REPRESENTATION AND PARTICIPATION
IN THE DEMOCRATIC GOVERNANCE OF
SCIENCE AND TECHNOLOGY

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Despite important philosophical and methodological differences separating them, policy analysis and political theory are fields of inquiry that have much to contribute to one another. Nowhere is their conversation more needed, or more conspicuous by its absence than in the area of science and technology policy. The current debate over the proper governance of science and technology in the United States is studded with assertions about the nature and purpose of democratic representation, accountability, and participation. Proponents of scientific autonomy and professional self-regulation often equate democratic governance with some kind of populist anti-intellectualism or bureaucratic Lysenkoism. Proponents of greater political accountability or of increased citizen participation in the policymaking process often assume that formal or procedural mechanisms alone are sufficient to attain democratic objectives.

Arguments of this kind do little to advance our understanding of the values at stake in the governance of science. I won't attempt to do so here, but there is an affirmative case to be made for what Robert Dahl has
aptly called scientific guardianship—professional autonomy and the
delegation of authority to scientific elites in public policy decisions
concerning basic research and technology development. Too often,
however, the case for autonomy is made, not by defending the distinctive
values—wisdom, the unfettered pursuit of truth, efficiency—intrinsic to
it, but by defending autonomy faute de mieux, as an antidote to the
disturbing excesses and distortions supposedly inherent in a democratic
mode of governance.

Similarly, the case for a more democratic governance of science and
technology must be made on its own terms; it cannot finally stand or fall
solely on the basis of our assessment of the merits of the case for
guardianship. Moreover, the case for democracy requires more than a
pragmatic defense of democratic means or procedures, important as these
are. In considering the prospects for democracy in the governance of
science and technology, as in political life and public policymaking
generally, it is essential to mount a principled defense of democratic
ends, to distinguish among the various moral values democracy may serve,
and to explore the possible institutional arrangements that are likely to
further the substantive democratic objectives we have defined.

In this chapter I will attempt to make, or at least to examine
carefully, the affirmative case for the democratic governance of science
and technology. Science policy debates are a microcosm where much
broader and more abstract controversies of twentieth century democratic
theory are replayed. By bringing this broader theoretical context to
bear on the question of science and technology governance, I hope to
underscore the importance of democratic ends as well as means and to
offer a framework within which the institutional reforms discussed
elsewhere in this volume may be assessed.
Reconciling Science and Democracy

What is distinctive about American society in the late twentieth century? What forces shape our way of life, define our deepest ideals and aspirations, and propel us toward a future containing both greater possibilities and greater dangers than humankind has ever known before? Among the many characteristics that could be mentioned in response to these questions, surely two stand out as essential: our reliance on science and technology, and our recourse to democratic principles and procedures in evaluating and justifying the exercise of public authority and power. Without the former most of our major social and economic institutions could not function; without the latter those institutions would be left without an overriding sense of public purpose. Throughout our history America has been seen as the exemplar of some new kind of social experiment, as a place where special human goals, untried or unrealized elsewhere, could be fulfilled. Over time the content of the mission defining America has changed, but the quest to fulfill some kind of higher human telos has remained a constant feature of American cultural self-identity. Today, at least in part, that quest is to reconcile the energies of science and technology with basic democratic values. Foremost among these values are individual autonomy and self-development, political equality, and the right of those significantly affected by public decisions to participate effectively in the decisionmaking process. Such notions still give us our moral bearings in the political world, and yet a suspicion is growing that these traditional democratic values are becoming obsolete in an era of increasingly specialized knowledge and technological complexity.
The reconciliation of science and democracy did not emerge clearly as an aspect of the distinctive mission of America until the late 1940s, although it has always been a prominent theme in American social thought. Despite the long shadows cast by the atomic bomb, the prognosis for reconciliation in the post-war years was generally optimistic. Scientific discovery and its technological applications seemed to offer the promise of virtually open-ended control over natural limits to the fulfillment of human and social goals. Science itself was widely taken to be a symbol of the power of human intelligence, reason, and freedom of thought in an open society. For social theorists like John Dewey, the ethos of science was a fertile breeding ground for the pragmatic, experimental temperament essential to a viable democratic culture. Finally, science and technology seemed to hold the key to a new era of economic growth, thereby eliminating the kind of class conflicts that had proved fatal to liberal democratic values and social stability in Europe in the 1930s.

The apparently benign *modus vivendi* between science and democracy was badly shaken in the 1960s and 1970s. During the Vietnam war the new left began a critique of the social consequences of technology and the political influence of scientific elites. This critique was subsequently extended and given wider currency by the environmental movement. In the process the image of science and the optimistic promise of technology have been transformed in the public mind. Questions largely glossed over in the post-war years have now become salient. Are the forces driving basic scientific research and the incentives operating within the professional scientific community necessarily responsive to public needs
and interests? Are these forces adequately sensitive to ethical considerations and social values? Does social and economic dependence on science and technology create in turn a political dependence on scientific and technological expertise that undermines effective democratic accountability and decisionmaking? Has the influence of science in the culture produced an active democratic ethos, as Dewey expected, or has it inclined instead toward a technocratic elitism?

However one answers these and similar questions, it is clear that the reconciliation of science and democracy can no longer be considered a simple problem, much less an accomplished fact. The practice of contemporary science—organized, expensive, bureaucratic science—is deeply entwined in the political, economic, and moral fabric of our culture, shaping that fabric and being shaped by it in turn. Increasingly, the conduct of scientific research and the technological applications of basic scientific knowledge raise social, political, and ethical questions that cannot—and should not—be resolved by the professional scientific community alone. Just as external political decisions, economic forces, and social values shape the basic direction of scientific and technological development, that development also profoundly affects society as a whole. Long gone is the era in which the practice of science was the "private" activity of scientists, and was solely their concern. Today, both basic research and technological development are "public" activities and are increasingly being held accountable as such. Tax dollars subsidize the education and capital investment that makes modern science possible. All citizens have a shared interest in the activities and decisions of professional researchers, technologists, and scientifically knowledgeable elites.
In saying this I do not mean only that citizens as private individuals have interests—economic interests and interests in personal health and safety, for example—that are affected by science and technology, although such interests are certainly important and deserve due consideration and protection in any scheme of science governance. I also mean that citizens as members of an integrated political community have an interest, a stake, in being meaningfully involved in determining the ends served by science and technology and in fashioning the policies which will guide science and technology toward those ends. The distinction between these two types of interests, which we might call the citizen's private interests and his or her democratic interests, is conceptually useful because these two types of interest place different sorts of demands on governance and science policy. Private interests call for governance by accountable and responsible elites; these interests are primarily negative in that they require protection from the destructive or disruptive consequences of science. Democratic interests, on the other hand, are positive in character and require not so much protection from, as shared involvement in science and technology. For democratic interests to be served, elite accountability and responsiveness are necessary but not sufficient; democratic interests require the further conditions of representative and perhaps participatory governance as well.

The regulatory and budgetary oversight exercised by representational institutions—Congress and executive agencies—has traditionally been considered sufficient to protect the public interest (understood as an aggregation of private interests) against the abuse of science and the misuse of technology. This traditional arrangement has usually, and
perhaps necessarily, involved granting a large measure of autonomy and
discretion to individual scientists or to professional associations by
governmental overseers. In recent years, however, the perceived
shortcomings of these oversight mechanisms have led to a search for new
ways to institutionalize more direct citizen involvement in shaping
public policies concerning scientific research and technological
development. It is important to note that this search, and its
underlying quest for the reconciliation of science and democracy, can be
inspired by a concern for either the protection of private interests or
the promotion of democratic interests. In order to protect the former,
many critics now assert, we must move beyond the current mechanisms of
democratic representation, for they alone are insufficient to assure
adequate accountability and responsiveness, and develop stronger
mechanisms of democratic participation. Alternatively, as we shall see,
arguments based on an appeal to positive, democratic interests are also
available which lead even more directly—and, I think, more
persuasively—to the same conclusion.

This participatory impulse—also evident today in many other social
and policy issues—has reopened important questions, not only about the
relationship between science and democracy but also about the meaning and
limits of democracy itself in the face of public policy issues that are
exceedingly complex and technical in nature. The demand for greater
citizen participation in science and technology policy began by
challenging the optimistic assumptions about the automatic social
benefits of science. As it has developed, however, it has been met by a
countervailing response which challenges some equally optimistic
assumptions about the viability and justification of enhanced participatory democracy. Interesting variations on this challenge have been developed by two critics of greater governmental regulation of scientific research, George Ball and David Baltimore.

In an address on "Biology and Politics" delivered to the American Political Science Association in 1977, George Ball took a strong position in favor of professional self-regulation of scientific research:

Scientifically trained men and women are far better equipped to decide whether and how certain types of research should be conducted so as to safeguard [the] public interest than legislatures or administrative tribunals or courts...

[They] should be permitted maximum freedom to decide what research to undertake and how to undertake it, subject only to such safeguards as they might individually or collectively impose to prevent experiments being conducted in such a manner as to threaten the public health or welfare. 

At about the same time David Baltimore advanced a similar, albeit more nuanced and qualified case for scientific autonomy:

The traditional pact between society and its scientists in which the scientist is given the responsibility for determining the direction of his work is a necessary relationship if basic science is to be an effective endeavor. This does not mean that society is at the mercy of science, but rather that society, while it must determine the pace of basic scientific innovation, should not attempt to prescribe its directions.
...As I see it, we are being faced today with the following question: Should limits be placed on biological research because of the danger that new knowledge can present to the established or desired order of our society? ...I believe that there are two simple, and almost universally applicable, answers. First, the criteria determining what areas to restrain inevitably express certain sociopolitical attitudes that reflect a dominant ideology. Such criteria cannot be allowed to guide scientific choices. Second, attempts to restrain directions of scientific inquiry are more likely to be generally disruptive of science than to provide the desired specific restraints.... [These] arguments pertain to basic scientific research, not to the technological applications of science. As we go from the fundamental to the applied, my arguments fall away. There is every reason why technology should and must serve specific needs. Conversely, there are many technological possibilities that ought to be restrained. 7

The nature and significance of these arguments are worth pursuing in some detail. Ball's position rests on what he sees as the superior competence of scientists to understand the real—as opposed to the popularly imagined—hazards of research and the superior effectiveness of professional self-regulation over political regulation in protecting the public interest. Baltimore's position rests on a firm demarcation between basic and applied research, and on a concomitant distinction between regulating the pace and regulating the direction of research. Finally, and most importantly for our purposes here, he suggests that democratic attempts to regulate the direction of basic research are
counterproductive on their own terms as well as antithetical to the flourishing of the scientific enterprise itself.

These claims have a wide bearing on the challenge that contemporary scientific research and technology development poses for the continuing viability of democratic institutions. At bottom these arguments reveal an underlying skepticism about the capacity of democratic procedures to cope with a wide range of technological, environmental, and economic problems. The line of reasoning behind this skepticism runs something like this. A fully democratic polity, the skeptics assert, cannot devise rational public policies when science is the object of policy; neither can it inject sufficient expertise and technical knowledge into decisionmaking in order to utilize science rationally as an instrument of public policy. In other words, democratic citizens and their political representatives cannot rationally manage the development of science and technology, nor can they understand modern science and technology sufficiently to use science effectively in other policy areas. Direct citizen participation should be mainly limited to electoral participation, and political representatives (both elected and appointed public officials and interest group activists) should largely defer to scientific and technological experts and ratify the substantive policies those experts recommend. Those who would move governance in the United States closer to the theoretical democratic ideal—by demanding a more assertive role in decisionmaking by elected representatives and new institutional mechanisms for direct citizen participation in policymaking—are out of step with the realities of a technological society. Their reforms would create a "democratic overload" or a
"democratic distemper" that would cripple or even paralyze rational, efficient governance in the public interest.  

This, then, is the new elitism that has developed on one side of the guardianship/democracy debate in science policy. Its roots run deep in the tradition of Western political thought (in many respects it echoes Plato's critique of classical Athenian democracy). More importantly, however, in the contemporary American context it does not appear to be an explicitly antidemocratic argument at all. Rather, it parallels, and draws upon, one important theoretical current in twentieth century democratic theory and mainstream political science, a current of thought that has been called "democratic revisionism" or "democratic elitism." To grasp the force and bearing of this elitism in science policy, we would do well to consider its place in democratic political theory more broadly. What classical theoretical problems give rise to it? And what arguments for a more full-bodied conception of representation and participation can be made in response to it?

The Contested Terrain of Democracy

Generally speaking, three distinct streams of democratic thought now vie with one another in contemporary political theory. I shall refer to them as liberal democracy, democratic revisionism, and participatory democracy. Liberal democracy is the oldest and most inclusive of the three; it is the core theory from which the revisionist and participatory perspectives have departed in the twentieth century, while nonetheless remaining linked to it in important ways. Before turning to these more
recent perspectives, therefore, it will be useful to review the basic tenets and problems of liberal democracy.

Liberal Democracy

Liberal democratic theory in general holds that the legitimate authority of the government rests on the consent of the governed, and that individuals have a right to take part in decisionmaking that significantly affects their own interests or affects the interests of the entire society. The government is not the privileged domain of a particular individual or class (Louis XIV's "L'état c'est moi"); it is the instrument of the political community as a whole. The actions of the government are the actions of the people (or at least of the majority); when this is the case, the democratic procedural ideal of popular sovereignty or popular self-rule is achieved. Democracy, the rule of the people, is rule by the people.

There are two principal procedural mechanisms through which this fusion of the government and its citizens, rulers and ruled, can be accomplished. Democratic participation achieves this fusion directly and literally—the assembled citizenry forms a legislature of the whole which becomes the government and acts through collective deliberation and decisionmaking. Democratic representation achieves this fusion indirectly and figuratively—a subset of the citizenry forms the government and makes decisions. But it is not they who rule; rather those they represent rule through them.

Democratic theory has always had to face the following dilemma in its choice between participation and representation as procedural arrangements. Democratic participation fulfills the procedural ideal best, but it seems practical only in a very small setting such as the classical Greek polis, the traditional Swiss canton, or the small New
England town. On the other hand, democratic representation is practical in larger settings, but it opens up the risk of significant deviation from the procedural ideal. Representatives may easily fail to be the instruments of the represented, and thus subvert democracy by transforming it into an oligarchy (rule of the people by the few). To guard against this danger, some mechanism must be found to keep the representatives accountable and responsive to those they are supposed to represent. This requires an open flow of information between representatives and constituents, a capacity on the part of citizens to understand and evaluate what the representatives are doing, and periodic renewal of democratic consent via free and competitive elections.

Moreover, in addition to its procedural ideal, liberal democratic theory contains a substantive ideal which demands that the actions of the government must in fact promote the public good. That is to say, the rule of the people must be both rule by the people and rule for the people—rule in their interest, rule in the service of their human flourishing and individual self-development. Here democratic theory confronts a second dilemma. There is no a priori reason to assume, and most democratic theorists have not in fact assumed, that rule by the people (either directly or indirectly) will automatically be rule for the people. Procedural democracy does not always produce substantive democracy. The resolution of this dilemma requires that some means be found to assure that democratic citizens have adequate intelligence, judgment, and the quality of civic virtue, a moral commitment to justice and the good of the community as a whole.

In regard to the substantive ideal one might argue that the relative advantages and disadvantages of participatory and representative forms of
democracy are reversed. Representative democracy seems less likely to deviate from the substantive ideal because it demands less cognitively and morally from the bulk of the citizenry. The few who are chosen as representatives must be capable of deciding what the public interest requires, but ordinary citizens need only be able to recognize those who have this capability; they need not have it fully themselves. On this view, then, representative democracy introduces a more realistic division of moral labor, so to speak, and a two-tier conception of the distribution of political knowledge and wisdom.

On closer inspection, however, this two-tier solution to the substantive dilemma of democracy breaks down. There has never been a democratic political community or state, not even Athenian democracy at its height, that did not combine representational and participatory institutions and practices in some fashion. Similarly, balancing substantive and procedural values is a problem that both representational and participatory institutions must face. Rather than pitting representation and participation or substantive and procedural values against each other and forcing some artificial trade-off between them, a more promising theoretical approach is to explore the complementarity and symbiosis that could be achieved under various institutional arrangements.

Consider, for example, the ways in which the character of political representation is affected by the kinds of participatory opportunities available to citizens at the community level. The democratic obligation of representatives (members of Congress, say) is to give voice to and promote the interests of the represented in the policymaking process.
But it is not clear what to make of this obligation until we know more about the nature of those interests, how they are formed and evolve, and the dynamics of reciprocal communication between representatives and constituents. Whether or not a process of representation serves the substantive ideal of democracy depends not only on the character and activities of representatives but also on the character and activities of the represented. It is one thing to attempt to represent a passive, alienated constituency and quite another to represent a constituency whose own community life is richly textured with a variety of participatory deliberations and activities. It is at least arguable that representation in the latter context will more readily serve substantive democratic goals because democracy from above will be supplemented and reinforced by democracy from below.

In principle, theories of representative democracy should be able to distinguish conceptually between a responsive, accountable body of representatives and a benevolent, paternalistic political oligarchy, even though empirically the representatives and the oligarchs may legislate exactly the same policies. Democratic theories that set up a rigid antithesis between representation and participation are unable to capture this distinction.

From Madison through Rousseau and John Stuart Mill the most significant debates among modern democratic theorists have centered on the relationship between representation and participation and on various strategies for resolving the procedural and substantive dilemmas I have mentioned. More recently these debates have been carried on in the rivalry between a perspective commonly known as democratic revisionism
and a growing body of work that emphasizes the positive value and practicality of participatory democracy. The revisionist position grew out of several sources, including empirical studies of public opinion and the pessimism about the future prospects for liberal democracy that many political theorists and social scientists began to feel when faced with the growth of totalitarian mass movements in the twentieth century. Participatory theory, by contrast, has been impressed by the significant rise of grass roots political activity in the United States and Western Europe beginning in the 1960s, activity generated by the new left and the civil rights movement, feminism, environmentalism, worker self-management, and a host of similar developments. These movements have called for, and to some extent have created, greater civic inclusion in powerful social institutions and important decisionmaking processes.

Democratic Revisionism

The basic goal of revisionist democratic theory has been to replace the aspirations of traditional democratic thought with a putatively more realistic and much more modest set of expectations about the necessary limits of democratic governance. The revisionists have, in effect, redefined the notion of democracy to make it compatible with a much larger substantive and procedural role for professional experts and other elites than earlier democratic theorists would have found acceptable. For the revisionists, the difference between oligarchy and democracy is not the difference between the rule of an elite versus the rule of the
people; it is the difference between the rule of a single elite versus the rule of competing elites.

Democratic revisionism dismisses direct or participatory modes of democratic governance as both unworkable and undesirable in the context of the modern nation state and in the face of what it calls "mass society." Participatory democracy requires small, decentralized political units and a fairly high degree of cultural homogeneity. Public policymaking in the modern state, by contrast, requires systemic coordination and cannot presuppose cultural consensus, but must artificially construct it by reconciling pluralistic interests and values. Also, participatory institutions are sociologically and psychologically unable to realize their own ideal of democratic self rule. They inevitably produce their own dominant elites who informally impose their own priorities and interests onto collective deliberations and decisions in accordance with what Robert Michels called the "iron law of oligarchy." Finally, participatory politics has a dangerously antidemocratic and illiberal potentiality in modern societies marked by a high degree of alienation and the breakdown of secondary associations. Under these conditions charismatic leaders and antidemocratic elites can mobilize mass movements which, under the misleading banner of democratic and populist values, overthrow liberal constitutional government and establish totalitarian control.

Thus, according to the democratic revisionists, participatory democracy fails both procedurally and substantively; it neither achieves rule by the people nor rule for the people. It must be discarded as an outmoded model of governance.

The revisionist critique of representative democracy also mounts both a procedural and a substantive attack. Procedurally, representative
institutions are unable to maintain their theoretically prescribed fusion between the representatives and those whom they represent. At best, electoral competition can ensure only that competing elites will be somewhat restrained in their use of political power by their temporary tenure in office and by the need to avoid doing anything that would arouse widespread public opinion against them.

This argument casts representative democracy in a new light and gives it a considerably more negative substantive purpose. Representative institutions are not to be seen as the vehicles for the expression of some positive public mission. Modern publics have no coherent or concrete purposes or programs to have expressed; they live in a condition of general political apathy punctuated only be discrete interests, preferences, and fears. Therefore, the realistic and appropriate function of representative bodies is to protect particular interests from undue domination by other interests and to protect their constituents from the power wielded by private, unrepresentative, and unaccountable elites. The goal of those elites who compete for positions of democratic political authority is to prevent public harm rather than to promote public good.

For revisionist democratic theory then, democratic institutions have only a negative instrumental value. They are a means to achieve the values of political order and liberty by protecting against the permanent monopolization of political power by any single elite, and by protecting citizens against the unjust or exploitative exercise of private power in society. Representative institutions do not actually represent the citizenry in the process of governance, but they do provide the arena
where elites seeking political power to realize their own interests are forced to compete for public favor in order to achieve their ends, and hence are effectively restrained in their tendency to promote their own interests at the expense of the public interest. With arguments of this kind, democratic revisionists have constructed a new account of how the interests of the rulers can be made to coincide with the interests of the ruled. And this, for them, is the only necessary defining characteristic of a "democratic" political system; under contemporary social conditions no more idealistic aspiration for democracy is realistic.

Participatory Democracy

It is not surprising that such a sharp critique of traditional democratic hopes has occasioned an equally sharp response. Participatory democratic theorists share many of the revisionists' reservations concerning liberal representative democracy as it has historically functioned in the United States and Western Europe. But they draw diametrically opposed conclusions from their reading of democratic political history. The failure of representation to realize its normative goals in a democratic polity, for them, can be traced to the gradual withering of participatory activity at the community level and to the privatization of self-identity in a bureaucratic capitalist (or state socialist) system. Under these conditions ordinary individuals feel powerless and alienated from political life, not because they are inherently private egoists rather than civic beings by nature, but because they are in fact relatively powerless. The solution to the past
failures of representative democracy is not less democracy and greater reliance on authority entrusted to elite experts, professionals, and managers; but more democracy and more empowerment growing out of a combination of widespread participatory opportunities throughout society (in the neighborhoods, the workplace, and the various levels of government) and governmental representation based on increased accountability and a better mutual communication between representatives and constituents.

A central thesis of participatory theory is that the experience of democratic participation itself enhances the political reasonableness, judgment, and civic sensibilities of the participants. Only by being directly and meaningfully involved in the process of dialogue, deliberation, and decisionmaking about matters of public concern can an individual develop a motivating sense of citizenship and civic commitment. For this reason, participatory theorists maintain that there is a crucial linkage between fulfilling the procedural and the substantive requirements of traditional democracy. Achieving government for the people (the substantive condition) requires the creation of a certain kind of "people," a political community composed of genuine citizens. Concomitantly, achieving government by the people (the procedural condition) is the principal means to that end, forging the political being of citizens through the self-transforming activity of their political doing.

The revisionists are surely correct in holding that substantive democracy cannot be achieved merely by empowering mass publics or lonely crowds composed of defensive, fearful, self-interested individuals. But,
the participatory theorists counter, the way to achieve the civic sensibility substantive democracy requires is by gradually introducing more public, participatory opportunities into people's lives. The mistake the revisionists make is in assuming that a political system must be made up of ideal democratic citizens before they can be trusted to responsibly exercise democratic power. For the participatory theorists the issue is at once more complex and open to greater possibilities. On this view, the intriguing thing about democracy as a form of governance is that it must continuously create and recreate the preconditions of its own existence as it operates. Democracy is a ship of state that not only must be repaired but also must be built and rebuilt while at sea.

Finally, participatory theorists differ from democratic revisionists in that they view the democratic process as an intrinsic and not merely an instrumental good. This is an important theme in their work because they realize that making a case for citizen participation in a decisionmaking process solely on the grounds that participation gives individuals a way to protect their own private interests is vulnerable on two counts. First, if it can be shown that these interests are adequately protected in some other way, for instance through representational oversight or through professional self-regulation (George Ball's point), then the case for participation fades away. Second, the educational, self-developmental possibilities of the experience of participation are likely to be short-circuited if participation is seen merely as a protective device. In order to realize these possibilities participation must be seen as a more positive phenomenon, as an occasion for the sharing of pertinent information, and
for the deliberative refinement of political and moral judgment and the exercise of civic responsibility. It is when the impulse for participation is not informed by the promotion of democratic interests, in the sense I defined earlier, but only by the protection of private interests, that the self-defeating nature of participatory governance (Baltimore's point) looms as a serious problem.

How the basic purpose of participation is seen will also affect the institutional arrangements we devise to facilitate participatory activity. And it will affect as well the likely relationships between citizen participants and the professionals or experts concerned with the particular policies or issues under discussion. When participation is viewed as a protective device these relationships are likely to be highly adversarial, with each side attempting to defend itself against or coopt the other. If participation were seen in a broader, more positive way, as a process which has both instrumental and intrinsic value for those taking part and for society as a whole, then there is no reason, in principle, why the exercise of participatory (or representative) democratic governance need undermine the legitimate and valuable role played by experts or professionals in the policymaking process. Democracy and elitism may be antithetical, but democracy and expertise are not. It may be worth stating this obvious point because it so often seems to get lost in discussions of the democratic governance of science.

Democratic Lessons for Institutional Reform in Science Policy

What bearing do the points raised in this review of contemporary
democratic theory have on the governance of science and technology? As the debate over the governance of science and technology develops in the years ahead, both the proponents and the opponents of greater democratization in science policymaking must more clearly identify the values that democratic governance is supposed to serve or threaten. And they must more clearly distinguish between the relative strengths of representational and participatory institutions in realizing these values. The broader but parallel debate between democratic revisionists and participatory theorists indicates some of the directions this discussion could take. Other chapters in this volume explore some of these directions in detail. Here I shall conclude by simply outlining a few points that, in my estimation, merit special emphasis.

As a starting point let us return to the arguments of George Ball and David Baltimore. Earlier I noted that their arguments, which I take to be fairly typical of mainstream science policy analysis, echo many of the central tenets of democratic revisionism. These arguments were made in the context of the controversy over the regulation of recombinant DNA research. In the late 1970s this controversy was—and has remained—paradigmatic in shaping the terms of the debate over the governance of science and technology in the United States. It has been a useful prism through which to view this topic because it brings together several important facets of the complex relationship between one segment of the research community and governmental institutions at both the federal and local level. The dynamics at work here may indeed illustrate a pattern of events that could become increasingly common in similar controversies in the future.
The story of this dispute is well known, so I shall only quickly reiterate a few salient points here. In 1974, in advance of any widespread public awareness or concern about the possible environmental or health hazards of recombinant DNA research, a group of concerned researchers took it upon themselves to press for self-regulation and restraint within the scientific community. In so doing, however, these researchers set in motion a sequence of broader political responses that they probably did not anticipate and certainly could not control. These responses led to the promulgation of NIH guidelines in 1976 and to the creation of the NIH Recombinant DNA Advisory Committee (RAC) and Institutional Biosafety Committees (IBCs) at individual research institutions. Each of these committees included lay members or "public representatives" in an attempt to include a carefully circumscribed form of citizen participation in the regulatory process. During the same period an initially tumultuous political controversy in Cambridge, Massachusetts activated direct citizen involvement of a much more challenging kind.

The recombinant DNA debate shocked the scientific community for at least two reasons. First, it brought substantive governmental regulation into the domain of bench science and basic research, a domain previously affected by budgetary policies at the federal level, but traditionally subject to regulation only by peer review.

Second, it raised the specter of a highly diverse and inconsistent regulatory environment controlled by the vagaries of local politics. This prospect troubled federal policymakers as well as researchers because it would make the goal of creating a consistent and predictable
national science policy very difficult if not impossible to achieve. In the years following World War II, the scientific community had successfully established a cooperative working relationship with key policymakers and legislators at the federal level. This relationship virtually assured that professional attitudes and priorities would play a dominant role in the formation of science policy—both regulatory and budgetary policy—in Washington. At the local level, however, no such modus vivendi between scientific elites and politicians had been established or was likely to be. Local politicians were much less insulated from volatile public pressures and fears than federal officials. They appeared less likely therefore to give overriding priority to the value of scientific advance in their decisionmaking.

Scientific lobbying groups, joined by private industries which had an interest in the commercial development of genetic engineering techniques, fought strenuously in 1978 against a bill introduced by Congressman Paul Rogers that endorsed the legitimacy of local community control of laboratory research. Faced with a choice between federal and local regulation, professional organizations such as the American Society of Microbiologists were willing to opt for the former as the lesser of the two evils, but only if the principle of federal preemption over local laws was firmly established. The success of this lobbying effort forestalled radical change in the structure of the science policymaking process. But the traditional pact or "social contract" between science and society, to which Baltimore refers, was beginning to show signs of strain. A hitherto "private" domain of science, basic research, was being transformed into a "public" domain legitimately subject, as things
public generally are and things private generally are not in our society, to democratic controls. Democratic authority and power were gradually being shifted downward and outward.

In his provocative analysis of the recombinant DNA controversy, David Dickson argues that "technocratic" science policy ultimately triumphed over "democratic" policy. The efforts that were made to institutionalize citizen participation in the policymaking process were counterproductive, he says, because they merely created a facade of democratic accountability which masked the deeper consolidation of effective control in the hands of scientific and corporate elites. Dickson's analysis is less incisive, however, concerning an alternative to incremental attempts to institutionalize enhanced citizen participation in science and technology policy. Earlier I argued that meaningful participation and effective representation are vitally linked in a democratic political system. If we conclude that participatory reforms are inevitably prone to cooptation and degeneration into a legitimating facade for elite power, then we can hardly afford to be sanguine about the capacity of representative institutions, be they Congress, state governments or city councils, to achieve better scientific accountability.

Despite the limited participatory goals that were achieved, the recombinant DNA case does contain, in my estimation, some constructive lessons for the institutional reform of science and technology governance. First, it illustrates the fact that even when policy disagreements initially arise within the professional scientific community, they can quickly spill over into the public domain if those knowledgeable about the technical aspects of the controversy are willing
and able to grasp the ethical and social dimensions of the problems and make them explicit. For, at bottom, it is the ethical issues that transcend specialized professional and bureaucratic expertise. These normative issues become the focal point for public interest and concern, and provide the basis upon which compelling claims for civic inclusion and democratic decisionmaking can be made.

In addition, the recombinant DNA case provides one of the most interesting and promising examples of productive citizen participation in recent years. In Cambridge, after the initial period of sensationalism and political posturing had past, the deliberations of the citizen's advisory group demonstrated that when a participatory body is given sufficient time, information, and an opportunity to make decisions that will have a real impact on issues that truly matter to the participants, it can achieve a high level of sophistication and understanding. And it can produce decisions and recommendations on complex technological problems that are as well informed and reasonable as those made by expert, professional elites.  

Generalizing from these observations brings us back to the symbiotic relationship between representational and participatory institutions. Democratic representatives can be coopted by self-interested experts as readily as ordinary citizens, or perhaps even more readily. If public officials at the federal, state, or local level are to cope with the issues raised by science and technology in democratically responsible ways, they must be supported by informed publics. And it is surely through more widespread participatory activities—both formal ones, like the Cambridge citizen's advisory group, and informal ones, like the
workshops, debates, and town hall meetings once sponsored by the NSF Science for Citizens program—that the kind of informed citizenry that makes democratic representation possible will be fashioned.

Moreover, building a richer social infrastructure of participatory activity cannot be limited to the domain of science and technology decisions alone. My own view is that achieving greater civic inclusiveness and democratic accountability in the process of science policymaking will be possible only if it proceeds in tandem with a parallel democratization of decisionmaking in other areas. Conversely, since the growth of science and technology has such a significant ripple effect throughout our society, and since it plays such an important role in determining which groups control the direction of social change, an effective democratization of decisionmaking in other policy areas will hardly be possible unless we somehow ensure that the uses of science and technology reinforce rather than impede that democratization. This is not to say that what I referred to earlier as the "participatory impulse" currently abroad in our society should be directed at science and technology policy only after it has triumphed in other areas. But it is to say that the effective democratization of science governance will not be achieved except as a part of a broader movement toward greater participation at all levels of our society. Indeed, the permeation of science and technology issues into many other important areas of public policy—for example the emerging domain of "industrial policy"—may provide the most compelling argument for greater citizen participation in science policymaking. For if they lack, or are precluded from developing, an informed, engaged understanding of scientific and
technological issues and options, citizens will find themselves increasingly unable to comprehend and take part in all other policy debates. Scientific and technical illiteracy is fast becoming tantamount to civic illiteracy as such; it poses one of the gravest threats to meaningful citizenship in contemporary democratic societies.

With or without greater participatory governance, social and economic forces are transforming science, and nostalgia for a pristine state of professional autonomy can only distort our capacity to grapple with these changes. While no one can confidently predict the precise direction in which science and technology policy will move, two things do seem reasonably certain. First, policy and investment decisions made either in the public or in the corporate sector will produce new institutional pressures for scientists and will curtail the autonomy that the scientific profession has enjoyed in the past. The question is not whether that autonomy will be curtailed, but how much, by whom, and how democratically accountable those who curtail it will be. Second, science policy decisionmaking will become increasingly politicized, both by lay groups and organizations demanding a greater role and a greater voice in the policymaking process and by corporate decisionmakers who seek to invest in basic research and to exploit technological applications commercially.

Given that the politicization of science is inevitable in any case, one democratic challenge facing future science policymaking will be to integrate increased citizen participation into the policymaking process by devising creative new institutional mechanisms and procedures. A second democratic challenge will be to channel the politicization of
science toward a constructive and reasonable social consensus about the
ends and priorities of technology development and the growth of
potentially applicable scientific knowledge. How well we meet these
challenges will be determined—not wholly, but in part—by the clarity,
rigor, and imaginativeness of the democratic arguments we make, and by
the democratic vision we embrace.
NOTES


In my view the best and most significant work in this area is Benjamin Barber, *Strong Democracy* (Berkeley, CA: University of California Press, 1984).


