conductor such that the vortex core could sit in it.' " Taubes also writes that "the best tool for drilling a hole . . . suggested by IBM physicist Alan Marwick, was a high-energy ion, which could plow a long track through the material's crystal structure."

We must emphasize that this idea of a "hole solution" did not originate in the United States, but in France, and not in 1990, but in 1988. The researchers in our group (Laboratoire de Cristallographie et Science des Matériaux–l'Institut des Sciences de la Matière et du Rayonnement and the Centre Interdisciplinaire de Recherche sur les Ions Lourds) had several meetings in April 1988, not in a restaurant (although we also appreciate restaurants!), but at the University of Caen to discuss the possible pinning of vortices by creating nuclear tracks by heavy ions in YBCO. The first experiments were carried out 3 months later at the Grand Accélérateur National d'Ions Lourds by bombarding the "123" superconductor with xenon ions.

The first results were submitted at the end of 1988 and published early in 1989 (*1*). In these two articles, the creation of columnar defects (nuclear tracks) in a high-T_c superconductor is shown for the first time, and the increase of the critical current of YBCO by a factor of 3.5 by heavy ion bombardment is also demonstrated.

Our group also performed lead ion bombardments on YBCO in 1990 (maybe while our American colleagues were having discussions at the Chinese restaurant) that was published at the beginning of 1991 (*2*).

The next time we visit California, we will try this famous Chinese restaurant (if we can get the address), and perhaps there we will get some new ideas for the research and improvement of high-T_c superconductors.

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1. D. Bourgault *et al.*, *Phys. Rev. B* **39**, 6549 (1989); D. Bourgault *et al.*, *Nucl. Instrum. Methods Phys. Res.* **B42**, 61 (1989).
2. V. Hardy *et al.*, *ibid.* **B54**, 472 (1991).

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Is Dioxin a Human Carcinogen?

The statement in the article "Dioxin tied to endometriosis" by Ann Gibbons (Research News, 26 Nov., p.1373) that "[i]n human beings, there is evidence that high doses of [dioxin] cause cancer. . ." is incorrect. Dioxin's link with human cancer has not been established. Among others, the International Agency of Research for Cancer (IARC) considers the data "inadequate" for such a conclusion (*1*), and the particular publication that Gibbons' article is based on (*2*) clearly states that "[a]lthough dioxin is a carcinogen and teratogen in rodents . . . the true biologic effects . . . in humans are not clear."

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1. *Evaluation of the Carcinogenic Risk of Chemicals to Humans* (IARC Monogr. Suppl. 7, International Agency for Research on Cancer, Lyons, France, 1987), p. 350.
2. S. E. Rier, D. C. Martin, R. E. Bowman, W. P. Dmowski, J. L. Becker, *Fundam. Appl. Toxicol.* **21**, 433 (1993).

Response: Five recent epidemiological studies (*1*) show an increased risk of cancer for humans who have been exposed to high concentrations of dioxin. Several studies also have shown that dioxin causes cancer in both sexes of four species of animals exposed to dioxin—mice, rats, guinea pigs, and fish. A panel of outside experts in epidemiology recently reviewed the data on dioxin and agreed that "the human data are compatible with the animal data," says toxicologist Linda Birnbaum, director of the Environmental Toxicology Division at the Environmental Protection Agency's Health Effects Research Laboratory and one of the leaders of the agency's reassessment of dioxin risk.—***Ann Gibbons***

References

1. P. A. Bertazzi *et al.*, *Epidemiology* **4**, 398 (1993); M. A. Fingerhut *et al.*, *N. Engl. J. Med.* **324**, 212 (1991); M. Kogevinas *et al.*, *Cancer Causes Control* **4**, 547 (1993); A. Manz *et al.*, *Lancet* **338**, 959 (1991); A. Zober *et al.*, *Int. Arch. Occup. Environ. Health* **62**, 139 (1990).

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Accelerator Power Plants

An accelerator-driven energy production system at Los Alamos, as described by Peter Aldhous in News & Comment article "Rubbia floats a plan for accelerator power plants" (26 Nov., p. 1368), could provide an "unlimited" energy source and concurrently burn both long-lived fission products and highly radioactive actinide waste. The system essentially would have no long-term high-level waste stream. The thorium-uranium cycle would be much more practical in this regard than is the uranium-plutonium cycle. We also believe it could be economically competitive.

With accelerator-driven thorium-uranium power plants consuming most high-level wastes, it should then be possible to handle remnant waste from nuclear electric power production with man-made containers (engineered storage) that would need to retain continence for only a few hundred years—an attractive alternative to storage of untransmuted waste for tens of thousands of years by reliance on geologic containment in deep underground repositories. We cannot be certain at this point that our technology can meet the objective of economically competitive electric power production without a long-term high-level waste stream. Therefore, worldwide programs to develop geologic storage should continue, if only to take care of existing waste. Eliminating wastes, rather than bequeathing them (no matter how well stored) to distant generations is, we believe, appealing.

The use of a subcritical system in a thorium-driven power plant would absolutely prevent a runaway chain reaction such as that which occurred at Chernobyl. A loss-of-coolant accident such as that which occurred at Three Mile Island could be prevented by passively draining the liquid fuel.

We welcome the developing interest at CERN in this field, which may in some part be the result of our many presentations to the European Community over the past 3 years. However, eliminating only actinide waste, but not fission product waste (which is the most difficult to confine by geologic storage), would not justify the development of this advanced technology. We believe the CERN group eventually will recognize the need to address the whole waste problem, and we expect that their approach will evolve toward using the same liquid fuel (molten salt) that was studied thoroughly at the Oak Ridge National Laboratory and elsewhere, and which we have adopted.

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Basic Research and Weather Prediction

The shortsightedness of current attacks on basic research (E. Marshall, "Senate turns up the heat on NSF," News & Comment, 17 Sept., p. 1512) is well illustrated by the National Weather Service's (NWS's) modernization program (R. A. Kerr, "Upgrade of storm warnings paying off," Research News, 15 Oct., p. 331). The concept and development of Doppler radars, which are at the heart of the NWS's ongoing $4.4-billion modernization program, and the demonstration of their utility for the detection of severe storms, were carried out by the meteorological basic research community in the 1950s through the 1980s. Now, within less than 2 years of the initial deployment of Doppler radars by the NWS, it has been shown that they greatly improve the operational forecasts of severe storms: forecasts are more accurate and there are significantly longer warning times for tornadoes.

However, in the immortal words of Al Jolson, "You ain't seen nothin' yet." Not, that is, if research into short-range weather prediction continues to be supported. The enormous quantity of high-quality data that will be provided by the NWS modernization program, when combined with a rapidly increasing understanding of weather systems and their representations by high-resolution numerical models, has the potential to provide spectacular improvements in short-range weather forecasts nationwide. A blueprint for realizing this potential has been developed by a multiagency task force (*1*). Implementation of this program requires an investment of just a few percent of the cost of the NWS modernization program. The social and economic payoffs will be enormous. Let's get on with it!

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1. *United States Weather Research Program: Implementation Plan* (Subcommittee on Atmospheric Research, Committee on Earth and Environmental Sciences, Department of Commerce, Washington, DC, in press).

Corrections and Clarifications

In the report "Carbon monoxide: A putative neural messenger" by A. Verma *et al.* (15 Jan. 1993, p. 381), the first full sentence in column 3 on page 381 should have read, "Like NO, CO is a noxious gas that activates guanylyl cyclase (8), and it has been postulated that CO, derived from heme by the action of heme oxygenase, has physiological functions (9)." Reference 9 should have referred to an article by G. S. Marks *et al.* [*Trends Pharmacol. Sci.* **12**, 185 (1991)], which was erroneously included in reference 8. References 9 through 24 should have been numbered 10 through 25.

In the report "The drift of Saturn's north polar spot observed by the Hubble Space Telescope" by J. Caldwell *et al.* (16 Apr., p. 326), the revised System III rotation rate of the drift was incorrectly calculated. It should not have been "810.737° ± 0.008° per day," as stated (line 21, col. 1, p. 329), but rather "810.851° ± 0.008° per day."