

Exposure to electromagnetic fields by using cellular telephones and its influence on the brain

Michael Petrides

Montreal Neurological Institute, 3801 University Street, McGill University, Montreal H3A 2B4, Quebec, Canada

The widespread use of cellular telephones in recent years inevitably raises the question of the effects on brain function of the electromagnetic fields emitted by such telephones. A number of reports have now appeared indicating that the high-frequency electromagnetic fields emitted by cellular telephones do influence cognitive function and brain electrical activity. Two studies published this year in *NeuroReport* by Koivisto and colleagues showed that exposure to a 902 MHz electromagnetic field, typical of mobile telephones, decreased response times in simple reaction time and vigilance tasks and the time needed to perform a mental arithmetic task [1], as well as the response times on a working memory task [2]. Furthermore, the same group of investigators examined the effects of electromagnetic field exposure on electrical oscillatory activity in the human brain during an auditory memory task [3]. This study, which focused on event-related desynchronization and synchronization of the 4–6 Hz, 6–8 Hz, 8–10 Hz and 10–12 Hz narrow EEG frequency bands, found that exposure to the electromagnetic field increased EEG power in the 8–10 Hz frequency.

Other studies have also demonstrated effects on event-related brain activity [4,5] and cognitive function [6] as a result of the exposure of the brain to the electromagnetic field emitted by cellular telephones. In the present issue of *NeuroReport*, Huber *et al.* [7] report a study on the effects of exposure for 30 min to the electromagnetic field emitted by digital radiotelephone handsets on the EEG recorded during subsequent sleep. The electromagnetic field was directed either to the left or right hemisphere in order to simulate real life exposure conditions. Exposure to the electromagnetic field did not affect sleep stages or sleep latency, but it did enhance EEG power density in the 9.75–13.25 Hz range during the initial part of sleep. Interestingly, despite the fact that the exposure was unilateral there was no hemispheric asymmetry on the changes in

EEG power. These results show that even a short exposure to the electromagnetic fields emitted by cellular telephones can affect brain physiology.

The currently available literature suggests that some aspects of cognitive function and some direct measures of brain physiology may be affected by exposure to electromagnetic fields of the type emitted by cellular telephones. It has been suggested that the facilitatory effects on cognitive function may be the result of a slight increase in the temperature of the underlying brain tissue which might affect synaptic transmission [6], but the mechanisms remain unknown. It is too early to state whether there might be any long-term effects on human brain function. It is important to note that, in the study published in the current issue of *NeuroReport*, the changes in EEG power observed during the first 30 min of nonREM sleep were not observed at the end of the 3 h sleep episode. Similarly, the results of the studies that examined cognitive function do not allow conclusions about any long-term effects of cellular telephone use. Thus, it remains to be established whether repeated exposure to electromagnetic fields could have long-lasting effects on brain physiology and cognitive function.

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