THE EFFECT OF MRET NOISE FIELD GENERATOR ON METABOLIC ACTIVITY OF ASTROCYTE CELLS EXPOSED TO RF PHONES RADIATION

ABSTRACT

This article is related to the experimental data revealing the ability of MRET noise field generator (NFG) to compensate the inhibition of Astrocyte cells metabolic activity when Astrocytes are exposed to mobile phone radiation. Astrocyte samples exposed to mobile phone radiation were placed at the distance of 30 feet from NFG in this experiment. Due to the fractal geometry structure of MRET polymer compound and the phenomenon of piezoelectricity, this polymer generates subtle, low frequency, non-coherent electromagnetic oscillations (composite noise field) when exposed to electromagnetic field of 7.8 Hz and 14.5 Hz frequency oscillating in a repeating sequence for 5 seconds each time. Litovitz et al. proposed that living cells exist in an electrically noisy environment and these endogenous thermal noise fields are larger than those exogenous EMFs reported to cause effects. They suggested that only the EMFs that are temporally and spatially coherent such as radiofrequency fields could affect living cells while endogenous thermal noise fields, which cells do not respond to, were temporally and spatially incoherent. To verify the compensatory effect of amplitude modulated signals generated by NFG on metabolic activity of living cells exposed to mobile phone radiation the experiment was conducted at Molecular Diagnostic Services Inc., San Diego on normal human brain Astrocyte cell samples. The results of experiment reveal the following: when normal human brain Astrocyte cells are exposed to mobile phone irradiation cells growth is significantly inhibited within the first 3-4 days. Then Astrocytes metabolic activity begins to increase most likely due to the adaptation effect (cells structure and function are constantly modified in response to changing environmental influences). This experiment confirms that MRET noise field generator (NFG) placed at the distance of 30 feet from the treated plates has measurable compensatory effect on the inhibition of normal human brain Astrocyte cells growth when cells are exposed to mobile phone irradiation.

Keywords: *Astrocytes, MRET Noise Field Generator, piezoelectric effect, fractal geometry, noise field, amplitude modulation, metabolic activity.*

INTRODUCTION

While many polar polymers are highly flexible and form an amorphous solid upon the process of polymerization, a large number of polymers, such as epoxy, actually form partially crystalline structures. The epoxy polar polymer material is a good example presenting all qualities of volumetric fractal matrix.

A number of studies show that external electromagnetic field can affect local orientations and phase transitions in polymer crystalline systems of longitudinal chains. The longitudinal polymer crystalline system is a macromolecule of consecutively copolymerized liquid crystals and flexible polymer sequences. Polar polymers possess comparatively low values of relative dielectric permittivity (3-15) which means that macromolecules in the molecular structure of these polymers can be easily displaced by external electromagnetic force. Subsequently the external electromagnetic field can seriously modify the local orientation order of the system and affect phase transition parameters and dielectric properties of the polymer compound. The orientation of the polar groups in electromagnetic field affects the backbone orientation and determines the resulting anisotropy of crystalline structure of epoxy polymer introduced to electromagnetic field. The existence of orientations and phase transitions in crystalline systems of epoxy polymer introduced to external electromagnetic field leads to the origination of subsequent relaxation and strain phases in macromolecular structures that induces the phenomenon of piezoelectricity. Several investigations conducted on polymers with cholesteric elastomer structures including epoxy indicated that uniaxial compression parallel to the helicoidal axis of the cholesteric structure leads to a compression of the helix. Simultaneously an electric charge at the surface of the elastomer is observed. The correlation between the piezoelectric coefficient and the order parameter reflects a coupling and shows that the piezoelectric effect of polymer compounds directly depends on the state of order of the liquid crystalline phase structures [3].It means there is direct correlation between the topology of polymer molecular structures and the intensity of piezoelectric phenomenon.

The topology of polymer molecular structure is scientifically based on the principles of formation of fractal systems.

The first principle of fractalization is realized through the iterative algorithm of formation of complex structural systems based on the existence of the initial prototype matrix which governs the formation of the object. Any small fragment of fractal system reproduces the structure of the whole system under the increasing scale. This principle clearly describes the hierarchy organization of fractal system. This principle can be seen in the formation of crystalline lattice of mono crystals, development and growth of biological systems where genetic prototype is developed through the certain algorithm of replication from single cell into the organism, where all cells have a unique basic matrix in the form of DNA structure.

Another principle that governs formation of the fractal system is the principle of complementarity. The main criterion of the integrity of fractal system is minimization of tendencies leading to spontaneous formation of "inside" conflicts and contradictions in the system. It states that in order to achieve stability of any complex system the level of inside "contradictions" of this system should be directed to null. This statement is correct for any three dimensional system as well as any volumetric system that has the infinite number of different kinds of structural vectors. The basis of formation of stable complex system should be the structural module which has precise, balanced matrix structure and can clone self projections in the surrounded environment. The fractal cloning of structures consider the formation of self-similar replications of the initial basic module with specific coefficient of similarity. The object which is formed as a result of fractal cloning process has dimensions that are proportional to the dimensions of initial basic module.

The next basic principle that governs the formation of fractal system in nature provides the idea of existence of the lattice of "barrier" membranes. Any fractal system is separated by barrier membranes relative to central zone of the system, and those membranes play roles of transformers and converters of the previously existing algorithm or signal into another algorithm or signal which is more adequate for the present level. In this case the transmission of the signal from the central zone of the fractal system to the peripheral zone of the same system and vise a verse is related with its step by step adaptation. This principle can be interpreted as a process of quantum transformations of the entropy of the object. In this case each barrier membrane of the system is considerate to be some kind of a fractal “space – wave” filter which modifies previously existing algorithm or signal into the new form of algorithm or signal. This concept provides some evidence that the encounter of fractal matrix with the electromagnetic field has ability to affect this field in a way obviously characterized by the matrix’s structure [4].

In case of epoxy polymer the kinetics to a large extent determine the final crystalline structure of the polymer. The introduction of foreign agents (substances) in the parent lattice of epoxy polymer leads to the effect of superimposed periodicity and, as a result, develops modulated crystalline structures with specific fractal microstructure, phase transition, network topology and polarity. Due to the fractal structures of MRET polymer compound and the phenomenon of piezoelectricity this polymer generates subtle, low frequency, non-coherent electromagnetic field (composite noise field) when exposed to electromagnetic field of 7.8 Hz and 14.5 Hz frequency oscillating in a repeating sequence for 5 seconds each time. MRET polymer compound is driven by the solenoid that encapsulates the polymer material. The composite noise field can modify RF signals as a result of superposition phenomenon. The superposition of composite noise field generated by MRET Generator and RF microwave signals leads to amplitude modulation of RF signals where random low frequency signal generated by MRET Generator is a modulating signal and original microwave signal is a modulated one [5].

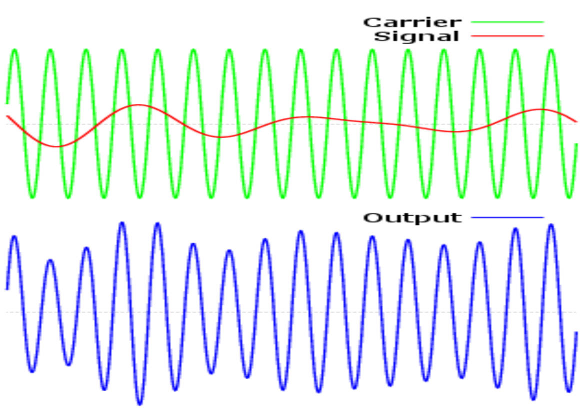

FIG.1 Amplitude modulated signal

Amplitude modulation consists of encoding information onto a carrier signal by varying the amplitude of the carrier (Fig.1). Amplitude modulation produces a signal with power concentrated at the carrier frequency and in two adjacent sidebands. The lower sideband (LSB) appears at frequencies below the carrier frequency; the upper sideband (USB) appears at frequencies above the carrier frequency. The sideband power accounts for the variations in the overall amplitude of the signal. Realizing mentioned above it is possible to conclude that MRET Noise Field Generator low frequency signal superimposed on RF carrier microwave field makes the resulting modulated spectral components of microwave field to resemble the characteristics of spatial incoherent field.

Litovitz *et al.* proposed that living cells exist in an electrically noisy environment and these endogenous thermal noise fields are larger than those exogenous EMFs reported to cause effects. They suggested that only the EMFs that are temporally and spatially coherent such as radiofrequency fields could affect living cells while endogenous thermal noise fields, which cells do not respond to, were temporally and spatially incoherent. A number of observations have supported this theory. In one experiment, the cellular effects induced by acute microwave radiation were mitigated by superposing with electromagnetic noise *in vitro*. DNA damage induced by 1.8 GHz microwave radiation at the SAR of 3 W/kg and 4 W/kg was significantly higher than sham exposure ($p<0.001$) whereas no significant differences could be observed in other exposure groups compared with the sham exposure group ($p>0.05$). Electromagnetic noise alone did not increase DNA damage of HLEC, and when it was superposed on the radiofrequency field, the electromagnetic noise could block RF-induced DNA damage [1]. Another experiment demonstrated that microwave fields, amplitude modulated by an extremely low-frequency (ELF) sine wave, can induce a nearly twofold enhancement in the activity of ornithine decarboxylase (ODC) in L929 cells at SAR levels of the order of 2.5 W/kg. Similar, although less pronounced, effects were also observed from exposure to a typical digital cellular phone test signal of the same power level, burst modulated at 50 Hz. It has also shown that ODC enhancement in L929 cells produced by exposure to ELF fields can be inhibited by superposition of ELF noise [2].
To verify the compensatory effect of amplitude modulated signals on metabolic activity of living cells exposed to mobile phone radiation an experiment was conducted at Molecular Diagnostic Services Inc., San Diego on normal human brain Astrocyte cell samples.

METHOD AND MATERIALS

The experiment was conducted at Molecular Diagnostic Services Inc., San Diego. Mobile phones model Samsung Gusto^{TM2} was used to administer the irradiation of Astrocyte cells. MRET noise field generator (NFG) of Global Quantech Inc. was used to test the compensatory effect of amplitude modulated signals on Astrocytes exposed to mobile phone irradiation.

- Astrocytes were thawed, plated into poly-lysine coated flasks and cultured for several days prior to seeding into 96 well plates. Cells were seeded in two poly-lysine 96 well plates (25,000 cells/well).

- Plates of astrocytes were treated with or without cell phone radiation daily for 6 hours/day (for a total of 5 days.

- Cell phone radiation was administered by placing the plate directly 1 inch above a Samsung Gusto^{TM2} cell phone at room temperature during which an active call was continuously ongoing for 6 hours. Phones were monitored every 10 minutes to ensure no interruption in the call occurred. The untreated plate was incubated at room temperature in a separate room. Room temperature was monitored throughout the experiment at each plate. Fluctuations in room temperature were minimal and deemed equivalent at each station.

- Three plates were included in the study. Plate one received no cell phone treatment, plate 2 received cell phone treatment alone, plate 3 received cell phone treatment and was placed at 30 feet distance from MRET Noise Field Generator. A plate 3 was treated in one room while plates 1 and 2 were kept in two separate rooms. Temperature in the rooms were monitored and controlled within 1 degree Celsius. On day 3, random temperature samples were taken on well in each plate and confirmed average temperature variations were a single degree Celsius or less from plate to plate.

- Following treatment, all plates were placed back into the 37ºC incubator.

- At days 2, 3, 4 and 5, an MTT-like assay was performed using the Cell Titer 96 Aqueous reagent (Promega) according to the manufacturer's recommendation.

MTT was added to wells and the plates were read on a 96 well plate reader (490 nm) (Molecular Devices Vmax kinetic microplate reader, Molecular Devices LLC) at various time-points after addition of the test reagent. Incubation time varied, as the number of cells increased over time. The same plate was used for all assay measurements and only a subset of wells treated with MTT on each assay date. To normalize data to account for the varying cell number and MTT incubation times, background (determined from average optical density value from wells containing media alone) was subtracted from individual data points and an average and standard deviation was calculated for the cell phone or no cell phone treated wells. The percentage of MTT signal in the cell phone treated wells relative to the no cell phone treated wells was calculated using the average and standard deviations from the two sample sets on each day of measurement. This percentage was then plotted as a function of days of treatment.

The results of the MTT-like assay are presented in the Results section below**.**

RESULTS

Figure 2 contains a dose response graph of the MTT assay data for Astrocytes with and without mobile phone irradiation treatment and in the presence of the MRET Noise Field Generator (NFG). The "no mobile phone" treatment signal on each day of measurement is set at 100% and the percentage of this signal obtained from the mobile phone treated or mobile phone plus NFG wells is graphed.

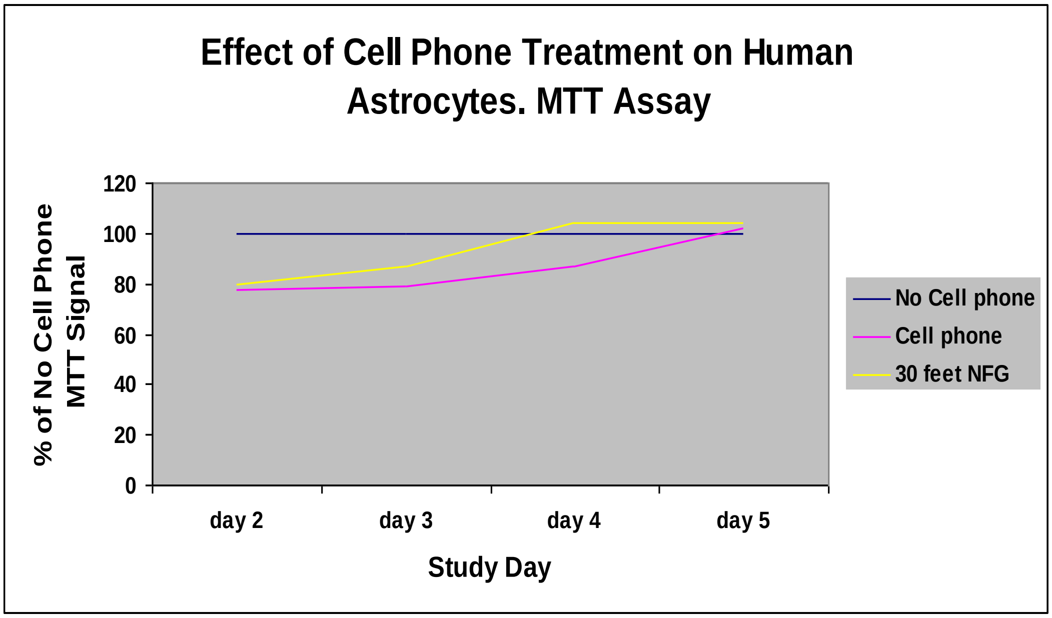

FIGURE 2: Effect of mobile phone radiation on human Astrocyte cells. Cells were treated with mobile phone irradiation plus or minus the NFG (at the distance of 30 ft away) for 5 consecutive days. On days 2, 3, 4, and 5, an MTT Assay was performed. Data was normalized as indicated in the Work accomplished section above, and the percent signal relative to the "no mobile phone" treated wells was plotted as a function of study day. Data points represent the average values for replicate wells. Error bars represent standard deviations. Standard deviations were calculated using standard methods for the propagation of errors.

Day 2	**Raw Data**			
Position	30 feet		Phone only	No phone
	1.366		1.350	1.451
	1.341		1.375	1.539
	1.466		1.387	1.626
	1.403		1.407	1.570
	1.332		1.404	1.579
	1.323		1.324	1.491
	Media			
	0.608		0.624	0.592
	0.602		0.630	0.572
Average	0.605		0.627	0.582

	Minus Background			
	30 feet		Phone only	No phone
	0.761		0.723	0.869
	0.736		0.748	0.957
	0.861		0.760	1.044
	0.798		0.780	0.988
	0.727		0.777	0.997
	0.718		0.697	0.909
Average	0.767		0.748	0.961
StDev	0.054		0.032	0.063

	30 feet		Phone only	No phone
Average % of No Cell	79.8		77.8	100.0
StDev	9.69		7.89	9.33

TABLE 1: Effect of mobile phone radiation +/- NFG on human Astrocyte cells: Day 2 Data. Raw Data and Analyzed Data are presented for the MTT reading on cells treated with mobile phone radiation for 2 days. Results are from an overnight read of the MTT data. After subtracting the average media alone signal, an average and standard deviation were calculated. The percentage of the Non-Cell Phone signal then calculated.

Day 3	**Raw Data**				**Minus Background**			
Position	30 feet		Phone only	No phone	30 feet		Phone only	No phone
	1.336		1.247	1.493	0.729		0.659	0.901
	1.424		1.249	1.509	0.817		0.661	0.917
	1.326		1.340	1.500	0.719		0.752	0.908
	1.448		1.320	1.545	0.841		0.732	0.953
	1.414		1.333	1.519	0.807		0.745	0.927
	1.366		1.304	1.379	0.759		0.716	0.787

	Media								
	0.602		0.588	0.594	Average	0.778		0.711	0.898
	0.613		0.588	0.591	StDev	0.050		0.041	0.058
Average	0.608		0.588	0.593					

	30 feet		Phone only	No phone
Average % of No Cell	86.6		79.1	100.0
StDev	9.10		8.66	9.09

TABLE 2: **Effect of cell phone radiation +/- NFG on human astrocyte cells: Day 3 Data.** Raw Data and Analyzed Data are presented for the MTT reading on cells treated with mobile phone radiation for 3 days. Results are from an overnight read of the MTT data. After subtracting the average media alone signal, an average and standard deviation were calculated. The percentage of the Non-Cell Phone signal then calculated.

Day 4	**Raw Data**				**Minus Background**			
Position	30 feet		Phone only	No phone	30 feet		Phone only	No phone
	1.728		1.508	1.578	1.016		0.850	0.940
	1.813		1.628	1.710	1.101		0.970	1.072
	1.876		1.618	1.770	1.164		0.960	1.132
	1.792		1.584	1.725	1.080		0.926	1.087
	1.837		1.535	1.691	1.125		0.877	1.053
	1.592		1.419	1.479	0.880		0.761	0.841

Media								
0.728		0.657	0.641	Average	1.061		0.890	1.020
0.697		0.660	0.636	StDev	0.101		0.079	0.109

Average	0.713		0.659	0.639

	30 feet		Phone only	No phone
Average % of No Cell	103.9		87.2	100.0
StDev	14.33		13.86	15.09

TABLE 3: Effect of cell phone radiation +/- NFG on human astrocyte cells: Day 4 Data. Raw Data and Analyzed Data are presented for the MTT reading on cells treated with mobile phone radiation for 4 days. Results are from an overnight read of the MTT data. After subtracting the average media alone signal, an average and standard deviation were calculated. The percentage of the Non-Cell Phone signal then calculated.

Day 5	**Raw Data**					**Minus Background**			
position	30 feet		Phone only	No phone		30 feet		Phone only	No phone
	1.799		1.851	1.668		1.100		1.120	0.970
	1.924		1.929	1.842		1.225		1.198	1.144
	1.999		2.037	2.022		1.300		1.306	1.324
	1.945		1.780	1.990		1.246		1.049	1.292
	2.036		2.045	1.945		1.337		1.314	1.247
	1.816		1.894	1.751		1.117		1.163	1.053

	Media			
	0.696		0.717	0.691
	0.702		0.746	0.706
Average	0.699		0.732	0.699

Average	1.221		1.191	1.171
StDev	0.096		0.104	0.141

	30 feet		Phone only	No phone
Average % of No Cell	104.2		101.7	100.0
StDev	14.34		14.86	16.98

TABLE 4: Effect of cell phone radiation +/- NFG on human astrocyte cells: Day 5 Data. Raw Data and Analyzed Data are presented for the MTT reading on cells treated with cell phone radiation for 5 days. Results are from an overnight read of the MTT data. After subtracting the average media alone signal, an average and standard deviation were calculated. The percentage of the Non-Cell Phone signal then calculated.

For the Astrocytes treated with mobile phone irradiation, a reduction in the MTT signal was observed compared to the untreated cells between days 2 and 4. However, when Astrocytes samples were placed at the distance of 30 feet away from NFG a difference in MTT signal of the NFG plus cell phone treated cells was observed. This difference was most dramatic at day 4. By day 5, all treatments resulted in similar MTT signals likely due the fact that cells were beginning to reach confluence in the wells.

CONCLUSION

Thus, it appears that cell phone treatment had a negative effect on the Astrocytes growth up until the 5th day of culture. This result correlates with the previous experiment results (Fig.3) when Astrocytes were exposed to cell phone irradiation for 13 days period of time:

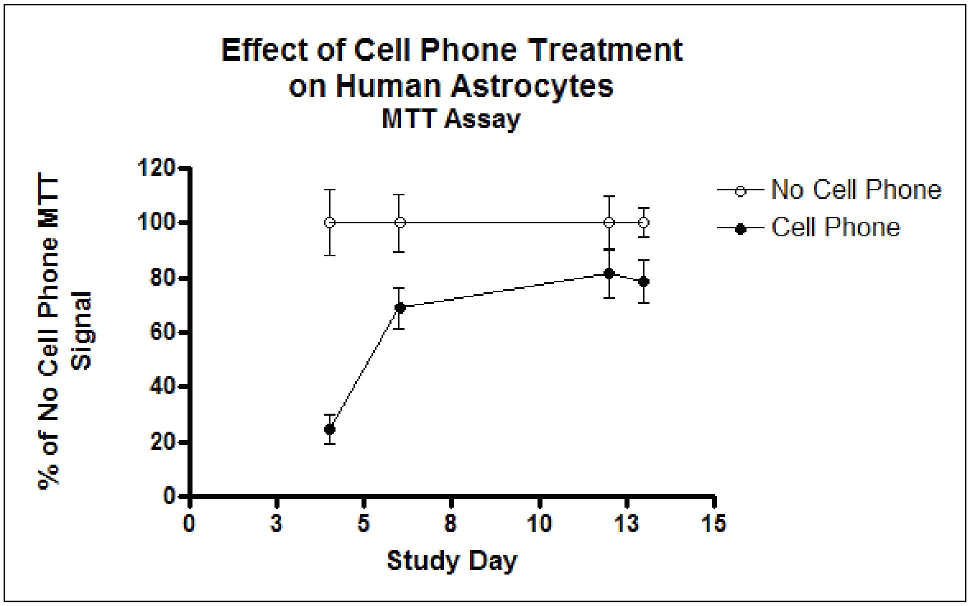

FIGURE 3: *Effect of cell phone radiation on human astrocyte cells. Cells were treated with cell phone irradiation for 12 consecutive days. On days 4, 6, 12 and 13 (24 hours after the last cell phone treatment), an MTT Assay was performed. Data was normalized and the percent signal relative to the no cell phone treated wells was plotted as a function of study day. Data points represent the average values for replicate wells. Error bars represent standard deviations. Standard deviations were calculated using standard methods for the propagation of errors.*

The results for the both experiments reveal the following: when normal human brain Astrocyte cells are exposed to mobile phone irradiation cells growth is significantly inhibited within the first 3-4 days. Then Astrocytes metabolic activity begins to increase most likely due to the adaptation effect (cells structure and function are constantly modified in response to changing environmental influences). The negative effect of mobile phone irradiation on the Astrocytes growth was partially relieved when MRET noise field generator (NFG) was placed at the distance of 30 feet from the treated plates. There was average 7.2% increase of Astrocytes metabolic activity due to NFG compensatory effect compared to the treated cell samples without NFG influence (see Fig.2). This experiment confirms that MRET noise field generator (NFG) placed at the distance of 30 feet from the treated plates has measurable compensatory effect on the inhibition of normal human brain Astrocyte cells growth when cells are exposed to mobile phone irradiation.

REFERENCES

[1] Ke Yao, et al, (2008), "Electromagnetic noise inhibits radiofrequency radiation-induced DNA damage and reactive oxygen species increase in human lens epithelial cells", *Molecular Vision*, 14:964-969

[2] Litovitz T.A, Penafiel L.M, Farrel J.M, Krause D, Meister R, Mullins J.M., (1997) "Bioeffects induced by exposure to microwaves are mitigated by superposition of ELF noise*", Bioelectromagnetics* 18(6):422-30

[3] Meier, W. and Finkelmann, H. (1993) "Piezoelectricity of Cholesteric Elastomers. Influence of the Helicoidal Pitch on the Piezoelectric Coefficient*" J. Macromolecules*, 26: 1811-1817

[4] Serov, I. N. (2003) "Aires Ecological Converter", *Aires New Medical Technologies Foundation, St. Petersburg, Russia*

[5] Smirnov, I.V. (2011) "The Passive Generation of Low Frequency Noise Field by MRET-Shield Polymer Compound and Following Amplitude Modulation of RF Carrier Signals", *International Journal of Biophysics* 1(1): 1-10