Can we ask the brain to tell us how EMFs affect it?

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Abstract

Our civilization created an artificial environment. New substances and especially electromagnetic fields (EMFs) have been introduced by human activity suddenly in the environment. Humans and other animals are exposed to EMFs at levels they were never prevalent in the past, so evolution had no time to select in optimal genetic variants. The consequences for human health are not easy to study because the influence are subtle, often below conciousness, with any harmful effects becoming apparent after variable, often long exposure. There is some evidence that EMFs influence the brain, not surprisinly at the frequency bands that the characterize the brain's own activity [1] and also at much lower [2] and higher frequencies [3,4]. Testing for influence of EMFs on the brain has so far relied on changes in brain activity measured through changes in the EEG signal, changes in autonomic function and adverse health effects.

The usual way of studying brain function is by either recording the correlates of electrical neuronal activity (with EEG and MEG) or by stimulating the brain through strong external electrical drive with transcranial magnetic stimulation. In each case the where question is paramount: where is the activity coming from in the case of EEG and MEG and where the strong magnetic impulse should be directed. We propose to do the same for studying the influences of weak EMFs. We already have some (unpublished) evidence that this may indeed be possible in our earlier studies of electrical stimulation of paraplegic subjects below (clinically) complete lesions [5].

A possible small project to explore this issue is to use a sophisticated constant current generator capable of delivering arbirtrary waveforms to different parts of the body. Applying such stimulation on the body at various strengths from subthreshold to strong enough but below the pain threshold and through an external resistance but electrically isolated from the body. Different protocoles can be used to investigate possible mechanisms ranging from the orthodox propagation through the sensory pathways, to some somatic transfer or even direct detection of the resulting weak magnetic fields.

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