Letters

Cost of International Congresses

Recently I received the first circular of the 28th International Geological Congress, to be held in Washington, D.C., in 1989. Preregistration costs $250 (U.S.), and the cost of the technical excursions (probably the most informative and useful activity at geological congresses) ranges from between $300 and $2000. This means that the minimum cost of attending the congress and one excursion is $550, which is equivalent to approximately 1 month of my salary. If one takes into account the cost of air travel to and from Washington (approximately $500) and a 10-day stay in Washington (at least $1500), the total cost of attending the Congress is approximately $2550, or the equivalent of about 8 months of my salary. The total official allowance currently available for foreign travel at our institute is $500. These figures clearly indicate that many Venezuelan and Latin American geologists will not be able to attend the most important international meeting in their profession. And this situation is likely to worsen in the future.

Therefore I would like to urge the organizing committees of *international* meetings to take these considerations into account and to seek to provide facilities for Third World participants. Otherwise, international congresses will just be regional, rich-country meetings.

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Risk Assessment

Risk assessment may have its funny side, as noted by Daniel E. Koshland, Jr. (Editorial, 17 Apr., p. 241), but current mismanagement of risk by regulatory agencies is no laughing matter. Identifying, controlling, and setting priorities for risks within the areas that Congress has designated for federal activity has been extraordinarily inconsistent and unprotective. Koshland's reaction is not unlike that of most environmentalists, who have long worried that the practice of risk assessment to date has not improved health or advanced policy.

Unfortunately, the special Risk Assessment issue of *Science* (17 April) does not provide a fresh examination of issues, in large part because the authors selected have familiar and entrenched positions. Instead, it reinforces three persistent fallacies: First, that the only primary concern is cancer; second, that the data on exposure are reliable; and third, that bare calculations of health risk can be expected to guide human behavior.

Richard Wilson and E. A. C. Crouch (p. 267) have long lamented the failure of the public to rationalize their "risk portfolios," which suggests that the authors rather than the public are slow to learn that no one makes choices solely on the basis of simple equations or point estimates. Physicist-sociologists of risk need to note that some of the recent work in the study of economic behavior has provided a framework for a more complex analysis of consumer choice in the marketplace in place of simple comparisons of marginal benefit and cost. The proposal by Bruce N. Ames *et al.* (p. 271) for ranking risk of carcinogens, while elegant in structure, is not realistic or implementable. First, as a basis for the HERP (*H*uman *E*xposure dose/*R*odent *P*otency dose), it relies heavily on the assumption that there are reliable data on exposure. Assessment of exposure remains the weakest aspect of evaluating risks for regulatory purposes. The failure to require meaningful information on new chemicals and overreliance on models rather than on monitoring have resulted in a void of information for calculating human exposure. When this lack of data is factored into an equation already burdened by the range of unresolved issues and uncertainties of risk assessment (*1*), it is doubtful how much practical use the approach of Ames *et al.* can be. Second, any comprehensive system ranking risk should be capable of devolution to deal with risk control decisions at the margin. That is, it is important to be able to determine how to deal with, for instance, risks of dioxin from incinerator emissions in populations who smoke, eat certain foods, sunbathe, or otherwise engage in risky business. It is hard to know how to use the approach of Ames *et al.* for this critical assessment.

Finally, the approach of Ames *et al.* and much of the discussion of risk assessment in *Science* and elsewhere continues to confine our national debate to one end point—cancer risk. While evaluating the potential risks of chemicals as carcinogens is important, the human disease and dysfunction that can reasonably be associated with impacts of chemical exposure and environmental modifications are likely to be expressed in many other outcomes. The debate on risk assessment needs to be radically revised; it should start with an assessment of health status in the United States and then move to a consideration of which impairments of health might reasonably be associated with exposure to chemical agents, with the use of such techniques as biological markers to support proposed linkages (*2*). After such an analysis, rational ranking might occur.

This method would revise our current practice of going from the chemical by means of its toxicology to the estimation of health impact, the Environmental Protection Agency dogma of hazard identification, risk characterization, exposure assessment, and then to risk assessment, as explicated by Milton Russell and Michael Gruber (p. 286). Such an approach, while radically different from current science policy, could avoid some of the silliness of current regulatory practice, which provokes not only the amusement of scientists but also the disgust of the public as it observes continued failure to deal efficiently, at the source, with obviously significant environmental risks like lead, sulfur dioxide, radon, formaldehyde, and asbestos.

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REFERENCES

1. E. K. Silbergeld, *Nat. Res. Environ.* **2**, 17 (1986).
2. Board on Environmental Sciences and Toxicology, National Academy of Sciences–National Research Council, *Biological Markers and Environmental Medicine* (National Academy Press, Washington, DC, in press).

Response: Silbergeld does not emphasize the importance of setting priorities in research and regulation, so that efforts to protect public health are not diverted from the most important issues. Since regulation of carcinogens has been based largely on results of rodent bioassays, it is necessary to recognize that about half of all chemicals tested at the maximum tolerated dose are carcinogens in rodents, whether the chemicals are natural or man-made. We believe that our attempts to provide a framework for setting priorities among human exposures to rodent carcinogens is of practical use. One contribution is to show that possible carcinogenic hazards to humans from current levels of pesticide residues or water pollution are likely to be of minimal concern *relative* to the background levels of natural substances, although one cannot say whether these natural exposures are likely to be of major or minor importance. Another contribution is to examine the many uncertainties in relying on animal cancer tests for human prediction given our current understanding of the mechanisms of carcinogenesis.

Silbergeld states that it is a fallacy to treat