

# Proposal for an Institution for Scientific Judgment

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Federal support of science and technology has created an establishment whose power for the performance of applied research and for the training of people to do this work is now immense and growing rapidly. It is my view that, at the present time, the most significant task in the application of science to social problems is no longer the actual doing of applied research or even the training of people to do this work, but the making of the great decisions which determine the rate and directions of progress. The federal government has had to make decisions on questions which have an important scientific component—that is, which involve areas of science so new that no unanimity has been achieved in the scientific community and so important that the decisions inevitably have important political and perhaps moral implications. I refer to these as mixed decisions. Historical examples of mixed decisions are, the World War II decision to build an atom bomb; the German decision (a blunder I think) to build ballistic missiles during World War II; the U.S. decision not to use our ballistic missile capabilities to launch a satellite until after the Russians had beat us to it; the current decision to direct our primary space effort toward beating the Russians to the moon. These decisions all involved technologies so new that debatable extrapolation of hard scientific fact was required. All these decisions were of great political and sometimes moral importance. We now face a variety of mixed decisions—in connection, for example, with control of our physical environment, with the relationship of weapons technology to disarmament, and so on. The enormous gains that can be foreseen from the application

of modern technology to medical problems will present us with a variety of great mixed decisions whose importance may well be as great as the historic mixed decisions mentioned above. These decisions must be made before unanimity exists in the scientific community. The problem of communicating with a divided scientific community is and will remain one of the most difficult aspects of making mixed decisions. I should like to discuss the procedures employed in the Executive Branch for achieving this communication, and how, in my opinion, they may be improved.

The essential input from the scientific community to decision making is via the scientific advisory committee. Without going into detail about this process, I would like to make three points. First, in seeking scientific advice on questions of great social importance we must recognize that the moral responsibility which many scientists feel very deeply can easily affect their judgment as to the state of scientific fact when the scientific facts are not yet crystal clear. Second, the selection of scientific committees has always been beset by the dilemma that one must choose between those who have gone deeply into the subjects under discussion, and, accordingly, will have preconceived ideas about what the outcome should be, and those who are perhaps unprejudiced but relatively uninformed on the subjects under discussion. Finally, scientific advisory committees have, in many cases, played an influential role in decision making without taking public responsibility for their judgments. In the making of mixed decisions the validity of the scientific input has frequently been brought under question.

I have three recommendations, directed toward institutionalizing the scientific advisory function with a view toward increasing the presumptive validity of the scientific input.

1) Separate the scientific from the political and moral components of a mixed decision.

It has occasionally been maintained that scientific and nonscientific components of a mixed decision are generally inseparable. It is, of course, true that a final political decision cannot be separated from scientific information on which it must be based. The reverse is not true; a scientific question which logically can be phrased as anticipating the results of an experiment can always be separated from any political considerations (*I*). Thus, the question "Should we build a hydrogen bomb?" is not a purely scientific question. A related scientific question, "Can we build a hydrogen bomb?" could in principle be answered by an experiment.

Scientific objectivity is very difficult to achieve and is a precious component of wise mixed decisions. I do not believe it is possible for scientists to have deeply held moral and political views about a question and simultaneously maintain complete objectivity concerning its scientific components. In the past, scientific advisory committees have frequently developed close relationships with the officials who have final decisions to make. They have frequently advised political figures about what final decisions they should reach, not only about the scientific components of a decision but about the moral and political implications as well. The close relationship may be valuable; however, it does point up a need for an alternative source of scientific judgment which shall forego taking any moral or political stands and seek to achieve maximum objectivity.

2) Separation of judge and advocate.

To my mind there is no solution of the problem, discussed above, of combining the highest level of expertise with lack of prejudice except the solution arrived at centuries ago in the similar legal problem. If one insists only on expertise in advocates and expects them to marshal the arguments for one side of a question, one can call on the services of people who have gone most deeply into a particular subject and who have in the course of this work arrived at a point of view. Such advocates, in addition to presenting their side of the case, can be very useful in criticizing the cases made by opposing advocates. The requirement of the judges, on the other hand, is simply that they must clearly understand the rules of scientific evidence,

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have no intellectual or other commitments regarding the matters before them, and, finally, have the mature judgment needed to weigh the evidence presented. Thus, it is almost inevitable that a scientific judge would have earned his distinction in areas other than those in which he could qualify as unprejudiced.

It has occasionally been suggested that the advocates should present their points of view directly to the political leaders who have decisions to make. This procedure suffers from the grave difficulty that political leaders will not be able to spend the time necessary to understand scientific debates in sufficient depth to distinguish the relative validity of positions taken by sophisticated advocates. The scientific judge would differ from the political leader sitting in judgment on scientific questions in that his scientific background should enable him to more quickly assess the evidence presented by opposing advocates and to participate in something analogous to a cross-examination procedure. He would, on the other hand, not be expected to have the deep acquaintance with the field that would be required of the advocates.

Scientists are traditionally advocates, and judicial functions in small-scale science have never had an importance comparable to that of advocacy. An experiment can always overturn anyone's judgment on a scientific question. However, the judicial function becomes important in large-scale science and technology when we must anticipate the results of experiments which cannot be performed without the expenditure of great amounts of money or time. This increase in the importance of the judicial function requires the development of a group of distinguished people who will devote themselves to scientific judgment. The point has been frequently made that a scientist needs to keep actively engaged in creative work in order to maintain his expertise. I submit, however, that if a mature scientist is deeply involved in finding the truth between the claims and counterclaims of sophisticated advocates, his education will be continuously improved by the advocates and his thinking will be continuously stretched in the effort to reach wise judgments. Communication from the judges to the scientific community and the public is an essential part of maintaining their expertise and reputation. A provision for publication

of judgments, suggested below, will help accomplish this.

The problems of selecting people to serve as judges and advocates will, of course, be the most difficult matter in reaching wise decisions under this scheme, as under any other. It would be very important that everything possible be done to elevate the positions of advocates and especially of judges so as to attract people whose wisdom would match the importance of the judgments they must make.

3) The scientific judgments reached should be published.

In many cases the opinions of scientific advisory committees have not been made available to the public for reasons other than considerations of national security. The existence of such privileged information makes it very difficult for the public to assess the degree to which a mixed decision is based on political grounds.

I propose that the opinions of scientific judges reached after hearing opposing advocates be published, within the limits of national security. The publication of these judgments would serve two purposes. First, it would provide the whole political community with a statement of scientific facts as currently seen by unbiased judges after a process in which opposing points of view have been heard and cross-examined. Hopefully, these opinions would acquire sufficient presumptive validity to provide an improved base on which political decisions could be reached. Second, the publication of opinions reached by scientific judges would inevitably increase their personal involvement and, thus, could help to attract distinguished scientists to serve in the decision-making process.

A grave difficulty is the traditional conservatism of scientists, even those who have exhibited great imagination and daring in their own work. I have no formula to offer to overcome this bias other than an insistence that the advocates of novel approaches be heard. It is important that they be cross-examined by skeptical experts and that the judges feel a responsibility for not rendering negative judgments on inadequate evidence. It is actually very difficult to offer rigorous proof that something cannot be done, and usually the most that can be said is, "I cannot see how to do it." Scientific judges whose opinions would be published should be more accountable for errors in judgment. It is very important that this type of formal procedure not

be allowed to interfere with the small-scale creative science which must precede any major decision making. This work has always been pursued, with wide opportunity for initiative, in a kind of private-enterprise, laissez-faire system in which I firmly believe. When large-scale funding is required we must restrict the number of approaches that are made, and the question can be asked, Would the formalization of institutions for scientific judgment result in harmful restrictions on initiative? However, scientific advisory procedures that now exist have also been guilty in this respect, and more formalization of these procedures could be designed to control the narrowing of the number of alternatives pursued simultaneously as a project grows in size.

### Experimental Institution

Congressional review of important scientific programs requires an independent source of scientific judgment. It would be valuable if the Congress could acquire that judgment in a manner different from the procedures which have been developed in the Executive Branch. I propose that the Congress create, on an experimental basis, an institution for scientific judgment. The scientific questions referred to the institution by the Congress should relate directly to forthcoming major congressional decisions. The future of such an institution would depend on the degree to which political and scientific communities would accept its initial judgments in comparison with the judgments arrived at through existing procedures. It seems to me possible that a relatively modest start could be made toward developing an institution which, in the course of time, could achieve a much higher level of presumptive validity in communication of the Congress with the scientific community than now exists. Such an institution could be invaluable in providing an improved scientific basis for future mixed decisions of the Congress.

### Note

1. It is true that there are important questions which are best answered by scientists yet which are not scientific questions, according to this definition. An example of this sort of question is the relative competence of scientific groups which might be important in a decision as to where to locate a major scientific facility. In many cases, however, the essential information which the political community requires from the scientific community is a considered and unbiased statement of the currently available scientific facts. It is to such cases that this communication is addressed.