Water Resources Programs Under the Ax

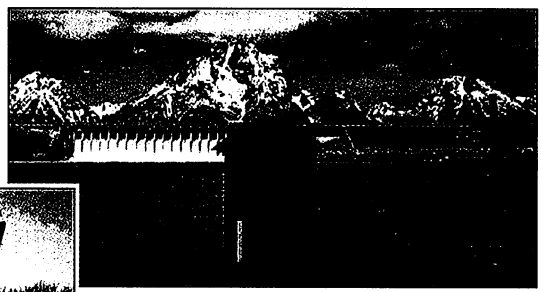
IN HIS ARTICLE "USGS BRACES FOR SEVERE budget cuts," Erik Stokstad does a good job of explaining the impacts of cuts to the Water Resources Division's Toxic Substances Hydrology Program and National Water Quality Assessment (News of the Week, 11 May, p. 1040). However, his report does not reveal the true depth of cuts to the U.S. Geological Survey (USGS) water resources programs. Also under the budget ax are the streamgaging program and the State Water Resources Research Institute Program.

Budget cut casualties? Streamgaging stations such as these provide critical data for many water resource–related decisions.

CREDIT: USGS

Stage and flow data from USGS streamgaging stations support dozens of critical water quality, water supply, power generation, navigational, and recreational activities, as well as water-related research. When states struggle to comply with the total maximum daily load (TMDL) requirements of the Clean Water Act, stream flow data are indispensable, and we need many more—not fewer—streamgaging stations. Federal agencies (such as the Corps of Engineers) that have been cooperating with USGS on the streamgage network have drastically cut back funding in recent years, and for the Bush Administration to suggest that these agencies would make up for cuts in the USGS budget is simply disingenuous.

The State Water Resources Research Institute Program—which the Bush Administration proposes to completely eliminate—is a vital part of our nation's water science agency, leveraging a modest amount of federal funds with state, local, and private funds to sponsor hundreds of studies each year that are critical in solving water quality problems at the local and state level. Without federal funds to offer state and local agencies as incentives for investment in water science research and in the education of our future water scientists, many of our 54 state/territory water resources research institutes might disappear.



The cuts aimed at the USGS Water Resources Division are deep and serious. They are suggestive of a bias against physical science research and lead me to question the Administration's pledge to use "sound science" in setting environmental policy.

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Directions to "Eureka!"

THE PROCESS OF SCIENTIFIC DISCOVERY IS presented by David Paydarfar and William J. Schwartz as a tongue-in-cheek flow diagram, as well as a (presumably) more serious set of informal heuristics (or "principles") (Editorial, 6 Apr., p. 13). I find it somewhat disappointing that the psychology of discovery would be treated in such an informal fashion.

Albert Einstein did say, as the authors quote him, "The whole of science is nothing more than a refinement of everyday thinking." But Einstein went on to say much more—and, in effect, he suggested a program of further investigation that we now call cognitive science. The full quotation reads as follows: "The whole of science is nothing more than a refinement of everyday thinking. It is for this reason that the critical thinking of the physicist cannot possibly be restricted to the examination of concepts of his own specific field. He cannot proceed without considering critically a much more difficult problem, the problem of analyzing the nature of everyday thinking" (*1*, p. 59).

In the more than 60 years since Einstein made this remarkable statement, the cognitive sciences have made substantial advances in our understanding of the "difficult problem...of analyzing the nature of everyday thinking." At the same time that we have gained scientific knowledge about human thought processes, we have also learned how those processes are used in scientific discovery. The connection between everyday thinking and scientific thinking is, as Einstein correctly suggested, more in the detail than in anything fundamental: "The scientific way of forming concepts differs from that which we use in our daily life, not basically, but merely in the more precise definition of concepts and conclusions, more painstaking and systematic choice of experimental material, and greater logical economy" (*2*, p. 98). Several decades of research on the psychology of the scientific discovery process have revealed how normal cognitive processes enable humans to generate the "precise definitions," "systematic choice of experimental material," and "logical economy" that Einstein identified as the hallmarks of scientific thought (*3*).

"The whole of science is nothing more than a refinement of everyday thinking."
—Albert Einstein

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References and Notes
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2. A. Einstein, "The common language of science" (1941), reprinted in A. Einstein, *Out of My Later Years* (Philosophical Library, New York, 1950), p. 98.
3. For reviews of this extensive literature, see G. J. Feist, M. E. Gorman, *Rev. Gen. Psychol.* **2** (no. 1), 3 (1998); D. Klahr, *Exploring Science: The Cognition and Development of Discovery Processes* (MIT Press, Cambridge, MA, 2000); ———, H. A. Simon, *Psychol. Bull.* **125**, 524 (1999); C. Zimmerman, *Dev. Rev.* **20**, 99 (2000).

Response

AS WE WROTE IN OUR EDITORIAL, THERE ARE great treatises on discovery in science, including its cognitive psychology, and Klahr's rigorous analyses are certainly among them. But we believe that there is still a place for some personal counsel for practicing scientists and, for further reading in this genre, Sir Peter Medawar's *Advice to a Young Scientist* (*1*) should not be missed.

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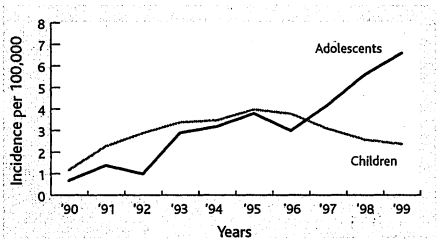
Health Consequences of the Chornobyl Accident

THE NEWS FOCUS ARTICLE "LIVING IN THE shadow of Chornobyl" by Richard Stone (20 Apr., p. 420) serves to remind us that the health consequences of an accident that took place 15 years ago are still occurring. In the article, however, Stone reports that the incidence of thyroid cancer in children rose as early as 1 year after the accident. My colleagues and I were the first to draw the attention of the West to the rise in thyroid cancer, after a visit to Minsk in 1992 (*1*), and we continue to work on the incidence, pathology, and molecular biology of the increase.

The first significant rise in thyroid cancer occurred in 1990, 4 years after the accident in 1986; there was a possible rise in 1989, but only natural variation in the previous years. I do not believe that there was a rise 1 year after the accident, because of the time needed for the acquisition of further mutations after the original exposure, and the time needed for growth of the tumor to a detectable size. The combination of these factors with the growth pattern



Thyroid cancer is one health problem that continues to increase 15 years after the accident at Chornobyl; others need to be monitored as well.

of the thyroid gland, diminishing during childhood to reach very slow growth levels in adult life, accounts for the sensitivity of very young children to this cancer (*2*).

Although Stone says that the risk of health problems in the exposed population is a subject of intense scrutiny, the major international effort has been devoted to thyroid problems. It is not surprising that these were dominant in the early stages, because radioiodines (together with tellurium-132, which decays to iodine-132) formed the greatest proportion of the activity released, excluding the biologically inert xenon. However, it is important to have a coordinated international effort to investigate all the possible consequences. It is particularly important to create a balance sheet of the health risks of conventional and nuclear power generation at a time when the United States is reportedly considering new nuclear power stations. The health risks could then be considered along with the other effects, such as the contribution to global warming. But without full information on Chornobyl, we cannot make a fully informed decision.

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2. E. D. Williams, in *Radiation and Thyroid Cancer*, G. A. Thomas *et al.*, Eds. (World Scientific Publishing, Singapore, 1999), pp. 177–188.

Response

REGARDING THE LAG TIME IN OBSERVED thyroid cancer cases, Williams is correct: The sentence at issue should have read "...the number of childhood thyroid cancer cases began rising within a few years after the accident." My remark that health effects in the exposed population have been subject to intense scrutiny is based in part on efforts by researchers in several countries to reconstruct doses and trace Chornobyl-related health effects of the liquidators (clean-up workers). These studies are alluded to but not discussed in detail in my article. Belarusan, Russian,

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