LETTERS

Lost Opportunity

We are neurobiologists who recently attended the International Conference on the Neural Control of Locomotion at Valley Forge, Pennsylvania. One of the major inducements for our attending the meeting was our expectation that five internationally known Soviet neurobiologists, whose work we wished to know more about, would be in attendance. When we arrived at the meeting, we learned that the Soviet government had not allowed these distinguished scientists to attend.

We are deeply distressed that we have lost the opportunity to engage in scientific discussion with these important colleagues. Whatever reasons the Soviet government may give for their action, there can be no doubt that they have, in this case, hampered scientific progress both inside and outside Russia. It is absurd to spend millions of rubles to have a Soviet cosmonaut shake hands with an American astronaut in space, while real scientific communication on planet Earth is stifled. We look forward to the day when the control of Soviet science by bureaucrats is lifted and an honest détente begins.

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HMPA: A Possible Carcinogen

Hexamethylphosphoramide (HMPA), $[(CH_3)_2N]_3PO$, has been used increasingly in the last few years as a solvent with exceptional power. Consequently, it is now found in a great many chemical laboratories. In experimental animals, the acute toxicity of HMPA is low to moderate by ingestion, inhalation, and skin absorption. It is also a skin irritant. The chronic toxicity of HMPA is, by contrast, more severe.

HMPA has been used as an effective chemosterilant for a number of insect pests. It is a chemical mutagen for several insect species and interferes with spermatogenesis in rats. Investigators have noticed that rats exposed to HMPA by inhalation frequently develop a fatal pneumonia which apparently results from activation of the usually rather benign organisms which are responsible for the endemic chronic murine pneumonitis found in most laboratory rats.

With this background, and because of the increasing use of HMPA in the Du Pont Company, we decided to carry out a long-term inhalation toxicity study with rats. Because we had previously had difficulties controlling pneumonia among exposed rats, we used Charles River CD strain rats, housed them in rooms with laminar flow ventilation, and paid strict attention to sanitation.

The experiment started in December 1974, with four groups of 120 male and 120 female rats each, exposed to, respectively, 0, 50, 400, and 4000 parts per billion (by volume) of HMPA 6 hours a day, 5 days a week. Eighteen animals in each group were killed after 6 months and showed no compound-related lesions. Between the sixth and the eighth months, an excess of animals died or were killed at the point of death in the two groups that received the largest doses of HMPA. The cause of death was predominantly degenerative changes in the convoluted tubules of the kidney.

In August, the eighth month, it was noted that some rats in the same two groups were developing enlarged noses and experiencing difficulty breathing. When the animals were killed, autopsies revealed squamous cell carcinoma which in some cases filled the nasal cavity and penetrated into the brain. The tumors originated from the epithelial lining of the nasal turbinate bones. The incidence was dose-related, 12 nasal tumors being found in 15 rats (out of 240 exposed) that died or were killed in the eighth month in the high-exposure group (4000 ppb), as compared with 7 tumors in 8 animals (out of 240 exposed) that died or were killed in the mid-exposure group (400 ppb). Six rats were randomly selected from the low-dose group (50 ppb) and killed; no malignancy was found.

There appears to be no doubt that this rare form of cancer has been produced in rats by inhalation exposure to HMPA in a concentration as low as 400 ppb (analytical) in a period of about 8 months. We urge everyone using HMPA to handle it with the precautions appropriate to a potential carcinogen.

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Minerals and Plate Tectonics

In his article, "Minerals and plate tectonics (II): Seawater and ore formation" (Research News, 12 Sept., p. 868), Allen L. Hammond cites examples of active hydrothermal systems known on the sea floor. An additional documented example is the TAG hydrothermal field (*1*), discovered on the crest of the Mid-Atlantic Ridge at 26°N by the Trans-Atlantic Geotraverse (TAG) project of the National Oceanic and Atmospheric Administration. Manganese oxide of hydrothermal origin (*2*) present on one wall of the rift valley (*3*) is inferred to have been deposited by hot (*4*), metal-enriched (*5*), aqueous solutions discharging from fractures in the sea floor (*6*). The existence of such sub-sea floor hydrothermal systems at sites along oceanic ridges indicates that hydrothermal activity may concentrate metals in oceanic crust throughout the opening of an ocean basin, from the Red Sea stage to the Atlantic Ocean stage, by sea floor spreading about a divergent plate boundary.

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In his article "The new metallogeny: Impact on exploration is slow, but some see good prospects" (Research News, 12 Sept., p. 868), Hammond states that exploration of the copper deposits on the island of Bougainville, Papua New Guinea, "was inspired primarily by plate tectonics ideas." The deposits were discovered in 1964 because a field geologist recognized similarities between outcrops on Bougainville and porphyry copper deposits in the Philippine Islands. Plate tectonics had nothing to do with the subsequent discovery, exploration, and exploitation of the copper deposit on Bougainville. Plate tectonics research projects are often partly justified by their potential value to mineral exploration, but they contribute little to ongoing exploration programs in various mining districts. New discoveries will be made primarily by correct interpretations of bedrock outcrops, toward which exploration-oriented research should be directed.

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