Alternatives in Occupational Health • Kicking the Military Habit

SCIENCE FOR THE PEOPLE

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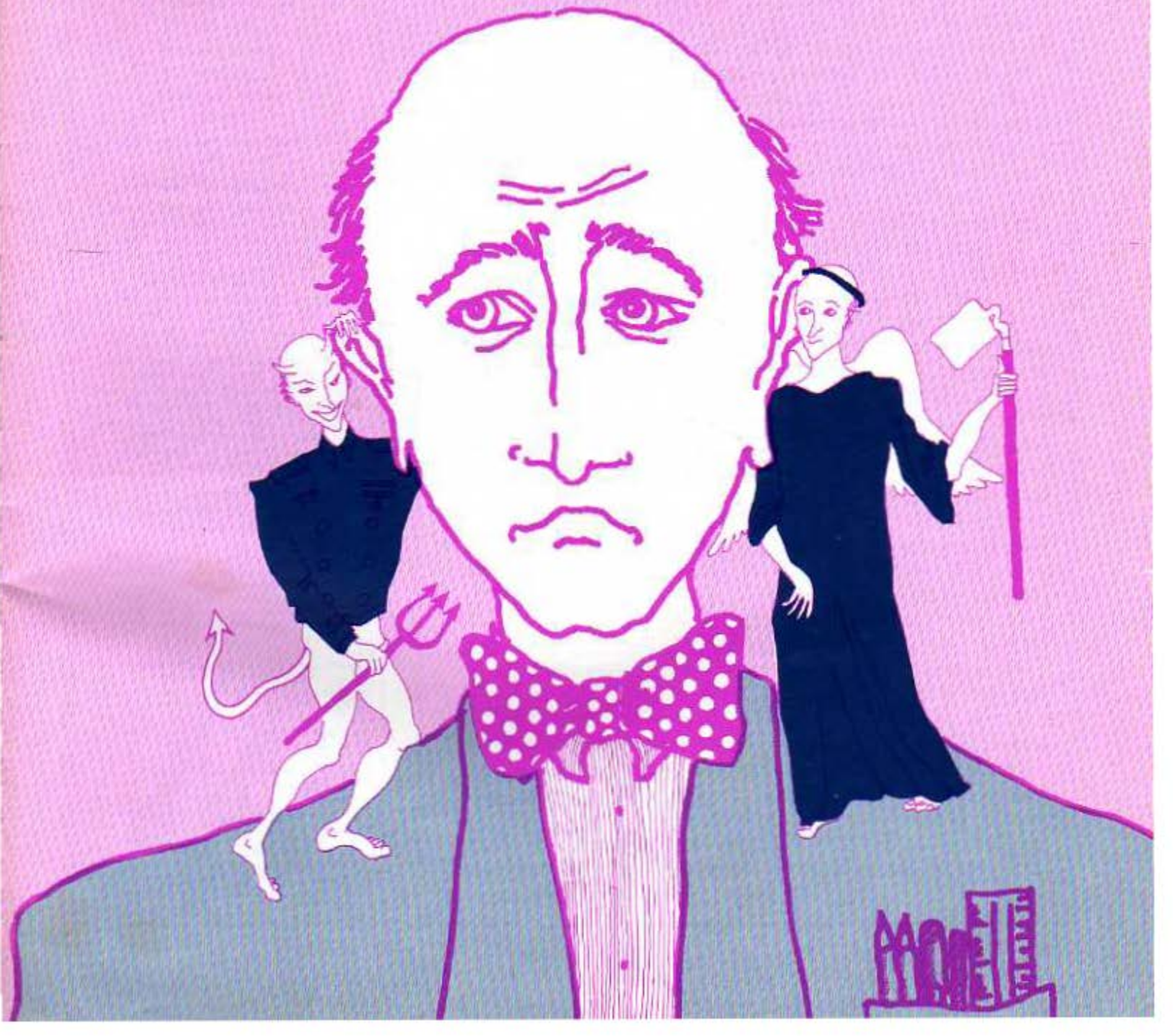
CAREER OPTIONS

Applying Science to Social Needs



Preview

When Jon Beckwith—SftP's outreach coordinator and pillar member of the Sociobiology Study Group—returned from a sabbatical in Berkeley last summer, he brought back stories of being continually approached by students who were demoralized by career choices.

So many of the jobs in fields like physics, chemistry, and high tech are tied to military funds. And much of biology and other research science is sustained by pharmaceuticals, biotech corporations, and industry-supported grants to academia. How can young scientists ensure that their work is applied to human needs rather than big business or the military?

Jon submitted a proposal to our editorial committee for publishing a special issue on alternatives in science, with a focus on job prospects. We wanted to provide our readers with some examples of alternative work in science, in and out of the mainstream, so we began soliciting articles for a special issue.

It was harder than we thought. Many of the alternatives of the seventies—self-help and community health centers, alternative energy and technology, democratically managed labs, progressive research in universities and industry, public interest science groups—haven't survived or have lost much of their financial support. We had trouble finding scientists to share their experiences and suggestions for career options with us.

But there have been some enduring and more recent successes. With this issue of Science for the People, we've tried to examine the career dilemmas faced by individual scientists, as well as present some alternatives and resources. If the response to this issue is good, we'll add a new "alternatives" column to the magazine. Readers are invited to send in examples of career, research, and workplace alternatives.

There's something else that's special about this issue of Science for the People. Stapled into the center spread is a reader survey card for you to tell us what you think about SftP and then mail it back to us postage paid. Our members and readers shape the contents and direction of the magazine, so we need your feedback. We also want to reach new readers, so in appreciation for answering the survey, we'll send a six-month gift subscription to someone you think would be interested in SftP.

You don't have to confine yourself to the multiple-choice questions. Tell us what articles you'd like to see in the magazine. Can you suggest authors to contact, or researchers who could enlighten us about a topic you'd like us to cover?

Should we concentrate more on science policy and political analysis? Should we devote more of the magazine to examples of positive uses of science and technology? Should we be more of a journal—oriented to students, academics, and professionals—or more of a general-audience magazine? Do you have any ideas on how we can address both audiences more effectively? We'll print comments and survey results in an upcoming issue. So keep in touch.

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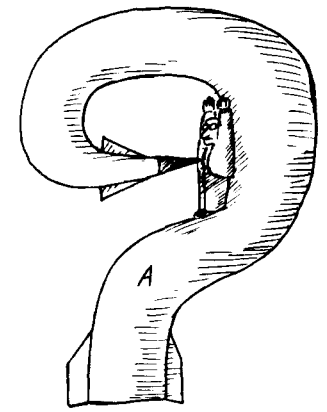
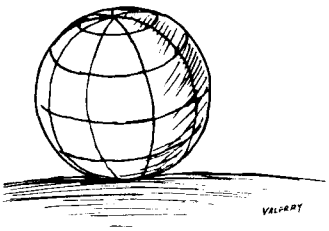
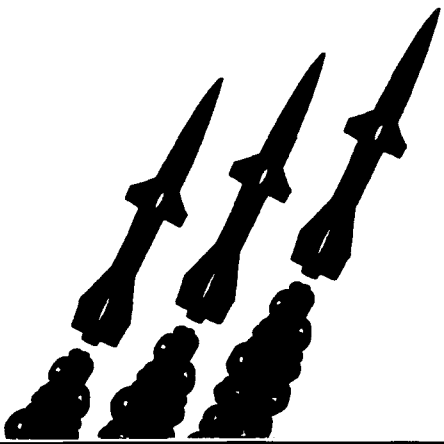






DEPARTMENTS

Newsnotes

NO MORE TEARS

Good news for research rabbits! New tests to measure the harshness of chemical exposures are being sought by several researchers. Right now the standard test involves placing chemicals into rabbits' eyes to determine the reaction. "A battery of such tests will be available within three years," according to Jerald Silverman of Ohio State University, who is working with a common protozoan as a replacement for rabbit eyes.

—information from the Chicago Tribune

HEALTH CARE HAZARD

A recent study has found that people exposed to ethylene oxide, a chemical used to sterilize lab equipment, are ten times more likely to develop leukemia and stomach cancer than the average population. The Swedish study by Dr. Christer Hogstedt and colleagues concluded that ethylene oxide can cause malignancies even at low-level and intermittent exposure. An earlier Finnish study also showed exposure to ethylene oxide was associated with reproductive abnormalities, such as higher than normal rates of spontaneous abortion. Hogstedt estimated that 75,000 health care workers in the U.S. have been exposed to the chemical.

—information from the Chicago Tribune

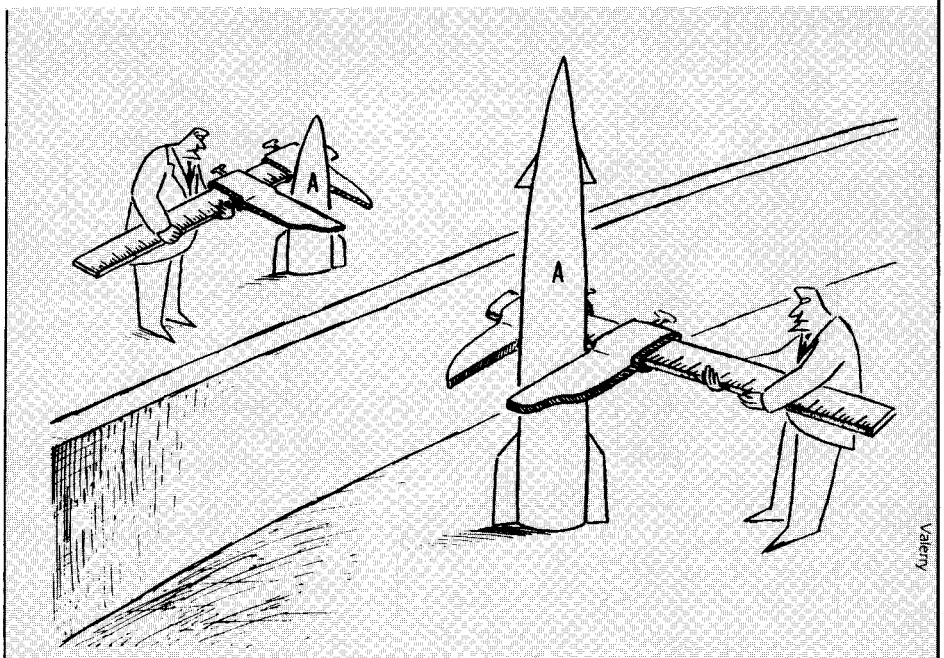
SMOKERS BEWARE

Probably by now you've noticed the new disclaimer on all cigarette packs and ads: "SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, and May Complicate Pregnancy." But did you know that one effect of the warning is to protect cigarette companies?

A federal appeals court ruled in April that the new warning label (as well as the old one that says simply that cigarette smoking may be hazardous to your health) effectively gives tobacco companies immunity from lawsuits for smoking-related diseases.

The tobacco companies have never admitted that smoking is hazardous to health. Currently they spend $1.5 billion a year to sell their products.

—information from the Chicago Tribune



SOVIET AND AMERICAN SCIENTISTS MONITOR WEAPONS TESTING

The National Resource Defense Council (NRDC), in cooperation with the Academy of Sciences in the USSR, won a significant victory for arms control in July. An unprecedented agreement, initiated by Thomas Cochran of the NRDC, recently allowed American scientists into a previously off-limits area of the USSR to set up seismic monitors to check Soviet nuclear weapons testing.

In the past, seismic tests were not reliable for nuclear testing verification because nuclear explosions could be masked by earthquakes. Last year Norwegian scientists noticed that by using a high frequency seismometer, nuclear test explosions could be easily distinguished from earthquakes.

The NRDC, realizing that much of the debate about a Comprehensive Test Ban Treaty hinged on the verifiability issue, sought to eliminate that argument. The Soviets can easily monitor American adherence to such a treaty by reading American scientific journals. But U.S. scientists have never before had the opportunity to monitor Soviet tests—Americans do not have access to Soviet journals.

In mid-July, a team of Soviet and American scientists set up three seismic listening posts in the vicinity of the Soviet testing site of Semipalatinsk. The first was installed on July 11 in Karkaralinsk, Kazakhstan, about 100 miles southwest of Semipalatinsk. Although the U.S. has used seismic techniques to monitor Soviet tests in the past, this new chance to gauge the readings of seismic instruments so close to the testing site will insure almost perfectly accurate results.

The USSR ended a one-year unilateral nuclear testing moratorium on August 6, the anniversary of the bombing of Hiroshima. On August 19, the USSR announced plans to resume the moratorium. NRDC scientists don't know how long they will be able to continue their work if the moratorium ends. However, as Cochran points out, "Even if we are asked to turn the instruments off, we will always know if they are testing. If they ask us to turn the instruments off, they are telling us they are testing, so they are not hiding anything."

To completely verify a comprehensive test ban, a total of 25 similar seismic sites would have to be created. The first three are intended as a model. The project will cost the NRDC $1.35 million to run for one year, with the Soviets contributing a similar amount. The NRDC is funded by private donations.

The U.S. has conducted 803 nuclear weapons tests to date and the Soviet Union 604. The cost of each test ranges anywhere from $6 million to $20 million. Nuclear weapons tests in this country are funded by taxpayers. *—Sarah Wilson*

Newsnotes

URBAN ALTERNATIVE HEALTH CARE

Activist health care often seems an impossibility in the age of Reagan cutbacks. But at least one organization, the Institute for Social Therapy and Research (ISTR), is growing.

Since its modest beginning in 1978, when the original ISTR staff took a table, chair, and blood pressure cuff to the corner of 125th St. and Adam Clayton Powell Boulevard in Harlem, the ISTR has opened three centers—in Harlem, the Bronx, and Boston—and has plans to expand to Chicago, Mississippi, Washington, Los Angeles, Philadelphia, and Denver. They currently serve over 600 patients. The Harlem Center, the oldest, has 25 hours of office sessions per week, provides exercise programs, nutritional counseling, and comprehensive health care.

The ISTR is a worker-owned and women-led organization with its roots in the progressive psychology movement of the 1960s. It practices "social therapy" as a therapy of empowerment which addresses the particular emotional issues that arise from living in a time of crisis. This approach acknowledges the extreme degree of crisis that is a continual part of people's lives in the inner city. It rejects the old solution of a "pill for every disease." Instead, it sees problems as embedded in society and requiring social solutions.

The health centers do not limit their responses to reassurances or dispensing pills; they also encourage patients to work on issues of racism, cynicism, and elitism, and ask them to help change the conditions which are causing the problems. The ISTR has formed grassroots organizations called Healthy Clubs which educate people about health rights and lobby to maintain and improve existing health care services.

The ISTR works to build community bases of support for its centers, both with individuals and with other institutions like churches, agencies, community centers, and the independent leftist New Alliance Party. The institute aims for a partnership with its patients, who often work for the centers as volunteers. It avoids government funding, and instead relies on committed low-paid and volunteer staff whose rewards come from practicing without the strictures of traditional health care.

Centers share resources; centers in more middle-class neighborhoods subsidize those in poor areas. Grants and contributions are only used to expand the institute's programs, not for operating expenses.

The ISTR sees itself as working to engage and reorganize the relationship between medicine and politics in the inner city. It hopes to inspire people to build more of these new health care institutions, not just as individuals, but as a community working together.

—information from Dr. Susan Massad, Medical Director

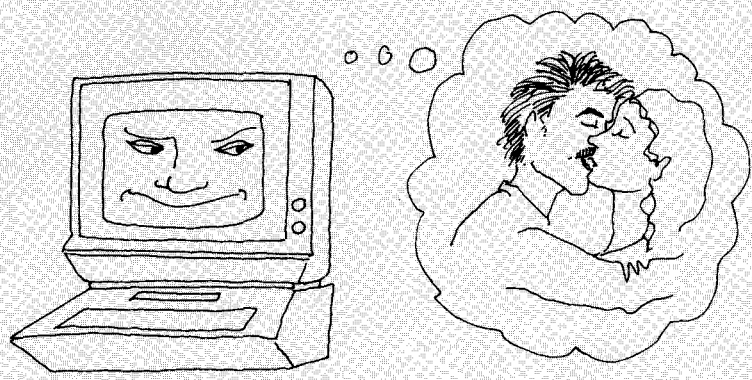
NO WAY OUT

Disaster planners for nuclear emergencies have it hard these days. To begin with, county officials across the country have refused to participate in evacuation plans for nuclear war and accidents at nuclear plants, feeling, with good reason, that such plans serve to endorse nuclear deterrence and allow questionable nuclear plants to operate. Even worse, those mock evacuations that have been carried out have been plagued with problems.

When the emergency plan for the Seabrook plant was tested last February, a typo in a press release gave the phone number of the Portsmouth BankEast Savings and Loan Department as the place to call for help. In an evacuation drill for Vermont Yankee, one emergency center was so understaffed that nobody was listening to the radio when the general emergency was announced. In a Pilgrim plant drill in Plymouth, Massachusetts, the person responsible for checking cars for radiation at an evacuation site didn't show up because his training class had been canceled. And at the Salem, New Jersey plant, special phone lines to notify Delaware officials of an accident were out of service eight out of eleven times they were tested.

Some disaster experts, faced with increasing opposition and evacuation plan failures, are taking the view that the problem lies with trying to arrange comprehensive evacuation plans at all. Rather than specifying what every individual and organization should do in an emergency, Russell Dynes, codirector of the University of Delaware's Disaster Research Center, says planners should build on the natural rhythms of life. "Just tell people to get out of the area and head north."

—information from the Wall Street Journal



Mittie Cuetara

THIS IS ARTIFICIAL INTELLIGENCE?

With all the concern generated over the past few years about computers replacing skilled workers, there's finally a job truly worthy of the silicon serfs:

Michael Lebowitz, a professor at Columbia University, having "studied" the television show "Days of Our Lives" for several years, now claims to have created a computer program that writes story lines for soap operas. Although Lebowitz says his program is not yet ready for the networks, it has already generated plot outlines based on a cast of characters and character traits that were input by scientists in his lab.

While many of his colleagues are busily at work on artificial intelligence for the military—projects like pilotless planes and self-guided missiles—Lebowitz and his coworkers have clearly set out to put the computer to productive social ends. Just think: with computer-generated soaps, no longer will humans have to toil over the hackneyed love and jealousy story lines. We only have one question: is this supposed to qualify as artificial intelligence?

—Seth Shulman

Network

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STOCK SALES UP, REGULATIONS DOWN IN BIOTECH INDUSTRY

This has been a healthy year for U.S. biotechnology companies. After a few years of general skepticism among investors, who saw scant promise for new product development in the biotechnology industry, investor interest has recently perked up. Through the end of July, public stock offerings in 1986 have grossed more than $679 million for biotech firms, more than 100 times the money invested in biotech stocks during all of 1985.

Why has the glamour returned to biotechnology as we move into the latter half of the eighties? Part of it may have to do with low interest rates, which encourage investment in the stock market. Just as significant, however, are signs that biotechnology companies are finally coming out with highly marketable products —primarily pharmaceuticals.

One of these signs of progress was the federal approval of Genentech's recombinant-DNA-produced human growth hormone. Additionally, promising results have been reported by National Institutes of Health researchers working on two possible biotech products—interleukin 2 (a possible cancer therapy) and tissue plasminogen activator (for treatment of heart attacks). Two drug industry giants, Eli Lilly and Bristol-Myers, recently acquired biotechnology companies and are working on biotech products.

Publicity from these and similar developments has convinced investors that biotechnology is both very legitimate and very marketable. This impression was not too widely held in the years following the initial explosion of biotech start-ups around 1980.

A few of the companies that were most successful in selling stock include Cetus, Amgen, California Biotechnology, and Chiron, all located in California, and Genetics Institute, based in Cambridge, Massachusetts. These companies have added tens of millions of dollars in stock sales to their accounts since the turn of the year. Most of the firms offering new shares of stock are producers of pharmaceuticals, and these types of products are the ones best known to investors.

Less attention is being paid to the

agricultural biotech companies, possibly because investors aren't as accustomed to applications of biotechnology in this area. Additionally, agricultural products garner less publicity, since they are not utilized in medicine and take longer to be developed and to get to market. Whether or not they get to market is the concern of the federal government—and of activist Jeremy Rifkin, a longtime opponent of genetic engineering who has filed suit against the government's recently released biotechnology regulatory policy.

The biological guidelines of the proposed new policy, which was published in the Federal Register on June 26, are being challenged by Rifkin in his suit. An example of one of the new guidelines being proposed: a nonpathogenic organism into which a regulatory DNA sequence from a pathogenic organism has been introduced will still be considered nonpathogenic.

Rifkin's lawsuit, filed on July 15, is also critical of the procedures by which the policy was developed. The government agencies involved in releasing the policy failed, according to Rifkin, to compile a record of the policy's development as required by the Administrative Procedures Act and to issue an environmental impact statement. This particular legal approach has been successful for Rifkin in some suits involving product approvals and field tests; in fact, he hopes to halt federal approval of field tests of genetically engineered organisms via the present suit.

Actually, very few applications for field tests are now on file with the regulatory agencies involved, although one test was recently approved by the U.S. Department of Agriculture: Ciba-Geigy was cleared on June 30 to field-test a tobacco plant made resistant to the herbicide atrazine, a major Ciba product. Atrazine is used extensively to control weeds in corn crops.

The first open-air test of a genetically altered microorganism without going through the Environmental Protection Agency permit process was approved in June. The EPA said that Ecogen Inc. of Langhorne, Pennsylvania may conduct the tests of *Bacillus thuringiensis*, an insecticide, without a permit because the strain is similar to a naturally occurring bacterium and because the new strain was produced by being exposed to heat rather than by using recombinant DNA technology.

In an apparent attempt to consolidate the hodgepodge of governmental agencies that share the regulatory responsibility for the biotechnology industry, a Biotechnology Science Coordinating Council has been established. Agencies included in the council are the Environmental Protection Agency, the U.S. Department of Agriculture, the Food and Drug Administration, the National Science Foundation, and the Office of Science and Technology Policy.

The council's first meeting, held on July 9, was spent in discussion of the proposed regulatory policy which is the target of Rifkin's lawsuit. The council announced a 30-day extension of the public comment period for the new biotech guidelines; the period will now end on September 26. Also announced were the formation of several subcommittees to examine various issues including greenhouse containment, risk assessment, scientist training, development of an agenda with the European community, and public information and education.

It will be interesting to see how the federal government goes about educating the public on genetic engineering and biotechnology. Given the current administration's pro-business/deregulation attitude toward regulatory agencies, the public may end up looking elsewhere for accurate and fairly presented information. Moreover, the biotechnology industry, in all likelihood, need not worry about its progress being checked by the new biotechnology council or by the new regulations environmental concerns and public health priorities notwithstanding.

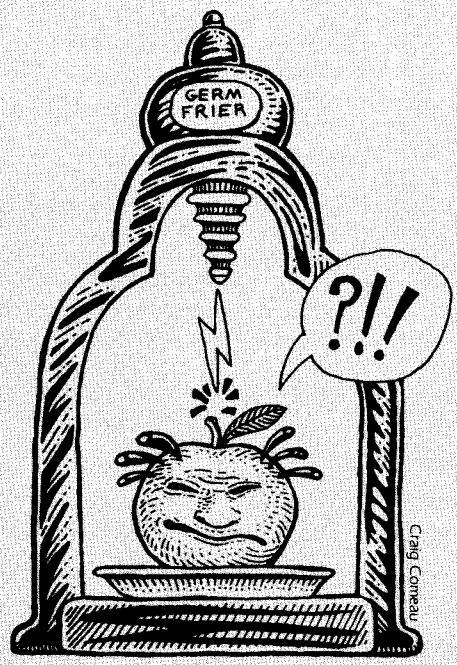
—Roger Felix
information from Science

FOOD IRRADIATION FALTERS

In our March/April issue, *Science for the People* pointed out the numerous potential hazards of commercial food irradiation. It now seems that while the Food and Drug Administration might turn a blind eye when confronted with reports of insufficient evidence, the Nuclear Regulatory Commission is not willing to plug its ears against screaming violations of safety standards.

On June 23, 1986, the NRC ordered Radiation Technologies, Inc. (RTI) to close its first plant in what was to be "one of the largest growth industries," according to RTI's president Martin A. Welt, "in the history of the nation." RTI was the driving force in the successful movement to secure FDA approval of selective food irradiation. Unfortunately, Welt was overzealous to the point of "willfully providing false information to the NRC staff."

RTI has been further beleaguered by the constraints of a Union County, New Jersey nuclear free zone (NFZ) ordinance. Before their first plant was closed, RTI had begun plans for a second plant in Elizabeth, New Jersey. This May, the Port Authority of New York and New Jersey revoked the lease they had granted for the Elizabeth plant last September on the grounds that the "proposed use of the property" would be "inconsistent" with



the Union County NFZ ordinance. There are now 118 nuclear free zones in the U.S. The Union County ordinance represents one of the 47 legally binding NFZs.

RTI filed the first lawsuit against existing NFZ legislation. On August 12, a federal district court judge struck down the Union County NFZ ordinance as unconstitutional and unenforceable. The Union County Board of Freeholders will not appeal the decision, but plan other legal challenges to RTI.

—Sarah Wilson

SEND US A NOTE

Keep a lookout for news that might have missed the mainstream. Send us newsnotes about science and technology news, and we'll extend your subscription for six months for every item we print. Please enclose clippings and sources. Newsnotes were compiled by Mike Wold and Sarah Wilson.

Newsnotes

ANOTHER REASON TO WALK TO WORK

Concern over indoor air pollution surfaced a little over a year ago when a five-year Environmental Protection Agency (EPA) study revealed that concentrations of indoor airborn chemicals are often ten times greater than those outside, and sometimes as much as 100 times greater.

Considering that people spend an average of 80 percent of their time indoors—especially young children and the elderly—researchers realized that the potential health risks from indoor pollution were far too large to have been so thoroughly ignored.

In a natural extension of this work, researchers at the South Coast Air Quality Management District in El Monte, California, outside of Los Angeles, reported at this fall's national meeting of the American Chemical Society that the toxic hazards of commuting to work may have been similarly underrated.

Driving in the Los Angeles Basin during rush hour, it seems, subjects thousands of commuters to levels of chemicals inside their cars many times higher than those outdoors. Results from this study found mean levels of benzene, toluene, lead, nickel, manganese and chromium ranging from 2.4 to 5.5 times higher than outdoor concentrations.

According to these researchers, EPA has expressed strong interest in funding a larger follow-up study to investigate the effects of freeway versus city driving, car air conditioners, and how much it might help to lower the windows. In the meantime, those who were looking may have found another reason to commute to work on foot. Then they need only worry about the toxic airborn concentrations inside when they get there.

—Seth Shulman

BIODIVERSITY CRISIS UNITES SCIENTISTS

It is a rare event to see longtime political adversaries Stephen Jay Gould and E.O. Wilson—who have argued publicly for years over issues of sociobiology and genetic determinism—on the same side of an issue involving biology and public policy. But that happened recently at a Smithsonian conference on biological diversity.

Although Wilson's arguments favoring genetically determined explanations of human behavior have ranged from exaggerated to downright diabolical, his efforts to alert the public to the specter of a current "biological diversity crisis" is certainly on the right track.

For years, environmentalists have tried to raise public concern over individual "endangered species," but now Wilson and many other scientists tracking all types of flora and fauna are increasingly alarmed at the rapidity of their extinction rates across the board, in species ranging from exotic flowers to rare apes.

CONTINUED ON PAGE 40

BRINGING GOOD THINGS TO LIFE?

INFACT, the Boston-based organization which was the driving force behind the successful seven-year Nestle boycott, is in the midst of an intensive campaign to stop the production of nuclear weapons. Its target is the corporate giant General Electric. Representing a major escalation of its two-year Nuclear Weapon-makers Campaign, the drive to stop GE's participation in the nuclear arms buildup is based on GE's sordid track record of creating the tools of the next holocaust. INFACT's tactic is a boycott of all GE products and services.

The campaign's goal is to halt the production of nuclear weapons by highlighting the often overlooked but perhaps most important stimulus to the arms buildup: the enormous profits that giant corporations stand to make by continuing the arms race. Although INFACT has targeted eleven nuclear weapons corporations (including GTE Sylvania, Martin Marietta, Monsanto, Morton Thiokol, Rockwell, and Westinghouse), GE seems to make the point most effectively.

These are some of the good things GE has brought to life as a result of its influence with the Pentagon and Congress: the B-1 bomber (major contractor), the neutron triggers for all U.S. nuclear bombs (sole producer), the MX, Trident, and Minuteman missiles (all first-strike weapons whose primary components are manufactured by GE), propulsion systems for nuclear-powered submarines (major producer), reentry vehicles for the Titan II and Minuteman III ICBMs, and engines and components for various bombers, fighters, and missiles.

During fiscal years 1984 and 1985, GE grossed close to $6.5 billion from the U.S. Treasury for its nuclear weapons work. From 1981 to 1983, not only did this bastion of corporate America earn another $6.5 billion in profits, it also paid no federal income tax, and even claimed a $283 million refund.

But even with a Washington lobbying staff of 120 and a ranking of fourth among all weapons contractors in PAC contributions to Congress in 1984, GE's profits are not all legal. GE was the first Pentagon contractor indicted for defrauding the government. It was charged with filing false claims and altering employee time cards on Pentagon contracts. (GE does not restrict its dirty work to nuclear weapons: the Environmental Protection Agency has fingered GE as one of the worst dumpers of hazardous waste in the U.S.)

With corporate entities like General Electric standing to gain so much from a climate of cold war and its attendant buildup of armaments, one can easily start to wonder whether the Soviet "threat" itself has also been manufactured by GE and its ilk. After the enormous profits garnered from wartime production during World War II, GE's president, Charles E. Wilson, called for a "permanent war economy" at the war's end. That task accomplished, it is up to people everywhere to dismantle Wilson's dream and replace it with a permanent peace economy.

For more information and to get involved in the General Electric boycott, contact INFACT, 186 Lincoln St., Room 203, Boston, MA 02111, telephone 617/338-6101.

—Joseph Regna

Letters

Crime and Reason

Dear SftP:

As a child, I was familiar with the stresses among my friends and neighbors resulting from uncertainty of employment and hence income, and the trimming of the laws necessary to make ends meet. This became a way of life that resulted in frequent conflict with the police. Not a small factor was the awareness that the shopkeepers and others whom we became obligated to financially were cheating us at every opportunity by overcharging, providing inferior quality even when we had paid for the better, and failing to provide a service when needed.

It is no surprise, therefore, to see the same sort of games being played by my community today. Nor does it require any "sophisticated" research to find reasonable explanations for this behavior.

Leon Kamin's article (July/August 1986) about the work of James Wilson and Richard Herrnstein points up the kind of bias (is it "unconscious" in their case?) that provides both an excuse for the harshness with which the "delinquent" is treated, and a diversion from the much more serious crimes of the super-wealthy class in this country. The example I've chosen to illustrate this is but one of many such. That is, the expenditure of resources, talents and people for the benefit of the military industry and the military establishment who work together to milk the national wealth.

How do they proceed? First, by creating the bogey of "national security" and, having diverted massive production to military hardware, by raising the bogey of unemployment if military procurement is drastically reduced. Leaving alone the issue of national security, whatever that may be, the unemployment issue so raised is obviously phony. No real effort has appeared to alleviate the real unemployment from which many millions have been suffering—yet we have the example of the Depression era that much can be done by meeting the needs of the cities and the farms, as was done, for example, with programs like WPA, that produced useful, constructive results for the nation.

As for the workers in military industries, why they should have such special consideration appears to me unjustified. Their production is to kill and destroy, not to build and benefit. That, to me, is engaging in criminality at its worst.

—Sam Zaslavsky
New York City

Deductive Differences

Dear SftP:

I suppose the implication presented by a group of facts depends upon one's assumptions. In the July/August 1986 issue of your magazine, the question surrounding generalization reared its ugly head. Could it be that no generalization of humanity can be made?

Leon Kamin ("Are There Genes for Crime?") questions the accuracy and replicability of professors Wilson and Herrnstein's studies as well as their ability to draw conclusions. The underlying assumption is that there is value in the study of humanity in order to gain insight into individuals. In "Science Writing: Reporting on the Front Lines," Julie Ann Miller tells the reader that "if there are differences in the male and female brain," then it is valuable to isolate them, since one does not "want to ignore the topic just because it has certain political implications." Personally, I could not identify a single personality trait that is common to all the human males that I have met, or the females.

If I enlisted the services of a medical doctor and she were to give me a questionnaire to fill out, examine me in a predescribed manner, and compare her data to a standardized statistical chart that indicated what ailed me, would anyone question my distrust of the prescription for a bottle of pills that I would receive as cure? Attempting to determine how an individual will behave based upon data collected on others fails in the most fundamental way: the researcher has failed to study her subject. Physicists have been forced into this realization by the fact of the behavior of subatomic particles. No one can tell what, where or how such a particle will manifest itself, but if you simply take five billion....

Perhaps it is easier to think of one's self as "one in a million" than as simply "me."

—John R. Friedrich II
San Antonio, Texas

My Frog, Myself

Dear SftP:

The "Science and Gender" article (July/August 1986) voices disagreement with the concept that the dissection of a frog is an initiation rite into science, while acknowledging that this technique is very inadequate to understand a frog.

If the dissection of a frog is not an important procedure for influencing a young student's attitude toward science, I would suggest one small addition to this experiment in understanding reality. After the student has observed how the frog is constructed and held together, I suggest that the frog be prepared as part of a meal.

Eating the frog will give the student an opportunity to understand that any hazardous material which finds its way into the frog will ultimately end up in the student's body. In addition, the student may be influenced to associate killing with the practical need for food, as opposed to the romantic notion of being in control of other species or people. Making it a cultural habit to eat what you kill for experimental purposes will encourage a more thoughtful attitude toward this form of investigation.

—Paul Schaefer
Kansas City, Missouri

Science for the Future

Dear SftP:

Congratulations! You and *Science for the People* are doing just what so many are seemingly unable to do, to critically examine particular

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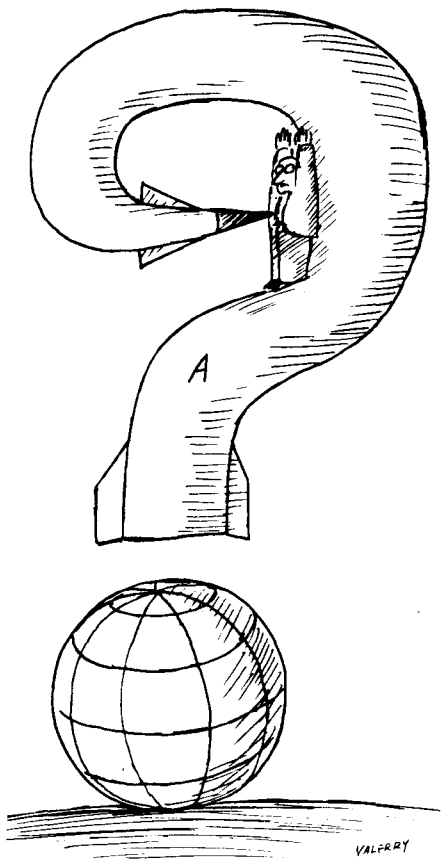
CAREERS IN SCIENCE

Ethical Dilemmas Between A Rock And A Hard Place

BY NATASHA ARISTOV, CHESTER REGEN & ELLIOTT SMITH



As young scientists we face a central dilemma. We fear that our scientific work might eventually be used in harmful ways, and we see that science as a whole does not answer to public needs. The dilemma, then, is to reconcile our love of science with these troubling realities. It makes decisions about the direction of our careers particularly agonizing. But much more than personal choices are at stake.

The experience of Arthur Galston is a case in point. As a graduate student, Galston discovered a growth-slowing hormone, triiodobenzoic acid (TIBA), which increases soybean crop yields.[1] When applied at higher concentrations, though, TIBA causes shedding of leaves. Galston writes about the misuse of his discovery:

"I have some reason to believe that my early investigations on TIBA helped several researchers at the chemical warfare laboratories at Fort Detrick in their design and understanding of the defoliating action of chemicals of the plant hormone type.[2]"

The U.S. sprayed massive quantities of these chemicals on Vietnam during the late 1960s, in an operation succinctly described as "ecocide". Needless to say, Galston was not consulted. His experience shows the danger of academic research being misapplied to be very real.

Unfortunately, not only experimental results, but also the methodology developed to do an experiment can be misused. This is ever more true as all fields of research become increasingly reliant upon advanced technology. Laser technology developed to study the chemistry of metal surfaces may later have military applications; recombinant DNA techniques developed to investigate gene function can be used in the production of biological weapons. In such a framework, individual scientists have little control over the misappropriation of their work.

Choice of a scientific career involving public service would seem to be a way out. The fear of possible misuse of one's work would be offset by palpable contributions to public welfare.

In this article, we set out to profile alternative science careers. We looked for scientists addressing the pressing needs of society—alternative energy sources or reclamation of the environment, for example. We considered jobs in the scientific mainstream—universities, national laboratories, and corporate research institutes—as well as less traditional environments. Unfortunately, we found few examples of laboratory research which adequately respond to our concerns.

We have come to realize that the lack of alternative careers and the real potential for misuse of scientific discoveries are closely linked. Scientific research is very capital-intensive, and thus is the prerogative of only the most powerful institutions in our society. The need to cooperate on research priorities and funding is an important tie binding together government, the military, academia, and major corporations. Both the types of research performed and the uses to which it is put are directly determined by these institutions. National science policy then reflects the profit and power-motivated perspectives of the almost exclusively affluent, white, male leaders of these institutions, rather than the public interest.[3]

CAREER ALTERNATIVES

There are, of course, examples of mainstream scientific researchers motivated by public concerns. To the extent that their research genuinely addresses these concerns, we applaud it. Development of alternative energy sources is an obvious example. Scientists at the Solar Energy Research Institute (SERI) in Golden, Colorado work to improve photovoltaic

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Elliott Smith teaches laboratory chemistry at Mills College in Oakland, Califorina.

cell efficiency, energy recovery from biomass, and energy storage via electrolysis of water. The sad fact is, though, that the Reagan administration has slashed SERI's budget so that few permanent positions are available there.[4]

Regrettably, while some mainstream scientists are motivated by concern for the public, their work usually benefits large corporations first, and the public only incidentally. SERI's work in alternative energy illustrates this process. Eighty percent of the photovoltaic cell market is controlled by three companies owned by Arco, Amoco, and Exxon.[5] Similarly, major utilities will likely be the ones to profit from advances in electrolysis. At a time when virtually all incentives for conservation and alternative energy use by consumers have been eliminated, SERI's work reinforces centralized corporate control of energy.

Some nontraditional industries do exist whose products and services are less subject to centralized corporate control. One hopeful example is the field of environmental protection, which expanded greatly in the early 1970s after the establishment of the Environmental Protection Agency. Independent environmental testing is needed when disputes arise between polluters and government agencies or watchdog groups.

In a search of the San Francisco Bay area, we were able to find several scientists working in environmental testing and consulting. We learned of one zoologist who performs applied biological research sponsored by the EPA. She is testing the effects of pulp-mill effluent on the embryonic development of marine animals known to be sensitive to pollutants. Her results will be used to adjudicate a dispute between the EPA and paper companies in the Northwest. This particular job will last several years, and may well lead to a lifelong career.

Systems Applications of San Rafael, California, an environmental consulting firm, does computer models of the effect on air quality of specific regulations concerning industrial emissions. These studies have important effects on public policy. Roughly half of their studies are funded by the EPA and other federal agencies; the remainder are paid for by industry, state and local governments, and environmental groups. Systems Applications employs roughly 30 full-time analysts with some scientific training.

A variety of public advocacy groups employ scientifically trained people of all stripes. Citizens for a Better Environment, for example, focuses on pollution of the San Francisco Bay, hazardous waste management, air pollution, and pesticide use. Of the ten paid staff members in California, half have scientific training.

The Center for Science in the Public Interest is a consumer-interest organization that deals with drugs, cosmetics, food, and food additives, and employs several Ph.D. and Masters-level nutritionists and public health scientists. The Union of Concerned Scientists focuses on prevention of nuclear war, and has several physicists on its staff. In each of these organizations, scientifically trained persons analyze the available data on issues of public concern to help formulate organizational policy for government lobbying and public education efforts.

None of the jobs we discovered in nontraditional industries involved basic laboratory research. Choosing such a career, then, will almost certainly involve turning one's back on years of academic scientific training—which few scientists are prepared to do. Then how can a research career be reconciled with one's convictions? We have some recommendations.

FOOD FOR THOUGHT

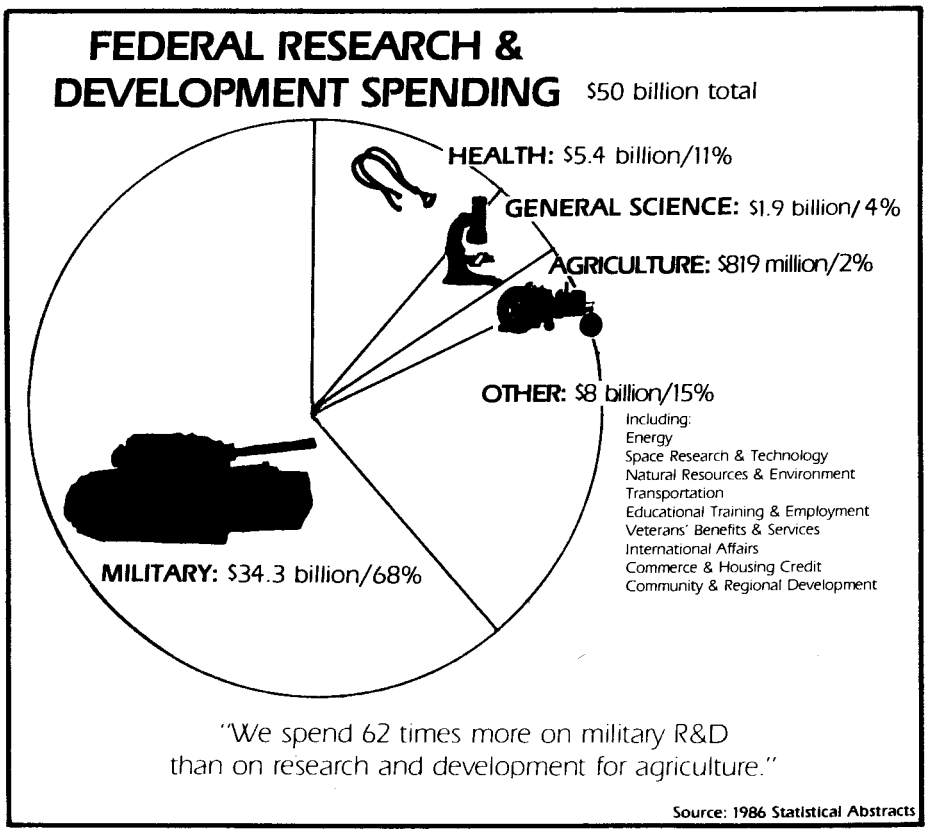
It seems that the scientist committed to a career in laboratory research must look to mainstream scientific institutions for employment. One can usually choose from a wide range of research environments, and we believe strongly that ethical criteria should play a major role in that choice. As our discussion of SERI shows, the ethical issues involved are complex. Here we survey some of the issues relevant to the common research environments—the military, corporations, and academia.

Of these options, working for the military is the most troubling. Supposedly, the primary function of the U.S. military is to protect our democratic and peaceful way of life from enemies. The reality is far different. Military might is used to impose the will of American elites on much of the rest of the world.[6] The defense establishment siphons off a hugely disproportionate amount of resources—both capital and intellectual—from all other societal needs.[7]

Rapid innovation in weapons technology has led to the proliferation of arms of all types, from ICBMs to cluster bombs. Stockpiling of strategic weapons drives the superpower conflict, while worldwide sales of sophisticated tactical weapons make regional conflicts more dangerous and prolonged. Scientists working for the military and defense contractors are particularly responsible for these innovations. Such research is antithetical to the public interest.

Whatever our choice of research environment, we must each decide what degree of involvement with the military we can justify. Assuming that one decides not to work on militarily useful projects such as private-sector weapons research, should one also avoid projects which, while not directly related to weapons, still receive funding from the military? If such projects should be avoided, should one also avoid working for institutions which receive all or part of their funding from the military? These are difficult questions, particularly because there are fewer and fewer scientific jobs unconnected to the Pentagon.[8]

The corporate research environment presents a second option. Ethical decisions about a particular corporate research career



INTEGRATING SCIENCE WITH PROGRESSIVE POLITICS

BY STEPHEN J. RISCH

I currently hold a faculty position (assistant professor) at the University of California, Berkeley. In some respects this hardly seems like an "alternative" to doing conventional science. What makes it different is the kind of research and teaching I do here at Berkeley, and have done at my previous job at Cornell.

My research focuses on the ecology of agriculture, including social and political aspects of agriculture in developed and developing countries. My teaching largely reflects this research area, but is somewhat broader so that it includes general political aspects of science.

I started graduate school in 1972 at the University of Michigan, not at all anticipating that my interests would move towards agriculture. In fact, I intended to do a thesis on avian sociobiology. However, there was a small Science for the People group at Ann Arbor at the time, with which I became involved.

Discussions in the group focused on what questions in biology, and science in general, were worth asking. After approximately a year and a half, this resulted in my deciding to abandon behavioral ecology and pursue agricultural ecology. Although this was to be the first agricultural-related thesis done in the Zoology Department (which had always prided itself on its basic science), there was a small core of faculty that effectively shielded me from the department's general antipathy.

Funding, it turned out, was relatively easy to come by since research in tropical agro-ecology combined a number of themes that were then in vogue. In fact, I was to learn that, in general, money for applied research in agriculture, even alternative agriculture with an explicit social and political connection, is easier to come by than money for many basic science projects. I also learned that it is generally accepted by people working in agriculture that there are significant social and political variables connected with this work, even if the basic questions being asked are biological.

While most people working in agriculture are not on the political left, many at least recognize the legitimacy of incorporating social phenomena into the research agenda. After all, it's hard not to admit that human beings are the most important participants in agricultural activity. This, then, makes it easier for people interested in doing work in alternative science to work in agriculture than in basic science.

In 1979 I took a job as assistant professor at Cornell with a joint appointment in Ecology and a program called Science, Technology and Society. The job was extremely unusual in that it was explicitly described as a position for someone who would do research in social questions related to biology—almost a made-to-order Science for the People professorship.

Although it became obvious that there were general political bounds within which it was appropriate to operate and that certain faculty were threatened by an explicitly Marxist analysis, I was generally allowed to teach and research as I liked. I found that graduate students in particular were eager to interact with and get advice from someone doing alternative work in agriculture. They could see this as a viable career option and one that they could politically identify with at the same time.

Several of the graduate students started an alternative agriculture research collective which included nonstudents and undergraduates. The explicit purpose was to conduct research in a nonhierarchical way with all major decisions being made by consensus. They successfully sought funding from the Agricultural Experiment Station at Cornell, but it was clear that the faculty, while they could identify with the research questions being asked, did not understand and were suspicious of the way the research was to be done. I was cautioned to distance myself from such a methodology.

In 1983 I took a position at Berkeley in the Department of Entomology and was again surprised to learn that the faculty search committee was quite comfortable about my work with social issues in agriculture. At the same time they were quite clear that I would be evaluated and promoted primarily on the basis of "hard science", and not on any papers I might write on social aspects of agriculture. During the last three years this has proved to be the case.

In general, I would summarize my experience as follows: The university administration and my colleagues are supportive of research on alternative agriculture and encourage, up to a point, the inclusion of social variables. Yet it is interesting that the University of California system seems much more cautious than does Cornell in its attitude towards serious social critiques of agriculture, probably because in California agriculture really counts, while in New York it is much more of an afterthought. The general rule seems to be that it is much safer to be a critic of agriculture if it doesn't matter so much.

Some of my current research and that of my graduate students is located in Central America, especially Nicaragua. There appears to be no problem with this since it fits rather well into the general tradition of agricultural development work in the Third World, a very traditional and respectable focus of research in Land Grant universities.

Beyond conducting my own research, teaching my courses and supervising graduate students, I have been actively involved as an informal advisor for graduate students in other departments who wish to do research projects in some aspect of alternative science. While these individuals are usually constrained to have someone from their home department as their major professor, the system is flexible enough to allow and even encourage a variety of input.

In summary, I would say that I feel extremely fortunate to have been able to integrate progressive politics in my university teaching and research. In part this was due to accidents of history—being in the right place at the right time for unusual academic jobs. Yet I think it is extremely important to recognize that the specific discipline itself has a tremendous influence on whether one can or cannot hope to successfully do alternative science. Agricultural ecology, especially as applied to developing countries, happens to be one field that historically allows much greater latitude in integrating social and political variables than do most areas in science.

Stephen J. Risch is an assistant professor in the Division of Biological Control at the University of California, Berkeley.

depend in large part on the way in which that corporation wields its economic power. The economic clout of the largest national and multinational corporations gives them a special place in the world economy. The global character of such corporations reduces their public accountability, and enables them to dominate democratic political structures in the countries in which they operate.

Usually, the hierarchies within such corporations prevent worker participation in decision-making. Smaller corporations are less subject to these generalizations, and may provide a more acceptable research environment to those troubled by the special features of multinationals.

A company's management practices should also be carefully weighed: its relations with labor, environmental record, and the specifics of its political behavior. In the case of subsidiaries, the actions of the parent corporation are also relevant. The nature of the company's products and services is also an obvious and important concern. Often, the products or services a company provides are so varied that an overall assessment of whether they are harmful or beneficial is not possible.

The most common environment for basic researchers is the university. Ivory-tower image notwithstanding, the management practices of universities can be just as unsavory as those of corporations.

Major universities are usually vigorously anti-labor. They may also be disturbingly cavalier in their handling of toxic wastes and radioactivity.[9] Further, while universities operate on a presumption of freedom of expression, administrations have often moved to suppress dissent.[10] Finally, formulation of a personal stance toward military funding and institutional military ties are as relevant to the evaluation of an academic research environment as to any other.

STRATEGIES TO EFFECT CHANGE

The ethical choices we have outlined are difficult ones, and the options available are deeply unsatisfying. We feel that the present role of science in society is unacceptable, and that scientists themselves are in a unique position to change that role. We see a number of ways to create openings for more progressive uses of science:

• *Network.* Most scientists feel powerless to influence national research priorities. Organizations of scientists can attain access to the public and to the corridors of power that individuals cannot. We envision a functioning network of progressive scientists, which would provide an alternative voice to those of the American Academy for the Advancement of Science and particularly the elite National Academy of Sciences.

Alternative organizations could keep track of the public interest careers that do exist, so as to channel conscientious young scientists into them. One specific function might be to provide a vocal constituency for progressive federal programs and policies, such as tax credits for energy conservation.

A network of progressive scientists might also begin to address the problem of misuse of research for weapons development. When potential misuse is suspected, we could publicize it, organize political action, and possibly litigate.

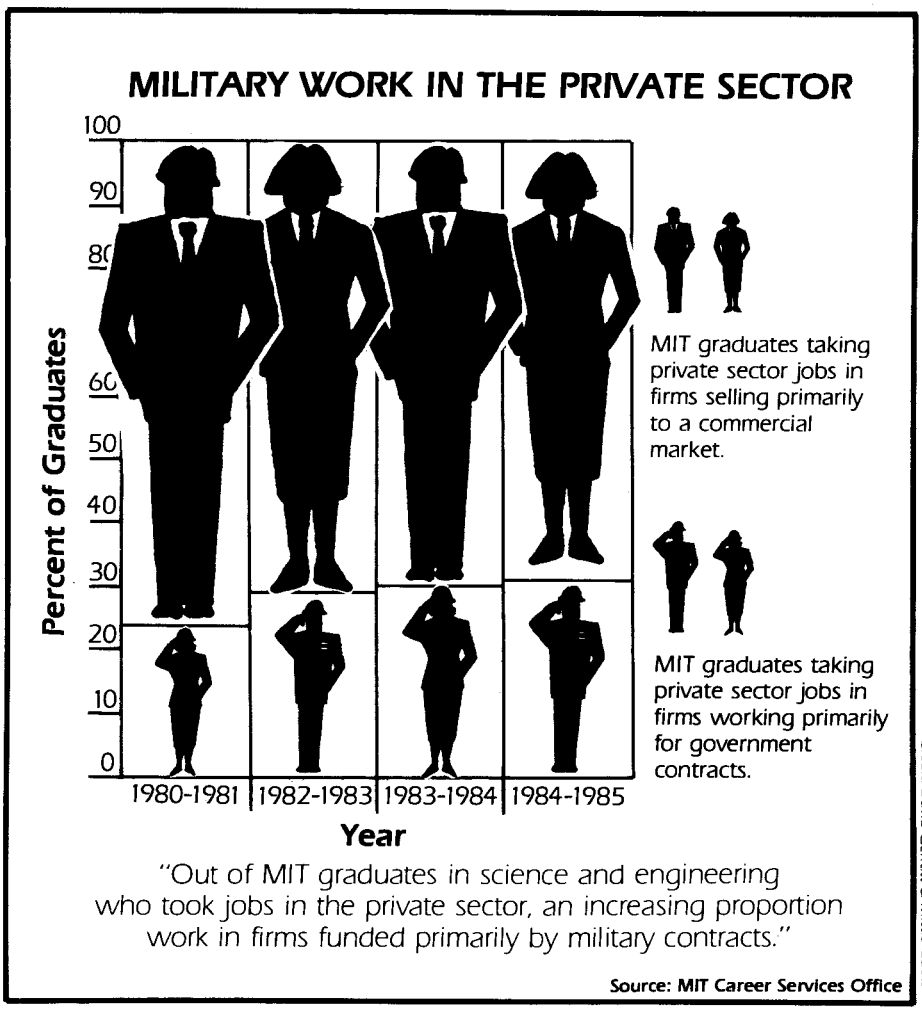
• *Speak out.* In addition to participating in a network, individual scientists can act as the conscience of their research institutions by advocating freedom of speech, labor's right to organize, recycling, and proper handling of toxic chemicals. A handful of physicists at the national weapons laboratories have successfully opposed Reagan administration efforts to classify a range of scientific publications. This is a hopeful example.

• *Connect with peace and environmental groups.* These groups need scientific expertise and approval; we need their political support. Much more public input is needed in setting scientific priorities. Input from these groups would be an excellent start.

• *Refuse military funding.* This action, especially if taken by groups of scientists, is a clear public statement of dissent. The recent campaign by academic and corporate physicists to boycott Star Wars funding is a case in point. Also, military officials often learn about individual research projects through proposals and summary reports. Why place results directly in their hands?

• *Establish a specific alternative agenda.* Our sketchy idea of a science oriented to public benefit needs to be expanded into a full-fledged agenda and program. We need to be clear on what we stand for, not just what we oppose.

• *Pressure campus career centers.* Placement and career development offices should provide more balanced information about employers. These centers are often students' only source of career information. Unfortunately, they uncritically transmit recruiters' glossy brochures without providing any independent, substantive information. By providing an unquestioning and poorly informed labor pool, they unwittingly work hand in hand with



BEYOND SOCIALLY RESPONSIBLE SCIENC

BY RALPH A. MAGNOTTI

After I graduated from college, I decided to seek a job doing socially responsible science. Believing that work in a health-care-related area would necessarily be socially responsible, I worked as a research assistant in a medical school, then as a research assistant in a pharmaceutical corporation. Several events happened to change my thinking.

In my first job, an effort was made to organize workers in the medical school where I worked, and I was appalled by the insensitive and unscrupulous tactics used to defeat the union.

Later, working in a pharmaceutical corporation, class conflict became even more apparent. Merrell Research Center was split by a road dividing the areas where the blue and white-collar staff worked. Blue collars produced bottles of drugs in the processing plant, while their white-collared counterparts did science in the contemporary-styled brick building with the expansive smoked-glass windows.

As far as I could tell, the operation ran like this: A research director would put together a team of biochemists, biologists, pharmacologists, and organic chemists who would invent types of products, and a high-powered legal and marketing staff would sell the products at a profit.

As with the discovery of penicillin, most pharmaceutical discoveries are serendipitous: that is, the organic chemist would, almost at random, make hundreds of chemicals, which would then be tested, using animals, for the desired effect. The drugs were "run through the screen." If a potentially profitable effect (e.g., tranquilizing, muscle-relaxing) was found, the marketing and sales force would go to work to sell the drug. The drug thalidomide, which was distributed by Merrell, is an example of this sort of approach. It was prescribed to prevent morning sickness in pregnancy, but caused thousands of birth defects.

In another instructive episode, a group with which I was associated at Merrell, using knowledge of biochemistry and metabolism (one of the first so-called rational drug design efforts) produced an anti-cancer drug which then proved effective against malaria and cattle sickness. However, very little profit was to be made from Africans, who are severely affected by these problems, and the drug was not produced for that market.

When I left Merrell in 1980 to pursue graduate studies in biochemistry, the company was being sued for the production of birth defects by Bendectin, an anti-nausea drug. I became aware that, rather than drugs being produced to cure disease, diseases were being exploited to produce and sell drugs.

Some scientists hear the cries for better health care & a safer environment but few establish a dialogue with those who cry out.

These examples showed me that as long as hunger and disease remain unprofitable, scientists working under capitalism will never solve these problems.

While a graduate student, I worked with a grassroots organization, the Ohio Public Interest Campaign, to pass a strong Right-To-Know law. I would go door-to-door telling people about the high rate of cancer in Cincinnati and the need for labeling toxics. This involvement also brought me into contact with public health professionals, labor organizers, and other progressive activists from whom I learned what the essential needs of the community were. I also worked part-time as a clerk and orderly in a nearby hospital, both to understand the health care system and for the camaraderie I enjoyed with the other workers there.

Curiously it was the 1984 presidential campaign of Jesse Jackson that allowed me to make sense of the disparate elements of my political and scientific experience.

Jackson raised the issue of empowerment, the idea that people should be given the power to make their own choices. Rather than Blacks looking to white politicians for justice, he emphasized, they should challenge the unfairness of the electoral system by electing their own political leaders from within their own movement. Jesse Jackson's campaign was not radical at the outset, but he constructed a dialogue with a constituency concerned with many issues, which he linked together brilliantly through the theme of empowerment.

It seems clear to me now that the difference between socially responsible and radical science is the difference between hearing and active listening. Some scientists hear the cries for better health care and a safer environment but few establish a dialogue with those who cry out.

My political experiences have shaped my understanding of the need for radical science. It was through the Cincinnati Central American Task Force, for example, that I met an epidemiologist who was studying pesticide poisoning in Latin America. That's how I learned that there is no reliable way to quantitatively measure pesticide poisoning under field conditions.

Coincidentally, I had begun a comprehensive survey of various analytical technologies for their potential in rural medicine, and found one that could be used for measuring pesticide exposure. A sympathetic electronics engineer helped me construct the necessary instrumentation. Because I could not leave my job, my wife, a sociologist trained in experimental and survey methods, helped the epidemiologist use the device to test Nicaraguan farmworkers who had been exposed to pesticides.

We had several goals in doing this. First, it was a concrete way to express both our opposition to the policy of the U.S. towards the Nicaraguan government, and our support for a developing socialist country. Second, by using a quantitative measure of chemical toxicity, we could determine the effect of exposure before a life-threatening or acute dose of pesticide was inflicted. An effective, inexpensive treatment could then be administered to affected workers, or they could be removed from exposure by rotation. Third, the workers we tested helped workers everywhere by enabling us to quantify a hazardous level of exposure based on scientific evidence. This information could then be used to argue for legislative limits on pesticide exposure in the U.S. and elsewhere.

Because I have a small child and believe that I should participate equally in childcare and housework, I had to forego doing almost all other political activities

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while I was working on the Nicaraguan pesticide testing project. This delayed publication of some scientific work and placed additional burdens on my personal life, using up time that would have otherwise gone to securing my career and being with my family.

My job helps me to organize my life by allowing for a great deal of flexible time. Because part of my job involves operating a hospital service laboratory, there isn't as much time as I would like to do research. However, I'm not totally dependent on grant support, the work is very socially responsible, and I don't have to spend most of my time publishing or writing grants. My favorable job situation owes a great deal to the strong, continuing support and encouragement of my graduate mentor. Friends help!

Being able to work in a largely stress-free job situation greatly increases the efficiency of my academic work, which makes it easier to handle extra political work. Having a mutually supportive relationship in which feelings and needs can be discussed helps immeasurably.

Obtaining funds for radical science can be quite difficult. Certain types of research receive more funding than others, such as cancer cures and artificial hearts, which are of more benefit (coincidentally?) to the wealthier classes than research into preventing cancer and reducing work-related hazards. Radical science ends up relegated to "spare" time, during weekends and vacation.

When I began working as a scientist, my goal was simply to do socially responsible science. Now I am committed to doing radical science, that is, science which challenges existing inequalities of wealth and power. Although it's possible to get paid for doing socially responsible science, it's much more difficult to get financial support for radical science. In my own life, involvement in mass movements has led to an opportunity to do radical science, which in turn curtailed my other political activities.

As scientists, I believe we have a crucial role to play in the empowerment of the people. As Karl Marx rightly foresaw: "It is only possible to achieve real liberation in the real world and by employing real means...slavery cannot be abolished without the steam engine and the mule and the spinning jenny, serfdom cannot be abolished without improved agriculture...in general people cannot be liberated as long as they are unable to obtain food and drink, housing and clothing in adequate quality and quantity."

multinationals and military contractors.

Instead, such career planning centers should educate students about the costs and benefits of particular careers and employers. The needs of persons looking for public interest careers in science must be addressed as well. The centers could help to unearth and distribute information about these alternatives.

• *Demand effective affirmative action programs.* Research will become more responsive to societal needs when the diversity of society is reflected in the ranks of scientists. Simple justice demands it.

NOTES

1. The discovery was later patented without his knowledge by an Illinois corporation, which now sells large quantities of the substance for use in the Midwest. Galston receives no royalties.

2. Arthur Galston, "Education of a Scientific Innocent," *Natural History* 80 (6): 16-22 (1971).

3. Irwin Goodwin, "Pentagon's R&D Chief Blasts Science Critics of DOD Policies," *Physics Today* 39 (7): 48-49 (1986). Donald Hicks, undersecretary for research and engineering, says, "The support of basic research is one of the ways the Department of Defense uses resources to accomplish its mission."

4. Colin Norman, "Solar Programs on the Chopping Block Again," *Science* 214: 36 (1981).

5. Richard Munson, "Big Oil's Solar Power Eclipse," *The Nation* 237: 627-628 (1983).

6. Noam Chomsky, *American Power and the New Mandarins*. New York: Alfred Knopf, Inc., 1967.

7. In 1980, government outlays for military and nonmilitary research and development were equal. The military fraction, which was two-thirds in 1985, continues to grow. See Colin Norman, "Science Escapes Brunt of Budget Ax," *Science* 231: 785-788 (1986).

8. Linda Shaw, Jeffrey Knopf, and Kenneth Bertsch, *Stocking the Arsenal: A Guide to the Nation's Top Military Contractors*. Washington, D.C.: Investor Responsibility Research Center, 1985.

9. Brian Hill, "New Complaints Over UC Toxic Waste Handling," *The Daily Californian*, Oct. 17, 1985, p. 1. Hill reports that "charges include illegal transportation, storage, labeling, packaging, disposal, record-keeping, reporting, and training with regard to hazardous waste."

10. Howard Levine and David Pickell, "Conference Explores Campus 'Disruption'," *The Daily Californian*, Sept. 18, 1985, p. 1. They report that representatives from the major universities, corporations, and the U.S. and South African governments met to develop strategies to thwart protest aimed at divestment of university funds from corporations doing business in South Africa.

KICKING THE MILITARY HABIT

Exploding the Myths of an Armed Society

BY SETH SHULMAN

Close readers of this magazine will know the figures: over 70 percent of all federal research and development funds are spent on military research, a rate unprecedented in peacetime. And more than one third of all U.S. engineers and scientists now work in military-related jobs. For science and engineering students in academia, especially those entering the job market, these figures have grave implications.

Despite many students' qualms about working on military-related research, there is a surprisingly pervasive sense at engineering and computer science departments in academic institutions around the country that to do research in a high-tech field that is both interesting and well paying, one must work for the military in some capacity. This view is unfortunate; it is also wrong on both counts.

MYTH #1:

MILITARY-RELATED WORK IS MORE INTELLECTUALLY INTERESTING

Visit an electrical engineering department at a local university, and you will hear debate about working on military-related research, especially thanks to the recent, widespread success of the Strategic Defense Initiative (SDI) research boycott (see "Stopping Star Wars" in the January/February 1986 issue of SftP).

Understandably, many students have grave doubts about contributing to the design and production of weapons of mass destruction. Still, the myth that this work is somehow more sophisticated and exciting than that found in other areas usually goes undisputed. And at least partly because of this belief, large numbers of students—even those with misgivings take military-related jobs.

These military-related jobs fall into three broad categories: work for defense contractors researching, designing, and building weapons systems, ships, planes and tanks; research in academia that is funded by the Department of Defense (DOD) or the Department of Energy (DOE) expressly for military purposes; and finally, working directly for the armed services or DOD in some capacity as a scientist or engineer.

Nationally, a third of all new engineers entering the job market between 1984 and 1987 will choose work in military-related jobs, according to one estimate. Some job placement professionals, though, put those figures considerably higher. Dr. Linda Gast, director of the career development center at the University of Maryland, for instance, reports that 60 to 70 percent of engineering students there take jobs with defense contractors or with federal agencies like the Pentagon (ten miles from their campus).

All too often the fact that a given field is particularly reliant on military funds is not clear until it is essentially too late.

Across the country at the University of California in Los Angeles, the picture is similar. Dr. Chenits Pettigrew, placement officer for the UCLA's engineering school, says that 45 percent of UCLA graduates stay in Southern California and for these, as he puts it, "there is no turning away from defense." UCLA's largest recruiters of engineers are Hughes Aircraft and TRW.

Although campus recruiting by defense contractor firms has increased across the country, these firms do not necessarily provide students with work that is more interesting or projects that are more exciting even on technical terms—regardless of the broader implications of the work. The following excerpt from a report published by the MIT career office, hardly a source biased against firms with military contracts, describes a very oppressive work environment:

"Many of the best-known defense contractors have the reputation of being overwhelmingly large and bureaucratic, of putting hundreds of engineers together in rooms the size of playing fields, of giving the young engineer very little chance of calling any product his (sic) own. Few are known for the quality of their management."

Another mainstream source, *The 100 Best Companies to Work for in America*, a directory published in 1984, lists only three firms involved in any significant defense work, out of dozens of firms with potentially interesting opportunities for engineers.

MYTH #2:

MILITARY-RELATED WORK PAYS HIGHER SALARIES

Contrary to widely held beliefs among students today, the military sector does not pay larger salaries than

Seth Shulman is a freelance science writer and former editor of SftP. This article draws upon research on SDI funding by Jonathan B. Tucker, whom the author wishes to thank.

its civilian counterpart. The College Placement Council, which collects information on starting salaries from placement offices, tabulates the offers to bachelors degree recipients by industry. According to this report, in 1986 salary offers for engineering students in the military-related aerospace and computer industries trailed those of other sectors, especially the chemical and petroleum industries.

According to a report by the MIT Career Services Office, these data are corroborated by surveys from professional societies such as the Institute for Electrical and Electronics Engineers on the salaries of their members.

MYTH #3:
IF I DON'T DO IT, SOMEONE ELSE WILL

Also extremely common is the cynical argument made by many young scientists and engineers that, especially since so much of the available work in their fields is related to the military, there is no harm in accepting military funds for research that they are interested in, even if they don't believe in the military project aims. In fact, this argument was so commonplace among scientists who did accept Star Wars research funds that the Undersecretary of Defense for Research and Engineering was prompted to state earlier this year that scientists voicing these types of public comments would not be welcome to receive funds in the future.

Hicks told the Senate Armed Services Committee: "I am not particularly interested in seeing department money going to someplace where an individual is outspoken in his (sic) rejection of department aims, even for basic research." Hicks's comment, despite its McCarthyesque overtones, is noteworthy as an indication of how widespread this attitude is among scientists and engineers.

Actually, aside from its serious philosophical flaws, the argument that accepting defense money needn't mean acceptance of project aims is especially shaky in light of current funding trends. As several observers have noted recently, the Pentagon has placed increasing emphasis on highly directed research and development. Funding for projects in basic science accounts for approximately only 2.5 percent of the military research and development (R&D) budget, less than half of the proportion of R&D it accounted for two decades ago. The rest goes strictly to applied research.

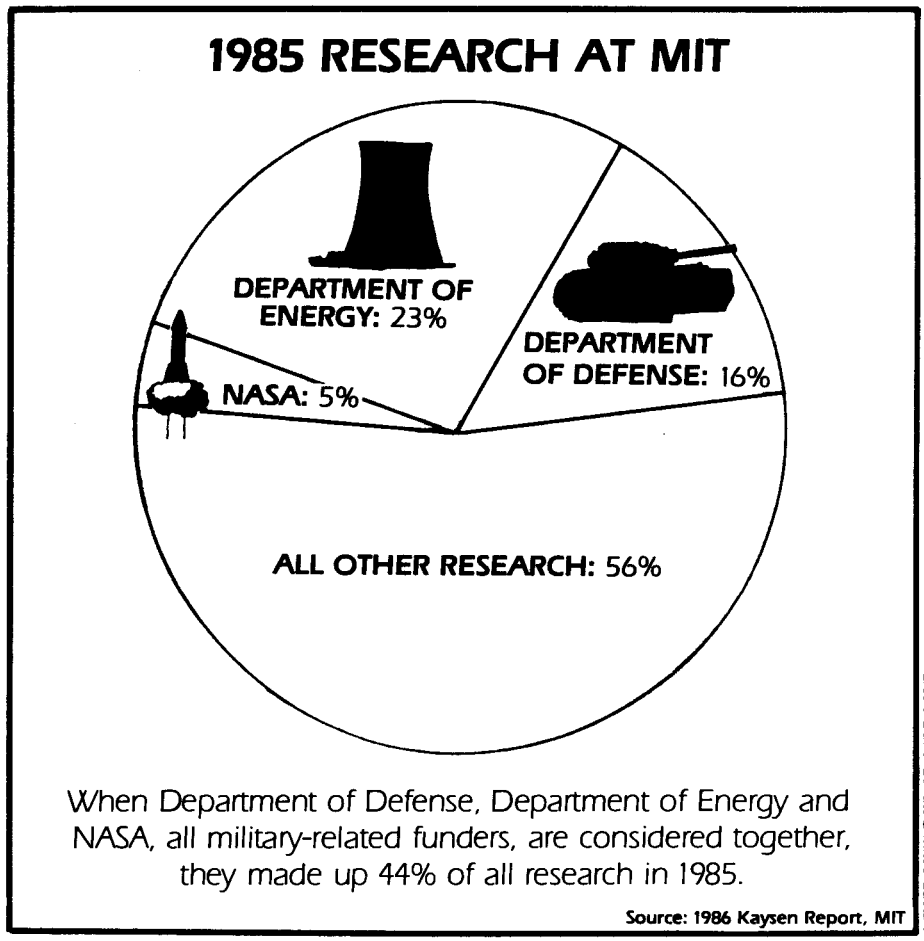
As MIT physics professor Vera Kistiakowsky commented on Strategic Defense Initiative funding, "There is no pretense here that the SDI program supports free basic research carried out by independent researchers. This is intended to be a highly structured program with funding for only seventeen narrow research areas."

Jonathan B. Tucker, in a report on Star Wars, has attributed this trend toward more directed military research to the 1970 Mansfield Amendment, which required Pentagon-funded university research to have some "clear relevance to military missions." However, this trend, Tucker says, "has accelerated sharply under the Reagan Administration."

Because of the directed nature of the research, scientists who contribute to this sector must acknowledge the direct connection of their research to the military effort. For those who choose to work for defense contractors, the situation is much the same. The fact is, their individual contributions do make a difference.

CAUGHT IN THE GRIP OF MILITARISM

If the myths about military-related work are as flimsy as they seem, then why does the military sector continue to draw so many young scientists and engineers? It is



When Department of Defense, Department of Energy and NASA, all military-related funders, are considered together, they made up 44% of all research in 1985.

Source: 1986 Kaysen Report, MIT

Credit: David Gerratt & Mittie Cuetara

a vexing question. To a large degree, the answer lies in the intricately dependent relationship among the military, academia, and industry.

This relationship becomes more obvious the closer one looks at the statistics of funding and R&D ventures at universities. Basic science research at universities is extremely dependent on federal support. Thus it is especially significant that military research and development has made up a steadily growing portion of these federal research funds in recent years. Meanwhile, federal support for civilian R&D projects as a percentage of Gross National Product has diminished to the point that the U.S. now trails behind Japan and West Germany in this area.

In 1986, the Department of Defense allocated almost a billion dollars to support university research, a figure that makes up roughly a sixth of all federal money given to universities. DOD's share of these federal funds has risen from one tenth in the past six years alone. What these aggregate figures fail to highlight, of course, is that the DOD money goes to certain fields almost exclusively; consequently, a field like astronautics received over 80 percent of all its federal funding from the Pentagon. For the field of electrical engineering, the figure is close to 60 percent.

These figures also diminish the fact that the Department of Defense is not the only funder of military-related research. Nuclear weapons research is often funded by the Department of Energy, and NASA projects have military connections as well. In short, the military permeates many fields of academic science to a startling degree. And there is little doubt that working on military-related projects socializes students to accept this as a fact of life in their field, and to consider a career in military-related work.

It is important to realize that despite the pervasiveness of this incestuous relationship among industry, academia, and the military, there are alternatives. The individual choices that students in these fields make are literally the only chance we have to wean ourselves off of these increasingly striking dependencies.

KICKING THE MILITARY HABIT

For scientists and engineers entering the job market, the key variable is personally recognizing the direct connection to the military establishment that comes by taking military-related jobs. As some, like Materials Science Professor Gretchen Kalonji at MIT, have pointed out, an essential element in this equation is to provide counseling early on to undergraduates

about the military's especially heavy influence in certain fields. All too often the fact that a given field is particularly reliant on military funds is not clear until it is essentially too late: when the student faces the reality of landing a job.

Several groups around the country specialize in aiding students in this way. In the Boston area, the High Technology Professionals for Peace (HTPFP) are one example. HTPFP, founded in the late 1970s, offers an information clearinghouse and job placement service that helps people in scientific and engineering fields who seek work outside the military sector. This service is available as well for people in defense-related jobs who want to stop working directly for the military.

Says former HTPFP director Andy Langowitz: "The job placement program has been extremely difficult to implement because we've found that we have to be as good as a top job placement office and better, because we are looking for nonmilitary jobs in a heavily militarized sector. Nonetheless, we've found that the support we have provided, the referrals, and counseling have been almost as important a contribution."

In addition to their other services, HTPFP provides an on-line bulletin board called the Career Assistance Information Project for people to share information about military contracts in the private sector, nonmilitary job possibilities, and other alternatives.

In addition to groups like HTPFP, other organizations focus more broadly on conversion of the military economy. The Jobs with Peace campaign, for instance, has sponsored a variety of activities designed to raise public awareness of our dependence on a military economy.

Another group, INFACT, the organization that successfully won concessions from Nestle over marketing techniques for infant formula in the Third World, has recently announced a boycott of General Electric, one of the largest defense contractors, which sells a significant number of products to commercial markets as well. INFACT's effort is another attempt to raise awareness of our economic connections to and dependence on the military in this country. For scientists and engineers entering the job market, these efforts can help to raise the public's consciousness of the importance of these issues.

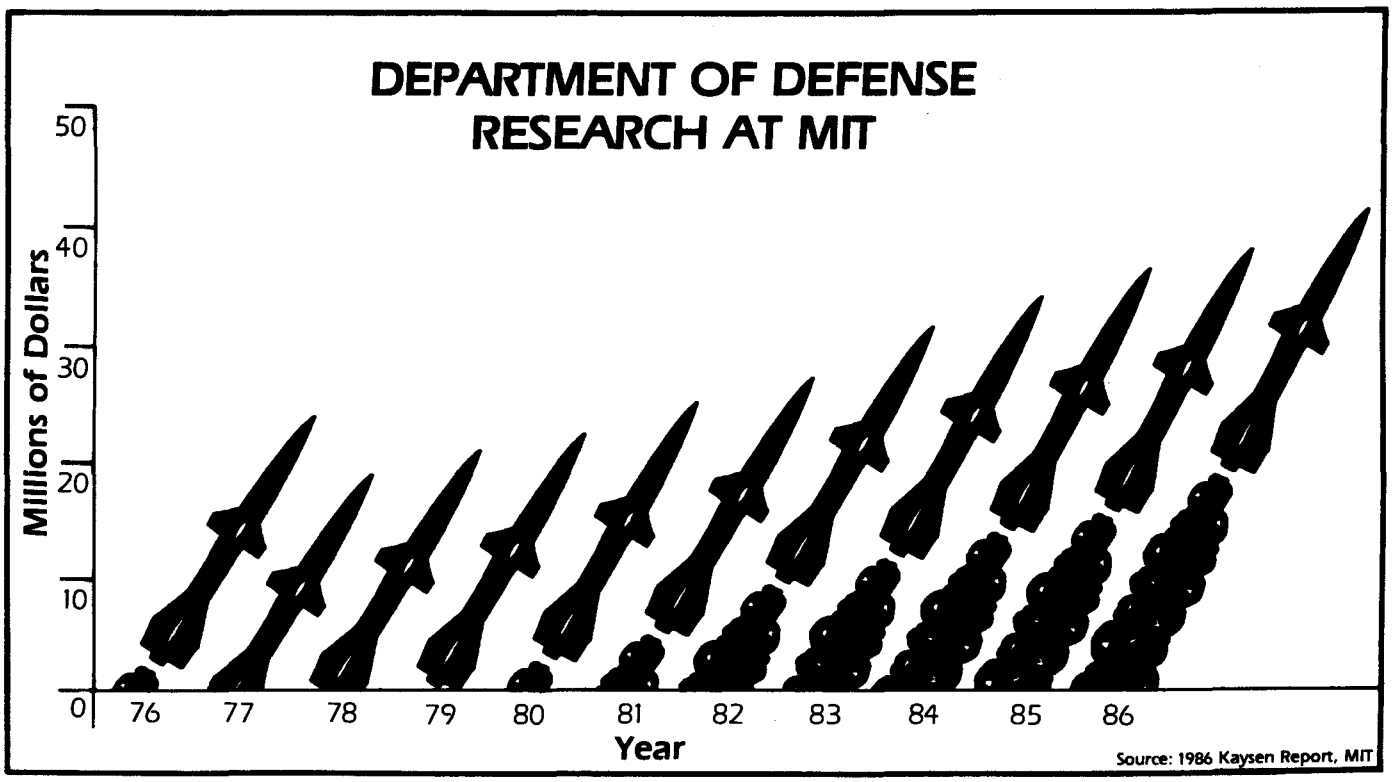
In another important strategy for breaking the military dependency in academia, several faculty members at campuses around the country have publicly pledged their personal resistance to military-related work in their fields.

Professor Charles Schwartz at the University of California at Berkeley, for instance, has refused to teach the general introductory course for physics majors, in protest of the heavy militarization of his field. Instead, he teaches courses which include discussion of the implications of research. Calling on other professors to stop teaching physics for the military, Schwartz says, "We physicists should engage collectively in a deliberate and gradual withdrawal of services which contribute to weapons development."

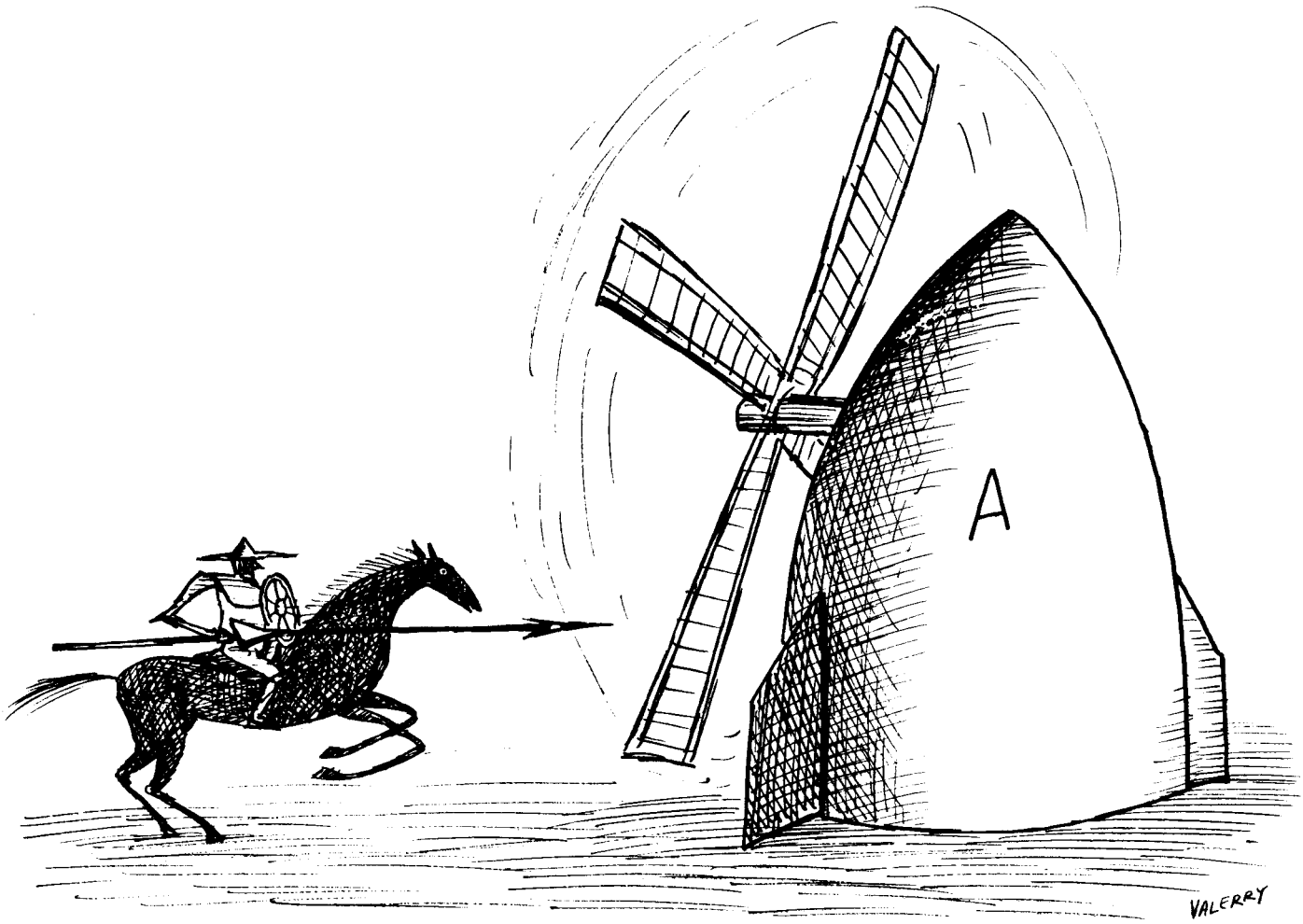
At MIT, another SftP member, Professor Joseph Weizenbaum, recently announced his refusal to contribute in any way to military-related work in his field and has urged his colleagues to stop contributing in this capacity as well. Faculty members such as these, as well as setting an example and raising the consciousness of their colleagues, can often provide important support to younger members of the field who are making choices about military involvement.

Many schools' career services offices have also established alternative jobs fairs and alternative job information which exposes students to options outside of military-related work. Nonetheless, as Richard Cowen, of the Science Action Coordinating Committee at MIT states, "The challenge is to make alternative jobs carry the broad political impact that non-alternative jobs have. For them to provide a serious alternative, they will have to somehow become more of a political force."

The experience of the Strategic Defense Initiative research boycott approached this type of political force in many departments across the country, because of the numbers of scientists involved and the challenge it delivered to scientists to make an active choice about their involvement with this military project. However, if we are ever to truly kick the military habit in science and engineering fields, a movement like the SDI boycott will have to draw attention to the socially productive, alternative work that young scientists and engineers can engage in.



Credit: David Gerratt & Mittie Cuetara



NOT WITHOUT US

Computer Science in the Service of Life

BY JOSEPH WEIZENBAUM

Whenever I come to Europe, especially to West Germany, I am amazed by the aparent normality of everyday life. As only an occasional visitor to Germany, I see strange things that must by now appear routine, even natural, to Germans. For example, holes in the streets that are intended to be filled with nuclear land mines, or the closeness of every German to nuclear weapons storage facilities, and so on. I notice, in other words, the Germans' physical and, even more, their psychological proximity to the final catastrophe.

We in America are no more distant from the catastrophe than the Germans. In case of war, regardless of whether intentionally initiated by technology allegedly designed to avert war, or by so-called statesmen or women who thought it their duty to push the button, Germans may die ten minutes earlier than we in fortress America, but we shall die.

We have no holes in our streets for atomic land mines. We see our missile silos only now and then, that is, whenever it pleases someone to show them to us on television. No matter how passionately our government tries to convince us that the nasty Soviets are effectively as near to us as to the Europeans, that they threaten us from, for example, Cuba or Nicaragua, Americans are unconvinced, on the whole, and therefore untroubled by such efforts.

It would therefore be more astounding were the average American aware of the danger that confronts us all than that he worries so little about it. The American experience of war allows an "it can't happen here" attitude to grow, rather than a concrete fear of what appears to be far removed from the immediate concerns of daily life.

I am aware that it is emotionally

Joseph Weizenbaum is a professor of computer science at MIT and a member of Science for the People's editorial advisory board. He translated this talk, which was given to the Gesellschaft fur Informatik at Karlsruhe, West Germany on July 17, 1986.

impossible for people to live for very long in the face of immediate threats to their very existence without bringing to bear psychological mechanisms that serve to exclude those dangers from their consciousness. But when repression necessitates systematically misdirected efforts or excludes potentially life-saving behavior, then it is time to replace it by a deep look into the threat itself.

This time has come for computer professionals. We now have the power to alter the state of the world fundamentally and in a way conducive to life.

It is a prosaic truth that none of the weapons systems which today threaten murder on a genocidal scale, and whose design, manufacture, and sale condemns countless people, especially children, to poverty and starvation, could be developed without the earnest, even enthusiastic, cooperation of computer professionals. It cannot go on without us! Without us, the arms race, especially the qualitative arms race, could not advance another step.

Does this plain, simple and obvious fact say anything to us as computer professionals? I think so.

First, those among us who, perhaps without being aware of it, exercise our talents in the service of death rather than that of life have little right to curse politicians, statesmen and women for not bringing us peace. Without our devoted help, they could no longer endanger the peoples of our earth. All of us must therefore consider whether our daily work contributes to the insanity of further armament or to genuine possibilities for peace.

In this context, artificial intelligence comes especially to mind. Many of the technical tasks and problems in this subdiscipline of computer science stimulate the imagination and creativity of technically oriented workers particularly strongly. Goals like making a thinking being out of the computer, giving the computer the ability to understand spoken language, making it possible for the computer to see—goals like these offer nearly irresistible temptations to those among us who have not fully sublimated our playful sandbox fantasies or who mean to satisfy our delusions of omnipotence on the computer stage, that is, in terms of computer systems.

Such tasks are extraordinarily demanding and interesting. Robert Oppenheimer called them sweet. Besides, research projects in these areas are generously funded. The required moneys usually come out of the coffers of the military—at least in America.

It is enormously tempting and, especially in artificial intelligence work, seductively simple to lose or hide oneself in details of subproblems and their subproblems, and so on. The actual problems on which one works—and which are so generously supported—are disguised and transformed until their representations are mere fables: harmless, innocent, lovely fairy tales.

For example, a doctoral student characterized his projected dissertation task as follows: A child, perhaps six or seven years old, sits in front of a computer display on which one can see a kitten and a bear—all this in full color, of course. The kitten is playing with a ball. The child speaks to the computer system: "The bear should say 'thank you' when someone gives him something." The system responds in a synthetic but nevertheless pleasing vote, "Thank you, I understand." Then the child answers, "Kitty, give your ball to your friend." Immediately, we see the kitten on the computer display throw the ball to the bear. Then we hear the bear say, "Thank you, my dear kitten."

This is the kernal of what the system, whose development is to constitute the student's doctoral work, is to accomplish. Seen from a technical point of view, the system is designed to understand spoken instructions—that alone is not simple—and translate them into a computer program which it will then integrate seamlessly into its own computational structure. Not at all trivial, and beyond that, quite touching.

Now a translation to reality: A fighter pilot is addressed by his pilot's associate system, "Sir, I see an enemy tank column below. Your orders, please." The pilot responds, "When you see something like that, don't bother me. Destroy the bastards and record the action. That's all." The system answers, "Yes, sir!" and the plane's rockets fly earthward.

This pilot's associate system is one of three weapons systems which are expressly described, mainly as a problem for artificial intelligence, in the Strategic Computing Initiative, a new and major research and development program of the American military. Over six hundred million dollars are to be spent on this program in the next four or five years.

It isn't my intention to assail or revile military systems. I intend this example from the actual practice of academic artificial intelligence research in America to illustrate the euphemistic linguistic dissimulation whose effect is to hinder thought and, ultimately, to still conscience.

I don't quite know whether it is especially computer science or its subdiscipline, artificial intelligence, that has such an enormous affection for euphemism. We speak so spectacularly and so readily of computer systems that understand, that see, decide, make judgments, and so on, without ourselves recognizing our own superficiality and immeasurable naivete with respect to these concepts. And, in the process of so speaking, we anesthetize our ability to evaluate the quality of our work and, what is more important, to identify and become conscious of its end use.

The student I mentioned above imagines his work to be about computer games for children, perhaps involving toy kittens, bears, and balls. Its actual end use will likely mean that some day a young man, quite like the student himself, and who has parents and possibly a girl friend, will be set afire by an exploding missile which was sent his way by a pilot's associate system shaped by the student's research.

The psychological distance between the student's conception of his work and its actual implications is astronomic. It is precisely this enormous distance which makes it possible not to know and not to ask if one is doing sensible work or contributing to the greater efficiency of murderous devices.

None of the weapons systems which today threaten murder on a genocidal scale could be developed without the earnest, even enthusiastic, cooperation of computer professionals. It cannot go on without us!

One can't escape this state without asking, again and again, "What do I actually do? What is the final application and use of the products of my work?" and ultimately, "Am I content or ashamed to have contributed to this use?"

I am reminded in this context of a well-known American journalist who, during a Middle East highjacking, suggested that, under certain circumstances, the Israelies shoot ten Arab prisoners, selected from the many prisoners they were at the time holding, and, should the circumstances not change, shoot ten more the next day, and so on. He should not have made this

suggestion unless he was prepared to go personally among the prisoners, to look with his own eyes into the eyes of the men to whom he will say, "You, you will die today," and then hold the pistol to the heads of those selected for murder and command his own finger to pull the trigger.

Just so should we, once we have abandoned the prettifying of our language, begin to speak realistically and in earnest about our work as computer professionals. We should, for example, ask questions with respect to attempts to make it possible for computer systems to see. Progress in this domain will, with absolute certainty, be used to steer missiles like the Cruise and the Pershing ever more precisely to their targets. And at their targets, mass murder will be committed.

Such statements are often countered with the assertion that the computer is merely a tool. As such, it can be used for good or for evil. In and of itself, it is value-free. Furthermore, scientists and technicians cannot know how the products of their work will be applied, whether they will find a good or an evil use. Hence, scientists and technicians cannot be held responsible for the final application of their work.

I see this argument concretely manifested in the building next to the one in which I work, the world-famous Draper Laboratory. This institution is devoted almost entirely to missile guidance and submarine navigation. (It was once, by the way, part of the Massachusetts Institute of Technology.) Many of the scientists employed there adopt the argument just stated as their own. They say that the systems on which they work can take men to the moon and bring them back just as these same systems can guarantee that missiles aimed at Moscow will actually hit Moscow when fired.

They cannot know in advance, they say, which of these two or still other goals their work will serve in the end. How can they be held responsible for whatever consequences their work may entail? So it is, on the whole, with computer professionals. The doctoral student I mentioned, who wishes to be able to converse with his computer display, does in fact believe that future applications of his work will be exclusively in innocent applications like, for example, children's games. Perhaps his research is not sponsored by the Pentagon's Strategic Computing Initiative; perhaps he never even heard of SCI. How then can he be assigned any responsibility for anti-human use to which his results might be put?

Here we come to the essence of the matter. Today we know with virtual certainty that every scientific and technical result will, if at all possible, be put to use in military systems. The computer, together with the history of its development, is perhaps the key example. In these circumstances, scientific and technical workers cannot escape their responsibility to inquire about the end use of their work. They must then decide, once they know to what end it will be used, whether or not they would serve these ends with their own hands, that is, with the psychological distance between themselves and the final consequences of their work reduced to zero.

I think it important to say that I don't believe the military, in and of itself, to be an evil. Nor would I assert that the fact that a specific technology that has been adopted by the military is, on that ground alone, an evil. In the present state of the evolution of the sovereign nation-state, each state needs a military, just as every city needs a fire department. (On the other hand, no one pleads for a fire station on every corner, and no one wishes for a city fire department that makes a side business out of committing "preventive" arson in the villages adjacent to the city.)

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Valerry

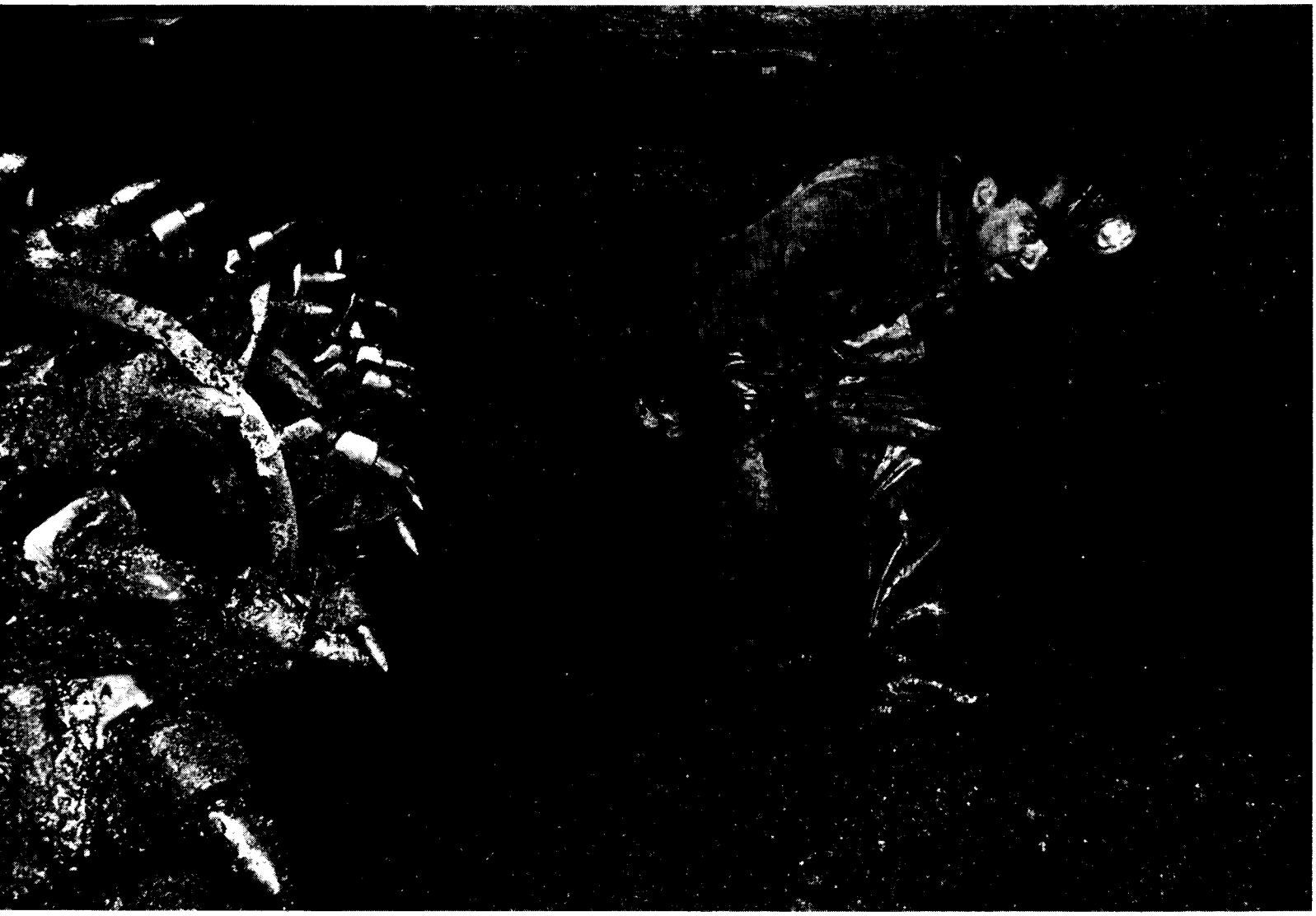

Photo: Earl Dotter/American Labor

WHY WORK FOR OCCUPATIONAL HEALTH?

Occupational health and safety has a long and colorful history. It has attracted activists such as Alice Hamilton who, while living at Hull House at the turn of the century, conducted the first study on lead poisoning among workers in foundries.

My generation, raised on the activism of the 1960s, naturally turned to this field as a vehicle for expressing our desire for social justice and change in a concrete way, and for combining our politics with jobs in a way that few workers could. This was especially true for those of us in science. Rather than being closeted in a laboratory with test tubes, we chose to get professional degrees in occupational health and work in the labor movement. We used our expertise to help workers and build the labor movement as a way of doing science for the people.

The four essays that follow accurately summarize that experience. Jim Weeks describes his evolution from engineering towards the field of occupational health. Fran Conrad discusses the difficulties in finding such a job and some of the contradictions one lives with when working in the labor movement. Clare Sullivan gives an excellent description of what one does as an occupational health specialist for a big international union. And finally, Rich Youngstrom discusses his work from the perspective of an employee of a large union local, and the concrete and philosophical challenges he faces every day.

Taken together, these pieces give an inside look at how the slogan "science for the people" has been put into practice in the field of occupational health and safety, and the problems encountered along the way. It is not easy. There may be no more than 50 people in the U.S. working as occupational health professionals for unions. But the movement continues to grow, and that offers us some hope.

Scott Schneider

INTEGRATING PERSONAL AND POLITICAL GOALS

BY JIM WEEKS

I have principal responsibility for all matters of occupational health for the United Mine Workers of America. I have had this job for four years and have been working in the field of occupational health in the labor movement, in one way or another, for about 15 years. I like my job; I get to do science in an explicitly and reasonably progressive political context. But none of it was planned.

I started college in engineering. Science was interesting and, it was impressed on me early, engineering was a job ticket. But engineering was plagued with tunnel vision. For example, in my senior project we were assigned to redesign a conveyor belt section at a local cannery. We concluded the technical work, but in the process eliminated two jobs. I suggested that for us to complete the project, we needed to consider this problem also. I was told that job elimination was not our concern, not only by the class instructor but by my classmates as well.

For our own sake, we need jobs that are not alienated and isolated politically.

Because of this isolation in engineering, I dropped out, went to the seminary, then eventually dropped out of that too. I worked in various anti-poverty programs, a progressive think tank in Washington, D.C., and was also active in the antiwar movement and the women's liberation movement. All this time, I felt out of place and wanted to get back into science of one sort or another. I tried graduate school in science and public policy, thinking that it might be possible to think about science and technology in political terms, but again the approach was too narrow for me. I still wanted to *do* science, not merely talk about it.

To make a long story short, I discovered occupational health and found a place where there was a constituency (labor) with whom I felt at home and where I could do science. After a few years as an amateur (whose Latin root means "to love" things, or to do things for pleasure; it is curious how this word's secondary meaning—equated with incompetence—has come to dominate), I decided to get some professional training in the field of occupational health.

During those years, I was sustained by a social and political movement that appears absent now. A phrase attributed to Fidel Castro, "It is easier to turn a red into a expert than an expert into a red," was something of an organizing theme for me. While I found myself aspiring to those things this society considers expertise, I was continually, and sometimes painfully, reminded that expertise is as much a social barrier as it is a useful tool. My own experience in engineering taught me as much.

Fidel's admonition became a useful device to focus a personal/political/professional struggle that came to a peak when I decided to go back to school at an elite university. With that decision, I had chosen to do something that I liked, that was fun, and to place that first on my list of priorities. I hoped that what was "politically correct" (however vague that was in my own mind) would work itself out. But at the same time, I was also determined not to become seduced by the trappings of a professional career.

The *unavoidable* problem with this approach is its defensiveness. By negating a career in science as yuppie self-indulgence, it is possible to miss much of what is useful with scientific expertise; part of the utility of scientific skills resides in their mystique. Science is, to quote T.H. Huxley, "common sense at its best." And scientists have no particular corner on common sense. What we do have is a personal and professional preoccupation with certain technical issues, much as anybody develops personal interests. Professional mystique, useful in certain contexts, is nevertheless part of the cultural corruption of science.

So with this rumbling going on in my head, I started graduate school. Much of it was genuinely fun, though in a limited context that, by this time, I had come to expect. Throughout, I often felt like a spectator or a thief, since I declined to buy into what I considered the cultural corruption of science. But at the same time I wanted those things that were useful.

Many of the people I came to know in graduate school remain my closest friends; the surroundings where we met, however, were often a bore. I have often wondered what my time would have been like had it not been for the presence of an active occupational health movement—a statewide coalition for occupational safety and health (COSH) group in my case—outside the academy's walls.

The next, and more difficult, step was to find a job—income, fringe benefits, and a certain amount of security—doing what I liked doing in a political context that I was at home with. This difficult quest, I believe, is fundamentally the same quest that most Americans have: to find a good job. Work is alienated in the U.S., and the struggle against this alienation is intensely personal and political at the same time.

I was lucky. My own search for a good job happened to coincide with a political and economic environment in which money was available to pay for my education and to provide me with my first job out of graduate school. That job was working for a large local labor union that had secured federal funding for an occupational health and safety project. The political history of this local was the same history—with different details, of course—that I had experienced in the 1960s and '70s and that had generated the support which paid for my education and, now, for this job. I was a product and benefactor of the times.

Today, however, the political environment is different, to say the least. While the times are different, the fundamental demands on us as persons, citizens, and scientists are not. Those demands require us to pursue those things that touch our imaginations and are politically appropriate, and to find a way to support ourselves simultaneously.

For our own sake, we need jobs that are not alienated and isolated politically. Isolation and alienation are the very foundation that makes it possible for many scientists to do things that are hellish, like building weapons or exploiting people. The struggle against job alienation in science, as in other vocations, is political and personal simultaneously. And it does not stop with a good job.

Jim Weeks works as an occupational health specialist for the United Mine Workers of America.

Photo: Earl Dotter/American Labor

WORKING AS AN OCCUPATIONAL HEALTH SPECIALIST

BY CLARE SULLIVAN

The role of a union-based occupational health specialist is a relatively new one, as yet undefined by any professional society. Although some unions had health and safety programs that predated the mid-1970s, most developed occupational health staff and structures under the New Directions program which was initiated under the Carter administration.

Different unions have conceptualized the work of occupational health specialists in different ways. It is probably safe to say, however, that an occupational health specialist is *not* an industrial hygienist, an occupational health diagnostician, an epidemiologist, a toxicologist, or a physiologist—but a little of each of these. Adult education skills, public health perspective, and program development experience are also prerequisites. And as important as any formal training, one needs tolerance and patience to work through union structures and to accept their lack of resources.

Many occupational health specialists developed experience in the COSH movements of the 1970s. COSHes, as most *SftP* readers are probably aware, are coalitions or committees for occupational safety and health. They were founded by labor unions and health and legal professionals to build upon the rank and file momentum that led to the enactment of the Occupational Safety and Health Act in 1970, and to deal with the inadequacies of that act and the agency it brought into being, OSHA. The primary role of COSHes (and of many union occupational health specialists) is to support shop-floor struggles concerning health and safety issues through technical assistance and empowering forms of education.

My job description reflects, to a large extent, that COSH philosophy. If it existed on paper, it would probably read as follows:

1. Respond to requests for technical assistance by working with a local union to review the process of production. Research the hazards of those processes and translate the technical descriptions of health risk into terms that are operational, i.e., that can help people decide what actions to take to correct the source of the problems. Defining what the most appropriate exposure controls would be on a short-

Clare Sullivan works as an occupational health specialist for the United Paperworkers International Union in Nashville, Tennessee.

term and long-term basis is also an important part of defining a winnable strategy.

2. Provide union members with information about their legal rights and about the labor, governmental, and community resources available to them to support their efforts to exercise their rights. Also provide a framework for analyzing the advantages and disadvantages of calling upon OSHA, the National Institute of Occupational Safety and Health, or other groups to assist their efforts.

3. Develop strategies (surveys, screening programs, and epidemiological studies) to document the extent of work-related illness that exists among the members of the union.

4. Advocate for compensation of those illnesses and for investments that prevent further disease and disability.

5. Develop educational programs that are problem-focused and group-oriented to enhance the skills and confidence of union members in taking on health and safety programs and struggles.

6. Prepare testimony on public policy questions, such as OSHA standard revisions or workers' compensation legislation, that directly affect the health and safety of the union's membership.

7. Help prepare proposals for negotiation at the bargaining table.

8. Keep membership informed of changes in laws and new information that affects their health and safety work.

9. Affirm the success of local union health and safety committees.

10. Help analyze and learn from their failures.

The training is one of the most challenging aspects of the job. For every health and safety skill a "specialist" might have acquired through formal education, there is one as relevant that can only be learned from the experience of the shop floor. People who have worked with a process for years and years, who have watched coworkers become sick and disabled, who have been disgusted by management's attitude that human health is an expendable variable of production rather that a human right, and who have struggled long and patiently for whatever improvements in working conditions can be achieved—these are the true trainers, and they are eager to learn what you have to share.

The greatest rewards come when the case studies or role plays you have planned in the classroom begin to "click", and people recognize the value of their own experience and how the new information you have provided can be applied. And then there are actual victories in the workplace—a carcinogenic chemical removed from a process, a local exhaust system installed on a machine, a compensation case won for an occupational disease claim.

More the rule are the frustrations that surround the need to accept that, in these times, the fight to retain jobs, health insurance, living wages, and the very right to organize often take precedence over the health and safety concerns that you have defined. That is why the most important quality in an occupational health specialist, the one that sustains through inevitable periods of burnout, is a faith and hope in the labor movement one serves.

FINDING JOBS IN OCCUPATIONAL HEALTH

BY FRAN CONRAD

For someone who prefers applied science to theoretical, and who is drawn toward socially progressive work, occupational health can be a satisfying field: science is applied to real-world situations that directly affect people's health. Occupational health exists in an arena of workplace struggle, simply because protection is expensive and management will go to great lengths to avoid any expense which cuts into profits.

I have seen managers lie to workers about health hazards on the job, engage in extensive cover-ups of hazards when I visited as a government official, and permit exposures which caused eye burns severe enough to require hospital treatment. If one reads the history of occupational health, one discovers that there is nothing managers will not do to make sure profits are maximized. The deaths of thousands of workers from asbestos exposures, which occurred when the effects of asbestos were well-known, are a major example. There is no lack of motivation once one becomes aware of what goes on in the workplace!

Finding a position in which one can effect change is, however, no easy matter. In the discussion which follows, I am speaking mainly of the job picture in industrial hygiene. Management does not usually hire health and safety professionals to protect workers' health, so there are few jobs in business. Outside of private industry, there are three types of workplaces: unions, government, and academia.

Union jobs can be very rewarding, though many are fraught with problems of internal union politics. In the late 1970s, the Occupational Safety and Health Administration (OSHA), under President Carter, funded worker education grants to unions and other organizations. For a decade, under these New Directions grants, there were a number of jobs for industrial hygienists and labor educators with a health and safety background. Most of the grants have ended, and a few unions have retained their health and safety staff on salary.

New jobs in unions do come up periodically, however. For example, New York State recently passed legislation which puts a small surtax on companies' worker compensation premiums, and that money is used for worker health and safety education. The funds are being allocated to local unions, among other groups in New York, thus creating some jobs for health and safety worker educators.

Government jobs are primarily regulatory, with varying degrees of authority. One can work for the federal OSHA, though there has been a hiring freeze for most of the Reagan administration's tenure and jobs are scarce. The National Institute of Occupational Safety and Health periodically has jobs for all kinds of health and safety professionals in Cincinnati, Washington, D.C., and Morgantown, West Virginia. If interested in a federal job, one must have and maintain a civil service rating.

A few state governments, such as New Jersey, Maryland, New York, Michigan, and California, employ some health and safety professionals, including industrial hygienists, occupational physicians, and

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epidemiologists. Except in states with a state OSHA plan, such as Maryland and California, most of these jobs involve research. In some cases they include investigation and, less frequently, regulation.

In the New Jersey Department of Health, where I work, the situation is unusual, in that the department has a large occupational health group which does all of the above-named types of work. Whereas New Jersey does not have a state OSHA plan, we have no regulatory authority in the private sector (federal OSHA has it). We do investigate certain complaints and problems in private workplaces, but we can only make recommendations or put pressure on management indirectly to make changes.

But we do have a public employee OSHA law. The health department has the responsibility to investigate complaints made by public employees under this law. One section also administers and enforces the New Jersey Right-to-Know law, which requires labeling of workplace chemicals and employee education on chemical hazards. Many research projects of an epidemiological nature are going on as well, including a cancer registry and a silicosis registry.

My own experience has been in state government and union work. My first job after getting a masters degree in industrial hygiene was with a union international on an OSHA New Directions grant. Unfortunately, I worked for a rather reactionary union, which was determined to maintain tight control over all information to local unions. They understood how powerful knowledge can be and went to great lengths to control its flow.

When a union local would call with a health and safety problem, for example, the international's officers were immediately suspicious that there was a local power struggle going on, and that someone was trying to use health and safety as an organizing issue to unseat the local leadership, or worse, the international leadership. While such things certainly do happen, they should not be the primary concern at the exclusion of building a mililtant and informed rank and file.

Another problem I had in that union, which is not at all uncommon, is that I was automatically suspect for being an outsider, rather than someone who had come up through the ranks. It was no small cause of fear and suspicion that I was middle class and female, too. The more parochial and paranoid a union is, the more problematic are its fears of outsiders and women, resentment of middle-class people, and tight hold on power.

Other health and safety professionals have found more hospitable situations, and some have done remarkable worker education, advocacy, and testimony on standards from their union positions. My purpose in discussing the worst-case unions is to warn of the pitfalls, but not to discourage people from seeking union jobs. It is important for unions to have health and safety professionals, and union occupational health work is a good platform from which to act. In seeking a union job, it is a good idea to try to find out from contacts you may have within the union what sort of attitudes the leadership has toward the members and toward professionals recruited from outside the labor movement.

With academic jobs, I have little experience so I can only speak generally. Certain universities allow not only research and teaching, but work with unions and the community as well. Universities can serve as technical resources for all kinds of activities needed by working people: conducting epidemiological studies in a community or workplace, linking clinics with community or workplace organizations, educating health providers to better serve working people, providing academic support for community struggles over toxics, and testifying in workers' compensation hearings or legislative battles.

There is one other type of work in industrial hygiene which a few people have pursued successfully: freelance consulting work for labor unions. There is a limited but real market for industrial hygienists to inspect workplaces, evaluate hazards, and review compensation cases. After a few years of experience in some job which allows field work, an industrial hygienist might be able to make a go of union consulting.

Currently there is quite a bit of work around asbestos. Many unions are concerned about direct exposure in the workplace and indirect exposure from asbestos contained in old buildings. Some are hiring their own consultants to make independent evaluations of hazards and conduct appropriate medical testing, not trusting opinions solicited by management.

The only advice I would add is that if one wants to be a health and safety professional, it is best to get a specific graduate degree in industrial hygiene, epidemiology, occupational health nursing, medicine, or a related area. Avoid general degrees such as a Masters in Public Health, unless it has a strong specialty component. Jobs are scarce and specific technical knowledge helps. You are also more valuable as a resource if you have such knowledge.

An alternative path, and one of at least equal merit, is to be a union organizer knowledgeable enough on health and safety to use it as an organizing issue. Many trade union activists have done wonderful health and safety organizing with no formal training. You can use sympathetic professionals as resources and pick up quite a bit of knowledge along the way.

THE POLITICS OF INDUSTRIAL HYGIENE

BY RICHARD A. YOUNGSTROM

Although my background is varied, I call myself an industrial hygienist, and I work for a local union representing about 8,000 workers. The practice of industrial hygiene is defined briefly as the health-half of health and safety: anticipating, recognizing, evaluating, and controlling occupational hazards from chemical, physical, and biological agents. People come to this field from various disciplines, and my own route included mechanical engineering, a year as a VISTA volunteer, environmental engineering, and time as an OSHA inspector.

Although industrial hygiene is typically defined in narrow terms, it is often difficult to separate health issues from safety issues, and there are strong connections between occupational issues and environmental concerns. The toxic cloud that devastated the city of Bhopal, India, for example, came from inside the plant but did not stop at the Union Carbide property line.

My belief that industrial hygiene must be viewed in the broadest context is a minority view among the 4,000 or so practicing U.S. industrial hygienists, but even more unique is the practice of this

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profession from my position in a local union for the past seven years. Hired originally through a U.S. Department of Labor New Directions grant program, this work has been supported directly by the union since 1983 through a 10-cents-per-week dues increase voted on by the entire membership.

My belief that industrial hygiene must be viewed in the broadest context is a minority among the 4,000 or so practicing U.S. industrial hygienists.

In generally hard times for unions, this resource might seem extravagant. But it remains a model for focusing health and safety resources close to the source of health and safety (and environmental) problems: the shop floor or worksite. This situation has allowed the union to bargain with management on an equal footing, to follow up quickly on problems, and to facilitate direct negotiation on the local (steward-foreman) level in the plant.

Health and safety is an interesting field. It is multidisciplinary and far-reaching: almost everything can be related to health and safety that involves the well-being of people. This field involves technical aspects, from epidemiology to control equipment design, but it is primarily people-oriented.

Most health and safety people see the goal of their work as protecting health on the job. There are contradictions in this work, however, because most people who identify themselves as industrial hygienists are paid by profit-oriented institutions. They are bound by the fact that protecting workers' health must come second to the bottom line.

This contradiction is manifested through the widely-held belief that accidents are caused by careless workers (accident proneness) and that occupational diseases occur in inferior or hypersusceptible people. These notions, along with the newer health promotion or "lifestyle" issues, see health and safety problems as individual, not institutional, problems. This "blame the victim" mentality lets the company-paid professional off the hook: he or she can have only limited responsibility if the problem is caused by inherent or individual behavior.

The distinct difference between corporate-level policies, procedures, and attitudes and what happens on the shop floor is further evidence of this contradiction. Company safety departments, when they exist, are always staff functions with no real authority over production. They advise, when requested, but generally operate separately from production. They often have limited budgets (since production units budget health and safety expenditures as well as everything else), and their health and safety policies and procedures often do not get wide distribution on the shop floor.

A third aspect of this contradiction may be the most important. The goal of all health and safety professionals is to prevent accidents and exposures that cause disease. Everyone talks about prevention, but the concept is not that easy to practice in our society. Prevention is predicting potential problems based on experience and limited information (no victims) and then taking action to make sure those predictions do *not* happen.

In this country, that is not the way it works: occupational regulations, to put it bluntly, are written in people's blood. There is little pretesting of materials or processes, animal studies are ridiculed, and once materials are established in commerce (like asbestos and PCBs), even the worst hazards are strongly defended because of vested interests.

The health and safety professional is put in the position of defending the status quo in these situations because of business, not health, considerations. In a similar way, company industrial hygienists may have difficulty getting hazards eliminated unless the Occupational Safety and Health Act is violated, regardless of other information that may be known.

As a union-based professional, I feel that these contradictions are avoided. Acting from a labor base not only allows me to represent the constituency I am supposed to protect, but also allows me to advocate for prevention-oriented approaches to many health and safety-related issues. This has included expert testimony in workers' compensation and other hearings, but is best exemplified by the "neighborhood inspection" work I have done with community groups.

This has involved gaining access to polluting factories and worksites through community organizing pressure, where particular environmental issues have brought the neighborhood together. The inspection process (education and plant walk-around) and the written report can then be used to suggest new demands and strategies for the community. It's also an opportunity to introduce the concept that workers' interests and community interests are often the same. The focus on source reduction—looking to the workplace as the source of environmental problems—combined with occupational health and safety is a start toward bringing together workers and neighbors to demand a clean environment *and* safe workplaces.

My work as a health and safety professional in a local union is not only a model for other labor groups, but also shows how technical experts can participate in various health and safety struggles. As an expert not controlled by a profit-oriented concern or bound by the bureaucracy of a regulatory agency, my recommendations can back up worker or community demands for prevention. This counters the "you're not an expert" argument and can facilitate direct negotiations (on a more equal basis) as a method to resolve the problem. Organized labor uses this approach to address health and safety problems through collective bargaining with management, but it can also be used to assist community residents with environmental concerns.

A final comment about science and the concept of prevention: as an advocate for prevention and local control, it is inappropriate to wait for enough people to get sick or die before defining the problem. We often want to take action before we have all the facts, reproducible studies, or statistically certain conclusions. Although these studies are very important, we also need to incorporate common sense into our thinking and actions.

I remember, for example, a discussion concerning the effects of environmental pollution on drinking water which failed to incorporate the fact that dumping waste fuel oil on the ground is not a good practice. It may be difficult to know there is a problem until a study or test has been done, but a preventive approach to people's concerns cannot wait for what is considered scientific proof.

I have tried to describe some of the difficult issues I struggle with every day. It is sometimes frustrating, but my job is a license to use my expertise for what I think is important. I literally work for each member of my union, and they collectively allow me to fight freely to represent their interests in important health and safety struggles at the workplace and community level. Best of all, through day-to-day events, conversations, and interactions, I am able to see change and progress and feel good about it.

CLUSTERS AND ENVIRONMENTAL DISEASE

Finding the Cause of Leukemia in Woburn, Massachusetts

BY DAN WARTENBERG

With the new awareness of environmental disease, the terms "clusters" and "excess cancers" have become commonly used phrases by our news media. But what do they really mean? What exactly is a disease cluster? When is an observed rate of cancer determined to be in excess? When are these reasons for public health concern?

These are some of the questions underlying the current Woburn, Massachusetts childhood leukemia lawsuit, in which families allege that the W.R. Grace Co. and Beatrice Foods contaminated their drinking water wells, thereby causing needless cases of leukemia in their children. Is the contamination of our environment really threatening the health and safety of this and future generations?

Cluster, not surprisingly, is a term used by different people to mean different things. In the traditional sense, a cluster is an aggregation of objects. For instance, we think of housing clusters (grouped housing leaving portions of an area undeveloped), or star clusters (stars more nearby one another than expected).

In public health, a cluster is an aggregation of diseased individuals. The aggregation implies more cases (in a statistical sense) in a subgroup of people than one would expect in the whole group of people being considered. The subgroup may be employees in the same factory, neighbors living in a particular part of town, children attending the same school, or residents all using the same drinking water supply.

The way we detect clusters varies. Sometimes, in a routine surveillance program in which we monitor disease incidence over time, we notice an unusual

increase in the rate of incidence of a particular disease. Other times we are asked by a community or neighborhood if a given toxic chemical exposure can cause health problems and, in investigating their concerns, we find an unusual number of disease cases near the exposure site relative to the number of cases found in the town or state as a whole. But the important fact is that we have found more cases of a particular disease outcome than we expected.

Next, we ask how unusual our observation is. Disease rates vary, and we must determine if the observation we have made, even though in excess of what we expected, is sufficiently unusual to warrant further investigation. Traditional statistical methods assume that we have randomly chosen our sample for which we wish to evaluate the clustering. This is not true.

In the two cases cited above, either we have been monitoring all neighborhoods or towns in our vicinity and have selected that one with the highest rate of disease, or we have selected that town in which residents think they have found a disease cluster from all towns in which people are watching for these effects. In either case, we have a sample more likely to reveal an unusual situation than one selected at chance. That means our sample is biased.

For instance, in the second situation, we are more likely to detect an increased rate of disease than a decreased rate because residents will not be alarmed if they learn that their town is unusually healthy. So, even if statistically unusual, we need corroborating evidence to substantiate the claim that an apparent cluster is not just normal statistical variation but indeed is reason for concern.

There are two main ways in which we can get independent corroboration. One is the identification of a likely source of exposure for which we know that the contaminant causes the disease of concern. The other uses independent information to derive a better statistical evaluation, free of bias.

To develop the exposure data, one must find a source of contamination that occurred long enough ago to allow the disease to develop, that sufficient number of people in the subpopulation were exposed for the observed increased rate of disease, and that sufficient number of people were not exposed so the base population is different in terms of exposure. Also, the contaminant should be known to cause the looked-for disease in another situation or a laboratory study.

Asbestos is, perhaps, the most well known example. In an occupational setting, the worker subpopulation was exposed to high levels of asbestos while the general population was not. The exposure occurred over decades. The exposed subpopulation developed particular types of lung disease that unexposed

CONTINUED ON NEXT PAGE

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Opinion

people did not, and these lung conditions were found routinely in asbestos-exposed organisms and not in others. Scientifically, there is no problem linking some types of lung disease to asbestos exposure.

To develop independent statistical information, various methods are possible. One can look at a variety of unrelated disease outcomes in one subpopulation and see if the rates are all elevated. For instance, one could look at cancer rates and birth defect rates in the same populations and see if patterns of unusual occurrences are coincident.

Or one could condition the data based on independent statistical information. For instance, one could adjust the expected rates not only based on population size, but also for the age and sex distribution of the individuals being studied. Or even more sophisticated statistical methodology could be used for conditioning too complex to detail here. In essence, these methods take advantage of certain information to make other information independent of the bias with which it was collected.

In practice, a variety of methods are used to develop corroborating information. In the Woburn case, the apparent cluster was detected when the mother of one of the afflicted children noticed the surprisingly large number of other children in the neighborhood who also were seeing the same childhood cancer specialist in Boston.

Following further information gathering by the residents, a study by Harvard scientists revealed that there was a statistical association between the childhood leukemia cases and the amount of water the families had received from contaminated wells. Further, the organic contaminants in the wells have been shown to cause cancer in laboratory animals. While short of absolute certainty, the data make a compelling story of cause and effect with strong corroborating information.

The court case surrounding these cancers, however, must not only show statistical association, but it must assess responsibility and assign liability. In the first phase of the trial, a jury found the W. R. Grace Co. guilty of negligence with regard to the contamination of the drinking water wells in question, while absolving Beatrice Foods of the same offense. In the jury's view, the unsavory practices of this company directly led to the presence of low levels of toxic chemicals in the town drinking water supply.

In the second phase of the trial (underway at the time of this writing), the plaintiffs are attempting to show that indeed this contamination was responsible for a variety of adverse health outcomes in those exposed.

Two aspects of the case are particularly unusual. One is the population-based health outcome data (the leukemia cases) being used as one of types of evidence of personal injury. Relatively inefficient epidemiological methods showing association will be argued in the context of causation. If successful, this could open the way for many cases with similar types of evidence to be tried. Second, the causative agent is low-level chemical contamination, rather than the more common single, high-level exposure.

These types of health problems and low-level chemical exposures reflect characteristics of the new environmental health concerns. The Woburn plaintiffs' arguments fly in the face of some industry assertions that low-level contamination is not dangerous, but rather is a reflection of our new analytical chemistry capabilities; they claim that the human body doesn't respond to these levels of contaminants. (However, humans can smell hydrogen sulfide—rotten eggs—at these low levels. Perhaps other organs respond at these concentrations as well.)

Is there reason for concern? Absolutely. Every day we are all being exposed to new and complex chemicals for which we do not understand the health effects. For the time being we are still investigating ways of detecting population-based effects of low-level exposure.

While some may argue that low levels of toxic chemicals cannot cause cancer, such arguments are not substantiated by consideration of current models of cancer growth. At its simplest, cancer is thought to operate at the molecular level in the cells of our body. Even parts-per-billion concentrations of contaminants in our food and water lead to billions of contaminant molecules invading our bodies every day. And it only takes one of these molecules to begin the cancer process.

For the time being, our tools for assessing health risk are much weaker than those for detecting the contaminants, enabling some to argue that we cannot detect any adverse health outcome. While this may be true, it does not mean that these effects are not occurring. We simply may not know how or where to look, as yet.

A prudent public health strategy is the prevention of exposure until we can show relative safety. Circumstantial evidence compiled to date indicates that low-level exposure to some chemicals may be causing adverse health outcomes in people. Until we can show that not to be true, minimizing exposure is the only reasonable course of action.

Books for the Holidays

Radical Science Essays

Edited by Les Levidow

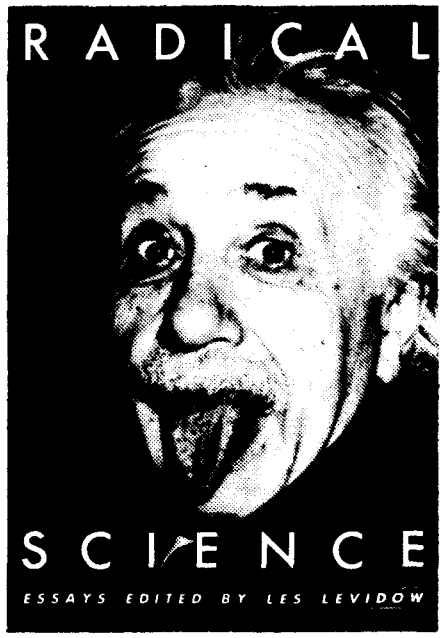
Free Association Books, Distributed by Humanities Press International, Inc., Atlantic Highlands, NJ 07716, 1986

This latest volume from the *Radical Science Series*, published in Great Britain by Free Association Books, collects essays from the first four years of the Radical Science Journal Collective. Begun in the early 1970s, the collective put forward a general critique of science and technology as an inherently biased activity, then identified different biases in science. Over the years, their examination of automation, nuclear technology, health care, psychoanalysis and other fields has consistently demonstrated the need for a socially responsible practice of science.

The essays collected by Les Levidow include Robert Young's introductory look at some of the changes in science since the founding of *Radical Science*. Despite rapid changes in newly developing technologies, Young finds the original questions asked by RS authors still relevant. How should we organize our work as scientists? What values do our technologies embody? What forces go into their development and use?

Young's 1969 review of David Darlington's *The Evolution of Man and Society*, reprinted from *New Statesman*, follows. Young neatly exposes the arrogance of genetic determinism, its logical inconsistency, and its place in the history of "scientific" racism.

The authors of the succeeding chapters include historians of science such as David Dickson and Alfred Sohn-Rethel, scientists bringing a social perspective to their work. Mathematician Luke Hodgkin analyzes math as ideology and politics. Charlie Clutterbuck writes on occupational health issues in the plastics industry. Simon Pickvance describes his life as an alienated worker in a biology lab. Mike Hales analyzes management science and new applications of Taylorism. Sheila Ernst considers the politics of abortion as family planning.



The closing essay is by Albert Einstein, "Why Socialism?" This last piece, from a 1949 issue of *Monthly Review*, is a fine example of how ruling interests select and create a self-serving reality. The popular image of Einstein is the genius who failed at simple math, the creative violinist, and the prime mover of the nuclear age. But Einstein deeply believed in socialism, which he saw as "the only way to eliminate grave evils" in capitalism. His brief and eloquent justification of this conviction is reason enough to pick up *Radical Science Essays*.

—Gary Keenan

Faces of the Enemy

The Psychology of Enmity

By Sam Keen

Harper and Row, San Francisco, 1986

In an era of unprecedented image production, how does the human imagination reproduce itself? In an age when the potential for violence seems limitless, how does the imagination cope with its responsibility for that violence?

Sam Keen's fascinating graphic history of war propaganda explores the techniques of vilification used by governments to create and maintain "enemies". His approach is indebted to Jungian psychology, as he examines what he calls "archetypes of the enemy:" the enemy as stranger, the enemy as rapist, the enemy as enemy of God, the enemy as aggressor. He uses hundreds of reproductions of cartoons and posters, largely from the 20th century, to show how these themes are used by governments of all political persuasions whose common purpose is to sufficiently dehumanize the people they wish to kill.

Keen's archetypes are the products of human imagination. He looks at the psychology of hatred as a process of projecting the unacknowledged qualities of the self onto an "enemy" other. Thus the descriptions of an enemy become a self-portrait, most obvious in the conflict between the world's two dominant empires, the US and USSR. (Which one is the evil empire seems hardly worth the distinction, a good Trident sub being as effective an instrument of genocide as an evil SS-20 missile.)

If this cycle of endless enemies is to be halted, it will involve a tremendous individual and collective effort. On an individual level, Keen asks for a commitment to resist dehumanization by accepting one's own capacity for hatred and murder as a beginning. One must also recognize the humanity of one's opponent. This fuller sense of individuality and deeper recognition of common interests can lead to a breakdown of the myth of the warrior as the ultimate expression of manhood. It can lead to a reduction of nationalism in diplomacy.

Keen's suggestions for strategies of integration include educational programs on conflict resolution and international institutions to defuse violent conflict and prevent "accidental" war by computer malfunction. His search for more humane resolutions of conflict has such wide-ranging implications that some areas, such as the patriarchal character of war propaganda, are not explored. But, in the process of tracing the dehumanization of ordinary citizens, he has made a compelling case for a psychology of resistance and empowerment.

—Gary Keenan

ORGANIZATIONS AND PUBLICATIONS

Although the groups listed here are quite varied, all are of interest to people looking for alternatives in science. Some of them provide assistance for science and technology professionals seeking careers outside of the military sphere of influence. Other organizations are concerned with the broader idea of economic conversion from military-supported production to peaceful, socially useful industry. Still others are composed of science professionals attempting to redefine society's priorities in terms of human needs, especially in these professionals' own area of expertise.

Additionally, there are advocacy organizations and publications that educate the public and monitor legislation concerning specific dangers and misuses of current technologies, and groups proposing alternatives to these technologies. The following organizations are a representative listing of groups doing work in these areas.

Jobs with Peace National Network

77 Summer St., Boston, MA 02110
Publication: "Campaign Report," a bimonthly newsletter

JwP is a national campaign to redirect spending of federal funds away from the military and into domestic, socially productive industries. The JwP campaign includes public education, referral to various relevant local organizations, political action around referenda, and cultural activities.

Bay State Center for Economic Conversion

2161 Massachusetts Ave., Cambridge, MA 02140
Publication: "Bay State Converter," a bimonthly newsletter

This regional group organizes political work and public education around the conversion of local military-supported industry to socially useful purposes.

High Tech Professionals for Peace

2001 Beacon St., Brookline, MA 02146
Publication: "Technology and Responsibility," a quarterly newsletter

HTPFP provides a job and information clearinghouse for science and technology professionals seeking nonmilitary jobs. They also provide an online (personal computer-accessible) bulletin board listing of such jobs. Local chapters have hosted alternative job fairs on their campuses. Student Pugwash also publishes the "Technology and Society Internship Directory," listing over 200 positions in nonprofits, federal agencies, research institutes, professional and scientific organizations, and industry.

Union of Concerned Scientists

26 Church St., Cambridge, MA 02238
Publication: "Nucleus," a quarterly newsletter

UCS includes scientists and other people concerned with the impact of technology on society. Their work involves advocacy, research, and public education. Issues include energy policy and nuclear arms limitation.

Student Pugwash

505B Second St. NE, Washington, DC 20002

A national organization of undergraduate and graduate science students devoted to examining the social and ethical implications of science and technology. They sponsor an annual conference and coordinate chapters at universities across the U.S.

Wayne Hogan

Computer Professionals for Social Responsibility

Box 717, Palo Alto, CA 94301
Publication: "CPSR Newsletter," quarterly

CPSR is an educational alliance of computer professionals dedicated to the development and public presentation of expert analyses of society's use of computer technology, particularly as it contributes to the threat of nuclear war.

Physicians for Social Responsibility

1601 Connecticut Ave. NW, Washington, DC
Publication: "PSR Newsletter," quarterly

PSR is an organization of medical doctors and others educating physicians and the public about nuclear war as the ultimate threat to health. Their work also focuses on the arms race's diversion of resources from human needs such as health care.

Committee for Responsible Genetics

186A South St., Boston, MA 02111
Publication: "geneWATCH," a bimonthly bulletin

CRG's members include molecular biologists, other scientists and nonscientists who discuss, evaluate, and distribute information about the social impacts of genetic engineering. Among their activities: submitting comments on biotechnology regulations to federal agencies and working to halt the use of genetic engineering for weapons purposes by the military.

Architects/Designers/Planners for Social Responsibility

225 Lafayette St., New York, NY 10012
Publication: "Planning and Designing for Peace," a quarterly newsletter

This group organizes against the myth of civil defense planning for nuclear war, forms networks with planners in other countries (including the Soviet Union), and emphasizes the need to redirect resources from military purposes and into areas such as housing for those who need it most.

American Public Health Association
1015 15th St. NW, Washington, DC 20005

A national public interest and member organization for public health workers that publishes issue papers on health concerns. Many of APHA's subcommittees are involved in public education on specific health issues.

National Women's Health Network
224 7th St. SE, Washington, DC 20003
Publication: "The Network News," a bimonthly newsletter

A network of women's health providers and centers. They do research and education on women's reproductive rights, occupational health issues, women's health in developing countries, and national health care.

Committee for a National Health Care Referendum
11 Garden St., Cambridge, MA 02138

A local organization working by means of a referendum initiative to educate the public on the need for a national health care system.

RAIN
3116 North Williams, Portland, OR 97227
Publication: RAIN, a bimonthly magazine

Research and education on appropriate technology and community/regional self-reliance.

SCIENCE, TECHNOLOGY, AND SOCIETY PROGRAMS (STS)

For those interested in pursuing serious study of the relationship of society and its values to science and technology, dozens of universities and community colleges offer STS programs. Some of these are oriented toward the history or sociology of science; others are concerned with the impact of science and technology on society and with the manner in which technology policy is formulated.

The universities listed below offer STS programs focusing on science policy and social impact. This list is merely a sampling. For more comprehensive directories and information on STS programs, write to the STS program at Lehigh University (address below), or to the American Association for the Advancement of Science, Office of Public Sector Programs, 1776 Massachusetts Ave. NW, Washington, DC 20036. The Lehigh STS program publishes a newsletter, "Science, Technology & Society."

Boston University
Center for Technology & Policy
Program in Technology Strategy & Policy
197 Bay State Rd., Boston, MA 02215

Carnegie-Mellon University
Dept. of Engineering and Public Policy
Baker Hall 129, Schenley Park, Pittsburgh, PA 15213

Clark University
Environment, Technology & Society Program
950 Main St., Worcester, MA 01610

George Washington University
Graduate Program in Science, Technology & Public Policy
Suite 714, Gelman Library, 2130 H St. NW, Washington, DC 20052

Georgia Institute of Technology
Technology and Science Policy Program
School of Social Sciences, Atlanta, GA 30332

Harvard University
Program in Science, Technology & Public Policy
John F. Kennedy School of Government
79 Kennedy St., Cambridge, MA 02138

Lehigh University
Science, Technology & Society Program
327 Maginnes Hall #9, Bethlehem, PA 18015

Massachusetts Institute of Technology
Program in Science, Technology & Public Policy
Political Science Dept., MIT, Cambridge, MA 02139

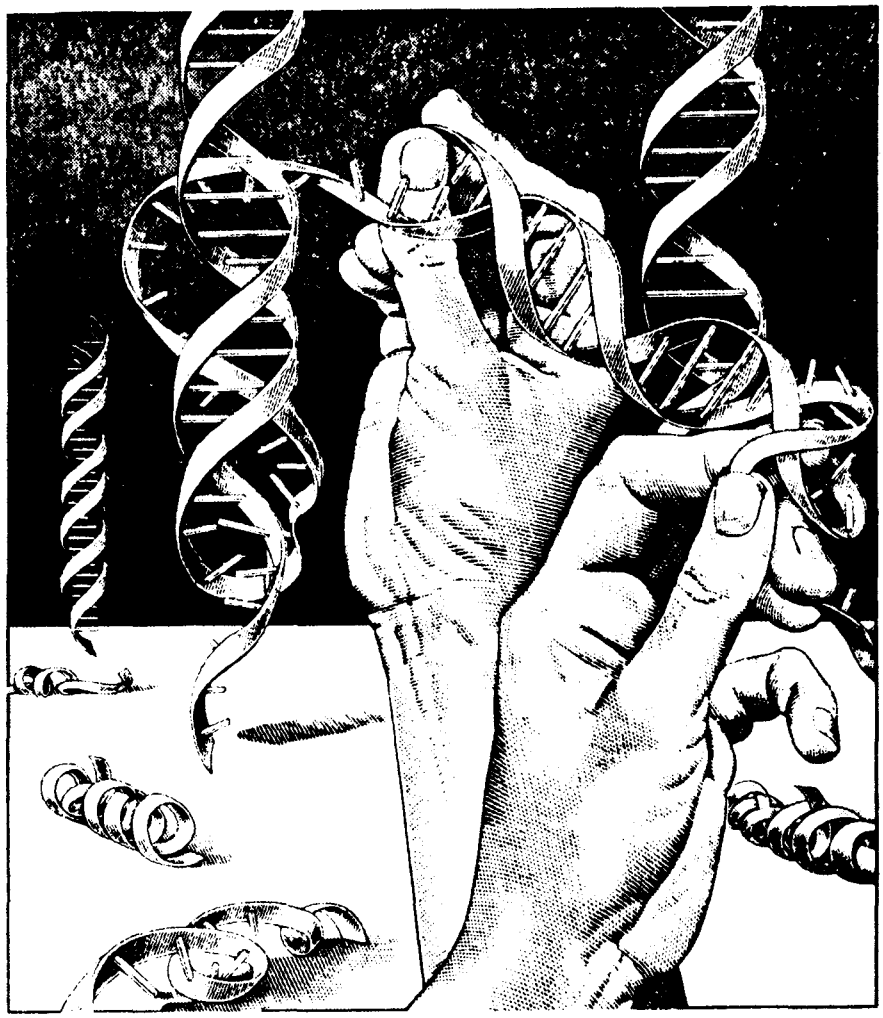
Pennsylvania State University
Science, Technology & Society Program
164 Chambers Bldg., University Park, PA 16802

Rensselaer Polytechnic Institute
Dept. of Science and Technology Studies
RPI, Troy, NY 12181

University of California at San Diego
Science, Technology, and Public Affairs
UCSD, Q-060, La Jolla, CA 92093

University of Denver
Technology, Modernization & International Studies Program
Graduate School of International Studies, Denver, CO 80208

BIOTECHNOLOGY IN EUROPE



BY BEATRICE CHASSE

Following the Footsteps of American Industry

In the United States, after a dangerous period of *laissez-faire* on the part of the government, several groups have become increasingly concerned about the eventual consequences of deliberate release experiments of recombinant DNA organisms. Similarly, in Europe some are beginning to attempt to fill the legal void that covers the products of recombinant DNA technology.

In Europe especially, little is known of the already concluded experimentation involving the products of recombinant DNA currently or soon to be on the market. There is no efficient regulatory system, obliging industry or scientists to take specific precautions. Hence little is known, even of possible accidents which may already have taken place.

The U.S. serves as a regulatory model for those countries involved in recombinant DNA research. As Skip Stiles, legislative assistant to U.S. Congressmember George E. Brown, has stated: "The whole point of attempting to put a regulatory program in place is that we have the chance to do it right this time. The nuclear physicists said, 'Trust us, there is no danger from nuclear power.' The chemists said that without pesticides

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and petrochemicals, life itself would not be possible—we should trust them too. Now, the biologists are coming forward with their powerful technology and the goverment is saying we want to see what we can do to avert environmental and public health calamities."

Unfortunately, Stiles's commentary has not been confirmed by recent events.

Using the U.S. as a Model

In April 1986, the U.S. General Accounting Office (GAO) released a report critical of U.S. Department of Agriculture (USDA) regulation of recombinant DNA (see the May/June 1986 issue of *SftP*). The GAO report termed the current situation as "inadequate and confusing," pointing out that the primary USDA biotechnology committee, the Agricultural Recombinant DNA Research Committee, has "almost no authority, meets infrequently, has no budget and meeting records show confusion as to future action."

The report also stated that USDA lacks clear policy about who should review biotechnology proposals and what rules should be applied. Furthermore, the report claimed that USDA has done little to communicate to Congress or to the public the benefits and risks of biotechnology.

As USDA scientist Dr. John Fulkerson acknowledges, the beginnings of the biotechnology era bear "striking similarities" to the agency's regulatory efforts at the onset of the pesticide era. During that period, from 1947, when the U.S. pesticide control law was promulgated, to the early 1970s when pesticide regulation was transferred to the Environmental Protection Agency, USDA scientists approved some of the most hazardous chemical substances ever manufactured, including DDT, chlordane, and EDB.

The 1976 National Institutes of Health (NIH) guidelines contained a category of "Forbidden Experiments," which included "those experiments employing deliberate release of organisms having molecules of recombinant DNA." In 1978, the guidelines were revised, changing the "Forbidden Experiments" into a category of "Prohibited Experiments," stipulating that "exceptions to the prohibition can be obtained provided that the experiments be approved by the Director of the NIH, by the notification allowing for public comment."

A second revision of the NIH guidelines in 1982 erased the word "prohibited," replacing it with "experiments necessitating a review by NIH and the Recombinant Advisory Board." The most recent revision of the original 1976 guidelines, done in 1983, stipulates that certain deliberate release experiments with recombinant plants need only the authorization of a specific advisory group.

One has to question on what scientific basis did the 1976 forbidden experiments become acceptable in 1978. The course of events suggests that the decisions were based more on economic pressure to bring products to market than on solid scientific research into ecological effects. It would be difficult to conclude that it was on the basis of scientific data gathered from deliberate release experiments that the prudence expressed in the 1976 NIH guidelines was dissipated.

Europe Follows Suit

Regulations proposed in 1981 and adopted by the European Economic Community Council envisaged construction by member states of a system of obligatory notification and registration for certain kinds of laboratory experiments involving genetic engineering. According to the European Commission, to date, only the United Kingdom and Denmark have established compulsory notification of all university experimental work with recombinant DNA.

In the Federal Republic of Germany, notification is compulsory only for research funded by the federal government. In no European Economic Community member state is industrial research regulated by a system of obligatory notification, nor are there official guidelines for deliberate release experiments or precise definitions of what constitutes deliberate release.

For example, in the midst of the elaboration of guidelines for deliberate release by the British government, researchers at the U.K.'s National Environmental Research Council's Institute of Virology received approval in March 1986 for the deliberate release of a "genetically tagged" virus in Scottish pine forests last summer, in order to study its behavior as a biological insecticide. The *Panolis Flammea* moth virus was thus released in advance of publication of guidelines by the U.K.'s Advisory Committee on Genetic Manipulation (ACGM).

The ACGM guidelines do not include compulsory notification of planned deliberate releases and are to evolve on a case-by-case basis. Neither will it be obligatory for industry to heed ACGM's advice nor even to solicit it, but ACGM officials say they expect that "nobody will risk bypassing the voluntary notification procedures."

Meanwhile, in April of this year, the government of the Federal Republic of Germany admitted that Gen-Bio-Tech, a biotechnology firm based in Heidelberg, had conducted genetic engineering experiments without registering them with the Central Commission for Biological Security (ZKBS). German officials were thus forced to admit that the stated commitment of the German biotechnology industry to voluntarily adhere to such notification guidelines was violated.

International Cooperation

On other fronts in Europe and the U.S., the development and commercialization of the products of biotechnology proceeds apace. Omnivac, the first living recombinant DNA viral vaccine, for use on livestock, was commercialized in the U.S. recently. While it has been widely documented in the press that both experimental and commercial licensing procedures within the USDA were highly irregular for this vaccine, a spokesperson from the Biologics Corporation (a division of TechAmerica and responsible for Omnivac's commercialization) has confirmed that negotiations have been underway for some time with, at least, German and French companies for the marketing of Omnivac in Europe.

Similarly, Professor Marc Van Montagu's research team at the University of Ghent, one of the most important European research centers for molecular biology since the latter half of the 1960s, has made an essential contribution to recombinant DNA research and its applications.

In an interview, Dr. Van Montagu stated: "Twenty years ago, I would have said that we scientists would never have accepted someone—a nonscientist—telling us what direction to take. But, being involved in applied research, we have discovered that there is a great deal of innovation and creativity which can be "applied." He went on to add that, "Yes, there are certain restrictions or constraints. In general, industry makes important financial decisions without worrying too much about the individuals affected; a program financed today can be terminated tomorrow. We are thoroughly aware of the precarious nature of this 'cooperation'."

Van Montagu's team has successfully transferred foreign DNA into asparagus which (unlike all other plants with which recombintant DNA manipulations have been successful) belongs to the general botanic group that also includes cereals. This team has joined with none other

ANNOUNCEMENT

International Peace Week

The first International Peace Week of Scientists will take place from November 10-16, 1986. Its purpose is to encourage well-informed discussions among scientists and non-scientists about the arms race, arms control, verification, the impact of scientific developments on international security, the economic impacts of the arms race, SDI research and the militarization of space, classified research on campus, the relationship between the military and academia, alternative forms of defense, and the social and ethical responsibilities of scientists.

The Peace Week is part of the International Year of Peace, with events throughout the world. It is endorsed by the Federation of American Scientists and UNICEF. Events in the U.S. are being coordinated by the Kansas Institute for Peace and Conflict Resolution at Bethel College, North Newton, Kansas 67117, telephone 316/283-2500. Supporters are encouraged to organize a public talk, meeting, or panel discussion in their community or local campus.

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than Advanced Genetic Sciences (AGS)—the American company responsible for the deliberate release of "ice-minus" bacteria on the roof of their building (see the May/June 1986 issue of *SftP*) in violation of Environmental Protection Agency guidelines. AGS will control 32 percent of Plant Genetics Systems, the industrial research sponsor created by this collaboration to conduct experiments in Belgium.

When asked about the use of ice-minus bacteria in Belgium, an AGS representative stated, "For the moment we consider that it would be bad publicity for AGS to carry out an experiment in Europe which has been blocked in the U.S. Since AGS has received its second authorization, we are planning to wait a while and then certainly it will be used here in Europe." Meanwhile, Plant Genetics Systems is preparing to market a commercial line of its "killer tobacco" plant: the successful incorporation of a bacterial toxin coding gene into the genome of the tobacco plant which allows it to produce its own "insecticide."

Plant Genetics Systems is also involved in a research program financed by the World Bank and in cooperation with a Brazilian laboratory. The objective is to construct a flageolet with a nutritive value equivalent to that of meat. It is a very serious problem in South America that a large part of the population nourishes itself almost exclusively with flageolets which have a rather poor protein and amino acid composition. They are now trying to incorporate a protein gene into the flageolets. According to Van Montagu, "The financial and distribution aspects of such technology transfers need still to be resolved."

The Organization for Economic Cooperation and Development (OECD) has only recently approved a series of draft guidelines on biological security, which are to be discussed during 1986 by its 20 member states for eventual adoption in 1987. Although the socioeconomic interdependence of science and industry in this area makes it increasingly difficult to effectively assess the risks that come with biotechnology's "progress," it is important that we continue to try. International agreements of any kind which set standards to regulate this emerging field are a helpful start.

The consequences of the misregulation of pesticides are well documented. But one question remains: have the reasons for this misregulation been sufficiently exposed to avoid the same situation from developing with the products of recombinant DNA technology?

LOW-TECH FOOD TECHNOLOGY

Alternative Protein for the Poor

BY DAVID KENNEDY

The New Protein Information Project is a small nonprofit organization based in Murfreesboro, Tennessee that is trying to develop cheap alternative protein sources for the poorest people in rural parts of the tropics. An estimated half-billion children under twelve suffer from protein-calorie malnutrition today. Approximately 500,000 children become blind each year because they do not have enough vitamin A in their diets.

World hunger problems won't be resolved by "techno-fixes" such as genetic engineering or single cell protein. Long-term solutions will involve major redistribution of power between the wealthy and poor nations, and between the wealthy and the poor within hungry nations. While the gross maldistribution of resources that causes most hunger cannot be blamed on technology, some agricultural and food processing technologies foster dependency and exploitative economic relationships.

When Third World countries raise monoculture export crops, they become increasingly dependent on wealthy countries for farm chemicals and machinery. This problem can be especially severe with food technology. For example, corn is deficient in the essential amino acid lysine. Lysine can be synthesized from by-products of nylon manufacture and used to fortify corn meal. Some of the drawbacks with this kind of high-tech approach are:

- A lysine plant costs about $6 million to

Mara Loft

Panel from the Great Pasta Libre Mural

(with apologies to Diego Rivera, Mexican muralist)

build and requires highly trained technicians to run.

- The raw materials, catalysts, centrifuges, and gauges all must be imported from wealthy countries. The U.S. trade embargo against Nicaragua brings home the vulnerability of poor countries who depend on rich ones for essential spare parts.

- Only cornmeal produced in large centralized mills will get fortified. The rural poor, who are by far the most likely to be malnourished, continue to grow and grind their own corn. The spread of benefits between the rural and urban people is thus increased.

The New Protein Information Project is working on low-tech food technology that is worthless to the rich, but can increase productivity in poor villages. Our current focus is on two extremely nutritious new foods: leaf protein concentrates (LPC) and okra seeds.

Leaf protein concentrates can be make by running leaves thru a meat grinder, squeezing out the juice with a truck jack press, and heating the juice to 180 degrees F. At that temperature, a green cottage cheese-like curd forms. One ounce of that curd when dried provides more than half of the USRDA of protein for a four to six year-old child, about two-thirds the recommended calcium, and over 100 percent of the needed vitamin A, iron and vitamin E. Per acre, LPC can produce up to four times the protein of soybeans, and 10-20 times that of raising meat. The fibrous residue from LPC production is an excellent feed for cows or goats.

We are also promoting mature okra seeds as a potential new protein source. Sifted okra seed meal contains about 33 percent protein and 32 percent oil. A tasty tofu-like curd can easily be made from okra seeds. They are also very rich in calcium, iron, niacin, and vitamin E. Okra is an easy-to-grow, pest-resistant, and high-yielding crop, well suited to most of the tropics.

One of the best ways to introduce these two new foods has been in the form of dried pasta. Pasta making is a simple food technology that can incorporate a large percentage of LPC, okra seed curd, or soy flour into convenient, desirable, high protein foods. With about twice the protein of normal spaghetti, LPC, okra, or soy-fortified spaghetti is more nutritious than beans, yet requires far less cooking. This saves time and can reduce the environmental damage associated with cooking fuel: mainly soil erosion from over-cutting of firewood and air pollution from smoke.

We have introduced simple hand-operated pasta making machines at four nutrition projects in Mexico and Nicaragua and they have been well-received. We are working on several designs for pasta machines capable of greater output, but still very cheap, simple to operate, and dependable. We are trying to lower equipment costs by modifying inexpensive grinders and jacks to extract leaf juice and to extrude pasta. Bicycles and small electric motors are being adapted to these processes. We are also looking at ways to adapt the small commercial wet-corn mills in use in many Central American towns.

Another important aspect of the New Protein Information Project is food education. In researching possible protein sources, it became obvious that there is a crisis of access. The distance between the scientists developing information about food and the malnourished people in tropical villages is immense. We felt the need to dig out relevant information about food, translate it into simple language, and make it available to people actually working on nutrition projects in the Third World.

One step we are taking in this direction is a simple computerized program that will enable nutrition workers to quickly assess the quality of a potential protein source and to combine them efficiently. The program will also provide information on the yield and cost of different protein sources and their usefulness as sources of vitamin A, iron, and calcium. These nutrients are frequently lacking in the diet of poor people. This program will be available as a diskette or in the form of a booklet.

So far, the best educational tool we have found is the hands-on workshop. By showing people exactly how the food is processed and letting them operate the equipment, the introduction of these radical food technologies is rapidly demystified. In addition to Central America, we have been giving many workshops for American civic groups and schools. We are trying to increase the clarity and impact of these workshops in an effort to raise understanding of world hunger and to encourage simple direct actions both here and in the developing world.

The New Protein Information Project is looking for financial and technical support. Help with testing and analysis of food products used in this project is also needed. Their address is Route 5, Box 10-A, Murfreesboro, TN 37130, telephone 615/895-2841.

David Kennedy has worked on nutrition and alternative protein projects in Mexico and Nicaragua.

NOT WITHOUT US

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But we see our entire world, particularly its universities and science and engineering facilities, being increasingly and ever more profoundly militarized every day. "Little" wars burn in almost every part of the earth. (They serve in part to test the high-tech weapons of the "more advanced nations.") More than half of all the earth's scientists and engineers work more or less directly in military institutions or in institutions supported in the main by the military.

Scientific and technical workers cannot escape their responsibility to inquire about the end use of their work.

It is only our already deeply internalized habit of prettifying our language that permits us to speak in terms of weapons and weapons delivery systems at all, when we are, in fact, discussing atomic explosives and hydrogen bombs. Those aren't weapons! They are mass murder machines and mass murder machine delivery systems—and that is how we should speak of them, clearly, distinctly and without evasion.

When one once recognizes that a nuclear mass murder machine is nothing other than an instant Auschwitz, an instant extermination camp, an Auschwitz without railroads or Eichmans or Dr. Mengeles—but an Auschwitz just the same—can one then work on systems that steer devices of this kind toward living cities? That is what I ask my colleagues. They must earnestly ask themselves such questions and deeply consider responses they find in themselves. Their answers will finally manifest themselves in their actions—concretely in what they do every day.

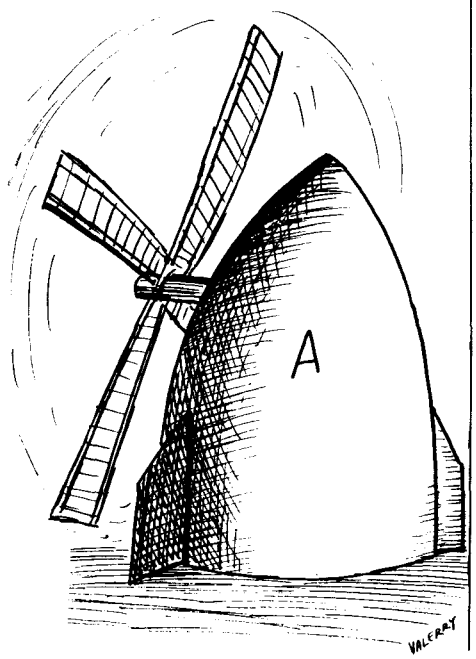
Probably the most pandemic mental illness of our time is the almost universally held belief that the individual is powerless. This self-fulfilling delusion will surely be offered as a counter argument to my thesis. I demand, do I not, that a whole profession refuse to participate in the murderous insanity of our time. "That cannot be effective," I can already hear it said. "Yes, if no one actually worked on such things... but that is plainly impossible. After all, if I don't do it, someone else will."

First, and on the most elementary level, I must say that the rule, "If I don't do it, someone else will," cannot serve as a basis of moral behavior. Every crime imaginable can be justified on its basis. For example, "If I don't steal the sleeping drunk's money, someone else will."

But it is not at all trivial to ask after the meaning of effectiveness in the present context. Surely, effectiveness is not a binary matter, an either/or matter. To be sure, if what I say here were to induce a strike on the part of all scientists with respect to weapons work, that would have to be counted as effective. But there are many much more modest degrees of effectiveness toward which I aim.

I think it was George Orwell who once wrote, "The highest duty of intellectuals in these times is to speak the simplest truths in the simplest possible words." For me, that means first of all the duty to articulate the absurdity of our world in my actions, my writings, and with my voice. I hope thereby to stir my students, my colleagues, and everyone to whom I can speak directly. I hope thereby to encourage those who have already begun to think similarly, and to be encouraged by them, and possibly rouse all others I can reach out of their slumber.

Courage, like fear, is catching! Even the most modest success in such attempts has also to count as effectiveness. Beyond that, in speaking as I do, I put what I here discuss on the public agenda and contribute to its legitimation. These are modest goals that can surely be reached.



But finally, I want to address such larger goals as, for example:

- Ridding the world of nuclear mass murder devices and perhaps also of nuclear power generators.

- So reordering the world that it becomes impossible ever again to convince workers of one country that it is a necessity of life that they feed their families on the flesh and the blood and the tears of people of other countries. (That is, unfortunately, the fate of many workers today—and not only of those who earn their daily bread in armaments factories, but equally that of those of us whose daily work is to sharpen high-tech weapons.)

- So reordering the world that every human being has available to him or herself all material goods necessary for living in dignity. (I have often heard well-meaning people say that if we apply technology, especially computer and communications technology, wisely we may reach this goal in perhaps fifty to a hundred years. But we can reach it sooner, and without waiting for technological advances. For the obstacle is not the absence of technology, it is the absence of political will!)

I once heard Elie Wiesel say, "We must believe the impossible is possible." I understood that in two different ways. First, had we been able to believe that "the land of the poets and the thinkers" could give birth to human extermination factories which could compete in efficiency with the automobile factories of Detroit, we might not have had to experience Bergen Belsen. The impossible horror proved possible and became reality.

Second, it was "impossible" in the America of only 150 years ago to abolish the slavery of the black people. After all, the entire economy of America's South was built on cotton. Cotton could neither be planted nor harvested without the unpaid toil of thousands of human beings out of whose wretchedness the plantation master could squeeze his profit. Nevertheless, at first only a few farseeing men and women, dreamers all, in Massachusetts and later many more citizens, realists among them, came to believe the impossible was possible, that the slaves could be freed and slavery ended. And it became possible. And it became reality.

The impossible goals I mentioned here are possible, just as it is possible that we will destroy the human race. None of us can alone achieve the one nor prevent the other. But each of us must believe "it cannot be done without me."

I beg you all: think about what you actually accomplish in your work. Think about in what context and to what end what you do will be used. Think about whether you are in the service of life or of death.

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Newsnotes

CONTINUED FROM PAGE 6

The Smithsonian conference sought to unite topics of shrinking genetic diversity among plant life, insects, and animals, topics that are rarely discussed together at one gathering. As such, the conference seems to have been a success. Few solutions were offered, but awareness of the extent of the problem seems surely to be growing.

A few examples taken from a wide range of species illustrate the extent of the problem. For instance, if present levels of deforestation continue in Latin America, says one reputable estimate, within the next century that region will lose 15 percent of its plant species and 12 percent of the 700 bird varieties in the Amazon basin.

For agriculture, the centers of diversity so important for breeding new crop varieties exist only where the crop plants have been able to grow in the wild over thousands of years. These centers are shrinking and are often threatened. Coffee, for example, grows wild with a good store of genetic diversity in only one place: Ethiopia. With that country's drought and famine problems, in addition to the threat to the Ethiopian people, the world's genetic store of coffee is also threatened.

While many scientists claim that the diversity of life on earth is largely unmapped (Wilson has stated that we don't know it even to the nearest order of magnitude), they fear that we are losing as many as 2,000 species a year, some before they have even been identified and classified by scientists.

—Seth Shulman

THE HEAT'S ON HOT SHOWERS

In our September/October 1984 issue, we reported on data which pointed to the inadequacy of government drinking water standards for toxic chemicals. Ingestion turns out to be not the only route for these substances to enter the body. In 1984, public health researchers highlighted the significant contribution of skin absorption of drinking water to the body's burden of toxic chemicals.

Now it seems that inhalation, the other major route of exposure to toxics, is an important factor as well. *New Scientist* (Sept. 18, 1986) reported on findings presented at the September meeting of the American Chemical Society in Anaheim, California. Scientists from the Environmental Protection Agency reported on a five-year study which measured 600 people's exposure to toxic chemicals indoors and outdoors. Among the seven activities associated with high indoor exposure to pollution was taking a hot shower.

University of Pittsburgh researchers corroborated these findings. Taking long, hot showers—and to a lesser extent, baths—exposes one to more toxic chemicals than drinking the water. That's because the chemicals evaporate out of the water and are inhaled. Fifty to eighty percent of the trichlorethylene and chloroform, hazardous chemicals commonly found in drinking water, vaporize. The longer and hotter the shower, the more chemicals build up in the air—four times higher for a ten-minute shower than for one lasting five minutes. Other hot-water sources—sinks, boiling kettles, dishwashers, and washing machines—can spread water vapor throughout the house where it can be inhaled by those inside.

Other activities associated with high levels of ingested, absorbed and inhaled toxics include smoking, living with a smoker, driving, filling up the gas tank, visiting a dry cleaner's, using air fresheners or moth crystals, and exposure to toxic solvents, paints, and spray cans stored in the home. For those hooked on taking a hot shower every day, researchers suggest switching to short, cold--or at least cooler—showers, and leaving the bathroom door shut but opening a window to let the vapor escape.

—Joseph Regna

Letters

CONTINUED FROM PAGE 7

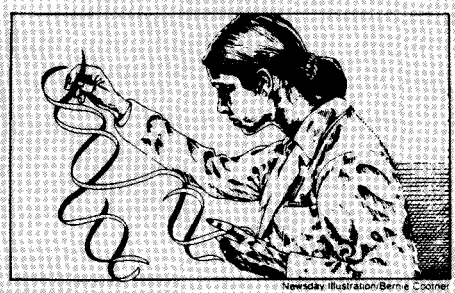
technological developments, yet neither regard the general course of scientific discovery as inherently evil nor its applications as inevitable.

In reading one issue of your magazine, I've gained many valuable insights and even a little hope. Being twenty years old in 1986, I could use a lot of both at this point. You know, my generation is not as bad as they say, we just have a lot on our shoulders. There are those of us who will not stand by passively watching the disappearance of socially responsible attitudes and practices from our future society.

A student of microbiology, I recognize the importance of my role in that society, in assuring that science actually serves the people, and not vice versa. And my friends and I will be around for another half century or so. So sign me up—I'm interested.

—Paul Steinberg
University of California at Santa Barbara

BIOTECHNOLOGY CONFERENCE



Newsday Illustration/Bernie Coolner

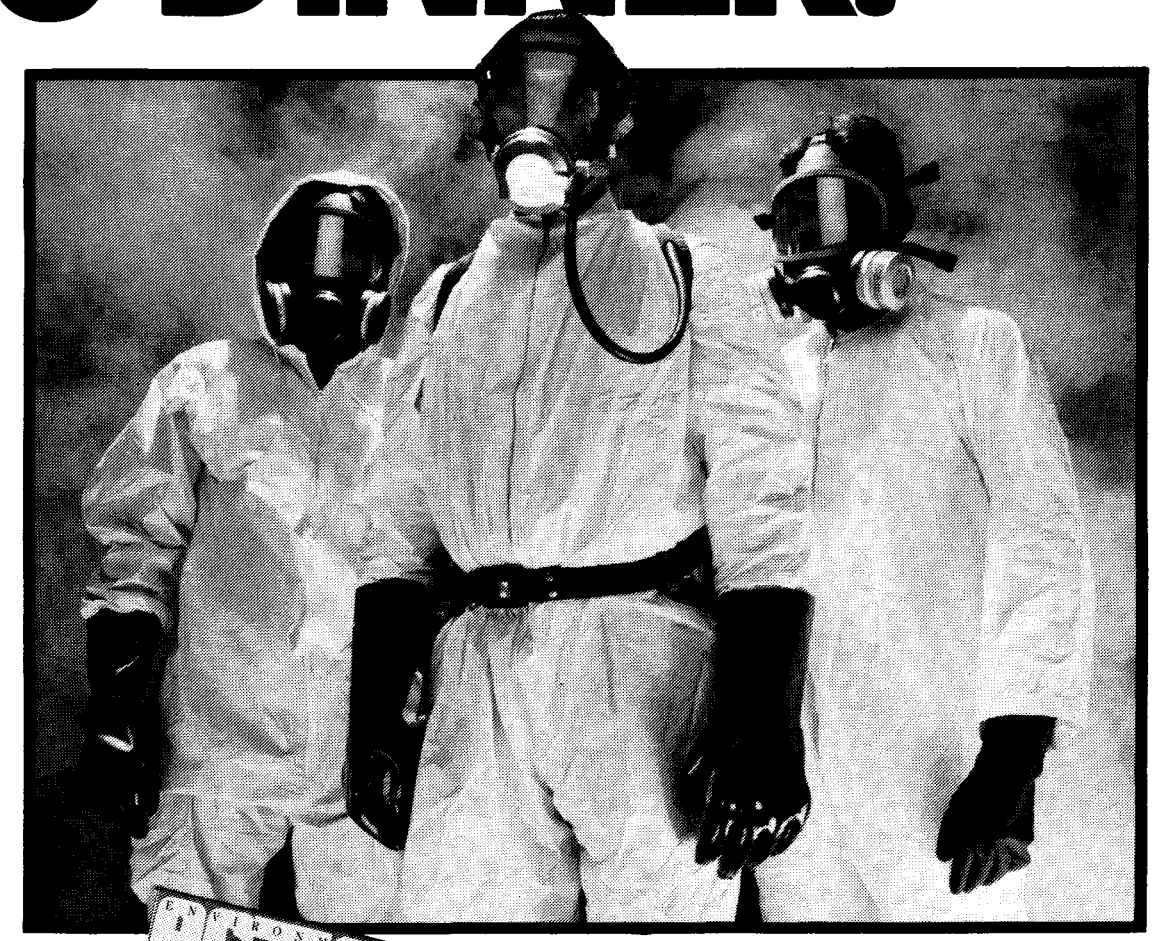
Creating a Public Agenda for Biotechnology: Health, Food and the Environment is the title of a conference sponsored by the Committee for Responsible Genetics at the Marriott Twin Bridges Hotel in Arlington, Virginia on November 13 and 14, 1986.

This is a working conference for individuals and groups interested in encouraging biotechnology to develop in a democratic manner, toward socially responsible objectives. Briefing sessions will cover reproductive technologies, genetic engineering of crops and animals, environmental releases, human gene therapy and screening, agricultural biocontrol methods, workplace hazards, disease prevention and treatment, Third World agriculture, and biological warfare.

Discussions will focus on public interest criteria and policies for biotechnology. Workshops will address strategies, tactics, and development of public agendas for different issues. Speakers include Kevin Danaher, David Dickson, Jack Doyle, Sen. Albert Gore, Ruth Hubbard, Ralph Nader, Jeremy Rifkin, Victor Sidel, and William Winpisinger.

To register or for more information, contact the Committee for Responsible Genetics, 186A South St., Boston, MA 02111-2701, telephone 617/423-0650.

GUESS WHO'S COMING TO DINNER.



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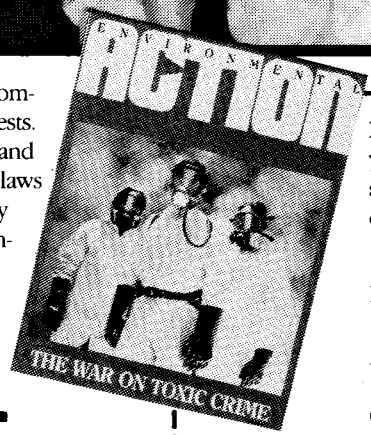

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