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radiation on individual plants and animals. However, it is well known that, in Kerala, India, where the natural radiation level (up to about 400 millisieverts per year) is much higher than the average global one (2.4 mSv), black rats for 800 to 1000 generations have shown no adverse biological effects.³ The new policy will likely confuse both the public and the regulators who are developing guidelines for biota. It will complicate decision making and increase the cost of radiation protection far above its present level for protecting humans. I sincerely hope that the committee will resist the pressure of environmentalists and return to its traditionally neutral, independent, and rational position on this topic.

In the past, UNSCEAR helped resolve basic issues concerning the effects of ionizing radiation on humans and the environment. Results of its studies became the foundation for radiation protection systems from the ICRP and other organizations. I argue that the current system based on the LNT model will collapse, because it is overly complicated, enormously costly to society, and now overshadowed by knowledge gained over the past

decade. UNSCEAR's task is to supply a scientific foundation for a new radiation protection system. One issue is the known hormetic (beneficial or positive), adaptive, biphasic response of cells and organisms to radiation dose. Implications of that universal biological phenomenon for economics, risk assessment and risk communication to the public, clinical medicine, and regulatory strategies have recently been presented in a brilliant commentary in *Nature*.⁴

References

1. See, for example, R. E. J. Mitchel, D. R. Boreham, *Proc. of the International Radiation Protection Association, 10th Quadrennial Meeting, Hiroshima, Japan, 15–19 May 2000, Plenary Session 1*.
2. UNSCEAR, *Sources and Effects of Ionizing Radiation*, UNSCEAR, New York (1996).
3. P. C. Kesavan, in *High Levels of Natural Radiation*, L. Wei, T. Sugahara, Z. Tao, eds. Elsevier, Amsterdam (1996), p. 111.
4. E. J. Calabrese, L. A. Baldwin, *Nature* **421**, 691 (2003).

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Financial Planning 101 for Career Physicists

The December 2002 issue of PHYSICS TODAY contained timely reexaminations, by Kenneth Hass (page 54) and Robert Laughlin (page 10), of the university's role in educating physicists for industrial positions. Students do need to be prepared to cope with several realities that they will encounter in nonacademic life.

First, industrial science is not a lifetime career. There is no tenure. Some older scientists will be able to find work in marketing or management in the industries they joined, but most will be eliminated in mid-career due to industry downsizing. They will need to find second careers, yet few employers are comfortable with entry-level workers in their fifties and fewer still pay new hires enough to send children to college or save for anticipated medical expenses. It is better to have a parallel career—or a potentially lucrative hobby—while employed. I recommend that young physicists learn about finance, politics, or real estate, and that they marry well.

A second reality is that institutions

are dysfunctional. Every organization has, on one hand, people whose interests would best be served if the targeted problem is never actually solved and, on the other, rivals who want the credit for solving it, whether or not they contribute. Such types often control resources, influence decisions, and act to advance their interests. Scientists are typically rank-ordered in yearly reviews in which groups work to advance their careers and position others for outplacement. I recommend reading the "Dilbert" comic strip daily.

Third, science has incurred a catastrophic loss of prestige over the past 40 years. These days, scientists are perceived as just another self-absorbed interest group, less significant or effective than, for example, the Klamath Valley horseradish farmers. In a company, those who make the sales—not those who make the deliveries—get the rewards. I recommend that students be taught how to write proposals and sell programs as well as how to promote themselves and their scientific fields.

The values and traditions recounted by Laughlin—above all, truth-seeking—enabled the exploration of the universe and the har-

nessing of knowledge to benefit humanity. Those were remarkable 20th-century feats in which government, university, and industrial science played honorable roles. However, this is the 21st century. Wake up and smell the corruption!

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Continuous Neutron Source Needed

An article in the September 2002 issue of PHYSICS TODAY (page 27) reports a "shortage of neutron sources available to US scientists." As many physicists and others are aware, more than three years ago, the US Department of Energy abruptly decided to permanently shut down the High Flux Beam Reactor at Brookhaven National Laboratory.

The PHYSICS TODAY article reports that the shutdown decision was due to groundwater tritium from the spent fuel storage pool. Actually, the Secretary of Energy saw no public health or environmental concerns for the future operation of the reactor; he based his decision on the abundance of neutrons in the US and on econom-

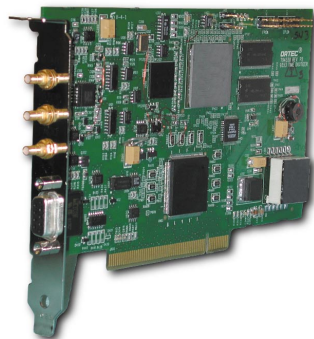
ics. The US Nuclear Regulatory Commission independently determined that the tritium plume in the groundwater did not pose a health risk to any member of the public.

Now the reactor is gone, other facilities are aging, and planned new ones will meet only part of the projected demand for neutrons. Therefore, it is time to start thinking about a new continuous neutron source. Several years ago, the Advanced Neutron Source project was canceled because of cost and proliferation concerns. Since then, new information has been developed on the performance of low-enriched uranium fuels, and the nuclear industry has become extremely aware of cost in the design of future, safer reactors. A preliminary analysis of a heavy-water-cooled, particle-bed reactor fueled with low-enriched uranium indicates that a thermal flux of 10^{16} neutrons/(cm²·s) is achievable. It is important for researchers to have a new world-class continuous source, at an acceptable and convenient site, to complement the forthcoming accelerator-based pulsed source.

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