

Mobile phone derived electromagnetic fields can disturb learning

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High frequency non-ionizing radiation, emitted by mobile phones, is a redundant matter of discussions. The effects of [high frequency electromagnetic fields](#) (HEFs) derived from mobile phones have been discussed since the 1950's. [Neuroscientists](#) from Bochum were now able to elucidate this question. For the first time, they provide proof that extremely high-powered electromagnetic fields (EMFs) indeed influence learning processes on the synaptic level within the brain, independent from other factors like stress. "For this effect, very high values are necessary. These do not occur during the daily use of mobile phones", explains Dr. Nora Prochnow (Medical Faculty of the RUB).

HEFs are not only used in mobile phones, but also in a variety of other [communication systems](#) like radio, television or cordless telephone sets. Mobile phones of the so called third generation utilize the UMTS technology (Universal Mobile Communication System) with a frequency of 1200 MHz and a relatively weak operating range (3.8-4.8 V/m). With increasing power, EMFs are able to elicit local warming of body tissues,

being also described as a "thermal effect". Reportedly, mobile phones can cause local warming of the brain by less than 0.1 C. The effect on function and structure of the brain during long term use of mobile phones (e.g. > 30 min) remains unexplained until now.

Furthermore, statements regarding the non-thermal effects of [mobile phone](#) emitted EMFs are unclear and contradictive. These comprise for instance an increase in permeability and fluidity of cellular membranes, which can be implicated in changes in ion-channel integration and metabolism, even without a detectable change in temperature. This may impair synaptic learning processes in the brain. Until now, experiments could only insufficiently enlighten, whether these effects are derived from non-thermal HEFs or from stress, like it can be induced by handling of the experimental animal (e.g. placing a rat into an unknown environment).

To investigate this question, a new study was performed by scientists of the Department of Neuroanatomy and Molecular Brain Research (Professor Dr. med. Rolf Dermietzel) in cooperation with the Chair of Electromagnetic Theory of the University of Wuppertal. For the experiment, rats were placed into differently powered non-thermal HEFs in the UMTS operating range. Synaptic learning and memory formation were analysed by electrophysiological methods. Furthermore, all animals were tested for stress hormone release immediately following the HEF exposure.

The results: Although there was daily training and effortless contact to the exposure environment, increases in blood derived stress hormone levels could be detected for all exposed groups. The stress clearly influences learning and memory formation on the synaptic level in the rat brain. High powered EMFs (SAR 10 W/kg) also have a significant effect on learning and memory formation. In contrast to this, weak EMFs (SAR 0 and 2 W/kg) lead to no detectable changes or

impairments. "These results cannot directly be transferred to humans", says Nora Prochnow. "But in the animal model, it can be demonstrated that neuronal mechanisms of synaptic [learning](#) can serve as a target for high powered EMFs". However, there is no need for serious concerns: humans are not exposed to this type of high powered EMFs during daily mobile phone use. Nevertheless, the matter has to be regarded differently in special occupational situations, for instance during the use of body worn antenna systems as it is common for security services or military purposes. Here, critical levels for occupational exposure may be reached more easily and have to be controlled carefully.

Provided by Ruhr-University Bochum

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