Letter to the Editor

Comments on the article entitled "Review of Possible Modulation-Dependent Biological Effects of Radiofrequency Fields" by Juutilainen et al.

We appreciate that the recent review of possible modulation-dependent bioeffects of radiofrequency fields by Juutilainen et al. [2011] was comprehensive, well-compiled and used appropriate scientific criteria. We write in reflection of the concluding remarks where the authors indicate that there might be effects from pulse-modulated radio frequency (RF) electromagnetic fields specific to the human central nervous system, particularly changes in the electroencephalogram (EEG) and cerebral blood flow.

We agree with the review authors that further studies are warranted to shed light on the mechanisms of modulation-dependent effects on the central nervous system and applaud the introductory comments on the value of science-based approaches. Thus, we are perplexed by suggestions that future studies be done without an express caveat that they be guided by specific scientific hypotheses.

It appears to us that past tests of EEG modifications were conducted with techniques and instruments that might subtly have introduced nonlinearities. In laboratory studies with pulse-modulated signals, it is possible, but not easy, to eliminate incidental nonlinearities in source and recording instruments. A recent article provides data that should raise awareness that EEG wire leads can act as antennas that carry RF energy to the scalp, skull bone, and brain, thereby changing localized exposures by large factors [Angelone et al., 2010]. We suggest that a further impact of RF currents picked up on EEG leads may be rectification (a nonlinear effect) at the contacts between the scalp and EEG electrodes, thereby introducing a demodulated signal into tissue. As we cannot determine the magnitude of such effects, we eagerly await full exploration of mechanisms more plausible than demodulation by nonlinearities inherent in brain tissue. Unlike demodulation at electrode contacts, demodulation within brain tissues, and especially at the single-cell level, is implausible because, as the authors reported, recent experimental findings on nonlinearity in living tissues, including brain slices [Kowalczuk et al., 2010], showed no demodulated signals at a detection level so sensitive that if there were any such signals they were attenuated by more than 140–160 dB. It is inconceivable that there could be a biological effect from amplitude-modulated signals that upon demodulation might yield such ultra-weak low frequency fields in tissue.

Despite the passage of over 36 years since Bawin and colleagues attempted to demonstrate a biochemical correlate for observed behavioral effects in mammalian brain [Bawin et al., 1973, 1975], understanding of mechanisms for effects of modulated RF energy on the brain has been wanting. Nonetheless, the tally of isolated, intriguing and inexplicable experimental data continues to mount. It is time that the research community sharpens the focus on mechanisms, whether exotic or mundane, that could bring understanding instead of more phenomenology to the literature.

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