

## Risky arguments about chemicals

SIR—David Lindley made several important points in his News and Views article on risky arguments (*Nature* 346, 507; 1990) but still in my opinion missed the most important. Decisions about perceived risks must in the end be social or personal rather than scientific, and inevitably involve value as well as scientific judgements. People take into account in their perception of risks not only probability but also other types of uncertainty, whether the risk was imposed by others or undertaken voluntarily to achieve a desired end, whether or not the distribution of the risk is equitable, whether the event risked is catastrophic or easily borne, and the degree of public trust in any expert giving advice on the level of risk. To believe that such an assessment is any less "logical" than one that takes account only of numerical probability requires a very narrow and philosophically suspect definition of rationality<sup>1</sup>.

Recent advances in the philosophy of science suggest that in giving expert advice, scientists can no longer claim that there is only one inference that can be argued from the available evidence, but rather that there are a number of possible inferences that can be defended by rational argument<sup>2</sup>. Expert arguments are constrained not only by the evidence, but also by the overall conceptual paradigm,

methods and standards accepted within the expert community, and these constraints are culturally determined. A colleague of mine who works on uncertainty and risk claims that, historically, cranks have got it right more than often than experts. Be that as it may, the lay public has every reason to doubt whether expert advice on risks given by employees of governments, chemical companies, nuclear power authorities or electricity companies is always dispassionate. Unfortunately, the fact that an opinion is expert and expressed numerically does not guarantee its accuracy, impartiality or even probity.

As a case in point, Lindley accepts the conclusions of the Centers for Disease Control (CDC) that significant numbers of Vietnam veterans were not exposed to Agent Orange, and of the Veterans Administration that there were no unusual or excessive causes of death attributable to dioxin. It has, however, since been reported by others that the conclusions of CDC about exposure were incorrect, and that follow up studies of a particular group of Veterans, "Ranch Hands" who were definitely exposed to Agent Orange, showed statistically significant excesses of a number of cancers and birth defects<sup>3,4</sup>. The Ranch Hands are the operators of the aircraft that delivered Agent Orange, not

ground troops. These conclusions are consistent with evidence of the carcinogenic and teratogenic effects of 2,4-D, 2,4,5-T and 2,3,7,8-TCDD in animal experiments, and in human occupational exposure<sup>3-5</sup>. The evidence does not prove a causal link, but is strong enough to make unethical a social decision that ignores it<sup>2</sup>. Social decisions about risk cannot be based solely on what experts consider probable, but on the whole spectrum of evidence, scientific and lay opinion, and the value system on which individual acceptance of risk to achieve social goals is based.

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3. Clapp, R. W. et al. in *Agent Orange and the Vietnam Veteran* (The National Veterans Legal Services Project, 1990).
4. Zumwalt, E. R. Jr Report to the Secretary of the Department of Veterans Affairs on the Association between Adverse Health Effects and Exposure to Agent Orange (1990).
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## No EOS rethink

SIR—G. Christopher Anderson ("Safety in numbers for Earth Observing Systems" *Nature* 346, 399; 1990) is incorrect in stating that members of an American Institute of Aeronautics and Astronautics review panel "have called on NASA officials to rethink the EOS design, arguing that the same scientific results can be achieved more reliably with the tightly-grouped 'clusters' of specialized satellites . . .".

The report of our workshop on this subject, *Mission to Planet Earth: Background and Issues*, dated 5 June 1990, does no such thing, nor do any of its earlier drafts. The specifically stated goal of the workshop, organized primarily for the benefit of congressional staff members, was to define and discuss all the issues surrounding Mission to Planet Earth. Our report, copies of which are available from the institute, neither supports nor opposes either the Earth Observing System's large platforms, clustered satellites or Earth probes; it simply identifies and discusses the pros and cons of each.

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## Rome University

SIR—We welcomed the letter (*Nature* 345, 658; 1990) from four professors at the University of Rome denouncing to the international scientific community the negative attitude of their faculty of medicine. We would like to express our support and to say that the situation they describe is not unique to Rome.

We (and many other Italians working like us as postdoctoral research fellows at US universities) have had similarly discouraging experiences while trying to find positions at Italian universities. Our research interests and achievements have rarely been appreciated. The study and research experience gained at major US universities has, in fact, turned out to be a handicap. It is humiliating to try to explain to our American advisers why it is so difficult for us to get a university position in Italy.

There are, however, Italian professors who are trying to improve the university system in Italy. We admire and support their efforts.

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## Snow and cholera

SIR—In an otherwise excellent polemic against the views of Peter Duesberg on AIDS, Weiss and Jaffe's parthian shot repeats two commonly held though erroneous views on the work of John Snow on cholera (*Nature* 345, 659; 1990).

John Snow was indeed a genius. His achievement was to evolve an elegant, internally and externally consistent theory on the mechanisms and processes of cholera, and to offer practical suggestions for the prevention of the disease arising out of his theory. He did not, however, remove the handle of the Broad Street pump. Nor did this act stop the cholera epidemic in London<sup>1</sup>.

The pump handle was removed by, or on behalf of, the local vestrymen and the epidemic was already waning by the time this was done. Nevertheless, his powers of persuasion, as his friend and collaborator, the Reverend Henry Whitehead, showed, prevented a recurrence. The father of the child whose excreta infected the Broad Street well between 30 August and 2 September 1854 took ill on 8 September, the day the handle was removed. He was ill and died in the same room as his daughter, and as his domestic cesspit leaked into the well it was presumably reinfected.

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