

Technology review

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

APRIL 1995

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**ARCHITECT I.M. PEI:
A FEELING FOR
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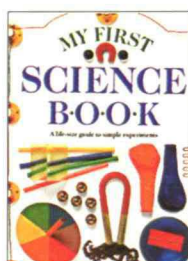
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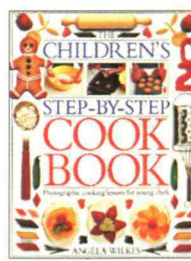


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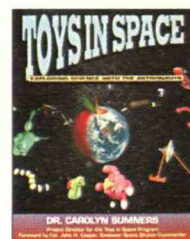


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by Dr. Carolyn Sumners

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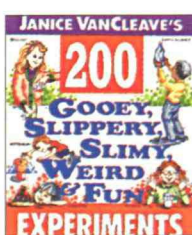


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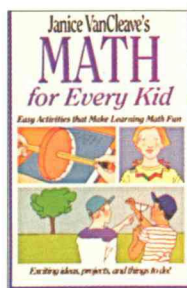


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by Janice VanCleave

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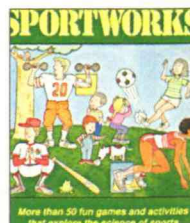


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by the Ontario Science Centre
Illustrated by Pat Cupples

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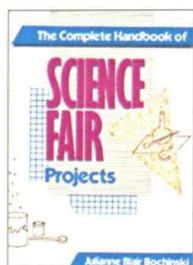


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The Complete Handbook of Science Fair Projects

by Julianne Blair Bochinski

The only book you'll need for selecting, preparing, and presenting award-winning science fair projects. Written by a veteran contestant and judge, this step-by-step guide describes 50 projects in detail and suggests 500 other topics suitable for grades 7 and up.

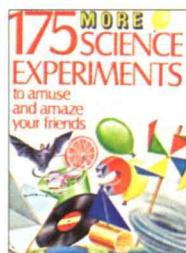


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175 More Science Experiments

by Terry Cash, Steve Parker, & Barbara Taylor

A sequel to the popular *175 Science Experiments*, this book brings further enjoyment to curious kids. Within four main sections—Sound, Electricity, Simple Chemistry, and Weather—it provides a lively menu of experiments, tricks, and things to make.

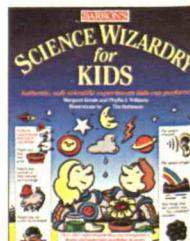


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Science Wizardry for Kids

by Margaret Kenda & Phyllis S. Williams

More than 200 authentic, safe experiments that use everyday, inexpensive materials. Kids will get to know the thrill of discovery by looking at their immediate world: making toy boats, brewing sun tea, growing violets, collecting rocks. Includes step-by-step instructions and glossary.



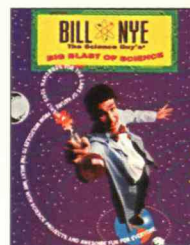
Ages 9–12, Spiral-bound, 316 pages, \$13.95

Bill Nye The Science Guy's Big Blast of Science

by Bill Nye

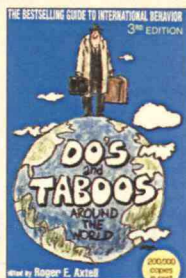
A highly cool handbook for the laws of nature from molecules to the Milky Way. With science projects and awesome fun for everyone. Bill Nye the Science Guy knows how cool science can be! After all, everything in the universe involves science. You already think scientifically every day, even if you don't know it!

Ages 10–14, Paperback, 171 pages, \$12.95



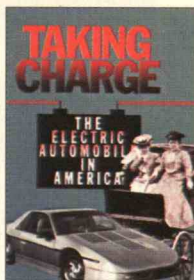
Do's and Taboos Around the World

This fascinating guide helps thousands of high-powered executives and tourists avoid the missteps and misunderstandings that plague the world traveler. It includes facts and tips on protocol, customs, etiquette, hand gestures, body language, idioms, and gift-giving.



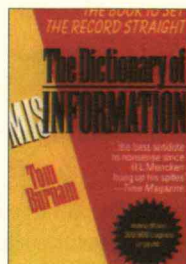
Taking Charge: The Electric Automobile in America

Discover the history and future promise of the electric car in America. This book revisits the race between electric and gas-powered cars in all its aspects, including the little known collaboration of Henry Ford and Thomas Edison. Schiffer suggests that for Americans it may be time for the fabled victory of the tortoise over the hare. *Hardcover, 224 pages, \$24.00*



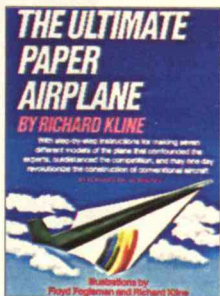
The Dictionary of Misinformation

A remarkable book that contains enough information to help you win bets the rest of your life: London's Big Ben is neither a clock nor a tower, scores of people had flown non-stop across the Atlantic before Lindbergh, and no witches were burned at Salem.



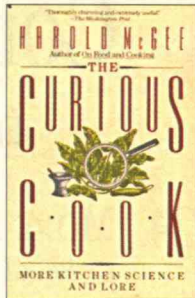
The Ultimate Paper Airplane

More than just a toy, the Kline-Fogleman airfoil earned its inventors two patents and was tested by NASA. Here is the story of its creation, along with the secrets behind its unmatched performance. Plus, instructions and patterns for making seven different models.

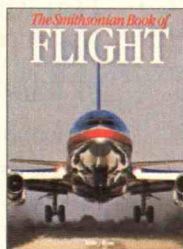


The Curious Cook

How can you keep the green in guacamole and pesto sauce? What's the best way to make fruit ices? Packed with fascinating scientific lore, *The Curious Cook* answers these questions and more to help the home cook make use of scientific discoveries about food.

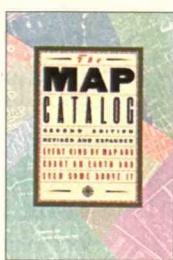


The former director of the Air & Space Museum has composed this beautifully illustrated history of flight. It chronicles the rapid evolution of aviation technology, and focuses on the meaning of flight for the human spirit. A beautifully illustrated single-volume history. *Hardcover, 288 pages, \$35.00*

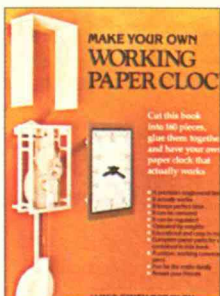


The Map Catalog

This ever-popular guide to all kinds of maps in the U.S. is now revised and expanded to offer new sections on geography education, map software, more travel and transit maps, and more illustration. It shows that the world is still seen from many perspectives, for the maps described pinpoint everything from bicycle routes to farms, politics to treasure.



A remarkable book that can be transformed into a working clock. Cut it into 160 pieces, add a few odds and ends and glue them together. You'll have a piece that keeps perfect time. A fun and challenging project for you and your friends!



Order Form

How to Order

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Contents

FEATURES



24

24 MORE MOON PROBE FOR YOUR MONEY

BY BRUCE D. BERKOWITZ

Clementine, a spacecraft that recently gathered a wealth of new information from the moon, was planned, built, and launched in less than half the time required for most space probes and at one-fourth the cost. This non-NASA mission suggests how the U.S. space agency might rethink its methods.



32

32 HACKERS TAKING A BYTE OUT OF COMPUTER CRIME

BY WADE ROUSH

The former bad boys and girls of the nation's electronic corridors are beginning to apply their prodigious computer skills in the service of society. By working with the security professionals and other authority figures they used to take pleasure in outsmarting, hackers are helping to foil the truly malicious interlopers.



42

42 SUFFER THE LITTLE CHILDREN

BY STEPHEN D. SOLOMON

As the neonatal nursery grows in sophistication, it keeps ever-more-premature infants alive. But this costly and intrusive care is sometimes administered with little regard for the children's chances of survival or future quality of life.

52 THE MYTH OF THE SPECIALIZED MILITARY CONTRACTOR

BY MARYELLEN R. KELLEY AND TODD A. WATKINS

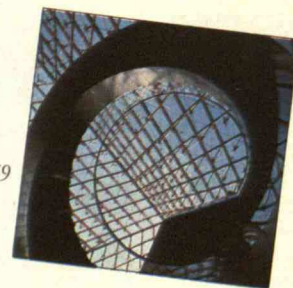
Far from viewing defense contracts as a commercial kiss of death, most firms in the vast military production network not only use the same people and plants for civilian manufacturing but gain surprising competitive advantages.



52

59 A FEELING FOR TECHNOLOGY AND ART

In an interview, architect I. M. Pei talks about his respect for the aesthetic demands of specific sites, his passion for the technological details, and how he combines them in prominent projects such as the recent renovation of the Louvre.



59

COVER: JON MCINTOSH

DEPARTMENTS



10



14



75

5 FIRST LINE

6 LETTERS

10 MIT REPORTER

The Inside Story on Spines and Bone; Spinning a Better Web

14 TRENDS

Preserving Movies; Smoother Shifting; High-Tech Help for the Nearsighted; High-Tech Help for the Blind; Deciphering the Dead Sea Scrolls

70 FORUM

LAWRENCE J. SUSSKIND

Companies would be wise to try a little tenderness when dealing with environmental controversies. By engaging in consensus-building mediation with government agencies and public-interest groups, firms can resolve conflicts before they degenerate into court battles that drag on for decades.

73 THE HUMANE ENGINEER

SAMUEL C. FLORMAN

Despite the appetite of the new Congress for less and less government, regulation is vital to a technological civilization. Rather than deregulate, we must reregulate, preserving useful rules and redesigning those that are defective.

74 THE ECONOMIC PERSPECTIVE

BENNETT HARRISON

As trade barriers fall, countries are pursuing a variety of strategies to avert a global "race to the bottom"—the likely result when multinational firms transfer operations to regions on the basis of low wages and weak labor standards alone.

75 REVIEWS

Jonathan B. Tucker on the threat of emerging viruses.

Robert J. Crawford on conservative economics and its critics.

80 PHENOMENA

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Alumni/ae Travel Program

1995

Sailing the Lesser Antilles, March 4-11. Sail from Martinique to Guadeloupe, Antigua, St. Kitts and Nevis and then to Dominica, on board the three-masted sailing ship, the *Lili Marleen*.

Swiss Winter Escapade, March 16-23. A one week independent stay in Switzerland. Skiing and tour packages available. Great Value!

Beijing to Hanoi by Train, March 26-April 13. Board the *China Orient Express* for a journey from Beijing to Chengdu, Guilin, and on to Hanoi, ending in Hong Kong. Stays in local hotels en route.

Passage to India, March 28-April 19. A repeat of last year's sold out program on the *Song of Flower*. Visit Singapore, Malaysia, Bombay, Jaipur and Delhi.

Italy, May 11-23. Start your voyage in the Italian Lakes region for two nights, then explore the countryside and visit the cities, traveling by motorcoach to Verona, Venice, Ravenna, Siena, Florence, Assisi and Rome.

Educational Seminar in France, May 13-21. Join us for an eight day seminar in the Alsace region of France. Morning educational programs and afternoon excursions offered. All inclusive price.

Journey of the Czars, July 5-19. Two night stay in Moscow followed by a cruise on the Volga River toward Lake Onega, the Svir River and Lake Ladoga. A three night stay in St. Petersburg concludes your voyage.

The Changing Tides of History, July 12-25. Cruise from Helsinki to Estonia, Latvia and Lithuania, then down to Poland and Germany. Optional overnight excursions to Vilnius, Lithuania and Berlin offered.

Alaska, July 16-23. Expedition cruise through Alaska's coastal wilderness on board the *M.V. Sea Lion*.

Voyage to the Lands of Gods and Heros, July 20-31. Sail from Athens to Rhodes, Crete, Santorini and Istanbul. This program offers great family rates and activities for adults and children alike.

Scotland/England/Wales, July 31-August 10. Start in Inverness, travel southward to Edinburgh and the beautiful Lake District in England, ending with two nights in Wales. An optional five night extension to Ireland is available.

Alaska, July 31-August 12. Part land tour/part cruise, this program is a great way to see Alaska and its coastline. Aboard the five star *Crown Princess*.

Victoria Passage, August 11-21. Explore the inland coasts of British Columbia from Victoria through the Strait of Georgia to Quadra.

Alumni Campus Abroad in England, August 29-September 6. Harrogate, England will be your home for this week long program that will offer daily seminars on British culture and history, as well as full and half day excursions.

Cruise the Mediterranean, September 9-22. Explore the spectacular cost of Spain, France, Italy, the Greek Islands and Turkey on board the *Pacific Princess*. Unpack only once and cruise in comfort. Optional extension in Barcelona.

Classic China, September 14-26. Travel by air from Hong Kong to Shanghai, Beijing and Xi'an.

Swiss Alumni College, September 19-27. A one week continuing education program in Switzerland.

Around the World, September 30-October 23. Touch down and visit Hawaii, New Zealand, Australia, China, India, Kenya, and England via the *Concorde*.

Not all brochures available at the time of this printing. The above tours and dates are subject to change.

For further information and brochures, please call 617-253-8265 or 800-992-6749.

MIT Alumni/ae Travel Program, 77 Massachusetts Avenue, Rm. 10-110, Cambridge, MA 02139.

First Line

So Credible, It's Incredible

IN his prime, boxer Muhammad Ali used to delight in boasting, "I am the greatest." Some people thought this was arrogant, certainly immodest. But since when is a public figure modest? And besides, there was some truth to his claim: the only fighter ever to achieve the world heavyweight championship three times, he was proud to observe he could "float like a butterfly, sting like a bee."

In a comparable spirit of achievement and pride, let me share some news about another "public figure," one that similarly aims to be both graceful and pointed—the very magazine you are now holding in your hands. In terms of credibility, *Technology Review* is also "the greatest"—we can legitimately claim to be the most credible media outlet in the United States—and in terms of objectivity and influence, it is almost the greatest.

I'm referring to the recently announced results of "Opinion Leaders 1994," a biennial "national study of contemporary issue involvement and media influence" conducted by Erdos & Morgan/MPG, a prominent New York-based opinion-research firm that describes itself as "the leading supplier to the publishing community for reader surveys."

The company sampled a universe of some 320,000 accomplished people from business, government, and academia who were asked to evaluate 64 of the country's leading magazines and newspapers and 31 television news programs. If they read or watched a publication or program at least occasionally, they essentially voted on whether it embodied each of five "qualitative measurements": *influential* on economic, social, cultural, or political issues; *objective* reporting; *current* on topical issues; *credible* source of information; and *enjoyable*.

It would have been a sufficient honor just to belong to this august group. Imagine: of all the thousands of media outlets in the United States, *Technology Review* was included—right up there

with the *New Yorker*, the *Washington Post*, and *NBC Nightly News*—in an elite listing of 95 (only two-thirds of which were print). But we also stood out in that company. *TR* ranked in the top 10 in two of the five categories.

As you may have already guessed, *Technology Review* was number one among the "most credible," ahead of the others in the top 10—*Scientific American*, the *Economist*, *National Geographic*, the *New England Journal of Medicine*, *Science*, the *MacNeil/Lehrer*

*It's good
to be a contender,
even better to win.*

News Hour, the *National Review*, *Smithsonian*, and *Harvard Business Review*—and all the rest.

Number six is also good among an elite 95, and that is where *Technology Review* ranked in "most objective," behind the *National Journal*, the *MacNeil/Lehrer News Hour*, the *New England Journal of Medicine*, *Science*, and *Scientific American*, but ahead of *Harvard Business Review*, the *Journal of the American Medical Association*, *Roll Call*, *National Geographic*, and 85 others.

People often have a winner-take-all mentality: if you're not number one, or not in the top 10, say, then you're off the screen. Thus at first we celebrated *TR*'s distinction in the "credible" and "objective" categories while studiously ignoring the other three. But it pays to look at the data: sometimes there are useful results to discover—or, as a newspaper-reporter friend commented in this case, to "spin doctor"—among the also-rans.

It turns out that we fared quite respectably in the other three categories as well. *Technology Review* was number 13—just slightly removed from the top 10—in "most influential," ranking only a smidgen behind *Science* and well ahead of, for example, *Scientific American*, *Business Week*, and the *New Republic*.

TR was 45 in "most enjoyable," cer-

tainly far from the top 10. But although science and technology policy are not usually associated with "enjoyment," we were still in the top half. And to this ex-roadrunner, often older and heavier than others in the race, to finish in the top half seems like a real accomplishment. In any case, look who finished behind us: the *New York Times*, *Fortune*, and the nightly half-hour news shows of the three major TV networks, plus 45 others.

Our seemingly poorest showing was among the "most current," where we ranked 66th—not even in the top half. But the majority of the entrants—virtually all the 31 TV programs, for example—were dailies or weeklies, which by definition are more current than a monthly. The real question is: How current was *Technology Review* compared with other monthly magazines? There we showed very well, nearly tied with *Scientific American* and ahead of the *Atlantic*, *Audubon*, *Harper's*, and *Smithsonian*, for example.

In his typically terse and understated way, our associate publisher, Peter Gelatly, summed up *Technology Review*'s performance in the Opinion Leaders 1994 survey like this: "We are far more influential than our size would lead anyone to believe."

And in the manner of a film director receiving an Oscar, I would like to acknowledge the MIT Alumni/ae Association for having the guts and imagination, and willingness to marshal its resources, to sponsor such an effective outreach. We at *TR* like to think that we partially fulfill MIT's mission to educate not only students and graduates but also the whole world on "technology and its implications" and thereby help make the world a little better. To both readers and patrons, we promise to try to consolidate our gains and go beyond them. In future surveys, for example, I hope to tell you we're top 10 across the board, or to at least provide even more impressive spin doctoring. After all, if you can't believe the editor of the country's most credible publication, who *can* you believe? ■

—STEVEN J. MARCUS

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Letters

SCIENCE AND THE PEOPLE

In "Updating the Social Contract for Science" (*TR November/December 1994*), David H. Guston and Kenneth Keniston ably summarize government-science relations over the past half-century. However, as a basis for negotiating a new contract, their analysis of science is oversimplified. The authors characterize university science as a closed and delicate social enterprise funded principally by government and necessary to technological progress and socioeconomic well-being. On this basis, they conclude that government and an informed public have a right to participate in setting broad scientific research priorities but dare not intrude more deeply into the actual conduct of science.

While some may point to Stalinist and Nazi distortions of science as examples of what can result from societal interference, it's important to remember that those experiences did not result from political or social involvement per se but from the interventions of totalitarian states. Under different circumstances, one can find numerous examples of lay public involvement that have been constructive. Laypeople sit on medical ethics review boards, and research collaborations between grassroots groups and university scientists are responsible for a growing number of epidemiological insights. Pharmaceutical companies display enormous interest in indigenous peoples' botanical acumen, while cutting-edge agricultural biotechnology relies extensively on the selective breeding achievements of Third World farmers.

In Sweden, laypeople are in the majority on the government's well-regarded Council for Planning and Coordination of Research; and Japan, Germany, and other European nations have pioneered processes for involving both workers and users in developing new technologies and consumer products. The Danish government appoints panels of everyday citizens to cross-examine a range of experts, deliberate among themselves, and then publish their own social assessments of

scientific consequences and of alternative science and technology policies. This process is now being emulated in other countries, including the United Kingdom.

Meanwhile, Dutch universities have created a network of 50 public "science shops" that screen questions from community groups and refer challenging problems to university volunteers, both students and faculty. This system has helped environmentalists analyze industrial pollutants, employees evaluate the health and employment consequences of new production processes, and social workers better understand the life circumstances of disaffected teenagers. Thus while also forging U.S.-style collaborations with government and industry, the Dutch university system has found a way to more directly serve society as well.

Guston and Keniston emphasize science's traditional dedication to truth; others might counter that a more democratic science harbors the potential to advance the pace and breadth of understanding, technical invention, and socially responsive economic innovation. Surely any new and fruitful social contract for science will have to draw on a more nuanced account of science-society relations than that advanced by the authors.

RICHARD E. SCLOVE
Executive Director
The Loka Institute
Amherst, Mass.

OUR PLANET, OURSELVES

As Eric Chivian suggests in "The Ultimate Preventative Medicine" (*TR November/December 1994*), human population growth, environmental degradation, and emergence of infectious diseases are inextricably linked. Chronic problems such as drought, depletion of soil, and disappearance of fish from streams, lakes, and oceans draw humans to explore new territories or, more frequently, to join masses of others barely surviving in huge slums at the fringes of large urban centers. These areas tend to spawn infectious diseases, especially among newcomers who lack immunity

and adequate nutrition. Family movement between urban slums and rural areas transfers disease in both directions.

The size of displaced and migrating populations on the earth today is unmatched in human history. Although socioeconomic and political factors play potent roles, degradation of food and water supplies is the driving force behind many of the conflicts leading to such displacement. We tend to look outside ourselves for explanations, although we carry goods and continue to transport animals all over the world, use substances (antibiotics, chemicals, pesticides) that alter the microbial flora, and reduce biodiversity and alter ecosystems.

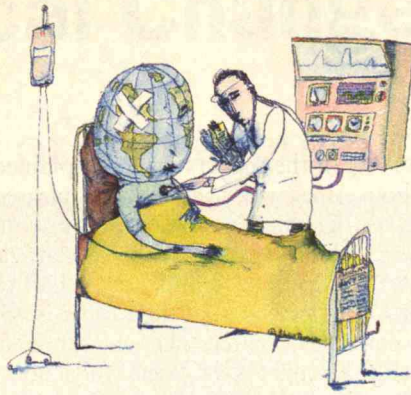
We must do a better job of educating individuals and institutions about the direct and indirect effects of environmental change on our health. The public responds to dramatic stories about streptococcal infections, malaria outbreaks, and cholera epidemics but we want a quick fix—a drug, a vaccine, a simple solution that will not interfere with lifestyles or consumption patterns. Any framework developed to guide both understanding and interventions must be global in scope.

MARY E. WILSON, M.D.

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Dr. Eric Chivian's excellent article sounds a much-needed wake-up call not only to physicians but also to the general public as well. However, the ramifications of global environmental degradation on human health are, unfortunately, even more serious and complicated than he reveals.

In November 1991, the Union of Concerned Scientists released "Global Warning to Humanity," signed by more than 1,670 scientists, including 104 Nobel laureates. This document asserts that "great change in our stewardship of the earth and the life on it is required if vast misery is to be avoided and our global home on this planet is not to be irretrievably mutilated."



A panel established by the United Nations Environment Programme prompted this warning in part with its finding that "accelerating ozone depletion will have serious impact on most of the planet's life forms. For every 10 percent depletion of the ozone layer, we can expect a 20 percent increase in ultraviolet radiation arriving at the ground in life-damaging wavelengths. This radiation could change genetic structure, alter immune systems, damage crops, disrupt the marine food web, and enhance greenhouse warming."

Could this phenomenon explain the growing number of failing human immune systems, the soaring rate of cancer and infectious diseases, the diminishing effectiveness of vaccinations, expanding crop and forest damage, and escalating species extinctions? By eliminating the natural protections provided by our planet and our bodies, we are damaging ourselves and our environment.

Research is unmasking "environmental hormones"—chemicals and pollutants that disrupt biological processes, often by mimicking the effects of naturally produced hormones such as the feminine hormone estrogen. Scientists are observing the effects of reproductive changes in numerous species as these hormones render them sterile and, ultimately, extinct. This may explain why some human males in the industrialized nations are experiencing reproductive problems as well.

Although we are altering our planetary health from its original balance, we have yet to address the undeniable connection between our physical health and our planet's well-being. To continue to ignore this connection is to jeopardize the future.

KAREN HENDERSON
Washington, Va.

I agree with Eric Chivian's view that environmental issues are health issues. I especially agree with his statement that "no discussion about the environment is complete without mentioning the central role of population growth in promoting environmental degradation." As Peter Berle of the National Audubon Society says: "World population growth and unsustainable production and consumption are the environmental challenges of our time."

I think overpopulation not only affects our environment and health; it is also the fundamental factor underlying our troubled economy, high crime rates, and difficulties achieving world peace. We must all take an active role in addressing population, both here at home and abroad. It can't be resolved instantly, but its impact will only worsen the longer the problem is pushed aside.

AVI ORNSTEIN
New Britain, Conn.

JUST REWARDS

I was greatly dismayed by the specious arguments and lack of rigorous analysis in "Distributing Our Technological Inheritance" (*TR* October 1994) by Gar Alperovitz. Socialist thinkers have long labored under the naive assumption that any single apportionment of wealth that exceeds the average is by definition obtained unjustly at the expense of society as a whole.

The reason that Bill Gates of Microsoft is worth so much money is that a finished product is worth infinitely more than the sum of its parts. Boolean algebra is not a computer operating system, steel is not an automobile, and the alphabet is not *Hamlet*.

Alperovitz favors a society in which a large amount of generated wealth is spread equally among those who added absolutely nothing to its creation. Such a system is not only unjust but also doomed to failure. Only in a free-market society is there sufficient enough incentive for an entrepreneur with drive, intelligence, and imagination to use our shared technological and cultural history to create new products and services. The

entrepreneur gets much richer than the average wage earner but also bequeaths far more to the human heritage.

ROBERT LEDER
Brewster, N.Y.

You're undoubtedly familiar with those horrible letters to the editor that scream, "You published such and such. I am so angry I want to cancel my subscription immediately!" Well, I had that feeling when I read editor Steven Marcus's First Line (*TR January 1995*) on the overwhelmingly negative reaction of your readers to Gar Alperovitz's piece. My response was not provoked by the editorial or the original article, but by the realization that so many seemingly benighted people subscribe to the magazine.

Alperovitz gave a modest scholarly perspective on the accumulation of knowledge and asked reasonable and humane questions about the distribution of wealth on a planet where few exult and many starve. Yet he is excoriated as some kind of maniac.

Does the editor really feel the need to adjust the content of the magazine so as not to "get too far ahead" of such reaction? And even more disturbing is his statement that "we do not aim to convert you to any particular cause." What about the survival of the planet—how's that for a worthy direction?

Who are the readers for whom stimulation is irritation and surprises unpleasant? I would have thought your audience consisted of citizens concerned with the implications of the technology explosion. Instead, they seem to believe that the trenchant analysis of the consequences of capitalism and the necessity for organizing against injustice are passé or irrelevant.

Ministers are sometimes instructed to comfort the afflicted and afflict the comfortable. Groucho Marx and John Lennon, both cited by Mr. Marcus, did just that. Why can't *Technology Review*?

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As one of the readers who complained about Alperovitz's article, I was pleased to see the editor's response to our concerns. However, he described the article as a "think piece" and not "a call to action." If the goal of the former is not eventually the latter, then why ruminate at all? Thought is the essence of action.

MILES ARNONE
Woburn, Mass.

Considering the wealth Bill Gates has created for society, I disagree with Alperovitz's call to redistribute his personal income. Although Alperovitz is right to encourage generosity for humanity's benefit, I strongly feel the choice should belong to Gates and not the government.

GERARD MOSSERI MARLIO
Marion, Mass.

HONORING THE AGREEMENT

In "Kill the Whales?" (*TR November/December 1994*), Langdon Winner argues that Norwegians should give up eating whale meat so that one country's preference does not fatally undermine the whaling moratorium and become an excuse for other nations to similarly jeopardize cooperation on other environmental issues.

But, he fails to note that there are two environmentally sustainable policies on whaling. A preservationist policy would prohibit the slaughter of whales for any human purpose, whether food, lamp oil, or scientific research. The conservationist policy advocates the prudent exploitation of whales in a way that ensures the continued existence of the species. The arguments between preservationists and conservationists on whaling, as on other environmental issues, involve different visions of an ecologically viable future.

Many Norwegians (and Japanese) regard a complete moratorium on whaling as a repudiation of the original conservationist rationales advanced through the International Whaling Commission—especially as the scientific case for believing that all whale populations are threatened with extinction has eroded. While it is good to constantly try to improve environmental policies, efforts to recast basic

points of an agreement where consensus does not exist could increase the likelihood that governments will opt out and even become more cautious about making agreements in the first place.

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DATA'S DATE WITH DESTINY

I was delighted to read Terry Cook's "It's 10 O'Clock: Do You Know Where Your Data Are?" (*TR January 1995*). Cook does an outstanding job of explaining that the long-term access to electronic records presents questions that transcend media and even hardware longevity. At the center of the issue is the concept of a record as

incorporating information content, structure, and context to serve as evidence. By that definition, archivists realize that the majority of today's information systems are not record-keeping



systems. The University of Pittsburgh project Cook mentions provides specifications that, if incorporated into information systems, will ensure the creation of reliable and authentic evidence.

My own organization, the National Historical Publications and Records Commission (NHPRC), is proud to support the University of Pittsburgh project. As a funding agency that is part of the National Archives and Records Administration, the NHPRC sustains a variety of work in archives across the country and has considerable interest in supporting projects that tackle electronic records issues. We invite your inquiries and can be reached at NHPRC, Room 607, National Archives Building, Washington, D.C. 20408, (202) 501-5610.

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