

LETTER

**IS A TOXICOLOGY MODEL APPROPRIATE AS A
GUIDE FOR BIOLOGICAL RESEARCH WITH
ELECTROMAGNETIC FIELDS?**

A "dose-response relationship" between electromagnetic field (EMF) exposure and cancer incidence was repeatedly referred to in the series of articles by Robert Pool in the Research News section of Science (1). In essence, Pool found most people use a toxicology model as their frame of reference in the selection, funding, design and analyses of experiments. Data and theory show, however, that this is the wrong model (2-4). Thus, much of the research has been inappropriate or irrelevant. This is one reason why hundreds of millions of dollars have been spent on EMF biological research with so little return for the investment.

Electromagnetic fields are not a foreign substance to living beings like lead or cyanide. With foreign substances, the greater the dose, the greater the effect - a dose-response relationship. Rather, living beings are electrochemical systems that use very low frequency EMFs in everything from protein folding through cellular communication to nervous system function. To model how EMFs affect living beings, one might compare them to the radio we use to listen to music.

The EMF signal the radio detects and transduces into the sound of music is almost unmeasurably weak. At the same time, there are, *in toto*, strong EMFs impinging on the radio. We don't notice the stronger EMF signals because they are not the appropriate frequency or modulation. Thus, they don't disturb the music we hear. However, if you impose on the radio an appropriately tuned EMF or harmonic, even if it is very weak, it will interfere with the music. Similarly, if we impose a very weak EMF signal on a living being, it has the possibility of interfering with normal function if it is properly tuned. This is the model that much biological data and theory tell us to use, not a toxicology model.

As Pool indicates, many people are calling for more money to be spent for research. But spending additional hundreds of millions of dollars for research using an inappropriate model will not provide the information needed to decide whether the biological effects are significant to the health of the population. Because this easily understood toxicology model approach prevailed, we still have the

original questions. If money is to be fruitfully spent, we must first rethink and reorganize, at the funding agency level, so the appropriate experiments will be selected and funded.

Randomline, Inc.
Huntingdon Valley, PA 19006

Allan H. Frey

REFERENCES

- (1) Pool, R.: *Science* 249, 1096-1098, 1378-1381; 250, 23-25, 1990.
- (2) Frey, A.H.: Evolution and results of biological research with low-intensity nonionizing radiation, in *Modern Bioelectricity*, A.A. Marino, ed., Marcel Dekker, New York, 785-837, 1988.
- (3) Frey, A.H.: A means by which cancer can be promoted by electromagnetic field interactions with the neuroimmune system, in *Symposium on Electromagnetic Fields and Biological Systems*, Seventy-fourth Annual Convention of the Federation of American Societies for Experimental Biology, April 1-5, Washington, DC, 1990.
- (4) Frey, A.H.: Biological function as influenced by low power modulated RF energy, *IEEE Trans. Microwave Theory and Techniques MTT-19*, 153-164, 1971.