Ten examples of cell-phone studies showing effects at levels below 1.6 W/kg, or current US SAR cell phone safety standards

Level of SAR Below	Effect	Long Term Illness associated	Author's description of results of study	Author, Title of Study, Citation and Pub Med link
0.6 W/kg	**Decrease in Memory Performance**	Early dementia	The results showed retarded learning while performing in the radial-arm maze to obtain food rewards, indicating a deficit in spatial "working memory" function. We believe that neurotransmitter systems in the brain are involved in the microwave-induced reduced memory performance.	Lai H et al, 1994 Microwave irradiation affects radial-arm maze performance in the rat, Bioelectromagnetics 1994;15(2):95-104 http://www.ncbi.nlm.nih.gov/pubmed/8024608
1.2 W/kg	Single and double strand DNA breaks.	Malignant and benign brain tumors, acoustic neuroma.	DNA breaks were found in individual brain cells were measured at 4h post-exposure at an exposure level of Exposure SAR of **1.2 W/kg** to 2450 MHz pulsed RF. **An increase in both types of DNA strand breaks was observed after exposure to either the pulsed or continuous-wave radiation.** These effects could result from a direct effect of RF energy on DNA molecules and/or impairment of DNA-damage repair mechanisms in brain cells.	*Lai H, Singh N. (1996) Single- and double-strand DNA breaks in rat brain cells after acute exposure radiofrequency electromagnetic radiation.* Int J Radiat Biol 69(4): 513-21 http://www.ncbi.nlm.nih.gov/pubmed/8627134
1.2 W/kg	**Decrease in memory performance**	Dementia	The rats were exposed to pulsed 2450 MHz microwaves at a SAR of **1.2 W/kg** for 6 hours in total over a week. **The results show that exposure to pulsed microwaves caused a deficit in spatial " reference" memory in the rat.**	**Wang B, Lai H**, (2000) *Acute exposure to pulsed 2450-MHz microwaves affects water-maze performance of rats*, Bioelectromagnetics 2000 Jan; 21(1):52-6 http://www.ncbi.nlm.nih.gov/pubmed/10615092

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1.2 W/kg or 2 W/kg	**Effect: DNA single- and double-strand breaks**	Malignant and benign brain tumors, acoustic neuroma.	RF-EMF exposure (1800 MHz; **SAR 1.2 or 2 W/kg**; different modulations; during 4, 16 and 24h; intermittent 5 min on/10 min off or continuous wave) induced single- and double DNA strand breaks. Effects occurred after 16 h exposure in both cell types and after different mobile-phone modulations. **The intermittent exposure showed a <u>stronger</u> effect than continuous exposure. We conclude that the induced DNA damage cannot be based on thermal effects.**	**Diem E** *et al*, (2005) *Non-thermal DNA breakage by mobile-phone radiation (1800 MHz) in human fibroblasts and in transformed GFSH-R17 rat granulosa cells in vitro.*, Mutat Res 583(2):178-83 http://www.ncbi.nlm.nih.gov/pubmed/15869902
0.00012, 0.0012, 0.012, or 0.12 W/kg.	**Neuronal damage in the brains of rats at very low SAR levels**	early dementia, ALS Parkinsin's disease, other neurolgical diseases	Rats were either exposed to microwaves or sham exposed for 2 h at SARs of **0.00012, 0.0012, 0.012, or 0.12 W/kg**. The rats were sacrificed after a recovery time of either 14 or 28 days. **The occurrence of dark neurons (dead brain cells) in the rat brains was significantly enhanced after 28 d ($p = 0.02$)**. Furthermore, in the 28-d brain samples, neuronal albumin uptake was significantly correlated to occurrence of damaged neurons (Spearman $r = 0.41$; $p < 0.01$).	**Eberhardt J** *et al*, (2008) *Blood-brain barrier permeability and nerve cell damage in rat brain 14 and 28 days after exposure to microwaves from GSM mobile phones*, Electromagn Biol Med 2008;27(3): 215-29 http://www.ncbi.nlm.nih.gov/pubmed/18821198

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0.12 W/kg	**Decreased cell growth**	Impairment of normal DNA repair, immune system malfunction, birth defects	Prepared cell samples were exposed to a 935 MHz continuous wave frequency field for 1, 2, and 3 h. The structure of microtubule proteins has been determined using the immunocytochemical method. In comparison with control cells, the microtubule structure clearly altered after 3h of irradiation ($p < 0.05$). Significantly decreased growth was noted in cells exposed for 3h three days after irradiation ($p < 0.05$). **We found that 935 MHz radiation similar to that from a cellphone affects microtubule proteins which consequently may obstruct cell growth.**	**Pavacic I** *et al*, (2010) *In vitro testing of cellular response to ultra high frequency electromagnetic field radiation*, Toxicol In Vitro 2008 Aug;22(5):1344-8 http://www.ncbi.nlm.nih.gov/pubmed/18513921
1.4 W/kg	**Decreased spatial memory performance in humans**	Early Dementia	This study investigated the effects of a 2.5h RF exposure at 884 MHz on spatial memory and learning, using a double-blind repeated measures design. The exposure was designed to mimic that experienced during a real-life mobile phone conversation. The average exposure was a peak SAR (10g) of **1.4 W/kg**. The participants were daily mobile phone users, with and without symptoms attributed to regular mobile phone use. **Results revealed a significant adverse effect of RF exposure on spatial memory.**	**Wiholm C** *et al*, (2008) *Mobile phone exposure and spatial memory*, Bioelectromagnetics 2008 Sep 15. http://www.ncbi.nlm.nih.gov/pubmed/18792947

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.016 W/kg to 2 W/kg	**Reduced brain cells in rats exposed to cellphone radiation at an early age.**	Learning problems, ADD/ ADHD, early dementia, Parkinson's, ALS and other Neurological illnesses	The study investigated pyramidal cells of the 16-week -old female rat hippocampus following postnatal exposure to RF at 900 MHz (1 h/day for 28 days). The SAR varied between **0.016 W/kg** (whole body) **and 2 W/kg** (locally in the head). All of the rats were sacrificed at the end of the experiment and the number of pyramidal cells was estimated. Histopathological evaluations were made on sections of the CA region of the hippocampus. Results showed that postnatal EMF exposure caused a significant decrease of the pyramidal cell number in the CA of the EMF group ($P<0.05$). Additionally, cell loss can be seen in the CA region of EMF group even on a visual observation. **This could relate to the chronic effects of 900 MHz cellphone radiation on teenagers' brains.**	**Bas O** *et al*, (2009) *900 MHz electromagnetic field exposure affects qualitative and quantitative features of hippocampal pyramidal cells in the adult female rat*, Brain Res 2009 Apr 10; 1265:178-85 http://www.ncbi.nlm.nih.gov/pubmed/19230827

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.7 W/kg	**Adverse effect on brain function**	Learning problems, ADD/ ADHD, early Alzheimers, Parkinson's disease, other Neurological illnesses	The rats were exposed to ELF-MW (915 MHz, 20-ms pulse duration, approximately 0.3 mW/ cm2, 4 Hz) intermittently (1-min 'On', 1-min 'Off') for 10 min at a SAR about **0.7 W/kg** several times per day. A cumulative phenomenon under repeated exposures to ELF-MW was revealed. These results are in line with evidence that **repeated low-level exposure to pulse modulated microwaves similar to cellphone radiation adversely affects brain functioning.**	**Vorobyov V** *et al*, (2010) *Repeated exposure to low-level extremely low frequency-modulated microwaves affects cortex-hypothalamus interplay in freely moving rats: EEG study*, Int J Radiat Biol 2010 May;86(5): 376-83 http:// www.ncbi.nlm.nih.gov/pubmed/ 20397842
.95 W/kg	**A significant decrease in Purkinje cells in the brain that could affect brain function**	early dementia, ALS Parkinsin's, and other neurolgical diseases	Pregnant mice were exposed to GSM mobile phone radiation at 890-915 MHz at **0.95 W/kg SAR** to investigate the effect on Purkinje cells. In humans, Purkinje cells are affected in a variety of diseases ranging from toxic exposure (alcohol, lithium), to autoimmune diseases and to genetic mutations (including ataxias and autism) and neurodegenerative diseases that are not thought to have a known genetic basis. Result: **A significant decrease in the number of Purkinje cells and a tendency for granule cells to increase in cerebellum was observed. This could adversely affect brain function.**	**Ragbetli M** *et al*, (2010) *The effect of mobile phone on the number of Purkinje cells: a stereological study*, Int J Radiat Biol 2010 Jul;86(7): 548-54 http:// www.ncbi.nlm.nih.gov/pubmed/ 20545571