

SPECIAL ISSUE • RETHINKING ENVIRONMENTAL & OCCUPATIONAL CANCERS

# SCIENCE FOR THE PEOPLE

Vol. 21 No. 1

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A scanning electron micrograph (SEM) of a cell, likely a cancer cell, showing a large, textured nucleus and a complex network of cytoplasmic filaments and organelles. The image is in grayscale and has a high-contrast, detailed appearance.

*The  
Environmental  
Cancer Debate  
Updated*



## THE ENVIRONMENTAL CANCER DEBATE: WHERE ARE WE NOW?

Science for the People has published many articles over the years arguing or assuming that environmental pollution is responsible for an increased incidence of cancer and that occupationally-induced cancer is a major part of the problem. This assumption has become increasingly controversial in recent years. First the British epidemiologists Sir Richard Doll and Richard Peto and, more recently, Bruce Ames have contended that environmental pollution and occupational exposure do not contribute significantly to this country's cancer burden.

A prominent group of progressive scientists, led by Dr. Samuel Epstein and labeled by Edith Efron as "apocalyptic," have criticized the Doll/Peto/Ames position in the pages of *Science* and elsewhere. They have attacked its very real scientific flaws and defended the legitimacy of the conservative assumptions used in regulatory decisionmaking.

But while Epstein and others have launched a "traditional" progressive counterattack, other activist and progressive scientists have remained strangely silent. *SftP* itself has largely ignored the raging debate.

This issue was conceived to remedy that silence. While the articles that follow review some of the more important aspects of the ongoing debate, the authors were selected to present a wide range of less often heard progressive perspectives that go beyond criticizing specific assumptions or defending current regulatory approaches. The question the authors were asked to address was not just whether Doll and Peto and Ames' science is "right" or "wrong" but what policy conclusions should be drawn from what we now know about the nature and extent of occupational and environmental cancers.

Each author's answer is different, but this collection of articles taken as a whole points in the direction of a different progressive position on why and how to attack the problem of environmental and occupational cancer. It suggests we should be less concerned with overall cancer rates than with clusters of excess cancer that seem to be related to environmental or occupational exposure. All of the recommendations have a common goal: empowering workers and community residents to fight against exposure to industrial carcinogens.

—from the introduction

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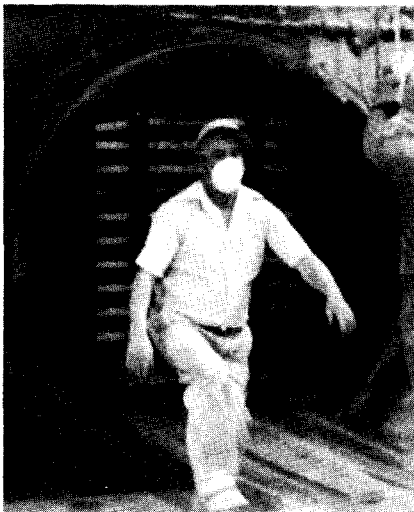
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## SCIENTISTS STRIKE 1969-1989

In the sixties, America discovered her poor. She awoke to the pollution of her air and water, to the congestion of her cities and to the sterility of the ever-increasing advertisement and consumption of "technological miracles." (As young scientists), we awaited action on these problems. We expected America to negotiate arms control on the basis of "stable deterrent" and bring resources to bear on the solution of environmental and social problems. But instead, America undertook to bring democracy to Viet Nam. We watched with increasing disbelief as America brought technological expertise to an underdeveloped nation in the form of napalm, B-52's, anti-personnel weapons, strategic hamlets. THE WAR CONTINUES...

We feel that the time has come for scientists and engineers to assert responsibility for the fruits of their research. We must come to maturity and realize our potential power in a technological society, and the moral burden we assume.

(We urge) you to join us in making a symbolic gesture on March 4. Along with thousands of other scientists across the country, we ask you to withhold your research work for one day—not because your work is, in itself, objectionable, (it may be of great social importance) but in order to protest the whole context in which it is done.—

With these words, a group of MIT students called on scientists and engineers to step back from their immediate technical concerns, and ask in whose name and for what purposes the efforts of their minds and hands were taken and used. The research stoppage was the idea of three graduate students in physics: Joel Feigenbaum, Alan Chodos and Ira Rubenzahl. It grew generally out of the politics of the time, namely the increasing brutality and scale of the U.S. involvement in Vietnam coupled with a deeper understanding of the racial and economic disparities within this country, an understanding gained by the civil rights and Black Liberation struggles earlier in the decade. More specifically, it came from the students' questioning of their own responsibilities, and wondering what would happen if scientists refused to work until the Vietnam War was over.

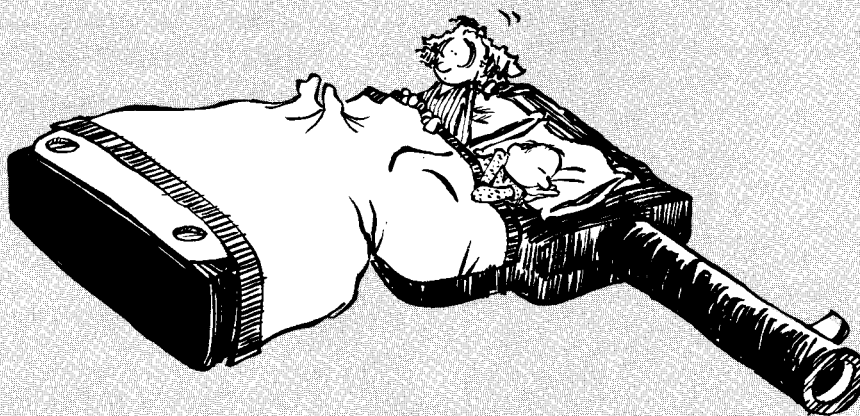
Although the work-stoppage was student-initiated, it rapidly became a joint student, faculty and staff effort. Faculty members brought an air of legitimacy to the struggle and were able to reach a wider audience. The coalition was not without tension, however. One particular conflict involved a letter to Dr. Lee DuBridge, science advisor to President Nixon. DuBridge had said that universities should assist the Defense Department. The Science Action Coordinating Committee (SACC), the students' organizing vehicle for the March 4th activities, wanted to respond to DuBridge by publicly urging closer ties with the Departments of HEW, HUD and Transportation. Faculty on the March 4th planning committee felt these issues were beyond the scope of the steering committee's mandate. It was agreed that SACC would solicit signatures separately. Because of this and similar incidents, faculty and students agreed they would work through two separate organizations, SACC and Union of Concerned Scientists (UCS). Following this decision, the two groups were able to cooperate more easily.

The final program was a series of lectures and "teach-outs" over the course of March 3-8. A Saturday was chosen for the last day so scientists uncomfortable with the idea of a work stoppage could attend. Similar actions were held at other universities throughout the country.

We have gained much from the March 4th actions, including the legitimization of the idea of collectively stopping work on certain projects (witness the pledge not to work on SDI research). But twenty years later, we are still facing many of the same dilemmas: what is scientific research used for? How much of our research funds are defense-related? What are the responsibilities of scientists? The environmental and social crises we face now are at least as grave as those of the late 60s. Where do we go from here?

Scientists around the country are planning activities to mark the twentieth anniversary of the March 4th research stoppage. For more information or to get involved, contact:

Chris Moore  
Society for Awareness in Science  
Dept. of Physics, Clark Hall  
Cornell University, Ithaca, NY 14853



John Klossner

## THE RIGHT TO BEAR ARMS

According to a *Mayo Clinic Health Letter* reprinted in *Consumers Union News Digest*, about half of United States households own firearms. This should not cause any of us to sleep easier. A recent study in King County, Washington found the chances of the gun turning against household members over 200 times as likely as its use against an

intruder. A non-resident friend, acquaintance or relative was 13.5 times more likely to be killed than a stranger, and the murder of a resident was 18 times more probable than an intruder's. The greatest threat was suicide; it was 166 times more likely that a member of the gun-owning household would kill him or herself than an outsider.

## APPEN ACTION ALERT

**T**he Asia-Pacific People's Environment Network (APPEN) is beginning a campaign in the Asia-Pacific region to address the problem of ozone layer depletion. APPEN calls for a "concerted effort from all concerned groups to establish ourselves in a stronger position in the world community to highlight the implications of the use and misuse of fluorocarbons."

Ozone layer depletion is thought to result from the interaction of chlorofluorocarbons (CFCs) and stratospheric ozone. Even a small loss of ozone seriously diminishes the ozone's protective capacity, and is expected to lead to a higher incidence of radiation-induced skin cancers, eye damage and immune system disorders in humans, as well as serious and unpredictable ecological changes. The depletion of the ozone layer over the Antarctic has been widely reported; although insufficiently publicized, the phenomenon has also been observed over the Northern Hemisphere.

International efforts to reduce industrial production of CFCs, widely used in refrigeration, liquid cleaners and plastic foams, led to the Vienna Convention for the Protection of the Ozone Layer held in Montreal in September, 1987. The



John Klossner

resulting agreement, signed by 24 nations, called for a 50% reduction in the production of CFCs.

Activists from Sahabat Alam Malaysia, coordinator of APPEN, note that Malaysia never signed the Montreal protocol. While pushing their government to do so, they are concerned that the treaty is far too weak to protect the ozone layer. Some US and British scientists believe that only a 85-90% reduction in CFC production will stop ozone layer depletion, while under the terms of the treaty, CFC output is permitted to increase 10% until 1990. Major CFC producers, including the US and Britain,

agreed to cut back production 35% while continuing to increase exports to the third world. APPEN expresses a final fear that multinationals could build CFC plants in non-signatory countries and export the products to the developed world.

APPEN has developed a four-point program for activists in Asian-Pacific countries. They urge activists to call on their governments to:

1. Establish a program which phases out the use of CFCs over a ten year period. This is permitted under Article 2, Clause 11: "Parties may take more stringent steps than those required by the Protocol";

2. Be wary of a loophole (Article 2, Clause 5) which permits developed countries to export CFCs to the Third World, thereby maintaining or increasing production while decreasing domestic consumption;

3. Join other countries in calling for an early scientific review of the Protocol, in the hopes of leading to a stronger international consensus to phase out all use of CFCs;

4. Work to protect the tropical rain forest, and reduce their use of fossil fuels.

For more information on APPEN's efforts to protect the ozone layer, contact APPEN, c/o Sahabat Alam Malaysia, 43 Salween Rd. 10050 Penang, W. Malaysia.

—adapted from the APPEN Action Alert

## BRAZILIAN ECOLOGIST MURDERED

**O**n Christmas day, in a silent service, Chico Mendes, one of Brazil's leading advocates of rain forest protection, was buried in the small town of Xapuri. He had been killed by a single shot fired at point-blank range the previous Thursday. For weeks, Mendes had announced that local cattle ranchers who opposed his environmentalist efforts had hired gunmen to kill him. No one was arrested for Chico Mendes' murder.

As a rubber tapper and leader of the Union of Rural Workers of Xapuri, a small forest town near the Bolivian border, Mendes had seen vast tracts of rain forest felled by owners of huge

ranches to make way for range land. To save the forest, Mendes' union banded together with other environmentalists and the radical Workers' Party (PT) in a program to set aside twelve reserves totalling more than five million acres. These reserves, scattered through five Amazonian states, would be protected from encroachment by ranching and other destructive activity. Instead, the forests would be used for production of rubber, resins and medicinal plants, thus benefitting local peasants rather than large landowners.

Mendes' efforts gained him an international reputation. In 1987 he was honored by the U.N. Environment Program with the Global 500 award, given annually to the world's 500 most prominent environmentalists.

His efforts also earned him the enmity of Brazil's powerful ranchers and landowners. Mendes' campaign to

preserve the rain forest was a threat to the ranchers' practice of seizing and destroying forests at will. It was known that gunmen, who often kill with impunity in Brazil's wild Amazon region, were hired by ranchers to silence Chico Mendes.

Environmentalists and the Workers' Party have organized a campaign to halt crucial foreign loans to Brazil until Mendes' killers are brought to justice. Throughout the world, environmental organizations and such major lenders as the World Bank are pressuring Brazil to improve its performance on conservation. In December, Chico Mendes was murdered, but his death has given new energy to his cause.

—Michael Filisky

*As this issue goes to press, Darci Alves da Silva, 21, a Brazilian landowner, is being held in connection with Mendes' murder.*

## PILGRIM: 1 PEOPLE: 0

**A**t 6 PM on December 30, the Pilgrim nuclear plant in Plymouth, Massachusetts reached criticality for the first time since its shutdown 32 months ago. The NRC and Boston Edison officials were quietly jubilant. The plant, now at 1% power, is expected to be in full operation by May.

Not everyone was happy. 27 activists were arrested protesting the restart.

The plant has been plagued by technical and management problems throughout its history, beginning with radiation releases from faulty fuel rods in the early seventies. Pilgrim's many technical difficulties are exacerbated by a management that has insufficient "respect for radioactivity," according to a report released earlier this year by the Massachusetts Public Interest Research Group. The report notes Pilgrim's historically poor record on worker exposure to radiation. The shutdown hasn't corrected the problem; the Critical Mass Energy Project has documented 4,710 incidents of worker exposure to radiation in 1987—the highest number for any plant in the country.

Community opposition to the plant has been mixed. In November, Massachusetts voters overwhelmingly rejected a ballot initiative to prohibit commercial production of electricity by means which produce nuclear waste—effectively closing Pilgrim and Yankee Rowe nuclear power plants, the only ones in the state. However, the utility companies outspent the Massachusetts Citizens for Safe Energy, the coalition of environmental and citizen's groups that sponsored the initiative, by a 20-1 margin, turning the campaign into a "greenhouse referendum," with the debate presented as a choice between "clean" nuclear energy and dirty fossil fuels.

Elected officials, even long-time opponents of Pilgrim, notably Governor Michael Dukakis, were reluctant to embrace the initiative. Their efforts instead concentrated on attacking the inadequacies in Pilgrim's evacuation plans, including the proposed closing of the bridge providing access to Cape Cod and the insufficient attention paid to the needs of children and the differently abled. Washington is forcing the state to change tactics. Following the November election, President Reagan issued an executive order giving the Federal Emergency Management Agency (FEMA)

power to approve emergency evacuation plans—breaking a pledge he had made in 1984. Dukakis is now looking to state health officials for help. A five-town area around Plymouth is being investigated for elevated cancer and leukemia rates. State Health Commissioner Deborah Prothrow-Stith has promised to close the plant if the excess cancers can be linked to suspected radiation releases.

The Bush victory was a clear boon to the nuclear industry, as his appointment of John Sununu as chief of staff attests. Its effects can be felt at Pilgrim and beyond. The NRC gave Long Island's Shoreham plant the right to bypass local and state approval of evacuation plans—long a sticking point for the plant's startup. The NRC also approved evacuation plans for the long troubled Seabrook plant in New Hampshire. Massachusetts Attorney General James Shannon is expected to appeal the decision.

Perhaps most frightening is Reagan's second, less publicized, executive order, permitting the federal government to

take over a nuclear plant in the event of a national security emergency. It is not yet clear how broadly this will be defined. FEMA's power in this and in emergency evacuations may be enforced through the new State Defense Forces (SDF)—volunteer state militias now found in 21 states. The SDFs were authorized in 1956 to replace the federalized National Guard. According to Peggy Moore and Mike Meyer of the St. Louis Pledge of Resistance, in 1984, in a nationwide readiness exercise, Reagan authorized FEMA to take control of the military, the National Guard and the SDFs. The SDFs were to be responsible for "internal security," detaining critics of the U.S. administration. As part of the exercise, arms were distributed to SDFs. In Louisiana, the SDF retained half of the arms and ammunition, apparently forwarding these to the contras.

For more information about SDFs, contact Peggy Moore, c/o St. Louis Pledge of Resistance, 438 N. Skinker, St. Louis, MO 63130.

## TESTING 1-2-3

**T**esting for HIV, the virus thought to cause AIDS, may soon be a five-minute procedure. The Cambridge BioScience Corporation's new test uses recombinant technology to test for specific HIV antibodies. It is expected to receive FDA approval soon.

The news came only a few weeks after the Massachusetts Supreme Court decided that insurance companies may require HIV tests for health, life and disability insurance—without the informed consent of the applicant—and only a month after California voters passed Proposition 96, a measure requiring HIV tests for anyone charged with a sex-related crime or who "interferes" with police, fire, or emergency medical personnel. It also permits mandatory testing of prisoners without confidentiality guarantees. (California voters defeated an even more repressive question, Proposition 102, which would have ended anonymous HIV tests and mandated tracing of sexual partners for those found seropositive.) Testing has become routine in Illinois, where couples are required to be tested for HIV in order to be granted a marriage license. In a quiet show of resistance, almost 20,000 couples may have chosen to marry out of state to avoid the test.

The emphasis on testing over treatment has angered many AIDS activists. Some charge that the FDA licensing process favors diagnostic tests over drugs. In addition, companies considering marketing AIDS related products are far more likely to invest in tests than treatments; the former is a guaranteed and safer market. This latest addition to diagnostic testing causes greater concern than usual among activists because the ease of testing may make it more difficult to ensure confidentiality of test results, limit the availability of counseling, and, at worst, may encourage calls for mandatory testing of the general population.

AIDS activists around the country have pressured the FDA and drug companies to release life-saving drugs. In the largest action to date, almost 1500 activists took over the FDA's headquarters in Maryland last fall. 176 protestors were arrested. Small groups of protestors unfurled banners reading "Silence Death," staged a die-in, and set up a "pharmacy" to sell black-market AIDS drugs. The activists demanded the release of some 100 drugs held up in the FDA's drug approval process, the opening of the drug trials to more of the 1.5 million people infected with HIV, particularly those usually excluded (women, I-V drug users, people of color, prisoners, hemophiliacs, children) and a guarantee

## EPA'S NEW ADMINISTRATOR

**B**usinesses can meet their social responsibility and benefit greatly by integrating the support of conservation into their commercial strategies." So writes William K. Reilly, president of the World Wildlife Fund, in the introduction to its *Conservation and Business Sponsorship* brochure. Chevron Corporation, for instance, "found WWF's 'Future in the Wild' program an ideal way to increase its identity among families nationwide," boasts the brochure. Mutual of Omaha, Ralph Lauren, Rolex, even Jaguar have all teamed up with WWF to tap into the "popular appeal" and "enormous audience" of conservation to sell their products.

Reilly's willingness to put conservation up for sale might have remained merely another cynical sign of the times had he not been appointed in December to head

the Environmental Protection Agency in the Bush Administration. As EPA administrator, Reilly will have vastly expanded opportunities to offer industry while still retaining his environmentalist mantle. But who is Reilly, and what does he stand for?

Reilly has none of the sleazy, abrasive qualities of Reagan's early environmental appointees, but like Bush, he is more at home talking corporate responsibility with industry executives than leading the victims of toxic spills in the battle for appropriate recourse. Since 1973, he has been president of The Conservation Foundation, a Washington based environmental think tank. While the organization prides itself for its "moderate" and "responsible" positions, many environmentalists consider it merely an industry front. This reputation is not unfounded. Last September, for instance, the chairmen of sixteen Congressional committees and subcommittees sent a letter to Lee Thomas, then administrator of EPA, asking him not to go ahead with plans to pay The Conservation Foundation to direct a 2 year study of the Superfund program. The Congressmen were concerned with reports that the Foundation

was planning to supplement EPA's \$2.5 million contribution to the project with funds solicited from a coalition of chemical and insurance companies. No matter how individual projects are funded, the Foundation is heavily indebted to industry coffers. Its list of corporate sponsors is a shocking catalog of oil, chemical and paper companies, utilities, banks, and conglomerates.

Reilly is one of the leading proponents of what he calls the "third wave" of environmentalism. In essence, he believes that strict regulatory penalties and deadlines, derisively called "command and control regulation" have outlived their usefulness. "Industry knows those (environmental) laws aren't going away," says Reilly. "And environmentalists have come to realize that its going to take cooperation from industry to get laws working." Environmentalists, he believes, should spend less time protesting, boycotting, and screaming, and more time exploring the "costs" and "benefits" of the various "options," and making sure that environmental programs are "effectively and efficiently implemented."

—John Green

of freedom of information on all AIDS drug trials.

There are some signs that these dissenting voices are being heard. In late October, the FDA streamlined its drug approval process somewhat. In early January, the National Cancer Institute testified before President-elect Bush's newly formed subcommittee of the President's Cancer Panel, urging the FDA to take further steps: permitting earlier human trials on new drugs and allowing more relaxed protocols in early stages of drug trials. The new panel's task is to improve the process for evaluating drugs for AIDS and cancer.

Given more effective treatments, a fast and accurate HIV test could be a boon. Patrick Mulcahey, of San Francisco's Project Inform, notes that even now treatment can prolong the lives of people with AIDS once they have been diagnosed—assuming they can get access to effective pre- and post-test counseling and compassionate, timely health care. However, at a time when a Texas judge can choose to impose more lenient sentences on a murderer because his victims were gay men, it is clear that bigotry is alive and well. If we want to say the same for people with AIDS, we will need much more than a test.

## UNCLE SAM MAY FACE LIFE SENTENCE

**N**igeria will no longer serve as a dumping ground for toxic wastes. The Nigerian government has declared that anyone found guilty of dumping toxic wastes, or encouraging others to do so, will face a life sentence. The declaration

comes after an incident earlier this year; 4,000 tons of toxics from Italy were dumped in Koko, a town in southeastern Nigeria.



John Klossner



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but what policy conclusions should be drawn from what we now know about the nature and extent of occupational and environmental cancers.

### REGULATING CARCINOGENS

The "traditional" progressive position in the environmental/occupational cancer debate involves a delicate balancing act. On the one hand, progressive scientists argue that such cancers are indeed a very serious problem and that industrial carcinogens are horribly under-regulated. On the other hand, they generally support the method by which regulatory limits are set, in

regulate enough carcinogens. This is true enough and the reason is obvious: little is known about the vast majority of industrial chemicals acting individually, and almost nothing about the potential synergistic effects of the toxic soup to which most workers and urban dwellers are exposed. Even less is known about the extent of actual exposure.

An equally troubling problem is that those substances which are regulated may not be regulated in a manner adequate to protect public and worker health. This point is made most clearly in Ken Silver's review of recent work by Drs. Barry Castleman and Grace Ziem, who have

# Rethinking Environmental & Occupational Cancers

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particular the assumption that there is no threshold for carcinogenicity and the legitimacy of using animal data and extrapolating potencies from high doses to low. The party line is that regulatory agencies are generally going about their tasks the right way—they just aren't doing enough.

The defense of current regulatory practice with regard to carcinogens is obviously important, since it is all we have and is constantly under attack. Both Howard Frumkin and Franklin Mirer and colleagues review the arguments for using animal data and making extrapolations from data on exposure to high doses. As Mirer et al. observe, "(a) chemical which" has qualified as a human carcinogen is a special creature." If we are limited to reliance on evidence of cancer in humans, "we can either give up and go home or look for other indirect sources of evidence."

Nevertheless, activists should not overlook the very real inadequacies of current regulatory practices. The usual criticism focuses on the scope of regulation: the federal and state governments do not

carefully documented the extent to which occupational exposure limits are based on unpublished, non-peer-reviewed data provided by corporate scientists.

Such biased data can then be plugged into the ever-popular risk assessment process to produce either a justification for not regulating an industrial discharge or a regulation that permits potentially harmful exposures. Progressives have never liked risk assessment for, as Howard Frumkin notes, "(i)mplicit in the practice is the assumption that tradeoffs are inevitable and that some cancer risk may be justified by economic or other benefits." Daniel Wartenberg's article reviews some of the weaknesses of quantitative risk assessment.

### ASKING QUESTIONS

Debates over the adequacy and meaning of data on occupational and environmental cancer, and how to use that data in setting regulations, will undoubtedly continue unabated. But some of us who work on issues of environmental and occupational exposures do not see these debates as

*Stephanie Pollack is an environmental attorney in Boston.*

I N T E R O D



addressing what is troubling us. We need to step back from the question of how to regulate carcinogens and ask why.

I, for one, am torn. On the one hand, even after all the caveats are weighed, the expected epidemic of industrially-caused cancer simply does not seem to have occurred. On the other hand, I frequently encounter situations where workers and community residents are being exposed to unacceptably high levels of carcinogens. I believe that there is still a need to battle the industries—and regulators—who refuse to take the problem seriously. And while I acknowledge that voluntary behaviors—particularly smoking—are major contributors to cancer rates, I remain uncomfortable with those Samuel Epstein has called the “lifestyle academics,” who tell us to watch what we eat and smoke and forget about what we breathe at work and in our communities.

The questions activists such as myself ask ourselves are more practical and political than scientific. Are we right to remain concerned about environmental and occupational cancer? How can we justify our concern? What should we be doing about the problem that we believe continues to exist?

We ask these questions against a very different background of assumptions than were made a decade or two ago. Let us assume—as Rick Hester and Howard Frumkin do—that there is no massive cancer epidemic associated with occupational and environmental exposure to industrial chemicals. Let us accept that smoking and lifestyle account for more cancer than we once thought and that exposure to occupational and environmental carcinogens accounts for less. What are the implications of this realization for progressive and activist scientists?

## A NEW CONSENSUS?

There is no one answer to this question. But while the viewpoints differ significantly among authors, this collection of articles taken as a whole points in the direction of a different progressive position on why and how to attack the problem of environmental and occupational cancer.

None of the articles conclude that the appropriate response to the “non-epidemic” is to ignore those cancers that are, in fact, associated with occupational and environmental exposure. These authors are asking a different question from those whose concern is how best to allocate cancer research dollars. The question is not how much cancer is attributable to occupational and environmental

exposure but how much of the damage from industrial discharges—inside and outside the workplace—is attributable to carcinogens. While we cannot ignore teratogens and neurotoxins, it is clear that the battle against carcinogens is one that is well worth fighting.

Admittedly, the objective is different than we once thought. Now we are less concerned with overall cancer rates than with clusters of excess cancer that seem to be related to environmental or occupational exposure. We are concerned about the risk to identifiable individuals, especially in the workplace where, as both Scott Schneider and Frank Mirer and colleagues point out, a sub-population of workers is exposed to unacceptably high risks. As Rick Hester concludes, environmental and occupational cancer clusters represent “not an insignificant amount (of cancer), and, in principle, all of it is preventable.”

A common theme among the authors is the need to focus on preventable cancers. Frank Mirer and his colleagues sum it up best: “We should control the risks we can control.” What “we” can control does not, however, mean only what we as individuals can control. Unlike those who focus only on smoking and diet, industrial activists see exposure to industrial carcinogens as something within our control.

It is, in fact, more appropriate to focus on exposures to industrial carcinogens than on smoking and diet because the former are not only preventable but involuntary. As Howard Frumkin notes, even if we are talking about less than 10% of all cancers, “that amounts to a lot of avoidable deaths, concentrated for the most part among unwitting victims from the working class. We are right to be profoundly concerned.”

## A CALL TO ARMS

These authors, then, are confident that there are important reasons for continuing to battle against environmental and occupational exposure to carcinogens. We are admonished not to exaggerate the extent of the problem and urged not to ignore smoking as a cancer-causing behavior, but never advised to ignore the plight of those—no matter what their number—who are involuntarily exposed to industrial carcinogens.

The sometimes unstated reason for the progressive scientist’s concern with involuntary exposure, even to small numbers of individuals, stems from viewing the occupational/environmental cancer debate in the context of a political and economic system that empowers large corporations and disempowers workers

and community residents. “We see the struggle against pollution,” Joseph Regna explains, “not only as an end in itself, but also as a means for achieving a more fundamental objective.” The fight is not only part of the larger battle against preventable cancers, but part of a broader political agenda to, in Rick Hester’s words, “expose the corporate greed at the root of many outrageous instances of excess cancer among workers or in communities.”

There is, as always, less consensus on what to do than on the need to act. Joseph Regna urges progressives to stop playing the “numbers” game. Daniel Wartenberg, on the other hand, believes that quantitative risk assessment, the traditional tool used by corporations and regulators to justify inaction, can be used to empower communities and workers. Frank Mirer and colleagues would take a somewhat different approach, downplaying risk assessment and focusing on risk management, since their experience is that when people really evaluate what needs to be done, “the extent and costs of controls turns out to be much less than industry feared during risk assessment.”

Another approach is to change not only the inputs to the regulatory process but the process itself, as California voters did in 1986. Diane Fisher describes Proposition 65, an innovative regulatory scheme adopted by California voters to ensure that environmental toxins do not contaminate drinking water supplies and that people and workers are warned of potential exposures.

All of these recommendations have a common goal: empowering workers and community residents to fight against exposure to industrial carcinogens. This is a very different goal than the earlier effort to lower overall cancer rates, but it strikes me as just as important and more consonant with the proclivities of many progressive scientists. Battles over cancer research spending and how to translate science into regulation are often fought primarily by experts and professionals in Washington, D.C. But the new perspective on environmental and occupational cancer frees us from the burden of stopping a cancer epidemic and focuses our attention on specific workplaces and communities where people are in danger. This new focus presents a host of opportunities for more meaningful and participatory efforts to fight against what Rick Hester calls “outrageous misconduct” by people who have put profit before the health and safety of their neighbors (or their workers).”



U C T I O N

# *The Environmental Cancer Debate*



**UPDATED**

## BY RICK HESTER

In the past ten years, there have been a series of major studies and reports on the magnitude of the environmental cancer problem in the U. S. and the lines of debate have sharpened considerably. The position taken by *Science for the People* in an early special issue (May/June 1980), and in subsequent articles on water quality (July/Aug 1983), asbestos (May/June 1986), the right-to-know (Jan/Feb 1984) and many others, has been that there are major excesses of cancer caused by exposure to human-made chemicals or industrial processes. Meanwhile, the mainstream scientific opinion in the U.S. and Great Britain has been shaped by articles authored by Sir Richard Doll and Richard Peto,<sup>1</sup> and more recently, by Bruce Ames and his collaborators.<sup>2</sup> The thrust of these authors has been that there really is no significant contribution to the cancer burden from environmental pollution, and the occupational component is quite small (2-8%). What are the implications of this wide difference in perspective on the magnitude and sources of the cancer problem in the U.S.? Perhaps a good place to start is with the data on which the arguments are based.

### DOLL AND PETO'S ANALYSIS

The main work on the topic of cancer causes in the U.S. in the past ten years was commissioned by the Office of Technology Assessment of the U.S. Congress and carried out by the eminent British epidemiologists, Sir Richard Doll and Richard Peto. It involved an exhaustive review of cancer mortality data from 1933 to 1978, although other sources of data such as cancer incidence rates from the National Cancer Institute's Surveillance, Epidemiology and End Results program, are incorporated in the document. They focus particularly on cancer deaths among whites under the age of 65 for reasons that might be summarized as data quality issues. These two authors are among the world's foremost experts in the field of cancer research, and Richard Doll in particular has conducted some of the leading research on the association between cigarette smoking and lung cancer. He was quite politically courageous in the early part of his research career, and reportedly was denied entry into the U.S. at one point because of his politics.

*The Causes of Cancer* is really an encyclopedic work, incorporating as it does a wide range of epidemiologic evidence for risks from tobacco, diet, food additives, medicines, and geophysical factors, as well as occupational exposures

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*Rick Hester works for a state public health agency. He is writing under a pseudonym. Paul Billings is a human geneticist and physician at Harvard Medical School.*

and general environmental pollution. It has been attacked by Devra Davis and her co-authors for relying too narrowly on data on whites and those under 65, which ignores important differences in occupational exposures to non-whites and sidesteps a discussion of some important trends in cancer mortality in older age groups.<sup>3</sup> In a recent article, Davis emphasizes increases in mortality from brain cancer and multiple myeloma in the elderly and offers as a possible explanation "exposure to carcinogenic



The beautiful, mysterious shapes in these photos are embryonic chicken cells transformed by the rous sarcoma virus. They were obtained by electron scanning microscope by Lan Bo Chen at Harvard Medical School.

substances in the workplace and the general environment."<sup>4</sup>

Although many other progressive authors have taken on various aspects of the Doll-Peto arguments, or have suggested that the real cancer epidemic from environmental exposures has not yet occurred, none have seriously undermined their position as the dominant explainers of the pattern of cancer in the U.S. Virtually every author on the topic has to acknowledge their work, although it is used very differently on the right and the left of the political spectrum.

My view is that their work is valid although limited, essentially along the lines of the critique by Devra Davis and her co-authors. One major weakness of the critique of Doll and Peto's analysis of cancer mortality is their failure to incorporate trends in "competing causes of death." Briefly, this means that an analysis of the pattern of cancer mortality must also encompass patterns of mortality from other major diseases such as heart disease and stroke to be a full representation of a dynamic process. In a simplistic sense, one of the reasons why age-adjusted or age-specific cancer mortality rates in the elderly may be rising is because other major causes

of death are declining (rapidly) and we all have to die of something. In a discussion of these issues among progressive public health people a couple of years ago, the question was turned around from "Is there a cancer epidemic?" to "Why haven't cancer death rates gone down as rapidly as heart disease and stroke rates?" Perhaps that is really a better way to frame the debate, since there are inevitably going to be limited data to prove that there is a real epidemic, defined as a 5% annual increase in cancer incidence or mortality. The terrain then shifts from arguments about the availability or quality of data to the question of priorities and research agenda as set by the "Cancer Establishment" (see, for example, *Re-Thinking the War on Cancer*<sup>5</sup>).

### THE AMES-EPSTEIN DEBATE

Another major series of articles has appeared in the past few years on the nature and relative potency of carcinogens. The principal authors around whom the debate has been carried on have been Bruce Ames and his colleagues on one side and Sam Epstein and Joel Schwartz on the other. Most recently, the debate has been carried out in the pages of *Science*.<sup>6</sup> Ames and co-authors put forward a new index of carcinogenic potency (which they call HERP, for Human Exposure/Rodent Potency) and then proceed to a few dozen examples of human exposure to environmental pollutants, pesticide residues, natural pesticides, food additives, drugs and occupational exposures. The point of the exercise is to "put the possible hazard of man-made carcinogens in proper perspective..." and to show that levels of "synthetic pollutants in drinking water and (of) synthetic residues in foods suggests that this pollution is likely to be a minimal carcinogenic hazard relative to the background of natural carcinogens."<sup>7</sup>

In particular, Ames' ranking scheme suggests that daily exposure to contaminated well water in Woburn, Massachusetts is several orders of magnitude less hazardous than a daily raw mushroom, a daily glass of wine or a worker's average daily exposure to formaldehyde. Ames was subsequently interviewed on "60 Minutes" about his views and they have been widely cited in the popular press. Epstein and Schwartz, in a rejoinder published a year later, take Ames to task on both his science and his politics. Their extended comments are co-signed by a list which comprises a virtual "who's who" of progressive environmental scientists in the U.S. They cite alternative interpretations of animal data and recently published data on trends in U.S. cancer incidence and mortality from the SEER program to counter the thrust of Ames' work. Here again, the debate is largely on technical grounds. My reading of the cancer epidemiologic data is that there is still no convincing evidence for a



chemically-induced cancer *epidemic* even though there are certain types that may be increasing in some areas because of historical exposures.

But the main contribution of this exchange is to focus on the question of preventable vs. non-preventable cancers. Here is where the popular perception of cancer is most at odds with the mainstream scientific opinion.

In Woburn, Massachusetts, for example, the most organized expression of public opinion is not against the natural carcinogens in mushrooms or the potential hazards represented by drinking wine. The motivating force that has driven individual citizens and a group (FACE) to confront state and Federal bureaucracies and two of the largest multinational corporations in the U.S. is the possibility that recklessly handled industrial solvents may have caused leukemia deaths in children. Whether Bruce Ames and his colleagues, or Richard Doll and his supporters in the scientific establishment like it or not, people are moved to act on what they perceive as "outrageous misconduct" by people who have put profit before the health and safety of their neighbors (or their workers). The fact that Ames campaigned against a citizens' initiative to control carcinogens in California, known as Proposition 65, because it takes the approach that chemicals regulated under its provisions are "guilty until proven innocent," shows how fundamentally at odds with the average citizen he has become.

### RECENT CANCER FINDINGS IN MASSACHUSETTS

In the past five years, there has been a great deal of attention paid to the pattern of

cancer in relation to known environmental exposures, largely through the use of a statewide Cancer Registry set up for that purpose. For example, the continuing monitoring of childhood leukemia incidence in Woburn has shown that the cluster of cases brought to light by citizens and parents in the 1970's has continued into the 1980's. The leading hypothesis is still that exposure to contaminated water from wells G and H is the cause of some if not all of this excess. Similarly, a five-town area around the Pilgrim Nuclear Power Plant has experienced nearly a doubling of the types of leukemia most related to ionizing radiation exposure about ten years after releases of large amounts of radiation because of faulty fuel rods. Although it will never be possible to reconstruct exactly who was exposed and at what level, certainly a likely explanation for the leukemia excess seems to be the emissions from the power plant.

In examining occupational data submitted to the Cancer Registry, it appears clear that people employed in the shipyards in Quincy and Boston have experienced up to ten-fold greater incidence of mesothelioma (a tumor caused uniquely by asbestos), and significantly higher respiratory cancer rates than other working people in the state. Also, a significant excess incidence of male bladder cancer in Pittsfield, on further examination, was revealed to be concentrated in one division of the General Electric plant there. These findings are not unique to Massachusetts, but they point up the fact that there are pockets of excess cancer that seem to be clearly related to environmental or occupational exposure, some of which may be continuing right into the present. In these situations, the science is not hypothetical but directly related to human suffering, much of it preventable. The

scope of these situations is not large compared to the thousands of cases that occur statewide that have no particular environmental determinants, but that there are any such situations is inexcusable.

### IMPLICATIONS FOR SCIENCE FOR THE PEOPLE

The implications of these recent debates and mainstream scientific positions on cancer and the environment on *Science for the People* are that we need to continue to demand an accountable science that is rooted in the same values that led to our formation some twenty years ago. We may have taken positions in these pages that were not fully cognizant of the limitations of the data about cancer, or that exaggerated the magnitude of the effect of chemical exposures in the total scheme of things. Whether occupational and environmental exposures are responsible for 20% or 40% of the cancer burden, the point is that it is not an insignificant amount and, in principle, all of it is preventable.

The overall import of our work has been to advance criticisms that expose the corporate greed at the root of many outrageous instances of excess cancer among workers or in communities. We have emphasized the ways in which multinational corporations have put profits before people with some very deadly consequences, both in the U.S. and in the Third World, and have drawn links between individual corporate behavior and the particular political-economic system from which the behavior arises. Our contributions have generally not been to advance the science about the issue of the environment and cancer as much as to look at the broader context and political processes within which the issue is played

## THE BIOLOGY OF CANCER

BY PAUL BILLINGS

**W**e have known for many years that environmental factors including chemicals, radiation and viruses could promote cancer development. Furthermore, we have known that some families were afflicted with inherited forms of cancer indicating genetic factors might be involved in tumor formation. Recent data from animal and human cancer studies suggest a theory for understanding this interplay of environmental and genetic influences in cancer development.

At the cellular level, cancer is manifested by abnormal cell growth and movement. The theory proposes that a cell must undergo at least two genetic changes to

be transformed from a normal cell to a cancer cell. These alterations often seem to involve genes which normally participate in cellular proliferation. Though they also participate in normal cellular physiology, these genes are called **oncogenes** because their abnormal function or expression leads to tumor formation. Some oncogenes may act by disrupting the normal activity of other genes.

Though oncogenes seem to produce cancer by being activated too much or at the wrong time, a second class of genes—the **tumor suppressor genes**—are absent (or do not function) in tumor cells but are present in at least one normal copy in non-cancerous cells. This suggests that these genes normally inhibit cancer producing

events. When these genes' function is disrupted by mutation or when they are lost completely from a cell, that cell is likely to become cancerous.

The multiple events required for a tumor to develop may involve environmental factors, inherited changes in onco/tumor suppressor genes or both. Chemicals and radiation directly alter the DNA code of genes, which can result in abnormal function of oncogenes or tumor suppressor genes allowing cancer to develop. Viruses have been found which have DNA sequences similar to that found in oncogenes. Infection with these viruses may mimic abnormal oncogene activity or may disrupt normal endogenous oncogene function. Finally, in some families

out. As Dick Levins put it in our 100th issue, "we approach the pesticide not only as a molecule that kills some insects, but at the same time as a commodity and as the embodiment of the approach of a particular intellectual community of researchers, and we trace the effects of pesticides through their devious ecological and social consequences."<sup>8</sup>

In the future, our challenge will be to link more directly the effects of new chemicals and industrial processes on workers with their effects on communities, to point out the commonality of interests between workers and community residents in opposing corporate greed and disregard for the environment, and to continue to critique the diversions and obfuscations of the scientific apologists for the multinational companies.

## NOTES

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3. Devra L. Davis, K. Bridbord and M. Schniederman, "Cancer Prevention: Assessing Causes, Exposures, and Recent Trends in Mortality for US Males, 1968-1978", *Teratogen Carcinogen Mutagen 2*: 105-35, 1982.

4. Devra Davis and J. Schwartz, "Trends in Cancer Mortality: US White Males and Females, 1968-83," *Lancet*, March 19, 1988.

5. J. Bailer, "Rethinking the War on Cancer," *Issues in Science and Technology*, Fall, 1987.

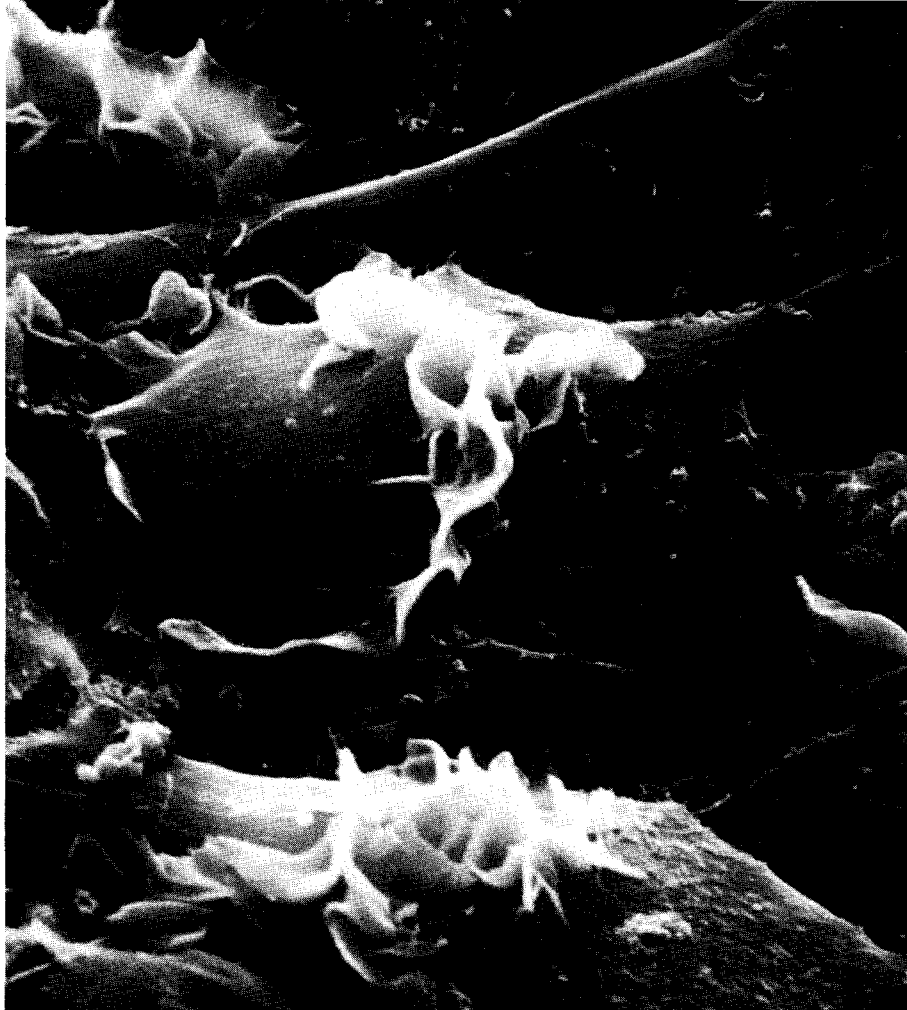
6. The debate has been carried out between Ames, et al, op. cit. and Sam Epstein and Joel Schwartz, "Carcinogenic Risk Estimation," *Science*, Vol. 240, May 20, 1988.

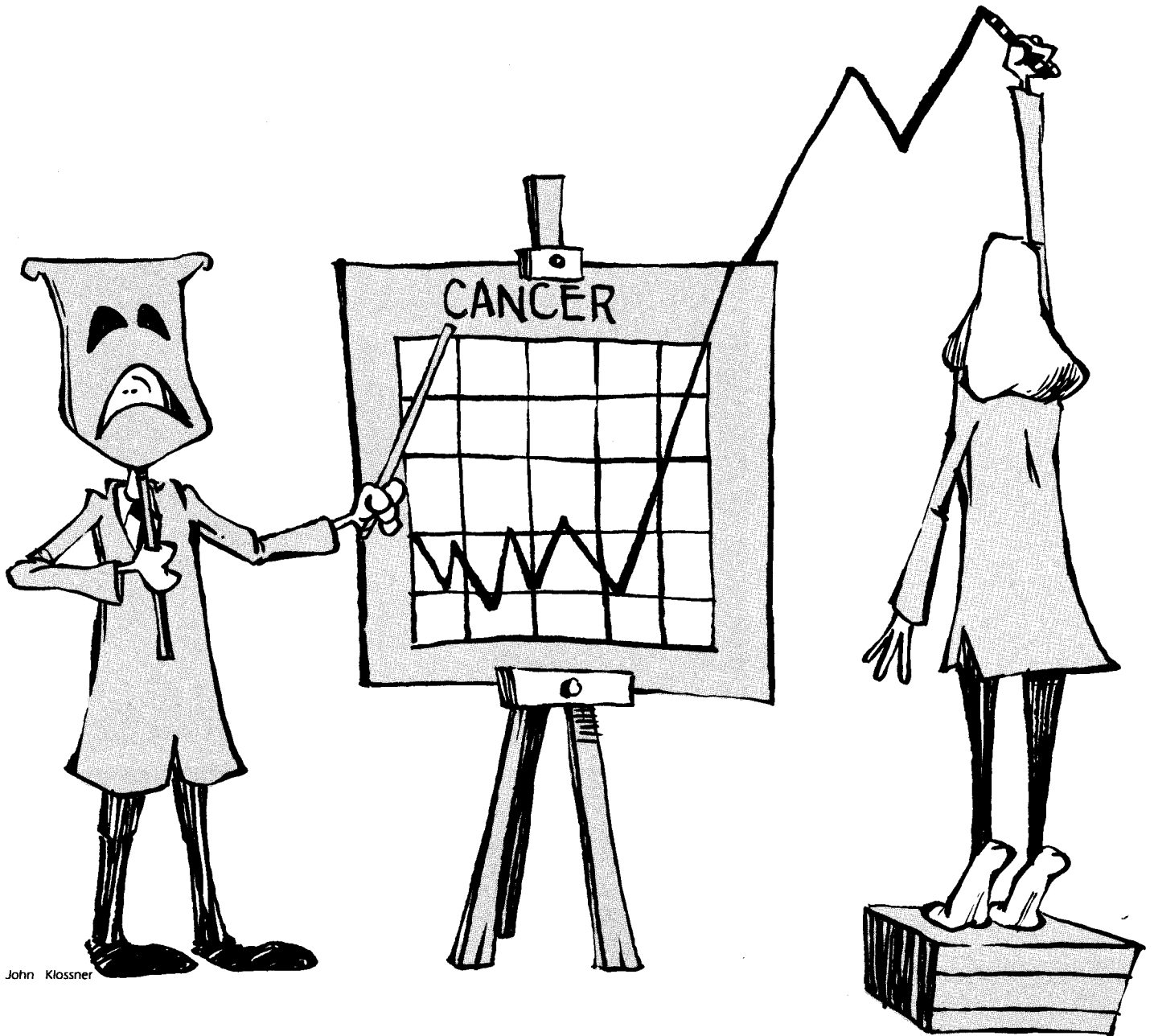
7. Ames, et al, p. 277.

8. Richard Levins, "Creating People's Science," *Science for the People*, July/August 1985.

burdened with hereditary forms of cancer, genetic alterations in oncogenes or tumor suppressor genes have already occurred prior to environmental exposures. Cells containing these inherited alterations may be particularly sensitive to environmentally mediated cancer producing agents.

Evidence is accumulating that cancer is produced by a disruption in normal genetically regulated cellular physiology. Though some individuals may have inherited alterations in genes which make them susceptible to cancerous events, environmental agents can also produce or mimic genetic events that result in tumor development. Almost everyone—irrespective of their genetic inheritance—will develop cancers given enough noxious, cancer producing environmental stimuli.





John Klossner

# *Occupational & Environmental Cancer*

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Radical Chic and Mau-Mauing  
The Carcinogens



## BY HOWARD FRUMKIN

Is cancer on the rise or not? What proportion of cancers is due to occupational and environmental causes? What is the role of tobacco smoking? When identifying carcinogens, how should in vitro and animal evidence be utilized? When regulating carcinogen exposures, how should low levels of exposure be approached? And finally, what is the significance of quantitative risk assessment? These six separate questions have each been central to the debate over the threat posed by occupational and environmental cancers.

As progressive scientists, environmentalists, community groups, and labor unions have rallied around the issue of environmental and occupational cancers for the last three decades, a paradigm has developed which can be seen in the popular press, in the pages of journals like *SftP* and *Health/PAC Bulletin*, and in books like Samuel Epstein's *The Politics of Cancer*. Industry, the paradigm posits, releases thousands of toxic substances into workplaces, communities, and the general environment; these substances are potent carcinogens; an epidemic of cancer is resulting. This paper, like this issue of *SftP*, will attempt to examine some of the issues raised by that paradigm. Specifically, I want to raise a caution: that despite a coherent political framework, some progressive scientists have made arguments not adequately grounded in facts, and that we need to remedy that problem.

### CANCER RATES: UP OR DOWN?

The first question, regarding cancer rates, should be the simplest. Larry Agran, in *The Cancer Connection*, provided one answer: "In truth, what we are witnessing is the unmistakable emergence of a national cancer epidemic. An epidemic of frightful proportions. A cancer pox. The numbers and the trends point clearly to the calamity that is already upon us."<sup>1</sup> Samuel Epstein, in *The Politics of Cancer*, expressed a similar view. He wrote that "there has been a real and absolute increase in cancer incidence and mortality during this century." He called cancer a "killing and disabling disease of epidemic proportions," and dubbed it "the plague of the twentieth century."<sup>2</sup>

The answer that emerges from reviewing data is considerably less dramatic. According to the most recent American Cancer Society report, mortality is increasing for some cancers, decreasing for others, and stable for still others.<sup>3</sup> Among women, lung cancer mortality is rising,

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colorectal, uterine, and gastric cancer mortality are declining, and breast cancer mortality is stable. Mortality from leukemia and ovarian and pancreatic cancer rose until about 1960 and then stabilized. Among men, lung cancer mortality increased rapidly during the last five decades, although that increase has recently begun to slow. Prostatic cancer mortality is increasing slightly and gastric cancer mortality is falling, but no other sites show major changes. Combining men and women, and excluding lung cancer, overall cancer mortality since 1950 has shown a 13 per cent decline.<sup>4</sup> (All these figures are age-adjusted.) Brain cancer and multiple myeloma mortality show increases among those aged over 75<sup>5</sup> (although accurate data may be elusive in this age category<sup>6</sup>). Of course, mortality data must be viewed circumspectly. They are based on death certificates, which are often inaccurate, and changes over time may reflect changes in diagnosis, treatment and other factors.

Incidence data show prominent increases in lung cancer among both men and women. In addition, there are slight increases in breast cancer among women and in prostatic cancer among men.<sup>7</sup> Bladder cancer, a type related to chemical exposures, has increased in incidence; leukemia incidence increased until the last decade, when it began to decline. In sum, certain site-specific cancers do appear to be increasing, particularly in selected age groups, as shown in disaggregated incidence and mortality data. This is certainly a serious concern. However, if there is an "epidemic" of cancer, it probably involves only lung cancer.

### CANCER FROM OCCUPATIONAL AND ENVIRONMENTAL EXPOSURES

What proportion of cancers can be attributed to occupational and environmental causes? During the 1960's, Higginson estimated that up to 90% of cancer is environmentally induced, based principally on geographic comparisons.<sup>8</sup> Of course, "environmental" in this context includes all extrinsic factors, such as diet, tobacco, and sunlight. Much of the debate has focused specifically on occupational causes of cancer, and we can review that narrower debate here.

In the context of political and scientific struggle during the 1970's, both high and low estimates of the workplace contribution to cancer emerged. An important document was prepared and circulated by the National Cancer Institute and other agencies in 1978, but never published.<sup>9</sup> In this report, a group of prominent federal agency scientists noted the cancer risk ratios that had been observed in occupational cohorts heavily exposed to any of six substances. They applied these risk ratios to all workers currently exposed to the substances, and they projected numbers of cancers that would result. From these

calculations, they estimated that 20-40% of all U.S. cancers were (or would soon be) attributable to occupational factors. This argument was widely criticized after its release.<sup>10</sup> It ignored differences in dose between the study cohorts and the currently exposed workers, and it generated numerical predictions that diverged dramatically from observed rates. Despite these problems, many of us at the time accepted the high estimates and cited them uncritically. Three years later, Doll and Peto published *The Causes of Cancer*, in which they estimated that about four percent of cancers are attributable to occupational exposures.<sup>11</sup> Their analysis considered specific cancers with known occupational etiologies, estimated the proportion of each ascribable to workplace exposures, and summed these. These authors, too, have been criticized, along several lines.<sup>12</sup> They excluded data for nonwhites and for people over 65 years of age, they accounted only for known carcinogens and excluded potential (and animal) carcinogens, and they did little to approach the issue of possible synergistic effects from exposure to multiple carcinogens. However, it is unlikely that these problems caused more than a twofold error in their estimates, and the four percent estimate accords well with prior work.<sup>13</sup> In summary, the weight of current evidence suggests that something under 10% of cancer is occupational in origin, despite higher claims by some progressive scientists.

Of course, that amounts to a lot of avoidable deaths, concentrated for the most part among unwitting victims from the working class. We are right to be profoundly concerned. We should be alert to revelations of new occupational and environmental carcinogens that may alter our quantitative estimates. But in the meantime, we only weaken our case when we stretch the numbers!

### THE SMOKING CIGARETTE

A third question, regarding the role of tobacco smoking, poses a different sort of problem. Progressives are justifiably concerned that undue focus on lifestyle factors, including smoking, may divert attention from such involuntary exposures as occupational carcinogens. (This is a strategy amply exploited by corporate interests in workplace health promotion programs, "prostituted" epidemiological studies, and similar efforts.) It may seem more congruous to our political views to target environmental toxins rather than smoking as our major environmental health concern. And at the level of practice, many of us have undoubtedly squirmed uncomfortably at union or community meetings while people raged against relatively low-level chemical exposures while filling the meeting room with cigarette smoke.

The facts are fairly clear. Tobacco is by



John Klossner

far the major single environmental cause of cancer, not only in the general population, but in most working populations as well. Accordingly, we have good progressive analyses of the social causes of smoking and of the political economy of tobacco. The "question," then, is one of emphasis. There has been a tendency among some researchers and activists in occupational and environmental health to minimize the role of smoking in causing cancer, to overstate the relative role of chemical toxins, and to justify this all more in political terms than in scientific terms. Certainly, there are compelling reasons to struggle against toxic exposures in the workplace and community. But there are equally compelling reasons to

acknowledge honestly that smoking causes a lot of cancer.<sup>14</sup>

### ANIMAL STUDIES

The fourth question concerns the role of *in vitro* and animal evidence in establishing carcinogenicity. These methods have been controversial for at least two reasons. First, we attempt to extrapolate human cancers from nonhuman data. Second, we attempt to extrapolate low-dose outcomes from high-dose data. In both efforts, we need to make assumptions that are difficult to verify.

The standard progressive position has been to argue that animal carcinogens

"may be" human carcinogens, and that public health prudence requires that we regulate based on this "conservative" assumption. That is a sensible approach, and it has been adopted by most regulatory agencies worldwide. The corporate response has been one of cynicism. Bacteria and animals, it is argued, are metabolically distinct from humans (so extrapolation is unjustified). In some cases, test animals are so resistant to cancer that many species must be tested before just one demonstrates a response (so the stuff probably isn't carcinogenic in humans). And animals typically are tested with extremely high doses, far higher than typical human exposures (more about this below).

In fact, it *is* difficult to extrapolate from animals to humans, because species *do* differ considerably in their biology. But we are on firm intellectual ground here, it seems to me, precisely because we don't need to pretend that our position is rooted in data. This is an issue that clearly centers on political assumptions rather than on data interpretation.

### THE DOSE-RESPONSE CURVE

The high-dose to low-dose issue is more controversial; like the issue of animal evidence, it embraces both conflicting political interests and profound scientific ignorance, but the political assumptions tend to be buried more deeply in scientific debate.

Briefly, we do not know the molecular mechanisms of carcinogenesis, and we do not know the shape of the dose-response curve that relates carcinogenic exposures and resulting disease. Therefore, using data based on high-dose exposures (whether from animal studies or epidemiology), we cannot predict with any certainty how much cancer will be caused by low-dose exposures. There are many mathematical models in currency, so you can pick a curve that bends at low doses according to your political preferences. The curves of progressive scientists have tended to predict more cancers at low doses, while corporate curves have tended to minimize the effect of low-dose exposures.

An extreme form of this argument concerns the existence of threshold levels of carcinogenic exposure. These are exposures below which no cancers will be induced, presumably because our bodies have repair mechanisms that can protect us at low levels of exposure. Progressives have argued that thresholds cannot be demonstrated, noting correctly that both animal studies and epidemiology are insensitive to subtle effects occurring at low dose levels. In any case, the argument goes, it theoretically takes just one molecule to induce a malignancy. Opponents have argued that thresholds do exist, based on several considerations: there are recognized cellular repair mechanisms; some carcinogens function at late stages of carcinogenesis (promoters) and may have reversible effects; in some cases carcinogenic

exposures seem to induce cancers only when abnormalities like tissue scarring are present.

Here again, scientific theories and data provide precious few certain answers. It surely makes sense, as with animal data, to err on the side of safety, and to proceed as if there were no thresholds. But we need to admit that some of the arguments in favor of thresholds are plausible, and we need to be open-minded on this issue: we may well learn someday that certain carcinogens have thresholds.

## THE ROLE OF RISK ASSESSMENT

This leads to the final question I want to discuss, the role of quantitative risk assessment. This practice is an attempt to characterize dose-response relationships quantitatively, based either on animal data or on epidemiology. The goal is to predict the incremental public health gain achieved by particular regulatory strategies.

Needless to say, the development of risk assessment was driven more by regulatory mandate than by adequate data. In occupational health, for example, the need

for risk assessment grew out of the stringent benzene standard proposed by the Occupational Safety and Health Administration (OSHA) in 1977. Industry challenged the standard, claiming that OSHA had failed to demonstrate a "reasonable relationship" between the benefits of the standard and the costs of implementing it. The appeal went to the Supreme Court, which vacated OSHA's proposed standard.<sup>16</sup> This was interpreted by OSHA and other regulatory agencies as requiring quantitative risk assessment and cost-benefit analysis in subsequent standard-setting.

Accurate quantification of risk requires extensive, precise exposure and outcome data that are almost never available.<sup>17</sup> On this basis alone, there is plenty of reason to doubt the conclusions of quantitative risk assessment. But progressive scientists have pointed to other problems. First, attempts to quantitate effects of low-level exposures may harbor the assumption that some low level is safe, violating the no-threshold argument. Second, certain quantitative risk assessments have purported to demonstrate that politically charged

exposures are safe, and even that natural exposures and common foods are more carcinogenic than many industrial contaminants.<sup>18</sup> For example, current evidence indicates that household radon exposure is a far more important cause of cancer in the U.S. than air pollution and contaminated drinking water combined.<sup>19</sup> We may take issue with particular risk assessments, citing inadequate data or arbitrary assumptions, and we will usually be correct. But the very existence of risk assessment suggests a nagging possibility: that exposures with considerable political significance may have a trivial effect on health. Obviously, this would undermine political efforts that depend on the perception of hazard.

There is a larger political challenge in quantitative risk assessment. Implicit in the practice is the assumption that tradeoffs are inevitable and that some cancer risk may be justified by economic or other benefits. Progressive critics have pointed out that those who bear the risks, such as workers, are usually not those who reap the benefits, such as capitalists. Moreover, the assumption of risk in these circumstances is rarely voluntary or informed. Equity considerations therefore compel the argument that workers and communities should not "buy into" risk calculations.

But that position begs the question. In a perfectly egalitarian socialist society, there would in fact be tradeoffs between safety and productivity, and among various social spending options. It is quite conceivable that people in that society would voluntarily assume some cancer risk in return for some other benefits. This tradeoff would be unpleasant and unfortunate, but it is not inherently evil or exploitative. It might even be the case that some workers and community groups would make such a choice today. Progressive scientists, environmentalists, and occupational health workers have been conspicuously reticent to take up these calculations.

## RESPONSIBILITIES OF PROGRESSIVE SCIENTISTS

In summary, I have suggested that progressive positions on occupational and environmental carcinogenesis have from time to time contained certain problems: arguments that cannot be supported by existing data, a failure to acknowledge the limitations of existing data, and a failure to address some difficult but important dilemmas raised by these matters.

If my observations are correct, at least in part, then they raise the questions of why the problems exist, and how they might be corrected. The cynic might answer this way: progressive scientists are distracted from the dispassionate search for truth by the exigencies of political struggle. Our political views subvert our scientific judgment.

That analysis is both simple and





# CANCER AND THE WORKPLACE

## Another View

BY SCOTT SCHNEIDER

The controversy over what percentage of cancer is caused by occupational exposures is reminiscent of old arguments about what percentage of human behavior is genetic versus environmental. That controversy faded with the understanding that behavior has both a genetic and environmental component. The real issue is how much and how easily we can change behavior.

Occupational cancers have multiple and synergistic causes. We'll never be able to determine what percent are caused by occupational exposures. But we might ask, in what percentage of cancers have occupational exposures been a contributing factor, aggravated or facilitated the development of cancer? And what percentage of occupational cancers are preventable?

Even if the absolute percentage of cancers that have been affected by occupational exposures is low, for the subpopulation of workers exposed to carcinogens on the job, individual risks may be very high. Just as epidemiologists look at cancer maps to identify geographic "hot spots," one can also identify cancer hot spots among populations. For nonexposed workers, who are probably the vast majority of the population, the risks from environmental exposures such as smoking or diet are clearly the decisive factors.

But this is probably not the case for workers who are occupationally exposed to carcinogens. Since this group is relatively small, their percentage of contribution to overall cancer deaths seems less important. However, for those exposed workers, this is their highest risk factor, and lowering their exposure to carcinogens is most important.

Doll and Peto framed their argument with the question of how we can best spend our resources to prevent the most cancer cases. In terms of sheer numbers, eliminating smoking deaths is the most effective way to reduce the total number of cancer deaths. But in the United States, workers who are occupationally exposed to carcinogens have a separate right: their on-the-job exposures should not be allowed, by law, under the Occupational Safety and Health Act. In addition, there are equity considerations: businesses make profits by not cleaning up their workplaces, and workers

pay the price with their lives and health. Consequently, society must spend money to prevent occupational cancers.

In addition, the number of occupational cancers in the U.S. may be seriously underestimated. For most people with cancer, health workers don't draw the links between cancer and their occupations. Physicians aren't required to consider one's occupation when diagnosing and treating cancer, as they are in Scandinavian and other European countries. There are also few cancer registries in the United States for data collection and analysis regarding the occupations, medical histories, and residences of cancer sufferers.

Until the 1970s, few doctors could diagnose mesothelioma, an asbestos-related cancer. Even in this decade, a study in Minnesota found mesotheliomas underreported. Only one in four of the mesotheliomas were diagnosed and reported on the death certificate. A similar problem occurred with diagnosis of asbestosis, an asbestos-related lung disease. Most asbestosis victims died of heart failure related to their reduced lung capacity, but few were diagnosed or identified as having asbestosis on their death certificates early in this century.

Quantitative risk assessment has been touted as providing a rational basis for decision-making regarding resource allocation for controlling cancer. While this seems to make sense on the surface, in most cases the data which they are based on are so poor that the risk assessments have error bounds of one or several orders of magnitude. With risks so imprecisely defined, their value in decision-making is minimal.

Given the multiple causation of cancers, high risk for exposed workers, equity questions, underreporting of occupational cancers, and lack of precise risk assessments, it is not misplaced to fight for cleaning up carcinogens from the workplace. This does not mean that other pursuits in the war against cancer, such as fighting the tobacco lobby, should not also be continued. Each are important targets.

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complex. It implies a duality between scientific "truth" and sociopolitical "opinion" that is certainly false.<sup>20</sup> It implies that there is a single correct truth, rather than a multiplicity of viable interpretations. It suggests a range of intriguing insights about the sociology of both science and political activism beyond the scope of this article.

It must also be said, in our defense, that the excesses of progressive scientists pale in comparison to those of corporate interests. Suppression of data, gagging of scientists, and outright prevarication are all well documented.<sup>21</sup> In fact, the debates rarely take place on a level stage; the customs of scientific discourse, in which a hypothesis is assumed false until proven true and a statistically nonsignificant study is equated with a negative study, stacks the odds against a progressive viewpoint.

For all of this, it still seems true that we are sometimes given to excess. There is no virtue to being dispassionate in the face of exploitation, injustice, and preventable suffering. Political activism is not only acceptable; it is necessary. And we should take care never to be paralyzed by excessive caution masquerading as good science. But as we undertake to be activists, we need to be faithful to the facts, and frank about what we don't know. Exaggeration and distortion are unacceptable and in the long run counterproductive. These are the challenges, and the potential, of progressive science.



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# QUANTITATIVE RISK ASSESSMENT



PHOTO/Earl Dotter

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PUBLIC HEALTH  
PROGNOSTICATION

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**R**isk assessment is a process scientists use to project the likely (or worst case) human health effects from a planned activity. They use it to evaluate hazard in situations where little or no health effects data are available, often because the planned activity (such as construction of an incinerator or application of a pesticide) has not taken place yet. Government officials may use risk assessment when they are required to make a decision as to the relative safety and/or advisability of an activity, or when the public demands to know the health consequences of the planned activity before allowing it to go forward. In performing a risk assessment, scientists make some guesses on how dangerous a planned activity would be based on experience with similar activities, on hazards derived from other similar situations (or laboratory-based animal tests) and on the anticipated human health responses. They hope that their guesses are close to what will actually occur if the activity goes ahead or at worst that they have over-estimated the severity of the impact.

Ideally, to evaluate health hazards, one would conduct an epidemiological study of adverse human health effects attributable to the activity or substance in question. By using historical data for people with known exposures, or by monitoring people's health after they have been exposed, an investigator can determine the true risk of adverse outcome for a particular group of people. Although this is the preferred method of evaluating the human health risk, it may not be practical in all situations. For example, the activity or substance may be so new that a sufficient number of people have not been exposed to the hazard to permit statistically reliable evaluation. Or there may not have been sufficient time since the putative exposure for the adverse health outcome to have developed. Some types of cancer develop 10 - 30 years after a person has been exposed to a carcinogenic agent. This time between exposure and disease is called the latency. Often people may not be willing to wait for the results of a study accommodating this latency. Or, investigators may not be able to identify all other risk factors for the same adverse outcome for each study subject to enable calculation of the excess risk attributable to the situation or substance of concern (e.g., it is difficult to attribute causation for some lung disorders to environmental risks if the subject smokes). But, where possible,

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epidemiological studies should provide a much more sound basis for understanding risks and hazards and should be more reliable than the extrapolations used in risk assessment when one has sufficient data on exposure, disease and personal habits.

### **THE PRACTICE OF RISK ASSESSMENT COMPUTING THE RISK**

The fundamental goal of risk assessment is to predict a hazard (or assure safety) before it exists. Based on the identification of a dangerous substance or situation, an estimate of the amount of this substance to which people will be exposed and the severity of the hazard, risk assessors calculate an overall risk. Standard methodology stipulates four steps to the risk assessment process: hazard identification, exposure assessment, dose-response modeling and risk characterization. Two questions to keep in mind while considering these steps in the process: (1) Is risk assessment accurate quantitatively, or at least qualitatively, given extant data? (2) What assumptions have been made in the risk assessment process that might invalidate the entire consideration of this activity?

Risk assessment begins with hazard identification, the identification of situations or substances that can, in a particular circumstance, pose substantial risk to human health. For instance, in considering the risks of incinerating municipal solid waste (garbage), risk assessors have identified acid gases, heavy metals and trace organics (such as dioxin) as potentially harmful. At this stage of risk assessment, the amount of material is not considered; one need only identify compounds that have the potential for harm. Each compound will be followed through the risk assessment process. It is important to be sure that at this stage all compounds are considered, regardless of the amount thought to be emitted. Any assumptions eliminating particular health outcomes or possible routes of exposure must be considered carefully.

Next, one conducts the exposure assessment. In this step one evaluates the amount of material that the subjects are likely to encounter. Typically, this is a complex statistical or mathematical evaluation of the simulated movement of the hazardous material. Coupled with estimates of human activities that would bring people into contact with this material, one derives a hypothetical estimate of exposure. That is, scientists identify a source of a contaminant. Then they model a means of transporting it (e.g., via air, water, animals) along various routes to the people being studied and estimate how much actually enters these people's bodies.<sup>1</sup> It also is important to note that for an exposure assessment to be

reliable, it must consider all compounds and all routes of exposure.

To be conservative and protective of public health, risk assessors often use a "worst case scenario." That is, they ask exposure assessment experts to model an unlikely but plausible set of circumstances that would give rise to very high exposures. If the risk assessment shows no significant hazard even under this unlikely and unusually dangerous scenario, they argue that the activity is safe. If the worst case risk is higher than acceptable, the risk assessors recommend more refined analyses to identify the components of the activity that give rise to the greatest risk and that potentially should be modified. The degree to which a worst case scenario is unlikely and truly a worst case is a source of constant debate and consternation.

The third step in risk assessment is the dose response modeling. Here, investigators draw on whatever data are available (most often animal test data) to determine the quantitative relationship between historical exposures to each compound in question and the frequency of adverse outcomes. This is called the potency. Controversies arise over the extrapolation of data from high dose experimental situations to low dose real life situations, from short-term to long-term exposures and over extrapolation from animal species to humans (see Frumkin this issue).

One major controversy in this dose response modeling is the identification of health outcomes to consider, and the class of models to be used. Carcinogens are thought to have an effect no matter how small the exposure (no threshold model). Even one molecule increases an individual's risk of cancer, albeit by a very small amount. Most other health outcomes are thought to be affected only if one is exposed to at least a certain minimum amount of the hazardous substance (threshold model). Exposures below this level are believed to be completely harmless. Most risk assessors consider only cancer in their evaluations, ignoring adverse effects on the reproductive system, the nervous system, the immunological system, etc. This is based, in part, on the use of threshold models for carcinogens and non-threshold models for non-carcinogens; no-threshold models contribute risk at concentrations far below threshold models. Two issues arise from this observation: (1) Is the threshold/no threshold dichotomy appropriate biologically? (2) Even with threshold models, might significant effects be found for non-carcinogenic substances at low levels of exposure? For example, acute respiratory distress resulting from inhalation of acid gases from incinerator emissions is considered in California evaluations.

Recently, some scientists have tried to enhance these purely statistical dose-response models by incorporating some



# COMMUNITY USE OF QUANTITATIVE RISK ASSESSMENT

BY CARON CHESS AND  
PETER M. SANDMAN

**S**ome environmental activists have rejected out of hand quantitative risk assessment (QRA) as a legitimate approach to protecting public health. Because industry and government have used QRA to bully communities into accepting risks defined by QRA as "minimal," activists may be tempted to define QRA as a weapon of the enemy.

Unquestionably, there are problems with QRA. First, QRA is inevitably uncertain, based on models, judgments, and incomplete data. Anyone who says he or she is sure based on a QRA is being misleading, at best. In fact, most risk assessors will admit privately, if not publicly, that the risk assessment process requires a lot of guesswork. Assumptions made at each stage of the process can radically influence the outcome.

Second, QRAs can be badly done—due to either bias or incompetence. Given the susceptibility of QRAs to uncertainties, biases, and other flaws, activists are often appropriately skeptical of risk management strategies or regulatory proposals based largely on a single risk assessment.

Third, QRA deals only with the hazard—not whether the hazard is acceptable. It doesn't deal with property values, fairness, whether there's a history of an agency or a company lying to the community, or whether the risk (however small) could easily be reduced if the agency (or company) wasn't so busy arguing that there's no need. Communities object to the logic that because a QRA defines a risk as minimal, they must accept the risk—and swallow any other concerns. Understandably, they resent agencies and industries using risk assessments as a means of preempting their rights to control their own future.

Though formidable, these problems with QRA are not insurmountable. The problem of uncertainty is built into QRA and means insisting on a margin of error and never mistaking a QRA for a divine writ—but it isn't a good reason for rejecting the methodology altogether. The community should always be wary about

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technical concerns; it helps to have a good technical advisor to tell you if the QRA is decently done. Agency and industry misuse isn't really a problem inherent in QRA but a problem with agency and industry decision-making. Communities can insist on the importance of issues other than risk in resolving disputes—and they can organize to make sure they aren't shut out of the decision-making process.

Notwithstanding these flaws, QRA is the best tool available to distinguish large environmental risks from small ones. Even a small hazard may be unacceptable—because it's unfair, or easily reduced, or a product of mistreatment, or whatever—but whether it is a small hazard or a big one is worth knowing.

Agencies and industries have more resources and expertise to use QRA than do community and environmental groups. But that is true of most tools used to solve environmental problems—from computer modeling to monitoring to epidemiology. This is an argument for better community access to expertise not rejection of QRA.

Although QRA has problems, as with most tools the potential of QRA depends, in part, on understanding its limitations and using it appropriately. While continuing to fight risk assessments that are done poorly or misused, communities can also consider using risk assessments to help them protect public health in the following ways:

1. Documentation of Community Concerns. Risk assessments need not be developed in isolation from community concerns. Community groups can provide information to risk assessors about routes of exposure and history of the environmental problem that can both increase the validity of the risk assessment while documenting community concerns. Communities can also commission their own risk assessments that include such information.

2. Assistance in discriminating among risks. QRAs are not sufficiently reliable and environmental health problems are not sufficiently clear cut to label most situations "safe" or "dangerous." But QRAs can be used to appreciate the relative risks of different activities. For example, QRAs of different options for waste disposal can provide a way of comparing their health impacts. Similarly QRAs can help evaluate the potential health effects of varying approaches to cleaning up hazardous waste sites. QRAs can also identify which aspects of a given activity can be riskiest, helping define where safeguards may be needed most.

3. Providing input into government decision-making. Whether or not community groups like the risk assessment process, QRAs are now an integral part of government decision-making. Evaluating the elements of a risk assessment may help critical analyses of agency proposals. Community groups and environmentalists may discover that a QRA is faulty. Or they may determine that the QRA's definition of risk is likely to be accurate. This understanding does not preclude objecting to government proposals on other grounds, but it can better define the battleground.

4. Helping to set priorities for action. Citizen groups can take on only so many battles. While risk may not be the only factor that determines which issues get on the agenda, communities can factor information from QRA into their own decision-making. There are serious environmental risks—such as naturally occurring radon gas in homes—which most community and environmental groups choose not to organize around. Other problems which pose less risk but may be more objectionable on other grounds—such as ocean dumping and medical waste—may command more attention. While environmentalists and community groups will continue to set priorities based on a range of variables, understanding QRA can make it easier for risk to be among them.



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indices of the biological processes involved.<sup>2</sup> These are called physiologically-based pharmacokinetic (PBPK) models. They are more complex and still more cumbersome than the purely statistical models, but add a degree of realism to the consideration of health outcomes. One of the limitations of their formulation is acceptance of analogous biological systems in test animals and humans. At this point,

population of people. Rarely is an index of reliability or uncertainty reported, even though risk estimates for the same activity by different scientists may vary by a factor of 1000 or more.

### **EVALUATING THE ACCURACY OF RISK ASSESSMENTS**

To utilize risk assessment, one must



PHOTO/American Cancer Society

these models still are very new and not used in many practical applications.

The final step in the risk assessment process is risk characterization. In this step, the assessor combines information from the other steps into an overall evaluation of the hazard of the activity or substance under consideration. Statistical allowances are incorporated into the calculations to allow for certain aspects of uncertainty. The degree to which uncertainty is categorized, combined over the stages of the risk assessment process and then reported is controversial. Often, uncertainties in one aspect of an activity may be compounded by those in another aspect. Generally, the overall risk is reported as the likely number of excess cancers per million people exposed for a lifetime. That is, they report what the risk is to an individual. Occasionally, risk estimates are coupled with population density or activity data to yield community risk estimates, the number of excess cases one would expect to observe in a specific

have an understanding of the reliability and uncertainty of the estimates produced. A few scientists even believe that the quantitative estimates of hazard derived from risk assessment are accurate. Others limit inferences to rank ordering of the relative hazard of activities. Still others use the methodology to identify the most risky aspects of a given activity but do not compare risks across activities. Finally, some use it only as a screening tool. They evaluate the risk and if it is large<sup>3</sup> they undertake more detailed analysis. However, they place little faith in the risk numbers derived.

The primary reason for these different views about the utility of risk assessment stems from different people's interpretation of the uncertainties involved in the estimation process. Two areas of large uncertainty are the exposure assessment and the dose-response modeling, as noted above. Additionally, the consideration of each compound independently and the addition of their separate risks for risk

characterization implies that each operates independently, that there is no interaction. This is true in some situations but not others. Few risk assessors consider interaction explicitly.<sup>4</sup>

### **COMPARING RISKS**

One of the main purposes of conducting risk assessments is to enable scientists and managers to make judgements and decisions regarding alternative activities and technologies. In essence, the goal is to determine what is best for the public. Rather than being simply an issue of what is safest, however, the determination of what the public wants depends on their perception of the hazard and the way in which they learn about it. This is the area of risk communication and risk perception. It is a large field onto itself, and I discuss it only as it relates to risk comparisons. For risk comparison, various approaches have been tried.

### **THE CROUCH AND WILSON MODEL**

Crouch and Wilson present one method of comparing risks.<sup>5</sup> They suggest that all risks should be placed on a common basis. For cancers, this common basis should be the number of excess cases per million exposed. Thus, whether the activity is voluntary or involuntary, easily remedied or impossible to change, familiar or exotic, they all should be compared equally.<sup>6</sup> For example, in my local newspaper, the local government officials ran ads comparing risks of living near a garbage incinerator with risks of smoking cigarettes and risks of drinking soda with sweeteners. When I asked these officials if I gave up smoking to reduce my risk of cancer if they also would not build the incinerator to limit my cancer risk they showed a look of disgust. The point I was trying to make was that my smoking (or not smoking) has nothing to do with my desire to dispose of waste materials. Crouch and Wilson's goal is to communicate something about relative severity of activity, in essence to say that the risks from an incinerator would be infinitesimal compared to other routine risks that I encounter each day.

### **THE AMES ET AL MODEL**

Ames et al. propose another way of comparing risks.<sup>7</sup> They begin by considering one of the most controversial and rapidly changing aspects of risk assessment, the dose-response model. The basic premise in most dose response models is that there is a smooth, predictable relationship between the degree of exposure to a chemical and the likelihood of adverse outcome. Historically, evaluation of this relationship has been entirely statistical. Risk assessors decided whether the substance was likely to have a threshold below which exposure

did not pose any risk or if any exposure increased risk however minutely and what the functional form of the relationship should be beyond this threshold. Then, using sophisticated statistical computing software, they estimated the parameters of the statistical model.

Ames and co-workers have proposed an approach that simplifies the statistical evaluation of the data. Rather than using the sophisticated models statisticians have developed to fit the data, rather than considering issues of high dose to low dose extrapolation and across species extrapolation, rather than addressing issues of comparability of exposure pathways, the implications of the Ames et al. model is that the rank order of cancer potencies will be the same virtually regardless of how that rank order is determined. What's more, they derive the rank order on the basis of high dose, animal experiments. They recommend that one should calculate the tumour dose 50 (TD50) for all chemicals and use that one index as the starting point for all calculations.<sup>8</sup> According to Ames et al, this single index, usually derived from studies on test animals, always derived from exposures that far exceed the doses of concern, often evaluated for different routes of exposure than those of concern, is sufficient to characterize hazard. They divide the TD50 by the putative environmental exposure to estimate the "Human Exposure/Rodent Potency (HERP)". These HERPs, Ames et al. claim, should be used to compare the risks of different hazards in the environment, in our diet, in the workplace, etc. (See also Rick Hester's article in this issue.)

Problems with this approach are many-fold. There is no basis presented for assuming that substances that show a certain rank order at high dose (e.g., the TD50) will show the same rank order at lower doses. Potencies derived for different animals, via different types of exposures or through different media are not necessarily comparable. In essence, Ames et al. use a very simple dose-response model and experience shows that dose-response relationships are often much more complicated.

### **SUBSTITUTABLE ACTIVITIES**

An alternative approach to these broad based comparisons is to compare only substitutable activities. That is, one can compare risks of different activities but only if they achieve the same goal. If one is trying to dispose of one's waste, one could compare incineration, landfilling, recycling, reuse, source reduction and other technologies. One should compare them in terms of health risk, economics, ease of implementation, etc. In this context, the comparison is more realistic as one of the options will be selected.

A more formal approach for comparing substitutable activities is to consider

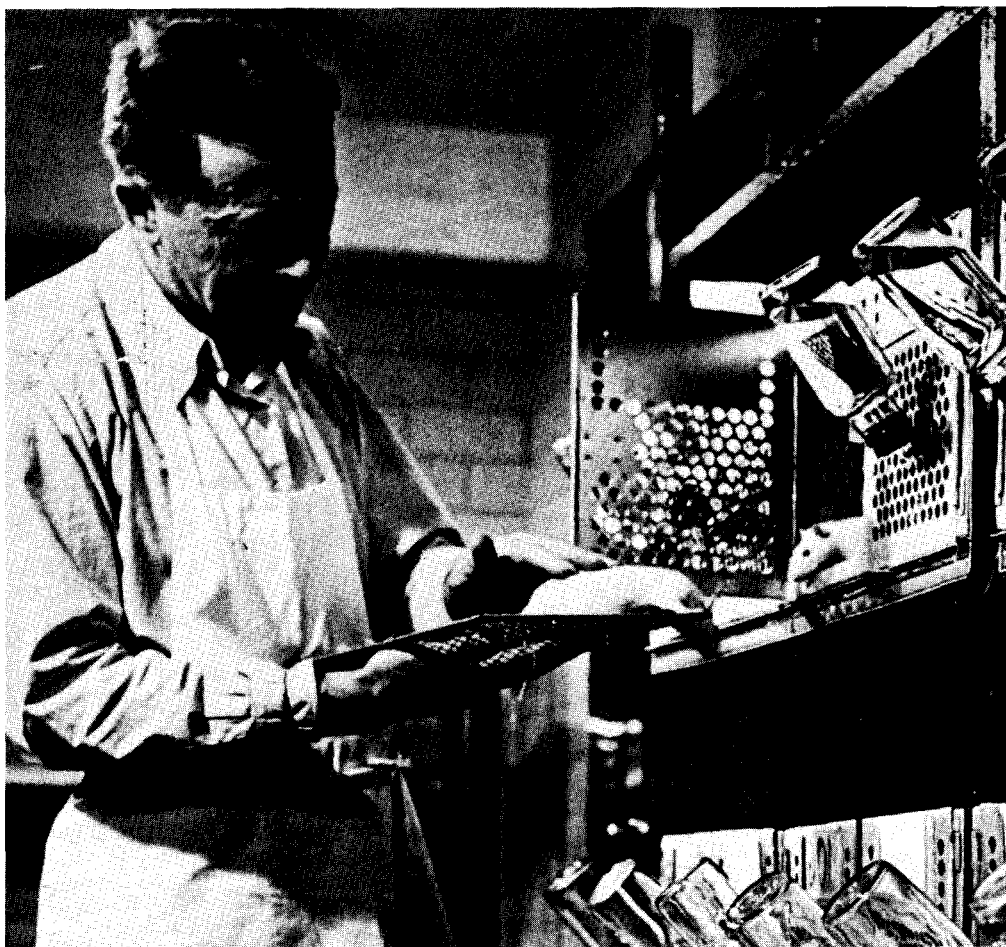
homogeneous strata of people. For example, people who smoke comprise a demonstrably different population than those likely to be exposed to incinerator emissions. Comparing risks of smoking and living near an incinerator is inappropriate. Casting the risk of living near an incinerator in terms of the equivalent smoking risk (number of cigarettes smoked per lifetime) is misleading. Comparison across these strata is incorrect and violates basic epidemiological principles. Comparison of risks for different methods of disposing of garbage, however, likely affect similar (or the same) populations and can be compared directly. The approach of comparing a set of risks for the same activity that will affect the same people avoids the need to adjust for inter-population differences. Additionally, one should consider the sources of the risk data, their comparability in terms of routes of exposure, species tests, number of subjects tested, etc.

### **ASSESSING THE BENEFITS**

The complement to assessing risk is evaluating the benefits that accrue from a given activity. Frumkin (this issue) argues that many people question the basic tenet of risk assessment, "that tradeoffs are inevitable and that some cancer risk may be justified by economic or other benefits."

He argues that, in principle, considering the tradeoffs is not inherently bad. I would take the argument further. Risk assessment can be used to raise community awareness and to encourage action. By knowing the risks and identifying the hazards the public can help define the solutions or remediations that are acceptable to them. They can affect policy decisions based on their understanding and use of risk assessment. Rather than taking power from the grass roots, risk assessment is a tool to be used by communities to identify problems and seek a satisfying resolution.

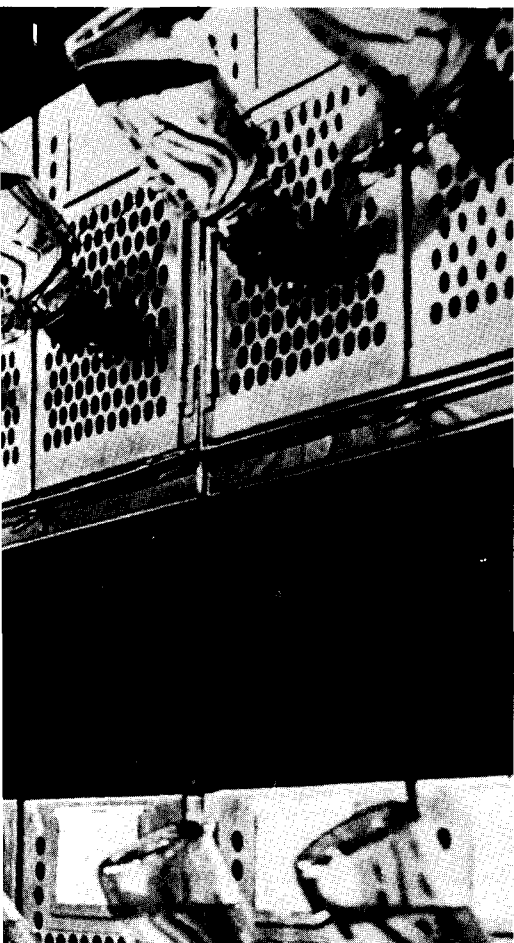
Consider, once again, the case of solid waste disposal. Our current society creates vast amounts of waste materials that must be disposed of. Disposal via landfills or incinerators creates hazard. Even recycling of materials has some adverse by-products. However, by identifying the most serious risks of each process, we can effect short-term change to minimize risk. We can require acid gas scrubbers, sophisticated particulate removal systems and real-time monitoring of burn conditions to limit danger. By identifying problem areas and creating incentives for remedies, we can push technology towards decreased risk. For instance, particulate removal efficiencies have improved over an order of magnitude during the last 10 years of incinerator operation. In part, many believe this has been encouraged by public concern over



emissions from incinerators and the problems companies have had siting these facilities. Now, opponents are encouraging industry to remove the most toxic components or precursors from the waste stream with laws, taxes or other types of incentives. Recycling programs thought impossible 5 years ago have been put into place so that many believe we can reduce our waste stream by 50% or more nationwide. Citizens also may be able to have complex monitoring programs put into place to characterize the nature and extent of emissions, and develop data that eventually may lead to shut down of improperly functioning facilities.

## CONCLUSIONS: GUIDELINES FOR THE EVALUATION OF RISK ASSESSMENTS

The use of risk assessment methodology in the evaluation of activities that affect a community can be used as a tool in raising community awareness and involvement. In the first stage, those planning the activity will be forced to document the activity in detail, identify potential hazards and quantify them. Residents can learn about the process, identify the most dangerous aspects of the process and focus their attention on them. Citizens can supply useful information on exposures and other risk factors to risk assessors. By



PHOTO/American Cancer Society

working with the government agencies and possibly the industry, residents can have stringent guidelines established to protect their interests. Rather than always attempting to defeat a new activity in total, when appropriate residents can accept the activity while forcing the industry to employ safeguards beyond those originally considered. Rather than an all or nothing battle, residents can protect themselves by showing a willingness to compromise on non-hazardous activities while exerting extreme pressure on those that are most dangerous. For technologies that are unproven and inadequately documented, residents can demand more data, force implementation of monitoring and sampling programs and even suggest alternative technologies for parts of the activities. If industries see that citizens are willing to work alongside them in developing, evaluating and implementing activities, they are far more likely to pay heed to the stringent demands that citizens exercise.

Risk assessments are a new tool for the evaluation of human health hazard that is here to stay. Rather than simply advocating its abolition, I suggest that it can be used as a tool of community education and empowerment. Citizens can learn about proposed activity and use that knowledge to identify the most troublesome aspects. Then, by directing attention to these components, they can effect change where it would be most useful. And, in the case where the hazard is too great, they can use this information to stop an activity entirely.

## NOTES

1. See for example "Assessing the Risks of Superfund Sites" prepared for EPA by CH2M Hill, June, 1988.
2. D. Krewski, D.J. Murdoch and J.R. Withey, "The Applications of Pharmacokinetic Data in Carcinogenic Risk Assessment," in *Pharmacokinetics in Risk Assessment: Drinking Water and Health Vol. 8* (National Academy Press: Washington, D.C., 1987), p.441-468.
3. The EPA considers one case of cancer per million persons exposed for a lifetime "large".
4. For a discussion of synergistic effects, see C. Perrow, *Normal Accidents: Living With High-Risk Technologies* (Basic Books: New York, 1984).
5. E. Crouch and R. Wilson, *Risk/Benefit Analysis* (Ballinger: Cambridge, MA, 1982).
6. Peter Sandman, "Risk Communication: Facing Public Outrage," *EPA Journal*, Nov. 1987, pp. 21-22.
7. B.N. Ames, R. Magaw and L.S. Gold, "Ranking Possible Carcinogenic Hazards," *Science*, April 17, 1987, 236:271-280.
8. The tumour dose 50 (TD50) is the dose of a substance that results in 50% of test animals in a laboratory study getting cancer over their lifetimes. It is analogous to the lethal dose 50 (LD50), the dose of a substance that kills 50% of the test animals. LD50 is used as a benchmark for evaluating acute toxicity. TD50 is an estimate of the potency for severe health effects from long-term exposure, rather than death from a single short-term exposure.

## OBJECTIVES

CONTINUED FROM PAGE 27

need to decide what we are really after, and reexamine our strategy for getting there. We need to ask ourselves: will our current tack of playing and immersing ourselves in a numbers battle result in a set of institutions merely "adapted to ecological constraints; or (in) a social, economic, and cultural revolution that abolishes the constraints of (those institutions) and, in so doing, establishes a new relationship between the individual and society and between people and nature? Reform or revolution."<sup>4</sup> In other words, do we want decisions to be made for us as long as those making the decisions don't pollute, or do we want real control over our lives?

Although I think that decentralization, human-scale organizations, and grassroots democratic control wherever we are—school, family, work—must be components of our vision and the struggle for control, I must also say that I do not have the cure-all for how we do gain control over our lives. I believe that answer lies in all of us.

I do think, however, that if it is the latter vision that we seek, then we need to reevaluate whether our present approach is the best that we, as aware, thoughtful, and caring people, can do. We need to discover, ultimately, our true potential energies for social change. And, in so doing, we need to take seriously the necessity and potential for success of being totally honest, both with others and with what we discover in our own hearts.

## NOTES

1. The environmental cancer debate is not alone in provoking the question of whether the choice of relying on numbers can work against those struggling for justice. For example, the reliance on the measurement of "stress," rather than on subjective work conditions, as the basis for legitimate grievances may have contributed to the defeat of the PATCO strike. See: Sylvia Tesh, "The Politics of Stress: The Case of Air Traffic Control," *International Journal of Health Services*, vol. 14, no. 4, 1984, pp. 569-587. In addition, some have argued that reliance on studies which tried to demonstrate the social and psychological damage suffered by children attending segregated schools, instead of using arguments based on freedom, choice, and equality, could easily have led to the opposite decision in the landmark 1954 Supreme Court *Brown v. Board of Education* case. See: Kenneth B. Clark, "The Social Sciences and the Courts," *Social Policy*, vol. 17, no. 1, Summer 1986, pp. 33-38.
2. Rick Hester, "The Environmental Cancer Debate Updated," in this issue.
3. Andre Gorz, *Ecology as Politics*, Boston: South End Press, 1980, p. 3.
4. Gorz, p. 4.





PHOTO/American Cancer Society

# Corporate Influence on Chemical Exposure Levels

BY KEN SILVER

**C**elebrated public scandals have occasionally rocked the foundations of environmental and occupational health policy. In 1983 executives of Industrial Biotech (IBT) were sent to federal prison for carrying out fraudulent toxicology studies of pesticides, drugs and other chemicals while under contract to government and industry over a period of 15 years. A year later, EPA administrator Anne Gorsuch Burford was forced to resign amid charges of mismanagement in the Superfund dumpsite cleanup program. Her lieutenant, Rita Lavelle, served time in a federal penitentiary on conflict of interest charges. And thanks to a handful of aggressive lawyers, journalists and public interest sleuths, the asbestos industry's "cover-up" of at least 30 years is now widely accepted as fact.

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Such highly visible and clear-cut cases of wrongdoing have provided health advocates with powerful ammunition in the struggle for the hearts and minds of lay citizens. (Witness the explosive growth of the grassroots toxics movement around the time of the EPA scandal and the impressive jury awards to the plaintiffs in asbestos cases.) However, such blatant cases of wrongdoing are the exception rather than the rule, and may even distract us from weightier problems at hand. Far more common are the subtle, insidious breeches of ethics which fail to cause alarm on a daily basis, yet produce cumulative effects that can be staggering. Arendt at the trial of Eichmann referred to "the banality of evil." Exposing it as wrongdoing is usually much more difficult, since established norms of behavior were not clearly violated. "We've always done business this way," is a familiar defense. Once such problems are exposed and corrected, however, new norms are set and society will never again be the same.

Drs. Barry Castleman and Grace Ziem, with their paper "Corporate Influence on

Threshold Limit Values" in the May 1988 issue of the *American Journal of Industrial Medicine*, have fired the opening salvo in what promises to be a protracted struggle to clean up the process by which occupational health standards are established world-wide. At some time in their careers, all occupational health professionals have cracked open the latest edition of the *Documentation of Threshold Limit Values*, a looseleaf tome published annually by the American Conference of Governmental Industrial Hygienists (ACGIH), for insight into a particular chemical. Threshold limit values (TLVs) are numerical limits for worker exposure to airborne toxic agents. Many occupational health professionals—and industrial workers—have also been in situations where exposure below the ACGIH-recommended TLV seemed to be

**The American Cancer Society encourages worker education about cancer; industries may find this far more palatable than cleaning up carcinogens. This may not be as true for small companies like Clearwater Laundry in Jamaica Plain, pictured above in 1950.**

causing health problems. The work of Castleman and Ziem puts the ACGIH TLVs in proper perspective: it demonstrates a pattern of industry domination over the TLV-setting process whereby the flimsiest of industry-generated scientific evidence easily gained the imprimatur of the ACGIH TLV Committee and (to our peril) was translated into the numerical limits widely used today.

Despite its name, ACGIH is not a government agency. Its membership includes many (if not most) industrial hygienists in North America, a large portion of whom work for industry. However, since ACGIH began issuing its TLVs in 1946, dozens of countries' regulatory agencies—including our own OSHA—have relied heavily upon them in the development of legal exposure standards. And, at last count, 37 American states have used TLVs as the basis for air toxics standards, usually cutting the TLVs by a factor of 100 or more. In general, the TLVs serve as a key point of departure in many regulatory efforts aimed at protecting the public from toxic chemicals.

The ACGIH documentation for a particular chemical typically consists of a short review (one to three pages) of its known health effects in humans, toxicology data and several citations to the literature. Dr. Ziem, an occupational physician who was hired as a part-time employee by the New Jersey Department of Health to write chemical factsheets under the state's worker right-to-know program, grew leery of the ACGIH documentation when she noticed that it was laced with citations to unpublished literature—"personal communications," "memo from" so-and-so, etc. Such communications tended to be between technical representatives of the industries that used or manufactured the chemical in question and the ACGIH TLV committee. Exercising the healthy skepticism and zeal for data that mark any good scientist, Ziem attempted in 1985 to obtain specific references on 67 substances by writing to the ACGIH and the companies named. Very few companies came through, and ACGIH provided little data.

Barry Castleman, a chemical engineer and a long-time expert witness in asbestos cases, then collaborated with Ziem on a comprehensive analysis of the 1986 *Documentation of Threshold Limit Values* which covered slightly less than 600 chemicals. For 104 chemicals they concluded that major or total reliance was placed on unpublished corporate communications. Next they sought to obtain copies of the cited corporate documents on these 104 chemicals from several sources, including the files of government employees who had served on the TLV Committee. The ACGIH Board of Directors denied Castleman and Ziem access to the minutes of the TLV Committee. Overall, their attempts to obtain the original documentation were largely unsuccessful.

From the documentation they did obtain, Castleman and Ziem draw a series of case studies of the TLV-setting process for several carcinogens:

- A confidential report from the Medical Director of ASARCO served as the basis for increasing the TLV for arsenic five-fold in 1961. Subsequent critical evaluation found this study woefully inadequate; independent health studies of the same work force later provided support for OSHA's *fifty-fold reduction* of the arsenic standard.

- A member of the TLV Committee employed by Dow Chemical Company had primary responsibility for TLVs for vinyl chloride and a number of chlorinated hydrocarbons. Dow was also the major producer of these chemicals.

- An employee of DuPont was in charge of the TLV for dimethyl sulfate (DMS), a DuPont product (and also a carcinogen so potent that one of its major uses today is in experimental mutagenesis studies). Under his guidance, the TLV Committee lagged six years behind West Germany in designating DMS a carcinogen. The TLV finally recommended by ACGIH was ten times the German limit.

- Observations—still unpublished and inaccessible—by affected companies served as the basis for downgrading ACGIH's warnings for the carcinogens acrylonitrile and ethylenimine.

Tracking down the institutional affiliations of members of the TLV Committee was no simple task either: individuals are listed simply as "consultants." Castleman and Ziem used professional directories and the published literature to figure out who worked for whom and when.


In rebuttal, Dr. Herbert Stokinger, retired past chairman of the TLVs Committee, and for many years chief toxicologist of the U.S. Public Health Service, labels their work "a union-handed webwork, [full of] guesswork, conjecture and surmise." He defends the use of industrial representatives as consultants by quoting bank robber Willy Sutton ("That's where the money is!")—i.e. industries know more than anybody else about their products. He also asserts that TLV Committee members were regularly involved in field surveys pertinent to the development of TLVs. However, Stokinger's rebuttal never progresses past the oft-repeated stage of "trust us": nowhere does he address the point that good science demands wide dissemination of published, or at least peer-reviewed, data. Similarly, a response from the Chemical Manufacturers Association dodges the issue of why these unpublished studies are still unavailable.

Other past members of the TLV Committee have remained relatively tight-lipped, even in the wake of Castleman and Ziem's revelations. The first exception, however, is Dr. Hervey Elkins, former industrial hygiene director for the state of Massachusetts, who served as chairman of

the TLV Committee for a short time in the 1970s. "I must admit," Elkins writes in a recent letter-to-the-editor of *AJIM*, "that [Castleman's] major premise, that the bias of some of the industry consultants on the committee affected its recommendations, has some validity ... There were a few incidents, however, to which the word 'chicanery' might be applicable." Elkins goes on to describe how he was apparently forced out of the chairmanship by a committee member employed by Dow Chemical Company. When studies demonstrating the carcinogenicity of ethylene dibromide (EDB) were published Elkins voiced support for a stricter limitation on worker exposure to EDB, a Dow product. The chairmanship was turned over to a Dr. Vernon Carter, "a veterinarian with no record on TLVs and not even a member of the conference [ACGIH]."

The ramifications of Castleman and Ziem's work are already being felt in the U.S. and around the world. After seven years of somnolence, federal OSHA has recently proposed to update its permissible exposure limits (PELs) for more than 400 toxic substances. In 1970 OSHA adopted 1968 ACGIH TLVs "by reference." Less than 30 of these limits have been lowered by OSHA since then. Now, OSHA is proposing to once again adopt the current ACGIH limits. The AFL-CIO and major unions oppose the proposal for several reasons, including the heavy industry influence over the TLV process. Instead, the unions want OSHA to focus on 50 to 100 of the most hazardous chemicals.

Internationally, the article has provoked responses from occupational health experts in Japan, Israel, West Germany, Sweden and Canada. Interest appears to be building for a more open, peer-reviewed process for establishing occupational exposure limits, perhaps involving the efforts of many countries.

What role the ACGIH TLV committee will continue to play is uncertain. In light of these revelations, a growing number of occupational health professionals will likely support abolition of the Committee. Yet doing so might leave out in the cold a large number of practicing industrial hygienists, many of whom are walking encyclopedias of valuable information and field experience on the shortcomings of the existing TLVs. Unlike academics, practicing hygienists receive few rewards for publishing their observations. Much of their knowledge is anecdotal, but en masse it would be essential to any international standard-setting effort. In addition to the usual industry vs. labor conflicts, the political struggle to reform the standard-setting process may find industrial hygienists working overtime to reassert their professional credibility in the eyes of workers, policy-makers and occupational physicians. The Castleman and Ziem paper suggests that, with the possible exception of hygienists employed by organized labor, they will face a long uphill battle. 

# ARTICULATING OUR REAL OBJECTIVES

BY JOSEPH REGNA

"Since it is not for us to create a plan for the future that will hold for all time, all the more surely what we contemporaries have to do is the uncompromising critical evaluation of all that exists, uncompromising in the sense that our criticism fears neither its own results nor the conflict with the powers that be." — Karl Marx, letter to Arnold Ruge, 1844

Community people can base their opposition to pollution, including carcinogens, on subjective factors: the air smells, the water tastes funny, my children don't feel well. I, however, cannot. Fundamentally, I desire a major change in the social fabric, but having been trained as a health professional, my approach must be based on "objective" facts. Yet when these facts—the evidence, the numbers—to support this approach fail to materialize and thus fail to put the lever of social change into my hands, my

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strategy's basis of opposition evaporates. With the myth of objectivity operative and numbers as my platform for attack, lack of objective data, or uncertainty about that data silences me.

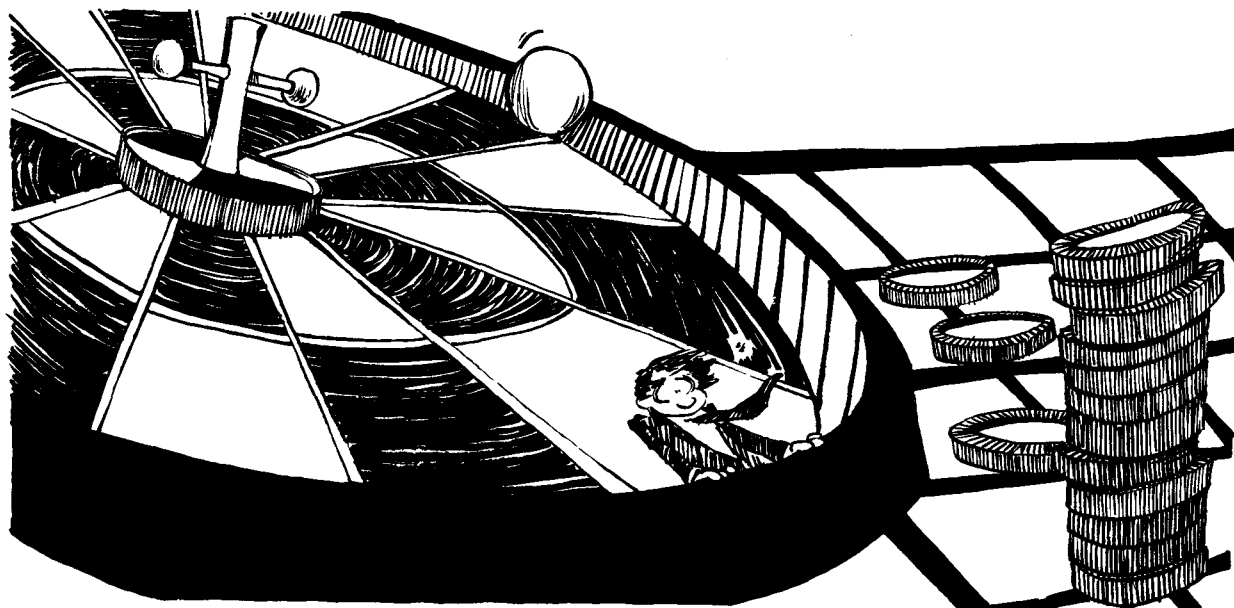
As scientifically trained health professionals desirous of fundamental social change, virtually every author in the magazine you are now reading has undoubtedly had to face this same issue. I am not about to argue that we who are in this position should not use health and environmental data to save lives, prevent further damage, and oppose immoral institutions. What I am saying is that—for reasons I will explain—use of such numbers should not be the *sole*, nor even the major, basis for our opposition to those institutions.

Not everybody fighting against pollution is motivated by the same thing. On one dimension, concern ranges from cancer as an endpoint to other impacts on human health—such as neurological disease, reproductive effects, liver damage, respiratory illness—and, beyond this, to effects on plants, animals, microorganisms, soil, air, water, the ecosystem. On another dimension, some may wish only to lower pollution,

regardless of the endpoint, to some so-called acceptable level, whereas others may not be satisfied unless and until pollution is eliminated altogether. Beyond these two dimensions, however, something even deeper and more fundamental—i.e., radical—motivates many who struggle against pollution, including people, like myself, who choose to work in the fields of environmental and occupational health.

Fundamentally for me, as for many other health professionals, the major problem in the world is that people do not have adequate control over their own lives, their one chance at being. I think we feel that a major cause of this reality is the existence of large and powerful institutions which usurp the earth and the people and life on it for their own perceived needs. We see that some of these institutions are producing what seems to be measurable health and environmental damage.

Armed with our insights into the nature of these institutions and wanting to change or even eliminate them, we think that if only we could demonstrate this damage, we could use that incriminating evidence not only to save people's lives



Klossner

**MOVING BEYOND THE ENVIRONMENTAL CANCER DEBATE**

and protect the environment, but also as a lever to organize against and erode the power of those large and powerful institutions, and thus to empower people to take more control of their lives. It's not that we have a hidden agenda; it's just that, because of our analysis, we see the struggle against pollution not only as an end in itself, but also as a means for achieving a more fundamental objective.

Incriminating evidence means demonstrating that pollution from, say, the petrochemical industry or the Department of Energy's bomb plants—not compounds found in mushrooms or basil—is causing a cancer epidemic, more congenital abnormalities than expected, increased leukemia, or what have you. (Our underlying beliefs and desire for anticorporate evidence also account for why indoor radon and cigarettes are absent from or get little attention on our list of priorities for action.) In essence, incriminating evidence means relying on numbers. However, from what I know about decision-making in environmental and occupational health, discussions with others in these fields, and my own experience and the frustration which has accompanied much of that experience, I believe that such a reliance on numbers includes some serious drawbacks.

To begin with, the numbers we seek are often not yet collected, unclear, or not supportive of a negative overall effect from pollution, including potential carcinogens. Certainly, the lack of evidence for negative effects on people and the environment may reflect the fact that there are none. This would be a welcome piece of news. But not measuring an effect—whether that be cancer or any other negative impact—when something unnatural or foreign is introduced into the environment does not necessarily mean that nothing is wrong.

Furthermore, our choosing to rely on a number to measure negative effects as grounds for opposing, for example, the petrochemical industry means that when we lack such a number, or even if we have one which lies in a so-called acceptable range, we lose our base of legitimacy to oppose that polluting industry. Said differently, in a world in which decisions are based on objectivity and numbers, we would be expected, by buying into this strategy and in the absence of a number showing an increase in a certain bad effect, to shut up.<sup>1</sup>

In addition, reliance on numbers invariably means dependence on so-called experts. When this happens, grassroots decision-making and citizen involvement take a back seat to the issue

of which expert is able to be most persuasive about his or her way of doctoring the data and his or her choice of model for, say, a cancer risk assessment. In other words, as we claim objectivity based on a number as the basis for opposing a polluting institution, we often forget that even when we are lucky enough to have evidence (or unlucky enough, for having evidence means that people and the environment have already suffered), the institution can easily marshal experts who will also claim objectivity in stating that *no* health or environmental damage exists. The fact that their objectivity is nothing but an excuse to ignore injustice does not mean that their words, ideas, and explanations do not prevail. Again, our acceptance of the dominant mode of decision-making, in effect, may be a very potent trap.

And then, of course, there is the deeper issue of whether numbers ever constitute a legitimate basis for making ethical and moral decisions. After all, for example, is it just the numbers of them or is it on principle, merely their presence, that we oppose nuclear weapons? Are we against U.S. intervention because it kills or because it kills too many? Is it the amount of pollution, or pollution per se, as an example of disregard for the natural environment, that we oppose?

I think that the frustration that I and many others in my position have experienced in trying to carry on the struggle solely based on numbers stems from the fact that the numerical approach obfuscates, puts up a smokescreen, and deflects attention from the more fundamental goals we seek. It is not just the measurable effects of pollution that cause us to oppose the institutions which cause that pollution. It is, on one level, the fact that they operate not within but against ecological cycles. Furthermore, on another level, if the day would ever come when Dow, Monsanto, or the DoE stopped putting unnatural substances into natural systems, I do not believe that even then we would feel that the job is done.

The reason would get back to the fact that our lack of control over our existence is the real bone we have to pick with the large and powerful institutions in society, not just whether they pollute or not. We lose control over our lives anytime a corporation or a government agency makes a decision which determines the social contours in which we exist. Some of these decisions have health and environmental ramifications; most do not.

We should state openly that the actual

basis of our opposition to those institutions is our lack of control over their actions. It is based not only on showing "major excesses of cancer caused by exposure to human-made chemicals or industrial processes,"<sup>2</sup> but also on the fact that we see that industry as one example of the multitude of institutions, polluting or not, which exploit people and the environment for their own narrow interests, then we should say so—right from the start.

Stated bluntly, we must see that opposition based solely on numbers measuring pollution's health and environmental effects is, at best, a tenuous and shallow approach, and, at worst, a potent and effective snare. The basis for saying there's something wrong with chemicals and for acting against them should depend not just on trying to prove their disease, including carcinogenic, potential, but, more fundamentally, on realizing that they are substances which are foreign to the natural cycles of our planet. Furthermore, we should state explicitly the real basis for opposing those institutions which pollute: that it is not *just* that they pollute, but also that they are centers of power which make decisions about our lives which only we should be making for ourselves.

Many of us are already aware of this but still choose to rely on numbers for various reasons: maintaining credibility within our own fields, tactical choice, political expediency. Yet, whatever the reason, I believe that honesty dictates that we be explicit about the true basis of our opposition, and not make it into a hidden item on an agenda that is publicly expressed solely on the basis of the measurable health and environmental effects of pollution. That strategy may work for a while, but, as happens when you paint yourself into a corner, you do get something done, but then you're stuck.

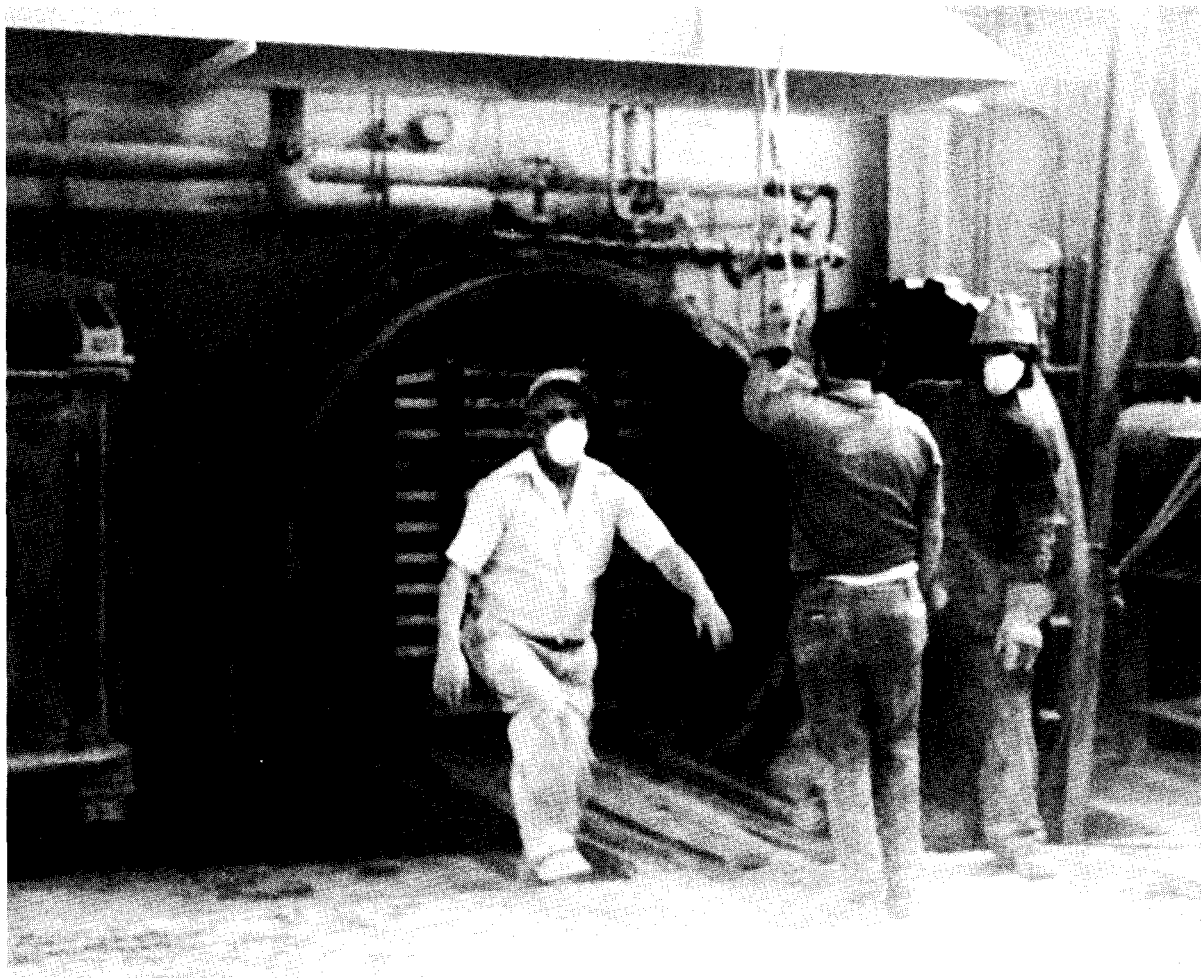
We must see that the institutions we oppose have a variety of adroit and well-financed ways of responding to the numbers game, including the ultimate reform: cleaning up, or as Andre Gorz has put it, "assimilat[ing] ecological necessities as technical constraints."<sup>3</sup> The institutions may indeed pollute less and be cleaner, but they will still be in place, as much in control of our lives as ever.

The question of whether or not there is an environmental cancer epidemic may be important to address, but it is not even close to being the central issue. I think what needs to happen is that all of us—health professional, radical, or otherwise—

**CONTINUED ON PAGE 23**



## CALIFORNIANS MAKE ENVIRONMENTAL HISTORY



PHOTO/MASCOSH

BY DIANE FISHER

In November of 1986, the voters of California overwhelmingly approved the first major environmental or health initiative to succeed on the state ballot in almost 15 years. "The Safe Drinking Water and Toxics Enforcement Act," known as Proposition 65, was

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born out of frustration with the ineffectiveness of existing toxics controls and was designed to avoid the pitfalls of previous laws. The new law creates strong incentives for industry to cooperate with the regulatory process, and allows for direct citizen action to enforce the measure's basic requirements.

In principle, Proposition 65 is actually quite simple. First, it requires the state to convene a panel of experts to identify a select group of chemicals that cause cancer or reproductive disorders (such as

birth defects and sterility). Second, it prohibits: (1) the discharge of any of these listed chemicals into sources of drinking water; and (2) the exposure of anyone to these chemicals without clear and reasonable warning. Exemptions are provided if the level of exposure is below an established threshold, or safety level. It is up to the responsible company, however, to show that a discharge or exposure is below the level qualifying for exemption.

By placing the burden of proof on

companies that would cause chemical exposure, the law makes a dramatic and far reaching departure from previous legislation. Traditional toxics laws, such as the Safe Drinking Water Act, the Toxic Substances Control Act, and the Clean Air Act, require, in effect, that government have the burden of showing that a chemical event *exceeds* a level deemed to be "safe." This flaw has created a strong incentive for companies to delay the process of identifying safe levels for as long as possible—stymying government enforcement. This motivation has operated for two decades to prevent industry from performing the necessary studies to determine the dose-response relationships of many industrial chemical suspected of causing severe health effects.

As a result, industry has had every reason to delay and obstruct the line-drawing process for chemicals that might otherwise be controlled under existing toxics laws. Such tactics have been especially popular in the pesticide industry, since the market for many agents declines quickly as pests develop a resistance to them. A delay of a few years can keep these products in use while a new generation is being developed.

Under Proposition 65, in contrast, once listed, a chemical is covered whether a safe exposure level for it has been established or not. No exemption can be granted. A warning is required for *any* exposure, and *all* discharges to drinking water are prohibited, until this level has been set. And it is the responsibility of industry to determine if the risk of exposure to chemicals found to be carcinogenic or reproductively toxic is significant. With the burden of proof thus shifted, delay becomes counter-productive for industry, which now has a powerful incentive to cooperate in this line-drawing process. Indeed industry is now demanding that California establish safe exposure levels as quickly as possible. The results have been dramatic. California has established levels for 45 chemicals in less than 12 months—roughly twice the number established under federal law in the past twelve years. In each case, an effective and readily enforceable legal control has been created.

Compliance with the new law is further guaranteed through enforcement by direct citizen suits. Although citizen suits are nothing new, they are substantially easier to bring and to win under Proposition 65. Under previous laws, it was the responsibility of citizens bringing a suit to resolve complicated technical issues such as the relationship between exposure and the incidence of a

health effect or how a chemical released into the environment would reach a drinking water supply. As a result, citizen enforcement under federal laws has been primarily limited to a few national environmental groups with the resources and staff to address such questions. Since Proposition 65 has shifted the burden of proof, however, the responsibility for answering these technical issues now rests with industry.

The new law gives substantial financial incentives to bring citizen suits as well. Plaintiffs are awarded 25% of any fines levied—which at a maximum of \$2500 per product per day can grow to be quite substantial. Fines accrue throughout the duration of a violation, even before an enforcement action has been brought. This encourages businesses to police themselves and bring themselves into compliance in advance of the filing of a citizen suit. For example, one major company, after reviewing its entire product line, introduced a replacement for an item containing cadmium, a chemical listed under the law. Similarly, several snack food manufacturers pulled their products from the shelves last February to avoid having to warn about excess levels of lead.

The power of citizen enforcement under Proposition 65 was used successfully in the first major citizen suit—challenging a bogus product "warning system," devised by industry to circumvent the law's warning requirement. Instead of labelling individual products with warnings, the Grocery Manufacturers of America (GMA) set up a toll free hotline for consumers to request information. To use it, shoppers actually had to leave the store and ask about each product one at a time. Not surprisingly, few availed themselves of this "service." Last August, however, four leading groups supporting the law initiated a suit against several major tobacco companies and supermarket chains. The suit asked for a penalty of \$1.3 billion in violations for failure to adequately warn consumers of the cancer risk posed by cigars, pie and chewing tobacco, and other non-cigarette products. These items are exempt from federal warning requirements but are covered under Proposition 65. The tobacco companies had provided shelf signs but the supermarkets had declined to use them. Rather, these stores were relying on the hotline to fulfill their warning obligation.

Within days of receiving notice of the suit, several of the affected supermarket chains notified the tobacco companies that they would not carry their products

unless packages carried warning labels. When the tobacco firms failed to comply, Vons Corporation, the state's largest supermarket chain, began pulling the products off the shelves. The tobacco companies quickly agreed to put warning labels on the products, and to pay legal fees for the plaintiffs (The amount of fines to be levied is still undetermined). In three weeks, citizens were able to close a loophole in tobacco labeling that had existed in federal law for more than twenty years.

Supermarkets have put other manufacturers on notice that their products must either be free of significant quantities of listed chemicals, or carry warning labels. To avoid having to warn that their products may be the cause of cancer or reproductive hazards, manufacturers now have a strong incentive to reduce the toxic contents.

The citizen suit is also expected to provide a powerful tool for enforcing the law's discharge prohibition which went into effect last October. Many of the state's local citizen environmental groups are concerned with contamination of groundwater and other drinking water supplies. They have pointed to leaks in underground tanks storing halogenated hydrocarbons, as well as the widespread presence of ethylene dibromide (EDB) dibromochloropropane (DBCP), and other agricultural chemicals in the groundwater of agricultural regions. Businesses in these regions are likely to be in violation of the law, and as long as the problem is not cleaned up, the fines are increasing every day. Since every citizen is potentially an enforcer of the law, the threat of suits encourages polluters not only to clean up existing problems but to avoid polluting in the future.

Even at this early stage of implementation, Proposition 65 has had a profound impact on how toxics are regulated in California. It has created incentives for industry to cooperate in the regulatory process, and to bring itself into compliance with the law in advance of regulatory action. It has accelerated the process of identifying hazardous chemicals and establishing "safe" levels of exposure. Most importantly, it has provided the citizens of California with new weapons to reduce their exposure to toxic chemicals. According to Thomas Warriner, the state's top official for administering the law, "there are probably people who wish the Proposition had never happened." But, he acknowledges, "the world is a different place post-Proposition 65."



## The Apocalypitics

By Edith Efron  
Simon and Schuster,  
1984

REVIEWED BY FRANKLIN MIRER

**T**here is a long-standing difference of opinion within the industrial hygiene community regarding standards for chemical exposure. This legitimate debate is slowly being resolved with each chemical carcinogen that is successfully identified and regulated. In contrast to this debate, Edith Efron's *The Apocalypitics* attacks governmental regulation of cancer-causing chemicals through a misrepresentation of the scientific process and available data, and discusses the validity of risk assessment principles in a global fashion which makes the debate politically divisive and logically unresolvable.

*The Apocalypitics* should not be dismissed merely because Efron is not a scientist. Political decisions on public health and also on issues such as Star Wars, energy policy, and the farm crisis all turn on public evaluation of issues that scientists frame. Therefore, popularizing science and making it understandable to the great majority of Americans who are not scientists is a vital role in our democracy. Nonscientists may well be the best people to do this. However, there are standards for reporting that both lay people and scientists must observe.

*The Apocalypitics* opens with the Big Lie: large numbers of scientists support the book's thesis but refuse to say so because they fear losing their academic positions as a result of attacks from leftist professors. This is demonstrable nonsense. The membership of the American Industrial Hygiene Association is made up of several thousand professionals from industry, several hundred from government and universities, and a dozen from labor. The Society of Toxicology and The American Occupational Medicine Association show the same domination by industry-affiliated members. Many scientists are paid large fees to testify for industry, in public, on the record, before government agencies and in court, on exactly the subjects that Efron discusses.

Efron directs her most biting attacks at the "apocalypitics": the people who believe the world is coming to an end. Into this group Efron lumps early

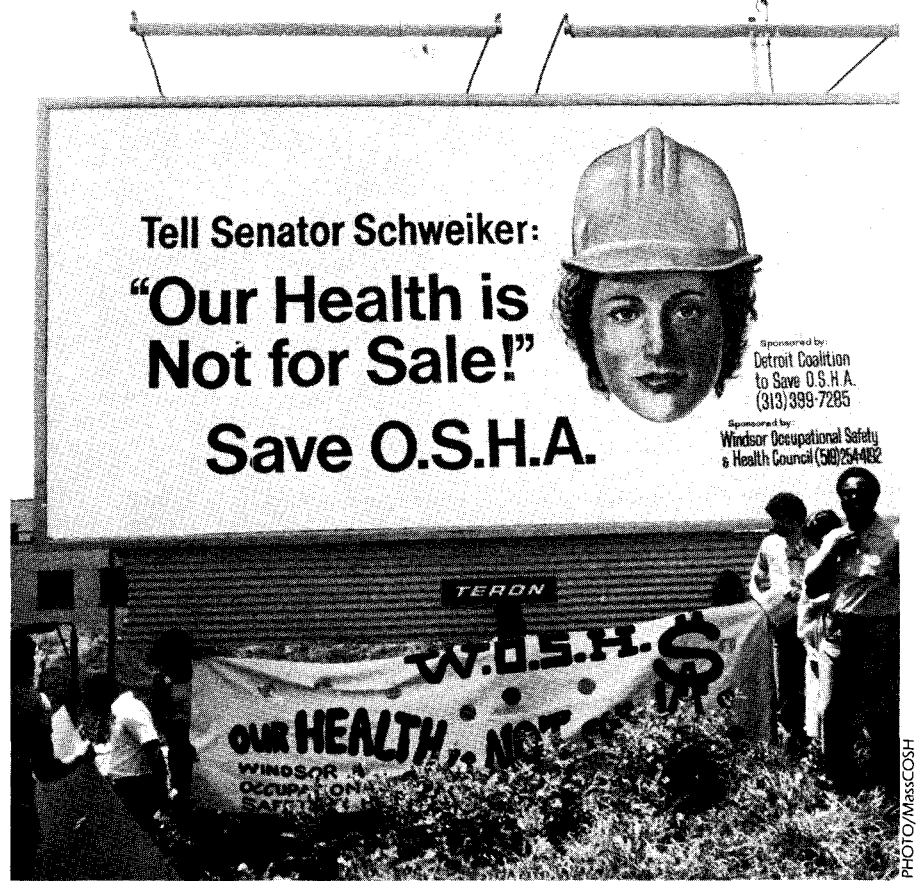
environmentalists like Rachel Carson, population theorists like Paul Ehrlich, the Club of Rome, which was concerned about resource issues, and politically active scientists like Barry Commoner and George Wald. Particular heavy fire is directed at Dr. Samuel Epstein, whose outspoken writings promoted the Toxic Substances Control Act (TSCA). Efron forces a diverse group of people with often contradictory views into an artificial mold of her own making. She also implies that government would never have regulated cancer-causing chemicals if people had not been panicked by the apocalypitics' claims. By this outright sophistry Efron tries to discredit a series of modest and practical laws, such as TSCA and the Occupational Safety and Health Agency (OSHA) Act, that empower public health officials to control the use of chemicals.

*The Apocalypitics* rehashes the ongoing argument about whether the cancer rate is going up and what percentage of cancer is due to chemicals in the environment. By referring preferentially to studies that minimize the cancers caused by chemicals, Efron uses statistics to buttress her case against government regulation. Her

argument is akin to opposing controls on lead in a battery plant because few people outside the plant are exposed to lead.

In reality, the extent of occupational cancers is larger and better documented now than it was when OSHA's cancer policy was being developed in the 1970s. In particular, in the last few years research has shifted to basic chemicals that are widely used in industry. Recent mortality studies in the metalworking industry have demonstrated excesses of cancer among workers in machining plants, foundry workers, certain welders, model and pattern makers, die cast and plating workers, and even among workers in vehicle assembly plants. The conventional analyses that discount the proportion of cancers caused by environmental exposure may be underestimates because they do not include these data, which involve very large numbers of workers.

The loudest controversy in *The Apocalypitics* concerns the evaluation of risks for chemicals that have been shown to be carcinogenic in animals but that lack positive epidemiological evidence of carcinogenicity in humans. Animal studies have provided evidence of



carcinogenicity of several basic industrial materials which have not yet been shown to be carcinogenic by epidemiological studies. Bioassays of gasoline, methylene chloride, perchloroethylene, and chlorinated paraffins have demonstrated clear evidence of carcinogenicity in rats and mice. There is now strong evidence that silica is carcinogenic in rats by itself and in hamsters when administered in combination with polynuclear aromatic hydrocarbons. These chemicals are distributed widely throughout our environment, but exposures are highest in occupational settings or in home uses (such as paint stripping) that mimic industrial uses.

The controversy over the use of animal studies arises from an insufficient understanding of the use of this data in conjunction with data on the degree of human exposure to chemicals. These data can be used to estimate the risk of cancer as an absolute rate. For example, to consider regulation of a chemical, OSHA requires the estimated risk to be one cancer per year in a worker population of 1000. In contrast, epidemiology measures relative risk: the ratio of cancer rates between a test group exposed to a chemical and an unexposed group.

Epidemiological studies that do not show at least a tenfold risk in at least one group of high-exposed, long-observed workers are generally described as yielding "limited evidence of carcinogenicity." Thus it takes a very special set of circumstances for a chemical to qualify as a human carcinogen on epidemiological grounds. A large enough group of workers must be exposed to the chemical at a high enough level for a long enough period of time to produce a statistically significant increase in cancer rate. Good personnel records and environmental data must exist to document the chemical's effect. Finally, someone must do the study.

By contrast, consider a carcinogen which at prevailing exposure levels causes an increased risk of two lung cancers per 100 workers exposed. This would be considered an enormous attributable risk but would present as "only" a 33% increase in cancer rate compared to the background rate of six cancers per 100 workers. Such an observation would be considered shaky evidence for carcinogenicity at best. This very large absolute risk would achieve statistical significance only if we had a group of 10,000 or so workers exposed at the given level and followed for 20 years afterwards.

At this point we public health scientists can either give up and go home or we can look for other, indirect, sources of evidence about carcinogenicity of chemicals. The indirect sources are animal bioassays and the varied research on the basic mechanisms of cancer using humans, animals, and laboratory cultures. Observation of phenomena that cannot be directly measured is a fairly standard procedure in science. However, this procedure is more controversial in the public health field because conclusions about risk are used to guide public health interventions.

Our mechanistic understanding of chemical carcinogenesis is well established at the level necessary to make reliable judgments about the need for public health interventions. This mechanistic understanding is the basis for the so-called inference guidelines generally used by public health agencies such as OSHA, the Environmental Protection Agency (EPA), and the Consumer Product Safety Commission. Efron tries to demolish these inference guidelines, which she calls "regulatory science." Her main example of regulatory science is OSHA's proposed cancer policy from the 1970s, which she calls "an active manipulation of basic research and an active violation of it."

A general outline of our knowledge of the mechanism of chemical carcinogenesis is found in the document on Risk Assessment published in 1984 by the White House's Office of Science and Technical Policy. These guidelines are essentially the same as those that have been followed by OSHA. Supported by hundreds of references, this document describes a process that begins with interaction of a chemical with a cell's genetic material, or some other initiating event, followed by one or more stages of transformation to a full-blown tumor cell, followed by growth of the tumor. Chemical carcinogens can act at the initiation of this process or at a number of later stages. The model suggests that, at least for initiators, there no threshold, no risk-free dose. The mechanisms by which chemicals promote the expression of the genetic information into cancerous cells are not as well known, and therefore anomalous results can be expected for chemicals that act in this way.

Obviously there is considerable uncertainty in the data and conclusions that are the basis of decisions to limit exposures to chemicals. There is much we would like to know about basic cell biology and the detailed mechanism of

action of many chemicals. The robust interest in the area and the many potentially productive avenues for further investigation should be taken as a validation of our present knowledge, not as a sign of poor understanding. In many



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cases the uncertainty results from a lack of data on exposure of workers to chemicals that could be readily acquired if industries were more cooperative. A reasonable level of research funding and a stable and cooperative arrangement between industry and independent researchers could quickly improve our scientific basis for decision making. The failure to meet these needs is a political choice that places workers and the public at greater risk.

Efron's alternative to the use of inference guidelines for public health decisions is to throw out the general model and to deal with each chemical separately. According to this view, no action can be taken on a chemical until direct evidence of cancer in humans is produced.

We have been spending too much time in the risk assessment process debating points that cannot be resolved by direct evidence. We could move much faster in regulating cancer-causing chemicals if we could reach the risk management stage earlier in the process. Rather than front-loading the process with elaborate requirements for formal risk assessments, we can much more effectively respond to new evidence of danger from a chemical by immediately evaluating exposure and control options. Let's do our job as hygienists by looking at the things we usually look at: who is exposed, at what level, where is the chemical coming from, and how can exposure be minimized. Whatever risk assessment is required for regulation will be greatly assisted by accurate exposure information. We may disagree on what can be done or what certain engineering changes will accomplish, but we can resolve these issues by direct evidence. Determination of controls is much more likely to accomplish our aims than paralysis by analysis.

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## A BURST OF LIGHT

by Audre Lorde

Firebrand Books, Ithaca, NY 1988

**A**udre Lorde. The name and the life claim attention, our intellectual spontaneity and our emotional need to connect with her experience, authority and vulnerability. I have learned and am still learning in the years of reading her poetry and prose that Lorde is *serious*. Writing is living. Ideas and ideologies must be claimed, and there must be a lesbian voice and person claiming them. Lorde has been that voice and person, most visibly in the decade of the 1980s. I have gained strength from her vigilant presence in my own struggle for a black lesbian feminist integrity. Her work is a neighbor I've grown up with, who can always be counted on for honest talk, to rescue me when I've forgotten the key to my own house, to go with me to a tenants' or town meeting, a community festival.

There is no doubt about Lorde's competence as a poet. Nine books attest not only to virtuosity but to tenacity as well. To be a black lesbian poet in racist, heterosexist, *prose-ist* America is not easy. Lorde, like Adrienne Rich and June Jordan, has been loyal to poetry and to feminism. Yet, as expansive as poetry is and as magnanimous and gifted as the poet might be, the audience had its limitations. The poet must foray from the chamber of reverie into the arena of essay sometimes to have her say.

*A Burst of Light* is Audre Lorde's third book of essays. The most stunning contribution is the 82-page journal piece, "A Burst of Light: Living With Cancer."

When the "Cancer Journals" was published in 1980, the essay "Breast Cancer: A Black Feminist Experience" shouted down the silence around breast cancer and terminal illness in a way that discussions of these issues will never recede to the margins again—at least among feminists. Lorde continues to give us her voice, her strength, her example in "A Burst of Light" in beautiful, unsentimental and provocative prose. In the introduction to this section, she says:

*On February 1, two weeks before my 50th birthday, I was told by my doctor that I had liver cancer, metastasized from the breast cancer for which I had a mastectomy six years before.*

*At first I did not believe it...As I grew steadily sicker in Berlin, I received medical information about homeopathic alternatives to surgery, which strengthened my decision to maintain some control over my life for as long as possible...*

These entries bear witness to Lorde's battle with the cancer industry, personal physicians, her own denial and fear, and

the cancer itself to maintain her self-determination. We are given glimpses of her everyday living: memories of her whereabouts when Martin Luther King was assassinated, the conferences, the parties, the readings, the sojourns in Berlin, Switzerland, New Zealand, France, St. Croix. Lorde portrays her struggle not to be psychologically, spiritually, or physically victimized by the disease. She bargains with her living for coexistence:

*...But first I am a poet. I've worked very hard for that approach to living inside myself, and everything I do, I hope, reflects that view of life, even the ways I must move now in order to save my life.*

The writing is direct, succinct, compressed and humbling. So, she moves to save her life by doing her work, seeking out alternatives to surgery, the dominant regime of cancer treatment in the U.S. It is in Berlin where she begins the Iscador injections, "a biological made from mistletoe which strengthens the natural immune system, and works against the growth of malignant cells." Though these treatments make her stronger, they do not alter the fact of liver cancer. On December 15, 1985, she travels to Arlheim, Switzerland to Lukas Klinik, where primary research on Iscador is being conducted. For three weeks, Lorde engages in a regime of rest, relaxation, eurhythm, and active meditation. Still the diagnosis is liver cancer.

The journal illustrates in very poetic terms the simultaneity of the stages of grief—the denial, anger, bargaining, despair and acceptance. And it is the bargaining which most sharply characterizes Lorde's struggle to make her life useful for as long as she can:

*It takes all my selves working together to fight this death inside me. Every one of these battles generates energies useful to others.*

This bargain not "to go gently into anybody's damn good night!" and the acceptance of "the positive energies of so many women who carry the breath of my loving like firelight in their strong hair" are the healing strategies.

Lorde's prose is so conscious of its work, i.e. generating "energies useful to others," while at the same time so spontaneous and vulnerable. She gives us her unflinching example, but not without the dogged ambivalence, self-doubt and fear:

*...I've given myself plenty of practice in doing whatever I need to do, scared or not, so scare tactics are just not going to work. Or I hoped they were not going to work. At any rate thank the goddess, they were not working yet. One step at a time.*

*But some of my nightmares were pure hell, and I've started having trouble sleeping.*

Through her prose Lorde brings the

totality of her environment to bear on the cancer, to bear on us. She celebrates all the energies which mediate the disease, the energies of the women who love her and whose lives are possible because of her. One of the lessons she learns and gives is the precious nature of living and doing our feminist work. To live, i.e. to *do*, to connect with women of color in Germany, England, New Zealand, Washington, D.C., Michigan, to start an organization in concert with women organized in South Africa, to enjoy the company of black women in France and St. Croix, to be in the world are Lorde's instruments of power, her bargaining chips, her means to negotiate her daily living with cancer. Cancer is not the enemy, only a symptom of inimical forces. To struggle against the dominance of those forces keeps the cancer from consuming her life. I was at first doubtful of Lorde's observance that "in order to win, the aggressor must conquer, but the resisters need only survive." Either Lorde seemed to be settling for too little or implicit in her definition of survival is triumph. She continues, however:

*Our battle is to define survival in ways that are acceptable and nourishing to us, meaning with substance and style. Substance. Our work. Style. True to ourselves.*

Lorde works through this journal to explore the meanings of her identity as a black person and a person of color. Is "Black" only a "geographic fact of culture and heritage," meaning Africans and Africans in Diaspora? Is "Black" a code word for all oppressed peoples of color, reflecting "the empowerment and the world-wide militant legacy of our Black Revolution in the 1960s..." This latter position, thinks Lorde, may run the risk of "providing a convenient blanket of apparent similarity under which our actual and unaccepted differences can be distorted or misused." In spite of theoretical musings, racism always obtains: whether Lorde is in Australia being accosted by a white Australian who thinks she's Koorri (Aborigine) or in New York City being called "girl" by a white physician to whom she must pay \$250 for a consultation.

"A Burst of Light: Living With Cancer" is indispensable reading. The instruction of the other essays is undeniable, but "A Burst of Light" is a design for living, reflective of hard, feminist, work. And Lorde, like most black women, and most lesbians, is no stranger to hard work. I thank her for her work and her life.

*This review is excerpted from a longer piece originally published in Gay Community News (GCN). Reprinted with the kind permission of the author and GCN.*

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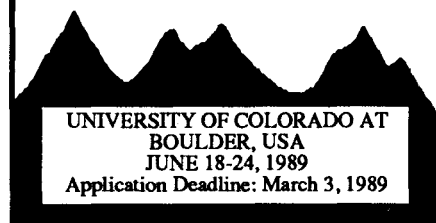
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