

Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 6 months or issues of general interest. They can be submitted by e-mail (science_letters@aaas.org), the Web (www.letter2science.org), or regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.

The Human Cost of the SSC

THE RECENT ARTICLES ON THE LEGACY OF THE Superconducting Super Collider (SSC) ("Physics tries to leave the tunnel," C. Seife; "Lots of reasons, but few lessons," J. Mervis, C. Seife; "Scientists are long gone, but bitter memories remain," J. Mervis, *News Focus*, 3 Oct., pp. 36–41) did an excellent job of assessing the costs of the SSC's cancellation on high-energy physics, physics in general, and the Waxahachie community, where the SSC was located. However, the articles largely neglected the people who suffered the most: the scientists who worked at the SSC lab.



The SSC project was shut down by the U.S. Congress in 1993.

These people and their families suffered both financially and emotionally. Not only did they have to deal with rather suddenly losing their jobs, they also had to deal with the disappearance of most of the jobs in their field, as universities cut back on their particle physics hiring. Within reasonable (or even unreasonable) commuting distance, there were few jobs even in remotely related fields. Despite the best efforts of SSC management, and help from the Department of Energy and other national laboratories to create a few positions for SSC veterans, job searches were almost invariably difficult. Most of the jobs were hundreds or thousands of miles from Waxahachie; almost everyone had to uproot themselves and their families. Homeowners were forced to sell their houses in a suddenly glutted market, often at considerable financial loss.

The emotional cost was spread beyond the suddenly unemployed. The toll on our friends demoralized many in the field. Others became wary of megaprojects, as the SSC clearly demonstrated their perils. In my view, a significant portion of the post-SSC exodus from accelerator physics noted in the articles is due to just such human factors, rather than any analysis of the relative merits of particle physics and other fields.

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The Lesson of the SSC

THE SCIENTISTS WHO MOURN THE DEATH OF the Superconducting Super Collider (SSC) project but claim there are no lessons to learn (J. Mervis, C. Seife, "Lots of reasons, but few lessons," *News Focus*, 3 Oct., p. 38) are wrong. If big science were paid for by scientists, no more justification would be required for a project than that it would generate knowledge researchers felt was of interest. If big science is to be paid for by taxpayers, it must be justified to them as somehow being a better way to spend the money than the myriad alternatives all pressing for some amount of public funds. If high-energy physics had the obvious importance to the public that health care, medicine, food, agriculture, and environmental toxicity and poisoning have, the SSC would have been built. If having the world's largest accelerator had the public relations value of a space station, it would have been

built. The atomic bomb project, the grandfather of all government-funded physics projects, was justified by World War II—cost was no object. If the SSC could win the war on terrorism, it could be built today. That is the lesson of the SSC—big science will be paid for by the U.S. Congress only if it has big public support.

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Decommissioning Russia's Nuclear Subs

IN HIS ARTICLE "HAUNTED BY RED OCTOBER" (*News Focus*, 12 Sept., p. 1460), Paul Webster indicates that significant hurdles

remain in Russia's attempt to decommission submarines and store nuclear waste. He also highlights achievements in facilities in Severodvinsk, Russia. The United States, Norway, and other nations have provided crucial financial support for Russian programs. Some U.S. officials contend that the Russians have not been forthcoming over how they have used past moneys. Others raise concerns over access and liability issues. However, these criticisms should not lead to the curtailment of successful programs such as those sponsored under the Cooperative Threat Reduction program. Cutting funds will prevent stewardship of nuclear materials and proper waste storage.

There is a problem with the low level of funding that Russia's Minatom contributes to nuclear waste containment, given that it has embarked on an overly ambitious program to build dozens of civilian power stations, including floating reactors, by the year 2020 (1). Shouldn't Minatom focus on old problems before creating new ones?

There are also other important ways to foster openness and accountability in Russia's nuclear industries. One is a combination of private, foundation, and federal funding to support cooperative efforts between Russian and U.S. citizens for openness and accountability. A variety of effective federally funded programs exist, and the U.S. government could easily increase the level of support for them, which would purchase goodwill, openness, and cooperation at a low cost.

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Reference

1. P. Josephson, *Hist. Technol.* **19**, 279 (2003).

Building a Space Weather Aerie in Armenia

ACCORDING TO THE INFORMATION PROVIDED in Richard Stone's article "A space weather aerie in the Caucasus?" (*News Focus*, 29 Aug., p. 1175), there seems to be no reason why the Cosmic Ray Division (CRD) of the Yerevan Physics Institute should not be supported in its efforts to develop a worldwide solar storm alert service. Quality research in Armenia is cost-effective, and the reputation of Armenian scientists is extremely high. Moreover, the cosmic ray monitoring stations on Armenia's Mount

Aragats are ideally situated for such research and for providing valuable data to international partners.

The recent electrical blackout in the northeastern United States and parts of Canada illustrated the vulnerability of our power distribution networks. Similar power outages can be triggered by solar storms. The article mentions, as an example, the failure of Quebec's power grid in March 1989. The cost of funding CRD's space weather research is small in comparison to the potential savings that will result from the ability to forecast dangerous solar events. One must also consider the consequences of losing key intelligence and communications satellites due to the effects of solar storms. Thus, an effective solar alert service would not only be of economic value, it would also enhance our security.

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Europe's Fight for the Tree of Life

THE U.S. NATIONAL SCIENCE FOUNDATION has now awarded about \$43 million to its Assembling the Tree-of-Life program (AToL) since last year (1). When the NSF initiated this program, it was recognized that to be effective in addressing the scale of the problem, any "Tree-of-Life" initiative would have to be a large international venture and that ultimately, success would depend on scientific expertise and resources from many nations, according to Diana Lipscomb, former program director of AToL at NSF. In response to the U.S. initiative, a succession of European AToL meetings were held (in Patras, Paris, London, and Brussels), and a consortium of group leaders within 80 institutes from 20 countries, including virtually all phylogeneticists in Europe, sent an expression of interest (2) to the sixth EU framework (FP6) for Research and Technological Development proposing a European Tree-of-Life project.

On 23 October, the FP6 held a meeting in Brussels to prepare its next call for projects due in spring 2004. The European Tree-of-Life initiative was discussed, but several European systematists found it difficult to convince their national delegates of the relevance of AToL to the FP6 thematic areas of life sciences, information technologies, and ecosystems. Although *Science* recently reported that a new generation of systematists seeks to transform their field using the tactics of big science (Special Issue on the

“[W]hy is it that Europe faces a struggle in setting up its own tree-of-life program?”

—SAVOLAINEN AND CHASE

Tree of Life: A. M. Sugden, B. R. Jasny, E. Culotta, E. Pennisi, "Charting the evolutionary history of life, 13 June, p. 1691; E. Pennisi, "Modernizing the tree of life," 13 June, p. 1692), why is it that Europe faces a struggle in setting up its own tree-of-life program? Perhaps the best explanation is that AToL is still seen to be about taxonomy, a domain that urgently needs rebranding if it wants to attract funds for big programs such as the Genome Project (3). Only when the linkage of the tree of life to conservation (4), genomics (5), and DNA-based identification for medicine and ecology (6) is made obvious will the project be put in its proper perspective. Taxonomic study is fundamental to all areas of science, but as demonstrated by the projects funded by the NSF program, it is only a starting point. A great deal more needs to be done to move modern evolutionary science to the heart of society's efforts to understand the living world and make its utilization sustainable and effective. The opportunity offered by the European Commission is fundamental, and it is now up

to European systematists and their countries to make sure that they will be able to compete with the U.S. initiatives in the spirit of making AToL a truly international effort.

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References

1. See www.nsf.gov/bio/progdes/bioatol.htm.
2. See http://eoi.cordis.lu/dsp_details.cfm?ID=31692.
3. H. C. J. Godfray, *Nature* **417**, 15 (2002).
4. G. M. Mace, J. L. Gittleman, A. Purvis, *Science* **300**, 1707 (2003).
5. J. A. Eisen, C. M. Fraser, *Science* **300**, 1706 (2003).
6. D. Tautz, P. Arctander, A. Minelli, R. H. Thomas, A. P. Vogler, *Trends Ecol. Evol.* **18**, 70 (2003).

Life Scientists and the Dual Use Dilemma

THE U.S. NATIONAL ACADEMY OF SCIENCES has recently published a report, "Biotechnology Research in an Age of Terrorism: Confronting the 'Dual Use' Dilemma" (1), in which the first recommendation is to educate the scientific community about the dual use dilemma in biotechnology: the potential risks to humanity that can develop from research done with beneficent intent. In this area, molecular biologists and other life sciences researchers could learn from the experiences of the medical community.

TECHNICAL COMMENT ABSTRACTS

COMMENT ON "Tumor Response to Radiotherapy Regulated by Endothelial Cell Apoptosis" (I)

Herman D. Suit, Henning Willers

García-Barrios *et al.* (Reports, 16 May 2003, p. 1155) stated that "microvascular damage regulates tumor cell response to radiation at the clinically relevant dose range." A spectrum of studies are inconsistent with this proposal. Radiation has been demonstrated to kill cells *in vitro* and *in vivo* with equal efficiency. The role of endothelial cells in tumor radiation response remains undefined.

Full text at www.sciencemag.org/cgi/content/full/302/5652/1894c

COMMENT ON "Tumor Response to Radiotherapy Regulated by Endothelial Cell Apoptosis" (II)

Martin Brown, Robert Bristow, Peter Glazer, Richard Hill, William McBride, Gillies McKenna, Ruth Muschel

Important issues need to be resolved before the conclusion of García-Barrios *et al.* that the radiation response of tumors is determined by their endothelial cells can be accepted as general. In particular, the much slower tumor growth rates and very low TCD₅₀ values in the control (*asmase*^{+/+}) mice are of concern.

Full text at www.sciencemag.org/cgi/content/full/302/5652/1894d

RESPONSE TO COMMENTS ON "Tumor Response to Radiotherapy Regulated by Endothelial Cell Apoptosis"

Richard Kolesnick, Zvi Fuks

Data from diverse fields now support the vasculature as a determinant target for normal and tumor tissue damage. It is debatable whether the *in vivo* and *in vitro* radiation responses equate, because the *in vivo* tumor response measured by the TCD₅₀ is commonly subject to experimental manipulations such as clamp hypoxia and total body irradiation. New genetic and pharmacological approaches are required to address these issues.

Full text at www.sciencemag.org/cgi/content/full/302/5652/1894e

LETTERS

Medical research involving human subjects has had a lengthy history involving studies done with beneficent and not-so-beneficent impact on its subjects. As a result of this history, the U.S. government has set up a system of oversight to protect individual subjects. Although not perfect, this system has provided education to the medical community on this issue. For example, since October 2000, the National Institutes of Health require all researchers submitting grants or proposals to complete an online educational course in the protection of human subjects in research (2). This course covers areas such as the history, legal standards, and bioethics of human subjects research. Certificates are provided to those who complete the course.

An analogous online course should be developed and required for scientists seeking funding to do basic science research. The course would include topics such as the history of the Biological Weapons Convention; the Asilomar Conference in 1975; bioethics, legal, and regulatory issues; and the challenges of the dual use nature of life sciences research. Students would be required to take an appropriate-level course before beginning laboratory work. On a global scale, other nations' research funding institutions should require comparable courses for their scientists seeking grants.

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References

1. National Academy of Sciences, "Biotechnology research in an age of terrorism: Confronting the 'dual use' dilemma" (National Academies Press, Washington, DC, 2003).
2. National Institutes of Health, Human Participant Protections Education for Research Teams, <http://cme.cancer.gov/c01/>.

CORRECTIONS AND CLARIFICATIONS

Special Issue on Brain Disease: Review: "Looking backward to move forward: Early detection of neurodegenerative disorders" by S. T. DeKosky and K. Marek (31 Oct., p. 830). Uppsala University should have been listed in the credit for Fig. 3. The corrected credit should read "Figure courtesy of the University of Pittsburgh and Uppsala University."

Brevia: "Healthy animals with extreme longevity" by N. Arantes-Oliveira *et al.* (24 Oct., p. 611). In the 2nd paragraph of the first column, in line 11, "dal-2" should read "daf-2."

Reports: "*n*-Type conducting CdSe nanocrystal solids" by D. Yu *et al.* (23 May, p. 1277). In the first column on p. 1279, in line 30, the reference cited should be (14), not (13). The sentence should thus read "Previous work on ZnO nanocrystal films (14) showed only a monotonous increase of the conductance with charging."