AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

ISSN 0036-8075
5 JANUARY 1990
VOLUME 247
NUMBER 4938

■ **SCIENCE is published weekly on Friday, except the last week in December, and with an extra issue in March by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005.** Second-class postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Domestic individual membership and subscription (51 issues): $75. Domestic institutional subscription (51 issues): $120. Foreign postage extra: Canada $46, other (surface mail) $46, air mail via Amsterdam $85. First class, airmail, school-year, and student rates on request. **Single copy sales:** Current issue, $3.50; back issues, $5.00; Biotechnology issue, $6.00 (for postage and handling, add per copy $0.50 U.S., $1.00 all foreign); Guide to Biotechnology Products and Instruments, $18 (for postage and handling add per copy $1.00 U.S., $1.50 Canada, $2.00 other foreign). Bulk rates on request. **Authorization to photocopy** material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of $1 per copy plus $0.10 per page is paid directly to CCC, 27 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 $1 + .10. **Change of address:** allow 6 weeks, giving old and new addresses and 11-digit account number. **Postmaster:** Send Form 3579 to *Science*, P.O. Box 1722, Riverton, NJ 08077. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

COVER Mapping the muscle glycogen phosphorylase gene on human chromosome 11 by chromosomal in situ suppression (CISS) hybridization. Fluorescent signals from the dinitrophenol-labeled cosmid probe are visualized as yellow dots on the propidium iodide (red) counterstained chromosome spread. See p. 64. [Photograph by Peter Lichter and David C. Ward]

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To See Ourselves As Others See Us

The words of Robert Burns, "O wad some Pow'r the giftie gie us to see oursels as others see us!" are as applicable to scientists as they are to all other individuals. As we make our New Year's resolutions, this may be an important admonition to remember while we strive to preserve the health and vitality of scientific institutions. As science has become more visible and more powerful, it has also attracted more armchair critics and more adversaries. The visibility delights, but the criticism bewilders. We see ourselves as out to do good and to increase the standard of living, yet we are accused of torturing animals, polluting the environment, embarking on megaprojects of little interest to the populace, and tampering with the genetics of natural species. While most of these types of charges can be answered, and some of them are demonstrably false, most scientists would agree that others may have some substance. When the public has been asked to vote, it has supported science on most issues. But there appears to be growing skepticism toward science and a willingness by the public to believe illogical alternatives.

It is vital that scientists sensitize themselves to public concerns and address them in a compassionate and candid way. It is probably hopeless to convert the extremists—the no-animals-in-research, no-pesticides, no-genetic-engineering, and no-progress crowds—although careful answers to each of their positions should be developed. It is more important to understand why a portion of the general public is sympathetic to the argument that science can produce more harm than good.

The most unsettling feature of science is probably the rapidity at which it changes cultural values. When science was curing a few diseases and producing a few labor-saving gadgets it was viewed with unmitigated awe and respect. Now, the speed of scientific advances threatens to alter values faster than the social system can accommodate to such change. Sydney Brenner's statement that a modern computer hovers between the obsolescent and the nonexistent illustrates the speed of advances in modern science. If practitioners of science then talk in a language that is not easily understood or retreat into their laboratories, the problem is exacerbated. Birth control pills, automobiles, and increased longevity are all admirable, yet they have brought major changes in the sexual mores, family mobility, and lifestyle of all of us.

The practice of science is opportunistic. We solve the problem that is before our eyes and are not required to predict the widespread ramifications that result if the solution is more popular than we expect. No one can assess at the inception of an invention all of its social implications. We could not predict that an understanding of radio waves would change the way we communicate, that understanding control of bacterial growth would lead to a population explosion, or that a simple equation, $E = mc^2$, would change the nature of warfare. But as architects of change, we have occasionally oversold the product, implying that it will bring unmixed good, not acknowledging that a scientific advance is a Pandora's box with detriments or abuses as well as benefits. By confessing that we are not omniscient we may lose some awe and admiration, but we will gain in understanding and rapport.

Ultimately society controls the rules of scientific application mainly by its control of funding. We of course have the option to work for organizations of which we approve and the citizen's right of political advocacy. Scientists are the servants of society, not its masters, and we should remain so. But because we are close to the events of change, it is our special responsibility to spell out the disadvantages as well as the advantages of a new discovery as far as we can. What is good for science is not necessarily good for the country, and we should be particularly cautious in endorsing megaprojects (or microprojects) that compete for dollars in a significant way with other needs of society.

It is the nature of scientists to advocate change more than most people do. The increasing complexity of science, furthermore, requires language that is unfamiliar outside the scientific community. This tempts some to accuse us of being a secret cabal that embarks on projects society would reject if it had a chance to do so. The antidote is to explain the serendipitous nature of science, to display our own limitations with candor, to express our intensions and reservations in clear, nonspecialized terms, and to empathize and communicate with those whose lives will be changed by discoveries now being made in mysterious laboratories and published in esoteric journals.—DANIEL E. KOSHLAND, JR.