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## Letters

### 'Humble research' needed

When I initially encountered the evidence linking ELF magnetic fields to cancer ("ELF: The Current Controversy," SN: 2/14/87, p.107), I reacted with the same skepticism as physicist H. W. Lewis (Letters, SN: 3/28/87, p.195). Back-of-the-envelope calculations with elementary physics (as well as more sophisticated modeling) rule out any major effect on the human organism from residential ELF magnetic fields through a magnetic induction mechanism. Naturally, the scientific community searched skeptically through the ground-breaking epidemiologic study by Wertheimer and Leeper for flaws that would produce an erroneous association. Surprisingly, the original study turns out to be sound, and has now been replicated twice for childhood cancer. A body of supporting epidemiologic and experimental research has now accrued, although causation is far from

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Cover: Here, the San Andreas fault near Parkfield, Calif., displays itself. The land on the right of the picture is slowly moving in the opposite direction from the land on the left. Scientists have their instruments at the ready for an anticipated earthquake. Estimated time of arrival: 1988. (Photo: Joanne Silberner)



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proven in the absence of a biophysical mechanism.

The epidemiologists have given the physicist's paradigm a resounding kick in the butt, so now is the time for biophysical scientists to get to work. The search for a biological mechanism for ELF fields has now turned to ion cyclotron resonance in the cell membranes and rotations of single-domain biological ferromagnets. The energy from either mechanism would be so low that they would have to trigger other biochemical processes to induce or promote cancer. Whatever the eventual outcome of this issue, the physicist's arrogance is no longer justified, and must be replaced with some humble research.

*Joseph Bowman*  
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**Lewis might consider** the unequivocal evidence that some marine vertebrates reliably detect electric fields as weak as nanovolts per

centimeter, levels readily achieved by body movement in the earth's magnetic field, the preemptive test by which Lewis would dismiss observations of ELF effects as scientifically fraudulent.

Lewis fails to grasp a most profound aspect of the physics of biological systems—namely, that they operate at an extremely high level of cooperativity. Cooperativity implies ordered interactions over long atomic distances, based on highly ordered structure and equally ordered patterns of energy distribution. It is truly the miracle of living matter that extremely weak environmental and intrinsic electromagnetic fields exercise powerful influences on intracellular enzyme systems that govern signaling within cells, cellular metabolism and cell growth.

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APRIL 25, 1987

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