Editorial & Letters

EDITORIAL

Better Approaches to Science Policy

Who should sit at the table when science policy is being decided? Across the higher echelons of U.S. government, the long-standing norm is to invite scientific leaders, but no one else who will be affected or who might have an illuminating alternative perspective.

For example, to help frame a year-long effort to develop a post–Cold War U.S. science policy, the House Science Committee on 23 October convened an elite group: the presidents of the National Academies of Science and Engineering, representatives from the Council on Competitiveness, leaders of the Sandia and Lawrence Berkeley National Laboratories, the president of MIT, and so on. Notably absent were any representatives from the many grassroots, worker, and public-interest organizations concerned with science policy. There were no social scholars of science, no proponents of alternative science policies (from within the science community or without), and only a solitary science policy critic.

This event's restricted roster was hardly anomalous. For example, in 1992 and 1993—when Democrats controlled Congress—the House Science Committee organized 30 hearings on a comprehensive National Competitiveness Act. Among 120 invited witnesses, there was not one from an environmental, defense conversion, or labor organization commenting on a major piece of legislation with ecological, employment, and other social implications. In the Executive Branch, the composition of high-level science advisory panels—such as the President's Committee of Advisors on Science and Technology and the National Science Board—is similarly constricted.

The problem with exclusively elite, insider approaches to science policy-making is that they fly in the face of inescapable realities: (i) All citizens support science through their tax dollars and experience the profound consequences of science, both good and bad. (ii) In a democracy, those who experience the consequences of an activity and those who pay for it ordinarily expect a voice in decisions. (iii) Scientific leaders have no monopoly on expertise, nor do they have a privileged ethical standpoint for evaluating the social consequences of science and of science policies. (iv) Nonscientists already do contribute to science and science policy (for example, women's organizations have redirected medical research agendas to reduce gender biases). (v) Elite-only approaches are antithetical to the open, vigorous, and creative public debate on which democracy, policy-making, and science all thrive. (vi) There is a danger that public support for science will erode if other perspectives are excluded. (vii) With the Cold War concluded, it is time for science policy to welcome new voices and fresh ideas for addressing the social needs of the 21st century.

There are proven methods that use broadened representation to inform and improve decisions. The Swedish government's Council for Planning and Coordination of Research includes a majority of nonscientists and is noted for promoting innovative interdisciplinary research programs. Japan, Germany, and other European nations have pioneered processes fostering collaboration between industrial engineers, university scientists, workers, and end-users in developing new technologies. Dutch universities advance social responsiveness via a decentralized national network of "science shops" that address questions posed directly by community and worker groups, public-interest organizations, and local governments. For a decade, the Danish government has appointed panels of everyday citizens to cross-examine a range of experts and stakeholders, to deliberate, and then to announce nonbinding science policy recommendations at a national press conference. A 1989 Danish citizens' panel on the Human Genome Project seconded expert support for basic genetics research, but called for more research on the interplay between environmental factors and genetic inheritance and on the social consequences of science, while influencing the Parliament to prohibit the use of genetic screening information in employment and insurance decisions. This carefully structured, participatory process is already being emulated in other countries, including the United Kingdom, Japan, the Netherlands, and Switzerland, and has undergone an independent pilot-scale demonstration in the United States.

Experiences such as these can light the way toward U.S. science policies that are more socially responsive and responsible, more widely supported, and more consonant with the tradition of openness that is the true lifeblood of science and a healthy democracy.

Richard E. Sclove

The author is executive director of the Loka Institute, Amherst, MA, USA, and author of "Democracy and Technology." E-mail: Loka@amherst.edu. Web: www.amhearst.edu/~loka

LETTERS

Evidence suggests

Was the fall of the Akkadian Empire "culturally or climatically driven"? (Left, grain storage vessels hint at ancient plenitude.) "A strong effort to study" the Higgs boson is called for. A 56-bit encryption algorithm bites the dust. And amateur scientists who funded their own work and were "their own 'guinea pigs'" are described.

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Akkadian Empire: Where to Look?

With regard to the Research News article "Sea-floor dust shows drought felled Akkadian empire" by Richard A. Kerr (16 Jan., p. 325), the sediment core described by Heidi Cullen and Peter deMenocal provides compelling data for the idea of atmospheric drying and an increasingly dust-laden atmosphere for the period 2200 to 1900 B.C. For the Gulf of Oman, this amplifies the data presented by Sirocko (*1*), which demonstrates increased arrival of dust in sea floor sediments during periods of decreased strength of the southwest monsoon. However, to explain this dust, rather than look at northern Syria, where trends in atmospheric moisture change may have been opposite to those of the monsoonal area (*2*), we should first look at Arabia, where a well-attested moist period terminated around 5000 years ago, or after. The Yemen highlands and the Arabian desert both show significant drying toward the end of the mid-Holocene and could have contributed increased atmospheric dust to the atmosphere. In the later third millennium B.C., abandonment of settlements and terraced fields (*3*) may have been related to atmospheric drying resulting from increased southerly penetration of summer northwesterly winds during a period of decreased ocean upwelling and reduced monsoonal strength.

In the north, although there was a dramatic decline in settlement in the Rhabur basin in Syria, climatically marginal towns like Tell Brak continued to be occupied in the post-Akkadian period, albeit perhaps with reduced populations. Further west in the Lake Tabqa area, where probably 250 to 300 millimeters of rainfall supported primarily rain-fed agriculture, we see in the final quarter of the third millennium B.C. an increase in settlement numbers and the growth of a town at Tell Sweyhat. In moister areas near Kurban Hoyuk in southern Turkey, growth in rural sedentary settlements was at the expense of towns. As Frank Hole states ("Wheat domestication," Letters, 16 Jan., p. 303), something was going on at this time, but whether it was culturally or climatically driven, or a combination of both, is unclear (*4*). A case for increased atmospheric moisture in the mid-Holocene can be made from lake sediments and alluvial sediments (*5*). The former record suggests that there was dwindling but fluctuating moisture toward the end of the third millennium B.C., followed by greater drying in the later second millennium B.C., when settlement in northern Mesopotamia did indeed decline, but did not disappear. Although I, too, accept a role for climate, especially in these fragile, highly stressed semiarid agricultural systems, archaeological evidence suggests that not only was settlement decline in one part of this zone counteracted by increases in other areas, but also that there were adjustments within both pastoral and sedentary communities that could absorb some of the stress of climatic shocks.

Tony Wilkinson
Oriental Institute,
University of Chicago,
Chicago, IL 60637, USA
E-mail: t-wilkinson@uchicago.edu

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Gentlemen of Science

In a Special News Report, Jon Cohen describes "Scientists who fund themselves" (9 Jan., p. 178). I would like to add the names of my mentor J. B. S. Haldane (1892–1964) and his father J. S. Haldane (1860–1936). The younger Haldane, in particular, exemplified the amateurish tradition by making significant contributions to genetics, physiology, biochemistry, and biometry, while possessing no academic qualification in any branch of science (*1*). Both Haldanes funded their own research as well as that of their students from their own pockets whenever they could.

Much of our research did not require expensive facilities, but we needed support for salaries, travel, and other expenses to attend scientific meetings, which was partially provided by Haldane. He even edited his own journal, the *Journal of Genetics*, which bypassed the usual peer-review system, but Haldane privately arranged for us to obtain the comments of distinguished colleagues before he accepted a paper for publication. His father, Oxford physiologist J. S. Haldane, built his own laboratory on the ground floor of his sprawling house in Oxford ("Cherwell"), complete with an airtight chamber with a sealable door and observation window. Both father and son conducted physiological experiments, in which they were their own "guinea pigs," that were often painful and involved the testing of the effects of various gaseous mixtures, atmospheric pressures, and temperatures.

Krishna R. Dronamraju
Foundation for Genetic Research,
Post Office Box 27701–0,
Houston, TX 77227, USA

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Muon Collider Studies

The article "Physicists dream of a muon shot" by Alexander Hellemans (News, 9 Jan., p. 169) gives a useful account of the 4th International Conference on Muon Colliders (San Francisco, December 1997), which I, with the assistance of others on the program committee, organized.

The concept of a Higgs factory muon collider (*1*) arose (and the name was coined, as I recall) at our first conference in 1992 in Napa, California, but it had little scientific support at that time.

At the 1997 conference, however, there were reports about four independent studies of the parameters of the electroweak theory that suggest the existence of a low-mass Higgs scalar particle (below 200 gigavolts). This is precisely the mass range in which a Higgs factory is designed to operate and that is expected by supersymmetry.

A similar situation happened with the Z particle. Before the Z particle was discovered in 1983 at the European Organization for Nuclear Research (CERN), the mass was known well enough to start the design of the Large Electron-Positron Accelerator (LEP, a Z factory) machine at CERN and the Stanford Linear Collider (SLC). History may