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The Exposure of Normal Human Astrocytes Cells to Mobile Phone Radiation with and without MRET-Nylon Protection

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Abstract

EMFs predominantly affect neurological tissue and the largest collection of this tissue is the brain. It is well documented that cell phones, which emit electromagnetic fields in the radio frequency range, can cause DNA damage, headaches, blurred vision, dizziness, fatigue, short term memory loss, neuralgias, tumors, sleep disturbances, aberrant brain wave activity and changes to cerebral blood flow, including altering the permeability of the blood brain barrier [Salford et al, 1994]. These findings, both the association and dose relationships between cell phone usage and disease, place cell phone users into a high risk health group. EMF effects are on a cumulative basis, and recent studies have concluded that cell phone users for greater than ten years have a significantly increased risk of glioma, a form of brain tumor [Wertheimer, Leeper, 1982]. The most common form of primary brain tumor is a glioma and astrocytomas are the most frequently occurring glioma. A study was conducted to examine the effects of cell phone radiation on Normal Human Astrocytes and the effects of mobile phone radiation on Normal Human Astrocytes when the MRET-Nylon polymer was used as an intervention to radio frequency radiation of the mobile phone. The results demonstrated that the mobile phone radiation decreased the number of Normal Human Astrocytes and when the cell phone was used with the intervention of the MRET-Nylon polymer, the number of Normal Human Astrocytes increased. This experiment also showed that the short term (one hour) exposure of Normal Human Astrocytes to mobile phone radiation did not have any genetic effect on cells.

The MRET-Nylon polymer belongs to the new generation of electromagnetic radiation shielding materials based on Molecular Resonance Effect Technology. The MRET-Nylon polymer compound has a special fractal geometric structure. Due to the fractal nano-rings structure and enhanced piezoelectric properties of this compound, it generates random, subtle, low frequency oscillations (noise field) when exposed to the external electromagnetic radiation. This polymer can significantly decrease the biological effects of electromagnetic radiation, both thermal and non-thermal, by imposing the random low frequency oscillations (noise field) on RF waves [Smirnov, 2006]. The theoretical concept of the electromagnetic noise field is related to the ability of the noise field to offset the thermal effects.

Keywords: Human Astrocytes, glioma, heat map, cell count, MRET-Nylon polymer, nano-rings, electromagnetic radiation, noise field.

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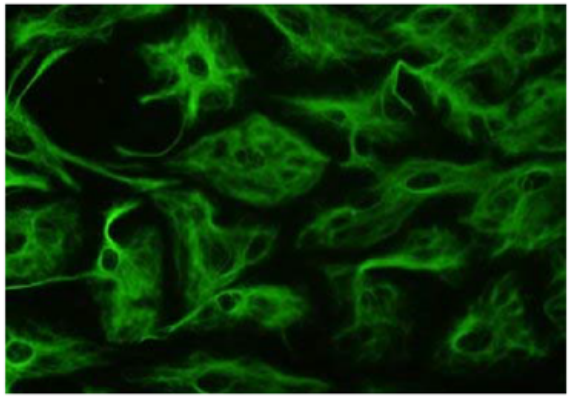
Introduction

The most common form of primary brain tumor is a glioma and astrocytomas are the most frequently occurring glioma [Komaroff, 1999]. Specifically there have been conclusive studies proving the relationship between cell phone usage and gliomas, which are the largest group of primary brain tumors [Lahkola et al, 2007]. There are several kinds of gliomas: astrocytomas are the most common and can develop anywhere in the brain or spinal cord; brain stem gliomas, which grow in the lowest part of the brain; ependymomas, which develop inside the brain or in the lining of the ventricles, and oligodendrogliomas, which most often grow in the cerebrum however these are extremely rare tumors. Astrocytes are also known as *astrocytic glial cells*. Star-shaped, their many processes envelope synapses made by neurons. Astrocytes are classically identified histologically as many of these cells express the intermediate filament glial fibrillary acidic protein (GFAP). The fibrous glia are usually located within white matter, have relatively few organelles, and exhibit long unbranched cellular processes. The protoplasmic glia are found in grey matter tissue, possess a larger quantity of organelles, and exhibit short and highly branched cellular processes. The three forms of astrocytes when in proximity to the pia mater sends out process to form the pia-glial membrane.

Figure 1: Astrocytes can be visualized in culture because, like other glia, they express glial fibrillary acidic protein.[Wikipedia]



- **Structural**: involved in the physical structuring of the brain.
- **Metabolic support**: they provide neurons with nutrients such as lactate.
- **Blood-brain barrier**: the astrocyte end-feet encircling endothelial cells were thought to aid in the maintenance of the blood-brain barrier, but recent research indicates that they do not play a substantial role; instead it is the tight junctions and basal lamina of the cerebral endothelial cells that play the most substantial role in maintaining the barrier. However, it has recently been shown that astrocyte activity is linked to blood flow in the brain, and that this is what is actually being measured in fMRI.
- **Transmitter reuptake and release**: astrocytes express plasma membrane transporters such as glutamate transporters for several neurotransmitters, including glutamate, ATP and GABA. More recently, astrocytes were shown to release glutamate or ATP in a vesicular, Ca^{2+}-dependent manner. But this glutamate release has not been proven yet.
- **Regulation of ion concentration in the extracellular space**: astrocytes express potassium channels at a high density. When neurons are active, they release potassium, increasing the local extracellular concentration. Because astrocytes are highly permeable to potassium, they rapidly clear the excess accumulation in the extracellular space. If this function is interfered with, the extracellular concentration of potassium will rise, leading to neuronal depolarization by the Goldman equation. Abnormal accumulation of extracellular potassium is well known to result in epileptic neuronal activity.

- **Modulation of synaptic transmission**: in the supraoptic nucleus of the hypothalamus, rapid changes in astrocyte morphology have been shown to affect heterosynaptic transmission between neurons. In the hippocampus, astrocytes suppress synaptic transmission by releasing ATP, which is hydrolyzed by ectonucliotidases to yield adenosine. Adenosine acts on neuronal adenosine receptors to inhibit synaptic transmission, thereby increasing the dynamic range available for LTP.
- **Vasomodulation**: astrocytes may serve as intermediaries in neuronal regulation of blood flow.
- **Nervous system repair**: upon injury to nerve cells within the central nervous system, astrocytes become phagocytic to ingest the injured nerve cells. The astrocytes then fill up the space to form a glial scar, repairing the area and replacing the CNS cells that cannot regenerate. [Wikipedia]

A study was conducted to examine the effects of cell phone radiation on Normal Human Astrocytes and the effects of mobile phone radiation on Normal Human Astrocytes when the MRET-Nylon polymer was used as an intervention to radio frequency radiation of mobile phone.

Materials and Methods: The experiment was conducted at AltheaDx Technology, San Diego under supervision of Project Director: Qiang Xu, Ph.D., Project Scientist: Pat Pezzoli, B.S., Project Technician: Neil Tedeschi, M.S.

- Normal Human Astrocytes (NHA) (Lonza #CC-2565, Lot 80982) were grown in a humidified incubator at 37°C and 5% CO_2 and were expanded until there were a sufficient number of cells for the experiment. The cells were harvested with trypsin and counted on a hemocytometer using trypan blue. The viability was 88.9% and 281,667 cells per well were plated in to six wells, two wells each on three six well plates. The cells were incubated overnight.
- An LG Verizon cell phone, Model # VX8350, FCC ID BEJVX8350, SW version # VX835V03, HW Rev. 1.1, MEID A000000C4F8FC5, using a AC power source was placed directly beneath and centered under one plate of duplicate NHA cell cultures at a distance of 0.5 inches below the growth surface (see Figure 2 and Figure 3).
- The MRET-Nylon chip belongs to the new generation of electromagnetic radiation shielding materials based on Molecular Resonance Effect Technology. The MRET-Nylon polymer compound has a special fractal geometric structure. Due to the fractal nano-rings structure and enhanced piezoelectric properties of this compound, it generates random, subtle, low frequency oscillations when exposed to the external electromagnetic radiation (EMR). This polymer can significantly decrease the biological effects of electromagnetic radiation, both thermal and non-thermal, by imposing the random low frequency oscillations (noise field) on RF waves. The theoretical concept of the electromagnetic noise field is related to the ability of the noise field to offset the thermal effects.

Figure 2: Exposure of tissue culture to cell phone radiation (side view)

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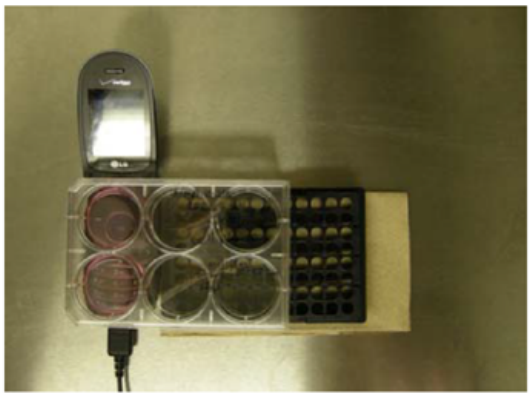
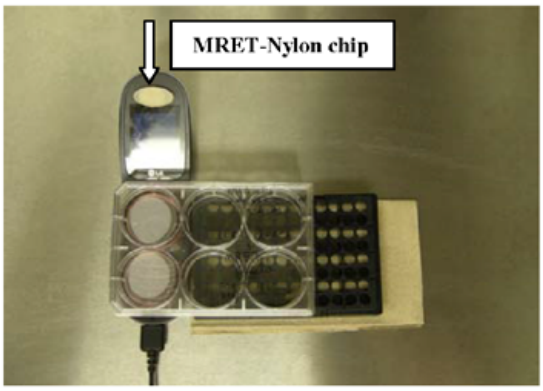
Figure 3: Exposure of tissue culture to cell phone radiation (top view)



The cell phone was called by a phone and the calling phone's hand set was placed next to the speaker of an operating radio so that the cell phone would be continuously active for duration of the exposure. The cells were exposed to phone radiation for one hour at room temperature. Following the one hour cell phone exposure, the cells were placed back in the incubator for 24 hours. A second identical NHA culture was then exposed similarly to the same cell phone and in the same geometry with the addition of the MRET-Nylon protection which was placed over the cell phone ear speaker as shown in Figure 4.

Figure 4: Exposure of tissue culture to cell phone radiation with MRET-Nylon protection.



The cells were exposed to the cell phone radiation for one hour and then the cells were placed into the incubator for 24 hours. During the cell phone with the MRET-Nylon protection exposure, a third plate containing identical cells was placed in another room for one hour and was labeled Control Plate. Following one hour of incubation at room temperature without any cell phone exposure, it was placed back into the incubator for 24 hours.

After the 24 hour incubation period, the cells were harvested from each well using trypsin and counted on a hemocytometer with trypan blue dye to obtain cell counts and viability data. The cell count data consists of replicate wells for each treatment condition. Each well was harvested using the same volumes and each was subjected to the same pipetting action.

For each sample, RNA was extracted from duplicate one - the top well shown in the experimental setup. The RNA was processed according to the Affymetrix GeneChip Whole Transcript (WT) Sense Target Labeling Assay. The resultant labeled cDNA was hybridized to Affymetrix Human Gene 1.0 ST arrays and scanned. The data was normalized using RMA normalization with the Affymetrix Expression Console software.

This normalized data was used for the correlation analysis.

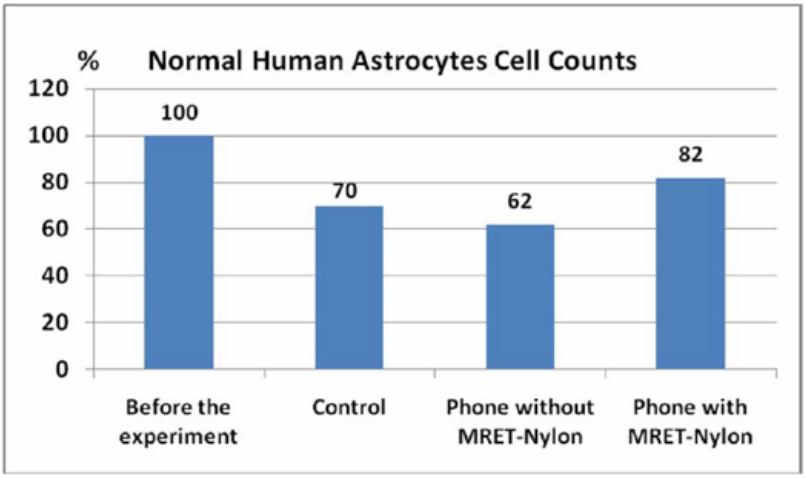
Results

Table 1: Human Astrocytes Cell Counts

	Before the experiment	Control	Phone without MRET-Nylon	Phone with MRET-Nylon
Cell number per well	281,667	196,000	175,000	231,000
Cell number per ml	93,889	70,000	62,500	82,500
Viability %	88.9	90.3	86.2	89.2

The *in vitro* experiment reveals that Normal Human Astrocyte cell counts after exposure to mobile phone radiation with MRET-Nylon protection decreased by 20% less compared to the cell samples exposed to the same mobile phone radiation without MRET-Nylon protection, and by 12% less compared to control samples not exposed to mobile phone radiation (Figure 6). The experiment also revealed that the viability of Normal Human Astrocytes cells in case of exposure to mobile phone radiation with MRET-Nylon protection was by 3% higher compared to the viability of cells exposed to the same mobile phone radiation without MRET-Nylon protection.

Figure 5: Human Astrocytes Cell Counts: Before the experiment (before 1 hour exposure to mobile phone radiation at room temperature and 24 hours of post exposure incubation); Control (after 1 hour at room temperature without exposure to mobile phone radiation and 24 hours of post exposure incubation); Phone without MRET-Nylon (after 1 hour exposure to mobile phone radiation at room temperature without MRET protection and 24 hours of post exposure incubation); Phone with MRET-Nylon (after 1 hour exposure to mobile phone radiation at room temperature with MRET protection and 24 hours of post exposure incubation).



Data Comparison: We compared each sample using the Pearson correlation coefficient. A coefficient of 1 indicates perfect correlation while 0 indicates no correlation. All samples are correlated at a level of 0.99 or higher.

Table 2: Pearson Correlation Coefficients of Signal Intensity Data between Each Pair of Samples.

	Cell Phone + MRET	Cell Phone	Control
Cell Phone + MRET	1.00	0.995	0.996
Cell Phone		1.00	0.994
Control			1.00

For further comparison, a 'heat map' was generated. The expression patterns are similar across the samples:

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Conclusion

The *in vitro* experiment revealed that Normal Human Astrocyte cell counts after one hour exposure to mobile phone radiation with MRET-Nylon protection decreased by 20% less compared to the cell samples exposed to the same mobile phone radiation without MRET-Nylon protection, and by 12% less compared to control samples not exposed to mobile phone radiation. The experiment also revealed that the viability of Normal Human Astrocytes cells in case of exposure to mobile phone radiation with MRET-Nylon protection was 3% higher compared to the viability of cells exposed to the same mobile phone radiation without MRET-Nylon protection. The results demonstrated that the mobile phone radiation decreased the number of Normal Human Astrocytes and when the mobile phone was used with the intervention of the MRET polymer, the number of Normal Human Astrocytes increased.

The visual inspection of cell samples with microscopy did not show a significant difference between the control and exposed samples. The microarray analysis showed no difference in mRNA expression patterns between the three sample types.

Thus, this study provides some evidence that one hour exposure of Normal Human Astrocytes cells to mobile phone radiation with 24 hours post exposure incubation did not affect cell genetics. On the other hand there was found measured effect of mobile phone radiation on cell counts and viability.

The study provides evidence that the application of MRET-Nylon chip on mobile phone reduced the negative biological effect of microwave radiation by enhancing cell viability and resistivity to EMR thermal and non-thermal biological effects.

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