Letters

Thyroid Protection

For a few days in the spring of 1979, during the accident at the nuclear power plant on Three Mile Island, federal health officials were concerned about the possibility of a major release of radioactive iodides to the atmosphere. The Food and Drug Administration (FDA) therefore requested two drug manufacturers to produce, on an emergency basis, approximately one quarter of a million bottles of a saturated solution of potassium iodide (*1*). The FDA wanted the potassium iodide to be available to block thyroidal uptake of inhaled radioactive iodides in case a large release should occur. Fortunately no major release occurred and the potassium iodide went unused.

It is quite possible that, if there had been a major release of radioiodides at Three Mile Island, the FDA's potassium iodide would have arrived too late. Some therefore argue that preparations against any future large release of radioactive iodides should include stockpiles of potassium iodide which could be made much more quickly available to the endangered population. The Swedish and Tennessee health authorities have adopted this position and have indeed gone so far as to distribute small packages of potassium iodide tablets to all residences surrounding nuclear power plants in their jurisdictions—out to about 5 miles (8 kilometers) in Tennessee and 7 miles (12 kilometers) in Sweden.

The implementation of a thyroid protection policy at a national level in the United States has, however, been strongly opposed by some individual scientists and engineers, by the electrical utilities, and by the senior staff of the Nuclear Regulatory Commission. The letters column of *Science* has been one arena for the resulting debate, in the course of which a report of the Committee on Public Health of the New York Academy of Medicine, which opposed the stockpiling of potassium iodide in New York City (*2*), was both invoked by one writer and critiqued by me. This exchange evoked a response from the Chairman and Executive Secretary of the committee, Norman Simon and Maurice Shils, (Letters, 22 July, p. 318).

Simon and Shils confirm my statement that the principal basis for their committee's recommendation was not in the domain of medicine but, in fact, in the domain of nuclear engineering. Specifically, they cite (*2*) two references that support the finding of their committee's report that

> [i]n the event of an accident, light-water reactors (e.g., Indian Point), prevalent throughout the U.S., are likely to release a very small portion of radioactive iodine into the atmosphere.

They agree that an in-depth review of the subject which was done at the national laboratories at the request of the Nuclear Regulatory Commission (*3*) found that this would not be true of all classes of reactor accidents, but they complain that the authors of the review

> emphasize the low-probability, high-risk accident sequences in which there is a major release from the fuel during a postulated meltdown and a subsequent rupture of the containment vessel.

However, this has long been recognized as the *only* class of reactor accidents that has the potential for causing a public health catastrophe (*4*). The controversy relates to whether or not the probability of such an accident is high enough to be worth preparing against.

Simon and Shils also point out that radioiodide uptake by the thyroid would not be the only radioactive hazard resulting from a catastrophic failure of a reactor containment. That is true, but, because of the enormous factor by which inhaled radioiodides would be concentrated by the thyroid, doses to this organ could remain above the 25-rem level at which the FDA recommends thyroid blocking with potassium iodide (*5*) for more than 100 miles downwind—far beyond the distance at which the doses to other organs would have dropped below the official Protective Action Levels (*6*). And, of course, the thyroid is the only organ which we know how to protect in such a simple, safe, and effective manner.

Finally, Simon and Shils raise the problem that

> attempts to distribute KI [potassium iodide] at the time of an accident would bring massive numbers of people into the streets with the resultant risk of increased exposure to various radioactive substances.

This is indeed a valid concern and is one of the reasons why health authorities in Sweden and Tennessee decided to distribute the drug.

I believe that the debate that has occurred in *Science* has shown that the FDA was not obviously deluded when it rushed to make potassium iodide available to the public around Three Mile Island and that it might be wise to think through in advance how potassium iodide might be made available to the public in any future emergency. Unfortunately, the Nuclear Regulatory Commission, the agency to which all other agencies defer on this question, has, since its creation several years before the Three Mile Island accident, been unresponsive to requests even for just a study of this problem (*7*). Why?

My own interpretation is that the Nuclear Regulatory Commission and the industry which it regulates would like to believe that their joint efforts have reduced the probability of a major release of radioactivity to the atmosphere to the point where off-site preparations for thyroid protection are unnecessary. Of course, they don't know this to be so, but they fear that endorsing off-site preparations would be taken as an admission of failure on-site, further undermining the already shaky public image of the nuclear power enterprise.

Whatever the explanation, the distribution of the nation's investment in reactor safety should be reviewed. It has been proper to spend many billions of dollars for purposes of accident prevention. But it has been improper to refuse to consider the expenditure of one percent as much money on off-site preparations to mitigate the consequences of accidents should they occur.

FRANK VON HIPPEL
Center for Energy and Environmental Studies, School of Engineering/Applied Science, Princeton University, Princeton, New Jersey 08544

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4. *Reactor Safety Study* (WASH-1400, Nuclear Regulatory Commission, Washington, D.C., 1975); see also *NRC Statement on Risk Assessment and the Reactor Safety Study Report (WASH-1400) in Light of the Risk Assessment Review Group Report* (Nuclear Regulatory Commission, Washington, D.C., 1979).
5. *Final Recommendations, Potassium Iodide as a Thyroid-Blocking Agent in a Radiation Emergency: Recommendations on Use* (Food and Drug Administration, Washington, D.C., 1982), p. 28.
6. D. C. Aldrich, P. McGrath, N. C. Rasmussen, *Examination of Offsite Radiological Emergency*

Protective Measures for Nuclear Reactor Accidents Involving Core Melt (NUREG/CR-1131, Nuclear Regulatory Commission, Washington, D.C., 1978), figure 5.8.
7. Study Group on Light Water Reactor Safety, *Rev. Mod. Phys.* **47** (Suppl. 1), S52 (summer 1975); F. von Hippel, *Bull. Atom. Sci.* **36**, 44 (October 1980).

Dioxins

Thank you for Philip H. Abelson's editorial concerning "Chlorinated dioxins" (24 June, p. 1337). I am always suspicious of articles regarding toxic chemicals written by either the chemical industry or environmental groups. Abelson's concise, informative synopsis of the dioxin issue is one of the most objective I have read.

KAREN ANN WILSON
City of Clearwater Public Works, Post Office Box 4748, Clearwater, Florida 33518

Facial and Cardiac Anomalies

Further evidence to support the hypothesis of Margaret L. Kirby *et al.* (Reports, 3 June, p. 1059) that occipital neural crest cells give rise to the mesenchyme involved in aorticopulmonary septation is found among individuals with certain malformations of both the heart and the face. Abnormalities in the formation, proliferation, or migration of cells of the cephalic neural crest have profound effects upon the facial features of the developing individual, as evidenced by subjects with holoprosencephaly (*1*). In addition to the well-known facial deformities in these patients, anomalies of the conotruncal region may include persistent truncus arteriosus, transposition of the great vessels, and tetralogy of Fallot (*2*). More subtle changes may be seen in patients with the facies and conotruncal or aortic arch anomalies of the DiGeorge syndrome and the fetal alcohol syndrome. Prominent features of the DiGeorge syndrome include persistent truncus arteriosus, coarctation or interruption of the aorta, mild midfacial dysmorphia (downslanting palpebral fissures, short philtrum), and partial or complete thymic and parathyroid agenesis (*3*). Infants with the fetal alcohol syndrome may have cardiovascular defects within or near the conotruncal region (tetralogy of Fallot, ventricular septal defect, coarctation) and midfacial anomalies (cleft lip or palate or both, midface hypoplasia, short nose, and hypoplastic philtrum and upper vermillion (*4*).

The pivotal role of neural crest cells in craniofacial development and branchial arch development continues to be documented in a variety of experimental animals and humans (*5*). Thus, the association between certain facial and cardiac anomalies and topographically related tissues may well come to be understood as an abnormality originating in the region of the cephalic neural crest and most certainly deserves our continuing attention.

JOSEPH R. SIEBERT
Department of Laboratories, Children's Orthopedic Hospital and Medical Center, Seattle, Washington 98105, and *Department of Anthropology, University of Washington, Seattle 98105*

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R-DNA

The Briefing headline "Congress ponders rDNA and environmental risks" (8 July, p. 136) led me to ponder what hazard to public health was represented by the genes for ribosomal RNA. I was relieved that the topic was recombinant DNA (R-DNA). Whether the letter "r" is lowercase or uppercase clearly makes the topic a different case.

LEA K. BLEYMAN
Department of Natural Sciences, Baruch College, City University of New York, 17 Lexington Avenue, New York 10010

Love Canal

Contrary to what Barbara Culliton reported (Briefing, 17 June, p. 1254), our study of persons living near Love Canal (*1*) did not assess incidence of disease, death, reproductive abnormalities, or cancer. We measured the extent of cytogenetic changes (chromosome aberrations and sister chromatid exchanges) in peripheral blood lymphocytes from current and former residents of the Love Canal area and compared the results with those of residents from a control area. As part of this comparison, all study participants were asked about various past illnesses, medical experiences, and environmental exposures that might have been related to increased chromosome damage and hence have hampered detection of damage resulting from exposure to Love Canal chemicals. Taking into account information about prior illnesses and exposures, we found no statistically significant cytogenetic differences between residents of the Love Canal area and those from the control area.

Several other studies have addressed the question of whether residence near Love Canal is associated with increased frequency of illnesses of various sorts, especially cancer and reproductive abnormalities (*2, 3*). Thus far no firm evidence of increased illness frequency has been found. In this regard, however, absence of cytogenetic differences cannot be taken as evidence (directly, at least) that no differences in risk of illness exist. Our understanding of chromosome aberrations and altered frequencies of sister chromatid exchanges in peripheral blood lymphocytes is not yet sufficient to allow prediction of disease.

C. W. HEATH, JR.
MARION R. NADEL
MATTHEW M. ZACK
ANDREW T. L. CHEN
Centers for Disease Control, Atlanta, Georgia 30333
MICHAEL A. BENDER
Brookhaven National Laboratory, Upton, New York 11973
R. JULIAN PRESTON
Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830

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Erratum: In the report "Sequence of 16*S* ribosomal from *Halobacterium volcanii*, an archaebacterium" by R. Gupta *et al.* (12 August, p. 656), the last sentence of the abstract should read: "Since the *H. volcanii* sequence is closer to both the eubacterial and eukaryotic sequences than these two are to one another, it follows that the archaebacterial sequence is more like the common ancestral sequence than at least one of the other two versions." Also, the sentence beginning on line 6, column 3, page 658, should read: "Although the root of this tree cannot be determined, the data demand that the archaebacterial version be closer to the ancestral version common to all than are one or both of the other two versions."