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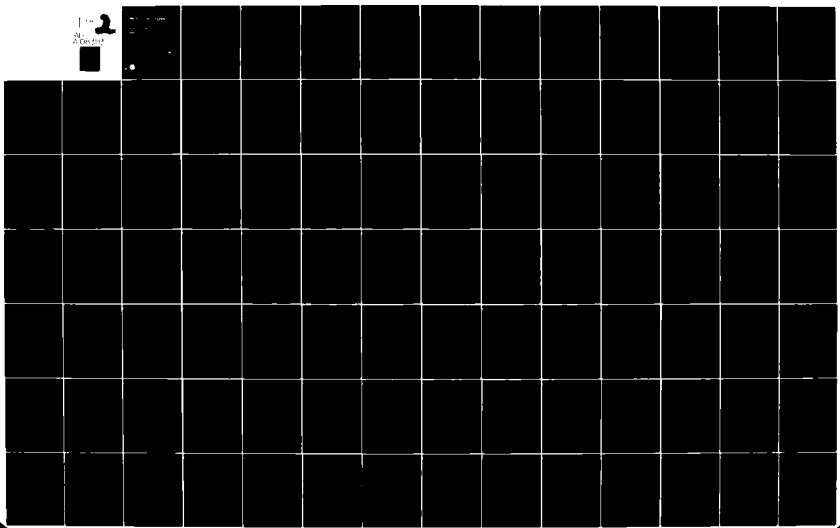

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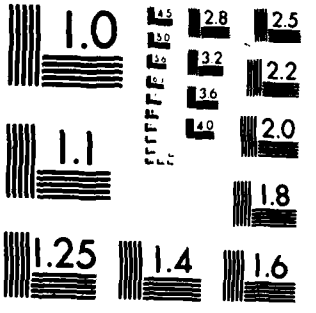

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BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

AD A108393

Better Accountability Procedures Needed In NSF And NIH Research Grant Systems

The National Science Foundation (NSF) and the National Institutes of Health (NIH) awarded $2.2 billion in fiscal year 1980 for the support of basic research at colleges and universities. Peer review (expert advice of selected researchers) is the primary component of the research grant scientific performance accountability systems used for selecting research proposals to be funded.

GAO studied a random sample of NSF and NIH basic research grants, and found that the peer review and internal review systems are working reasonably well. Although the systems are basically the same at the two agencies, the procedures differ. GAO found that some of the NIH peer review procedures have advantages over those at NSF, but believes that changes are needed by both agencies to improve their scientific performance accountability systems.

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GAO/ PAD-81-69
SEPTEMBER 30, 1981

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

To the President of the Senate and the
Speaker of the House of Representatives

The Congress is increasingly concerned about basic research and its importance in making technological advancements, improving productivity, and finding cures for dreaded diseases such as cancer. Much of this country's nondefense basic research is funded through basic research grants made by the National Science Foundation and the National Institutes of Health to colleges, universities, and other nonprofit research institutions. This report assesses the systems used by these agencies to determine those research proposals that are to be funded and how scientific performance on the grants is assessed when continued support is provided.

We made this review because in recent years several congressional committees and Members of the Congress have expressed concern over whether the Federal Government's basic research grants are adequately evaluated and whether only the most deserving of all research proposals are supported. In this report, we focus on the main element of the scientific performance accountability system--called peer review--which is used in large measure to evaluate proposed as well as completed research. The report includes recommendations for improvements to make the systems more effective.

We are sending copies of the report to appropriate House and Senate committees, Representatives and Senators who have a particular interest in the subject, the Secretary of Health and Human Services, the Directors of the Office of Management and Budget, the Office of Science and Technology Policy, the National Institutes of Health, and the National Science Foundation, and to other interested parties. We will also make copies available to interested organizations and individuals, as appropriate, on request.

Milton J. Socolar

Acting Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

BETTER ACCOUNTABILITY
PROCEDURES NEEDED IN
NSF AND NIH RESEARCH
GRANT SYSTEMS

D I G E S T

The quality of the scientific performance accountability system is of great importance to the Congress, the Federal Government, and university researchers. Peer review, in which selected researchers called "peer reviewers" evaluate the scientific merit of research proposals, is recognized as the primary component of this system. The Congress has been concerned with whether taxpayers' dollars are being invested wisely in these grants. One commonly asked question by the Congress and congressional committees with jurisdiction over Federal agencies funding basic research at universities (such as NSF and NIH) is how and to what extent basic research is being evaluated. Another question is whether the systems the agencies use to determine from all research proposals those most deserving of support work properly. This review was made to find out how the NSF and NIH scientific performance accountability systems are working and to identify improvements that could make both systems more effective.

In fiscal year 1980, the National Science Foundation (NSF) and the National Institutes of Health (NIH) provided 75 percent of the total amount awarded by the Federal Government, or $2.2 billion, for the support of basic research at colleges and universities. The bulk of both agencies' research support is provided through individual research grants.

OBJECTIVES, SCOPE, AND METHODOLOGY

GAO selected a random sample of 75 NSF and NIH basic research grants (whose funding ended during fiscal year 1978) made to 6 major research universities ranked among the top 20 in Federal funds received. GAO had two broad objectives in examining the scientific performance accountability systems NSF and NIH use (NIH peer review group, NSF panel, and NSF ad hoc) to review these grants. The first objective was to determine whether research was being funded but not accomplished and if grants were subsequently getting renewed support in spite of poor performance. The second objective was to assess how well the

Tear Sheet

(PAD-81-29)
SEPTEMBER 30, 1981

scientific accountability process identified unproductive researchers and prevented them from receiving continued funding. To achieve these objectives, GAO examined the five main elements of the accountability process (proposal submission, peer review, award decision, monitoring the research, and evaluating the research) as the agencies intended them to operate, then examined the steps in the process as they operate in practice. GAO did not attempt to make scientific judgments regarding any aspect of the grants it reviewed.

RESEARCH GRANT SCIENTIFIC PERFORMANCE ACCOUNTABILITY SYSTEMS OF NSF AND NIH CAN BE IMPROVED

Although the scientific performance accountability systems are basically the same at NSF and NIH, the procedures differ significantly. GAO believes that some of the NIH peer review procedures have certain advantages over those at NSF. (See chapter 2.)

For instance, at NIH, of the 25 research grants reviewed, researchers on 23 sought additional funding from NIH to continue their research. The peer reviewers prevented 4, or 17 percent, of these from getting funded because of lack of progress, impact of the research already done, or for other reasons. Also, at NIH, peer reviewers' comments directly affected 7 of the 19 that received continued funding by eliminating some proposed research objectives that lacked merit, or by reducing the funding or time requested to do the proposed research.

At NSF, of the 50 research grants reviewed, none of the 27 researchers who sought continued funding had their requests turned down, but the peer reviewers' comments did play a role in 10 cases in that some research objectives were eliminated or the funding or time requested to do the research was reduced.

NSF does not ask peer reviewers to comment on the performance of the immediately preceding grant when the researcher submits a proposal for a renewal grant. The reviewers are asked to evaluate the scientific merit of the renewal proposal and the researcher's overall track record. Of the 50 NSF grants GAO reviewed, 27 (54 percent) were renewed to continue the same line of research. In only 6

of the 27 cases (22 percent) did GAO find any evaluative comments in the peer review renewal proposal critiques concerning a researcher's performance during the preceding grant. (See p. 21.)

In contrast, at NIH, where peer reviewers are asked when reviewing renewal proposals to comment on the immediately preceding grant, GAO found that in 95 percent of the cases (18 of 19 grants renewed), the researcher's performance on the preceding grant was evaluated by the peers in critiquing the renewal proposal. (See p. 22.)

Even if peer reviewers were asked to comment on the immediately preceding grant, NSF renewal proposal instructions do not require sufficient information to insure that such an evaluation is feasible. NSF, unlike NIH, does not require an identification of the preceding grant's objectives and progress toward their accomplishment or identification of the preceding grant's publications in renewal proposals. (See p. 22.)

Renewal proposals which easily identify preceding grant results would be particularly important at NSF because (1) they often would be the only source of these results at the time of renewal; and (2) different peer reviewers and program officers usually review successive grants.

For new project proposals, neither NSF nor NIH requires researchers to discuss the prior grant results or identify prior grant publications. Also, peer reviewers are not asked to evaluate scientific progress on the prior grant. This is particularly important when researchers have two or more grants at the time they submit new project proposals, because there is little way of determining which grant produced the research results <u>or</u> publications that might be discussed in the proposal. These procedures do not preclude researchers from avoiding accountability by continually proposing new projects. Twenty percent of the researchers in GAO's review received grants for new projects. (See pp. 27-28.)

NIH automatically forwards peer review comments to researchers. NSF forwards them only when the researcher requests them. NSF's policy may inhibit some researchers from receiving useful information. In some instances, this

policy has an adverse effect on the conduct of the research. GAO found that about two-thirds of the researchers did not receive the peer review comments. Further, for many NSF grants which are panel-reviewed, no summary of the panel deliberations was available to be forwarded to the researcher. (See pp. 33-34.)

Neither NSF nor NIH uniformly monitors the progress or evaluates the results of research grants. The tools available to perform both of these functions, progress reports, final reports, and publications, are used by program officers in a variety of ways. Some program officers rely on peer review of subsequent proposals to identify unproductive researchers and determine whether the researcher's prior work justifies continued support. However, 19 percent of the researchers in the GAO sample did not seek another grant from NSF or NIH. (See pp. 35-38.)

Universities traditionally do not monitor the progress or evaluate the results of research grants. Their role is limited to reviewing proposals prepared by researchers for administrative matters and adherence to university policy prior to submission to NSF or NIH. (See p. 39.)

RESEARCHERS ARE ACCOUNTABLE FOR RESULTS--NOT ACCOMPLISHING OBJECTIVES

Most of the researchers who were awarded renewal grants did not accomplish all of the objectives of the immediately preceding grant. Peer reviewers and program officers were not concerned by this because they believe results are more important than accomplishing the proposed objectives, and because, for the most part, they do not expect all objectives to be accomplished. Most of them, however, did expect the researchers to attempt the grant's objectives. GAO believes that this method of operation is basically sound. However, unless the renewal proposal identifies the preceding grant's objectives, it is difficult to determine if the objectives were attempted. NSF, unlike NIH, does not require renewal proposals to restate the preceding grant's objectives. (See pp. 45-47.)

NIH requires researchers to specifically state the objectives (specific aims) to be attempted during the grant period as well as the overall

objective of the line of research. NSF does not distinguish between these types of objectives. (See p. 47.)

Neither NSF nor NIH specifies the extent to which researchers can deviate from a grant's original objectives without prior agency approval. (See p. 49.)

RECOMMENDATIONS

GAO recommends that the Director of NSF require that:

--Renewal proposal progress reports identify the objectives, evidence of progress toward their achievement, any major changes in direction or emphasis and the rationale for such changes, publications, and/or other output from a researcher's immediately preceding grant.

--Peer reviewers be asked when reviewing renewal proposals to specifically comment on a researcher's performance on the immediately preceding grant.

--The documentation of panel peer review deliberations include the major elements required of the NIH peer review group summary statement when individual peer reviewers' written reviews do not provide this information.

--Peer review comments be automatically sent to researchers.

--Proposals identify the research objectives to be undertaken during the grant period.

GAO recommends that the directors of NSF and NIH require that:

--Proposals for new projects include evidence of progress from the prior grant(s).

--Peer reviewers be furnished any available final technical reports and listings of publications from the prior grant(s) when researchers seek funding for new projects.

--More systematic and uniform review of annual progress reports be made by the program officers.

Tear Sheet

--More specific guidelines be established regarding the extent to which researchers can change grant objectives without prior agency approval.

AGENCY COMMENTS

NSF and NIH's parent organization, the Department of Health and Human Services, generally concurred with GAO's recommendations and with one exception by NSF agreed to examine current practices and/or develop better guidelines to implement GAO's recommendations. HHS stated that the report fairly presents the issues involved. NSF noted that while improvements should always be sought in any system, any changes must be considered in the context of workload implications. The recommendation NSF took exception to has been revised to reflect NSF's views.

MATTERS FOR CONSIDERATION BY THE CONGRESS

The House Committee on Government Operations and the Senate Committee on Governmental Affairs, during oversight hearings on NSF, NIH, or on matters relating to universities and research grant accountability, should consider the effectiveness of the scientific performance accountability systems at NIH and especially at NSF. Also, the House Committees on Science and Technology and Appropriations and the Subcommittee on Appropriations--HUD and Independent Agencies, Senate Committee on Appropriations, during their fiscal year 1983 budget hearings, should consider NSF and NIH actions taken to improve the research grant scientific performance accountability systems since the hearings mentioned on pages 6-7. These systems determine the quality of much of the basic research conducted at the Nation's universities, and this research is vital to the Nation's welfare. The systems NSF and NIH use should work as effectively as possible, especially considering shrinking research budgets and the ever-increasing demand for technological advances. The recommendations made in this report will help improve the scientific performance accountability systems at NIH and especially at NSF.

Contents

		Page
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CHAPTER		
1	INTRODUCTION	1
	Background	1
	The National Science Foundation	1
	The National Institutes of Health	2
	Research grants are used for basic research	3
	Maintaining accountability without inhibiting creativity	4
	The Congress is interested in how well peer review is working	5
	Objectives, scope, and methodology	7
	Evaluation approach limitations	10
	Other GAO reports and related studies	11
2	RESEARCH GRANT SCIENTIFIC PERFORMANCE ACCOUNTABILITY SYSTEMS OF NSF AND NIH CAN BE IMPROVED	13
	Scientific performance accountability	13
	Proposal submission	16
	The peer review process	16
	Evaluating scientific merit	17
	Evaluating the researcher's productivity	17
	Evaluating scientific merit vs. track record	18
	Funding received despite inadequate proposals	19
	Evaluating preceding grant performance	20
	Evaluating requests for new project support	27
	Effect of peer reviewers on grant award decisions	28
	The award decision	29
	Relying on peer reviewers varies	29
	Documenting results of peer review panel deliberations	33
	Releasing peer review comments to researchers	33
	Monitoring the research	35
	Progress reports	35
	Site visits	37
	Peer reviewers' role	38
	Universities do not monitor scientific progress	39

		Page
	Evaluating the research	39
	Outside of peer review	39
	Publications	42
	Negative results	43
	Comparing scientific performance accountability processes	43
3	RESEARCHERS ACCOUNTABLE FOR RESULTS--NOT ACCOMPLISHING OBJECTIVES	45
	Accomplishing objectives not always possible	45
	Proposal objectives differ	47
	Research is results-oriented	48
	Allowing for creativity	48
	Allowing for change	49
	Research objectives are speculative	51
4	CONCLUSIONS, RECOMMENDATIONS, AND MATTERS FOR CONSIDERATION BY THE CONGRESS	54
	Conclusions	54
	Recommendations	57
	Agency comments and our response	58
	Matters for consideration by the Congress	60
APPENDIX		
I	GAO reports and related studies	61
II	Letter dated July 2, 1981, from the National Science Foundation and our response	65
III	Letter dated July 9, 1981, from the Department of Health and Human Services and our response	76
IV	Letter dated June 24, 1981, from the University of Wisconsin-Madison and our response	80
V	Letter dated July 6, 1981, from the Stanford University and our response	83

Page

TABLES

1	Comparing NSF and NIH proposal review and grant award activity	3
2	Comparing the NSF and NIH systems used to review research proposals	15
3	Factors weighed in peer reviewing other scientists' proposals	19
4	Publications resulting from the preceding grant	24
5	Do program officials routinely contact researchers regarding negative peer review comments on all proposals they review?	31
6	Cognizant program officers with enough knowledge to have been a peer reviewer on the sample grant proposal	32
7	Comparing processes	44
8	Meeting objectives	46
9	Expecting objectives to be accomplished	52

ABBREVIATIONS

FY	Fiscal year
MRL	Materials Research Laboratory
NIH	National Institutes of Health
NSF	National Science Foundation

CHAPTER 1

INTRODUCTION

Research and development are vital to our national economy. Economic growth, national security, and quality of life all depend critically on technological development. Research contributes to the prestige and leadership of our Nation in international affairs. Scientific research leads to improvements in agriculture, in the diagnosis and treatment of disease, and in technologies which increase productivity and lead to new products. The keystone of and the underpinning for technological development is basic research, important because of broad potential for social benefits, not by its ability to generate specific products or services. Basic research is inherently exploratory. Furthermore, the ultimate significance of results may not be visible for years.

BACKGROUND

The objective of basic research is to produce new knowledge without regard to its application. Basic research is extremely important in providing the fundamental knowledge necessary for progress. Basic research inherently involves a long-term view, and provides seed for broad social benefits.

Project grant funding began its development in various private foundations before World War II. The Federal Government adopted the process as its primary mechanism to support basic research in colleges and universities because it avoided detailed and short-term political control of research. For the last 3 decades, the Federal Government has been the primary supporter of basic research in universities. Over 50 percent of the Nation's basic research is now performed in colleges and universities.

Federal agencies provided about $2.9 billion to universities and colleges during fiscal year (FY) 1980 to conduct basic research, which is about 54 percent of the total Federal funds spent on basic research. Federal Government funds which universities receive for basic research are about 72 percent of the total funds universities get for basic research. Over $2.2 billion, or 75 percent of the $2.9 billion provided by the Federal Government to universities came from two agencies--the National Science Foundation (NSF) and the National Institutes of Health (NIH).

THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency established under the National Science Foundation Act of 1950, as amended (42 U.S.C. 1861 et seq.) 1970. Its primary mission is to strengthen U.S. science by supporting basic research and science education. NSF is the principal Federal agency that supports non-mission oriented basic research at universities and colleges. In some fields, NSF provides the dominant share of Federal basic research support: more than 69 percent

in ground-based astronomy, 60 percent in environmental sciences and over 50 percent in mathematics and engineering. About 2,000 colleges, universities, and other institutions participate in NSF programs. Of the 26,000 proposals reviewed in 1980 by NSF, 11,500 (44 percent) were funded, for a total of $653 million.

NSF determines the quality of research proposals through a system of peer review. The scientists and engineers who participate in the peer review process give their views and evaluations of proposed projects. The Foundation has six organizational units, called directorates, which operate the proposal evaluation process and award research grants. Each directorate is headed by an assistant director of the Foundation and is subdivided into divisions, sections, and programs representing specific areas of science. The key individual in each program is the program officer who manages the program's proposal evaluation process. A program officer is the focal point between NSF and the science community, being responsible for recommending whether a proposal should be funded.

THE NATIONAL INSTITUTES OF HEALTH

The National Institutes of Health (NIH) is one of the six agencies composing the U.S. Public Health Service. NIH is under the leadership of a Director who reports to both the Assistant Secretary for Health and the Surgeon General of the Department of Health and Human Services. NIH is one of the world's foremost prestigious biomedical research centers, and is the focal point for Federal mission oriented biomedical basic research and research support. The mission of NIH is to improve the health of the people of the United States. To accomplish this mission, NIH conducts and supports research about the cause, diagnosis, prevention, and cure of diseases of man, the processes of human growth and development, the biological effects of environmental contaminants, and the sciences related to health. NIH is composed of 11 separate research Institutes, each of which supports biomedical research programs, and a division of research resources. All but one Institute are located at the NIH complex in Bethesda, Maryland. The other is located at Research Triangle Park, North Carolina.

NIH is by far the largest single source of funds for biomedical research conducted in the Nation's universities and medical schools. Its FY 1980 budget for basic research grants was nearly $1.6 billion. Table 1 illustrates the size of and compares NSF's and NIH's proposal review/grant award activity.

Table 1

Comparing NSF and NIH Proposal Review and Grant Award Activity

Proposals reviewed a/	NSF	NIH
FY 1979	25,000	26,000
FY 1980	26,000	26,600
Grants awarded		
FY 1979	10,700	15,300
FY 1980	11,500	16,500
Grant funds awarded		
FY 1979	$575 million	$1,400 million
FY 1980	$653 million	$1,600 million
Average cost of a grant (1980)	$56,800	$97,000
Average length of a grant (1980)	2.2 years	3.2 years

a/ Includes proposals for new or competing grants and proposals to continue existing or noncompeting grants.

RESEARCH GRANTS ARE USED FOR BASIC RESEARCH

Federal agencies use three basic types of funding mechanisms to support basic research in colleges and universities: research grants, research contracts, or cooperative agreements. In general, grants are used when the principal purpose is to support or stimulate research and the Federal agency is not substantially involved in the management or performance of the activity. Contracts are used when the Federal agency is obtaining specific types of information, products, or services. Usually, contracts are negotiated, managed, and monitored by Federal agencies much more closely than grants. Cooperative agreements, as introduced pursuant to the Federal Grant and Cooperative Agreement Act of 1977, are similar to grants in that they are oriented toward support or stimulation of a particular activity but provide for varying degrees of involvement by the Federal agency. Although both NSF and NIH use research grants and contracts almost exclusively, the bulk of research support they provide to universities is through individual research project grants.

Most proposals for grant support originate with individual researchers in a college or university who develop a proposed plan for research within an area of interest to them and to the agency from which support is solicited. Although grants are usually awarded to an organization such as a college or university that sponsors and conducts basic research, the agencies are still accountable to the public for the funds used to finance basic research grants.

MAINTAINING ACCOUNTABILITY WITHOUT INHIBITING CREATIVITY

The health of science and technology, and particularly the state of basic research in this country, are subjects of much concern. Our international leadership in science and technology is being challenged, and national policy issues such as those involved in energy resource development and environmental protection increasingly involve science and technology. Also, the current pressures of budgetary constraints have made accountability a leading issue in all areas of Government spending. Thus, the Congress and the public are concerned with how to obtain adequate accountability of federally supported basic research grants while, at the same time, not unduly inhibiting researchers' creativeness.

Each university is independent, and research is performed in independent departments, composed of individual, autonomous researchers. The structure of this environment is generally nonhierarchical and tends to be loose and flexible. The keystone of the research process is the individual researcher or the small group of researchers who perform the work. The process of investigation itself, like the overall "climate," is characterized by a lack of hierarchy. The researcher conceives, directs, performs, and publishes the work, often in conjunction with graduate students, who are essentially practicing apprentices. The researcher has a heightened sense of self-reliance, which serves as crucial motivation for the work. In fact, a researcher's independence has come to be viewed by many scientists, as well as nonscientists, as necessary to scientific excellence.

The distinction between basic and applied research is not always clear, but it is generally recognized that basic research is characterized by certain attributes which make oversight and accountability difficult. Basic research is inherently long-range and it is more difficult to plan definitively than is applied research. Potential payoffs are highly uncertain, with little or no assurance of positive results, even when the scientific methods used are correct. During the course of a basic research investigation, it is frequently desirable to change direction or methodology to overcome difficulties and take advantage of opportunities.

Notwithstanding this uncertainty, however, a good research proposal for a grant award should describe the phenomenon to be studied or the scientific problem for which a solution is sought. In the context of the existing state of knowledge, the scientific method or approach the researcher plans to use can be described. The proposal should include enough information about the intended objectives and scientific approach, not only to justify the merits of the proposal, but also to provide a basis for assessing the research performance in accordance with the commitment stated or implied in the proposal. Progress on a first-time grant in a new area may be minimal and not achieve significant advances or results prior to requesting a grant renewal, but it should be

possible to determine whether the research was performed in accordance with the scope and direction indicated in the original proposal and whether sufficient progress had been made to warrant continued Federal funding.

There are two principal forms of accountability: financial and administrative, which focuses on evidence of financial propriety and compliance with administrative requirements; and scientific, which focuses on scientific performance. In funding basic research, financial and administrative accountability refers to the degree to which funds are spent within the terms of the research agreement without diversion, fraud, or waste. This accountability is enforced largely by the Federal Government.

Scientific accountability is concerned with the quality of performance and the scientific integrity of the research in accordance with the standards and protocol of the scientific community and in relation to the commitment made or implied in the proposal which won the grant award. The scientific community outside the Government plays a major role in self governing in scientific accountability.

In the research community, selected researchers called peer reviewers play a major role in deciding what work will be supported, who shall carry out the work, and what is significant. Peer review is the primary system for evaluating research proposals and searching out opportunities to advance science. It is also essentially a method of accounting for and reviewing research on its own terms. Peer review is the method by which the Federal Government assures itself and the public of the quality and significance of the basic research being supported through the grant process. Thus, it is an essential element in the accountability system.

THE CONGRESS IS INTERESTED IN HOW WELL PEER REVIEW IS WORKING

The quality of the scientific performance accountability system--which is mainly peer review--is of great importance to the Congress, the Federal Government, and university researchers. Peer review is recognized by these groups as the primary source of scientific accountability for the public funds awarded to researchers in basic research grants. However, the widespread acceptance of peer review to ensure that scientific research is funded fairly and effectively and to provide scientific accountability has been questioned. The Congress, for example, has been concerned with whether taxpayers' dollars are being invested wisely in basic research grants. Criticisms of peer review made by the Congress often center on the secrecy of the systems, inadequate consideration of past performance of a researcher in evaluating the scientific potential of a research proposal, and inadequate protection against possible abuses.

Concern for the quality of peer review has grown because the Congress has increased its interest in scientific research for improving technological development and productivity, and because the Government needs to be assured that it is getting value for its research investment because of budget constraints. One commonly asked question by the Congress and congressional committees with jurisdiction over Federal agencies funding basic research at universities (namely, NSF and NIH), is how and to what extent basic research is being evaluated. Another question is whether the systems the agencies use to determine from all research proposals those most deserving of support work properly and provide adequate safeguards against abuse.

The fundamental issue in supporting basic research is how to choose from all researchers' proposals those most likely to produce high quality research that will advance basic knowledge. The peer review system removes scientific accountability from the public domain. Researchers--who are the peer reviewers--largely determine who gets funded, how well they perform, and the quality of the research results. Thus, the scientific accountability system is "closed" in that review by non-researchers is not done in most cases. The Congress requires that this "closed" system works well and that the best research is supported with the funds available. Considering the scale and importance of the scientific performance accountability system, the Congress' concern is warranted.

This report focuses on the scientific performance accountability systems used by NSF and NIH because these two agencies provide 75 percent of all Federal basic research grant funds that go to the Nation's colleges and universities. Also, both agencies rely on peer review as the primary means of assuring scientific accountability over basic research grants.

During the past several years the Congress, and particularly the authorization and appropriations committees with jurisdiction over NSF and NIH, have held special oversight hearings, conducted investigations, or have focused, during the annual budget hearings, on the scientific performance accountability systems used by NSF and NIH. In July 1975, the Subcommittee on Science, Research, and Technology of the House Committee on Science and Technology conducted 6 days of special oversight hearings on how NSF makes individual grant awards. The Subcommittee's hearings were prompted by (1) congressional and public concern that NSF might be supporting questionable research, (2) the spreading belief that Government operations ought to be open to public scrutiny (since at that time peer review of research proposals was conducted in almost total secrecy), and (3) concern that tightness of funds might result in complaints from the scientific community about NSF's decisionmaking systems.

The Subcommittee on HUD-Independent Agencies, Senate Committee on Appropriations, during hearings on NSF's fiscal year 1979 and 1980 budget requests, focused on how NSF evaluates research

results of the immediately preceding project grant before providing more funds to continue the project. The Subcommittee questioned how NSF determined that a research project was worthwhile, if the funds used on a previous project were well spent, and whether NSF ever looked at the results of previous projects before providing additional funding to continue a research project.

In August 1979, the House Committee on Appropriations directed its Surveys and Investigations staff to examine the process NIH uses to review and approve researcher-initiated research project grants for use during its fiscal year 1981 NIH budget hearings. The Committee asked, "Given a finite amount of Federal funds that can be allocated to medical research, how can they best be divided among competing demands?"

In April 1981, the newly constituted Investigations and Oversight Subcommittee of the House Committee on Science and Technology held hearings on the veracity of the scientific publications process as an accurate measure of the quality of research results produced under federally-sponsored research grants. The hearings stemmed from selected cases and widespread allegations of fraud in the scientific publications process.

The sensitivity of and relative secrecy with which peer review is conducted surrounds the controversy and importance of peer review in providing scientific accountability over basic research grants. Sponsoring agencies, and the scientists who are peer reviewers, believe and steadfastly support the notion that anonymity of individual peer reviewers' comments must be maintained if honest and objective peer review evaluations are to be made on basic research proposals.

As a result, on the one hand the Congress needs to be assured that public funds are well spent on basic research grants, which entails thorough scrutiny of the systems used to award the funds. On the other hand, the sensitivity of the "closed" nature of the peer review system needs to be recognized, as it determines who gets the funds. Thus peer review represents a "double-edged sword." Because of this dichotomy and the intense interest the Congress and congressional committees have shown in peer review, this report examines the scientific performance accountability systems NSF and NIH use for basic research grants, placing special emphasis on peer review, and shows how well the systems are working and the improvements needed to make them work better.

OBJECTIVES, SCOPE, AND METHODOLOGY

Our review of the systems NSF and NIH use to assure the scientific accountability of basic research granting procedures had two broad objectives. One was to determine from a randomly selected sample of 75 NSF and NIH research grants whether research was being funded but not being accomplished and if the grants were subsequently getting renewed support in spite of poor performance. By poor performance, we mean that condition in

which a researcher did not attempt the intended research objectives, did not make reasonable progress towards those objectives, or did not produce identifiable research results 1/ without any valid reasons as to why; and/or the quality of the research work that was done was below the level where continuing the work would not have been in the best interests of advancing science with the limited funds available. The other objective was to assess how well the scientific performance accountability process identified unproductive researchers and prevented them from receiving continued funding. We also reviewed NSF's and NIH's grant monitoring and evaluation systems which check on grants after they are made.

The information concerning our sample grants in this report is representative of most basic research grants made to major research universities that are evaluated by the peer review systems NSF and NIH use. As a result, we believe our evaluation results generally reflect the status of the scientific performance accountability process used for similar NSF and NIH basic research grants.

We selected a stratified, random sample of NSF and NIH basic research grants which ended during fiscal year 1978 made to 6 major research universities ranked among the top 20 in terms of Federal research funds received. The schools selected were MIT, Yale, University of Chicago, University of Wisconsin at Madison, Stanford, and the University of California at Berkeley. These universities are geographically dispersed and include public and private institutions. We limited our selection of universities to those in the top 20 because (1) they get 40 percent of all Federal research grant funds, and (2) we believe our results and recommendations would have greater credibility in the scientific community if they were based on grants involving prestigious research universities. We limited our selection of grants to those which NSF and NIH had identified as basic research grants. This type of grant represents the bulk of these agencies' research support. Also, scientific accountability is hardest to assess on basic research grants.

The subjects covered in the grants included chemistry, physics, materials research, engineering, geology, oceanography, the life and biological sciences, ecology, mathematics, computer science, law, economics, and other social sciences. In reviewing grants in these areas, NSF and NIH use three somewhat different peer review systems. NIH uses one system which is fairly uniform throughout NIH. NSF, however, uses two different systems--ad hoc

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1/Research grant results are evidence of progress toward objectives and the output describing such progress including publications, completed manuscripts or other printed material such as papers delivered at symposia or the progress report sections of renewal proposals. Such results are a major element in evaluating performance under the grant.

and panel. Since we wanted to compare the three systems, the total number of grants made to the six universities in our sample were grouped or stratified according to the peer review system used to evaluate them. NIH had 364 grants, the NSF ad hoc, 322; and the NSF panel, 181.

Our original sampling plan was to select 25 grants from each of the three systems. However, the actual sample ended up with 25 for NIH, 29 for NSF ad hoc, and 21 for NSF panel. The NSF samples changed slightly because of errors in the data NSF provided which did not become known until after the sample was selected. Sample sizes were derived based on statistical precision at the 90 percent confidence level with an error rate of ± 13 percent. The change in NSF sample sizes does not materially affect the samples' statistical precision.

Our evaluation approach to accomplish the review objectives included:

--Reviewing the files of the 75 sample grants to identify the research objectives proposed by the researcher, and the peer reviewers' and agency program officials' comments regarding the proposed research. We also reviewed, for many, the grant which preceded the sample grant, and all of the renewal applications for continued funding that immediately followed the sample grants. As a result, we reviewed over 150 grants and/or grant proposals to understand more fully what resulted from the sample grants and to evaluate better the scientific performance accountability process.

--Identifying the publications or other identifiable results that came from the grants and tracing, where possible, the published results to grant objectives.

--Discussing with the individual researchers the sample grants' objectives, performance, and results, to learn how many were accomplished or why objectives were not accomplished, and to verify the publications or other identifiable material that resulted.

--Discussing 69 of the grants with agency program officials responsible for approving and monitoring the grants. Responsible program officials knowledgeable about the remaining six grants were no longer at the agencies at the time of our review.

--Contacting 58 peer reviewers on 16 sample grant renewals to determine whether the reviewers had sufficient knowledge of the preceding grants to provide reasonably informed judgments regarding the success of the sample grant to justify continued funding. The 16 grants selected were chosen because analysis of the sample grants showed that some research objectives were not attempted, few or no

published results appeared, or other problems indicated that less than satisfactory performance was made under the sample grant that peer reviewers of the renewals should have been aware of in deciding whether renewed funding was warranted.

--Examining NSF and NIH policies and procedures for evaluating basic research proposals, operating the peer review systems, and monitoring and evaluating research grant results.

--Reviewing several reports and studies of scientific accountability over basic research grants and the peer review systems at NSF and NIH.

We accomplished these objectives by reviewing our sample of research grants to determine what was done, the results produced under the sample grants, and how requests for renewed support by the researchers with the sample grants fared in the accountability (peer review) systems. We compared the work that was done and the results produced under the sample grants to the information that was available on the decisions made to provide continued funding under the renewal grants to see if the accountability systems had considered the same information we found.

Our tests were based on NSF's and NIH's premise that poor performance under a preceding grant (as defined on pages 7-8) should in most cases result in disapproval of renewed funding on a renewal request. This premise was emphasized in testimony by NSF officials before a Senate Appropriations Subcommittee in response to Subcommittee members' questions concerning how research grant results are evaluated.

Another premise we used concerned how the quality of research results is determined. According to NSF and NIH officials and most researchers we contacted, research grant results need to be published in so-called refereed or peer reviewed scientific journals to achieve maximum credibility. Peer reviewed publications are the hallmark of a successful research grant, and in large measure determine the "track record" of the researcher. This criterion is a primary means to judge how successful each grant is.

Evaluation approach limitations

We did not attempt to make scientific judgments regarding any aspect of the grants we reviewed. We solicited comments regarding grants' objectives, research performance and results from the individual researchers, agency program officials, and in some cases the renewal grants' peer reviewers. As such, much of the evaluative information in this report is based on the responses provided by those ostensibly most knowledgeable about the grants. Our independent analysis of grant information was done by comparing and/or contrasting information in the official grant files with information provided by the researchers and others. The

resulting data, while representing our own evaluation of the process, does not include evaluations of the scientific aspects of the grants or the grants' results.

Our study approach was based on testing certain key premises underlying the scientific accountability system. In this system, assessing a researcher's progress and results on a preceding grant by peer reviewers, and at NSF by the program officer, is crucial for determining whether additional support should be provided. One premise is that peer reviewers are able to determine the quality and significance of research results on a given individual grant and thus ensure accountability regarding the scientific merit of researchers' work under that grant. At NSF, another premise is that program officers are sufficiently knowledgeable in the areas represented in the proposals they review to assure scientific performance accountability by evaluating research proposals along with the peer review comments. The study approach was also designed to determine whether appreciable differences existed in the scientific performance accountability provided by the NSF system as compared to the NIH system, and within NSF, between the ad hoc and panel systems. Financial accountability was not taken into consideration.

OTHER GAO REPORTS AND RELATED STUDIES

Within the last 5 years, several studies and reports have been issued concerning peer review and grant monitoring at NSF and NIH. Two of these are GAO reports. 1/ One contained specific recommendations to NIH to establish guidelines concerning the contents, the review, and the documentation of the review of annual progress reports submitted for research grants; the other recommended that the NSF better document in proposal files the selection of peer reviewers and how reviewers' comments are handled, and improve internal controls to assure that researchers receive all peer review comments when requested. Neither NSF or NIH has fully implemented the reports' recommendations. NSF and NIH each have conducted studies of their peer review systems. A study of NSF's peer review system, funded by NSF and conducted under the auspices of the National Academy of Sciences, did not answer definitively the main question the study was supposed to address: whether NSF's peer review system is an "equitable" one. 2/

1/"Better Controls Needed Over Biomedical Research Supported by the National Institutes of Health," U.S. General Accounting Office, HRD-76-58, July 22, 1976; and "Accountability in the National Science Foundation's Review Process for Grant Awards Needs Strengthening," U.S. General Accounting Office, HRD-78-121, November 17, 1978.

2/"Peer Review in the National Science Foundation, Phase I of a Study," National Academy of Sciences, November 7, 1978.

NIH conducted a lengthy internal review of its peer review system, and reached some of the same conclusions contained in this report about the adequacy of the peer review system. 1/ However, the methodology used to conduct NIH's review was based primarily on anecdotal information. Also, during 1980, the National Commission on Research issued two reports concerning scientific accountability, one of which specifically dealt with peer review at NSF and NIH. 2/ See appendix I for an expanded discussion of related reports.

1/"Grants Peer Review: Report to the Director, NIH Phase I, December 1976," National Institutes of Health; and "Grants Peer Review: Report to the Director, NIH Phase II, December 1978," National Institutes of Health.

2/"Review Processes: Assessing the Quality of Research Proposals," The National Commission on Research, May 1980.

CHAPTER 2

RESEARCH GRANT SCIENTIFIC PERFORMANCE ACCOUNTABILITY SYSTEMS OF NSF AND NIH CAN BE IMPROVED

Our analysis of the 75 sample grants disclosed that NIH, and NSF to a lesser extent, rely on the peer review process to provide scientific performance accountability of basic research grants. NIH peer reviewers evaluate (1) the scientific merit of the proposed research, (2) the past productivity of the researcher, and (3) the researcher's performance on the immediately preceding grant, for renewal proposals. At NSF, however, peer reviewers perform their function somewhat differently. In accordance with NSF guidelines, peer reviewers only evaluate the scientific merit of the research and the past productivity of the researcher--they generally do not evaluate performance on the immediately preceding grant. Additionally, even if evaluation of the immediately preceding grant were required, NSF's proposal instructions do not facilitate such an evaluation. More specific guidelines to peer reviewers and for renewal proposal requirements are needed at NSF because in many cases different program officers and peer reviewers evaluate the renewal proposal than evaluate the preceding grant proposal.

NIH uses peer reviewer evaluations more extensively than NSF does. NIH evaluations have a greater effect on grant awards than NSF's because of the greater flexibility NSF program officials have in making award decisions. Additionally, NSF's practice of only releasing peer reviewer evaluations to researchers upon request does not maximize the use of these evaluations. Our analysis of the 75 grants shows that these evaluations could be useful to researchers if they were routinely released. Further, for many NSF grants which were panel reviewed, no summary of panel discussion was available to forward to the researcher.

NSF and NIH do not uniformly monitor or evaluate research grants. Program officials vary in their approach to both these functions and they sometimes rely on peer reviewers to perform them. Additionally, the universities we visited do not monitor grant progress or evaluate grant results. They only review grant proposals for administrative matters and adherence to university policy.

SCIENTIFIC PERFORMANCE ACCOUNTABILITY

Science must be fundamentally accountable to society in that it uses society's resources to seek continually greater understanding of nature. When that happens, science is using resources as intended and is being accountable to its patrons. If that does not happen, then society is not getting what it should from science for the resources invested.

NSF and NIH attempt to maintain accountability for the science they support in basic research grants through a set of practices and procedures, which taken together form a process for assuring scientific performance that we call the scientific performance accountability process. We are interested primarily in evaluating the systems and procedures used by the two agencies to assure that their basic research grants foster good science.

However, the accountability process should not be viewed (and we do not view it) as an end in itself. The process is merely a means to an end--with the end being supporting the best science possible in the basic research grants NSF and NIH award. The process should serve science; it should aid in advancing science.

No single regulation or set of instructions defines the scientific performance accountability process used by NSF or NIH. We use the accountability process to describe and organize a set of customs, practices, and procedures these agencies use. The process consists of five major elements:

--proposal submission;

--peer review process;

--award decision;

--monitoring the research; and

--evaluating the research.

Peer review of proposals for basic research is used by NSF and NIH to solicit expert advice from the scientific community to help determine which research proposals merit funding. Agency program officers are responsible for the actual decisions regarding which proposals are funded and for monitoring ongoing research to insure that work is carried out under the terms of the grant. Acceptance for publication in the open scientific literature provides for dissemination of scientific results and some measure of evaluation, e.g., articles in leading journals are subjected to peer review prior to acceptance for publication.

The grant award process at both NSF and NIH depends heavily on peer review to provide scientific accountability and on agency program officers to make the basic award decisions on proposals for research grants. However, the operation of the grant award process and peer review at the two agencies differs significantly, the most significant being the authority of the peer reviewers at NIH as compared to the authority of the program officers at NSF. Table 2 compares the grant award systems of NSF and NIH.

Table 2

Comparing the NSF and NIH Systems Used to Review Research Proposals

Process	NSF Ad hoc	NSF Panel	NIH
Proposal requirements			
All proposals must show			
long-range objectives	yes	yes	yes
specific aims (objectives) to be accomplished during proposal grant period	no	no	yes
Renewal proposals must show			
objectives of immediately preceding grant	no	no	yes
summary of progress on immediately preceding grant	yes	yes	yes
specific publications that resulted from immediately preceding grant	no	no	yes
Peer reviewers			
Make the scientific merit decisions on proposals	no	no	yes
Determine budget amounts	no	no	yes
Required to comment on immediately preceding grant	no	no	yes
Prioritize proposals	no	yes a/	yes
Comments automatically released to researcher	no	no	yes
Award decision			
Can be made by program officer even if peer reviewers do not approve the scientific merit of a proposal	yes	yes	no
Monitoring the research			
Progress reports required	yes	yes	yes
Site visits made	yes	yes	yes
Evaluating the research			
Final project report required on every grant	yes	yes	no
Final project report required upon completion of a line of research	no	no	yes
Submission of publications required	yes	yes	yes

a/Some NSF panels prioritize proposals.

PROPOSAL SUBMISSION

The research proposal presents the researcher's past performance and describes a program of planned research which is tailored to determine whether he or she should receive a research grant from NSF or NIH. Proposals are submitted for either a new research project or to request continued funding for an ongoing project. The latter is called a renewal.

After the researcher has prepared the proposal, it is submitted to a number of university officials for review and signoff. Proposals are generally reviewed by the researcher's department chairman and/or university dean responsible for the department, and by an office responsible for the administrative aspects of the university's externally sponsored research. Universities are not required by either NSF or NIH proposal preparation instructions to review proposals for scientific merit, or for the need or relevance of the proposed research.

Both NSF and NIH require researchers to submit proposals describing the research to be supported by the grant being sought. With minor exceptions, the proposals for the grants in our sample included all the information required by NSF or NIH. The universities we visited review proposals for administrative and policy matters, but not for technical adequacy or the need for the research.

THE PEER REVIEW PROCESS

At both NSF and NIH, review of researchers' proposals by outside scientists (called peer review) is considered the most important and most effective means to assure scientific performance accountability. Almost all proposals for basic research submitted to the two agencies are subjected to some form of peer review.

> "The words 'peer review' [mean] review by scientists who are actively engaged in research, who are not employed by a funding agency, and who have the research experience and achievement which will permit them to make discerning judgments on the scientific merits of [research] proposals." 1/

Peer review is supposed to provide advisory information on the scientific merit or quality of the research being proposed, the track record or past productivity of the researcher, and the reasonableness of the proposed budget.

1/National Commission on Research, "Review Processes: Assessing the Quality of Research Proposals," May 1980, p. 3.

NSF guidelines do not distinguish proposals for renewal grants from new project grants and peers are simply asked to evaluate a researcher's recent accomplishments--they are not specifically asked to comment on the progress of the immediately preceding grant. Our analysis of NSF peer review comments shows that, while peer reviewers are evaluating the researcher's overall track record, they generally do not comment on the budget resources and environment or the progress under the immediately preceding grant.

NIH guidelines make an additional distinction which NSF's do not. For renewal grant proposals, NIH peer reviewers are specifically asked to comment on the progress of the immediately preceding grant. Our analysis of NIH peer review comments indicates that peer reviewers are evaluating all of the elements of the proposal they are requested to.

Evaluating scientific merit

Scientific merit is one element that NSF and NIH peer reviewers are requested to evaluate in proposals. They do this by examining the researcher's goals and the research work plan outlined in the research proposal. Research goals, known as objectives or specific aims, are described in the proposal in terms of their significance and relationship to current knowledge. Work plans include experiments, methods, and procedures intended to accomplish these goals. Peer reviewers evaluate the scientific merit of goals and work plans by considering their strengths, weaknesses, originality, creativity, adequacy of experimental design, etc. Our review shows that peer reviewers evaluated the scientific merit of all the proposals included in our sample.

Evaluating the researcher's productivity

Each researcher's productivity or track record is another element which NSF and NIH peer reviewers are requested to evaluate. Research proposals include biographical sketches of researchers, information on their qualifications to perform the proposed research and lists of their scientific publications. NSF requires a list of the researcher's publications for the preceding 5 years. NIH requires a list of all publications, or if this is not possible, a list of their most representative publications. Peer reviewers evaluate this information in terms of the competence of the researcher to complete the proposed research and the likelihood of their accomplishing the proposed research. Our review shows that with two exceptions peer reviewers evaluated the track record of all the researchers included in our sample.

Peer review of researchers' track records involves retrospective analysis of the productivity of their research. Peer reviewers do not review researchers' productivity in terms of their ability to obtain prior grants, but rather in terms of publications. As an NSF official testified during congressional hearings, "...in basic research one of the strongest tools for

evaluation is publication in the open literature and critical review by other scientists." Publication, however, is not the only factor determining a researcher's track record. Other factors include dissemination of research results through such means as theses, dissertations, speeches, and informal communications within the research community.

Given the importance of track record, experienced researchers would appear to have an advantage in obtaining grants. NSF and NIH have studied this problem. A 1977 study, funded by NSF, was made to determine the impact of various factors such as professional age on NSF's grant process. The study showed that professional age has almost no effect on peer review ratings or funding decisions, and that no systematic discrimination occurs at NSF against noneminent scientists. NSF award statistics for fiscal year 1977 support these conclusions. Of the 11,158 researchers funded, 3,557 (32 percent) were funded for the first time.

A 1978 study of the NIH peer review system was made using data gathered through public hearings, letters soliciting comments, and a survey of all 1975-76 NIH grant review groups. This study generally concluded that the NIH peer review system does not discriminate against inexperienced researchers.

These conclusions were echoed by 25 NSF program officers interviewed in 1978 by congressional staff members. 1/ Two-thirds felt that both peer reviewers and program officers attempt to give young investigators a "break." Specifically, they suggested that if an inexperienced researcher's proposal is of borderline quality, it will be funded at a modest level.

Of the 75 grants we reviewed in our sample (25 NIH and 50 NSF), 10 were first time awards to beginning researchers; 3 (12 percent) were awarded by NIH and 7 (14 percent) were awarded by NSF.

Evaluating scientific merit vs. track record

No clear pattern of emphasis regarding scientific merit versus track record emerged from our review. NSF and NIH peer review instructions make no distinctions on the relative importance of either factor. NSF funding guidelines, however, state that all funding considerations are "predicated upon the assumption that... competent performance will be the minimum expectation." Since track record indicates performance potential, this guideline

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1/Interview of National Science Foundation Program Officers-Final Report-prepared by the Subcommittee on Science, Research and Technology of the Committee on Science and Technology, U.S. House of Representatives, Ninety-sixth Congress, first session, July 1979.

suggests that track record may be viewed as more important than scientific merit.

Researchers and agency officials expressed differing views on the question of whether scientific merit or track record was emphasized more in proposal evaluations. When asked which they weighed more when peer reviewing other scientists' proposals, the majority of the 75 researchers involved in our sample grants who responded, as table 3 indicates, placed more emphasis on the scientific merit of the proposal.

Table 3

Factors Weighed in Peer Reviewing Other Scientists' Proposals

Factor	NIH	NSF-Panel	NSF-Ad Hoc	Overall
	(Percentages)			
The researcher's reputation (track record)	12	9	24	16
The proposed research (scientific merit)	34.5	32	55	42
Both are considered equal	19	41	7	21
No peer review performed for NSF and NIH	34.5	18	14	21
	100.0	100	100	100

However, most agency officials said that they had no set weights for track record versus scientific merit and that the emphasis changes for each individual case. These responses indicate that researchers and agency officials use their individual judgment in weighing scientific merit against track record when evaluating proposals.

Funding received despite inadequate proposals

Peer reviewers for the grants we reviewed also placed varying amounts of emphasis on scientific merit and track records. Scientific merit was stressed on first-time awards and track record was emphasized for some experienced researchers. For example, although one proposal (NSF ad hoc) submitted by an experienced researcher contained no work plan--an NSF requirement--peer reviewers did not comment on the omission and recommended that the proposal be funded. The program official responsible for this grant stated that on the basis of his past experience, he was certain the researcher would produce something worthwhile even without a work plan.

Another proposal (NSF panel) was criticized by peer reviewers for its vagueness and its lack of a work plan. One peer reviewer summarized his evaluation of the proposed work as "ill-considered; this halfhearted approach to such a range of difficult

and challenging problems cannot be taken seriously." However, another peer reviewer's comments suggest the eminence of the researcher compensated for his weak proposal. As this peer put it,

> "In conclusion it appears that little effort was made in writing this proposal to even hint at the possible approaches he intends to take on these very important questions. This is not to say that the work would not be worth supporting on the basis of past experience with the investigator."

When queried about the lack of a work plan, the researcher explained it was implicit in the proposed research which involved equation solving and theorizing. The program official responsible for this grant agreed. He added that he and the peer reviewers knew the kind of research performed by this researcher, and that he would produce publications.

In a third instance, a peer reviewer characterized the proposal (NSF panel) as vague on both its future objectives and past accomplishments. However, he concluded that since he was not sure what the researcher proposed to do, all he could do was look at the researcher's name and publication record and recommend that the proposal be funded.

The importance of a researcher's track record was very apparent in another instance (NSF panel). In this instance, the name of an eminent scientist may have been used to generate funding for a weak proposal. One peer reviewer mentioned his surprise that the experienced scientist's name was associated with such a weak proposal. The experienced scientist told us that he was unaware that he was listed as a co-researcher. The researcher explained that the experienced scientist only helped prepare the proposal and had not worked on the research. The program officer responsible for this grant stated he was unaware of the experienced scientist being a co-researcher in name only. The above examples show that some researchers because of their perceived scientific eminence can get NSF funds with weak or vague proposals, or without complying with the proposal requirements.

At NIH, we found no examples of proposals in our sample getting funded which did not comply with the proposal requirements or which were weak or vague.

Evaluating preceding grant performance

Progress on a researcher's immediately preceding grant is a critical factor in awarding grants to continue long-term research projects. Its importance was summarized in March 1978 congressional testimony by a top NSF official as follows:

"In the basic research areas, most investigators submit renewal proposals which are required to contain a summary of progress under the preceding award; this is evaluated by peer reviewers and program staff as a crucial part of the review process.

Our peer review system relies heavily on evidence in the immediate past of research productivity of significance. This does represent an ongoing monitoring of whether the recently granted Federal funds were well used and that is a heavy constituent in deciding whether additional funds should be directed that way.

We were contending that the peer process includes an implicit retroactive analysis of productivity on earlier grants and that we consider the analysis to be an important criterion of whether money is being well used."

NSF

While the above quotation indicates the importance of critiquing the researcher's performance on the immediately preceding grant, NSF still does not specifically request peer reviewers to do so, although the scientific merit of the proposal and the researcher's general track record are evaluated. More specific guidance to peer reviewers leading to more specific peer review comments is, in our opinion, extremely important because (1) program officers may not have the expertise to make such evaluations and (2) in many instances, different program officers and peer reviewers are evaluating the renewal proposal than evaluated the preceding proposal.

Our analysis of the peer review comments for the 27 NSF grants which were renewed (of the 50 reviewed) showed that evaluative comments concerning the grant preceding the renewal were made in only 22 percent of the cases. In only 6 of the 27 cases was performance on the immediately preceding grant evaluated as a factor in awarding the renewal.

A renewal proposal usually contains a summary of progress made under the preceding grant which is presumably read by the peer reviewers as part of proposal review. However, if the peer review comments furnished to the NSF program officers, who make the award decision, are silent regarding the progress of the immediately preceding grant, these officers either have to guess at what the peer reviewers thought about the preceding grant or make their judgment as to the progress. Both options involve risk. Also, in 5 of the 21 cases where evaluation of performance on the immediately preceding grant by the peer reviewers was not evident, the cognizant NSF program officers stated that they would not have had the expertise necessary to serve as a peer

reviewer for the renewal proposal in question. As a result, there is no evidence that evaluation of the researcher's performance under the immediately preceding grant occurred in these five cases.

NIH

At NIH, in addition to scientific merit and general track record, peer reviewers also evaluate a reseacher's performance on the immediately preceding grant when a research project is funded by a series of grants. Of the 25 NIH grants reviewed, 19 were renewed to continue the same line of research. In 18 of these 19 renewals, analysis of the peer review comments indicated that the researcher's performance on the immediately preceding grant was evaluated in critiquing the renewal proposal. Hence, the peer review process has a cyclical nature for long-term research projects in that research goals and preceding grant performance are periodically evaluated through renewal proposals as a basis for continued support.

NSF proposal requirements do not assure adequate information for easy evaluation of preceding grant performance

NSF proposal requirements do not reflect the importance of evaluating the performance of the immediately preceding grant. NSF instructions to researchers leave much to the researcher's judgment as to progress report content and researchers are not required to identify any publications which resulted from the immediately preceding grant. Proposals which easily identify preceding grant results (see definition on p. 8) are particularly important because (1) they often are the only source of these results at the time of renewal and (2) different peer reviewers usually review successive grants.

NSF only requires renewal proposals to include a "summary of progress to date (on the preceding grant) and its relation to the proposed work." Researchers, when preparing renewal proposals, are further instructed to assume peer reviewers will not have access to previous proposals.

In contrast, NIH currently requires specific information on the preceding grant to include the time covered since the last peer review; the preceding grant's specific aims (research objectives); a "succinct account of published and unpublished results indicating progress toward their (research objectives) achievement"; a discussion of the importance of results; a discussion of any changes in research objectives since the last peer review; and a list of titles plus complete references to all publications, completed manuscripts, patents, invention reports, and other printed materials that resulted since the last peer review. Additionally, copies of publications and completed manuscripts are to be appended to the renewal proposal.

Our analysis of 50 NIH and NSF renewal proposals showed that results of the preceding grant were not included in 1 of the 23 submitted to NIH and in 3 of the 27 to NSF. Furthermore, of the remaining proposals, all of NIH's contained a progress report section that was clearly labeled and identifiable. However, in at least seven of the NSF proposals, researchers interspersed results from their preceding grants throughout the general introductory and other material in the proposals instead of presenting the results separately.

According to several program officials and a peer reviewer, the lack of specific NSF reporting requirements for results on the immediately preceding grant makes performance evaluation difficult. NSF's failure to require reporting of research objectives for the preceding grant, for example, can make difficult determining how the proposed work relates to work under the previous grant. This problem was succinctly summarized by one peer reviewer of an NSF renewal proposal who wrote:

> "Furthermore, the other proposal (sample grant) also dealt with pipeline processing. I have no way of comparing the current proposal (renewal) with the other one and find out what is new."

Another peer reviewer for a different NSF proposal had problems with this format and made the following critical comments about the renewal proposal:

> "Specific objectives...are not described in as great detail by the proposer as this reviewer would wish." [As this is a renewal request, some of the reviewer's questions may have been addressed in an earlier proposal or progress report.]
>
> Yet there is no clear statement of accomplishments during the prior grant on which to base a judgment on how much of what is talked about here is likely to be finished during the renewal period."

To determine if research objectives were the same for successive grants, we compared sample grant objectives (specific aims for NIH) with renewal grant objectives. In only 2 of the 23 renewal proposals submitted to NIH did the research objectives appear to be the same. This sameness occurred in 7 of the 27 renewal proposals submitted to NSF. The work plans for these grants did change. (See chapter 3 for a discussion of research objectives.) However, if peer reviewers do not have information to compare research objectives under successive grants, determining how proposed work differs from the work under the preceding grant is difficult. Current NIH proposal review procedures provide information on research objectives for successive grants. In contrast, NSF procedures do not insure peer reviewers will have information on research objectives for successive grants.

NSF's not requiring researchers to identify the publications resulting from their preceding grants also creates performance evaluation problems. NSF currently only requires researchers to list all their publications for the preceding 5 years. While this does indicate general productivity, relating publications to a specific grant from a general listing is difficult. This difficulty is increased if a researcher has several concurrent grants. Fifty-two of the 75 researchers included in our review had other grants concurrent with their sample grant. Eighteen of these 52 had concurrent NIH and NSF grants.

Our analysis of renewal proposals showed that many did not identify publications resulting from the preceding grant. This was particularly true with NSF proposals, as our analysis shows:

Table 4

Publications Resulting from the Preceding Grant

	NIH	NSF	Total
Identified	19	10	29
Not identified	4	15	19
No renewal sought	2	23	25
Renewal proposal not analyzed	0	2	2
Total	25	50	75

One grant (NSF ad hoc) exemplifies the problem caused by not identifying the preceding grant's publications. In this example, the immediately preceding grant did not produce any publications. However, the renewal proposal contained a listing of publications from the researcher's concurrent grants, but the proposal did not identify the grants from which the publications resulted. Officials did not recognize that the grant the researcher wanted to renew did not produce any of the publications identified in the renewal proposal, and awarded the researcher another grant to continue the research project. The cognizant program officer said that this would not have occurred if he knew there were no publications. A peer reviewer echoed this observation by stating that unless a researcher voluntarily identifies publications resulting from the preceding grant, reviewers have no means to assess performance.

In total, 55 percent (32 of 58) of the peer reviewers we contacted stated that having the results of the immediately preceding grant as related to the grant's objectives would be useful information.

Publications are not always available when researchers submit their renewal proposals. Renewal proposals must be submitted 6 to 9 months prior to the expiration of the preceding grant. The progress report in a renewal proposal clearly showing the results

of the preceding grant often provides the best source of preceding grant results at the time of renewal.

We compared the dates that renewal proposals were submitted to NIH and NSF with the dates of the publications from the previous grant to determine if the publications were available to the peer reviewers evaluating the renewal proposal. At NIH, in 13 of the 19 cases (68 percent) where the renewal was awarded, publications from the previous grant were available when the peer reviewers evaluated the renewal proposal. At NSF, in only 10 of the 27 cases (37 percent) where the renewal was awarded were publications available. Officials at both agencies stated this timing problem is ameliorated by listing pending publications or appending manuscripts, preprints or reprints of articles from the preceding grant to renewal proposals. We found that such information was included in 5 of the 6 NIH cases where publications were not available, but was included in only 9 of the 17 NSF cases where publications were not available. Thus, the peer reviewers did not have printed results to review from the preceeding grant for one NIH renewal proposal and for eight, or 30 percent, of the NSF renewal proposals of grants in our sample.

Additionally, as discussed below, since different peer reviewers typically evaluate successive NSF grants awarded to pursue a long-term line of research, a clear, easily identified presentation of preceding grant results would improve proposal evaluation.

Effect of NSF program officer and peer reviewer turnover

The NSF program officers and peer reviewers who evaluate a researcher's renewal proposal frequently are different from those who evaluated the proposal from the immediately preceding grant. This lack of continuity in evaluative personnel can affect the renewal proposal evaluation.

Many of NSF's program officers are "rotators" who serve in this capacity for a period of 1 to 2 years. As a result, the program officer responsible for awarding a renewal grant may not have been responsible for awarding and monitoring the preceding grant and might not be cognizant of the researcher's performance on the preceding grant. This lack of continuity in program officers can be illustrated by two NSF ad hoc grant examples. In one case, five different program officers were involved over a 5-year span covering three NSF ad hoc grant awards (the last two being renewals of the preceding grant) totaling about $80,000. 1/ These three grants all had identical objectives and as of the end of the second grant (our sample grant) no peer reviewed

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1/A fourth proposal--the third renewal--had been submitted but not awarded at the time of our review.

publications had been produced. The researcher had, however, published non-peer reviewed technical papers. These papers were not included with the renewal proposal and were not furnished to the peer reviewers by the program officer. One of the peer reviewers for the third grant (the second renewal) did request these papers from the program officer before making his evaluation. The program officer turnover in this case was compounded with peer reviewer turnover. Of the 20 peer reviewers used to evaluate these three grants, none reviewed all three.

In the second case, five different program officers were involved over a 5-1/2 year span covering two NSF ad hoc grant awards totaling $525,000. Also, as in the first example, peer reviewer continuity was totally lacking between the two grants. None of the 11 different peer reviewers evaluated both grants.

In total for the 50 NSF grants we reviewed, we were only able to talk to the cognizant program officer 1/ in 28 instances (56 percent). In 21 of the 22 other instances, the program officer had left NSF; in one instance he was on sabbatical. At NIH, we were able to talk to the cognizant program officer for 20 of the 25 grants renewed (80 percent).

Lack of continuity is also a concern in NSF's selection of peer reviewers. For the 27 grants renewed, we examined the names of the peer reviewers for the grant included in our review and its renewal. In one case, three of the same peer reviewers were used, in two cases two of the same reviewers were used, in 14 cases (52 percent) only one of the reviewers was the same and in 10 cases (37 percent) totally different reviewers were used.

At NIH, peer reviewer continuity is less of a problem because of the tenure and continuity of membership of the peer review group. There will generally be individuals in the peer review group to review the renewal who also reviewed the preceding grant. Also, when a renewal proposal is submitted to NIH, the primary and secondary reviewers in the peer review group are provided copies of the preceding grant's proposal and peer review group comments. This information puts them in a better position to evaluate the progress on the preceding grant. NSF does not provide such information to its peer reviewers.

At NSF, the turnover in cognizant personnel who evaluate successive grant proposals coupled with renewal proposals not having the objectives and progress of the preceding grant specifically identified, as indicated previously, shows that the scientific performance accountability process can be strengthened. A clear, easily identified presentation of the preceding grant progress would improve proposal evaluation and the accountability process.

1/The individual responsible for making the sample grant award.

Evaluating requests for new project support

Researchers who submit proposals for research projects which are unrelated to their preceding grants are not required to (1) include in the proposal a progress report containing the results of the preceding grant or (2) specifically identify the publications from the preceding grant. Also, neither NSF or NIH requests peer reviewers to specifically evaluate the preceding grant performance. Instead, NSF and NIH expect that peer reviewers will evaluate preceding grant performance as a part of the researcher's general track record. Fifteen of 75 researchers in our review submitted subsequent proposals to NSF or NIH for research projects unrelated to their preceding grants.

Agency officials contend that if a series of unrelated grants had produced no published results, it would negatively affect the evaluation of the researcher's proposals. Both NSF and NIH procedures require that all proposals list the researcher's recent publications as a general indication of performance. Relating publications to a specific grant from this general listing is difficult, especially for researchers with more than one grant--about two-thirds of those in our review. This problem is further compounded by the fact that many publications do not credit the grant from which they came. These procedures do not preclude researchers from avoiding accountability on unproductive grants by seeking grants for new projects.

Our review provided examples of how specific grant performance can be clouded when researchers submit proposals for projects unrelated to the preceding grants. In one example, an NSF ad hoc approved grant for $65,000 expired in December 1977, but as of June 1979 results had yet to be published in any scientific journals. Despite this lack of publications, the researcher received a subsequent grant in March 1978 for research unrelated to that of the previous grant. Since the researcher was not required to discuss the previous grant's results in the subsequent proposal, this lack of publications was not apparent. The peer reviewers for the subsequent proposal all discounted this lack of publications. One peer reviewer was aware of the researcher's general track record and felt his past publications had been significant. The remaining peer reviewers said that knowing of this lack of publications would have had little or no impact since they personally place evaluation emphasis on scientific merit rather than track record.

Another NSF ad hoc approved grant for $17,000 expired in December 1977 with the only publication from the grant published in 1979. There is also a question regarding the researcher's performance under the preceding grant. His proposal objectives included an analysis of a broad spectrum or group of soil samples. The researcher even requested and received a no-cost extension through December 1977 because he needed more time to analyze more soils. Still, the grant's final technical report discussed analysis of only two soils as opposed to the broad spectrum or

group originally proposed. A subsequent grant unrelated to the preceding grant, was awarded by the program officer to this researcher effective April 1, 1978--despite no publications from the preceding grant at the time of the renewal and questionable performance under the preceding grant. Our discussions with three of the peer reviewers for the subsequent grant showed that two of them were not aware of the researcher's performance on the preceding grant while the third could not recall. All three stated that having results of the preceding grant would have been useful to them in evaluating the subsequent grant proposal.

These examples demonstrate that a researcher can receive funding for a project unrelated to the immediately preceding grant without consideration being given to the preceding grant's publications and/or the extent to which originally proposed objectives were attempted or accomplished. This problem is further compounded when a researcher has multiple grants. Since publications are not related to specific grants, a grant which resulted in no publications may not come to light and be considered in deciding to fund the researcher again. To provide better scientific performance accountability, this information should be included in new project proposals for consideration by the peer reviewers as part of the evaluation of the new project proposal.

Effect of peer reviewers on grant award decisions

Peer reviewer evaluations have a substantial effect on grant awards at NSF and NIH. Specifically, at NIH we found that peer reviewer critiques caused on renewal proposal to be declined and three others to be approved but not funded. Additionally, we found 19 instances (7 at NIH, 9 NSF panel, and 3 NSF ad hoc) where peer reviewer comments affected grant awards in terms of either proposed research objectives being eliminated, or budget and time reductions.

Of the 50 sample researchers seeking renewal grants to continue their research projects, 1 at NIH was declined. Peer reviewer comments cited lack of progress on objectives, deficiencies in technical management, and failure to make research results available to the scientific community as the reasons for the declination.

In the three cases, which were approved but not funded, the peer reviewers approved the proposals but with low priority which thereby greatly reduced the researchers' chances of funding. The problems in these cases were (1) researcher needed to better focus on his work, (2) research was having little impact on the rest of the scientific community, and (3) research had come to a natural end--objectives remain the same as 7 years ago.

Peer reviewers also affected our sample grants by eliminating proposed research objectives that lacked scientific merit and by cutting back on budget and/or time requests. In six instances (three at NIH, one NSF panel and two NSF ad hoc), peer reviewers felt that some of the research initially proposed was questionable. Subsequently, NSF and NIH did not fund the portions of the proposals that the peer reviewers felt were questionable and reduced the proposed budget to reflect the eliminated research. In 13 other instances, the budget and/or time requested in the proposal was reduced based on the comments of the peer reviewers. Four of these were at NIH and the other nine were at NSF (eight panel and one ad hoc). One other grant at NIH and two at NSF (one panel and one ad hoc) had the time requested increased because peer reviewers believed the research worthwhile but that the researcher needed more time to accomplish it.

Our contacts with peer reviewers suggest that their knowledge of sample researchers' accomplishments contributed to their reviews. Fifty-four of 58 (93 percent) peer reviewers contacted were aware of the researcher's track record, and had previously read the researcher's publications. Additionally, about three-fourths of the peer reviewers knew the researchers personally at the time they critiqued the proposals.

THE AWARD DECISION

The second major part of the accountability process for basic research grants at NSF and NIH is making the award decision. The basic decision regarding which proposals will be funded as grants at NSF is made by the program officers. At NIH, this decision is made by NIH program officials after the proposals have been approved by the peer review group and National Advisory Council. NIH peer reviewers are responsible for determining the scientific merit of proposals but not funding decisions.

Relying on peer reviewers varies

Both NIH, and NSF to a lesser extent, rely on peer reviewer advice in awarding research grants. NSF program officers play a much larger part in the award decision than their counterparts at NIH. Also, NIH does not focus the award process on one person.

At NIH, deciding whether a proposal has scientific merit, and determining the amount and duration of the award, if made, initially rests with the peer review groups. These decisions are reviewed by the National Advisory Council of each Institute. 1/ The NIH program officers then select approved proposals from the Council-approved list for funding.

1/The peer review group makes a recommendation to the National Advisory Council. The Council concurs with these recommendations in the vast majority of cases.

The peer review process culminates in priority scores that are the basis for funding each approved proposal. Since peer reviewers make these determinations, NIH funding procedures rely heavily on peer evaluations.

NIH health science administrators (program officers), however, may identify proposals, which were approved by the peer review group, having special program relevance that warrant funding without regard to priority. Some of these proposals would not be funded on the basis of the priority scores alone. Health science administrators indicated that proposals are only infrequently funded without regard to priority. Estimates ranged from less than 1 percent to 3 percent of all proposals funded.

The award of two grants demonstrates how this procedure works. The Institute funding the grants awarded 117 grants during fiscal year 1978 to proposals that had priority scores ranging from 103 (the best) to 361 (the worst). Two proposals having program relevance, however, were also funded without reference to their scores of 268 and 361. These scores were below the 254 priority score of the last proposal funded on the basis of priority scores alone. These 2 proposals of 117 proposals funded constituted 1.7 percent.

The NSF program officer makes the decision, with the advice of the peer reviewers, as to whether the proposal has scientific merit, whether or not it should be funded, the amount and duration of the award. Prior to making the scientific merit and funding decisions, the NSF program officer also (1) performs the initial proposal review for relevance, general merit and funds availability, (2) selects the ad hoc peer reviewers to evaluate the proposal, (3) selects the panel peer reviewers, if a panel is used, (4) evaluates the peer review comments, and (5) makes a site visit, if necessary.

At NSF, peer reviewers' comments are strictly advisory to the program officer and the degree to which the officers rely on peer reviewer comments is less clear. Twenty-five NSF program officers, interviewed in 1978 by congressional staff members, said that their approach to weighing a given peer reviewer's comments against their own opinion depends on their knowledge in the field of the proposal and on how strongly they hold their opinions. Several added that negative peer comments almost always result in declinations regardless of the program officer's opinion.

One example, however, demonstrates the flexibility that an NSF program officer has in dealing with peer reviewer comments. Ten ad hoc peer reviewers were solicited to evaluate the proposal. Their ratings were: one excellent, four very good, one good, two fair, one only provided comments with no rating and one disqualified himself because he felt he could not be an impartial reviewer. The overall rating was between good and very good. The main problem of the three reviewers who rated the proposal as good and fair was that they did not believe the research had potential

for significant scientific advancement. The program officer, however, believed the research had a potential payoff. He, therefore, omitted the two fair ratings in arriving at the final rating of very good--he did not omit the good rating. He also did not omit two of the very good ratings with accompanying comments termed by the program officer as "brief, friendly and fairly empty." The grant was awarded. The program officer who made the award was no longer at NSF at the time of our review.

When NSF program officers disagree with peer reviewers on significant points, they should justify and document their disagreements. Reasons for disagreement cited by program officers included such reasons as knowledge of prior grants, perspective gained through seeing a wide range of proposals, and knowledge of the rating styles (hard vs. easy) of individual reviewers. In one sample grant, a program officer disagreed with the peer reviewer's assertion that the grant's proposal was too ambitious or grandiose. Since the program officer did not act on this criticism, the grant was awarded as requested. But in this case the researcher later requested a grant extension because progress was not on schedule.

We asked all program officials we interviewed at NSF and NIH if, prior to making their decisions on all proposals, they routinely contact researchers regarding negative peer reviewer comments (see table 5).

Table 5

Do Program Officials Routinely Contact Researchers Regarding Negative Peer Review Comments on All Proposals They Review?

	NIH executive secretary	NIH health science administrator	NSF	Total
Yes	3	1	6	10
No	7	14	18	39
No response	3	7	11	21
Total	13	22	35	70

These responses indicate that program officials usually do not contact researchers regarding negative peer comments, but exercise their own judgment in assessing the comments.

Because of the flexibility, judgment, and decisionmaking authority exercised by NSF program officers, we asked the

cognizant program officers 1/ if they could have been peer reviewers, i.e., were sufficiently knowledgeable, for the grants we reviewed. Table 6 gives the results.

Table 6

Cognizant Program Officers with Enough Knowledge to Have Been a Peer Reviewer on the Sample Grant Proposal

	NIH	NSF	Total
Yes	10	17	27
No	9	10	19
No response	1	1	2
	20	28	48

The NSF responses indicate that a majority of the program officers felt that they had enough knowledge to have been peer reviewers on the sample grants. The 1977 NSF study discussed earlier (on p. 18) concluded, however, that peer review ratings are the most important determinant of the program officer's decision. This study compared peer ratings to awards made and showed 92 percent of the proposals receiving a comparatively high rating were funded. Conversely, only 10 percent of those receiving a low rating were funded. About half of those with middle range ratings were funded. The study concluded that NSF program officers rely "heavily" on peer rating.

While NSF program officers rely on peer reviewer advice, it should be noted that in most instances peer reviewers do not prioritize the proposals reviewed and do not recommend specific dollar amounts for the award. NSF program officers make these determinations.

As indicated earlier, no single evaluation process exists at NSF. As such, the role of the peer reviewers also varies. Some NSF panel peer reviewers do prioritize the proposals reviewed, some do not, and none of the proposals that are solely ad hoc reviewed are prioritized.

Regarding the amount of the grant, NSF peer reviewers are requested to comment on the proposed budget. Their comments, however, are usually general in nature, i.e., budgets appear reasonable or excessive. Only rarely, will an NSF peer reviewer specifically comment on how much should be deleted or added to a proposed budget--usually leaving this determination to the program officer. Most of the 25 program officers interviewed in 1978 by

1/The individual responsible for making the sample grant award.

congressional staff members said that they learned about budget evaluation on the job. About half had prior research experience useful for budget evaluations. (Evaluations generally entail seeing if the amount of money requested is what is needed to do the research. In most programs, the research is similar enough that comparisons can be made among proposals and funded grants.) The program officers also reported that experience has taught them what certain items cost, and five added that they eliminate desirable but non-essential items in order to fund as many scientists as possible. Program officers we interviewed made similar comments.

Documenting results of peer review panel deliberations

The NSF peer review panels function similarly to that of the NIH peer review groups, i.e., a number of peer reviewers meet to decide from a group of proposals those most deserving of support. The results of the NIH peer review group deliberations are clearly and uniformly documented. The results of the NSF panel deliberations, however, are not.

Twenty-one NSF panel grants were included in our review. Our analysis of the peer review comments for these grants disclosed that for nine of these grants (about 43 percent) there was no summary of the panel meeting. Fourteen of these 21 grants were renewed. In 5 of these 14 instances (about 36 percent) there was also no summary of the panel meeting. In many cases where there was evidence of the panel meeting, it was one paragraph or simply handwritten notes. In all cases there was a panel rating.

At NIH, at the conclusion of the peer review group meeting, the executive secretary prepares a summary statement which summarizes the peer reviewers' critiques and recommendations. This statement represents the group's decision and does not divulge the views of individual peer reviewers. The summary statement is based on the written evaluation prepared, in an almost identical format to the summary statement, by the reviewers prior to the meeting and the deliberations at the meeting. In addition to a recommendation and priority score, the summary statement includes a resume of the reasons for the recommendation, a description of the research, a critique of the research, a comment on the researcher's qualifications and competence, a comment on the resources and environment available to the researcher, and a budget evaluation. There was a summary statement for all NIH grants we reviewed.

Releasing peer review comments to researchers

NSF and NIH policies differ on releasing peer review comments to researchers. NIH automatically releases the comments, while NSF only releases them upon a researcher's request. These comments can be useful to researchers in conducting research or improving declined proposals for resubmission and re-evaluation.

For example, peer comments address strengths and weaknesses in approach, feasibility, and appropriateness of procedures, facilities, equipment, etc.

NIH automatically sends summary statements with priority scores to researchers after a Council's review. Researchers may also request a summary statement copy without its priority score prior to the Council's review. One NSF directorate is automatically providing researchers with peer comments on an experimental basis. NSF plans to evaluate the experiment to determine the benefits of automatically providing researchers with peer comments. The process has been well-received by researchers, according to NSF officials. We believe NSF should establish a policy of automatically providing researchers with peer review comments.

About two-thirds of the researchers included in our review did not receive the peer review comments for their grants. Of those receiving the comments, more than half felt they were useful for such reasons as changing the planned research, improving proposal preparation techniques, and obtaining alternate funding. We analyzed the peer review comments for those researchers who did not receive them. In about one-third of these cases, we believe these comments would have been helpful to the researcher because they offered suggestions and/or alternative approaches.

Failure to forward peer comments to researchers can adversely affect research. One researcher, for example, was unaware of why a requested piece of equipment was deleted from his proposed budget. NIH peer reviewers erroneously thought he would have access to this equipment at his university. He was unable to obtain access and thus did not complete a portion of his research. If he had been aware of the peers' rationale for deleting this equipment, he could have requested supplemental funding for the necessary equipment. NIH has changed its policy since this example occurred so that peer reviewer comments are now automatically provided to researchers.

In a second instance (NSF panel), a peer reviewer commented that he thought some experiments might be in jeopardy because of certain factors which he stated. The researcher did subsequently have some problems with these experiments for precisely the reasons stated by the peer reviewer. He never saw the peer review comments. The program officer acknowledged that in this instance the comments should have been sent to the researcher.

In another NSF panel grant, a peer reviewer suggested that the researcher should widen his area of research. The researcher, who did not receive his peer review comments, told us that this peer reviewer's suggestion and comment were quite accurate and that it would have been helpful to him to have seen this comment earlier.

In addition to contributing to the conduct of funded research, peer comments are useful to researchers whose proposals

have been declined [illegible]ing. Several program officials said that declined proposals can be revised to correct shortcomings identified by peer reviewers and resubmitted for reevaluation. This simple procedure assists researchers in obtaining grants and also alleviates the need for formal rebuttal procedures to resolve any disagreements between researchers, peer reviewers, or agency officials. We found one proposal that was awarded after the researcher had revised an earlier disapproved proposal to correct problems identified in peer comments. Peer reviewers noted that the "revised proposal and the information provided at the site visit addressed the previous criticisms, and progress has been made on strengthening a number of aspects of the project which were quite deficient."

In commenting on a draft of this report, NSF stated that it will now make universal the routine forwarding of peer review comments to researchers.

MONITORING THE RESEARCH

Monitoring is a process whereby the management and performance of a research grant are continuously reviewed through the collection and assessment of information gathered from various reports, site visits, and other sources. Agency program officers are responsible for monitoring federally funded grants to assure that the terms of the grant are carried out. Agencies' grant monitoring guidance varies and, consequently, the types and degree of research grant monitoring varies between NSF and NIH, and within the two. Also, both agencies' instructions require that the universities receiving the grants take an active role in grant monitoring.

Progress reports

NSF and NIH program officials are responsible for monitoring scientific progress. NSF program officers are supposed to review progress and final technical reports and may make site visits. NIH program officials similarly are responsible for reviewing annual and final progress reports and may make site visits.

Our review showed that NSF and NIH program officials primarily rely on progress reports to monitor scientific progress. NSF requires annual progress reports on all grants lasting 2 or more years. NSF currently requires that its progress reports contain: (1) a summary of overall progress to date and its relationship to proposed objectives, (2) an indication of any problems and favorable or unusual developments, (3) a summary of work to be performed during the succeeding budget period, and (4) other pertinent information to the type of project or information specified in the grant's terms and conditions.

NIH also requires progress reports annually in conjunction with requests for continued support. NIH currently requires that its progress reports cover (1) research objectives (overall and

current year), (2) results, to include their significance, relationships to objectives, changes in direction, negative results, and technical problems, (3) a description of the study's significance to health problems, and (4) objectives for the coming year.

Both NSF and NIH funded researchers appear to have complied with progress report requirements. NSF funded researchers, included in our review, that had grants with a duration exceeding 2 years submitted progress reports as required. For the progress reports we analyzed, all NIH funded researchers also submitted progress reports as required with relatively few omissions in required content.

Both NSF and NIH require program officials to review progress reports. Neither, however, specifies how these reviews will be conducted. Program officials varied in conducting these reviews. They said that they receive and read progress reports. However, only 5 of the 35 NSF program officers interviewed said that they compare progress reports to originally proposed research objectives to evaluate specific progress toward their accomplishment, while about half (10 of 22) of the NIH program officials interviewed made such a comparison. Additionally, for 7 of the 25 NIH grants reviewed, the NIH program officials prepared a progress report review check sheet. This check sheet requires the program official to state if (1) there were publications, (2) the report provides the required information, (3) the project has changed direction, and (4) further administrative action is required. The check sheet also requires the program officer to explain the highlights of the progress to date. Notwithstanding these check sheets, we did not find that any grant was changed as a result of a program officer's review of progress reports.

Most program officials said that progress reports are generally useful in keeping them informed of a researcher's progress, in monitoring progress, or in making a decision to renew funding of a research project. Typical program official comments on progress reports are as follows:

--Researchers are not pressed for progress reports because he does not feel a great deal of progress can be made in one year. He prefers that researchers delay reporting until significant results are achieved rather than submitting reports because of agency requirements.

--Progress reports are not compared to originally proposed research objectives. He evaluates productivity through publications and the detailing of events in progress reports rather than the degree to which original research objectives are completed.

--Progress reports are compared to original objectives. Consequently, progress reports are useful in evaluating progress toward original objective accomplishment.

--Progress reports are important because they discuss progress or lack thereof. He added that if progress has not been made, it is important that researchers discuss how problems will be overcome in the coming period.

In addition to progress reports, program officials also obtain information on grant progress through informal means such as site visits, telephone conversations, and contacts at professional meetings. Such contact occurred on about three-fourths of the grants we reviewed.

Site visits

Both NSF and NIH program officials may make site visits. Neither, however, specifies when such visits should occur. As with progress reports, program officials' approaches to making site visits vary. Fifteen site visits were made to the researchers in our review. Two were by NIH officials and 13 by NSF officials. Of these 15 visits, 4 were made as part of the award decision process as opposed to during the grant period.

Reasons for making site visits also varied. The largest number were not made to specifically review grant progress but were made in conjunction with other purposes, such as attending professional meetings in the same geographical area. NSF pointed out that contacts with researchers during professional meetings is a cost-effective way of accomplishing the objectives of a site visit in that both staff time and travel funds are conserved. Other reasons included the large size of the award, the need for additional information, and the nature of the research activity (theoretical versus experimental research). Typical program official comments on making site visits follows:

--He visits researchers having the most activity and strongest potential for significant results. He added these visits are not made as a result of indications of problems, but rather to check research progress, attend professional meetings in the same geographical area, and possibly visit potential grantees to make them aware of the agency's funding capabilities.

--Site visits are made to grantees having large dollar awards. He added that visits are made to grantees at laboratories having equipment and experiments that can be seen, discussed and evaluated. Site visits are not made to grantees performing essentially theoretical research.

--Site visits are made to obtain assurances that research is being conducted with a potential for significant results. Consequently, he does not use a checklist approach in relating research to originally proposed goals. His concern instead is with the significance of the research actually being conducted.

Peer reviewers' role

Progress on research grants is not uniformly monitored. The uses program officials made of progress reports varied from just reading them to comparing them with original research objectives to evaluate progress toward accomplishment. Uses of other monitoring techniques such as site visits were similarly varied. Several program officials said that scientific progress is not closely monitored during the grant period. Instead, they rely on peer reviewers to evaluate research results when a researcher seeks a subsequent grant to continue a line of research. If peer reviewers determine that a researcher has been unproductive, subsequent grants may not be awarded to continue the project. However, 19 percent of the researchers in our sample did not seek another grant from NSF or NIH.

Several program officials said that relying on peer reviews is a practical solution to their lack of time for closely monitoring grants. Similar thoughts were expressed by 25 NSF program officers interviewed in 1978 by congressional staff members. About three-quarters of these program officers said that they do less monitoring than they believe would be desirable. They attributed this to limited travel money and time.

One program official added that adequate monitoring requires the expertise of peer reviewers. He said that program officials often do not have this expertise. About 40 percent of the program officials we interviewed said they would not have had the expertise necessary to serve as peer reviewers for sample grants.

Monitoring implies termination for lack of progress. Both NSF and NIH have grant termination policies which state that a grant can be terminated if a grantee fails to comply with the terms and conditions of the grant. Both policies also state that correction of deficiencies is preferable whenever practicable. Both provide for notification of deficiencies, and time for corrective actions prior to termination.

Officials at both NSF and NIH said that grants are almost never terminated for lack of productivity. An NSF official gave several reasons for why grants are not terminated. First, NSF attempts to solve problems before taking such actions. Second, standard grants normally last for 1 or 2 years, and this is not sufficient time to enable the agency to assess lack of progress with sufficient conviction to terminate a grant. Third, researchers are only expected to put forth their "best effort" in accomplishing research goals. And lastly, the taxpayer's interests are best served by bringing a project to an orderly close rather than "chopping off" the project.

Universities do not monitor scientific progress

The NSF Grant Policy Manual requires that grantees (universities) monitor the performance of research projects to assure adherence to (1) such performance goals, time schedules, or other requirements as may be appropriate to the project and the terms of the grant; and (2) sound management practices and organizational policies. The manual also prescribes the ways in which grantees should carry out proper monitoring and approval in advance of any action that would result in either performance changes or modification of an NSF grant.

NIH requires that universities be responsible and accountable for the performance of grant-supported activity. NIH places maximum reliance on its grantees' (universities) controls and requirements. NIH expects that its grantees will exercise sound management practices in carrying out the terms and conditions of research grants.

The universities we visited do not monitor scientific progress despite NSF's and NIH's policy that they should. NSF policy requires universities to insure that researchers adhere to performance goals, schedules, project and grant requirements, and sound management and organizational policies. NIH policy states that universities assume legal and financial responsibility and accountability both for the awarded funds and for performance of the grant-supported activity. Only 1 of the 75 researchers we interviewed said that the university monitored grant progress. Several researchers said that the necessary expertise was not present at their university to monitor their research activities.

EVALUATING THE RESEARCH

Evaluating the results of basic research grants, as in evaluating the proposals which result in the grants, is carried out almost totally within the scientific community. In evaluating research results, as in proposal evaluations, both NSF and NIH rely on peer review--but of a somewhat different form than that used to evaluate research proposals. Both agencies also require researchers to submit final technical reports on completed projects.

Outside of peer review

Neither NSF nor NIH routinely evaluate the results of research grants. Outside of the peer review process very little evaluation of research results is conducted. If researchers do not seek additional support, however, their performance on the preceding grant is generally not evaluated. Fourteen of the 75 researchers included in our review (19 percent) did not seek additional support. Three (12 percent of the 25 NIH grants reviewed) of these 14 were NIH funded while 11 (22 percent of the 50 NSF grants reviewed) were funded by NSF. These NSF statistics are

somewhat different than those provided by NSF officials during FY 1980 Senate appropriations hearings. For one typical basic research program, NSF indicated that more than 90 percent of the researchers who completed their grants during FY 1978 (the same time period as our sample grants) submitted new proposals for further research.

Agency officials can evaluate research results for all grants through final reports and publications. Both NSF and NIH require final project reports which basically summarize progress toward accomplishing original research objectives, significant results actually achieved, published or planned publications resulting from the grant, and information on project personnel. NSF requires a final project report at each grant's termination. In contrast, NIH only requires a terminal report at the end of a project which may run over several successive grants. Information on grant progress and results, however, is available to NIH through annual interim progress reports and renewal proposal progress reports. NSF and NIH also require that researchers submit publication reprints and information on such items as inventions, patents, or material specifically required by the grant instrument. This information is available for evaluation by program officials and is used to inform the Congress and the general public about grant results.

With two exceptions, the researchers in our review submitted final reports as required for all of our sample grants. Program officials said that they read these reports, but only 21 percent said they actually compared these reports to the originally proposed research objectives to evaluate progress toward their accomplishment. These officials said that they used final reports for such purposes as evaluating a researcher's performance and closing out a grant. A few said that these reports are only submitted to fulfill an agency requirement and that they actually serve little purpose. Most researchers felt final reports were merely a necessary evil. However, for researchers who do not seek a renewal grant, the final report may provide the best disclosure of a researcher's performance under a specific grant.

Publications are also submitted to program officials as evidence of research performance. Eighty-three percent of the 75 researchers included in our review published some results of the grants we reviewed in peer reviewed journals--the method generally regarded as the most important measure of a researcher's performance. Although program officials said that they received the publications, only 20 percent of the NIH officials and 32 percent of the NSF officials said that they compared these publications to originally proposed research objectives to evaluate their accomplishment. A few indicated they did not even read them. One program official summarized a common view by saying that assessing results in relationship to original objectives is not appropriate since researchers are awarded grants, not contracts. The official felt that researchers thus should only be held accountable for making an honest effort to accomplish original objectives and that

actual results should be evaluated for their own significance rather than for their relationship to original objectives.

Evaluating results through final reports and publications by program officials has limited immediate value. Forty percent of the program officers (45 percent at NIH and 36 percent at NSF) we interviewed stated that they could not have been peer reviewers for the grant in question. These officials do not have the expertise to evaluate some grant results. Additionally, final reports are not required until after a grant's or project's expiration. Similarly, a grant's results frequently are not published until after it has expired. Consequently, as one program official said, evaluation of "water under the bridge" has little usefulness in monitoring or policing a grant. Typical program official comments on final reports and publications are as follows:

--Final reports are useful in providing general information about a grant. Additionally, they alert [the program official] to anything out of the ordinary from his basic understanding of the grant.

--Final reports are read and compared to research objectives. However, these reports are mostly just a record and reprints of publications are more useful.

--Publications are read and compared to research objectives because sometimes they do not resemble the grant progress as summarized in a researcher's progress reports.

--Publications are useful in evaluating productivity, but it is not reasonable to assume they should relate to all research objectives because many objectives do not work out.

--Publications are read to ascertain progress made toward research objectives. No attempt is made to specifically match publications to objectives because these objectives only provide an indication of where the researcher intends to go during a grant period. Additionally, publications are prepared around ideas and concepts that may include all or only a few of a grant's original research objectives.

When researchers do not seek additional support--almost 20 percent of those in our review--peer reviewers are not called upon to evaluate the results of the terminal grant. Additionally, agency officials, who are in the best position to evaluate terminal grants, do not always read the grants' final reports and publications and compare them to the grants' scopes and objectives. As a result, little or no evaluation occurs for a significant portion of the research grants funded by NSF and NIH.

NSF and NIH also perform general evaluations and analyses of certain aspects of their grant processes or particular research programs. For example, NSF is currently evaluating the publications from a sample of completed grants in its oceanography and

chemistry programs to determine if a useful assessment of completed research can be obtained by post-grant peer review of publications. In this project, NSF is also evaluating possible research quality indicators.

NSF compared materials research results from Materials Research Laboratories (MRLs) it supports to results of individually funded research grants at institutions without MRLs. 1/ A comparison of sample publications resulting from each was made to determine if MRLs produce better materials research than non-MRLs. The study showed there were some differences between MRL and non-MRL research publications. For example, MRL publications showed a greater emphasis on experimental engineering oriented research and a higher quality of procedures than those from non-MRLs.

NIH studied whether its large grant programs produce results consistent with their goals. The study compared NIH large grant programs to NIH research project grants to determine if they are comparable in quality, if projects are more focused than programs, if programs promote interdisciplinary research, and if programs address problems of high national priority. The study concluded that the programs do produce results consistent with their goals.

Publications

Given the apparent importance of publications in the grant process, we asked researchers and program officials if publications are an adequate measure of research success. They agreed overwhelmingly that they are a good measure of research success. Some cautioned, however, that the quality of the journal must also be considered. Specifically, refereed or peer reviewed journals were cited as being of the best quality. While counting the number of publications resulting from a grant is the simplest evaluation technique, the prestige of the journal indicates further the quality of the results.

Another indicator of quality is use of research results by other researchers. Several researchers and program officials mentioned frequency of citation as a measure of research success. However, neither NSF or NIH use these indices to aid in evaluating researchers' performance. Other measures of research success mentioned by researchers and program officials included the number of graduate students trained, and standing in the research community as reflected by professional awards, presentation of papers at conferences, etc.

1/ Evaluative Study of the Materials Research Laboratory Program: Summary Report (The MITRE Corporation, McLean, Virginia, September 1978).

Negative results

Our review indicated that results are often not published when researchers demonstrate that a hypothesis or approach is erroneous. These results, known as negative results, were published for 11 of the 26 grants in which they occurred. About half the researchers interviewed said that negative results should be published and that publishing negative results is currently a common practice. Most of these researchers also explained, however, that negative results are disseminated informally throughout the research community at scientific meetings and conferences and that they are published only when they are significant.

NSF and NIH requirements for reporting negative results vary. They are not required in NSF progress reports, but are in NIH's. Neither agency specifically requires their inclusion in renewal proposal progress reports or final technical reports.

COMPARING SCIENTIFIC PERFORMANCE ACCOUNTABILITY PROCESSES

One of the objectives of our review was to compare the scientific performance accountability processes, primarily peer review, used by NSF and NIH to determine if one process provided better accountability than the other. Table 7 compares these processes for issues developed during our review.

The comparison shows that for 9 of the 10 issues listed, the NIH process provided better scientific performance accountability than the processes used by NSF. The NSF panel process provided better accountability than NIH's in comparing publications to grant scope and objectives. Both the NSF panel and ad hoc processes were less effective than NIH for five of the issues discussed.

Table 7

Comparing Processes

Major issues	Peer review method: NIH peer review group	NSF panel	NSF ad hoc
	(numbers)		
Renewals of sample grants awarded	19	14	13
Other grants awarded by NSF or NIH not related to our sample grant	3	4	8
No other grants awarded by NSF or NIH	3	3	8
Sample grants reviewed	25	21	29
1. Grants in our sample where the evidence showed that scientific performance accountability processes were inadequate	1	5	6
2. Grants where peer review comments impacted upon grant award decision	12	10	4
	(percentages)		
3. Evidence found that renewal peer reviewers evaluated immediately preceding grant	95	29	15
4. No evidence found that renewal peer reviewers evaluated immediately preceding grant	5	71	85
5. Objectives of sample and renewal grants the same	9	29	23
6. Peer review comments sent to researcher	40 a/	9	34
7. Written summary of panel/peer review group deliberations			
sample grant	100	57	N/A
renewal grant	100	64	N/A
8. Publications of immediately preceding grant identified in renewal proposal	83	29	45
9. Progress reports compared to grant scope and objectives	45	13	15
10. Publications compared to grant scope and objectives	20	68	4

a/NIH policy has been changed to automatically forward comments to researchers.

CHAPTER 3

RESEARCHERS ACCOUNTABLE FOR RESULTS--NOT ACCOMPLISHING OBJECTIVES

Researchers varied significantly in accomplishing their grant objectives. While some researchers accomplished all that they originally proposed, most only partially met their objectives. That most researchers did not accomplish all that they originally proposed was of little concern to peer reviewers and program officials. The significance of the researchers' results was considered more important than the degree to which original objectives were attempted or accomplished. NIH requires that proposals clearly state the objectives to be undertaken during the grant period, as well as the overall objective(s) of the research project, while NSF proposal requirements do not distinguish between these types of objectives. Neither agency specifically spells out the extent to which a researcher can change objectives without agency approval.

We agree that in determining whether a researcher should receive additional funding, the results of a research grant should be a more important consideration than accomplishing original objectives. However, based on our review, we believe that more specific objectives, guidelines for allowing changes in objectives, and the reporting of the grant results in relation to these objectives would assist peer reviewers in assessing (1) the progress made under the preceding grant, and (2) the difference between the preceding grant and the renewal proposal. It would also provide NSF and NIH with more assurance that the objectives which the peer reviewers thought had scientific merit were worked on.

ACCOMPLISHING OBJECTIVES NOT ALWAYS POSSIBLE

While most researchers who were awarded renewal grants conducted research and disseminated their results, most did not accomplish all their grant objectives. Forty-six researchers were awarded renewal grants to continue the same line of research as the grants included in our sample. Only 10 of these researchers said that all their grant objectives were accomplished. Table 8 summarizes the extent to which objectives were met by all 46 researchers:

Table 8

Meeting Objectives

	NSF ad hoc	NSF panel	NIH	Total
Objectives all met	2	3	5	10
Objectives partially met	11	11	14	36
Objectives not met	0	0	0	0
Total	13	14	19	46

The reasons most often cited by researchers for not fully accomplishing their objectives were budget cuts or the broad, long-term nature of objectives. Other less frequently mentioned reasons were changes in research focus or new objectives being developed during the grant period.

Only 2 of the 46 researchers did not disseminate their research results. They also only partially accomplished their objectives. One of these researchers had a 1-year NSF panel grant. He had actively published for several years prior to this grant, and peer reviewers for the proposal to renew this grant were pleased with his long-term productivity. The second researcher had a NSF ad hoc grant. The researcher said that three publications resulted from his sample grant. However, when we reviewed these publications we found that they did not acknowledge the sample grant. Two of these publications acknowledged support from a previous NSF grant, and the third only acknowledged NSF support in general without citing any specific grant.

Three of the 46 researchers did not publish any of their results in peer reviewed publications. They also only partially met their objectives. One of these researchers published the results of his NSF ad hoc grant in 12 non-peer reviewed publications. The second researcher discussed the slow progress made during the grant period in the proposal to renew his NSF ad hoc grant. However, the proposal also indicated that his methods had begun to work at last. The program official responsible for the renewal said that peer reviewers indicated interest in continuing the researcher's study. The peer reviewers told us that they had seen the researcher's results at conferences.

The third researcher also presented the results of his NSF panel grant at scientific conferences. We contacted the six peer reviewers who reviewed the renewal proposal. One advised us that he was aware of the researcher's results through these conference presentations. Two reviewers stated that they read preprints of publications and three stated that the progress report section of the renewal proposal satisfied them as to the researcher's progress and results.

Although 89 percent of the researchers did publish some of their results in peer reviewed journals, only 50 percent 1/ published in time for review by the peer reviewers of the renewal proposal. Thirteen of the 19 NIH grants which were renewed resulted in publications which were available at the time the renewal proposal was submitted. Ten of the 27 NSF grants renewed (7 of 13 NSF ad hoc, 3 of 14 NSF panel) had publications available at the time of the submission of the renewal proposal. Without publications, the peer reviewers of the renewal proposal, in most cases, must rely on the progress report in the renewal proposal to determine the results of the immediately preceding grant. Therefore, as discussed in chapter 2, a clear, easily identified presentation of preceding grant results and objectives would provide peer reviewers with more adequate information upon which to base their evaluation. Fifty-five percent (32 of 58) of the peer reviewers we contacted stated that having the results of the immediately preceding grant related to the grant's objectives would be useful information in evaluating the renewal proposal.

PROPOSAL OBJECTIVES DIFFER

One of the most often cited reasons for not accomplishing objectives was the long-term nature of the objectives. NIH has attempted to address this issue by requiring that proposals include overall research objectives or long-term goals, which it calls "objectives," as well as specific objectives for the period of requested support, which it calls "specific aims." NSF does not specify whether the "objectives" it requires researchers to include in proposals are long- or short-term.

Comparing the objectives for the grant in our review with renewal grant objectives showed that objectives generally were not the same. The highly technical nature of these objectives made such comparisons difficult. However, nine sample grant researchers appeared to have some of the same objectives for their sample and renewal grants. Work plans, however, changed between the two grants, suggesting that these objectives were long-term goals. NIH's policy of having specific aims for the requested grant period appears to have made researchers more definitive in their objectives for specific grant periods. The proportion of NIH researchers having the same specific aims for both grants was considerably less than the proportion of NSF researchers having the same objectives for both grants. Only 2 of the 19 NIH researchers having renewal grants had some of the same specific aims. In contrast, 7 of the 27 NSF researchers having renewal grants had some of the same objectives.

1/The publications either solely or partially acknowledged the grant we reviewed.

NIH also requires that renewal proposals identify the specific aims from the preceding grant and an account of the published and unpublished results indicating progress toward the achievement of the specific aims. NSF simply requires a summary of progress to date and its relation to the proposed work. Two NSF ad hoc grants demonstrate the problems this vague proposal requirement can cause peer reviewers in evaluating a renewal proposal (see page 23). In one instance, a peer reviewer was able to summarize his problem very clearly. In the second instance, a peer reviewer had problems evaluating the renewal proposal because the proposal did not clearly detail the results of the preceding grant. The accomplishments were somewhat different from what was originally proposed. Although the researcher's work was within the subject area of the grant, he added some objectives as the research progressed. Without a clear statement of the objectives and results of the preceding grant, the peer reviewers would generally not know about the added work.

At NSF, as indicated in chapter 2, a clear statement of the objectives and results of the preceding grant in the renewal proposal is important because, typically, different peer reviewers evaluate the renewal proposal than evaluated the preceding grant proposal. Twenty-seven NSF grants in our review were renewed. In about 37 percent of these cases, none of the same peer reviewers were used to evaluate the preceding grant and the renewal and in about 52 percent of the cases only one peer reviewer was the same.

For the seven renewed grants discussed earlier in which some of the objectives for the preceding grant and the renewal were the same, different peer reviewers were used in three cases, one peer reviewer repeated in three cases and three repeated in one case.

RESEARCH IS RESULTS-ORIENTED

According to researchers, peer reviewers, and program officials, researchers are primarily evaluated on the significance of their research and results. Hence, the degree to which research objectives are accomplished is of lesser importance. Research is results-oriented because of (1) the creative nature of basic research; (2) NSF and NIH grant policies allowing researchers to deviate from objectives; and (3) the speculative nature of objectives.

Allowing for creativity

While research objectives are important in making grant award decisions, they become less important during the grant period. The creative nature of basic research lessens their importance because the research process and results may differ from what was initially envisioned. Researchers and program officials characterize basic research as exploratory; results are unpredictable. Unforeseen problems make research risky. Spinoff ideas having

more significance than those initially proposed may emerge during a grant period and should be pursued. As one researcher said, research proposals are merely a point of departure.

Allowing for change

Change in research direction during a grant is recognized as a legitimate part of the research process. Both NSF and NIH grant policies allow such changes, and several researchers did deviate from their initial objectives. NSF and NIH instructions, however, do not specify how much leeway researchers have in changing their objectives before they must obtain agency approval for doing so. NSF instructions require prior approval for any changes in objectives and for "significant" changes in methods or procedures. NIH instructions state only that researchers are required to obtain prior approval for "major" changes in scope.

Most researchers said they have or should have leeway to change objectives. Most also said that they would notify the agency if they changed fields/subject areas or objectives as opposed to the scope of work within these objectives. None of the researchers included in our review said that they had materially changed the subject matter of their research from what they had initially proposed. Although 12 researchers did pursue some objectives not in their sample grant proposals, they stated that all these new objectives were in the same subject area. In these instances, the research objectives presented in the proposals were also frequently only partially completed.

Other researchers did not attempt all the research objectives presented in their proposals. Program officers (19 of 22) generally said that not attempting all the objectives presented in a proposal is not a change in research direction. Three others added that not attempting the major objective or central theme of a proposal would constitute a change in research direction.

Researchers who deviated from their initial objectives varied in their views on seeking agency approval for these changes. For example, one researcher only accomplished one of five initially proposed research objectives. The researcher said that during the course of the grant it became apparent that unanticipated research had to be performed before the initially proposed objectives could be attempted. The researcher contacted NSF regarding this problem prior to conducting the unanticipated research.

A second researcher thought researchers should have the freedom to change direction without contacting the agency regarding the change. He was aware of NSF's policy requiring contact before changing research direction, but he felt researchers did not adhere to this policy. He added that a significant change in research direction would have to occur to warrant agency contact.

A third researcher felt that researchers who adopt a new direction in their research should be allowed some time after

making the change before they must notify the agency of the change. He explained that this delay would allow researchers to use the time following their adption of a new direction to assure themselves that the new direction was viable. He said it would then be appropriate to notify the agency in the renewal proposal.

A fourth researcher said that he did not fully complete his broadly stated, long-term objective. He explained that during the research he developed a new technique which changed his priorities from the proposed scope of work to other new experiments. He said he notified NSF of this change via his final report.

Several researchers and program officials commented that it is a resercher's prerogative to change research direction during the course of a grant. They added, however, that if such changes do not produce significant results, adverse peer evaluations will occur when renewal proposals are submitted for continued support.

We would agree that the nature of basic research requires that researchers have the freedom to change their research as it progresses. However, reporting results as they relate to the originally proposed objectives would not stifle any need to change. Results are and still would be the most important consideration in deciding if the researcher should be funded again. This reporting requirement would provide better accountability because it becomes easier for peer reviewers to judge the progress made under the grant if they know what the researcher was striving to do. Secondly, it is easier for peer reviewers to judge the difference between the preceding grant and the renewal proposal. Finally, it offers the funding agency some assurance that the objectives which the peer reviewers deemed to have scientific merit were worked on.

A more specific definition is needed, however, as to what constitutes a change requiring prior agency approval. The four researchers discussed above each interpreted NSF and NIH guidelines differently as to when to let the agency know about a change. One didn't tell the agency, one contacted the agency prior to the change, and two told the agency after the fact--one in a final report and one in a renewal proposal. A "significant" or "major" change, as the NSF and NIH criteria respectively now state, does not appear specific enough to avoid this confusion and diversity. Researchers could unknowingly change their research to do something already being worked on by someone else. More specific guidelines as to when agency approval is required would alleviate this problem. Also, a reporting of objectives

in the renewal proposal would at least alert the agency that the change was made. 1/

Research objectives are speculative

Most of the researchers, peer reviewers, and program officials we contacted did not expect all grant objectives to be accomplished. Objectives were generally characterized as having broad long-term changing goals. Uncertainty surrounds objectives because researchers cannot predict what will happen once research is started, research may continue into subsequent grants, and relating objectives to published results can be difficult.

In contrast to NSF, NIH grant procedures appear to reduce the uncertainty surrounding objectives by requiring researchers to distinguish between long-term objectives and specific aims. That NIH requires researchers to report on objectives does not necessarily mean that researchers are held accountable for accomplishing these objectives. NIH requires researchers to report the progress made toward meeting the grant objectives which the peer reviewers deemed to have scientific merit. Of the 19 NIH researchers awarded renewal grants, 14 said that they only partially met their grant objectives, suggesting that the grant results were significant enough to warrant continuing support even though not all objectives were met.

Table 9 shows that the majority of researchers and program officials did not expect grant objectives to be accomplished.

However, many of the peer reviewers who expected a grant's objectives to be accomplished qualified their expectation by stating that results are still the most important consideration when they review proposals. Although these individuals did not expect the objectives to be accomplished, many of them did state that they expect researchers to try. It is easier to assess if a researcher attempted the objectives if the objectives of the preceding grant are identified in the renewal proposal.

1/Any change that amounts to a change in the scope of the grant will cancel the existing grant and have the effect of deobligating that grant. Unless the changed grant is approved either formally or informally, the costs associated with it cannot be allowed. If the appropriation from which the original grant was made is no longer available, the costs, where allowable, must be assigned to an appropriation currently available. See 57 Comp. Gen. 459 (1978).

Table 9

Expecting Objectives to be Accomplished

Researchers	NSF (Ad Hoc)	NSF (Panel)	NIH	Total
Yes	10	6	6	22
No	13	11	16	40
No response	6	4	3	13
	29	21	25	75
Program officials				
Yes	2	2	2	6
No	15	9	15	39
Sometimes	0	0	0	0
No response	0	0	3	3
	17	11	20	48
Peer reviewers				
Yes	11	12	4	27
No	13	5	7	25
No response	4	1	1	6
	28	18	12	58

Objectives were generally characterized as speculative long-term changeable ideas. Typical comments on the nature of objectives by researchers were:

--Researchers should have a lot of leeway to change their objectives and scope since research tends to branch out into different directions as discoveries are made and new scientific ideas arise.

--Objectives are general goals toward which a researcher moves. In pure research, it is impossible to have firm objectives similar to those in applied research. [He did not expect] objectives to be accomplished because results cannot be guaranteed in basic research.

--Objectives outline what a researcher hopes to accomplish during a grant period, and in another sense, they are the researcher's lifetime goals. [The researcher felt] objectives should be stated more broadly than they currently are.

--Grants are a continuum. Hence, while some research may be completed, other research will only "progress" and will continue in subsequent grants.

Typical comments by peer reviewers included:

--Any expectations about objectives must be viewed in the context of the researcher proposing them. Some researchers tend to be optimistic and broad in proposing research, while others are very explicit. At the very least some progress [would be expected] in the direction of proposed objectives during a grant period.

--Expecting objectives to be accomplished is very naive because a researcher cannot predict what will occur once research is started.

A comment by a program officer:

--It is unrealistic to expect objectives to be accomplished in one grant period for a theory-type grant. Many researchers obtain renewal grants to continue working toward the same objectives. In contrast, a peer reviewer said that in experimental grants some experiments have a high probability of success.

Objectives may be difficult to relate to published results. Forty-six percent of the program officers interviewed said that they do not examine publications to determine which objectives researchers have met. One reason is that publications stress results and do not necessarily describe objectives. Even when publications do describe objectives, program officials said publications are not used for this purpose because doing so is too time-consuming and difficult. Many program officials said they rely instead on explicit written acknowledgements in publications to identify which grant supported a publication when they are otherwise in doubt. Reading publications may not always alleviate the program officer's doubt, however. Our analysis of publications resulting from the grants reviewed indicated that, in many cases, the publication does not identify the grant which supported the work.

CHAPTER 4

CONCLUSIONS, RECOMMENDATIONS, AND MATTERS FOR CONSIDERATION BY THE CONGRESS

CONCLUSIONS

The individual researcher is the keystone of the basic research process. For this reason, the extent of the scientific performance accountability provided by the peer review process and the funding agency is somewhat limited. Additionally, there is no mechanism, nor probably can there be for individuals outside of the research community to provide this accountability. Even the universities, which theoretically are in a position to provide it, practically cannot and do not because of the "academic freedom" environment and the lack of expertise about the research being performed. Therefore, given these constraints, NSF and NIH research grants should be subjected to a thorough scientific performance accountability review. Also, the scientific accountability process should not be concerned only with the process alone. The process is merely a "means to an end and not the end itself." It exists to serve a purpose--that of enabling the best evaluation possible of research proposals to determine those that most merit funding.

Although the peer review and internal review systems NSF and NIH use to provide scientific accountability over basic research grants are working reasonably well, improvements--especially at NSF--are needed. Of the two agencies' systems, the NIH system contains better safeguards and therefore provides more assurance that the research supported is attempted and that unproductive researchers will be identified and prevented from receiving continued funding. This conclusion is based primarily on the fact that the NIH system provides (1) more specific instructions to peer reviewers for judging the quality of research performed and proposed, and (2) better identification in proposals of research results and their relation to research objectives of immediately preceding grants. Additionally, the NIH system makes more effective use of peer reviewer comments and better documents its panel peer review deliberations.

At NSF, more specific guidance to peer reviewers (the first point above) is needed in part, because in many instances program officers do not have the expertise to make judgments about the research proposed and performed. Better identification (the second point above) is needed because in many instances (1) the proposal provides the only source of a grant's results at the time of renewal, and (2) different program officers and peer reviewers evaluate the renewal proposal than evaluated the preceding proposal. This information will enable peer reviewers and program officers to determine how successful the researcher was in achieving the preceding grant's objectives, if the objectives changed, the difference between the proposed work and work accomplished,

and any publications which resulted from the immediately preceding grant.

There are, however, problems common to both agencies. New project proposals do not include information on the immediately preceding but unrelated grant and peer reviewers are not provided the final technical report or listing of publications resulting from the prior grant. Additionally, the monitoring of ongoing NSF and NIH grants by program officials is not systematic.

At both NSF and NIH, many research projects are funded by a series of successive grants, each grant having a duration of from 1 to 5 years. When a researcher seeks to renew a grant, we believe NSF, like NIH, should require more specific information about, and require peer reviewers to evaluate and comment on the progress and accomplishments of, the immediately preceding grant as one of the factors in deciding whether to fund the researcher again.

NSF does not ask peer reviewers to specifically evaluate researchers' performance on immediately preceding grants when researchers seek renewal grants. The reviewers are only asked to evaluate the scientific merit of the proposal and the researcher's track record--including recent accomplishments. Our analysis of peer review comments for researchers seeking renewal grants from NSF showed that in only 22 percent of these cases were evaluative comments made by the peer reviewers regarding the researchers' immediately preceding grant.

In contrast, at NIH, where peer reviewers are asked to comment on the immediately preceding grant, we found that in 95 percent of the cases the peer reviewers did comment on the researcher's performance on the immediately preceding grant.

Even though NSF requests peer reviewers to evaluate a researcher's recent accomplishments, this may not, in many cases, be adequate. Two-thirds of the researchers included in our review had more than one grant. For these researchers, when peer reviewers evaluate a renewal proposal, the researcher's recent accomplishments might result from a grant other than the one being renewed.

Further, if peer reviewers were asked to comment on the immediately preceding grant, the inadequacy of current NSF proposal requirements would make such an evaluation difficult. Researchers in their renewal proposal progress reports are not required to cite the objectives of the immediately preceding grant nor identify the resulting publications or other output. Without the objectives, it becomes a more difficult task for peer reviewers to determine how the proposed work differs from the work under the preceding grant. Without identifying the publications from the preceding grant, it is more difficult for peer reviewers to evaluate, for multi-funded researchers, specific grant performance.

NIH also makes more effective use of peer review comments by automatically releasing them to researchers. NSF's policy is to release them only when the researcher requests them. NSF's policy of not routinely providing this information to all researchers has adversely affected the conduct of the research in some instances. Further, for many NSF grants which are panel reviewed, no summary of the panel deliberations exists to be released to the researcher.

NSF and NIH also have problems which are common to their accountability processes. When multi-funded researchers submit new project proposals, neither agency requires the researchers to discuss the prior grant or identify its publications in the new proposal. Also, peer reviewers are not specifically asked to evaluate the prior grant's results, other than as part of the researcher's general track record, and they are not provided with the final technical report or listing of publications resulting from the prior grants. These procedures do not preclude researchers from avoiding accountability on unproductive grants by seeking grants for new projects.

NSF and NIH do not monitor scientific progress during grant periods in a uniform manner. Progress reports submitted by researchers are the primary tool available for performing this function. Yet, program officials at both agencies use them in a variety of ways--some just read them, some compare them to the grant's original scope and objectives and, at NIH, some officials prepare a checklist as evidence of progress report review. A more systematic and uniform approach at both agencies would provide more effective scientific performance accountability.

Most of the researchers who were awarded renewal grants did not accomplish all of the objectives of the immediately preceding grant. Peer reviewers and program officers were not concerned by this fact because they believe that the results of the grant are more important than the accomplishment of originally proposed objectives and because, for the most part, they do not expect all grant objectives to be accomplished. Most of the peer reviewers and program officers, however, did expect the researchers to attempt the grant's objectives. It is difficult to determine if a researcher attempted the grant's objectives, which the peer reviewers thought had scientific merit, if the renewal proposal does not identify what the preceding grant's objectives were. NSF, unlike NIH, does not require renewal proposals to restate the preceding grant's objectives.

The majority of peer reviewers we contacted believed that having the accomplishments of the preceding grant related to the objectives would be useful in evaluating the renewal proposal. Our review provided examples of instances where peer reviewers for NSF grants had problems determining the progress of the preceding grant and the difference between the preceding grant and the renewal proposal. The reporting of objectives in NSF renewal proposals is of even more importance because, typically,

different peer reviewers evaluate the renewal proposal than evaluated the proposal from the preceding grant.

The nature of long-term grant objectives was one of the most cited reasons by researchers for not accomplishing grant objectives. This continuation of research became apparent from our comparison of objectives of the prior grant in our review with the objectives of the renewal grant. This comparison showed that at NSF the two grants had some of the same objectives more than three times as often as NIH grants. This is attributable to the fact that NIH requires researchers to specifically state the objectives (specific aims) to be attempted during the grant period as well as the overall objective of the line of research. NSF does not distinguish between these types of objectives. NSF peer reviewers and program officers would get a more accurate picture of what the researcher intends to do during the grant period if NSF required specific grant period objectives.

The extent to which researchers can deviate from a grant's original objectives without prior agency approval is left primarily up to the researcher. While most researchers said that they would notify the agency beforehand if they were going to change research areas, a few said they wouldn't, while others generally said that they have a lot of leeway in this regard. Since the peer reviewers had previously determined that the objectives in the grant proposal had scientific merit, changing the objectives tends to complicate the peers' scientific merit determination. Under these conditions, researchers could deviate from approved objectives by attempting objectives which were not reviewed by peer reviewers for scientific merit. More specific guidelines are needed as to the extent research objectives can be changed without agency approval.

RECOMMENDATIONS

To provide for more effective scientific performance accountability, we recommend that the Director of NSF require that:

--Renewal proposal progress reports identify the objectives, evidence of progress toward their achievement, any major changes in direction or emphasis and rationale for such changes, publications, and/or other output from a researcher's immediately preceding grant.

--Peer reviewers be asked when reviewing renewal proposals to specifically comment on a researcher's performance on the immediately preceding grant.

--The documentation of panel peer review deliberations include the major elements required of the NIH peer review group summary statement when individual peer reviewers' written reviews do not provide this information.

--Peer review comments be automatically sent to researchers.

--Proposals identify the research objectives to be undertaken during the grant period.

We recommend that the Directors of NSF and NIH require that:

--Proposals for new projects include evidence of progress from the prior grant(s).

--Peer reviewers be furnished any available final technical reports and listings of publications from the prior grant(s) when researchers seek funding for new projects.

--More systematic and uniform review of annual progress reports be made by the program officers.

--More specific guidelines be established regarding the extent to which researchers can change grant objectives without prior agency approval.

AGENCY COMMENTS AND OUR RESPONSE

The National Science Foundation (NSF), and the Department of Health and Human Services (HHS) reviewed and commented on a draft of this report. HHS stated the report fairly presents the issues involved, and agreed with all of our recommendations to the Director of NIH. NSF noted that while improvements should always be sought in any system, any changes must be considered in the context of workload implications. Both agencies generally concurred with our recommendations and, with one exception by NSF, agreed to examine current practices and/or develop better guidelines to implement them. We asked six universities to comment on draft report excerpts dealing with university proposal submission and monitoring of research. We received comments from two universities in time to be incorporated in this report (see appendixes II-V with our responses to their comments on specific points).

NSF agreed with all the recommendations made to it with one exception. However, the actions NSF agreed to take are based somewhat on a misinterpretation of the intent of several of the recommendations--a misinterpretation that needs to be clarified. Our recommendations are aimed at assuring that adequate information is contained in research proposals regarding the objectives, any changes in direction, progress, and output under the immediately preceding grant. Our recommendations are also aimed at all proposals whether from researchers with multiple grants or only one grant and whether for continued support of an existing project or for support of a new project if the researcher already had a grant.

NSF interpreted the recommendations as meaning that only a greater distinction be made between long- versus short-term objectives in proposals from only those researchers having multiple grants. This, however, is not the intent of our recommendations. The problems discussed in chapter 2, while occurring more frequently when researchers have multiple grants, also occur when researchers have only one grant. More important, however, more information is needed in research proposals to resolve the problems in scientific performance accountability, identified in this report, than just a greater distinction between long- versus short-term objectives. More information is needed in the progress report sections of all proposals regarding the objectives, changes in objectives, progress toward the objectives and output under the immediately preceeding grant from all researchers.

The suggestion in our draft report that NSF took exception to has been modified to reflect NSF's views and our concern that adequate information be available to show the peer review that was done. The suggestion concerned documentation of NSF's panel peer review summaries along the lines of NIH's. NSF said that individual written peer reviewers' reviews mitigated the need for requiring a detailed summary such as NIH requires since NIH usually does not have individual written reviews and NSF does. We agree with NSF and accordingly are recommending that NSF's panel summaries should show the kind of information required in NIH panel summaries only when such data do not appear in any of the individual written reviews.

NSF's main concern about implementing our recommendations regards the additional staff time that might be required. Implementing the recommendations, with the exception of the one dealing with panel summaries, will require no additional staff time. In fact implementing the recommendations will probably save staff time in that proposal evaluation will be easier and thus less time-consuming.

NSF noted that our sample resulted in an abnormally large fraction of cases of researchers with multiple grants because only grants to a few large, prestigious universities were selected. Our sample of grants was drawn from major research universities in part because they get the bulk of NSF funds. According to NSF statistics, the top 20 received 40 percent of all NSF funds in fiscal year 1980. The top 50 got 61 percent and the top 100 got 78 percent. It necessarily follows that wherever the greatest concentration of researchers, research grants and grant funds, is where there is the greatest need to ensure scientific performance accountability. Researchers with multiple grants are concentrated in major research institutions. Since the major problem is with researchers with multiple grants, we believe the sample appropriately represents the bulk of NSF grant funds and points up problems that are not limited to a small fraction of NSF grants.

MATTERS FOR CONSIDERATION BY THE CONGRESS

Accountability for public funds spent on basic research grants to colleges and universities continues to present a paradox. Universities and university researchers want more freedom and less Government control over how actual dollars are spent. The Congress and the taxpayers want assurance that tax monies are invested wisely. But, the methods by which that assurance is provided should carefully avoid detailed controls over researchers' activities that do not siginificantly improve accountability, and which can also suppress the freedom of inquiry so essential to basic research. Our recommendations are intended to improve scientific performance accountability and peer review without inhibiting researchers' freedom of inquiry.

The House Committee on Government Operations and the Senate Committee on Governmental Affairs during oversight hearings on NSF, NIH, or on matters relating to universities and research grant accountability, should consider the effectiveness of the scientific performance accountability systems at NIH and NSF. Also, the House Committees on Science and Technology and Appropriations and the Subcommittee on Appropriations--HUD and Independent Agencies, Senate Committee on Appropriations, during their fiscal year 1983 budget hearings, should consider NSF and NIH actions taken to improve the research grant scientific performance accountability systems since the hearings mentioned on pages 6 and 7. These systems determine the quality of much of the basic research conducted at the Nation's universities, and this research is vital to the Nation's welfare. The systems NSF and NIH use should work as effectively as possible, especially considering shrinking research budgets and the ever-increasing demand for technological advances. The recommendations made in this report will help improve the scientific performance accountability systems at NSF and NIH.

GAO REPORTS AND RELATED STUDIES

In a report entitled "Better Controls Needed Over Biomedical Research Supported by the National Institutes of Health" dated July 22, 1976, GAO recommended that the Director, NIH

(1) establish specific guidelines outlining what should be included in annual scientific progress reports,

(2) issue instructions to grant administrators on how to review noncompeting grants, and

(3) incorporate written comments on the reviews into the official grant files.

NIH took the following actions to implement these recommendations:

(1) NIH established minimum requirements for progress reports which include "(a) actual accomplishments toward meeting project goals, (b) reasons for not meeting desired goals, (c) plans for activities during the coming year."

(2) NIH regulations were strengthened to require that program officials review progress reports for the above requirements.

NIH did not implement our recommendation to include written comments on progress report reviews in the grant files.

In a report on NSF's proposal evaluation process entitled "Accountability in the National Science Foundation's Review Process for Grant Awards Needs Strengthening" dated November 17, 1978, we recommended that the Director, NSF:

(1) require that documentation be included in proposal files to identify the proposal's critical elements and why the peer reviewers were selected and (b) show how adverse comments and constructive criticisms of the proposals which program officers recommend for funding were handled;

(2) require on all proposals where funding is declined an explanation of the peer reviews which support funding the proposal, and why the proposal was declined; and

(3) develop internal controls which assure that all documents regarding proposal peer review which NSF permits researchers to obtain are sent, when requested by the researcher.

NSF disagreed with the first two recommendations, and therefore, took no action to implement them stating that it had other controls

in its process which provides adequate accountability. NSF still maintains that position. On the third recommendation, NSF said assuring that all documents relating to the peer review of a proposal are sent to requesting researchers could be done without developing internal controls. NSF's top managers were instructed to correct any misunderstandings the staff might have had on what documents are to be released. According to the Director of NSF's Office of Audit and Oversight, the office has reviewed past requests to ensure that all the required documents were sent and will "spot-check" future requests for compliance. No formal internal controls have been implemented.

RELATED STUDIES BY NSF AND NIH

Both NSF and NIH have sanctioned reviews of their peer review systems. The NSF funded a study entitled "Peer Review in the National Science Foundation" which was conducted in two phases under the auspices of the National Academy of Sciences. The primary purpose of Phase 1, issued in November 1978, was to determine how the peer review system functions at NSF and whether the system is an equitable one in terms of fairly evaluating research proposals. Phase 2 is supposed to more definitively determine whether the peer review system is equitable by evaluating how NSF program officers' selection of peer reviewers affects grants awarded.

Phase 1 of the study contained several findings regarding the relationship of certain variables to (1) researchers' scientific achievements, (2) researchers' location and age, (3) the peer reviewers' rating of a sample of the researchers' proposals, and (4) the actions taken on the proposals by Foundation program officers. The report, however, contains the following qualifier regarding the study results.

> "* * * Where does the peer review system in practice diverge from the formal statement of how peer review is supposed to work? Our data are well suited for throwing light on this question, and also for pointing up problems with peer review. Problems were revealed in discussions with the people administering the peer review system, and by close analysis of the quantitative data. The research is not suited for definitively answering the question whether the peer review system is an 'equitable' one. Although our data allow us to speculate usefully on this question a more definitive answer awaits the completion of Phase 2 of our research." [Underscoring added.]

Although the study report contained the above qualifier, articles published by the study authors in advance of the report claimed the NSF review system was "eminently fair" without noting the qualifier. As of August 1981, the Phase 2 study report was not yet available.

NIH conducted a two-phase internal review of its grant peer review system and issued reports to the Director, NIH, on its findings in 1976 and 1978. The scope of the NIH review was intended to deal with some issues similar to those discussed in this report such as how well the award process works and the quality of peer review as it relates to assessing scientific accountability. However, the methodology NIH used to conduct its review was based largely on anecdotal comments by and questionnaire information from peer reviewers, grant applications, and NIH officials. The NIH study team, which was made up of various NIH officials, obtained the perceptions and opinions of members of the scientific community on NIH's peer review system. The study team concluded that, based on these perceptions and opinions, "the NIH peer review system is and has been extremely effective in identifying biomedical research activities of high quality." The study team did not review specific research grants or trace the scientific performance accountability (peer review) process from a specific grant to the renewal of that grant.

The NIH peer review study team reports contained numerous recommendations regarding the operation of NIH's peer review process. Most, however, concerned the administration and/or management of the process. None concerned the quality of peer review or were related to improving accountability for scientific judgments. A few recommendations were made regarding substantive issues of peer review but action on these was deferred by the NIH Director pending further study.

STUDIES BY THE NATIONAL COMMISSION ON RESEARCH

The National Commission on Research issued two reports during 1980 resulting from its studies of scientific accountability over federally funded research grants at the Nation's colleges and universities. The first, entitled "Accountability: Restoring the Quality of the Partnership" issued March 1980, represented the Commission's study of both accountability for scientific performance and for financial and administrative matters. Although this report dealt mostly with financial accountability, it contained some passages applicable to scientific accountability. In this regard the Commission found that scientific accountability is largely self-enforcing without Government interaction because, in the research community, peer reviewers play a major role in deciding what work will be supported, who shall do the work, and what work is significant. The Commission observed that the conduct and support of research carried out by universities with Federal support should seek to maintain, strengthen, and support the competitive processes used to assure integrity, objectivity, and excellence in the pursuit of new knowledge. These include fair and courageous use of review processes, "full" scientific accountability in the selection of research directions and programs to be pursued and supported, and critical evaluation and dissemination of research results. In this report the Commission did not make specific recommendations regarding scientific accountability.

The Commission's second report entitled "Review Processes: Assessing the Quality of Research Proposals" dated May 1980, specifically concerned the peer review processes used by NSF and NIH. According to the report the Commission conducted a special study of peer review because the quality of peer review is of great importance to the Government and to university scientists and because peer review has been criticized by some members of the Congress and the academic community. A Commission subcommittee made up of three Commission members conducted the study by surveying the available literature and holding meetings with and obtaining written comments from selected officials from business, Government, and the universities. The Commission's report concluded that "it is of the greatest importance to the scientist, particularly in a situation of keen competition for limited funds, that the proposal be considered fairly and critically by the most competent of his or her scientific peers. It is equally important that the public, represented by Congress and the agencies, be assured that the money invested in research has funded the best research available." The Commission's recommendations included (1) that funding agencies initiate retrospective studies on how effective their review processes have been in assessing the quality and effect of research they support which could suggest improvements in the predictive accuracy of the review of proposals, (2) experimentation by Federal agencies in which peer reviewers provide ratings for several aspects of a proposal as well as the overall rating, and (3) funding agencies make explicit the nature of the underlying scientific and policy considerations used in arriving at funding decisions particularly where meritorious proposals are clustered around a narrow range of priority ratings which are resolved by arbitrary numerical cutoffs.

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D C 20550

nsf

OFFICE OF THE DIRECTOR

July 2, 1981

Mr. Morton A. Myers
Director, Program Analysis
Division
General Accounting Office
441 G Street, N. W.
Washington, D. C. 20548

Dear Mr. Myers:

1 This is in response to your request for comments on the draft report, "Scientific Performance Accountability and Peer Review Processes for Basic Research Are Good But Could Be Better." We appreciate the opportunity to comment on the draft. As you note, the NSF system is basically in good shape but improvements should always be sought in any system. Changes must be considered in the context of workload implications. We depend very heavily on the unpaid assistance of thousands of reviewers; we must be careful not to ask more of them than they are prepared to give. In addition, as you know, our program staff has a very heavy workload; we can contemplate additional paperwork only if the results warrant the sacrifice of other things which would necessarily have to be left undone.

2 There are a few points which should be noted. The fact that the NSF peer review system has been studied a number of times over the past decade, in some cases with NSF support as well as assistance, demonstrates that we are concerned with finding ways to improve the system. This might be mentioned in Chapter 1. Our use of our advisory committees to review the process in each program over a several-year period might also be mentioned.

3 The sample of grants considered is quite small; the statistics are therefore not as reliable as the casual reader might infer. Also, the sample, being limited to awards to a few large institutions, includes an abnormally large fraction of investigators who have multiple support; it is only in the case of multiple support that confusion could arise as to whether or not the investigator's prior work was supported under a specific previous grant. We recognize that indications of possible improvements can be found in such a sample and also that your recommendations are not dependent upon the statistics which you display in various tables.

4 The statistics cited on page 1-2 are slightly different from those given in Federal Funds for Research and Development: Fiscal Years 1979, 1980 and 1981, Volume XXIX (NSF 30-318). In order to avoid confusion, the source(s) of your data might be cited.

5 Certain points displayed in Table 1 deserve consideration when comparing NSF and NIH. The competition for funding is much stiffer at NSF; while the same number of proposals are considered by both agencies, the number of awards made by NIH is much broader than that by NIH. The decision-making is therefore more difficult since NSF must decline to support a large fraction of truly worthwhile proposals. In addition, the average length of an NSF grant is less than that of one from NIH; the time for performance before submitting a renewal request is therefore shorter. This has effects on reporting and evaluating results from the previous award.

6 The first paragraph of Chapter Two can be read to say that the relationship of society to science is one-sided. A more balanced view would be to state explicitly that in the long run society benefits from the increased knowledge gained as a result of the support provided and that the support is thus an investment in the future.

7 Table Two states that in both the NSF systems, peer reviewers do not determine the scientific merit of proposals. I assume this is a typographical error since the function of peer review is to advise the NSF on the scientific merit and probability of success of the proposed work. As noted in the draft, as well as in other reports, this advice is generally the determining factor in the governmental decision. In this connection, the first sentence of the last paragraph on page 2-30 would more correctly state the NSF policy if it read ". . .peer reviewers on significant points, they must justify. . ."

8 The first paragraph on page 2-10 may be confusing. The relative importance of criteria vary from proposal to proposal depending upon circumstances; thus no general, rigid requirement would make sense. As noted, an expectation of competent performance is a sine qua non.

9 With regard to the case described in the last paragraph on page 2-12, we recognize that such a situation can occur. We try to avoid such instances but, in general, must rely on the institution to correctly identify the persons involved in a proposal.

10 Whether or not to use the same reviewers for a proposal as were used on an earlier proposal (page 2-20) is a complex question, since a broad review is desirable to avoid biases, especially on the question of the significance of the work proposed. We frequently use some of the same reviewers but also include a large proportion of new persons to obtain a larger sample of views and reasons.

11 As noted on page 2-31, NSF staff members, having been recruited on the basis of scientific expertise, do not routinely need to contact the investigator concerning negative comments by reviewers. It might be noted that they do request responses from the investigator when this would help to clarify points which are important to a funding decision; this is especially important in the cases where the program officer does not feel sufficiently expert in the sub-area involved.

12 The first sentence on page 2-32 does not follow from the question asked. Given a limited staff, expertise in detail in all sub-areas cannot be expected; thus a program officer will handle proposals for which he or she would not select himself or herself as a peer reviewer for the purpose of obtaining a detailed critique. This should not be taken to imply that the program officer is not competent to interpret the reviews; they are, indeed, qualified to do so (see also pages 2-46 and 4-2 where the same comment applies).

13 The second paragraph under "site visits" on page 2-40 should be clarified to point out that many contacts with investigators occur at professional meetings since this is a very cost-effective way of communicating, and combining several stops in one trip is done to conserve staff time and travel funds.

The draft report contains a number of recommendations:

1. Require that renewal proposal progress reports identify the objectives, evidence of progress toward their achievement, any major changes in direction or emphasis and rationale for such changes, publications, and/or other output resulting from a researcher's immediately preceding grant.

14 Our current requirement states that a proposal ". . .should include: objectives and expected significance; relation to the present state of knowledge in the field, to previous work done on this subject, and to related work in progress elsewhere. The statement should outline the general plan of work, including the broad design of experiments to be undertaken and an adequate description of experimental methods and procedures . ." For renewal proposals we require "a summary of progress to date and its relation to the proposed work." We interpret the GAO recommendation to suggest a greater distinction between short-term objectives and long-range goals and to suggest that, where an investigator has multiple support, renewal proposals should indicate more clearly which accomplishments were achieved under the predecessor grant(s). We will reexamine our current guidelines to proposers and make such changes as are necessary to clarify these points.

2. Establish a requirement that peer reviewers be asked when reviewing renewal proposals to specifically comment on a researcher's performance on the immediately preceding grant.

15 We currently ask reviewers to comment on an investigator's recent accomplishments which, in many cases, is sufficient. As noted earlier, the nature of the GAO sample resulted in an abnormally large fraction of cases of multiple support. The changes noted under the first recommendation will enable us to ask reviewers to comment more explicitly in cases of multiple support and we will do so.

3. Require that panel peer review deliberations be documented along the lines of the NIH peer review group summary statement.

16 We believe that the GAO has overlooked a major difference between NSF and NIH in making this recommendation. Almost all basic research proposals reviewed by NSF panels are also reviewed ad hoc. These reviews as well as written individual reviews by one or more panel members, are available verbatim to proposers. I also note that the GAO sample was drawn from awards made well before 1978 when the GAO staff drew our attention to the fact that some panels did not produce written summaries. We now require such summaries, but, because of the more detailed comments of ad hoc reviewers (including some panel members) are available, these summaries can be, and are, brief. A more extensive summary would not be a productive use of staff time.

4. Require that peer review comments be automatically sent to researchers.

17 The routine forwarding of peer review comments is already more extensive than the report implies. All divisions in the Biological, Behavioral, and Social Sciences Directorate now follow this practice as do a number of other units. We have been discussing extending this procedure and will now make it universal.

5. Require proposals to identify the research objectives to be undertaken during the grant period.

18 Our response is contained in the response to the first recommendation.

6. Require that proposals for new projects include evidence of progress from the prior grant(s).

19 Our response is contained in the response to the first recommendation.

7. Ensure that, when researchers seek funding for new projects peer reviewers are furnished the final technical report and listing of publications from the prior grant(s), when available.

20 We currently require the investigators to provide a list of their recent publications. Final technical reports are usually not available until well after a renewal proposal is reviewed; similarly, there is a considerable delay between the time work is done and the appearance of publications describing it. In addition to the changes discussed above, we will ask that those seeking renewal support specifically identify publications resulting from the work under the predecessor grant(s).

8. Assure more systematic and uniform review of annual progress reports by the program officers.

21 Many of our awards are made as "continuing" grants; these are approved for, typically, three years but are funded one year at a time. In order to receive the annual increment of funds, a progress report is required and is reviewed by the program officer prior to recommending the funding increment. Other annual reports and copies of publications resulting from grants are read by the staff when they arrive. We will reexamine our practice to see what changes

might be appropriate but cannot agree that the imposition of more paperwork on our busy staff would be beneficial.

9. Establish more specific guidelines regarding the extent to which researchers can change grant objectives without prior agency approval.

22 This is a complicated matter. In contrast to NSF, NIH has some mission interests even in the basic research that they support. As GAO has noted, research plans must change as new knowledge develops. The question of where in the continuum from a minor change of instrumental technique to a complete change of objective we should require prior approval is not an easy question to answer; it is not clear that a complete answer can be found. Much must necessarily be left to judgments. We will study this question to see if we can define improved guidance so that the individual judgments may be more consistent.

Thank you for the opportunity to comment on the draft report. If you have any questions, please contact Dr. J. H. Fregeau, Director, Office of Audit and Oversight.

Sincerely yours,

John B. Slaughter

John B. Slaughter
Director

GAO RESPONSE TO NSF COMMENTS

The number of the responses below correspond to the numbered paragraphs of the July 2, 1981, letter from John B. Slaughter, Director of the National Science Foundation.

1. Our proposed recommendations, with the exception of #3 noted on page 67, would not impose an additional workload on NSF's program officers. In fact, implementing the recommendations should reduce the workload in that proposal evaluation should be easier and thus less time-consuming. The proposed recommendation (#3) that would slightly increase the workload has been changed to reflect this and now asks only what is considered the minimum information necessary. Further response on this point is given on page 73.

2. We recognize that NSF has supported and assisted a number of studies of its peer review system. However, in chapter 1 and appendix I, we note those studies that are directly applicable to this report. Studies other than those we mention have been done of NSF's peer review system, but none directly involves the issue of this report--scientific performance accountability. Also, almost all studies of NSF's peer review system were initiated or requested by congressional committees and not by NSF. Regarding NSF's advisory committees, we are presently evaluating the advisory committees' role in reviewing the peer review process in each NSF program.

3. We selected our sample of grants from major research universities because these institutions receive the bulk of NSF grant funds. We agree that the problems noted in this report are greater when researchers have more than one grant. Since researchers with multiple grants are concentrated at large institutions and since these institutions get the bulk of NSF funds, our sample represents the area where the greatest concern is with assuring scientific accountability on basic research grants.

However, we disagree with NSF's contention that our recommendations only apply to researchers with multiple grants. Confusion regarding a researcher's prior work can arise when the researcher had only one previous grant (see example discussed on page 27 of this report). We intend that the recommendations in this report apply to proposals from <u>all</u> researchers either for renewed support of an existing project <u>or</u> support of a new project which immediately follows an existing project.

4. The statistics cited on page 1 regarding Federal funds provided to colleges and universities were derived from the NSF and NIH fiscal year (FY) 1981 budget presentations and the document NSF refers to in its letter (NSF 30-318). However, the statistics cited in NSF 30-318 to which NSF refers in its letter grossly understate NIH's basic research funding level. NIH confirmed the statistics we use in the report. NSF's statistics

reflect those given in NSF 30-318, which shows total Federal basic research funds to colleges and universities to be about $2.3 billion. NSF 30-318 shows the NIH portion to be about $1 billion in FY 1980 whereas NIH budget documents show it as $1.6 billion for FY 1980. The $2.3 billion total shown in NSF 30-318, when added to the $.6 billion underestimate for NIH, add to $2.9 billion--the figure we use.

5. The competition for funding at NSF varies greatly among the various programs. Some programs, such as physics, fund over 70 percent of all proposals received. Some life science programs fund only 20 percent. Of the proposals reviewed in FY 1980 NSF funded about 49 percent; NIH, about 62 percent. Both agencies must decline many truly worthwhile proposals. The average length of NSF grants, while still shorter than NIH's, is increasing as more 3-year continuing grants are awarded. However, with the shorter term grants it is equally if not more important to provide the peer reviewers and program officers with sufficient data which will permit an effective evaluation. Although the performance periods might be shorter, the need to adequately assess scientific performance accountability is just as great, if not greater.

6. No response is required.

7. We revised the wording in table 2 to reflect that the peer reviewers do not make the decisions on proposals although NSF's peer reviewers do advise NSF on proposals' scientific merit. NSF's suggested wording in the last sentence was added to this final report.

8. We are not suggesting that rigid criteria be used for every proposal. However, the criteria used by NSF appear to place more weight on a researcher's track record than on the scientific merit of the proposed work.

9. No response is required.

10. Our sample data on page 26 show that NSF does not frequently use the same reviewers to review successive proposals. Our sample statistics show that for 37 percent of such proposals none of the same reviewers were used to review the renewal proposal who also reviewed the sample grant proposal and that on another 52 percent only one reviewer who had reviewed the previous proposal also reviewed the renewal proposal. We do not intend that NSF use all the same reviewers on renewal proposals who reviewed the previous proposals. However, because of high program officer turnover at NSF, more continuity of reviewers from one proposal to the next is needed to improve proposal review than what we showed in our sample.

11. Our review of the sample grant files did not show evidence that program officers were contacting researchers when negative comments were made by the peer reviewers, so we asked

program officers whether they routinely contact researchers about negative comments.

12. Wording of the material on page 32 was changed to better represent the responses to the question. We do not imply on page 32 that program officers cannot properly interpret the peer reviews when they lack the expertise to be peer reviewers. We agree with NSF that program officers do not need to be peer reviewers to properly judge the peer reviews of a proposal. The report merely stresses the apparent importance of peer reviewer advice to the program officers. The information on pages 41 and 54 has no relevance to that on page 32. Report page 41 states that some program officers do not have the expertise to evaluate some grant results--which is not disputed by NSF. Report pages 41 and 54 do not suggest or imply that program officers who do not have the expertise to be peer reviewers on a proposal also cannot interpret the peer reviews that are received. Report page 41 suggests that when program officers cannot be peer reviewers on a grant, they also cannot evaluate the grant results, since they needed to be a peer reviewer on the grant.

13. The changes that are indicated have been made.

14. Our recommendation regarding the progress report section in renewal proposals is intended to have all researchers show the objectives, evidence of progress toward their achievement, any major changes in direction or emphasis and the reasons, and the publications or other output from researchers' immediately preceding grants. While the problem is greater with researchers who have multiple grants, it also occurs when researchers have only one grant. NSF's interpretation of only clarifying short- versus long-term objectives for researchers with multiple support does not solve the problem. All researchers seeking continued support for an ongoing project need to restate the objectives of their prior grant in the renewal proposal along with progress made and the resulting output. This requirement is particularly crucial for researchers having multiple support (see chapter 2). When a researcher has two or more ongoing grants and submits a proposal to renew one of them, unless the proposal clearly shows the objectives, etc., of the grant for which renewal is sought, the peer reviewers and program officers can be confused as to what work goes with what grant. Merely asking that a greater distinction be made between long- and short-term objectives does not rectify the situation. Our recommendation is intended to assure that peer reviewers and program officers have more specific information on the prior grant included in all renewal proposals regarding research objectives, progress made, changes in direction, and output under the immediately preceding grant for which renewal is sought. More specific information will enable reviewers and program officers to better assess a researcher's performance on a specific prior grant for which renewal is sought and the significance of that progress--which should improve the scientific performance accountability.

This recommendation requires no additional staff time or time of the peer reviewers to carry out. In fact, implementing this recommendation could save review time by providing information that could make evaluation easier, and thus less time-consuming. Restating specific prior grant objectives and showing progress made and any output that resulted from that specific grant will make it easier for peer reviewers and program officers to evaluate all proposals--those from researchers with multiple grants as well as those from researchers with only one prior grant. Better and more timely proposal evaluations should improve scientific performance accountability for all NSF grants. Chapter 2 contains examples showing the reasons for this recommendation and why it is needed for single, as well as multiple, funded researchers.

15. NSF states that they will ask reviewers to comment more explicitly in cases of multiple support. While this will help solve part of the problem which prompted the recommendation, NSF's intended actions are not sufficient. We intend the recommendation to apply to all renewal proposals including those from researchers who do not have multiple support. Peer reviewers should always specifically comment on the immediate past performance of the researcher requesting continued support. However, sometimes they do not. As noted on page 21, in only 22 percent of the renewal cases in our sample were there evaluative comments about the researcher's performance under the immediately preceding grant. When the peer reviewers specifically comment on the researcher's performance under the immediately preceding grant, a better assessment of the merits of continuing funding is obtained by the program officers.

16. We changed our recommendation to reflect NSF's views. NSF did not believe that it should document its summary of panel peer review deliberations along the lines of the NIH peer review group summary statement because, NSF noted, almost all its proposals that are panel reviewed also receive ad hoc review. As a result, NSF believes that because of the ad hoc reviews, which are written, as well as the written reviews of individual panel members, the panel summaries can be, and are, brief. At NIH, the peer review group summary statement provides the primary evidence showing the results of peer review. Written reviews by individual peer reviewers are not available.

NSF stated that for most panel reviewed proposals some written peer reviews are routinely available, which largely eliminates the need for a panel summary similar to NIH's. The thrust of NSF's concern is valid. However, we believe the individual ad hoc and panel peer reviewers' written reviews together with the panel summary should, collectively, show the peer reviewers' reasons for their recommendation, a description of the research, a critique of the research, comments on the researcher's qualifications, competence, resources and facilities, and a budget evaluation. When the individual reviews do not show this, the panel summary should. The recommendation in this report regarding

NSF's panel summaries reflects NSF's concern and our belief that panel summaries, together with other available written evidence, should show, as a minimum, information on the items noted above.

17. The changes that are indicated have been made.

18. NSF interpreted this recommendation to mean that proposals from researchers with only multiple support should show the short-term objectives applicable to the specific grant period. However, the recommendation is intended to require that all proposals from all researchers contain the research objectives the researcher plans to work on during the specific period of time that funding is sought. We intend that specific grant period objectives be included in both renewal as well as new project proposals and in proposals from researchers with single as well as multiple support. The purpose of the recommendation is to facilitate better evaluation by the peer reviewers and program officers of the progress made under the grant when, and if, renewal is sought. Knowledge of the specific grant period objectives will facilitate better evaluation.

19. This proposed recommendation is not intended, as NSF suggests, to apply only to researchers with multiple grants. This recommendation is applicable to all proposals for new projects when the researcher had, or has, another project in the same line of research, even if the researcher only had, or has one such project. The recommendation is especially important, however, for researchers with more than one project. The recommendation is intended to assure that there be evidence in the new project proposal showing progress made on the prior grant even though the prior grant involved a different research project. As shown in chapter 2, a researcher can continually propose new projects and not necessarily be held accountable, at least in the short term. This recommendation will better assure that peer reviewers and program officers have evidence in the new project proposal of the researcher's immediate past grant progress and performance. As noted in chapter 2, this is not always the case in that the peer reviewers could not adequately assess the new project proposal without some evidence of the researcher's immediate past work, which was not specifically stated. Also, because a proposal for a new project will often be submitted before results of the prior grant are published, the prior grant results might not be known and evidence in the new project proposal might be the best (and perhaps only) way peer reviewers or program officers have of assessing prior grant performance. As a result, this recommendation applies to all new project proposals whether from researchers with single or multiple support, recognizing that it is most important to have this information in those proposals from researchers with multiple grants.

20. No response is required.

21. NSF agreed to reexamine its practice to see what changes might be appropriate, but did not agree that the imposition of

APPENDIX II

more paperwork on its staff would be beneficial. We agree with NSF that additional paperwork might not be the best way to accomplish the proposed recommendation. We do not intend that unnecessary paperwork be generated. What NSF agreed to do in its letter is what we intended--that its progress report review practice be reexamined and changes made to assure the systematic and uniform review of progress reports without unnecessary paperwork.

22. No response is required.

APPENDIX III

DEPARTMENT OF HEALTH & HUMAN SERVICES

Office of Inspector General

Washington, D.C. 20201

9 JUL 1981

Mr. Gregory J. Ahart
Director, Human Resources
Division
United States General
Accounting Office
Washington, D.C. 20548

Dear Mr. Ahart:

The Secretary asked that I respond to your request for our comments on your draft report entitled, "Scientific Performance Accountability and Peer Review Processes for Basic Research Are Good But Could Be Better." The enclosed comments represent the tentative position of the Department and are subject to reevaluation when the final version of this report is received.

We appreciate the opportunity to comment on this draft report before its publication.

Sincerely yours,

Bryan Mitchell
For Richard P. Kusserow
Inspector General

Enclosure

COMMENTS OF THE DEPARTMENT OF HEALTH AND HUMAN SERVICES ON THE GENERAL ACCOUNTING OFFICE DRAFT REPORT "SCIENTIFIC PERFORMANCE ACCOUNTABILITY AND PEER REVIEW PROCESSES FOR BASIC RESEARCH ARE GOOD BUT COULD BE BETTER"

GAO Recommendation

We recommend that the Director of NIH:

--Require that proposals for new projects include evidence of progress from the prior grant(s).

--Ensure that, when researchers seek funding for new projects, peer reviewers are furnished the final technical report and listing of publications from the prior grant(s), when available.

Department Comment

We concur with the intent of these recommendations. However, any decision to implement GAO's recommended actions will be delayed until NIH's Review Policy Committee (RPC), which serves in an advisory capacity to the Director, NIH, reviews the practices and procedures involving information provided to peer reviewers. These items will be included on the agenda for the RPC's September 1981 meeting. RPC will provide its recommendations to the Director, NIH, in January 1982. If it is determined that changes are needed, NIH will take action to implement those items noted in the GAO recommendations by April 1982.

GAO Recommendation

We recommend that the Director of NIH assure more systematic and uniform review of annual progress reports by the program officers.

Department Comments

We concur. We will make a thorough examination of current practices at NIH and use this information to develop a uniform process for receipt and evaluation of progress reports by January 1982.

GAO Recommendation

We recommend that the Director of NIH establish more specific guidelines regarding the extent to which researchers can change grant objectives without prior agency approval.

Department Comments

We concur. We recognize the need to be as specific as possible regarding grant objectives and we will develop more definitive guidelines by January 1982.

Page 2

Technical Comments

1 In general, the report fairly presents the issues involved. However, the words "secrecy" and "anonymity" used to describe NIH peer review process could be misleading. In recent years, NIH has made changes in its peer review process making it significantly more open. For instance, complete rosters of all appointed and initial review group members are made available to the public semiannually. Further, summary statements of the grant initial review groups, which include deliberations and recommended actions on each application, are automatically given to the applicant Principal Investigator. In our opinion, these and other changes provide an openness to the peer review process that is not adequately conveyed by the words "secrecy" and "anonymity."

2 In Table 2 on page 2-3 of the draft report, the process "award decision based on scientific merit, made by program officer" is shown as "no" for NIH. This should be "yes" because program officers at NIH are involved in the decision to make an award based on scientific merit as evaluated by peer review.

GAO RESPONSE TO HHS COMMENTS

No response is required for the first two pages of the HHS comments. HHS concurred with all our recommendations to the Director, NIH, subject to review by NIH's Review Policy Committee. Our response to paragraphs 1 and 2 on page 78 follow.

1. Additional wording has been added to chapter 1 to clarify the words "secrecy" and "anonymity." Although the names of NIH peer reviewers who serve on the review groups are made public and summary statements are automatically given to the researchers, the NIH peer review process (as well as NSF's) is conducted in relative secrecy and the anonymity of individual peer reviewers who review specific proposals is maintained. Peer review group meetings are closed to the public. Individual peer reviewers' comments on specific NIH proposals are not disclosed or made available outside the group. The researchers only receive the summary statement prepared on each proposal. The summary statement does not identify a specific peer reviewer's comments. As a result, although the names of group members are made public, individual group members' opinions of specific proposals are not disclosed, even to the researcher.

2. The wording in table 2 was changed to show that NIH program officers cannot award a proposal as a grant unless the peer reviewers have first approved the scientific merit of the proposal.

UNIVERSITY OF WISCONSIN-MADISON

CHANCELLOR
Bascom Hall • 500 Lincoln Drive
Madison, Wisconsin 53706
608-262-9946

June 24, 1981

Mr. Osmund T. Fundingsland
Associate Director
Science and Technology
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Fundingsland:

1 I wish to comment upon the excerpts from the draft General Accounting Office report on NSF and NIH systems for scientific performance accountability.

2 Although various universities may exhibit some differences in detail, the description of the proposal submission process is generally accurate. It is appropriate that the review of proposals for scientific merit and need or relevance of the proposed research be carried out externally.

3 The second section of the report, headed "Universities do not monitor scientific progress" raises several questions, and contains assumptions which we must challenge. A distinction must be made between grants for basic research, and contracts for the performance of specific research tasks. Performance schedules and milestones in general are found only in the case of contracts. A very small fraction of NSF and NIH awards to the University of Wisconsin-Madison come in the form of contracts; however, in these cases we do monitor where appropriate and feasible the achievement of these milestones.

4 Research grants, on the other hand, are best monitored at the completion of the project period. Optimal strategy for performing the research may dictate non-uniform effort on the grant over the grant period. This is generally assumed in the funding agencies. It is important to recognize that both NSF and NIH grants require annual reports to the agencies, as well as periodic competitive renewals. Given the lead time necessary for annual renewals, reports to the agencies must be prepared from six to eight months into the grant period. This provides an effective nechanism for monitoring scientific progress. Indeed, for the reason cited above, even this may be too severe a monitoring mechanism.

5 Both the effort reporting system and general university fiscal controls provide effective mechanisms to insure sound management practices in the administration of grants.

Mr. Osmund T. Fundingsland -2- June 24, 1981

6 Finally, I must take strong issue with the statement in Conclusions regarding performance accountability "Even the universities, which theoretically are in a position to provide it, practically cannot and do not because of the 'academic freedom' environment and the lack of expertise about the research being performed." "Academic freedom," of course, does not enter into questions of performance accountability, nor is it fair to assume a lack of expertise. Rather, as explained above, the appropriate measure of performance accountability is being provided through agency review, which, being external, is probably preferable.

Sincerely,

Irving Shain
Chancellor

jrs

xc: Associate Dean Marvin E. Ebel

GAO RESPONSE TO WISCONSIN COMMENTS

The numbers of the responses below correspond to the numbered paragraphs of the June 24, 1981, letter from the University of Wisconsin-Madison.

1. No response is required.

2. No response is required.

3. This section of the report does not contain any assumptions. It only states the requirements of NSF and NIH grant policy manuals. The report also is clearly directed at only research grants. The report does not concern contracts and we state this in numerous places.

4. This paragraph confuses monitoring with evaluation. Monitoring implies an activity that occurs throughout the project period. Evaluation occurs at the end of the period. The rest of the paragraph apparently reflects the University's view on when monitoring should occur. However, both NSF and NIH grant policy manuals require that universities monitor the scientific performance aspects of research grants (see page 39). Researchers we interviewed stated that their universities do not monitor their research (see page 39). We did not interview university administrators on this subject.

5. Agency grant policy manuals also require that universities be responsible for the scientific as well as administrative aspects of research grants.

6. Academic freedom is not an issue in scientific performance accountability at the universities because all but one of the researchers GAO interviewed said their universities do not monitor the technical aspects of their research nor do the universities review research proposals for technical adequacy. Researchers also said that in many instances the universities do not get involved in the substance of their research at any level largely because few if any other persons at the university have the expertise to monitor the scientific aspects of the individual researcher's research.

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July 6, 1981

Osmund T. Fundingsland
Associate Director,
Science and Technology
United States General Accounting Office
Washington, D.C. 20548

Dear Dr. Fundingsland:

This responds to your June 9 letter to President Kennedy asking for review and comment on Pages 1-3 your draft Report PAD 81-29 on scientific performance accountability systems for NIH and NSF basic research grants.

We find ourselves in disagreement with the findings and conclusions regarding university proposal review and grant accountability with respect to scientific performance.

For the sake of convenience and facility of communication, I have framed our comments in the form of revisions to the draft report's text.

First page headed, PROPOSAL SUBMISSION -- third paragraph, first line: insert "centrally" between "review" and "proposals."

Page 2 -- replace first sentence as follows:

"While the universities we visited do not have central technical review boards to monitor scientific progress despite NSF's and NIH's policies that they be responsible and accountable for grant activities; in fact, they do accept those responsibilities. Rather, they place the scientific-technical accountability performance responsibility on the senior ("Principal") investigator (research director) named as responsible in the award notice. By doing so, by controlling the eligibility of personnel for that designation stringently, and by making the academic department heads and academic deans responsible for the oversight of the academic-research programs in their departments and schools, they believe they obtain adequate oversight of this aspect of the accountability requirements.

"In addition, schools we visited have appointed a senior academic officer with overall responsibility for the proper conduct of the research-graduate education programs across the institution and for the implementation and review of appropriate policies to assure effective academic controls. These officers are frequently assisted by professional staff and one or more academic policy advisory groups which include members of the faculty and administrative staff officers.

Osmund T. Fundingsland
United States General Accounting Office
July 6, 1981
Page Two

"Central administrative staffs maintain the official records for administrative accountability matters and have oversight responsibility for the effectiveness and integrity of the records."

Page 3 - CONCLUSIONS -- modify the fourth sentence as follows, beginning with the third line: "...-not do so centrally and believe there is no need to do so because of the existing system of delegations and controls noted above."

Page 3 - CONCLUSIONS -- replace the last two sentences as follows:

"They centrally review grant proposals for administrative matters, adherence to university policy, and use the academic governance structure to ensure adherence to appropriate scientific-technical performance standards and consistency with departmental and school academic objectives.

In most (all?) of the institutions with which we communicated, formal evidence of the performance of these reviews is required in the form of signatures of appropriate academic officers (academic department head and dean) on a proposal validation document, before the central grants and contracts office will act on it. [A similar review process is employed prior to the acceptance of awards if changes are made in either the nature or direction of the effort as proposed, or in the financial or administrative arrangements.]

Institutions with which we communicated indicated the presence of additional safeguards for quality of performance: juried publication of research results; juried review of graduate students' theses and dissertations (which frequently are based on grant-supported work and form partial documentation of results); the need to satisfy sponsor scientific-technical monitors as to the adequacy and sufficiency of the work, both to be discharged as to performance and to insure eligibility for continuing/future support; and the requirement for technical competence reviews as a condition of advancement/promotion in the employing university's academic staff."

Thank you for allowing the opportunity for comment. I hope the foregoing is helpful to the audit staff in acquiring a better understanding of the nature of academic accountability governance as

Osmund T. Fundingsland
United States General Accounting Office
July 6, 1981
Page Three

practised in this and other colleges and universities with which I am acquainted. I would also hope that at least the general thrust of these suggested changes to the draft might find their way into the final report. It is a complex and timely topic.

If further information is needed, please call.

Sincerely,

Earl G. L. Cilley
Director

EC:dp

cc: Donald Kennedy

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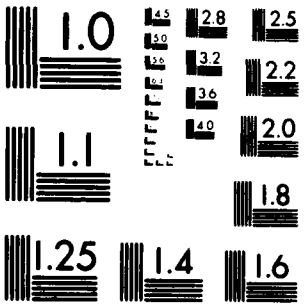

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GAO RESPONSE TO STANFORD COMMENTS

Stanford University's Sponsored Projects Office disagreed with our findings and conclusions regarding monitoring of research projects for scientific progress. Stanford stated that although it accepts the responsibility for such monitoring, as both NSF and NIH grant policy manuals require, Stanford in essence relies on its researchers to monitor their own projects. This is of course "self-policing" and does not appear to comply with the intent of the agencies' requirements. Stanford also said that "senior academic officers" are responsible for the overall conduct of research programs. Researchers told us that no one at the universities monitors scientific progress of their research projects (see p. 39).

University review for administrative matters does not necessarily mean review for technical or scientific matters. Researchers told us that universities do not review their proposals for scientific relevance. We did not interview university administrators on this subject.

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