where or when or which type of EMF(Electromagnetic field) hits or is exposed to the human body at the molecular level it is the cell which forms the main singular unit which is hit by the EMF , in the cell it is assumed that the prime target is the genes and protein which are hit (Phillips et al, 1992[3]; Wei et al, 1990[4]), for example heat shock protein, c jun, c myc are the important genes/proteins which are seen as prime target by the EMF.

Multiple studies have been carried out on an array of cells by exposing them to EMF; both by changing the frequency of EMF and as well as prolonging the exposure of the cells to EMF. It was found that the cells did show changes in the protein/gene structure . the changes in the protein and genes were analyzed by subjecting them to RT-PCR and PCR. But one thing which was a common out-come of many studies was that the gene or protein analyzed did not alter in it's structure rather it was the amount of expression of the gene which changed. Post exposure to EMF either the cell showed a two fold increased expression of genes or a drop of 50% in their expression. And there was no relationship seen between exposure to cell and differential gene expression (Ioberg et al, 2000[5]). Certain experiments carried out on human neuroblastoma cell lines by exposing them to intermittent exposure showed several genes being up or down regulated to almost five times in their expression, (Antonini et al[6]). Lupke et al[7]

carried out experiments on Human umbilical cord blood monocytes and on exposing them to non stop 45 mins of EMF, the cells definitely showed altered expression of cells in terms of cell metabolism regulation , physiological process within the cell, Signal transduction and altered immune response. Olivares-Banuelos et al[8] carried out studies on the following genes Phosphoglucomutase – 1, Neurofibromatosis interacting protein – 2, microtubule associated protein, Thiamine pyrophosphokinase and concluded suggesting that definitive changes were seen in the expression of the genes by there exposure to EMF. No significant change in gene were seen as regards to Heat shock response, DNA repair, Protien synthesis and cell cycle, by experiments carried out by Nakasono et al.,2003[9] by exposing cells to various intensities of EMF.

DNA and Electromagnetic Effects:

DNA form the actual building blocks and the information hubs in form of coded sequence to unfold the futuristic fate of the body. The DNA decides the embryologic, anatomic , physiological, Biochemical and overall integrity of body by right structure and function . Unfortunately the DNA are extremely sensitive in response to various physical, chemical, radiational as well as electromagnetic stimuli from external sources . Even minor breaks or shreads in DNA structure can lead to a severely amplified effect as far as the repercussions on the body as a whole is concerned both on cellular level as well as physiological functioning on the whole.

Several studies have been carried out to evaluated the toxic effects on the cell genome ultimately the DNA by the EMF. Cell have been thoroughly investigated for DNA damage assessment in form of DNA breaks – single or double strand breaks , cross linkages, chromosomal conformational changes, Micronuclei formations etc. the methodology employed at various centers may vary for genetic damage screening but the method commonly employed for the same was Single Cell Gel Electrophoresis. Studies in the epididemal spermatozoas were carried out and evaluated though no changes were qualified or quantified by gel electrophoresis method , PCR definitely showed extensive changes on the same the spermatozoa showed changes in the mitochondria and the beta globin locus of the nucleus, (Aitken et al, 2005)[10]. Studies carried out on human fibroblast cells showed breaks in the single as well as double strands of the DNA on exposure to EMF (mobile phone frequencies) and the damage to the DNA was even more severe on intermittent exposure, (Diem et al , 2005)[11]. In other similar studies carried out by (Gandhi and Anita et al, 2005,)[12] Human lymphocytes are found to show DNA single and double strand breaks as well as micronucleations in chronic cell phone users. Similar changes in the nuclear and DNA strand breaks were also seen in other studies carried out on lens epithelial cells (Lixia et al,2006)[13] as well as human blood cells by Zhang et al,2002[14]. But definitely many studies which have been carried out to estimate the DNA damage evaluation have turned out to be totally insignificant in terms of any substantial changes in the DNA or chromosomal changes, with the integrity of the genome being intact in totality, (Li et al 2001[15]; McNamee et al 2002a[16])

EMR and Immune system:

Immune system can be divided into innate and acquired as well as active and passive. What one has to realize is that the immunity is gears into action as a domino effect where in the T cell plays as the mastero and orchestrates through other lymphocytes and leukocytes as well as other cells of the body (eg: mast cells, eosinophils, dendritic reticulum cells, macrophages) by secreting cytokines and causing hypersensitive reactions.

The Electromagnetic radiations hit the cell and can cause immense immunomodulatory effects on the body including triggering of hyperimmune response to electromagnetic waves , the hyper immune response at low levels may be seen at the cellular levels triggering localized areas being affected like an atopy like situation but at higher electromagnetic frequencies , intense erythema , parasthesias like burning sensation on skin with hyperdermic response have been reported. Direct effects on the immune system were first reported in relation to people with symptoms of electrohypersensitivity. Subjective and objective

skin- and mucosa related symptoms, such as itch, smarting, pain, heat sensation, redness, papules, pustles, etc., after exposure to visual display terminals (VDTs), mobile phones, telephones, WI-FI equipments, as well as other electromagnetic devices were reported. Frequently, symptoms from internal organ systems, such as the heart and the central nervous system were reported.

A working definition of EHS from Bergqvist et al. (1997)[17] is:

"a phenomenon where individuals experience adverse health effects while using or being in thevicinity of devices emanating electric, magnetic or electromagnetic fields(EMFs)".

Stenberg (2004)[18] distinguishes between two groups: those who experience facial skin symptoms in connection with VDT work (sensory sensations of the facial skin including stinging, itching, burning, erythema, rosacea) while EHS symptoms include these and also fatigue, headache, sleeplessness, dizziness, cardiac and cognitive problems.

Hillert (2004)[19] reports that symptoms of EHS may include facial skin complaints, eye irritation, runny or stuffy nose, impaired sense of smell, hoarse dry throat, coughing, sense of pressure in ear(s), fatigue, headache, heaviness in the head, nausea/dizziness, and difficulties in concentrating. Cox (2004)[20] reported on a study of electrical hypersensitivity in the United Kingdom. Symptoms reported by mobile phone users included headaches (85%), dizziness(27%), fatigue (24%), nausea (15%), itching (15%), redness (9%), burning 61%), and cognitive problems (42%). For those individuals reporting EHS symptoms in the UK population, the percentage of patients with symptoms from cell phone masts was18%, DECT cordless phones (36%), landline phones (6%), VDTs (27%), television(12%) and fluorescent lights (18%). Gangi and Johansson (1997, 2000)[21,22] have proposed models for how mast cells and substances secreted from them (e.g., histamine, heparin, and serotonin) could explain sensitivity to electromagnetic fields similar to those used to explain UV- and ionizing irradiation-related damages. We discuss an increasing number of persons who report cutaneous problems as well as symptoms from certain internal organs, such as the central nervous system and the heart, when being close to electric equipment.

EMR and Neurological disturbances:

Amongst organ specific studies pertaining to the Electromagnetic radiations the neurological related changes pose the greatest challenges, as they form the most sensitive organ as well as tissue network in our body . The cells of the nervous system not only are permanent in nature of cell cycle mitosis (no more replication) making them extremely prone for irreversible injury but on long term the entire human nature, behavior, cognitive skills, motor as well as sensory reflexes and functions depend on the integrity of the neural system at the cellular level.

The brain is one particular organ which probably tops the charts for being in extreme proximity to the not only to the communication devices but even the radio/Electromagnetic frequencies which are used for communications. The wavelengths of these devices are coming in too close to the natural frequencies of the brain waves emanating from us, which could have disastrous as well as delirious consequences. The telephone be it wireless or in form of a mobile or say Wi-fi or even a blue tooth device is always kept close to the head and thus to the brain while conversing. This exposes the brain to excessive intermittent exposures for a long time and with repeated radiation, the effects on auditory neurosensory apparatus, neurological transmitters, Cognition, the brain waves etc. all have significant variations, but the most disastrous of them that is fatal brain tumors cannot be ignored.

EMR (electromagnetic radiation) leading to chemical and cellular changes:

There are several studies on the inhibitory and excitatory neurotransmitters. A decrease in GABA, an inhibitory transmitter, content in the cerebellum. Related to the findings of changes in GABA in the brain is that EMF has been shown to facilitate seizure in rats given subconvulsive doses of picotoxin, a drug that blocks the GABA system[Lopez Martin et al., 2006][23]. This finding raises the concern that humans with epileptic

disorder could be more susceptible to RFR exposure.

EMF leading to Electrophysiological changes in the brain:

Studies on EEG and brain evoked –potentials in humans exposed to cell phone radiation predominatly showed positive effects. Following studies also retariate the mentioned findings. Von Klitzing et al (1995)[24] were the first to report that cell phoe radiation affected EEG alpha activity during and after exposure to cell phone radiation. Mann and Roschke (1996)[25] reported that cell phone radiation modified REM sleep EEG and. shortened sleep onset latency. Rosche et al (1997)[26] found no significant findings in spectral power of EEG in subjected exposure to cell phone radiation for 3.5 mins. Eulitz et al[27]. reported that cell phone radiation affected brain activity when subjects were processing task-relevant target stimuli and not for irrelevant standard stimuli. Freude et al (1998)[28] found that preparatory slow brain potential was significantly affected by cellular phone radiation in certain regions of the brain when the subject were performing a cognitive complex visual task . the same effects were not observed when subjects were performing simple task.

Huber et al (2003)[29] reported EEG effect during NREM sleep and effect was not dependented on the side of head irradiated. They concluded that the effect involves subcortical area of the brainthat projected to both sides of the brain. Recently, Aalta et al. [2006][30], using PET scan imaging, reported a local decrease in regional cerebral blood flow under the antenna in the inferior temporal cortex, but an increase was found in the prefrontal cortex. There is little doubt that electromagnetic fields emitted by cell phones and cell phone use affect electrical activity in the brain. The effect also seems to depend on the mental load of the subject during exposure, e.g., on the complexity of the task that a subject is carrying out. Based on the observation that the two sides of the brain responded similarly to unilateral exposure, Huber et al. [2003][29] deduced that the EEG effect originated from subcortical areas of the brain.

EMF and the Cognitive functions:

At the cognitive level it is response reflexes which are altered along with significant changes in attention, sleep activity changes. The neurotransmitters show changes in their secretary properties and their by affect the functions Electromagnetic radiations are known to stimulate corticotrophin releasing factor which hits on the frontal cortex as well is responsible for secretion of peripheral opioids, basically behaving as a kind of stress response. The cognitive functions are definitely affected and altered to some state . the levels of awareness , response time and reflexes are increased flow to the thalamus, said to be more improved ironically , there is a change in the blood flow of the brain also more toward the parietal and occipital area as well a deep grey matter. Preece et al. [1999][31] were the first to report an increase in responsiveness, strongly in the analogue and less in the digital cell phone signal, in choice reaction time. Cao et al. [2000][32] showed that the average reaction time in cell phone users was significantly longer than that in control group in psychological tests. The time of use was negatively associated with corrected reaction number. Koivisto et al. [2000a, b][33] reported a facilitation of reaction in reaction time tasks during cell phone radiation exposure. In a working memory test, exposure speeded up response times when the memory load was three items but no significant effect was observed with lower loads. Jech et al. [2001][34] reported that cell phone radiation may suppress the excessive sleepiness and improve performance while solving a monotonous cognitive task requiring sustained attention and vigilance in narcolepsy patients. Lee et al. [2001[35]] reported a facilitation effect of cell phone radiation in attention functions. Smythe and Costall [2003][36] using a word learning task, found that male subjects made significantly less error than unexposed subject. However, the effect was not found in female subjects. It also reported that cell phone radiation affected male and female EEG differently. Thus, a majority of the studies showed that exposure to cell phone could affect cognitive functions and affect performance in various behavioral tasks. Interestingly, most of

these studies showed a facilitation and improvement in performance.

Auditory effects by Electromagnetic Radiations : Ear is the most remarkable of special senses and yet it has to face the direct stigmata of the so called radioactive fallout of the electromagnetic radiation. Obviously the direct injurious brunt is on the hearing sense. The Audibility has been seen to decrease in terms of decibels , as has been the case verified by various audiometric analyses over a consistent period of time. The cell phones proximity to the ear has prompted many a researchers to evaluate auditory pathology. Studies have been carried out to investigate the effect of cell phone radiation on the auditory system and its functions. Kellenyi et al. [1999][37] reported a hearing deficiency in the high frequency range in subjects after 15 minutes of exposure to cell phone radiation. Recently, Davidson and Lutman [2007][38] reported no chronic effects of cell phone usage on hearing, tinnitus and balance in a student population. Kellenyi et al. [1999][37], in addition to hearing deficiency, also reported a change in auditory brainstem response in their subjects.

EMR and Brain tumors:

Off lately the pro and con of extensive use of mobiles and their non stop company 24*7 has been no hidden fact , the common man owns a mobile keeps it with him all times and uses is without any restrictions. Infact Obessive Compulsive Disorders arising from the same can be sometimes very much evident. But the other part of the story also holds true , the side effects of the mobiles especially the brains tumors have also been doing the Chinese whispers amongst the scientist , the layman and the committees as well as corporate who tune in the radiofrequencies as per their own whims. During the recent decade potential health risks from microwave exposure and an increase in incidence of CNS neoplasms has been discussed both in scientific settings but also by the layman.

Brain tumors, accounting for the majority of CNS tumors, are rare. Annually about 36000 new cases are diagnosed in the US and about 180,000 180000 world-wide.There are some rare cases of inherited cancer syndromes (e.g. von Hippel-Lindau disease, Li-Fraumeni syndrome) that are related to brain tumor risk, accounting for a small fraction ofcases. Except for therapeutic x-rays no environmental or lifestyle life-stile factor has unequivocally been established as risk factor for brain tumors.

Since the report of Wertheimer and Leeper in 1979 of an increased incidence of brain tumors in children living in homes with an expected higher exposure to power-frequency electric and magnetic fields, exposure to electromagnetic fields have become an area of interest in the study of factors affecting brain tumor risk. The risk of brain tumors has been of special concern since the brain is the organ mainly exposed during such phone calls. Though very accurate and precise workup on many studies has been carried out for brain tumor and their development from Electromagnetic radiations, yet most of the studies have not been carried out for a very extensive period an average latency period for a tumor based study should atleast of >10yrs. It should be noted that for several carcinogens longer latency periods are often required, such as smoking and lung cancer, asbestos and lung cancer, dioxins and certain cancer

types etc. By now a number of studies exist that give results for brain tumor risk and use of mobile phones for subjects with latency period > 10 years. Most of these results are based on low numbers but nevertheless may together give a pattern of increased risk.

Occupational studies indicate that long term exposure at workplaces may be associated with an elevated brain tumor risk. The information technology (IT) is on the boom and the monetory financial benefits to the people directly and indirectly concerned to the industry is very much apparent to them but unfortunately on the sidelines is the dark side of this booming realized by the medical health fraternity as a whole and certain fixed guidelines can finally be formulated IT industry that is extensive exposures to uncontrolled, poorly monitor radio frequency levels emanating from the hubs , towers and banging on to the humans all around. It is only a matter with time that the human side effects will

be coming to the forefront.

Extensive studies have been carried out on exposure to various sorts of Electronic, Radio frequency and Electromagnetic devices with their effect on brain lesions and the outcomes have definitely shown a link up with brain lesions , primarily significant in causation of brain tumors, following researchers have shown valuable findings in their long term cohort studies on exposure of mobile frequencies (Electomagnetic radiation) and causation of brain tumors[39-46]

Their findings are further complied and tabulated below

Table1-2. Summary of a few studies on the use of cellular telephones and brain tumor risk. Odds ratio (OR), 95 % confidence interval (CI) and standardizedincidence ratio (SIR) are given

Study	Years Study Type	Age	Tumour type	No. of Cases	Odds ratio, 95 % confidence interval	Comments
Schoemaker et al 2005 Denmark, Finland, Sweden, Norway, Scotland, England, Interphone	1999-2004 Case-control	18-69 years (variable)	Acoustic neuroma	360	OR 0.9 (0.7-1.1)	Regular use
				23	OR **1.8** (1.1-3.1)	≥ 10 lifetime years of cell phone use on same side of head as tumour
				12	OR 0.9 (0.5-1.8)	≥ 10 lifetime years of cell phone use on opposite side of head as tumour
Christensen et al 2005 Denmark Interphone	2000-2002 Case-control	20-69 years	Low-grade glioma	47	OR 1.1 (0.6-2.0)	Regular use
				9	OR 1.6 (0.4-6.1)	≥10 years since first regular use of cell phone
			High-grade glioma	59	OR 0.6 (0.4-0.9)	Regular use
				8	OR 0.5 (0.2-1.3)	≥10 years since first regular use of cell phone 17 odds ratios for high-grade glioma, all < 1.0, indicates systematic bias
			Meningioma	67	OR 0.8 (0.5-1.3)	Regular use
				6	OR 1.0 (0.3-3.2)	≥10 years since first regular use of cell phone
Hepworth et al 2006 UK Interphone	2000-2004 Case-control	18-69 years	Glioma	508	OR 0.9 (0.8-1.1)	Regular use
				NA	OR 1.6 (0.9-2.8)	≥10 years of cell phone use on same side of head as tumour.
				NA	OR 0.8 (0.4-1.4)	>10 years of cell phone use on opposite side of head as tumour.

Study	Years Study Type	Age	Tumour type	No. of Cases	Odds ratio, 95 % confidence interval	Comments
Takebayashi et al 2006 Tokyo Interphone	2000-2004 Case-control	30-69 years	Acoustic neuroma	51	OR 0.7 (0.4-1.2)	Regular use
				4	OR 0.8 (0.2-2.7)	Length of use > 8 years
				20	OR 0.9 (0.5-1.6)	Ipsilateral use
Schüz et al 2006 Denmark	1982-2002 Cohort	>18 years	Glioma	257	SIR 1.0 (0.9-1.1)	420 095 telephone subscribers Latency ≥ 10 years
			Meningioma	68	SIR 0.9 (0.7-1.1)	
			Nerve sheat tumors	32	SIR 0.7 (0.5-1.0)	
			Brain and nervous system	28	SIR 0.7 (0.4-0.95)	
Lahkola et al 2007 Denmark, Norway, Finland, Sweden, UK Interphone	September 2000-February 2004 (differed between countries) Case-control	20-69 years (Nordic countries), 18-59 years (UK)	Glioma	867	OR 0.8 (0.7-0.9)	Regular use
				77	OR 1.4 (1.01-1.9)	Ipsilateral mobile phone use, ≥ 10 years since first use, p for trend = 0.04
Klaeboe et al 2007 Norway Interphone	2001-2002 Case-control	19-69 years	Glioma	161	OR 0.6 (0.4-0.9)	Regular use
			Meningioma	111	OR 0.8 (0.5-1.1)	
Schlehofer et al 2007 Germany Interphone	2000-2003 Case-control	30-69 years	Acoustic neuroma	29	OR 0.7 (0.4-1.2)	Regular use

The Beneficial effects of ElectroMagnectic Field:

Definitely without doubts, the Electromagnetic waves have been causing harm to our finitely tuned body cells , signals organ functioning cell cycles etc. But yes there seems to be a brighter side to this . Electromagnetic radiation is a known modality of treatment . Electromagnetic fields are widely used in therapeutic medical applications. Proof of effectiveness has been demonstrated in numerous clinical applications of low-intensity electronic radiation, each treatment employing specific characteristics of frequency, modulation and intensity to achieve its efficacy. Pilla AA. Et al (2007)[47]

Electro Magnetic Fields have been extensively employed in healing wounds Acute as well as chronic injuries as well as non healing wound repairs. Fractures are said to be very sensitive to EMF , fresh bone trauma are known to show an excellent healing response to these EMFs. Even Complicated malunions or non unions ,surgical repairs in form of osteotomies , spinal surgical procedure requiring bone fusions are well carried out by the EMF aids. These clinical results have been validated by well designed and statistically powered double-blind clinical trials and have survived meta-analyses.

The FDA has approved labeling for these biophysical devices, limited at present to these indications." "The potential clinical applications of Electromagnetic Force (EMF) therapeutics extend far beyond those considered here and the clinical rewards are certain to be huge." Initial stages of neoplastic proliferations can be halted or atleast curtailed, Studies on cases of myocarditis as well as cardiac muscle regeneration, arthritis, diabetes have shown promising results in the sense there has been good regenerative activity seen after stimulating the muscle to electrical or Electromagnetic Field therapies. Besides these at low frequency there are reports of even reparative changes in certain Neurological conditions, Bronchial asthama, healing of skin as well as venous ulcers and promotion of angiogenesis, In the coming years EMF definitely will be playing a larger role as a treatment modality or adjunct in various therapies for pain management, besides neuropsychiatric disorders like Depression, Insomnia and parkinson's disease, peripheral nerve regeneration. Shealy CN et al (2004)[48]

EMF modalities are simple, safe and definitely cost effective. They not only will allay the underlying symptommatology but will definitely go a long way in curing the underlying pathology as well.

The Final Out come and recommendations:

It is very evident from the entire write up of this review that Electromagnetic radiations emanating from the various devices and human technological innovations are causing an uproar in the medical research community and ringing alarm bells in the health centers as the side effects, temporary changes as well as permanent damage to the cell , tissue various systems of the body, special senses are a no more hidden fact, the intense studies and workup have being showing the dark effects of these so called convenient communication modalities or Electromagnetic radiations. Their negatives cannot be shelved in and no longer be ignored. Exposure to electromagnetic fields (EMF) has been linked to a variety of adverse health outcomes. The health endpoints that have been reported include childhood leukemia, adult brain tumors, childhood brain tumors, genotoxic effects (DNA damage and micronucleation), neurological effects and neurodegenerative disease, immune system dysregulation, allergic and inflammatory responses, breast cancer in men and women, miscarriage and some cardiovascular effects. From minimal to extreme detrimental effect leaving no nook and corner of the body unharmed.

It seems to be most important for all medical as well as non medical bodies regulating and dealing with electronic gadgets plus all the electromagnetic regulating hubs from cell phones to internet and wi fi modalities to reconsider and restudy the radio frequencies they broadcast and monitor the kind of electromagnetic radiations they emit precisely regulating the wavelength and those frequencies. It is important to evaluate that with the present frequency in usage much affect is being brunt directly and indirectly by the human body. Resulting effects can include DNA breaks and chromosome aberrations, cell death including death of brain neurons, increased free radical production, activation of the endogenous opioid system, cell stress and premature aging, changes in brain function. How do we respond to such frequencies are we adapting to that kind of electromagnetic flux or in time to come there can be serious repercussions not only to the humans being expose but to the unborn progency as well.

A public health action level that implements preventative action now is warranted, based on the collective evidence.

Conclusion

Finally it is time to decide and mend ways, Where do we go from here! more advancements in the Information tech field or Back to basics shielding our body from our own self destructive ways. Lets decide before we start developing pathological clones of ourselves and attain extinction as the ultimate prize of being so called superior life forms on mother Earth.

References:

1. Jokela K, Puranen L, Sihvonen AP 2004. Assessment of the magnetic field exposure

due to the battery current of digital mobile phones. Health Phys. 86(1): 56-66.

2. Sage C Johansson O Sage SA. 2007. Personal Digital Assistant (PDA) Cell Phone Units Produce Elevated Extra-Low Frequency Electromagnetic Field Emissions. Bioelectromagnetics 28:5, 386-392.
3. Phillips JL, Haggren W, Thomas WJ, Ishida-Jones T, Adey WR. 1992. Magnetic field-induced changes in specific gene transcription. Biochim Biophys Acta 1132(2):140-4.
4. Wei LX, Goodman R, Henderson A. 1990. Changes in levels of c-myc and histone H2B following exposure of cells to low-frequency sinusoidal electromagnetic fields: evidence for a window effect Bioelectromagnetics 11(4):269-72.
5. Loberg LI, Engdahl WR, Gauger JR, McCormick DL. 2000. Expression of cancer-related genes in human cells exposed to 60 Hz magnetic fields. Radiat Res 153(5 Pt 2):679-84.
6. Antonini RA, Benfante R, Gotti C, Moretti M, Kuster N, Schuderer J, Clementi F, Fornasari D. 2006. Extremely low-frequency electromagnetic field (ELF-EMF) does not affect the expression of alpha3,alpha5 and alpha7 nicotinic receptor subunit genes in SH-SY5Y neuroblastoma cell line. Toxicol Lett164(3):268-77.
7. Lupke M, Frahm J, Lantow M, Maercker C, Remondini D, Bersani F, Simko M. 2006. Gene expression analysis of ELF-MF exposed human monocytes indicating the involvement of thealternative activation pathway. Biochim Biophys Acta1763(4):402-12.
8. Olivares-Banuelos T, Navarro L, Gonzalez A, Drucker-Colin R. 2004. Differentiation of chromaffin cells elicited by ELF MF modifies gene expression pattern. Cell Biol Int 28(4):273-9.
9. Nakasono S, Laramee C, Saiki H, McLeod KJ. 2003. Effect of power-frequency magnetic fields on genome-scale gene expression in Saccharomyces cerevisiae. Radiat Res 160(1):25-37.
10. Aitken RJ, Bennetts LE, Sawyer D, Wiklendt AM, King BV. Impact of radio frequency electromagnetic radiation on DNA integrity in the male germline. Inter J Androl 28:171-179, 2005.
11. Diem E, Schwarz C, Adlkofer F, Jahn O, Rudiger H. Non-thermal DNA breakage by mobile-phone radiation (1800MHz) in human fibroblasts and in transformed GFSH-R17 rat granulosa cells in vitro. Mutat Res. 583:178-183, 2005.
12. Gandhi G, Singh P. Cytogenetic damage in mobile phone users: preliminary data. Int J Hum Genet 5(4):259-265, 2005.
13. Lixia S, Yao K, Kaijun W, Deqiang L, Huajun H, Xiangwei G, Baohong W, Wei Z, Jianling L, Wei W. Effects of 1.8GHz radiofrequency field on DNA damage and expression of heat shock protein 70 in human lens epithelial cells. Mutat Res. 602:135142, 2006.
14. Zhang MB, He JL, Jin LF, Lu DQ. Study of low-intensity 2450-MHz microwave exposure enhancing the genotoxic effects of mitomycin C using micronucleus test and comet assay in vitro. Biomed Environ Sci 15(4):283-290, 2002.
15. Li L, Bisht KS, LaGroye I, Zhang P, Straube WL, Moros EG, Roti Roti JL. Measurement of DNA damage in mammalian cells exposed in vitro to radiofrequency fields at sars of 3-5 w/kg. Radiat Res 156:328-332, 2001.
16. McNamee JP, Bellier PV, Gajda GB, Miller SM, Lemay EP, Lavallee BF, Marro L, Thansandote A. DNA Damage and Micronucleus Induction in Human Leukocytes after Acute In Vitro Exposure to a 1.9 GHz Continuous-Wave Radiofrequency Field. Radiat Res 158(4):523-533, 2002a.
17. Bergqvist U Vogel E, editors. 1997. Possible health implications of subjective symptoms and electromagnetic fields. A report by a European group of experts for the European Commission, DG V. Solna (Sweden): National Institute for Working Life (Arbete och Halsa 1997:19).
18. Stenberg B Eriksson N Hansson Mild K Hoog J Sandstrom M Sundell J Wall S. 1995. Facial skin symptoms in visual display terminal (VDT) workers. A casereferent study of personal, psychosocial, building- and VDT-related risk

indicators. Int J Epidemiol, 24:796-803

19. Hillert L. 2004. Cognitive therapy for patients who report electromagnetic hypersensitivity. Conference Presentation WHO International Workshop on Electrical Hypersensitivity, October 25-27, 2004, Prague, Czech Republic.
20. Cox R. 2004. Electrical Hypersensitivity – Human Studies in the UK. Conference Presentation WHO International Workshop on Electrical Hypersensitivity, October 25-26, Prague, Czech Republic.
21. Gangi, S., Johansson, O. 1997. Skin changes in "screen dermatitis" versus classical UV- and ionizing irradiation-related damage--similarities and differences. Two neuroscientists' speculative review. Exp Dermatol 6: 283-291.
22. Gangi, S., Johansson, O. 2000. A theoretical model based upon mast cells and histamine to explain the recently proclaimed sensitivity to electric and/or magnetic fields in humans. Med Hypotheses 54: 663-671.
23. Lopez-Martin E, Relova-Quinteiro JL, Gallego-Gomez R, Peleteiro-Fernandez M, Jorge-Barreiro FJ, Ares-Pena FJ. GSM radiation triggers seizures and increases cerebral c-Fos positivity in rats pretreated with subconvulsive doses of picrotoxin. Neurosci Lett. 398:139-144,2006.
24. Von Klitzing, L, Low-frequency pulsed electromagnetic fields influence EEG of man. Phys.Medica 11:77-80, 1995.
25. Mann, K, Roschke, J, Effects of pulsed high-frequency electromagnetic fields on human sleep.Neuropsychobiology 33(1):41-47, 1996.
26. Roschke, J, Mann, K, No short-term effects of digital mobile radio telephone on the awake human electroencephalogram. Bioelectromagnetics 18(2):172-176, 1997.
27. Eulitz, C, Ullsperger, P, Freude, G, Elbert ,T, Mobile phones modulate response patterns of human brain activity. Neuroreport 9(14):3229-3232, 1998.
28. Freude, G, Ullsperger, P, Eggert, S, Ruppe, I, Effects of microwaves emitted by cellular phones on human slow brain potentials. Bioelectromagnetics 19(6):384-387, 1998.
29. Huber R, Schuderer J, Graf T, Jutz K, Borbely AA, Kuster N, Achermann P. Radio frequency electromagnetic field exposure in humans: Estimation of SAR distribution in the brain,effects on sleep and heart rate. Bioelectromagnetics 24(4):262-276, 2003.
30. Aalto S, Haarala C, Bruck A, Sipila H, Hamalainen H, Rinne JO. Mobile phone affects cerebral blood flow in humans. J Cereb Blood Flow Metab. 26(7):885-890, 2006.
31. Preece, AW, Iwi, G, Davies-Smith, A, Wesnes, K, Butler, S, Lim, E, Varey, A, Effect of a 915-MHz simulated mobile phone signal on cognitive function in man. Int J Radiat Biol 75(4):447-456, 1999.
32. Cao Z, Liu J, Li S, Zhao X. [Effects of electromagnetic radiation from handsets of cellular telephone on neurobehavioral function] Wei Sheng Yan Jiu 29(2):102-103, 2000.
33. Koivisto, M, Revonsuo, A, Krause, C, Haarala, C, Sillanmaki, L, Laine, M, Hamalainen, H,Effects of 902 MHz electromagnetic field emitted by cellular telephones on response times in humans. Neuroreport 11(2):413-415, 2000a.
34. Jech R, Sonka K, Ruzicka E, Nebuzelsky A, Bohm J, Juklickova M, Nevsimalova S. Electromagnetic field of mobile phones affects visual event related potential in patients with narcolepsy. Bioelectromagnetics 22(7):519-528, 2001.
35. Lee TMC, Ho SMY, Tsang LYH, Yang SYC, Li LSW, Chan CCH, Effect on human attention of exposure to the electromagnetic field emitted by mobile phones. Neuroreport 12:729-731,2001
36. Smythe JW, Costall B. Mobile phone use facilitates memory in male, but not female, subjects. Neuroreport 14(2):243-246, 2003.
37. Kellenyi, L, Thuroczy, G, Faludy, B, Lenard, L, Effects of mobile GSM radiotelephone exposure on the auditory brainstem response (ABR). Neurobiology 7:79-81, 1999.
38. Davidson HC, Lutman ME. Survey of mobile phone use and their chronic effects on the hearing of a student population. Int J Audiol. 46(3):113-118, 2007.
39. Schoemaker MJ, Swerdlow AJ, Ahlbom A, et

al. 2005. Mobile phone use and risk of acoustic neuroma: results of the Interphone case-control study in five North European countries. Br J Cancer doi:10.1038 / sj.bjc.6602764.2006 Jan 27. Comment by Morgan in: Am J Epidemiol 2006;164:294-295.

40. Christensen HC, Schüz J, Kosteljanetz M, et al. 2005. Cellular telephones and risk for brain tumors. A population-based, incident case-control study. Neurology 64:1189-1195.
41. Hepworth SJ, Schoemaker MJ, Muir KR, Swerdlow AJ, van Tongeren MJ, McKinney PA. 2006. Mobile phone use and risk of glioma in adults: case-control study. BMJ15;332(7546):883-887. Epub 2006 Jan 20.
42. Takebayashi T, Akiba S, Kikuchi Y, et al. 2006. Mobile phone use and acoustic neuroma risk in Japan. Occup Environ Med 63:802-807.
43. Schüz J, Jacobsen R, Olsen JH, et al. 2006. Cellular telephone use and cancer risks: An update of a nationwide Danish cohort. J Natl Cancer Inst 98:1707-1713. neuroma (Interphone Study Group, Germany). Eur J Cancer doi:10.1016/j.ejca.2007.05.008.
44. Lahkola A, Auvinen A, Raitanen J, et al. 2007. Mobile phone use and risk of glioma in 5 North European countries. Int J Cancer 120:1769-1775.
45. Klaeboe L, Blaasaas KG, Tynes T. 2007. Use of mobile phones in Norway and risk of intracranial tumours. Eur J Cancer Prev 16:158-164.
46. Schlehofer B, Schlafer K, Blettner M, et al. 2007. Environmental risk factors for sporadic acoustic neuroma (Interphone Study Group, Germany). Eur J Cancerdoi:10.1016/j.ejca.2007.05.008
47. Pilla AA. Mechanisms and Therapeutic Applications of Time-Varying and Static Magnetic Fields. Handbook of Biological Effects of Electromagnetic Fields Third Edition: Biological and Medical Aspects of Electromagnetic Fields, 2007. Barnes FS and Greenebaum B. editors, page 357
48. Shealy CN Liss S Liss BS. Evolution of Electrotherapy: From TENS to Cyberpharmacology.Bioelectromagnetic Medicine. 2004, Rosch PJ and Markov MS, editors, page 93-114.