Public-interest science—an overview

Individual scientists and their professional societies are becoming increasingly involved in public debates over the impacts and regulation of technologies.

Martin Perl, Joel Primack and Frank von Hippel

The idea that the public, as well as the government and industry, should have scientific advisors is an old one. The idea that the interests of the public should have lawyers to defend them is old too, yet it was not until the 1960's that a renewed public understanding of the insensitivity of governmental and industrial bureaucracies led to a substantial commitment in the legal profession to public-interest law. It appears that the scientific community may now have reached a similar point; a growing awareness of the dangers of leaving the exploitation of technology to special industrial and governmental interests has led to an increased readiness among scientists to undertake work in public-interest science.

The obvious disarray of our policy for technology—despite the still impressive remains of the executive-branch science-advising establishment—has evoked a response from within the scientific community. New public-interest organizations are being formed by scientists, established organizations have recently been invigorated, and the scientific professional societies are beginning to get involved. In this article we survey these developments and discuss some of the implications.

What is public-interest science?

When scientists move outside industrial and governmental channels to help take issues to the public or the courts, we term their efforts "public-interest science." Such efforts have occurred, for example, in connection with the termination of the atmospheric testing of nuclear weapons, the curtailing of the use of the pesticide DDT, the stopping of the deployment of the Sentinel and Safeguard antiballistic missile systems, and the truncation of the US supersonic transport development program.

As these examples illustrate, public-interest scientists usually find themselves "in opposition," pointing out unacknowledged risks associated with government or industry programs. They act as a check to socially irresponsible activities on the part of government and industry, after internal opposition or government regulation has failed. But opposition alone is not necessarily responsible or even effective when important social objectives are involved. Therefore opponents to the excessive use of chemical pesticides push integrated pest-management techniques, and those scientists concerned about the rapid pace of our commitment to nuclear power push energy conservation in the short run and alternative supply technologies in the longer run.

To many scientists who have become accustomed to policy for technology being made in private by "expert officials," the idea of involving the public in these issues conjures up disturbing visions. They are concerned about some scientists exaggerating dangers in an effort to be heard and about the response of the Chicken Littles who will panic at the first suggestion that the "sky is falling." The fact is, however, that, when an issue such as the SST or DDT is taken to the public, it isn't the Chicken Littles who structure the protracted debate that follows—they will soon be distracted by the next day's sensation. The participants in the debate are instead the responsible officials in federal agencies, the public-interest groups who must decide whether or not to commit their limited resources, the journalists who will determine which issues are "newsworthy," the lawyers and judges who will present and make findings on the legal issues, the state and local officials who may feel that they must take initiatives to protect the public health and welfare, and the Congressmen and their staffs who must decide whether investigative or legislative action is called for. If important issues of public policy cannot be discussed productively by these groups, then there is little hope for democracy. In fact, the evidence from case studies would appear to indicate that the misleading statements of government spokesmen endanger the integrity of the public debate far more often than do exaggerated warnings by public-interest scientists or irrational behavior on the part of the citizenry.[1]

Traditionally, public-interest science has been an activity carried on in an entirely *ad hoc* manner by full-time scientists 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 con-

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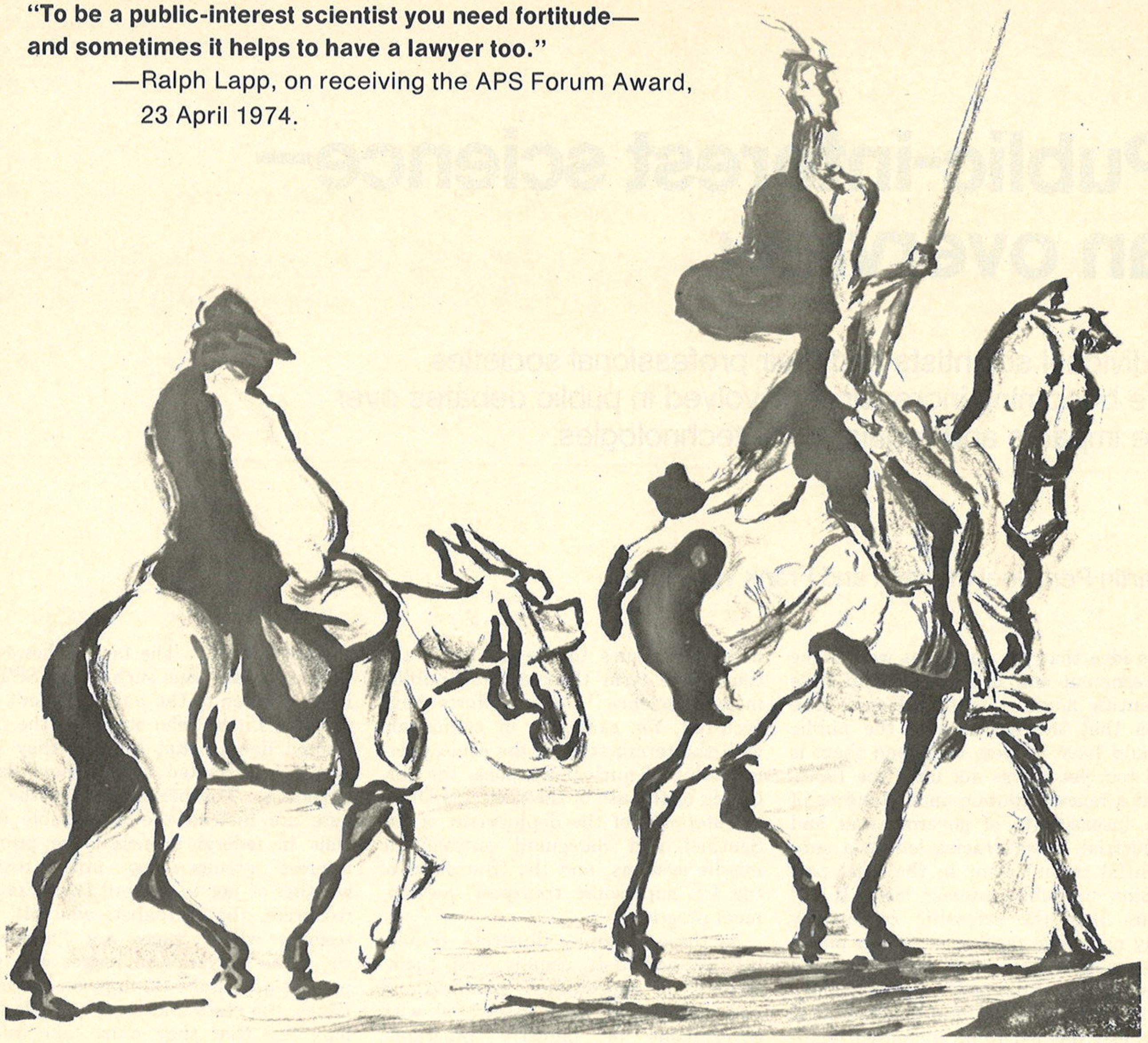
"To be a public-interest scientist you need fortitude—and sometimes it helps to have a lawyer too."

—Ralph Lapp, on receiving the APS Forum Award, 23 April 1974.



DRAWING OF DON QUIXOTE BY HONORE DAUMIER

tinue. The unfettered spirit and fresh perceptions of outsiders will always be required to keep the system honest. But the problems that our society faces in dealing with technology have grown to be too numerous and too sustained, and institutional vested interests too great, for the practice of public-interest science to continue satisfactorily on an entirely *ad hoc* basis.

There has, therefore, been an accelerating movement since the Second World War toward the institutionalization of public-interest science in the US. Part-time public-interest scientists have formed umbrella organizations—such as the Federation of American Scientists, the Scientists' Institute for Public Information with its affiliated local Committees for Environmental Information, and the Cambridge-based Union of Concerned Scientists. At least as significant a development, however, is that some scientists have taken up public-interest science as a profession. In recent years the lawyer-organized National Resources Defense Council has hired scientists, the scientist-organized Environmental Defense Fund has hired a staff of full-time public-interest lawyers and scientists, and a group of young scientists has set itself up in Washington as the Center for Science in the Public Interest. (See the article by one of these scientists, James L. Sullivan, on page 32.)

In focusing on these "outsider" organizations, it is not our intention to imply that it is impossible for a scientist to work for the public interest in any way other than by taking a public adversary position. If such were the case, the enterprise would have very limited effectiveness. Fortunately there is a whole spectrum of ways in which scientists can influence public policy for technology, each with its own advantages and limitations.

The federal science-advisory system

The traditional way for scientists to be involved with public issues is through the vast federal science-advisory system. In this system about 1500 committees of scientists advise executive-branch officials directly or through the quasi-governmental National Research Council of the National Academies of Science and Engineering.[2] The input of these advisory committees is important for the day-to-day operation of the government. At the same time, however, it is well known that when large political or bureaucratic interests are at stake the information and analyses that these advisory committees provide are often not seriously considered, and the main function of the advisory establishment may then merely be to help "legitimize" government policy.[1,3,4] The committee members also may feel inhibited from taking a strong adversary position on a critical issue for fear that they may imperil their future involvement in the policy-making process. That this fear is justified is illustrated by the abolition of the President's Science Advisory Committee and the Executive Office of Science and Technology, which was due at least in part to their opposition to the Nixon administration's supersonic-transport development program and Safeguard antiballistic-missile system.

Other avenues through which scientists may become involved in the policy-making process are rapidly opening up with legislative bodies. A very few scientists now work on Congressional staffs. (One of these is physicist Thomas Ratchford, the author of the article on page 38.) But Congress in 1973 set up an Office of Technology Assessment as a small counterpart to the massive executive-branch science-advisory structure. Also in 1973, the American Physical Society joined the American Association for the Advancement of Science, the American Society of Mechanical Engineers, and the Institute of Electrical and Electronics Engineers in sponsoring one-year-long fellowships for scientists to work with Congress. Two physicists are participating in this program: Richard Werthamer, who is serving on the staff of Rep. Charles Mosher (R-Ohio), and Ben Cooper, a member of the Senate Interior Committee staff. State legislatures are also setting up science-advisory structures. (Seville Chapman, author of the article on page 43, is science advisor to the New York State Legislature.)

Who can get involved?

Ultimately, the future of public-interest science depends upon the willingness of individual scientists to become involved. This in turn depends upon the presence of a certain amount of self-confidence, idealism (public-interest science is either unpaid or poorly paid work), and political sophistication (required to perceive the areas where one's skills would be useful). It also depends upon the attitude of one's fellow scientists toward public-interest science activities. In particular, the ability of scientists in industry and government laboratories to participate in public-interest science may be constrained by the attitudes of their employers—even when the activities are confined to their own time. As Ralph Nader has observed:[5]

> "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."

University scientists, on the other hand, are protected by a long tradition of academic freedom and are free, in principle, to speak their minds and take public stands on any issue. The majority of university scientists, however, are entirely uninvolved in public technological issues. And of those who do forsake their ivory towers for such activities, the number who consult for the government or industry is far larger than the number of independent public-interest scientists.

But this lifestyle is by choice. In particular, once university scientists have tenure, all of their nonteaching activities are in principle voluntary. Indeed, some scientists feel that they are no longer contributing in an important way to their fields by the time they are past their mid-thirties. On the other hand, the problems in public-interest science are important, socially worthwhile and crying for attention. Why do so few scientists pick up the challenge?

By reading the sociologists of science one can find a partial answer to this question. We scientists like to think of ourselves as very free and independent spirits, each going our separate skeptical ways. But this is only a lovely myth. As we have been analyzed by Warren Hagstrom[6] and many others, each scientific community is a tightly knit group in which there is a great deal of community social control of the individual scientist. This social control encourages good research to be done, encourages careful communication and publication of research, encourages honest criticism, discourages sloppy work, and prohibits dishonesty and fraud. And at the heart of the social-control system is the system of scientific recognition, which is obtained through the interest of colleagues in one's work, through acceptance of one's papers by professional journals, through invitations to speak at professional meetings, through appointments to professional committees, through prizes and election to honorary societies, and ultimately through job offers and promotions. But this extensive and important professional recognition system has generally *not* applied to public-interest science activities.

This situation is beginning to change, however. Many professional societies, such as APS, are giving a prominent place in their meetings to discussions of public-policy issues. And although public-interest science is rather an applied sort of science, it frequently involves issues that are of considerable scientific interest. Attempts to predict the effect of nitrogen oxides from SST exhaust on the amount of ozone in the stratosphere, for example, will probably shed considerable light on the natural mechanisms controlling atmospheric ozone concentration and thus help to determine the structure of the lower stratosphere—a matter of great interest to atmospheric physicists.[7] Such issues are clearly worthy of discussion in professional scientific journals.

In our own academic institutions, we should urge that serious work in public-interest science be considered appropriate research for graduate students as well as a legitimate basis for faculty promotions. Of course, public-interest science ought to have standards as high as those of basic and applied research. The premium should

> **The knowledge that the public possesses** on any important issue is derived from vast and powerful organizations: the press, radio, and, above all, television. The knowledge that the governments possess is more limited. They are too busy to search out the facts for themselves, and consequently they know only what their underlings think good for them unless there is such a powerful movement in a different sense that the politicians cannot ignore it. Facts which ought to guide the decision of statesmen—for instance, as to the possible lethal qualities of fallout—do not acquire their due importance if they remain buried in scientific journals. They acquire their due importance only when they become known to so many voters that they affect the course of the elections . . .
>
> . . . what ought to be known widely throughout the general public will not be known unless great efforts are made by disinterested persons to see that the information reaches the minds and hearts of vast numbers of people. I do not think this work can be successfully accomplished except with the help of men of science.
>
> . . . I think men of science should realize that unless something rather drastic is done under the leadership or through the inspiration of some part of the scientific world, the human race, like the Gadarene swine, will rush down a steep place to destruction in blind ignorance of the fate that scientific skill has prepared for it.
>
> *Bertrand Russell*[11]

be on originality and accuracy as well as effectiveness of presentation. Activism must not be rewarded simply for its own sake.

In order to recognize outstanding contributions to public-interest science, the Forum on Physics and Society has established the Leo Szilard Prize, to be awarded each year at the Washington meeting of the American Physical Society. Another annual award, the Forum Prize, will be given to the author of articles or books that contribute significantly to public understanding of a "physics-and-society" issue. At the April 1974 Washington meeting, the first Leo Szilard award was received by David Rittenhouse Inglis, and the first Forum Prize was awarded to Ralph E. Lapp (see PHYSICS TODAY, April, page 48). For more than two decades, both Inglis and Lapp have played leading roles in educating the public about the follies of the strategic weapons race. Indeed, Lapp has the distinction of being perhaps the first full-time public-interest scientist.

The professional societies

The Leo Szilard Prize and other activities of the Forum on Physics and Society represent rather a new departure for the APS. Traditionally, professional societies have restricted their activities to the sponsorship of professional meetings and the publication of technical journals—in other words, to the discussion of scientific developments in their respective areas of specialization. This single-mindedness has been defended as a virtue by leaders concerned that discussion of "political" matters, such as the social impact of the applications of their science, would polarize their membership, pollute their science, and generally bring scientists and the supposed objectivity of the scientific method into disrepute. The attitude has been that scientific discussion should be strictly segregated from the discussion of questions that 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 over the adverse impacts of technology has increased, 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. Although the defenders of the traditional aloofness have urged those who feel compelled to discuss the ways that science impinges on society to find another forum, the inescapable fact has been that there have not been other comparable forums for such discussions within the scientific professions.

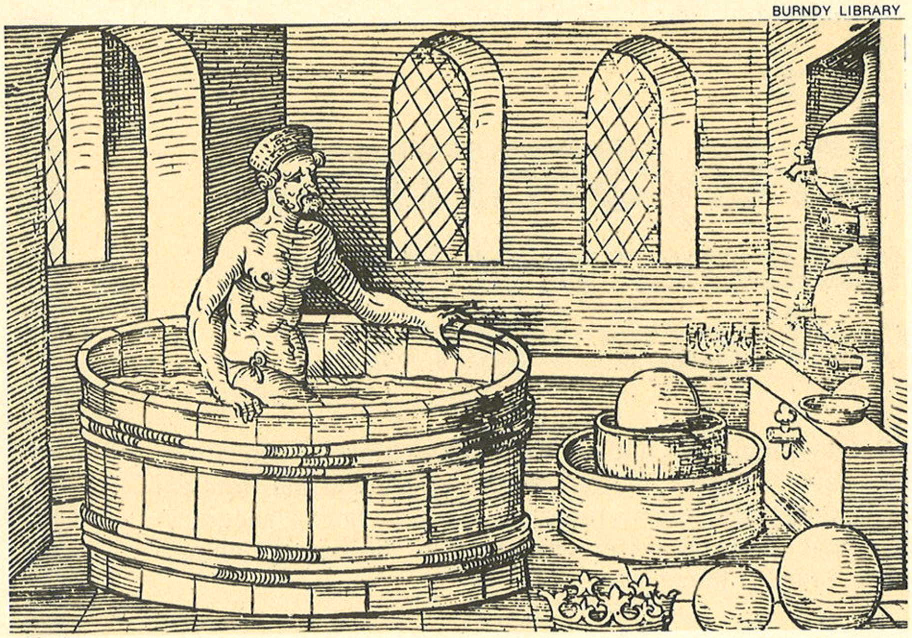
The 130 000-member American Association for the Advancement of Science has pioneered in this area. The AAAS, besides publishing *Science* with its excellent "News and Comments" section, has also sponsored studies of issues of public importance and organized sessions on these topics at its annual meetings.

The most venturesome study sponsored by the AAAS thus far has been the Herbicide Assessment Commission, which in 1970 mounted an expedition to study the environmental and public-health impact of the US Army's chemical defoliation and crop-destruction program in South Vietnam. The initial impetus for this project came in 1966 from E. W. Pfeiffer, a Montana zoologist. The AAAS leadership timidly resisted involving their organization in this highly charged issue for more than three years—during which time the Army conducted the bulk of its defoliation operations, which ultimately covered almost ten per cent of the area of South Vietnam. But when the project was finally undertaken—after all efforts to get governmental organizations to do a study had failed—the work of the Herbicide Assessment Commission under the leadership of Matthew Meselson was of such unimpeachable quality and its conclusions so carefully stated that it has reflected nothing but credit on the AAAS. At the same time the photographs of defoliated areas, which the Herbicide Assessment Commission brought back from Vietnam, had tremendous public impact in the US and helped bring an end to the Army's program of devastating the Vietnamese forests and rice fields.[1,8]

The 110 000-member American Chemical Society has been the pioneer among specialized professional societies in preparing public reports on

Professional society involvement in public issues

Activity	Examples
Establishment of "Science and Society" divisions, offices, committees, etc.	APS Forum on Physics and Society ACS Committee on Chemistry and Public Affairs
Congressional Fellowships for scientists	APS, AAAS, ASME, IEEE programs
Establishment of awards for outstanding achievement in public interest science	APS Forum Award and Leo Szilard Prize
Educational activities on public issues	Symposia at society meetings, resource letters, curricular materials
Publication of reports useful to laymen and legislators	*Cleaning Our Environment: The Chemical Basis for Action* (Washington, D.C.; ACS, 1969)
Sponsorship of technical studies relevant to public issues	AAAS Herbicide Assessment Commission APS Energy Summer Studies
Facilitation of member involvement in public issues	Biophysical Society's Roster of Scientists Available for Public Service Work
Professionalization of public interest science	Publication of articles in technical journals
Encouragement of professional responsibility	Adoption of code of ethics, establishment of professional-relations committee, legal defense fund, etc. (ACS has done all of these)
Support for public interest science groups	Dues check-off. Fellowships
Taking a stand on public issues	ACS support for ratification of the Geneva Protocol on Chemical Warfare



Archimedes' nondestructive investigation of the composition of the crowns belonging to the ruler of Syracuse illustrates that public issues sometimes involve questions of great scientific interest. (From *Der Neuen Perspectiva*, Vetruvius/Rivius, Nürnberg 1547.)

technical issues. In 1965, inspired by the President's Science Advisory Committee report *Restoring the Quality of Our Environment*, 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 chemical pollution that would be suitable for Congressmen and other interested laymen. The report, entitled *Cleaning Our Environment: The Chemical Basis for Action*, was finished in 1969. More that 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, and is currently being updated.

The APS Forum

Most professional societies have been less active in studying public issues than are AAAS and 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 one of the main functions of, for example, the Forum on Physics and Society of the APS. Barry M. Casper, in his article in the May PHYSICS TODAY (page 31), has explained how the Forum came into being, and in that article he describes current Forum programs and looks ahead to see what might be done in the future.

The Forum has sponsored programs at all major APS meetings during the past several years, 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. The Forum also led the way in the initiation of the APS Congressional Fellowship Program.

A more recent public-interest-science initiative within the APS has been its sponsorship of summer studies, planned for the summer of 1974, on scientific problems relevant to energy technologies. These studies were proposed by the APS Energy Planning Committee, which met at Los Alamos for a week during August 1973. The proposed subjects of study are nuclear reactor safety, a specific physics problem important in energy technology (radiation damage in materials), and ways of improving the efficiency of energy utilization at the point of use.

Studies of new technologies

The new opportunities that scientific societies are providing for discussion and study of public-policy issues by scientists may have a salutary impact on the way in which our society makes policy for technology. Ordinarily, when a new technological program is being "sold" to the executive branch (for example, the ABM or other weapons systems, the SST, the breeder reactor, the "war" on cancer), discussion is largely confined to that part of the technical community most closely tied to the industry or government agency involved. This results in 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 proposed American SST had been as widely understood in 1964 as they were in 1969, a much sounder basis for discussion and planning regarding the SST development program would have existed. There was no good reason why the seriousness of these problems and their intractability to any kind of "technological fix" could not have been made clear several years earlier.[1] Another such example is nuclear-reactor safety: If the adequacy of emergency core-cooling systems had been critically reviewed by members of the larger technical community before construction of the present generation of large power reactors was begun, the AEC and the electric utility industry might have been spared a lot of their current grief.[1]

Ideally, discussion of such issues should take place long before they reach the crisis stage. In cases where there is substantial disagreement over either the facts or their implications, more sustained and serious inquiry will be necessary. Professional societies, either individually or jointly, could then sponsor meetings or topical conferences at which all interested scientists would be able to discuss their views and clarify the specific areas of disagreement. In complex areas, such as reactor safety, prolonged studies can be organized—such as the summer study proposed by the APS. 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 are needed, they will be undertaken by an executive branch science advisory committee or by the National Research Council. It is important to appreciate, however, that these bodies are "other-directed," not "inner-directed"—they almost always respond to requests from the executive agencies rather than initiating studies on their own. The responsibility therefore remains with the larger scientific community to help identify and call public attention to the crucial questions that executive agencies ignore, overlook or haven't even thought of, and to see to it that necessary studies get done. If the government is willing to arrange for open, high-quality studies, fine. If not, the professional societies should be prepared to organize them on their own, as the AAAS finally did with the Herbicide Assessment Commission.

A roster of interested physicists?

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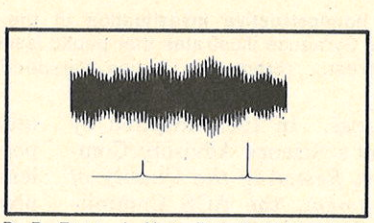
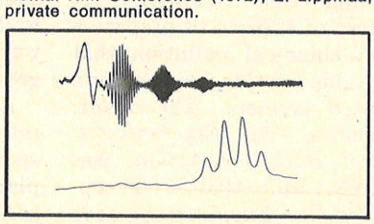


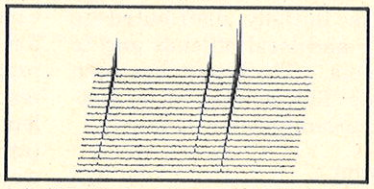
R. R. Ernst, *J. Mag. Res. 3* 10-27 (1970); R. Kaiser, *J. Mag. Res. 3* 28-40, (1970); J. Cooper and R. Addleman, 13th Experimental Nmr Conference (1972); E. Lippmaa, private communication.

RAPID SCAN NMR — In this technique, a spectral region is swept at a rate much greater than allowed for by slow passage conditions and the resulting ringing spectrum correlated with a spectrum of a single ringing line or of a theoretical line. Its principal advantage lies in the ability to acquire data rapidly even in the presence of strong solvent lines, without requiring that these lines be part of the signal averaged data.



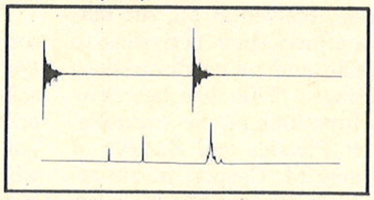
J. Dadok and R. F. Sprecher, 13th and 14th Experimental Nmr Conferences (1972, 1973); E. Becker, paper in press.

HOMOSPOIL T_1 SEQUENCE — This sequence allows the rapid measurement of long T_1's without the long $5xT_1$ waiting period needed by the inversion-recovery sequence. It is accomplished by a -(90-spoil-tau-90-sample-spoil)- sequence.



J. L. Markley, W. J. Horsley and M. P. Klein *J. Phys. Chem. 55* 3604 (1971); R. Freeman and H. D. W. Hill, *Ibid. 54* April (1971); G. G. McDonald and J. S. Leigh, Jr., *J. Mag. Res. 9* 358 (1973).

QUADRATURE DETECTION NMR — This technique allows $\sqrt{2}$ enhancement over conventional pulsed nmr since the rf carrier can be placed in the center of the spectral region and dual phase detectors used to receive the response. The two resulting free induction decays are Fourier transformed using a complex transform which results in a single frequency domain spectrum.



J. Schaeffer and E. O. Stejskal, 15th Experimental Nmr Conference (1974), and *J. Mag. Res.* March (1974) (in press). J. D. Ellett, etal. *Adv. Mag. Res.* 5 117 (1971)

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ing and diffusing the knowledge of their particular disciplines, professional societies can also provide unique scientific forums for the discussion and study of public issues with technical components. Indeed, the professional societies represent among their members the collective scientific wisdom and knowledge of the nation. The higher officials of the federal executive can call upon this expertise through their 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 do not usually have the concentrations of responsibility and expertise that 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 a tank farm for liquified natural gas, which is being built in his state? Or a committee of the state legislature that wants to know about how privacy of information can be protected in the state's computerized data banks? (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 help much—both because the group seeking advice may be in an adversary relationship with a federal agency and because many of the well known scientists who fly off to Washington to consult do not have the time to advise a mayor, state assemblyman, or local chapter of the Sierra Club.

In many instances, however, there are scientists who have the necessary competence and would be delighted to help. The problem is to get the interested and competent scientists together with the interested official or citizens' group. Scientific societies can help fill this need by facilitating the connection between the groups that need the advice and qualified scientists who are interested in participating in *pro bono* advisory activities.

The Biophysical Society's system

The Biophysical Society is pioneering in setting up a system for such "match-making." The scientists in this small society (2500 members) possess expertise especially relevant to determining the subtle biological affects of radiation, environmental pollutants and food additives. In a recent referendum they approved, by more than a ten-to-one margin, a proposal that their society should establish a science-advisory service for federal, state, and local government and citizen groups.

Much thought went into how the program should operate. The model finally chosen is 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 "clients." 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.

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 protect the scientists who have agreed to do *pro bono* work from being harrassed by inappropriate requests. For example, Peter von Hippel, president of the Biophysical Society, tells of one request from a lawyer in Wisconsin whose client had hurt herself in a fall and was sueing for damages; the lawyer wanted 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 . . . "

It was also decided that the editorial board will 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 meeting in Alta, Utah, on "Scientists in the Public Interest: The Role of Professional Societies" in fall 1973.[9] The response from the other participants, including representatives of a number of professional societies, suggests that other societies may soon join the biophysicists in offering their services to responsible public organizations. Rosters of scientists who are willing to do *pro bono* work are likely also to prove helpful in the choosing of members for science advisory committees organized by federal agencies, by the National Academy of Sciences, or by the professional societies themselves.

Codes of ethics

A number of professional societies have adopted passages in their professional codes of ethics that refer to the public responsibilities of their members. Thus we find[10] in the Engineer's Code, promulgated by 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."

And the Chemist's Creed of the ACS contains the following passage:[10]

> "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."

Only recently, however, have scientific societies taken steps to protect the interests of members who have tried to follow this ethical advice—and found themselves in trouble with their employers as a consequence. The ACS is undoubtably the leader in this area: 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 is also presently pursuing 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.

Problems that may arise

In the past, most scientists either have exhibited little interest in public-interest work or have participated largely in acquiescent and incremental activities. This kind of work is generally approved and accepted by government and industry; it acquiesces in an already fixed technological policy, and devotes itself to solving problems within that policy. Acquiescent and incremental activities tend to reinforce and legitimize existing technological policies and practices: They are a positive-feedback mechanism. There is nothing wrong with this when the policies are desirable—but what if they are outmoded or wrong? It is obvious that an adversary rather than acquiescent posture will then be more appropriate. But this has proved to be a difficult posture for most scientists to adopt, as we have remarked above, and it is not difficult to foresee that it will be an even more awkward posture for their professional societies.

Fortunately, this problem is probably more illusory than real. Although every scientist, as a responsible citizen,

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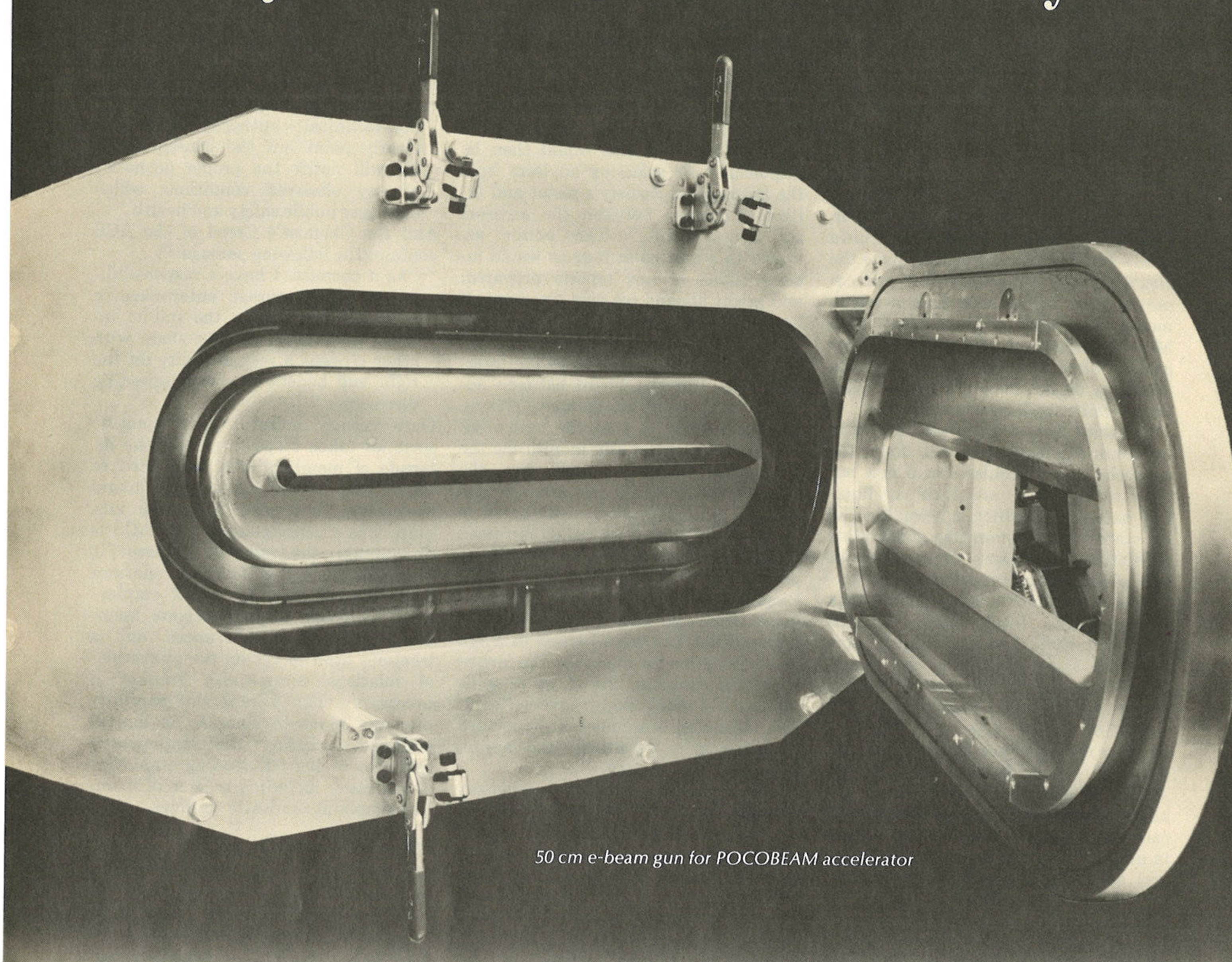

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is called upon to make personal decisions on various political issues, the professional societies do not have such a responsibility—except perhaps under extraordinary circumstances. Their main functions are, and must remain, educational and scientific. If they enter the political arena in connection with technological issues, their role should be primarily to facilitate the public interest activities of their members, to point out and clarify issues, to explain the relevant scientific facts, and to help resolve important technical uncertainties. Only very rarely will difficult public-policy issues arise on which there is a clear consensus of the membership of a professional society, both on the most desirable position and on the appropriateness of taking a public stand. A recent example is the ACS decision to support unqualified Senate ratification of the Geneva Protocol of 1925. This treaty, which bans the use of chemical warfare, has been ratified by all major nations except the US.

The fact remains that scientific societies are increasingly becoming involved in public issues—not only because of the demands of their politically more activist members, but also in response to requests from federal officials such as NSF director Guyford Stever, who now also serves as the Science Advisor to the executive branch. Stever has consulted several times in recent months with the presidents of leading scientific societies, including the APS.

Traditionally, leaders of professional societies have been chosen almost solely on the basis of their scientific reputations, without regard for their political judgment. But if scientific societies continue to take on projects like the APS energy studies and their officers continue to advise high governmental officials, new institutional arrangements may well be required. In any case it is evident that challenging times lie ahead for the scientific societies.

Perspective

A decade ago, public-interest science was the pursuit of a very few pioneers, such as Szilard, Inglis and Lapp. Only under exceptional circumstances did the larger scientific community become involved. Scientists generally were willing to leave policy for technology in the hands of executive-branch officials and their confidential science advisors.

It is remarkable to consider how much things have changed in the past few years. The Indochina war and Watergate have dramatized the hazards of making policy behind the closed doors of the executive branch, while the course of public debates over environmental and arms-race issues, such as SST and ABM, has demonstrated the effectiveness of sound scientific input. Now a substantial number of good young scientists have made career commitments to public-interest science. And virtually all institutions of science have become involved in public debates over the direction of technology—each according to its own style.

If public-interest science has come so far in just ten years, what will be the situation another ten years from now? One widely held view is that, once an administration is elected whose political orientation is more compatible with that of the scientific establishment, business-as-usual will be transacted again with the executive branch, and support within the scientific community for public-interest science will tend to dry up. There is, perhaps, some truth in this view, but we feel that the situation will never return to the *status quo ante* of the two postwar decades for a more fundamental reason: The environmental crisis, the energy crisis, and the impending worldwide food crisis are the first shocks that modern industrial man is experiencing in his developing confrontation with the fact that the Earth is finite. As the crises multiply, the blindness and incompetence of governmental and industrial bureaucracies will become more and more manifest. We will increasingly need the perceptions and criticisms of gifted individuals, powerfully expressed in the public arena where all can hear. If there is to be hope for the future of Man in a world dominated by technology these individuals must include public-interest scientists.

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Working with citizens' groups

In response to the growing demand for expert technical advice on public-interest issues, several organizations now offer help to scientists who want to work with citizen-action groups.

James B. Sullivan

Almost all decisions that affect significant portions of society—whether or not to develop solar energy, to build a local highway or to develop a new pop-top beverage container—are basically political rather than scientific. Nevertheless, technical input can be decisive.

Indeed, it appears to be particularly effective when introduced through adversary proceedings initiated by citizen-action groups. Such adversary proceedings can bring before the public eye views of scientists who are excluded from the traditional advisory mechanism for one reason or another, frequently bringing to light crucial technical input that would otherwise not be considered.

This is an important function, and a number of public-interest groups exist to facilitate its operation. Even the professional societies have begun to provide for their members' concern with the impact of technology on society. In the face of this apparent trend, it is necessary to remember that difficulties remain—not least among them being the problem of communication between scientists interested in public-interest work on the one hand, and citizen-action groups on the other.

Yet the problems are not insurmountable; there are lights to guide the way. Look at what some individual scientists have done:

- Two physicists in Washington, D. C., in conjunction with the Environmental Coalition in Prince George's County, Maryland, calculated the amount of mercury emitted from burning municipal refuse in a District of Columbia incinerator. Presenting their calculations at a public hearing before the D. C. City Council, the physicists convinced the Council that the mercury posed a potential health problem. As a result, the Council ordered the District's Department of Environmental Services to monitor mercury in the stack gases. Initial results from the monitoring program came remarkably close (within 1%) to the physicists' calculations, and the Council is now reconsidering the viability of operating the incinerator.
- A microbiologist, examining the safety of the preservatives, stabilizers and other chemicals added to alcoholic beverages, discovered an oversight in the Food, Drug and Cosmetics Act, which requires ingredients of foods and beverages to be listed on their labels. Somehow alcoholic beverages had never been labeled in accordance with the Act. The microbiologist submitted a petition to the government asking that the omission be corrected. The Department of the Treasury, delegated authority over the additives in alcoholic beverages by the Food and Drug Administration, at first claimed that the beverages were not required to be labeled. The FDA disagreed, however, and threatened to rescind Treasury's authority unless it did set forth labeling specifications.
- An economist with a federal agency in Washington, D. C. was asked by the local Ecology Center to examine the costs and benefits of a convention center planned for the downtown area. Agreeing to the project, he found that the benefits to be derived from the center had been described very well, but that many of the costs had not been adequately accounted for. Even before he conducted his examination there had been quite a bit of public concern over the center, so that his presentation of the analysis at a hearing before the City Council was much welcomed by several Councilmen. They, in turn, used it to argue for a reevaluation of the need for the center.
- A civil engineer, who wanted to work with more public-interest groups than his job with a big consulting firm allowed, left the firm and since then has been working with citizen's groups up and down the East Coast. Examining a proposal for a road to run through Vermont to the Canadian border, for example, he discovered that the highway department had overstated the number of lanes needed. Working with the Conservation Society of Southern Vermont, the engineer was successful in having the proposed road reexamined from a traffic-needs point of view and in urging the state to prepare an adequate environmental-impact statement on the project.

A growing demand

These are only a few examples of what scientists can accomplish when they enter the arena of public-policy

James B. Sullivan is co-director of the Center for Science in the Public Interest.