Truth in Super Collider Criticism

"The lessons of the Super Collider" (Editorial, 17 Dec., p. 1799) by David F. Voss and Daniel E. Koshland Jr., is, itself, an important lesson for scientists: The editor of an influential journal has the power to debase a science-policy debate. For more than 8 years, since he characterized the "extravagant" Superconducting Super Collider (SSC) as "the Big Bang of Budget Busting" (*1*), the editor of *Science*, long on hyperbole and short on accuracy, has heaped ridicule and scorn upon the SSC and the scientists who worked to make it a reality.

Continuing this tradition, he and coauthor Voss assert that the proposed Large Hadron Collider (LHC) at CERN (the European Organization for Nuclear Research) will cost only a tenth as much as an SSC. Yet a News & Comment article by Peter Aldhous, "CERN: Alone on the frontier," in the same issue (p. 1808) estimates the LHC cost at $1.8 billion, even without the cost of labor or the two detectors. With these included, the LHC will cost at least $3.5 billion, a third of the cost of the SSC.

The editorial repeats the canard that the "cost kept ballooning from the initial $3 billion to nearly $12 billion." The cost of the SSC, including detectors, was never $3 billion. The Department of Energy's cost estimate (including research and development) in 1988 was $4.4 billion in fiscal year 1988 dollars. When inflated to "then-year dollars," the cost (the same cost!) was estimated at $5.3 billion, if the project were completed in 1996. The doubling of that cost through design changes and mandated stretchouts was a serious concern to supporters and critics alike. What impelled *Science* to add its own spurious factor of 2?

The editors of *Science* estimate, without substantiation, $1 billion as the annual cost of operating the SSC and imply that this "fact" was little discussed. A reliable estimate, based on experience at Fermilab, is roughly one-third of this figure, and a portion would have come from the phasing out of older accelerators. Both the operating cost and its implications for other laboratories were widely discussed.

The SSC was designed to investigate the origin of mass, the unity of forces, and the nature of the most elementary particles. How could a journal named *Science* find these questions so uninteresting as to justify the shabby treatment the SSC has received

in its pages? Indeed there must be "truth in advertising, even for science projects," as Voss and Koshland propose. We would go further: There must be truth in advertising, even *against* science projects.

Robert N. Cahn
Director, Physics Division,
Lawrence Berkeley Laboratory,
Berkeley, CA 94720, USA
J. David Jackson
Department of Physics,
University of California,
Berkeley, CA 94720, USA
Chris Quigg
Theoretical Physics Department,
Fermi National Accelerator Laboratory,
Batavia, IL 60510, USA

References

1. D. E. Koshland Jr., "Addons and catchons," *Science* **229**, 429 (1985).

Response: When the particle physics community set forth its SSC plans in 1984, the Central Design Group advertised a price tag of between $2.7 and $3 billion [B. Schechter, *Phys. Today* **39**, 29 (April 1986)]. This is the figure that the SSC's promoters used to sell the project and build its momentum. As for final cost, there are no grounds for confidence that the SSC's cost escalation would have stopped at even $12 billion. In regard to operating costs, note that the SSC was offered as a qualitatively different endeavor, beyond anything tried before. A simple extrapolation from Fermilab to the SSC is misleading. We stand corrected on the figure for the LHC's cost, which still leaves it a good deal cheaper than the SSC. Far from expressing indifference to the "elementary nature of particles," our editorial supported high energy physics as an international effort, in large part because of the extraordinary cost of its instruments.

—David F. Voss and Daniel E. Koshland Jr.

■

Mathematical Development and Language

A study of ours, featured in Random Samples of 29 October (p. 651), suggested that the faster pronunciation of Chinese number words relative to that of English number words was one factor leading Chinese kindergartners to use more sophisticated counting strategies to solve simple addition problems than their American peers, and therefore provided the Chinese children with an early edge in basic arithmetic (*1*). Mary S. Erbaugh (Letters, 24 Dec., p. 1957) suggests that our conclusion was not justified because numbers take longer to pronounce in Japanese and Russian than in English, yet Japanese and Russian children outperform American children in mathematics. Erbaugh is absolutely correct that children in Japan and Russia substantially outperform American children in mathematics. However, mathematical development is influenced by a confluence of factors, including instruction and cultural attitudes, as well as some linguistic factors (*2*). Articulation rates for number words would only be expected to strongly influence performance on tasks that involved number counting, such as using counting strategies to solve simple arithmetic problems. They would not be expected to strongly influence performance on other types of mathematical tasks. Even for those items where number word pronunciation rates might be important, overall exposure to these items will probably be the best predictor of cross-national achievement differences in the long term. We suspect that the relatively poor mathematical development of American children is most strongly related to the low valuation placed on mathematics by American culture (*3*). Cultural values influence the quality and quantity of children's exposure to mathematics at home and at school. The linguistic influences we focused on appear to be one influential factor, but we do not believe they are the only one, nor did we say so in our study.

David C. Geary
Department of Psychology,
University of Missouri,
Columbia, MO 65211, USA
Robert S. Siegler
Department of Psychology,
Carnegie Mellon University,
Pittsburgh, PA 15213, USA

References

1. D. C. Geary *et al.*, *Cognit. Dev.* **8**, 517 (1993).
2. D. C. Geary, *Children's Mathematical Development: Theory and Application* (American Psychological Association, Washington, DC, in press).
3. H. W. Stevenson and J. W. Stigler, *The Learning Gap* (Summit, New York, 1992).

■

Smallpox Virus Stocks: More Votes

David Baltimore's letter about smallpox virus stocks (7 Jan., p. 13) is an excellent example of the scientist's approach to fundamental ethical and social policies.

For years there has been gentlemanly, and half-muted, debate among scientists concerning whether or not to destroy the last remaining cultures of the smallpox virus. This might seem to be a simple scientific matter, but it is of the highest ethical significance. Suppose that the debate had taken place in 1940, and the United States had destroyed its last virus. What might