

THE SCIENCE COMMITTEE

A Report by the Committee on the
Utilization of Young Scientists & Engineers
in Advisory Services to Government

Volume One

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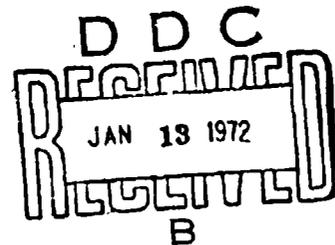
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A Report by the Committee on the Utilization of
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in Advisory Services to Government

Volume One

National Research Council

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NOTICE

The study reported herein was undertaken under the aegis of the National Research Council with the express approval of the Governing Board of the NRC. Such approval indicated that the Board considered that the problem was of national significance; that elucidation of the problem required scientific or technical competence; and that the resources of NRC were particularly suitable to the conduct of the project. The institutional responsibilities of the NRC were then discharged in the following manner:

The members of the study committee were selected for their individual scholarly competence and judgment with due consideration for the balance and breadth of disciplines. Responsibility for all aspects of this report rests with the study committee, to whom we express our sincere appreciation.

Although the reports of our study committees are not submitted for approval to the Academy membership nor to the Council, each report is reviewed by a second group of scientists according to procedures established and monitored by the Academy's Report Review Committee. Such reviews are intended to determine, *inter alia*, whether the major questions and relevant points of view have been addressed and whether the reported findings, conclusions and recommendations arose from the available data and information. Distribution of the report is permitted only after satisfactory completion of this review process.

PREFACE

It is a notable national tradition that men and women with special qualifications give freely of their wisdom and knowledge to advise their government at its call. Some receive compensation for such services; most do not. For the overwhelming majority, satisfaction lies in the deep and enduring reward of service for a purpose they regard as worthy.

Irrespective of needs expressed by government, scientists have long found it natural to consider together questions and issues of far reaching human consequence, either when these are raised by scientific advances or when they can be illuminated by scientific study.

Whatever may be its origin in any particular case, whether in the effort to meet a need perceived by government or in the spontaneous urge to face a problem or explore an issue, the science committee has a long and honorable history. As a human endeavor, it has not been exempt from human foibles. But it has nonetheless, in a remarkable and inspiring way, evoked from scientists through the years wholehearted and unselfish effort to further their calling and its usefulness to mankind.

A principal function of the National Academy of Sciences and its National Research Council is to advise many sectors of our federal government on scientific matters and on the scientific elements of matters of broader scope. This is done in response to specific requests of immediate concern and occasionally on a continuing basis for the consideration of enduring problems. Some of the most significant advice

given is initiated by scientists who perceive a need for study of problems unrecognized by those responsible for governmental policies and actions.

The frequency and scope of scientific advice requested by government and given by a diversity of individuals and agencies have increased greatly during the last three decades. This has been due in part to the widening role of science throughout government, in part to the need for a spectrum of scientific talents not encompassed within a department of government, in part to the breadth of competence required as problems become more complex and specialism increases. The advice then sought from the Academy-Research Council or other advisory agencies can in some cases be given by a single individual. But usually a group or committee with a diversity of knowledge and points of view is required in order to ensure competent, unbiased judgments and decisions. The judicious selection of the members of such an advisory committee is clearly of primary importance.

During the first half century of the Academy, it was not difficult to identify those most competent to give advice because there were relatively few scientists and engineers in our country and they were widely known among their colleagues. During the past fifty years, many who were best suited for membership on advisory committees were recognized through their scientific and technical services in the first and second world wars. How now to identify, select and recruit young scientists from succeeding generations for the widening needs of a more complex society was the task assigned to this committee.

In several meetings with a group of young advisers, we were impressed by the desirability of widening the scope of our study. What can be learned from the history of the science advisory committee? How should the practice of advice to government on scientific matters be modified to meet changing conditions? How can service on advisory committees be made rewarding to the members of a committee? How can we develop wider geographical, racial, and sexual representation on committees? How can a committee guard against advice that is influenced by the self interest of its members? As the social role of science and technology becomes more pervasive, how can the impartiality of committee advice be preserved? These and other significant questions regarding the status of scientific advisory committees were our concern.

We are especially grateful to Robert K. Weatherall of the Massachusetts Institute of Technology who drew together the great mass of material that came under discussion during the meetings of our committee which he served as secretary. The brief history of science committees in the United States and the other appendices that constitute the longer Volume Two are based on his extensive reading and on the discussions of our committee in which he participated. The report has greatly benefitted from the editorial assistance and the criticism of S. D. Cornell who was uniquely fitted for those duties by his twelve years' experience as Executive Officer of the National Academy of Sciences.

We have had effective staff support from the Office of Scientific Personnel of the National Research Council, including

the assistance of Clarebeth M. Cunningham, Lindsey R. Harmon, William C. Kelly, Doris Rogowski, and Herbert Soldz. The late B. J. Driscoll served as a consultant to the Committee and was most helpful. We acknowledge with thanks the financial support provided by the Advanced Research Projects Agency of the Department of Defense.

Detlev W. Bronk, Chairman

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THE SCIENCE COMMITTEE

Introduction

General

Advisors assist government in the United States at all levels, standing in many different relationships to the officials they advise and addressing themselves to a wide spectrum of issues and problems. They enter the picture as trusted friends, as expert consultants, and as members of panels, committees, commissions, and boards. Legislative bodies, executive agencies, and elected leaders, from City Hall and State House to Capitol Hill and Pennsylvania Avenue, turn to them for help. Their advice is sought on every kind of topic: the quality of the environment, the quality of education, tax reform, scientific research, economic growth, campus unrest, the improvement of transportation and of health care, national defense, and ways to celebrate the bicentennial of the Nation's independence.

The appointment of a committee to obtain advice or opinions is a characteristic of our process of government. The advisory committee was a device frequently used by the Nation's founders, and in the intervening years advisory committees have enormously expanded in number and breadth of activities. During the last three decades of rapid change and social upheaval, when complex problems have pressed urgently on all sides, new committees have appeared almost daily. Recent estimates have placed the number of committees in Washington at 2400. If one includes committees at the State and city level, the number of advisory committees in the nation at large is probably in the tens of thousands. A Congressional report has

suggested with good reason that after the legislature, the judiciary, the executive branch, and the regulatory boards possessing judicial and executive powers, advisory committees should be considered a fifth arm of government.

The proliferation of committees has created its own complexity. There are many in government who must on occasion have felt the same exasperation with committees as Winston Churchill, who complained: "We are overrun by them, like the Australians were by the rabbits." Efforts have been made from time to time to resist the creation of new committees, or to reduce their number, but such efforts have generally been short lived. If their survival and continued use is any measure, committees have clearly proved their value.

Our deliberations have dealt with one group of committees, those concerned with science and technology. Estimates suggest that the number of such committees currently advising government agencies in Washington is close to 1500. They constitute more than half of the committees used by government agencies in all fields. For the sake of brevity the term "science" is used arbitrarily in this report to include both science and technology, the term "scientist" to include both scientists and engineers. Our area of interest does not include committees of economists such as the Council of Economic Advisors, nor committees of educators such as the many expert advisory committees serving the U.S. Office of Education. Thus our concern is with committees dealing with matters lying generally in the area of the physical sciences and engineering, and in the life and medical sciences. Less frequently their topics lie in the areas of the behavioral sciences, although

committees on such topics are becoming more common.

Background of Present Report

There are about 15,000 appointments involved in the membership of the 1500 committees (see Table 1 of Appendix D). If one assumes that the lifetime of an ad hoc committee is typically three years and that continuing committees rotate their members on a three-year basis, then even allowing for perhaps 2000 reappointments of incumbents, 3000 new appointments are probably made each year. The figure represents a significant problem in recruitment. The problem is enhanced by the constantly expanding frontiers of science and by the growth of the profession. Paradoxically, each year it becomes harder to reach out for those best qualified for a given assignment. They are less visible in the rapidly multiplying population of scientists and engineers. In 1940, when many scientists now retiring from committee work were first recruited to Washington, or were soon to be, the American Physical Society, to name one professional group, counted a mere 3751 members. In January, 1970, its membership numbered 27,894. Then, the most talented people in physics all knew each other, or at least knew each others' reputations. Comparatively speaking it was not difficult to list the best candidates for a committee assignment, to weigh their effectiveness as committee members, and to make a choice. Today the scientist who is asked to help choose a committee can be familiar with only a small percentage of the leading people in his field. It requires a careful, concerted effort to identify the people who might make a contribution in a given area.

The problem of recruitment was the occasion for the present study. The National Research Council decided to examine the means by which new committee members were recruited and to recommend procedures for improving the process of search and utilization. The Council believed the study would be helpful to all organizations using committees, not least the National Research Council itself.

The recruitment of younger scientists was of crucial importance. The agencies have reason to ponder the question of age. The median age of committee members in the National Research Council is 50.0 years, equaling to a decimal point the median age of advisors in the Department of Defense (DoD). The median age of all doctorate-holding scientists in the nation, by contrast, is close to 40. Forty is not a young age in science. Most scientists have shown their full potential by this time. If an agency is not drawing actively on scientists in this age group it is overlooking important talent. It is also denying the opportunity of committee service to a group who can argue that they have something to offer. The Committee on the Utilization of Young Scientists and Engineers in Advisory Services to Government came into existence late in 1968 to examine this question in some detail and suggest remedies.

At an early stage in its work, the Committee convened a group of younger faculty members who were still in the early phases of their careers and who had had relatively few opportunities to serve on national committees advisory to government. It sought their views about committees and advisory service. The exchange was valuable, and the meeting was repeated several months later. The views expressed at those meetings have had a strong influence on this report. Subsequently two of those

who were consulted in this way accepted invitations to join the Committee.

In addition to the question of the recruitment of younger scientists and engineers, the Committee was asked to consider other aspects of composition of science committees. It was asked to look at such matters as geographical and institutional representation, the range of employment backgrounds represented, the recruitment of women, and the recruitment of members of ethnic minorities. How well, for example, does the geographic distribution of committee members compare with the geographic distribution of the scientific population? Do some institutions contribute a disproportionate share of advisors? Are scientists in industrial and non-profit laboratories considered as frequently as they might be? While women constitute 7% of all scientists with the doctorate, they constitute only about 1% of NRC committee members. The proportion of committee members from ethnic minorities is also small.

It became clear to the Committee during its deliberations that it could not consider the question of recruitment without addressing itself to the larger question of the purposes for which science committees are appointed, the manner in which different committees go about their business, and the work an individual member may be called upon to do. To ignore these issues would be to consider only a part of the whole problem.

The Report

Thus our deliberations expanded from our original charge and finally included much more general consideration of the science advisory committee system. We have placed the substance of our studies and dis-

cussions in six appendices:

- A. A Brief History of Science Committees in the U. S.
- B. The Role of the Science Advisory Committee in Government.
- C. Types of Committee
- D. Membership Characteristics of Two Advisory Structures
- E. Selection, Recruitment, Motivation
- F. Desiderata and Pitfalls

Appendices A, B, and C are concerned with the nature and purpose of the advisory system -- its development, the variety of its functions, and the several kinds of committee that have evolved to serve those functions.

Appendices D, E, and F are concerned with some major aspects of the operation of the system -- certain characteristics of its membership, how members are chosen, and a discussion of some things to be sought in committee operation and some to be guarded against.

While the first three appendices tend to give an unclouded picture of advisory committees and their usefulness, the last three make it clear that the system has its shortcomings and its hazards. Improvements and safeguards in a number of respects are needed. It is with these that the much shorter main body of our report is chiefly concerned.

The advisory committee as an institution has, in its best examples, demonstrated a high level of wisdom, judgment, and imagination. Through history there have been many examples of such performance. There have likewise been plentiful examples of a far lower order of performance on all three counts. Failure to achieve the best can usually be understood by reference to one or a combination of the following: administrative weaknesses in the requesting, appointing, or supporting machinery; the nature of the task assigned to the committee; the conditions under which

the committee has to work; or deficiencies among the members themselves. Our report contains, in brief form, our conclusions with respect to such causes of lowered performance and our recommendations related thereto. These are distilled from the material of the appendices, but also from experiences and impressions that cannot be satisfactorily represented in that form.

Our findings are addressed for the most part to two elements of the advisory system: the requesting or proposing agency, which asks for the services of an advisory committee, and the appointing agency, which names the committee and takes immediate responsibility for its support. In many cases, of course, the two are the same. The principal case where they are not is that of the National Research Council which, apart from studies and reviews undertaken on its own initiative, appoints committees to provide advice requested by governmental agencies on a wide variety of matters.

We have used the term "sponsoring agency" to include both the above kinds of agency, on the grounds that sponsorship implies responsibility and that in every case both the requester or proposer and the appointer of a committee are, in the final analysis, responsible for it.

A substantial number of committees in the advisory system are established by law. In varying degrees of detail the responsibilities of such committees are specified by law, and the selection of their members is often circumscribed in some manner. Nevertheless, we believe that our recommendations can be applied in general to them as well as to the more common committee established under executive authority and regulation.

To those who read any sizable portion of the appendices to our report it will be apparent that we have gathered our information predominantly, although by no means exclusively, from the experience and operations of the National Research Council. This information was, of course, readily available to us. But quite apart from convenience, there is justification for such stress. While the founding Act of the National Academy of Sciences is broad and general, the one purpose explicitly stated therein is that of advising the government. Correspondingly, while the National Research Council, the principal agency of the Academy, has done many other things also, it has accumulated more than half a century of experience in responding to needs of government through a total of thousands of advisory committees. It is the largest repository we have of institutional experience and systematic information bearing on the advisory function.

Some of our recommendations are no more than common-sense axioms of good practice. We include them because our study has convinced us that they are too often ignored despite their essential and obvious importance. Other recommendations may, we hope, contribute to efforts to revitalize the advisory system, to bring into it elements of the scientific population that are now almost entirely missing, and to preserve its strengths and bolster its weaknesses.

Administrative Considerations

Government now relies heavily upon the advice of committees and is likely to continue to do so in the future. The health and effectiveness of the advisory structure should be a matter of concern throughout government at all levels of executive and legislative responsibility.

In our explorations and in our own experience we have found both concern and neglect. We have also found examples of the improper employment of committees, for example to avoid or delay executive decision. Sometimes an existing committee is used or a new one is formed simply out of habit or inertia because the advisory framework exists and is convenient, without a clear decision that reference to a committee is the best course in the circumstances.

Apart from such examples, the extent of the present advisory system and its tendency toward continued growth lead to concern lest its well-earned reputation for usefulness may in many situations be degraded by attempts to extend it to areas or situations where committees cannot perform effectively or where a simpler device will do as well. Any organization proposing a committee should give careful consideration to the questions or problems to be put before the committee, the priority attached to obtaining answers, the feasibility of carrying out the task, and the readiness and ability of the agency to put findings into effect. The burden of proof should be on those who make the proposal.

Appendix F includes a discussion of appropriateness in connection with committee tasks. Advising on the division of limited resources is there cited as a task in which committees experience parti-

cular difficulty and the committee approach may simply be inappropriate.

As important as the question of whether and when to establish a continuing committee, or to assign a particular task to it, is the question of how to keep its approach fresh, how to maintain a lively interest in its tasks among its members, and how to avoid its becoming, with or without intent, a "captive" of the requesting agency. It is all too easy for a committee to become a reference point for approval of agency decisions and programs rather than a forum for imaginative and critical review and advice.

Rotation of members is one of the most effective stimulants and safeguards. The membership of a continuing committee should be changed regularly according to some clearly understood plan of rotation. The steady flow of new ideas and fresh enthusiasm into the work of a committee seems vital to us and far outweighs the loss of the knowledge and experience of the committee's task that the outgoing veteran member takes with him.

Related to the task of keeping a continuing committee fresh and independent in its viewpoint is the crucial problem of terminating it. Committees develop a life of their own. Even with a periodic influx of new members they can dig ruts that unnecessarily limit their scope and effectiveness. In general, it is much more difficult to terminate a committee than to form one. Even ad hoc committees have been known to continue long after the task for which they were originally created has been completed. Sometimes, of course, long life for a committee is desirable. Examples can be cited of committees that have remained lively, creative, critical, and useful for many years. Equally, there are examples

where a moribund committee has finally been terminated and has been un-
lamented, or has even been replaced by a new committee under new leader-
ship that has then succeeded in pumping fresh life into a program of
great importance. The great wrong is to continue a committee out of
administrative lethargy or out of reluctance to put an end to it when
its real value no longer makes its continuation worth while.

Recommendation 1- That one criterion for the formation
of a committee always be the satisfaction of a needed and
worthy objective, carefully related to the activities of
the proposing agency or to the field of science with which
the committee is to be concerned. And, as a corollary of
this, that critical evaluation of the need for a new com-
mittee and its probable usefulness, or of the appropriate-
ness of a new assignment to an existing committee, be made
by the proposing and appointing agencies before the commit-
tee is appointed or the assignment made.

Recommendation 2 - That the nominal term of service on
a continuing committee be not more than three years and
that extension be given infrequently and only for com-
pelling reasons.

Recommendation 3 - That proposing and appointing agencies
internally review the status of every committee at least
once each year, ask themselves why this committee should
not be terminated, and act promptly and decisively if
they do not find convincing answers.

These points are related to the more general question of what
the factors are that govern the effectiveness of advisory committees.

While some of the factors are obvious and well understood, we are convinced that the advisory function, its organization and use, offers the social scientist an interesting and potentially fruitful field of inquiry. Reducing the high degree of trial and error in dealing with the advisory function seems most desirable and well worth the attention of workers in the social and behavioral sciences.

In the absence of an adequate social-scientific theory of the advisory committee process, we have thought it rewarding to consider innovations that might be tried in an effort to find new techniques or mechanisms that would, at least in particular instances, increase the effectiveness of the advisory system. Two in particular have appeared to us worthy of trial.

It would be interesting, for example, occasionally to name two separate committees to consider the same problem independently, and then to compare results. The problem would have to be carefully chosen. It should not be a purely technical one, requiring only technical knowledge or expertise. A question of advising on what policy should be adopted on the basis of established technical facts, where scientific judgment was crucial, would probably be most appropriate.

The conditions of such an experiment would have to be carefully determined, and questions of double financing and staff support might be difficult. But one approach of this kind has already been proposed informally in the National Academy of Sciences and National Academy of Engineering, and we believe the experiment should be tried in a number of cases if it can be properly arranged.

As another innovation, which would bring an entirely new element into the advisory system, we have considered the possible role of self-generated committees. The size and complexity of modern government and of the scientific population itself combine to inhibit voluntary contributions from scientists and engineers who believe they have useful advice to offer but see no channel by which it can be expressed. Unlike the situation of the 1940's, when scientists came forward to offer their services as advisors and were heard, the current situation is one in which the initiative rests almost entirely with established organizations.

To be sure, there are outstanding examples from the past of committees assembling on the initiative of their own members in a common cause, and where as a result of the urgency of their self-assigned task and the excellence of their achievements they have found sponsorship and support in the formal advisory system. But these are rare enough to be regarded as curiosities, even though distinguished and important ones.

Without questioning the right of the government to seek advice where and when it sees fit, we believe that citizens should be given greater opportunity to offer advice when they believe that it is needed and that they are qualified to give it. A new link of the advisory structure might be tried -- self-generated committees, whose function might bear the same relationship to that of officially appointed committees as the thoughtful and insightful letter to the editor bears to the authoritative and comprehensive scientific article. Some possibilities suggest themselves: a registry of self-generated committees, a referral system for bringing their reports to the attention of national organizations and federal agencies that are concerned with the problems addressed,

and an affiliate or "corresponding committee" relationship with officially appointed committees. There are obvious financial problems that would need attention, along with questions such as that of criteria covering the qualifications and responsibilities of such committees.

Recommendation 4 - That federal agencies and private foundations give support to well-planned and imaginative research projects by competent investigators in the area of committee process, small-group dynamics, and the advisory function.

Recommendation 5 - That sponsoring agencies experiment with innovative advisory techniques such as (a) independent concurrent approaches to the same task by two or more committees, and (b) mechanisms to encourage self-generated committees to make their activities known and, where appropriate, to seek wider effectiveness, as a number have done through NRC over a period of many years.

Finally, we have found a classification of types of committee useful to us in our study. We believe that an improvement in nomenclature along similar lines would serve an important purpose by clarifying the functions of advisory bodies for the responsible agencies, other interested agencies, the public, and the committees themselves. We have suggested and elaborated in Appendix C the following terms:

(1) "technical committee." Concerned with a matter that is strictly technical or scientific.

(2) "survey committee." Established to review a whole field or program in a comprehensive way and to make recommendations on what it finds.

(3) "selection committee." Charged with choosing personnel for important appointive posts, with selecting recipients of research grants and fellowships, or with identifying those to be recognized by awards of honor.

(4) "general advisory committee." Normally a continuing committee serving an agency of the government in a variety of ways designed to strengthen a particular program or a particular function of the agency.

(5) "policy committee." Charged with the formulation of policy, or proposals for policy, typically policy for science.

(6) "administrative committee." Having a role that is primarily administration. Not properly an advisory committee.

We believe that these terms better describe what committees actually do than the commonly used term "advisory committee."

Recommendation 6 - That greater precision and descriptiveness be used in the nomenclature for scientific committees.

Selection and Recruitment of Committee Members

In Appendices D and E we have brought together the information that we have gathered on the characteristics of the membership of the advisory systems, together with the substance of our discussions of the critical problem of the selection and recruitment of committee members. From that material and a number of the considerations summarized in Appendix F, we have concluded that the most important steps that can be taken to renew the vitality of the system and to reinforce its effectiveness lie in the area of selection and recruitment. It is there that administrative imagination and perseverance are most needed in order to engage a wider range of the scientific population in advisory activities. To do so could, we believe, not only bring to the government advice from a more representative body of scientists but also satisfy scientists generally by bringing into active participation in governmental tasks and problems individuals from groups that would not otherwise have that opportunity.

Range of Search

Committee members are typically chosen from a relatively small group of qualified people who have been identified by the narrow and limited search procedures. Description of the search process as a "buddy system" (Appendix E) is not inappropriate, because those who are identified by means of it are readily visible in the scientific and engineering community and are usually known personally to current committee members and staff members of the appointing organization. This is not to say that the resulting choices are poor ones; on the contrary, the system has generally

worked well. Personal knowledge of technical competence and productivity, temperamental suitability, and degree of motivation will continue to be needed in considering nominees for committee service. Moreover, there is obviously little to be gained by enlarging the pool of nominees far beyond the capability of the advisory structure to utilize them. But we believe that the range of search for people with the desired qualifications could be broadened to the benefit of the advisory system. It is highly desirable that the greatest range of talents and interests be brought to the solution of the increasingly complex problems facing society. Ability to serve effectively should be utilized wherever it is to be found.

With reference to the types of committee distinguished in Appendix C, it is clear that for effective performance all require of their individual members certain subjective qualities, such as the ability to work with others, and balanced judgment in reaching conclusions when completely adequate facts are not available. Besides these basic requirements, the qualifications of members of a technical committee, as defined in Appendix C, embrace primarily the scientific and technical competences and experience necessary to accomplish the purely technical task. We see little reason, in general, to invoke other criteria for the selection of members of technical committees. Other kinds of committee, however, have quite different kinds of assignment. They need -- in addition to scientific and technical competence and experience -- to draw on a variety of points of view. They should therefore be constituted with a proper regard for representation. Age distribution, sex, geographic region, ethnic group, sector of employment, and discipline are some of the categories that must be considered. As we have noted in Appendix C

the shortcomings of the present system with respect to such representation are obvious in the areas of young scientists, women, and minority ethnic groups.

In Appendix E we have recorded certain special difficulties of selection that can arise in cases characterized by the controversial nature of an issue, its obvious importance, its political or public policy implications, and sometimes the publicity that attends it. Where there may thus be a special need for the wisest individuals on a committee, it may be nearly impossible to find enough highly qualified individuals who have not already formed judgments and, often, publicly pronounced and defended them. While we have no recommendations for the handling of such cases, the alternatives seem to be either to constitute a membership carefully balanced among points of view, under a non-expert chairman with extraordinary leadership qualities, or to conclude that the situation is one in which a committee can no longer make a helpful and credible contribution.

We note that the questions being asked of science advisory committees in these times tend more and more to have economic and social aspects that must be considered along with their scientific aspects, and not separately, if balanced and pertinent results are to emerge. Many of the most important -- and most interesting -- tasks that are particularly suitable for committees are of that kind. Appointing agencies accustomed to identifying and selecting "hard" scientists must now learn how to make wise selections in the fields of economics and the social sciences where criteria of excellence are often less sharp and more difficult to apply. We note with satisfaction that current discussions of organizational steps to be taken within NRC include explicit measures for thus broadening the approach to many tasks.

Recommendation 7 - That appointing agencies throw the net more widely in seeking nominees for committee service; particularly, that more younger people (35 years old and younger), women, and members of ethnic minority groups be included in committee memberships; and specifically, that every committee, unless there is compelling reason to the contrary, include at least one younger person of ability and promise as a way of providing experience and education for the oncoming generation of advisors.

Recommendation 8 - That sponsoring agencies, and particularly appointing agencies, give increased attention to the importance of economic and social questions in connection with many of the tasks assigned to advisory committees, and develop effective means for identifying qualified individuals from those fields for appointment.

Identification

Various techniques for identifying well-qualified nominees for advisory service have been suggested to augment those commonly used: the "snowball technique", whereby highly selected persons would nominate colleagues who would then be requested to nominate other colleagues; the compilation of a roster of nominators; the use of records of research grants and contracts; resort to lists of those who have received prestigious fellowships or other awards; solicitation of nominees from professional societies and the heads of graduate departments; and review of the

lists of those who have already served on committees. Some are further described in Appendix E.

We are especially concerned about the problems of identifying younger men and women, including all ethnic groups. Here especially it is important to build up as large and diverse a pool as possible, in order to minimize the tendency to over-use a few bright young or minority-group scientists once they are discovered. We have been impressed by the potential usefulness of the efforts of the Office of Scientific Personnel of the National Research Council, working with the heads of graduate departments, to compile lists of people still near the beginning of their professional careers. Most of the committees of the Office of Scientific Personnel are concerned with the award of fellowships and research associateships. On selection committees like these, charged with arriving at an ordered list of candidates, a member who is especially perceptive and helpful is easily identifiable; a member who is the opposite is also readily identifiable, but is likely to have little adverse effect on the result if most of the members have been more successfully chosen. Therefore, such committees, although composed principally of experienced advisors, strike us as excellent trial grounds for unknowns. Technical committees, in the definition of Appendix C, can serve a like trial role for testing qualifications of wider significance that are more difficult to assess than straight technical knowledge.

The difficulty is in the matter of progression from effective service on such committees to service on other types of committee, where it may be more important that most of the members be to some extent al-

ready tested in committee service. We applaud the explicit efforts of the National Research Council, sparked by the President of the National Academy of Sciences (Appendix E), to facilitate such a progression. We believe that these efforts need to be sustained, and that other appointing agencies should take similar steps.

A progression of this kind is of course useful not only for younger people but also for untried people in general. We are convinced that there are a great many individuals, older as well as younger, who would make excellent committee members but whose names have never surfaced in the course of the usual search and identification procedures. In this connection, we believe that appointing agencies as a rule set experience requirements too high for younger untried neophytes.

In Appendix E we have discussed the questions of aptitude, temperament, and motivation as they affect the performance of a committee member. Some individuals are especially adapted to working on broad problems rather than sharply focused ones, and vice versa. Some feel a special obligation for committee work and welcome it as a kind of national service; others do not. Some regard it as rewarding because of the pleasure of working with others in studying problems of importance for the furtherance of science, and because of the educational profit of the personal associations it affords. Some judge it according to the opportunities they feel it gives to address themselves to cogent national problems or ills. And so it goes. While we recognize that it is often difficult to evaluate individuals in these terms, we believe that appointing agencies pay too little attention to such matters in their selections.

In the larger agencies, central offices assigned responsibility for devising techniques for identifying suitable advisory committee members might be of great assistance in all the above problems; recourse to advice from appropriate sectors of the National Academies of Science and Engineering, the Institute of Medicine, and the NRC will in most cases be helpful. Such offices should contain the institutional memory about those who have served on committees and those who have been nominated for future service. A variety of paper files and tape files, which might range from informal collections of notes to computerized data banks, would provide a depository for information about the qualifications of persons whom the agency might want to consider for committee appointments. Information could be fed into the system as a result of systematic searches for suitable nominees or more informally as a result of suggestions by members of present committees or by staff members. Proper precautions should be taken to insure confidentiality of the information and to prevent unwarranted invasion of privacy. Such an office could provide upon request a list of persons and their qualification for review and further screening by those responsible for committee appointments. Any implication that inclusion of a name in the files or lists of such an office constituted a "certification", or that omission was an adverse reflection, would have to be avoided. A variant that might prove useful to some organizations would be to maintain a roster, not of nominees but of nominators in the various sectors of interest to whom the appointing

agency might resort for nominations of specific persons whenever they were needed.

Appendix F sets forth a number of more or less systematic ways for possible improvement of both the range of search for possible committee members and the methods of their identification. Despite difficulties with centralized rosters, like the National Register of Scientific and Technical Personnel, for these purposes, we believe that further effort should be devoted to their possible use. Likewise, we have been impressed by the experiment with Defense Science Seminars by the Advanced Research Projects Agency, and the organization of JASON by the Institute of Defense Analyses, as a way of stimulating interest among younger scientists and engineers in defense problems and of identifying those both motivated and qualified to help through service on advisory committees. In a similar way, the National Academy of Engineering has held a valuable workshop designed to provide an introduction to team attacks on urban problems. We believe that more such efforts should be mounted.

Recommendation 9 - That committee memberships be balanced so as to include both experienced, seasoned people and those newer to committee work, so that opportunities exist for progression in committee service.

Recommendation 10 - That effective performance in

advisory roles be recognized and individuals be enabled to progress from one advisory role to another.

Recommendation 11 - That the larger appointing agencies, such as the National Research Council and the larger federal agencies, assign to central offices the responsibility of assisting them in finding qualified persons for committee assignments.

Recommendation 12 - That the use of the National Register of Scientific and Technical Personnel, or equivalent national rosters, as locator files for committee recruitment be explored by the agencies compiling such rosters and by those seeking information from them.

Recommendation 13 - That sponsoring agencies experiment with conferences on topics of special interest and potential significance, which often lead to important committee studies, and which also serve to stimulate interest in committee service and to identify highly motivated people who have the potentiality of becoming unusually able advisors.

Relations between Advisory Committees
and Sponsoring Agencies

Administration

Administrative questions strongly affecting committee performance include the rights and responsibilities of committee members and chairmen, means for expressing minority opinions, the role of staff members, the relationship of the committee and its staff to the appointing agency and the agency requesting the advice, conflict of interest, the privileged nature of committee discussions and reports, and proper channels for the release of information to other executive agencies, Congress, and the public. These are discussed in some detail in Appendix F. They are mostly matters for policy guidance from appointing agencies, some of them in turn conditioned by legal or policy restraints within the agency requesting advice. Guidance with respect to them is best given to a committee in some systematic way at the beginning of its work, so that any doubtful or additional points can be cleared up and later misunderstandings can be avoided.

The task of evaluating committee performance is discussed in Appendix F. We believe that a system for periodic evaluation at reasonable intervals should be established by all sponsoring agencies. Some of the obvious criteria of evaluation should include progress toward the goal set for the committee in its charge, level of activity, impact upon the problem, and extent to which new ideas are emerging. The criteria themselves should be kept under review and made germane to the purposes of the requesting agency.

Earlier in this report we have referred to the problem of terminating committees that have been ineffective or have outlived their use-

fulness. In connection with the periodic evaluation of actual committee performance, a principle of parsimony should be followed in deciding whether a committee should be continued: strong justification should be required for the continuation of any committee. The concept of inactive "standby" committees should go into disuse.

As a counterpart of the evaluation of the committee itself, the performance of individual committee members should be regularly evaluated with the assistance of chairmen and perhaps the committee members themselves. The latter are often entirely frank about poor performance on their own parts and about the reasons therefor, which may clearly indicate that a member should resign for lack of time or interest, and consequently be replaced.

The supporting services provided by sponsoring agencies are usually crucial to the success of any committee. Often this applies not only to the preparation and presentation of material and to the making of effective arrangements for briefings, meetings, field visits, and the like, but also to the preparation of the committee's report and to its reception and effect within the requesting agency. Services beyond staffing are often required. Committees that deal with unusually complex problems or with those for which information must be collected on a large scale require many kinds of service (e.g., collection of original data, data processing, literature searches) that should not be expected of otherwise busy volunteer committee members. Much valuable time is wasted and the response time in providing advice is lengthened when committees and their professional staffs must struggle with logistical problems that should be handled expeditiously for them. Where many committees are involved,

appointing agencies should clearly identify an office responsible for seeing that supporting services are adequate.

Recommendation 14 - That appointing agencies clearly define the functions of committees, prepare guidelines for the conduct of committee activities, and see that every member is acquainted with them.

Recommendation 15 - That the performance and justification for continuance of committees be evaluated regularly and frequently by the sponsoring agencies and by the committee members.

Recommendation 16 - That sponsoring agencies provide timely and adequate supporting services so that each committee can make the most effective use of its members' time and energies.

Public Information

Some of the difficulties and misunderstandings that can arise because of lack of more widespread knowledge of a committee's purpose and progress are described in Appendix F. We believe that committee activities should, when appropriate, be given greater visibility by more frequent reports to the scientific community and to the general public. The advantages of acquainting various constituents with the process of committee work far outweigh, in our opinion, any disadvantages

of occasional premature release of findings. Among the advantages are those of making committee work better understood, of eliciting ideas and suggestions from the larger community of interest, and of possibly attracting to committee service highly motivated people of competence who have not previously been identified.

Recommendation 17 - That sponsoring agencies publish interim reports, issue news releases, and encourage oral reports on those aspects of a committee's work that can properly be made public without jeopardizing the effectiveness and integrity of the committee process.

Morale

Appendix E contains the substance of much of our consideration of the important questions of motivation and rewards for committee service.

The greatest reward for advisors and the greatest motivation for their work derive from contributing to the solution of an important problem. This is often not a one-step development, but a process of successive advances, disappointments, reconsiderations, new understanding, and sustained application to the task at hand. Committee members should be kept aware, both during their work and afterwards, of its effects and of the problems that may be encountered by the requesting agency in applying its results.

Advisory service is not a thankless task, and most sponsoring agencies make their appreciation known to members of committees. While personal satisfaction and realization of worthy achievement are the principal

rewards of committee service, public recognition is important also. News releases (including special releases sent to home-town newspapers) and prominent mention in reports can serve to recognize the work of individual committee members. Letters of thanks to the institutions that employ the committee members can be judiciously used to express appreciation. Awards and special citations are worth considering for those who have served with great distinction in advisory roles.

Appendices B and E contain references to the rewards of committee service. Among them, the educational opportunities for the members are often particularly great and are generally well recognized. We believe that they can and should be still greater in many cases.

Recommendation 18 - That sponsoring agencies make determined efforts to keep committee members informed about the results of their work, such as decisions taken or difficulties encountered, policy changes, awards made, and new programs or institutions created. Such feedback should continue during the lifetime of the committee and for a reasonable period of time after its discharge.

Recommendation 19 - That sponsoring agencies pay greater attention to recognition of committee service.

Recommendation 20 - That educational opportunities connected with committee service be enhanced wherever feasible by such devices as special briefings, discussion of scientifically relevant topics during committee meetings, circu-

lation of documents, and invitations to special conferences.

Ethic of Service

Finally, we wish to emphasize that motivation is of the greatest importance to effective performance, no less in a committee than elsewhere. If motivation is lacking in a member or prospective member, he should not serve. Thus self-selection must play a role in the choice of members of committees. The individual who is asked to serve should evaluate the proposed advisory assignment for himself with regard to (1) its worthiness as an activity in which he will invest his time, and (2) its match with his interests and available time and energies. The sponsoring agency must fulfill its responsibilities in this assessment by providing the prospective member with sufficient information so that he can make these judgments.

If his decision on either count is negative, he should decline.

Recommendation 21 - That an ethic of committee service be generally accepted: a person should serve as a member of a committee only if he is convinced of the value of the advisory task and is able to provide the time and effort that it requires.