LETTERS

Potassium Iodide Policy

In her letter of 23 July (p. 295), Rosalyn Yalow defends only one of the positions for which she was criticized by me and others at a 5 March congressional hearing. I will similarly limit my response. The subject of the congressional hearing was the possible use of potassium iodide to block thyroidal uptake of radioactive iodides downwind from a major release of such isotopes to the atmosphere from a reactor accident. Yalow supports the position that the risk to the thyroid from exposure to radioiodides is negligible up to very high doses with a passage from a review (*1*) by the American Thyroid Association (ATA) in which it is stated that

> projected thyroidal doses from radioiodine as high as 500 rads have recently been proposed as a realistic threshold for the institution of blocking counter-measures in the event of a reactor accident releasing radioiodines into the environment.

The unwary reader might conclude from this quote that the ATA thought that a projected thyroid dose as high as 500 rads might be a realistic threshold for protection. In fact, the ATA recommended a 50-rad threshold for children and pregnant women and, as is suggested by a later part of Yalow's quote from the ATA report, 100 rads for adults (*1*).

Yalow does not mention that the Food and Drug Administration (FDA) has also found arguments for high thresholds unconvincing. In April the FDA published its final recommendations on the use of potassium iodide in a radiation emergency (*2*):

> The FDA concludes that risks from the short-term use of relatively low doses of potassium iodide for thyroid blocking in a radiation emergency are outweighed by the risks of radioiodine-induced thyroid nodules or cancer at a projected dose of 25 rem or greater to the thyroid gland from radioiodines released into the environment.

In order to put the difference between the 500- and 25-rad choice into perspective, one can estimate the associated risks of thyroid damage using the dose-risk coefficients in the National Academy of Science's latest review (*3*) of the biological effects of low levels of ionizing radiation. According to this review (*4*):

> . . . the best estimate of risk for all ages appears to be approximately four [thyroidal] carcinomas per 10^6 PY [person-years after exposure] per rad which includes occult carcinomas in some series. Benign [thyroidal] adenomas are also induced by radiation with an absolute risk of 12 adenomas per 10^6 PY per rad.

Using these coefficients one can estimate that a person surviving 40 years after receiving a 500-rad dose to the thyroid would have an extra 8 percent probability of developing thyroid cancer and an extra 24 percent chance of developing benign thyroid nodules. For the threshold dose of 25 rads chosen by the FDA, the corresponding numbers would be 0.4 percent and 1.2 percent, respectively. In view of the fact that tens of millions of doses of potassium iodide have been consumed annually in the United States at dose levels far above those required for thyroid blocking with only a very small number of reported side-effects (*2*), it should not be surprising that the FDA settled on the lower threshold value.

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References and Notes

1. "The use of iodine as a thyroidal blocking agent in the event of a reactor accident" (American Thyroid Association, Worcester, Mass., 18 September 1981).
2. *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.
3. *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation* (National Academy Press, Washington, D.C., 1980), pp. 304–305.
4. The dose-risk coefficients in (*3*) are based principally on epidemiological studies of populations subjected to external (x-ray and γ-ray) irradiation. A recent, careful experiment with rats found, however, that "The proportion of animals with thyroid carcinoma is similar for I-131 and X irradiation within the range 0–1000 rads" (W. Lee, R. P. Chiacchierini, B. Shleien, N. C. Telles, *Radiat. Res.*, in press).

Rosalyn Yalow's defense of her congressional testimony in which she opposed the use of potassium iodide to protect against iodine-131 ingestion during nuclear power plant accidents is inaccurate on several counts.

For example, Yalow cites a study that allegedly found no increase in the incidence of thyroid tumors in adults exposed to 100 rads and children exposed to 159 rads of radiation. Based on this evidence, Yalow supports a threshold dose of 500 rads before measures should be taken to protect the thyroid. But the study (*1*) which Yalow and the American Thyroid Association use as evidence of the safety of low-level radiation followed subjects for only 18 years after radiation exposure, when thyroid cancer has been found to have a latency period of up to 40 years. Other studies have found a significant increase in thyroid nodules and thyroid cancer in those exposed to much lower doses of radiation. For example, Ron and Modan (*2*) found a significant increase of thyroid cancer in children exposed to less than 9 rads. Moreover, the American Thyroid Association made the recommendation of a 500-rad threshold dose to the Food and Drug Administration (FDA), and on the basis of all of the information considered, the FDA decided upon a threshold dose of 25 rads (*3*). The use of a high threshold for radiation exposure, which Yalow supports, could prove extremely dangerous to those exposed during nuclear power plant accidents.

Much of Yalow's presentation did not rely on the American Thyroid Association report (*4*), as claimed in her letter. For example, Yalow stated that, if one accepted the *Reactor Safety Study* (*5*) estimate of the incidence of thyroid tumors following radiation exposure, there would have been an increase of 70,000 deaths from thyroid cancer during the first 20 years of therapeutic use of iodine-131. This statement is not present in the American Thyroid Association report (*5*) but can be found in a report (*6*) written by Yalow that was presented at a symposium held by the Endocrine Society in June 1980. In fact, if one uses the *Reactor Safety Study* estimate of 334 nodules (40 percent of which are cancerous) per 10^6 rems (*4*), and an exposure of 200,000 individuals to therapeutic doses of 100 rads during this time (*6*), one would expect an increase of 26,700 cancers and 1000 cancer deaths. Given a minimum of 10 years between the time of radiation exposure and death from thyroid cancer, one-half of those 1000 deaths would not even occur during that 20-year period. That leaves a total of 500 additional deaths over a 10-year period, or 50 extra deaths a year, an increase which could well have escaped notice.

Yalow objects to the statement made by Constance Holden, the author of the *Science* article (News and Comment, 19 March, p. 1485), that "If the lineup at the hearing is any indication, it would appear that the main opponents of general distribution of KI are also the strongest nuclear power enthusiasts." But when it comes to the federal agencies, this is clearly the case. Both the FDA (*3*) and the Federal Emergency Management Agency (*7*) support the use of potassium iodide for the general population, while the Nuclear Regulatory Commission (NRC)—a major proponent of nuclear power—does not (*8*). The position of the NRC is based, in part, on an apparent unwillingness to publicize the dangers of nuclear power or to acknowledge that such an accident could occur lest the nuclear power industry fail even faster than it is at present. This position has contributed to a delay in the formulation

of federal policy on potassium iodide that would serve as guidance to states developing emergency plans.

Without this guidance from federal agencies, many states will be less likely to purchase potassium iodide for the general population, and those living near nuclear power plants will not have the option to protect themselves from a preventable disease. The fact that some states, including Tennessee, Vermont, and Alabama, have purchased potassium iodide to protect the general population despite the lack of federal guidance attests to the seriousness of this issue and to the fact that federal guidance is long overdue.

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1. L. E. Holm, G. Lundell, C. Wallinder, *J. Natl. Cancer Inst.* **64**, 1055 (1980).
2. E. Ron and B. Modan, *ibid.* **65**, 7 (1980).
3. *Fed. Regist.* **47** (125) 28158 (29 June 1982).
4. "The use of iodine as a thyroidal blocking agent in the event of a reactor accident" (American Thyroid Association, Worcester, Mass., 18 September 1981).
5. *Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants* (Report Wash 1400, Nuclear Regulatory Commission, Washington, D.C., 1975).
6. R. S. Yalow, "Risks in mass distribution of KI," paper presented at the Endocrine Society Symposium "Potassium Iodide: Good or Evil After Nuclear Accidents," Washington, D.C., 18 June 1980.
7. R. Krimm, assistant associate director, Office of Natural and Technological Hazards, Federal Emergency Management Agency, testimony before the U.S. House of Representatives, Committee on Interior and Insular Affairs, subcommittee on oversight and investigations (97th Congr., 2nd. sess., 5 March 1982), p. 1.
8. B. Grimes, director, Division of Emergency Preparedness, U.S. Nuclear Regulatory Commission, testimony before the U.S. House of Representatives, Committee on Interior and Insular Affairs, subcommittee on oversight and investigations (97th Congr., 2nd sess., 5 March 1982), p. 3.

Oil Consumption

Philip H. Abelson, in his editorial "Energy for Western Europe" (23 July, p. 309), says that a combination of conservation, improved energy efficiency, and substitution of alternative sources of energy for oil has reduced imports markedly. In fact, what appears to have had the greatest impact on reducing imports has been the decrease in economic activity. Manufacturing capacity utilization in the United States is down from 85 percent in 1979 to 68 percent as of last June, with the production of durable goods dropping 16 percent during this period (*1*). Total oil consumption, however, is projected to only decrease approximately 11 percent this year, assuming some economic improvement in the second half of 1982 (*2*). Yet oil imports are projected to be only 4.5 million barrels per day this year (*2*) as compared to 8 million barrels per day in 1979 (*3*). Unfortunately, rather than heralding a large increase in domestic oil production, this is due to the consumption of inventories acquired in 1981.

Certainly the factors Abelson mentions have had an effect on U.S. oil consumption, but it appears that they are outweighed by the effects of the low level of economic growth and inflation. When the economy regains its strength, oil consumption and imports will once again rise dramatically. The nation will again be devastatingly vulnerable to the loss of a vital commodity, having not used this period of relatively stable oil prices and supplies to accelerate the development of oil substitutes. As noted in a recent study (*4*), it is necessary to move boldly to replace oil with coal- and nuclear-generated electricity, oil shale, and liquids and gases from coal.

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References

1. *New York Times*, 25 July 1982, p. E4.
2. Energy Information Administration, *Short-Term Energy Outlook* (DOE/EIA-0202, Department of Energy, Washington, D.C., 1982).
3. *Mon. Energy Rev.* January 1982, p. 32.
4. R. S. Livingston, T. D. Anderson, T. M. Besmann, M. Olszewski, A. M. Perry, C. D. West, *A Desirable Energy Future* (Franklin Institute Press, Philadelphia, 1982).

The LEP Experiment

William J. Broad, in his article (News and Comment, 20 Aug., p. 710) on a possible controversy over U.S. support of experiments at the LEP accelerator in Europe, quotes only a part of what I have said to him, to the High Energy Physics Advisory Panel, and to many other physicists. This turns my position, which some have even called bland, into something that (to use Broad's words) would "kick up a certain amount of dust between two Nobel laureates in the United States."

To set the record straight, I fully support international scientific collaboration in high energy physics, and I have done a considerable amount of work to expand this collaboration. In the past the collaboration has resulted in the export overseas (principally to Europe) of about 10 percent of U.S. funds that go to university research groups in the United States. This overseas effort has on the average been balanced by work done by foreign groups in the United States. Five to 10 years ago Europe was the main source of foreign groups working in the United States. Recently the European effort here has decreased while the Japanese effort has increased, and the system still is in rough balance. The system is a healthy one for science, for it allows an important cross-fertilization as well as allowing physicists from all regions to follow their interests and to use facilities of a kind that may not be available near home.

Ting's request for $20 million over a period of 4 to 5 years for the U.S. share of the construction of a major LEP facility is the latest in a long line of requests for the support of work overseas. Looked at on a yearly basis, it is a large but not an enormous amount of money. It is a truism to say that his request must be examined on its merits and in light of available resources—all requests for funds are examined on these bases.

I also believe that requests for funds for overseas work should be monitored carefully, for these requests are a symptom of the health of the national program. Very roughly, 75 percent of U.S. funds for high energy physics goes to support the three big laboratories (Brookhaven, Fermilab, and SLAC), where nearly all of the U.S. experimental programs are carried out. The remainder goes principally to support the university groups that do most of the experimental work. A persistent and significant increase in funds exported from the United States by university groups would seem to me to be a clear sign that the U.S. program may face a combination of serious problems: our facilities might be becoming obsolete, we might not be building the right new facilities in a timely manner, or we might not be supporting accelerators here with enough funds to allow sufficient running time for the experimental groups that want to use these machines. I think that we face more than one of these problems.

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Erratum: In the article "Critical care at Tianjin's First Central Hospital and the Fourth Modernization" by Renée C. Fox and Judith P. Swazey (20 Aug., p. 700), in the third paragraph on page 703, the word "atrioventricular" should have been "arteriovenous."

Erratum: In the book review by T. J. M. Schopf (30 July, p. 438), the statement that "titles of the articles are not included in the references" of *Genome Evolution* (G. A. Dover and R. B. Flavell, Eds., Academic Press, New York, 1982) is incorrect; titles are lacking in only one of the reference lists in the book.