cate what is really bothering them. On the other hand, scientists too frequently find that reporters miss the real point and can be restrained only by force from rushing off to publish a completely misleading story. Obviously, both sides must work to close the gap.

One might add the observation that papers with well-educated readerships like the *New York Times* and *Los Angeles Times* have sophisticated reporters who are ordinarily given more time to work up a story than the reporter on your local *Daily Advertiser.* In this connection the Colorado Committee for Environmental Information initially found it easier to get coverage in the national media than in the local Colorado papers. Peter Metzger summed it up with the biblical observation: "A prophet is without honor in his own land."[8] Finally, when dealing with the ordinary reporter, who has probably just returned from filing a story on a former poetry teacher who took off her bikini top in the center of the financial district, there is obviously no substitute for a brief, well-written press release containing the essential information.

NOTES

1. Tom Wicker, "The Reporter and His Story: How Far Should He Go?" *Nieman Reports,* Spring 1972, p. 15.
2. *New York Times,* March 1, 1971, p. 15.
3. Peter Sandman has pointed out that the press is much more effective in telling us what to think about than it is in telling us what to think. See "Mass Environmental Education: Can the Media Do the Job?", to be published in *Environmental Education,* William B. Stapp and James A. Swan, eds. (Beverly Hills, Calif.: Sage Publishing Company, 1974).
4. Hans Bethe and Richard Garwin, "Anti-Ballistic Missile Systems," *Scientific American,* March 1968, pp. 21-31. See Chapter 13.
5. See note 43, Chapter 15.
6. Bryce Nelson, "HEW: Finch Tries to Gain Control Over Department's Advisory Groups," *Science* 164 (1969): 813. See also *Science* 165 (1969): 269, and *Science* 166 (1969): 357, 819, 1488.
7. James Singer, "Pressure by Scientists, News Media Figured in HEW Curb on Blacklisting," *National Journal,* January 10, 1970, p. 73. See also Bryce Nelson, "HEW: Blacklists Scrapped in New Security Procedures," *Science* 167 (1970): 154.
8. Peter Metzger, "The Colorado Committee for Environmental Information," *Report of the Conference on Scientists in the Public Interest: the Role of Professional Societies* (Salt Lake City: Physics Department, University of Utah, 1974). (The conference was held at Alta, Utah, September 7-9, 1973, under the sponsorship of the American Academy of Arts and Sciences, Western Center, and the University of Utah.)

CHAPTER 17

Organizing for Public Interest Science

Traditionally, public interest science has been an activity carried on in an entirely ad hoc manner by full-time scientists and engineers who have taken time off from their usual pursuits. They don their white hats and gallop off to rescue imperiled Paulines just as doom seems imminent—and then they return to the laboratory.

It is important that such "amateur" public interest science continue. Until recently the scientific community delegated its public responsibilities mostly to official government science advisors. This was a mistake. As the histories of government regulatory agencies have repeatedly demonstrated, responsibility cannot successfully be delegated—it can only be shared. The unfettered spirit of part-time outsiders will always be required to keep the system honest.

But neither is a system in which public interest science is practiced only by volunteers satisfactory. Nothing less than a full-blown crisis is required to motivate a dedicated scientist to drop his usual work. By that time, it may be rather late to initiate corrective steps. It would have been far better, for example, if the adequacy of the AEC's reactor safety program had been subjected to independent review a few years earlier. This would have saved the large amounts of money which may be required to fit existing reactors with improved safety systems and would have reduced the risk—whatever it may be—to those persons who will be living near those reactors in the meantime.

In most of our examples of independent public interest science activities—regarding DDT, plutonium and nerve gas in Colorado, defoliation in Vietnam, and so on—independent scientists reacted only after years of government misconduct of technological programs. It should by now be obvious that if the public interest is to be adequately represented in governmental decisions on technological issues, public interest science must to some degree be institutionalized.

Institutionalizing the outsider role poses a great challenge to the creativity of scientists and the scientific community. Funding is obviously required for such an effort, but the customary sources of funding for scientists—the federal government and industry—are just those institutions whose policies may have to be challenged. Even non-mission-oriented government agencies like the National Science Foundation (NSF) have been very reluctant to support "controversial" public interest science projects or groups, although controversy is often essential to bring out all the important considerations in governmental decisions. Thus in 1971 NSF refused to support the activist-oriented but responsible magazine *Environment*, while at the same time continuing to fund the noncontroversial (and rather dull) *Science News*.[1]

Fortunately, private foundations are beginning to show some interest in funding public interest science. The Ford Foundation, for example, sponsored the wide-ranging Energy Policy Project in 1972-1973 and has for several years provided partial support to groups like the Environmental Defense Fund. The Stern Fund contributes to the support of the new Center for Science in the Public Interest in Washington, D.C. Federal and state governments may yet decide to fund public interest science projects as the field becomes more respectable—like public interest law.

The more fundamental problems of public interest science are thus likely to lie less in the area of funding than in the professional motivations of and institutional constraints on scientists. In this chapter we will first consider the nature of these constraints and then examine some of the ways in which scientific professional societies and public interest organizations can organize—and to a certain extent are already organizing—public interest science activities.

Scientists

INDUSTRIAL SCIENTISTS

> Corporate employees are among the first to know about industrial dumping of mercury or fluoride sludge into waterways, defectively designed automobiles, or undisclosed adverse effects of prescription drugs and pesticides. They are the first to grasp the technical capabilities to prevent existing product or pollution hazards. But they are very often the last to speak out.[2]
>
> —Ralph Nader

Most scientists and engineers are employed in industry. There they are perfectly situated to see first-hand the potential and real hazards of industrial products and practices and to suggest steps to remedy them. But few industrial scientists speak out, even within the corporate hierarchy. Advancement comes to those whose work pays off in increased corporate profits (and sometimes to those who just put in their time); career stagnation or termination is the usual

reward for "troublemakers." The First Amendment protects the right of free speech only from governmental interference; private employers are not bound by it. Unless constrained by law—as in the federal antidiscrimination statutes—or by an explicit employment contract, any company can deal with its employees in an essentially arbitrary manner. Although industrial unions have won a variety of rights for blue-collar workers, few industrial scientists or engineers have even the most elementary employment safeguards. Indeed, their contracts, if they have any, are often replete with provisions intended to discourage independent action. Such provisions can apply even after retirement: Du Pont warns its retirees that their pensions can be canceled if they engage in "any activity harmful to the interest of the company."[3]

GOVERNMENT SCIENTISTS

Government employees would at first sight appear to be much better protected than corporate employees, since they benefit from both Constitutional and Civil Service safeguards. But the harassment and eventual firing in 1969 of A. Ernest Fitzgerald, the Pentagon cost analyst who revealed the cost overruns in the manufacture of the Air Force's C-5A transport, shows how limited these protections can be. (Fitzgerald was ultimately reinstated by the Civil Service Commission with three years' back pay because some memos surfaced during the Watergate investigation which allowed him to prove what everyone knew—that considerations entered into the abolition of his job other than those of "economy.")[4] Like other large bureaucracies, government agencies reward quiet mediocrity more regularly than aggressive pursuit of the public interest. That may be why none of the industrial or government scientists who were aware of the Bionetics Research Laboratories findings on the teratogenicity of 2,4,5-T spoke up during the three-year period while the information was being suppressed. And why the reactor safety issue festered quietly within the AEC for so many years before it was brought out into public view.

Efforts can be made to intimidate a government employee even when he is not criticizing his own agency. For example, during the controversy over the plutonium pollution outside Dow Chemical's Rocky Flats plant in Denver, Dr. Martin Biles, director of the AEC's Division of Operational Safety, approached Robert Williams and Dion Shea of the Colorado Committee for Environmental Information and informed them that he had a "personal hangup about one federal agency engaging in activities critical of another federal agency," adding: "You don't mind if I bring this matter up with the appropriate officials of [the Department of] Commerce [their employer] and the National Science Foundation [which funded the research of Edward Martell, the scientist who had done the CCEI plutonium measurements]."[5]

UNIVERSITY SCIENTISTS

As the world becomes more technically unified, life in an ivory tower becomes increasingly impossible. Not only so; the man who stands out against the powerful organizations which control most of human activity is apt to find himself no longer in the ivory tower, with a wide outlook over a sunny landscape, but in the dark and subterranean dungeon upon which the ivory tower was erected. . . . It will not be necessary to inhabit the dungeon if there are many who are willing to risk it, for everybody knows that the modern world depends upon scientists and, if they are insistent, they must be listened to.[6]

—Bertrand Russell

Thus we come to the universities. University scientists, protected by a long tradition of academic freedom, are in principle free to speak their minds and take public stands on any issue. And indeed many of the scientists whose public interest activities we have discussed have been affiliated with universities.

The majority of university scientists, however, have remained entirely uninvolved in public debates about technological issues. And of those who have forsaken the ivory tower for such activities, the number consulting for government or industry has been far larger than the number of independent public interest scientists.

One reason for this lack of involvement in public interest activities appears to be the fact that after World War II the university changed from a haven for poorly paid and rather solitary teachers and researchers into a busy confluence of traffic in the high-pressure world of advanced technology. The established academic scientist now typically administers a research group supported by several annually renewed government or industrial research contracts and is continually concerned that his group's output be of sufficiently high caliber to insure that its funding will be renewed or (hopefully) expanded. He makes frequent trips to Washington in search of funds and in his capacity as a government advisor. He attends conferences all over the world where he tries to make sure that the accomplishments of his group are visible and acknowledged. Finally, he usually also teaches a course at the university and supervises the work of several graduate students.[7] Rising younger scientists lead a somewhat less frenetic existence, but they are generally working overtime on scientific problems that interest them, establishing their own professional reputations, and competing to emulate their senior colleagues.

With such demanding professional lives, it is not difficult to understand why academic scientists have not been very open to the challenges of public interest science. Not only would such activities distract the scientist from his efforts to preserve and enhance his own and his group's position in the highly competitive world of scientific research, but they also might result in his being labeled a "controversial figure," an image that could adversely affect the delicately balanced judgments on which promotion and funding decisions are often based. None of these problems is likely to afflict a scientist who minds his own business or only consults privately for industry and the government.

Fortunately, in recent years the rigidity of these traditional professional patterns has shown signs of weakening as the scientific community has begun to recognize that the era of almost unquestioning faith in science and technology,

which began with the development of the atomic bomb and was sustained for a time by the challenge of *Sputnik*, has come to an end. The nation's primary concerns have finally turned from security against external threats to enhancing the quality of life at home. And here the public has discovered that many of the new devices and chemicals that technology has been constantly producing for the domestic market have a serious potential for damage to human and environmental health. Technological time bombs have begun to explode: smog, destruction of entire wildlife populations by DDT, jet noise near metropolitan airports, and the suspicion that birth defects and cancer may be linked to the new substances to which man has exposed himself in his work, environment, and food. A "backlash" against technology has developed. And many scientists have become genuinely concerned about ameliorating the adverse consequences of technology and regaining the respect of the public—including their students, families, and friends. The strong constraints imposed by professional ambition still exist, but attitudes within the technical community are changing from skepticism of public interest science activities toward neutrality and perhaps even a certain amount of encouragement. These changes are manifested in the new social activism of many scientific professional societies, the recent birth or reinvigoration of several public interest science groups, and the steadily increasing number of full-time public interest scientists.

Professional Societies

Traditionally, scientific professional societies have restricted their activities to the sponsorship of professional meetings and the publication of technical journals—i.e., to the discussion of developments in their respective areas of specialization—sometimes also awarding honors to members who have made notable scientific advances. This single-mindedness has been defended as a virtue by the leaders of various societies, who are concerned lest discussion of "political" matters such as the social impact of the applications of their field polarize their membership, pollute their discipline, and generally bring scientists and the supposed objectivity of the scientific method into disrepute. The common attitude has been that scientific discussion should be strictly segregated from the discussion of questions which cannot be answered using the scientific method and that the scientific societies, as the inner sanctums of the scientific enterprise, need special protection.

As concern has increased in the country over the adverse impacts of technology, however, scientific societies have found it more and more difficult to remain uninvolved. Recent unemployment problems have also led scientists to demand that their professional societies undertake a number of new activities—ranging from employment information services to outright lobbying for more federal support for science. Both because of the job crisis and because of general dismay over technological fiascos like the ABM and SST, the interaction of science with society has come to be recognized as a legitimate concern of scientists as professionals. Although the defenders of the traditional aloofness of professional societies have urged those who feel compelled to discuss the ways that science impinges on society to find another forum, the inescapable fact is that there neither are nor ever have been other comparable forums for such discussions within the scientific professions.

PROFESSIONAL SOCIETIES AS SPONSORS FOR PUBLIC INTEREST SCIENCE

> For the coming decade the main thrust of AAAS attention and resources shall be dedicated to a major increase in the scale and effectiveness of its work on the chief contemporary problems concerning the mutual relations of science, technology, and social change, including the uses of science and technology in the promotion of human welfare.[8]
>
> —Board of Directors,
> American Association for the
> Advancement of Science, 1969

The leader among professional organizations in science and society issues has been the 130,000-member American Association for the Advancement of Science (AAAS), the publisher of *Science* magazine. Although it is an organization dominated by scientists, AAAS is not itself a professional society, but rather a loose association of virtually all of the 300 specialized scientific and engineering societies in the United States. Since the early 1950s, the AAAS has increasingly concerned itself with public issues, leaving the work of furthering the development of each discipline to the more specialized societies.

In the constitution adopted by the AAAS in 1946, one of the principal goals of the organization was stated to be improving "the effectiveness of science in the promotion of human welfare." But the AAAS moved to implement this goal without noticeable haste. A decade and a half later, a Committee on Science in the Promotion of Human Welfare was appointed to look into the matter.

The committee decided that the single most important way in which scientists can help society solve the problems that have been created by scientific advances is by informing their fellow citizens of the relevant facts. "In sum," stated their first report,

> we conclude that the scientific community should on its own initiative assume an obligation to call to public attention those issues of public policy which relate to science, and to provide for the general public those facts and estimates of the effects of alternative policies which the citizen must have if he is to participate intelligently in the solution of these problems. A citizenry thus informed is, we believe, the chief assurance that science will be devoted to the promotion of human welfare.[9]

STUDIES OF PUBLIC ISSUES

Thus far, the most venturesome study sponsored by the AAAS—or, for that matter, by any scientific professional organization—has been that of the Herbicide Assessment Commission. As we recounted in Chapter 11, the initial impetus for this project came in 1966 from E. W. Pfeiffer, a Montana zoologist who was also one of the founders of the Scientists' Institute for Public Information. The AAAS leadership timidly resisted involving their organization in this highly charged issue for more than three years—years during which the Army conducted the bulk of its defoliation operations. But when the project was finally undertaken under the leadership of Matthew Meselson, the work of the Herbicide Assessment Commission was of such unimpeachable quality and its conclusions so carefully stated that it has reflected nothing but credit on the AAAS. And the undertaking had great political impact—the photographs with which the HAC returned from Vietnam brought home to the American people the devastation being caused by the defoliation program and helped to bring about its termination.

The 110,000-member American Chemical Society (ACS) has been the pioneer among specialized professional societies in preparing public reports on technical issues. In 1965, inspired by the President's Science Advisory Committee report *Restoring the Quality of Our Environment*,[10] the ACS Committee on Chemistry and Public Affairs, in cooperation with the ACS Division of Water, Air, and Waste Chemistry, recruited a panel of experts to prepare a handbook on pollution that would be suitable for Congressmen and other interested laymen. They received encouragement from President Johnson's science advisor, chemist Donald Hornig, and a number of Congressional leaders—but they were also cautioned by these men to avoid bias in favor of the chemical industry.

The experts were assembled for a two-day meeting in the expectation that the report could be drafted in one or two such sessions. What resulted, however, according to Stephen Quigley, ACS Director of Chemistry and Public Affairs, was "a veritable Tower of Babel."[11] Finally, after much more work than initially anticipated, a first draft of the report was finished. But it was intelligible only to scientists, so it was sent back for redrafting. Eight revisions later the steering committee agreed that it was both suitable for general consumption and scientifically sound. The report, *Cleaning Our Environment: The Chemical Basis for Action*, was finished in 1969.

All this work did not go unrewarded. More than 50,000 copies of *Cleaning Our Environment* have been sold to the general public and to students—in addition to the 21,000 copies that were initially distributed to federal, state, and local officials and to the news media. The report has been used in some 130 colleges as a textbook.

PROFESSIONAL SOCIETIES AS FORUMS FOR PUBLIC ISSUES

Most professional societies have been much less active in studying public issues than the AAAS or the ACS. Of those that have been involved at all, the majority have confined their activities to sponsoring talks and panel discussions at their meetings. That has been the main function, for example, of the Forum on Physics and Society of the 30,000-member American Physical Society (APS). At all major APS meetings during the past several years, the Forum on Physics and Society has sponsored programs on a very wide range of subjects, including the antiballistic missile debate, pollution problems, population and economic growth, problems of women and other minorities in physics, secrecy in science, Soviet scientists and human rights, and the employment crisis in physics. These sessions have almost always been very well attended.

It is very important that the opportunity exist for discussion of such issues among scientists. Ordinarily, when a new technological program is being "sold" to the executive branch (e.g., the ABM or other weapons systems, the SST, the "breeder" nuclear reactor, the "war" on cancer, etc.), discussion is pretty well confined to that part of the technical community most closely tied to the industries and/or government agencies involved. This results in troublesome issues "sleeping" long after they should have been brought out into the open and resolved. For example, if the very great psychological impact and substantial physical destructiveness of sonic booms from the heavy U.S. SST had been as widely understood in 1964 as they were in 1969, a much sounder basis for discussing and planning the SST program would have existed. There was no good reason why the seriousness of these problems and their intractability to any kind of "technical fix" could not have been made clear several years earlier than they were. Another such example is nuclear reactor safety: if the adequacy of the safety systems had been critically reviewed by the larger technical community before construction on the present generation of large power reactors was begun, the AEC and the electric utility industry might have been spared a lot of grief.

Through such institutions as the APS Forum on Physics and Society, it should now be possible for concerned individuals—such as Shurcliff in the case of the SST or Kendall on reactor safety—to raise important issues regarding the effects of the proposed technology in front of a disinterested but nevertheless competent group of scientists. Ideally, such discussions should take place long before issues reach the crisis stage. In cases where there is substantial disagreement over either the facts or their implications, more sustained and serious inquiry should be possible. For example, professional societies, either individually or jointly, could sponsor meetings or topical conferences at which all interested scientists would be able to discuss their views and clarify specific areas of disagreement. Or, in complex areas such as reactor safety, prolonged studies might be organized—over the summer, presumably, in obeisance to the academic calendar. The results of such efforts would surely be useful to both the executive and legislative branches of the federal and state governments and to all citizens who are concerned about these issues.

Traditionally, the scientific community has assumed that if such studies were needed, they would be undertaken by an executive-branch science advisory committee or by the National Academy of Sciences' National Research Council. It is important to appreciate, however, that these bodies are "other-directed,"

not "inner-directed"—i.e., they usually respond to requests from executive agencies rather than initiating studies on their own.[12] And as we have seen, such studies are vulnerable to suppression or subversion by the sponsoring agency.

Primary responsibility, therefore, remains with the larger scientific community to help identify and call public attention to the crucial questions and to see to it that necessary studies are performed. If the government is willing to arrange for open, high-quality studies—fine. But if not, the professional societies should be prepared to organize them on their own, as the AAAS finally did when it established Herbicide Assessment Commission.

FACILITATING PUBLIC INTEREST SCIENCE

We have been arguing that in addition to its usual function of advancing and diffusing the knowledge of its particular discipline, a professional society can also provide a unique scientific forum for the discussion and study of public issues with technical components. Indeed, professional societies represent among their members the collective scientific wisdom and knowledge of the nation. The higher officials of the federal executive branch can call upon this expertise through science advisory committees and the National Academy of Sciences. State and local governments could in principle go this route—and some have tried—but they usually lack the dual concentrations of responsibility and expertise which have made such arrangements successful at the federal level. Most citizen and public interest groups have the additional problem that they do not have the resources for formalized consulting arrangements.

So where does a governor turn when he wants independent advice about the potential safety problems of a new nuclear reactor or tank farm for liquified natural gas under construction in his state? Or if a committee of the state legislature wants to know how privacy of information can be protected in the state's computerized data banks, whom does it consult? (The local chapter of the American Civil Liberties Union may have the same question.) Or, again, where does the St. Louis People's Coalition Against Lead Poisoning go if it wants to know how to determine whether the paint peeling off a particular wall has a lead-based pigment? Access to names of executive-branch advisors will not be enough—if only because the group seeking advice may be in an adversary relationship with the federal agency or because many of the well-known scientists who fly off to Washington to consult would not have enough time in their busy professional lives to advise the mayor, state assemblyman, and local chapter of the Sierra Club as well.[13]

In many instances, however, scientists with the necessary competence would be delighted to help. The problem is to get the willing scientist together with the interested official or citizens' group. Scientific societies can help fill this need by making easier the connection between groups which need advice and qualified scientists interested in participating in public interest advisory activities.

The Biophysical Society is pioneering in setting up a system for such "matchmaking." The scientists in this small (2,500-member) society possess expertise which is especially relevant to determining the subtle biological effects of radiation, food additives, and chemical pollutants. Just before assuming the society's presidency in 1972, Peter von Hippel (brother of one of the present authors) sent out questionnaires to the membership asking whether the Biophysical Society should

> participate in an organized form in making available and providing scientific advice to the various branches of federal, state, and local government and to citizen groups.[14]

The proposal was approved by a ten-to-one margin. Accordingly, a committee was appointed to prepare a detailed computer-compatible questionnaire by which members could indicate the technical areas in which they were willing and competent to do public interest work.

Much thought went into how the program should operate. The model finally chosen was that of an "editorial board" of experts who would receive requests for assistance in their various areas of expertise and would then be responsible for selecting advisors from the Biophysical Society's roster and initiating contact between the advisors and their "client." The "editor" assigned to a particular request would receive copies of any reports prepared and might append his own comments if he felt this to be helpful or appropriate. It is anticipated that any costs for travel, secretarial help, and the like would be borne by the "client" individual or group; in exceptional cases the society might try to find an alternative source of funds or provide partial support from its own funds.

There are several reasons for interposing an editorial board between advisors and their prospective clients. Besides helping to find the best advisor for each request and monitoring the subsequent advisory relationship, the editorial board would also serve to screen out inappropriate requests. (For example, Peter von Hippel tells of one request from a lawyer in Wisconsin whose client had hurt herself in a fall and was suing for damages. The lawyer's request?—a complete list of all possible injuries his client might have suffered!) The following statement was decided upon to help determine the appropriateness of requests:

> The basic purpose of the advisory service of the Biophysical Society is to contribute to the improvement of conditions of society . . . to relieve suffering and prolong life, to improve the environment by reducing pollution of the air or water or protecting natural resources . . . .[15]

It was also decided that the editorial board would retain, and generally exercise, the option of making the results of investigations public.

Peter von Hippel reported on the progress of the Biophysical Society's public advisory project at a conference, Scientists in the Public Interest: The Role of Professional Societies, held in Alta, Utah, in the fall of 1973.[16] The enthusiastic response of the other participants, including representatives of a number of professional societies, indicates that other societies may soon join the biophysicists in offering their services to the public. Such services could also prove helpful to officials responsible for choosing members for science advisory committees organized by federal agencies or the National Academy of Sciences.

DEFENDING PROFESSIONAL RESPONSIBILITY

> Until recently, all hopes for change in corporate and government behavior have been focused on external pressures on the organization, such as regulation, competition, litigation, and exposure to public opinion. There was little attention given to the simple truth that the adequacy of these external stimuli is very significantly dependent on the internal freedom of those within the organization.
>
> . . . Within the structure of the organization there has taken place an erosion of both human values and the broader value of human beings as the possibility of dissent within the hierarchy has become so restricted that common candor requires uncommon courage.
>
> There is a great need to develop an ethic of whistle blowing which can be practically applied in many contexts, especially within corporate and governmental bureaucracies. For this to occur, people must be permitted to cultivate their own form of allegiance to their fellow citizens and exercise it without having their professional careers or employment opportunities destroyed. . . . Whistle blowing, if carefully defined and protected by law, can become another of those adaptive, self-implementing mechanisms which mark the relative difference between a free society that relies on free institutions and a closed society that depends on authoritarian institutions.[17]
>
> —Ralph Nader

Another topic much discussed at the Alta Conference on public interest science was the role of professional societies in defending the professional integrity of scientists. A number of professional societies have included relevant passages in their professional codes of ethics. Thus we find in the code of the National Society of Professional Engineers:

> The Engineer will have proper regard for the safety, health, and welfare of the public in the performance of his professional duties. If his engineering judgment is overruled by non-technical authority, he will clearly point out the consequences. He will notify the proper authority of any observed conditions which endanger public safety and health.[18]

And the *Chemist's Creed* of the American Chemical Society contains the following:

> As a chemist, I have a responsibility . . . to discourage enterprises or practices inimical to the public interest or welfare, and to share with other citizens a responsibility for the right and beneficent use of scientific discoveries.[19]

But most scientists and engineers have heavy family responsibilities and are locked into their jobs by the uncertainty of whether they could find another comparable position without an intervening period of severe dislocation. To them, therefore, the high-sounding phrases in their professional codes of ethics must seem pretty remote.[20] If scientists and engineers felt that their professional societies would stand behind them when they acted according to these codes of ethics, things might be somewhat different.

There are many things that scientific societies can do to defend the professional integrity that their codes of ethics urge upon their members. At the very least they can lobby for legal protection for the government or industrial professional who refuses to carry out orders which violate either the letter or spirit of the law or imperil the public health and safety. Professionals should have legal protection against losing their means of livelihood as a result of actions in the public interest, or at least they should be able to sue for compensation and expect a timely hearing of their suit.

Until our legal system recognizes the value to the public interest in offering protection to "whistle blowers," professional societies must fill the gap to the extent that they are able. The American Association of University Professors (AAUP) works to protect the academic freedom of its members by setting certain standards for the universities at which they are employed. When it appears that a university's treatment of one or a number of its faculty members has violated these standards, the AAUP often conducts an inquiry on the basis of which, in extreme circumstances, it may publicly censure the university. There is no reason why professional societies cannot involve themselves in similar activities in defense of the professional integrity of their members. In those cases where a society fails to dissuade an employer from seeking revenge on a whistle blower, the society could exert itself to help him find new employment and even provide legal assistance in a suit against his former employer if both the society and the member feel that the case has sufficient merit. Very few such cases have ever been taken to court, but a few well-chosen litigations could establish landmark precedents.

President Alan C. Nixon of the American Chemical Society reported at the Alta Conference that the ACS has undertaken essentially all of the activities mentioned above. It has established a professional relations committee to develop model employment contracts and investigate members' employment grievances and a legal aid fund to act on the professional relations committee's findings if necessary. The ACS also plans to compile an annual publication listing the employment practices of the 900 leading employers of chemists, including records of member complaints and ACS findings.

It was also suggested at the Alta Conference that the societies recognize notable accomplishments in public interest science just as they hand out awards for notable scientific discoveries:

> In order to strengthen the general respect for professional codes of ethics, societies could . . . give certificates of commendation to individual scientists whose integrity has defended the public health and welfare against significant hazards as in the famous case of the FDA medical scientist, Dr. Frances Kelsey, who held the line on Thalidomide.[21]

In this vein, the APS Forum on Physics and Society in 1974 established the Leo Szilard Award for Public Interest Science. The first recipient was David R. Inglis.

Public Interest Science As a Profession

Until the late 1960s, debates over technology generally focused on particular dangers of particular technologies: the side effects of drugs such as thalidomide, the dangers of fallout from atmospheric nuclear testing, the dangers of persistent pesticides, and so forth. In the past few years, however, the public has come to recognize that almost all technologies have potentially adverse side effects. The response has been to try to develop institutions and laws which set up mechanisms for the determination and regulation of the impact of technologies in general rather than continuing to react to problems on an individual and ad hoc basis. Thus we have the National Environmental Protection Act (1969) with its requirements of "environmental impact statements" for federally funded or regulated projects, the Environmental Protection Agency (1970), and Congress's new Office of Technology Assessment (1973).

The public interest science movement is also starting to institutionalize. As yet, the number of professional–i.e., full-time–public interest scientists is very small. We will discuss a few of these pioneers briefly here.

RALPH LAPP

Dr. Ralph Lapp is a "free-lance" public interest scientist: he works alone and with no organizational base. Lapp worked on nuclear weapons during the Second World War and on the development of nuclear reactors for a few years thereafter. Since about 1950, however, he has been an independent and respected critic of U.S. policy in these areas. Lapp's first great success in his new career was with his book *The Voyage of the Lucky Dragon*, the true story of an unlucky Japanese fishing vessel which was caught in the radioactive cloud from one of the United States H-bomb tests in the South Pacific.[22] This best-selling book helped bring home to the public the hazards of fallout from atmospheric nuclear weapons tests. More recently, Lapp has participated in the debates over the deployment of antiballistic missiles and the safety of nuclear reactors. He has written many books on issues relating to the arms race and most recently on the "energy crisis."[23] Many of his articles have appeared in the *New York Times Magazine* and in the *New Republic*.

Lapp supports himself by his writing, by giving talks to university and industrial groups, and as a consultant (in 1972, for example, to state officials concerned about the safety of nuclear reactors being sited in their jurisdictions). He prefers to act as a friendly critic of the AEC. As a result, he has good communications with the AEC's Commissioners and high-level bureaucrats, and he tries to influence policy through this access route both before and during public debates over AEC policies. He has been quite effective at this–perhaps because he has demonstrated that he is willing and able to take issues to the public when he thinks it is necessary.

JEREMY STONE

Still in his thirties, Dr. Jeremy J. Stone abandoned a promising academic career in 1970 to become the first full-time executive director of the Washington, D.C.-based Federation of American Scientists (FAS) since that organization's beginnings in 1945-1946. (The FAS had been born in the post-war scientists' campaign for the assignment of responsibility for atomic energy to an agency under civilian control.[24]) In the late 1960s at about the same time a substantial number of high-level government science advisors began to move outside government and work through the FAS—partly in order to bring before Congress the ABM debate which they had lost within the executive branch in 1967, also as a result of their frustration with the Indochina war, and finally—perhaps most importantly—because of their diminishing influence within the Johnson and Nixon administrations. The FAS welcomed the support of these former insiders, and by 1972 a former head of the elite Jason group of Defense Department consultants, Marvin Goldberger, had succeeded former Director of Defense research and Engineering Herbert York in the (unsalaried) FAS chairmanship. Partly as a result of the support of these prominent figures, and partly because of Jeremy Stone's dedicated and imaginative leadership, the FAS has experienced a considerable re-invigoration.

Stone's efforts were crucial in convincing the Armed Services Committees of both Houses of Congress to institute a new tradition of inviting witnesses opposed to administration proposals to hearings on weapons systems. And the testimony which he has organized against the Pentagon's favorite new weapons boondoggles, an effort that has sometimes pitted former high executive-branch officials against the current occupants of the same offices, has not been without effect. For example, FAS witnesses helped convince Chairman John Stennis (D.-Miss.) of the Senate Armed Services Committee to refuse flatly the Nixon administration's 1971 request to expand the Safeguard ABM system. In recent years FAS has developed positions on a broad spectrum of technological issues—the SST, reactor safety, world food supply, ways of reducing air pollution from automobile emissions, the oil crisis, and so forth—and its monthly newsletter, renamed in 1973 the *FAS Public Interest Report,* has become a steadily improving digest of informed scientific opinion on controversial issues. (In writing and editing this newsletter, Jeremy Stone adheres to the sort of independent journalism his father pioneered in *I. F. Stone's Weekly.*) As a consequence of its new record of accomplishment, coupled with Jeremy Stone's indefatigable campaigns to attract new members, the FAS's membership tripled over a recent two-year period and reached a total of about 6,000 in 1973.

JAMES MACKENZIE

Dr. James MacKenzie, a nuclear physicist, also in his early thirties, became involved in public interest science as one of the leaders of the Union of Concerned Scientists and director of UCS environmental activities. In 1970-1971 the group lobbied the Massachusetts Department of Public Health—first in favor

of setting air quality standards for the Boston area and then in opposition to Boston Edison's request for a variance from these standards for a large coal-burning power plant.

During this effort the UCS became disgusted with the proindustry bias of the Public Health Department and its relative insensitivity to threats to the public health. As a consequence, MacKenzie and his group prepared and distributed a Ralph Nader-type exposé on the pesticide-regulation, air-pollution control, and meat-inspection policies of the department that ultimately led to the governor's replacing several top state health officials with men more interested in public health.

In 1970 MacKenzie took a full-time position with the Massachusetts Audubon Society, where he has since established himself as an "environmental scientist" and as a nationally recognized generalist on energy technology. He is much sought after to serve on federal executive-branch advisory panels, he has become increasingly active as an advisor to Massachusetts state officials, and he continues his public interest work. In 1972, together with James Fay, a professor of mechanical engineering at MIT, MacKenzie called increased public attention to the dangers associated with the unloading and storage of liquified natural gas near metropolitan areas. They explained that if a large tanker or storage tank should rupture, it would release a large cloud of cold vapor which would drift along the ground ready to ignite. The resulting fire could incinerate more than a square mile.[25] MacKenzie also has a special interest in solar energy and has persuaded the Massachusetts Audubon Society to advance the state of the art by designing its new office building to be both heated and cooled using this energy source.

THE EDF SCIENTIFIC STAFF

In 1971 the Environmental Defense Fund began hiring young scientists to complement the increasing number of lawyers on its professional staff. Leo Eisel, a water-resource and land-use-planning engineer who had worked as a student with Jim MacKenzie and the Union of Concerned Scientists, was one of the first of the full-time EDF scientists. By 1973 the scientific staff of the EDF had grown to six and the scientific preparation of many of the organization's cases was being handled primarily by these scientists. Meanwhile, in other areas of activity—particularly pesticides—the traditional part-time public interest scientists such as Charles Wurster continued to pull their weight.

THE CENTER FOR SCIENCE IN THE PUBLIC INTEREST

Our final example of the professionalization of public interest science is the Washington, D.C.-based Center for Science in the Public Interest.

Dr. Albert Fritsch (an organic chemist and Catholic priest), Dr. Michael Jacobson (a biochemist), and Dr. Jim Sullivan (who is trained in meteorology and oceanography) all began their public interest careers by working for Ralph Nader. In January 1971 they incorporated as the nonprofit, tax-exempt Center for Science in the Public Interest (CSPI) for the purposes of:

1. Collecting and publicizing evidence to assess whether public and private activities involving technology are truly reponsive to the public interest;
2. Encouraging scientists and engineers working in government and industry to be more aware of citizen needs; and
3. . . . Promoting legal action or administrative appeals, supplying legislatures with requested data, or focusing public pressure on critical and consumer issues.[26]

Mike Jacobson has specialized in food additives. His popular writing on the subject has been quite well received: his book *Eater's Digest*,[27] written while he was still with Nader, had sold more than 25,000 copies by the summer of 1973, and his pamphlet, *Nutrition Scoreboard*, was then selling at the rate of 250 orders a day. In addition, Jacobson has written a number of more specialized reports on particular problems, including a pamphlet on sodium nitrite (entitled *Don't Bring Home the Bacon*) and one on *The Chemical Additives in Booze.*[27] As a result of Jacobson's activities in connection with the latter topic, the Internal Revenue Service in 1973 issued a ruling that the chemical additives in beer, wine, and hard liquor must be listed on the labels, as they are for food.

Two of Al Fritsch's projects have involved gasoline additives and asbestos pollution, and he has written several reports on these subjects. In the case of asbestos fibers, which are known to cause lung cancer, Fritsch has been pressing all the responsible federal agencies to act in their areas of responsibility in the expectation that their actions will be mutually encouraging and reinforcing. Regarding gasoline additives, his concern is that some of the additives may give rise to dangerous (e.g., cancer-producing) air pollutants. He has managed to persuade the Environmental Protection Agency to release a list of two-thirds of the additives in gasoline and has initiated a suit to obtain the rest. In response to the claim that this information involves trade secrets, the CSPI contended that the oil companies could always chemically analyze each other's products—and sent a gallon of gasoline off to a commercial testing laboratory to prove their point. The CSPI's suspicion is that the only real trade secret is that all commercial gasolines of the same octane rating are essentially interchangeable. The CSPI has also persuaded a public-interest law group, the Natural Resources Defense Council, to sue the Environmental Protection Agency to push for faster removal of lead from gasoline—i.e., at a rate which the agency's own consultants have suggested would be feasible.

Jim Sullivan has worked mostly to assist the hundreds of highway action groups which have sprung up nationwide in opposition to urban expressway projects. He has put these groups in contact with experts who can testify for them at hearings and has pressed the Department of Transportation to upgrade its standards for environmental impact statements on these projects.[28] Sullivan seems to be the CSPI's chief entrepreneur, and in 1973 he began a weekly radio program, "Watch-Dog," on a local Washington station with the hopes of syndicating it if it succeeds. In January 1974 he established a public interest science newsletter.

The first-year budget of the CSPI was $20,000, and in the second year it rose

to $55,000. Some of this money has been foundation grants, and other money has come in the form of contracts for specific projects (e.g., $10,000 from the Consumers Union for the gasoline-additive project). As the budget has grown, so has CSPI. As of 1973, the full-time staff numbered six, and the center had a regular program for summer science interns.

We have touched on only a few of the CSPI activities. Their scientists are in continual demand for testimony at Congressional hearings, and they have set up a clearing house, Professionals in the Public Service, which puts citizens' groups in touch with appropriate Washington, D.C.-area professionals available for public interest work. Altogether the Center for Science in the Public Interest represents a truly inspirational example of the possibilities of public interest science as a profession.

Conclusion

We have seen in this chapter—and in the entire book—how individual public interest science efforts have appeared in almost every possible institutional framework, and already produced exciting results. But a few robins do not make a spring: the scale of the current public interest science effort is not yet anywhere near commensurate with the challenge posed by technology to our society. Is this movement an echo out of America's individualistic past? Or can it be the seeds of a fundamental transformation of the relationship between scientists and society? It is to these questions which we turn in the next two chapters.

NOTES

1. The NSF later explained that *Environment* had not received the requested support because NSF "was not intended to support activities directed toward applications of science in specific social problem areas but rather to science in general." Quoted in U.S., Congress, Senate, Committee on Government Operations Hearings, *Advisory Committees*, October 6, 1971, Part 3, p. 785.
2. Ralph Nader, "Introduction," *Whistle Blowing*, Ralph Nader, Peter Petkas, and Kate Blackwell, eds. (New York: Grossman, 1972), p. 4.
3. Quoted in *Ibid.*, p. 186.
4. See "A. Earnest Fitzgerald" in *Ibid.*, pp. 39-54. On Fitzgerald's reinstatement, see the *New York Times*, September 19, 1973, p. 1.
5. Quoted in H. Peter Metzger, *The Atomic Establishment* (New York: Simon and Schuster, 1972), p. 258.

6. Bertrand Russell, "The Social Responsibilities of Scientists," *Science* 131 (1960): 391.

7. See, for example, Spencer Klaw's description of this life in *The New Brahmins* (New York: William Morrow, 1968).

8. Quoted in Phillip N. Boffey, "AAAS: is an Order of Magnitude Expansion a Reasonable Goal?," *Science* 172 (1971): 656. (This is the last article in a three-part series on the history of the AAAS. The previous articles begin on pages 453 and 542, respectively.)

9. American Association for the Advancement of Science, Committee on Science in the Promotion of Human Welfare, "Science and Human Welfare," *Science* 132 (1960): 71.

10. U.S., Executive Office of the President, Office of Science and Technology, *Restoring the Quality of the Environment*, Report of the President's Science Advisory Committee (Washington, D.C.: Government Printing Office, November 1965).

11. The information in these paragraphs is taken from Quigley's talk at the Conference on Scientists and the Public Interest: the Role of the Professional Societies, Alta, Utah, September 7-9, 1973. The final report of the ACS task force: American Chemical Society, Committee on Chemistry and Public Affairs, *Cleaning Our Environment: the Chemical Basis for Action* (Washington, D.C.: American Chemical Society, 1969). The direct cost of preparing the report was $67,000, not including ACS staff work and other overhead.

12. Some professional societies have also assumed this helpful but restricted role. For example, the Federation of American Societies for Experimental Biology (an association of six of the more prestigious biomedical professional societies with a collective membership of 13,000) contracted with the FDA in 1973 to convene some twenty-five ad hoc review panels to review the potential hazards of the substances on the FDA's "Generally Recognized as Safe List" of food additives.

13. Both citizens' groups and public officials have complained about their problems in getting scientific advice and assistance. For example, former New York Representative Richard Ottinger spent two years trying to locate a scientist who would testify regarding the effect of the proposed Storm King power plant on a bass spawning ground in the Hudson River. (See Constance Holden, "Public-Interest Advocates Examine Role of Scientists," *Science* 175 (1972): 501.) And the chief deputy attorney general of California complained in 1969 that he was unable to find university petroleum engineers who would testify for the state in its damage suit against four oil companies in connection with the Santa Barbara channel oil leak. (See John Walsh, "Universities: Industry Links Raise Conflict of Interest Issue," *Science* 164 (1972): 411.) A number of state governments have set up science advisory committees, but these have turned out to be mostly pro forma. (See Harvey Sapolsky, "Science Policy in American State Government," *Minerva* 9 (1971), p. 322.)

14. Referendum submitted to members of the Biophysical Society by Peter H. von Hippel, president-elect, winter 1972.

15. "Progress Report on the Development of the Science Advising System . . . ," from Peter H. von Hippel, president, to the members of the Biophysical Society, summer 1973.

16. The conference was sponsored by the American Academy of Arts and Sciences, Western Center, in cooperation with the University of Utah's Engineering Experiment Station, Engineering Department, and Physics Department. The conference was organized by the authors with Barry M. Casper (chairman-elect of the American Physical Society Forum on Physics and Society), under the chairmanship of Peter Gibbs, Chairman of the Physics Department of the University of Utah. Copies of the *Report of the Alta Conference on Scientists in the Public Interest: The Role of the Professional Societies* are available from the American Academy of Arts and Sciences, Western Center, Center for Advanced Study in the Behavioral Sciences, Stanford, California.

17. Ralph Nader, "Introduction," Nader, Petkas, and Blackwell, *Whistle Blowing*, pp. 4-7.

18. *Code of Ethics for Engineers* of the National Society of Professional Engineers (January 1971), quoted in Appendix B of Nader, Petkas, and Blackwell, *Whistle Blowing*, p. 258.

19. *Chemist's Creed*, Approved by the Council of the American Chemical Society, September 14, 1965, quoted in Appendix B of Nader, Petkas, and Blackwell, *Whistle Blowing*, p. 261.

20. For a fictionalized rendition of this situation see Louis V. McIntire and Marion Bayard McIntire, *Scientists and Engineers: the Professionals Who Are Not* (Lafayette, Louisiana: Arcola Communications Co., 1971). The hero of the book, Marmaduke Glum, is a chemist working for Logan Chemical Company. Apparently the book was not sufficiently fictionalized because Louis McIntire, chemist, working for DuPont, was fired after his book came out.

21. Peter Edmonds, Alan Nixon, Peter Petkas, and Frank von Hippel, "Report of the Alta Task Force on Professional Responsibility," *Report of the Alta Conference on Scientists in the Public Interest*, p. 58.

22. Ralph E. Lapp, *Voyage of the Lucky Dragon* (New York: Harper and Bros., 1957).

23. See, e.g., Ralph E. Lapp: *The Weapons Culture* (New York: W. W. Norton, 1968); *Arms Beyond Doubt: the Tyranny of Weapons Technology* (New York: Cowles, 1970); *The Logarithmic Century* (Englewood Cliffs, N.J.: Prentice-Hall, 1973).

24. Alice Kimball Smith, *A Peril and a Hope: the Scientists' Movement in America 1945-47* (Chicago: University of Chicago Press, 1965).

25. James A. Fay and James J. MacKenzie, "Cold Cargo," *Environment*, November 1972, p. 21.

26. Quoted from the first issue of *Center for Science in the Public Interest Newsletter*, April 1971, p. 1.

27. Michael F. Jacobson, *Eater's Digest: the Consumer's Factbook of Food Additives*, (Garden City, N.Y.: Doubleday, 1972).

28. James B. Sullivan and Paul A. Montgomery, "Surveying Highway Impact," *Environment*, November 1972, p. 12.