SCIENCE

Publisher: Richard S. Nicholson
Editor-in-Chief: Daniel E. Koshland Jr.
Editor: Ellis Rubinstein
Managing Editor: Monica M. Bradford
Deputy Editors: Philip H. Abelson *(Engineering and Applied Sciences);* John I. Brauman *(Physical Sciences);* Thomas R. Cech *(Biological Sciences)*

Editorial Staff

Assistant Managing Editor: Dawn Bennett
Senior Editors: Eleanore Butz, R. Brooks Hanson, Barbara Jasny, Katrina L. Kelner, David Lindley, Linda J. Miller, Phillip D. Szuromi, David F. Voss
Associate Editors: Gilbert J. Chin, Pamela J. Hines, Paula A. Kiberstis, Suki Parks, L. Bryan Ray
Letters: Christine Gilbert, *Editor;* Steven S. Lapham
Book Reviews: Katherine Livingston, *Editor;* Annette Theuring, *Assistant Editor;* Susan Randolph, *Editorial Assistant*
Contributing Editor: Lawrence I. Grossman
Editing: Valerie Jablow, Cara Tate, *Senior Copy Editors;* Douglas B. Casey, Harry Jach, Erik G. Morris, Christine M. Pearce
Copy Desk: Ellen E. Murphy, *Supervisor;* Linda B. Felaco, Joi S. Granger, Beverly Shields, Melissa M. Quackenbos, Kameaka Williams, *Assistant*
Editorial Support: Sherryf Farmer, *Supervisor;* Linda Dienavs, Carolyn Kyle, Michele Listisard, Diane Long, Jennifer Mattson, Patricia M. Moore
Administrative Support: Sylvia Kihara, Charlene King, Jeanette Prastein
Telephone: 202-326-6501; **FAX:** 202-289-7562; **TDD:** 202-408-7770

News Staff

News Editor: Colin Norman
Features Editor: John M. Benditt
Deputy News Editors: Tim Appenzeller, Joshua Fischman, Jean Marx, Jeffrey Mervis
News & Comment/Research News Writers: Ivan Amato, Christopher Anderson, Faye Flam, Troy Gately, *copy,* Constance Holden, Richard A. Kerr, Eliot Marshall, Richard Stone, Karen Fox, *Intern*
U.S. Bureaus: Marcia Barinaga (Berkeley), Jon Cohen (San Diego), Anne Simon Moffat (Chicago), John Travis (Boston)
Contributing Correspondents: Joseph Alper, Barry A. Cipra, Robert Crease, Elizabeth Culotta, Ann Gibbons, Virginia Morell, Robert Pool, Leslie Roberts, Gary Taubes, M. Mitchell Waldrop
Administrative Support: Fannie Groom, Jennifer Hodgin
Telephone: 202-326-6500; **FAX:** 202-371-9227

Art & Production Staff

Production: James Landry, *Director;* Wendy K. Shank, *Manager;* Lizabeth A. Harman, *Assistant Manager;* Laura A. Creveling, Scherraine B. Mack, Linda C. Owens, *Associates*
Art: Amy Decker Henry, *Director;* C. Faber Smith, *Associate Director;* Katharine Sutliff, *Scientific Illustrator;* Holly Bishop, *Graphics Associate;* Elizabeth Carroll, *Graphics Assistant,* Leslie Blizard, *Assistant*

Europe Office

Senior Editor: Richard B. Gallagher
Associate Editor: Jeffrey Williams
News Editor: Daniel Clery
Correspondent: Peter Aldhous
Editorial Associate: Belinda Holden
Business Manager: Julie Eastland
Address: Thomas House, George IV Street, Cambridge, UK CB2 1HH
Telephone: (44) 0223 302067; **FAX:** (44) 0223 302068

EDITORIAL

The Lessons of the Super Collider

Now that the Superconducting Super Collider (SSC) program has been halted, its fate will be either reviled as the end of basic research as we know it or praised as the slaying of the dragon of megascience. The fact remains that after a bruising battle, the U.S. Congress has killed off a huge scientific project that had the blessing of powerful politicians and influential physicists. This hardly tolls the death knell for basic research in the United States and the argument that this one project was a litmus test for support of basic research is unfounded. So what can be learned from this turn of events?

Lesson 1: Particle physicists, like researchers in many fields, do not receive all the money they want, but in the United States, facilities like Fermilab and the Stanford B factory are alive and funded. In Europe there is the Large Hadron Collider, designed to reach toward the upper end of what's possible in boson physics, not as high as the SSC, but at a tenth of the cost. High energy physics has become too expensive to be defined by national boundaries, and the cost of any one project has become too high to justify building competing accelerators on two continents. Rather, all countries should participate in building the next big particle accelerator, wherever it is to be located. The international community should use it to exhaust the possibilities of a particular line of inquiry and then, and only then, should the next machine be constructed. The European Organization for Nuclear Research (CERN) model works, and can work in the future if opened to non-European members who then pay their fair share of the costs.

Lesson 2: Just because particle physics asks questions about the fundamental structure of matter does not give it any greater claim on taxpayer dollars than solid-state physics or molecular biology. Proponents of any project must justify the costs in relation to the scientific and social return. The scientific community needs to debate vigorously the best use of resources, and not just within specialized subdisciplines. There is a limited research budget and, although zero-sum arguments are tricky, researchers need to set their own priorities or others will do it for them.

Lesson 3: A well-administered program is a politically sturdier one. No "little scientist" who gets an $80,000 grant from the National Science Foundation thinks of going back and saying, "I now find it will cost me $800,000 to do the job and you are obligated to give it to me because you gave the original grant." The SSC suffered from embarrassing price inflation, with a cost that kept ballooning from the initial $3 billion to nearly $12 billion. The overruns in the project's cost year after year played a large part in decreasing the SSC's credibility.

Lesson 4: Along with good management, there should be truth in advertising, even for science projects. Part of the problem of the SSC was the difficulty in finding the true cost, which includes not only the price tag of construction, but also the annual expense of keeping the facility running. Much was made about the cost overruns in getting the SSC built, but the long-term commitment estimated at $1 billion per year in operating expenses to keep it going was little discussed. Those who propose future large programs should count on congressional subcommittees and on researchers in other fields reading the fine print.

Lesson 5: If scientists do not take the lead and explain clearly why a program is being funded, others will fill the gap. The typical hide-and-seek game of "it's not the science, it's the jobs" on Monday, Wednesday, and Friday and "it's not about jobs, it is very good science" on Tuesday, Thursday, and Saturday wears thin after awhile. If it's jobs, it should not be called part of the science budget; instead, it should compete with dams and highways. If Congress wants to be the final arbiter of a big science–big jobs issue, it should improve its procedures to have orderly hearings on exactly what the contribution will be to jobs and science and should have representative experts on all sides of the issue.

It has been said that experience is the name everyone gives to his or her mistakes. Experience now tells us that big projects, whether in physics or biology, must have the support of the research community, be managed soundly, and have some clearly articulated value to society. Perhaps those lessons may be some small compensation for the money and effort that went into the SSC and may help in the formulation of a more successful strategy when the next big project is proposed.

David F. Voss and Daniel E. Koshland Jr.

The Lessons of the Super Collider

David F. Voss and Daniel E. Koshland Jr.

Science **262** (5141), 1799.
DOI: 10.1126/science.262.5141.1799