Letters

Scientists' Freedom to Travel

In the light of past problems arising with international scientific meetings, the International Council of Scientific Unions (ICSU) passed in 1974 a Resolution on the Freedom of Circulation of Scientists. This resolution, and the accompanying Advice to Organizers of International Scientific Meetings, state that ICSU and any of the affiliated international scientific unions will withdraw their sponsorship of scientific meetings if bona fide scientists are not granted travel visas by at least 1 month ahead of each meeting.

With increasing alarm have we followed evidence that the letter and spirit of the ICSU resolution have been violated in the past few years. It may be sufficient to quote here two documented examples: the 1977 meeting on ferroelectricity, sponsored by the International Union of Pure and Applied Physics (*1*), and the 1978 meeting of the International Genetics Federation (information received from officers in America). We believe that any infraction of the ICSU resolution greatly weakens the fragile fabric of international cooperation in science which all of us have at heart. We therefore urge that *Science* continue to publicize information concerning the freedom of circulation of scientists, specifically to (i) inform the American scientific community on a regular basis of any violation of the ICSU resolution of 1974 whenever it is brought to their attention and (ii) report on actions taken by ICSU dealing with such violations.

The American scientific community will thus be able to arrive at an informed opinion as to what further steps may be necessary to safeguard the freedom of circulation of scientists.

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Composting Hazardous Wastes

It is true, as reported in the 1 June issue of *Science* (Research News, p. 930), that biological degradation of organic matter (including hazardous wastes) can be accelerated at elevated temperatures. Furthermore, as indicated, composting is a promising means of providing suitable temperatures. If the potential of this technology is to be realized, however, it is necessary to examine the widespread belief that, in composting, "hotter is better" (my expression). Indeed the high temperatures routinely attained at composting plants, for example in the range of 70° to 80°C (*1*), while often interpreted as an indication of successful operation, in fact severely restrict degradation.

At least three lines of evidence demonstrate that degradation is maximal at moderate thermophilic temperatures (approximately 55°C).

1) Composting is based on biological self-heating (*2*), the course of which is characterized by the expansion and subsequent collapse of an indigenous mesophilic population, followed by a repetition of similar events in a thermophilic population (*3*). This is manifested by two bursts of heat generation in sequence, and a corresponding two-step temperature ascent. The collapse of these populations is self-induced in that intolerable temperatures are soon reached. The first sign of mesophilic retrenchment is at approximately 40°C and, for thermophiles, at 55°C.

2) In trials involving composting materials equilibrated to a fixed temperature (or to a reasonably narrow range), degradation measured as heat output, production of carbon dioxide, and other objective criteria, is maximal at 52° to 63°C (*4-6*). Higher temperatures representative of routine operation have been shown to be moderately to severely inhibitory (*7*).

3) In trials involving equilibrated material the species diversity of cultivable bacteria decreased sharply above 60°C (*6, 8*). At 65° to 69°C only *Bacillus stearothermophilus* was recovered. The presence of diverse species implies metabolic diversity, a characteristic that is much to be desired in connection with the treatment of hazardous wastes.

Clearly, a feedback system, involving an interaction between population and temperature, is operative in composting. The feedback is positive early in the temperature ascent but becomes negative as the temperature tolerance limit is approached.

Extreme bacterial thermophiles are known (*9*). Theoretically these could be involved in composting increasing the optimal process temperature; however, evidence indicates that the composting ecosystem is the domain of moderate thermophiles.

Heat production, because it represents organic matter degradation, should be maximized in composting. Therefore, process optimization consists of removing heat to the extent that this is necessary to restrain any undue temperature ascent. However, the design being adopted by many communities (*1*), including New York City on a massive scale (*10*), maximizes heat retention and temperature. In this design, a clear distinction is not made between the roles of heat and temperature in composting. This is to the detriment of the process's underlying microbial ecosystem and the objective of degrading organic matter.

In addition to the degradation of organic matter, the destruction of pathogenic microorganisms is a composting objective. Recently a task group concluded that exposure to 55°C for 3 to 5 days satisfies this objective (*11*).

We have found that these principles concerning heat and temperature pertain to the degradation of crude oil added to composting refuse. Also, we have developed practicable means of controlling temperature in field-scale, static-pile composting. The advantages of doing so are being demonstrated in large-scale research trials at Camden, New Jersey.

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7. For example, carbon dioxide production at 72°C was 5 percent of that at 56°C (*5*).
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Laboratory Animal Feed

The News and Comment briefing (13 Oct. 1978, p. 192), reporting the detection of more than 50 parts per billion (ppb) nitrosamines in a sample of National Institutes of Health (NIH) laboratory animal feed, generated considerable concern within the scientific community. We now provide information regarding the current status of this issue and report the preliminary results of more recent investigations regarding nitrosamine concentrations in laboratory animal feeds. Even though the issues regarding biological effects of low dietary nitrosamine concentrations have not been resolved, every effort should be made to identify and minimize contaminant levels in laboratory animal diets in order to facilitate the valid interpretation of results from various kinds of experiments.

The original report (*1*) indicated nitrosamines were present in concentrations of less than 0.1 ppb in nine commercial dog and cat feeds, between 1 and 3 ppb in eight of nine feeds used for small laboratory animals, and 52 ppb in the NIH feed. The authors suggested that the fish meal used in the formulation of the NIH diet was the primary source of nitrosamines, even though most of the other diets assayed also contained fish meal. Through conversations with an author of the report under consideration (*2*) and an inspection of records at the facility that manufactured the diet reported to contain 52 ppb nitrosamines, information has been obtained which appears critical to the evaluation of the original data and to its significance.

The NIH diet (*3*) from which the reported data were obtained was provided by the manufacturer in meal form. It was prepared by mixing appropriate amounts of ingredients in meal form and was packaged directly from the mixer into approximately 140 50-pound bags. The diet was not manufactured for delivery to NIH. All of the cat and dog foods assayed for the original report were either canned or extruded, and the nine laboratory animal feeds were pelleted and had to be ground before they were assayed (*2*). This suggests that the originally reported data (*1*) tested the effects of manufacturing procedures on nitrosamine stability rather than nitrosamine concentrations in specific diets. The single sample (NIH diet) that contained the highest nitrosamine concentration was also the only complete diet not subjected to a manufacturing process involving heat treatment. The potential effect of the heat associated with feed manufacturing processes on the concentration of volatile nitrosamines gives reason to reevaluate the significance of the reported assay results. A second point to reconsider is the amount of diet that was represented in the sample assayed. Apparently only a single bag of each diet was obtained for sampling. In the case of the NIH diet, the analytical results were reported as being representative of the "NIH diet." Data extrapolation of this magnitude does not seem reasonable because not enough information is available regarding the variability of contaminant concentrations in feeds.

In order to obtain more representative data regarding the distribution of volatile nitrosamines in laboratory animal diets, arrangements were made to assay samples collected from various production batches of open formula diets manufactured under NIH contracts. Results of analyses performed on the first three batches sampled indicate concentrations of 1.7, 1.8, and 1.9 ppb nitrosamines (*4*) in pelleted NIH diets formulated with 9 or 10 percent fish meal. Preliminary data regarding nitrosamine concentrations in NIH open formula diet have been provided by the National Institute of Environmental Health Sciences (*5*). Pelleted diets had concentrations of 1.3, 1.1, and 6.4 ppb nitrosamines (*6*), while the fish meal used in the diet formulation contained up to 172 ppb volatile nitrosamines. To confirm these preliminary data, we are collecting ingredient and diet samples for nitrosamine assay at five stages during the manufacture of an NIH diet. It is anticipated that at least four series of samples will be analyzed to provide the data required to make a rational judgment regarding the significance of volatile nitrosamine concentrations in laboratory animal diets.

Since preliminary information suggests that heat treatment of the complete diet substantially decreases volatile nitrosamine concentrations, it is tentatively recommended that all diets for laboratory animals be subjected to heat during their manufacture or to a steam sterilization process.

A high percentage of laboratory animal diets are marketed in extruded biscuits or pellets. To date, the potential problem with volatile nitrosamine concentrations appears to be only in diets purchased in meal form. A possible resolution is to require that diets purchased in meal form be manufactured by regrinding pellets.

An option being considered in the event that research and testing program objectives require decreased dietary volatile nitrosamine concentrations is to develop new diets using ingredients with a low probability of being contaminated with nitrosamines. The NIH open formula diets have the flexibility of reformulation to accommodate specific requirements of the biochemical research community. A series of experiments is now being designed to evaluate diets formulated to contain mineral nitrosamine concentrations in the event this type of diet is required.

The *Science* article also stated that the NIH diet was "Developed as the ideal diet for small rodents in carcinogen bioassays. . . ." The diet discussed (*3*) was in fact developed to maintain rodent production colonies and subsequently was recommended as a standard diet for small rodents in carcinogen bioassays.

The issue regarding a standard diet for carcinogen bioassays has received a considerable amount of attention and no doubt will remain unresolved for some time since the nutrient requirements of rodents beyond their reproductive life span have not been established (*7*). Laboratory animal nutrition is a dynamic discipline, and any specific diet for these species should not be presumed to be ideal. New information regarding dietary requirements of the various species and potential dietary contaminants are being reported with considerable frequency in the literature. Therefore, we must constantly seek to improve diets, a variable that can have a profound influence on experimental results.

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