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Non-thermal effects of EMF upon the mammalian brain

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The world's largest biological experiment ever, takes place since few years and now one third of the world's population is included in the experiment as test persons, voluntarily exposing their brains to electromagnetic fields produced by their mobile phones. The other two thirds constitute a control group, however not ideal, as many of the non-users are exposed to “passive mobile phoning” and other types of radio frequency radiation.

The question whether the type of electromagnetic fields used in mobile communication is harmful or not to the human body, is not clarified and the biological effects, which have hitherto been observed in laboratories around the world, deserve a serious evaluation by the community.

The effects of RF electromagnetic fields upon the blood-brain barrier (BBB) and upon tumour growth in the mammalian brain have been studied by us since many years and we have collected an extensive experimental experience in this field. While our studies on the effects of CW and pulsed modulated microwaves at 915 MHz upon brain tumour growth have not disclosed any growth-promoting effects in our rodent models (Salford ea 1997a), the same RF electromagnetic fields have been revealed to cause significantly increased leakage of albumin through the BBB of exposed rats as compared to non-exposed animals – in large series studied since 1988 in our laboratory. We have exposed rats to various magnetic and electromagnetic fields, as well 915 MHz as continuous wave (CW) and pulse-modulated at various repetition rates (4 - 200 pulses per s.), and in studies with real GSM-900 and GSM-1800 exposures.

One remarkable observation in our studies is the fact that SAR values around 1 mW/kg give rise to a more pronounced albumin leakage than higher SAR values – all at non-thermal levels (Salford ea 1992, 94, 97b, 2001, Persson ea 1996, 97). If the reversed situation were at hand, we feel that the risk of cellular telephones, base-stations and other RF emitting sources could be managed by reduction of their emitted energy. The situation that the weakest fields, according to our findings, are the biologically most effective, poses a major problem. The most pronounced BBB-opening effect of the cellular telephone may not be in the most superficial layers of the brain, but several centimetres deep in central cerebral structures! It can not be excluded that non-users in the vicinity of the cellular phone users, may be influenced by these weak effects. The SAR value of around 1 mW/kg is produced at a distance of more than one meter away from the mobile phone antenna and it can be calculated that this energy level exists centrally in the human brain or even in the contralateral hemisphere when the mobile phone is held at the ear. Concerning the emission from

base stations for mobile communication, the SAR value 1mW/kg exists at a distance of about 150 - 200 metres from the station. The possibility to control the passage of calcium through biological membranes by the use of weak ELF magnetic fields may have some bearing on this and has been described by our group (Bauréus Koch ea 2003).

Another remarkable observation in our studies is the fact that neuronal damage is seen in rat brains 50 days after a 2 hour exposure to GSM at SAR values 200, 20 and 2 mW/kg. Three groups of each 8 rats were exposed for 2 hours to GSM mobile phone electromagnetic fields of different strengths. We found highly significant ($p < 0.002$) evidence for neuronal damage in both the cortex, the hippocampus and the basal ganglia in the brains of exposed rats as compared to sham exposed (Salford ea 2003). We have followed up this observation in a study where 96 animals were sacrificed 14 and 28 days respectively after an exposure for 2 hours to GSM mobile phone electromagnetic fields at SAR values 200, 20, 2, 0.2 and 0 (controls) mW/kg (Eberhardt ea to be published). The results support our earlier published findings.

Conclusion

If mobile communication, even at extremely low SAR values, causes the users' own albumin to leak out through the BBB, which is meant to protect the brain, also other unwanted and toxic molecules in the blood, may leak into the brain tissue and concentrate in and damage the neurones and glial cells of the brain. It can not be excluded that this, (especially after many years intense use) may promote the development of autoimmune and neuro-degenerative diseases, and we conclude that the suppliers of mobile communication – and our politicians – have an extensive responsibility to support the exploration of these possible risks for the users and the society. This is especially true for the new and hitherto barely examined 3G technique which sends microwaves of a different character, and it is quite possible that the biological effects of 3G differ from those of GSM.

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