PURE SCIENCE AND IMPURE SCIENTISTS: DILEMMAS FOR PUBLIC POLICY

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Malcolm Goggin's article provides a useful inventory of the diverse issues that arise in thinking about the culture of science in the context of a democratic society. I read his article as a review essay. It covers a hundred writings in an efficient and accurate presentation consisting of opposing ideas and case examples that highlight dilemmas between science as an elite institution and the interests that seek greater accountability of science to society.

Goggin correctly distinguishes five independent problems where controversies over the public role in science have been played out in the political arena.

1. The determination of the priorities of science through the allocation of public resources for scientific research.

2. The conformity of scientific research to safety and ethical standards.

3. The consideration of whether any scientific research programs should be restricted or prohibited because of the consequences the knowledge may bring to society.

4. The appropriate role of the public sector in guiding the applications of scientific advances in medicine, commerce, industry, and the military.

5. The use of scientific expertise in public policy formation.

The article makes no pretense of offering a framework for understanding these problems or providing a preferred perspective. As commentator, I choose as my task to make some distinctions among the thematic variations in the science policy arena. I shall share some of my thoughts about the theoretical and philosophical underpinnings to several of these key issues.

Justification for a Public Role in Science

The public should have no role in pure science. However, not much pure science is going on. Pure science must meet three criteria (Krimsky, 1983): it is not publicly funded; it has no intended or foreseeable applications; and its methods of inquiry are not invasive, i.e., they do not cause harm or affect the environment. For everything we call science other than that which meets these criteria for pure science, public accountability is justified. The public may decide to give up its role of accountability either temporarily or permanently on the presupposition that internal governance may be in its best interest. It may also decide it wishes to negotiate the level of accountability with the scientific sector. However this is played out, the *right* of the public to govern science that is not pure exists by virtue of the fact that science lives off social resources or has a direct impact on the health and well-being of humans and their environment. Pure science meets the standards of First Amendment rights unambiguously, but where there are deviations from pure science, the rights and responsibilities of scientific research are derivative from the broader social context.

Public Participation in Technical Policy Decisions

In advanced technological societies, many policy determinations depend upon expert knowledge. Goggin has summarized several public controversies such as the recombinant DNA affair in which the appropriate degree of public involvement was debated. A widely held model for deciding on the proper mix of experts and lay people builds on what I have termed the separability thesis. According to this thesis, technically rooted policy controversies are divisible into two parts, a scientific component and a policy component. Consider Ashby's (1978) interpretation of the separability thesis:

> There is a useful distinction . . . between ecological problems, which are primarily social and political, and problems in ecology, which are narrowly scientific. It is for scientists to say whether there is a hazard to the environment and what its cause is; it is for administrators and politicians to decide what to do in the public interest about the alleged hazard. The scientific question—the problem in ecology—has to be answered first. Hard facts have to be dissected out of the distorted reporting of the hazard. So a common practice is for the responsible politician to appoint a committee of scientists and technologists to assess the problem and to make a report.

According to the separability thesis, each technically based policy problem can be separated into an objective and a subjective component. Experts are used exclusively in the objective sphere; nonexperts are involved in the subjective domain.

As a general rule, I find the separability thesis without adequate foundation. The technical and valuational sides to an issue are frequently intertwined except in the rare instances in which the technical solution to a problem has been codified with undisputed consensus among experts (Krimsky, 1978). The separability thesis is the basis for the science court model for resolving technical controversies. As an alternative, I introduced the model of a citizen court in the recombinant DNA debate where the division of the issues into objective and subjective components was not warranted.

The mix of scientific and lay people on panels has been shown to work effectively in cases where the separability thesis fails. The training of experts can sometimes restrict the locus of solutions to a technical problem at the earliest stage when the boundary conditions are set.

> the scientist does not deal with the whole crystal of reality; he deals only with one facet at a time. [Scientific problems] are complex; the only way to tackle them is to simplify them; and the only way to simplify them is to leave out less relevant information. So when a scientist gives you an opinion it is important to ask him what simplifications he has made (Ashby, 1978:33).

Examples where folk wisdom (a general term that describes the knowledge of nonexperts) has contributed to technical problems has been given in the literature (Krimsky, 1984a). The justification for using nonexperts in technically based policy decisions goes beyond issues of democratic theory. From an epistemological point of view it makes good sense to incorporate more than the perspective of the expert. There are several reasons for this. First, technical experts might at times restrict the scope of the problem because the problem will thereby adapt well to an analytical framework. Second, experts may emphasize generalized principles at the expense of the experiential knowledge or knowledge of particulars that indigenous people can offer. Third, valuations often enter into the technical side of a problem.

The study of scientific risk assessment leads me to the conclusion that the separability thesis is not dependable and should not be used to ground public policy formation. The split between scientific issues and policy issues is rarely clean. Therefore, public participation should be built into the decision-making process at the earliest stage when the problem is being defined and the options are maximum (Krimsky, 1984b).

Experts and Conflicts of Interest

Goggin neglects an important consideration in his question, is science too important to be left to the scientists. What shall be done when those who possess the expertise also have financial interests in selected policy outcomes. As more and more scientists take on the role of savant-entrepreneurs, public accountability becomes critically important. How can the public be assured that it is receiving disinterested technical analyses?

As the corporate capture of academic science intensifies, one can expect a reorientation of the scientific ethos from public to commercial interests. One can also expect that there will be a tacit or benign neglect by scientists of the adverse technological impacts related to their commercial interests. When knowledge becomes a marketable item, the market helps to determine the rules. The ethos of science becomes adapted to the new conditions. The savant-entrepreneurs are rationalized as the saints of technology transfer, bringing gifts from the gods to the mortals.

Those like Merton who wrote about the ethical norms of science were not dealing with venture capital, patent competition, and the secrecy of intellectual ideas for commercial success. In this age of commercialized science the norms must be reexamined.

In a current study, I am examining the degree to which academic biologists are forging permanent ties to biotechnology firms. The preliminary data show that the biologist-entrepreneur is becoming the norm. Bernard Davis of the Harvard Medical School was quoted in the *Boston Globe* as stating that those biologists who do not have commercial connections are considered wallflowers.

I have examined 50 of approximately 250 biotechnology firms. In these firms, I have identified 350 scientists as fulfilling one of the following criteria: (1) serving on a firm's scientific advisory boards; (2) holding substantial equity in a firm; and (3) holding a managerial position.

Approximately 10 percent of those in the data base served on public advisory committees or study panels of the National Institutes of Health between 1983 and 1984. Two-thirds of those in the data base served as reviewers for the National Science Foundation over the past two years. Approximately 20 percent of the biologist-entrepreneurs are members of the National Academy of Sciences representing 25 percent of the four major biological classifications in the academy.

These dual relationships signify a more complicated scientific culture. Biology is just the latest of several fields for which the line between academic science and commercial science has become

blurred. The situation is further complicated by the fact that the public gains something and loses something from these dual relationships. On the asset side, scientists are in closer dialogue with the industrial sector. The opportunities for technology transfer from the research laboratory to the marketplace are enhanced. On the liability side, the credibility of scientists as disinterested experts becomes diminished in the eyes of the public.

Added to its self-governance of technical standards, resource allocation, and professional ethical norms, the scientific community has taken on the additional responsibility of monitoring academic-industry relationships. Potential conflicts of interest are handled within individual institutions. The first and principal line of responsibility is at the departmental level. Without introducing draconian methods, the public interest can be served by requiring open disclosure of the financial ties of experts who serve on policy panels or who testify before legislative committees. Further, we must ask whether there are any benefits left for an academic biologist to remain unaffiliated with a commercial venture. The intellectual independence of the unaffiliated scientist is a public asset and should be preserved. This, also, is an issue too important to be left to the scientists.

DIVERSIONS AND CONFUSIONS IN THE DEBATE OVER THE GOVERNANCE OF SCIENCE AND TECHNOLOGY

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For some time, a small company of political and social scientists have pressed for increased social control in both the discovery and application of new knowledge. Seeking to counter these demands, scientific and technological leaders continue to assert that any control thwarts the workings of an unpredictable, tacitly beneficial, and inevitable process in the improvement of understanding and the discovery of solutions to interesting problems. In essence, they are saying, you can't stop it anyway. If you try, the other (foreign) fellows will get the jump on you. So why are you trying to make it hard for us to do our thing? Unfettered, we will get there first and produce beneficial opportunities.

Goggin captures the overall themes of these discussions, including many of the institutional proposals put forward as instruments of such social control. He also falls prey to the deep confusions that have characterized this debate since it began shortly after World War II. It is a confusion at least tacitly sanctioned by the scientific and technological communities and unknowingly reinforced by political and other social scientists. It stems principally from a lack of clarity about the social processes of discovering new aspects of physical and biological reality, i.e., basic science, as contrasted to the processes of application, i.e., applied science and research, development, advanced design, technology transfer, etc. Underlying these enterprises is the apparently seamless web of ideas, concepts, and methods that give expression to the theoretical and cognitive lineaments of science and technology. Viewed on this basis, these two bodies of activity are bound inexorably together, one providing a general understanding of natural processes (to be applied in solving particular problems), the other providing examples of nature's apparent intractability (to challenge the generality of scientific knowledge).

Science and technology do draw from each other, are logically related, and, as objects of public policy and intellectual discourse, are often treated as if they were quite homogeneous—similar enough to be addressed interchangeably and likely to respond equally to specific policy instruments. If this is true, scientists and science can be confronted when we are distressed by the fruits of technology. It's all the same, and scientists initiate the problem by advancing knowledge.

In their sociological expression, however, science and technology are quite different. The first sets of activities are carried on by scientists working usually in universities; the second, by technologists (and sometimes people who claim the title of scientist) usually working for industrial or governmental institutions. People who are devoted to each usually follow different norms, inhabit different types of institutions, follow the directions of different (reference) groups, and—in my view—should confront different governing norms as long as they stick to the activities signaled by the titles of their social roles.

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