Weighing the evidence in EME health research

Like other human activities, scientific investigation is subject to potential errors, personal opinions and uncertainties. This applies as much to research on radiofrequency (RF) electromagnetic energy (EME) health effects as it does to all other areas of science. When weighing up the evidence for RF EME health effects, scientists consider the following questions before drawing their conclusions:

Have the effects been reported in the scientific peer reviewed literature?
The added scrutiny of a study by scientific peers is a minimum 'check and balance' requirement. Although not guaranteeing the accuracy of the results, it does nonetheless provide an important element of quality control[1-2].

Have the reported effects been independently replicated?
Independent confirmation of new results is important to minimise the influence of experimenter bias and unrecognized sources of error in a particular laboratory setup.

Is there a credible mechanism of action for the reported effects?
The absence of a credible mechanism for an effect not only diminishes plausibility, but also makes it impossible to generalise reported findings to other different situations.

What is the strength of the reported effect?
It is often useful to compare the scale of a reported effect to other known causes (or confounders) in order to place it in a proper perspective. Weak and subtle effects can sometimes be due to experimental errors or random variability unless there has been careful attention to good laboratory technique.

Do the reported effects have any health significance?
Strong effects in human studies are regarded as important for public health policy. However, outcomes from cellular and animal studies may be more difficult to interpret, especially if the reported effect is weak and subtle.

Do the reported effects exhibit a dose-response relationship?
An increase in the level of effect with increased exposure is a good indicator of a real effect. Some researchers propose unusual and elaborate dose-response relationships to explain their data, but these are difficult to distinguish from pattern matching of the data after the experiment.

Have the statistical analyses of the results been conducted properly?
The significance of an experimental result is normally quantified by statistical analysis. A meaningful evaluation of a study requires the competent application of statistical tests and adherence to proper scientific methodology such as randomised experimental design, blinding, and the clear specification of hypotheses before experimental data is collected and analysed.

Many experiments test for a wide array of potential endpoints and are called hypothesis generating studies. In such studies the net is cast wide and so the probability of detecting effects due to chance alone increases accordingly. These effects may be false positives, and should be verified by more focused hypothesis testing studies that aim to test a specific effect. Sometimes, hypothesis generating studies are cited as though they were hypothesis testing, with an exaggerated importance that isn't statistically warranted.

Are there more obvious explanations for the reported outcomes?
Potential sources of bias and confounding should always be considered before accepting unusual outcomes. In many RF studies, it has been later found that reported athermal effects were likely caused by RF heating[3].

References

1 Science Media Centre Peer review in a nutshell, 2003, http://www.sciencemediacentre.org/

2 Sense About Science I don't know what to believe..., http://www.senseaboutscience.org.uk/

3 A Hoyto, AP Sihvonen, L Alhonen, J Juutilainen and J Naarala, "Modest increase in

temperature affects ODC activity in L929 cells: low-level radiofrequency radiation does not,"

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